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Phase II - Environmental Site Assessment

Commercial and Residential Properties
320 McRae Avenue, 1976 Scott Street,
311 and 315 Tweedsmuir Avenue
Ottawa, Ontario

Prepared For

The Estate of Carson Unsworth

January 28, 2016

Report: PE3391-2R

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EXECUTIVE SUMMARY

Assessment

A Phase II ESA was conducted for the commercial and residential properties addressed 320 McRae Avenue, 1976 Scott Street, 311 and 315 Tweedsmuir Avenue, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the areas of potential environmental concern (APECs) identified during the Phase I ESA. The APECs included the potential former landfill in the area of the subject site, the former and continued use of the eastern portion of the subject site as various automotive service garages and autobody shops, as well as, the former use of the northern portion of the subject site as a retail fuel outlet.

During a previous investigation in 2008, petroleum hydrocarbon (PHC) fraction F3, barium, cadmium, lead mercury and zinc impacted fill was identified on the east side of the commercial building and impacted groundwater (benzene, chloroform, toluene, xylenes and PHC (F1)) was identified in BH6, on the north side of the commercial building. Field observations indicated the presence of impacted groundwater in BH4, in the former pump island area. This well was not found at the time of the current assessment and could not be assessed.

The 2014 subsurface investigation at the subject site was conducted on October 8 and 9, 2014 and consisted of the drilling of three (3) boreholes and the installation of three (3) groundwater monitoring wells.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. Three (3) soil samples were submitted for laboratory analysis of metals, BTEX and/or PHCs. Arsenic concentrations in BH1 and a petroleum hydrocarbon (PHC) fraction 1 (F1) concentration in BH3 were identified in excess of the selected MOE Table 7 standards. Metals impacted fill in BH1 was visually identified at depths of 0.91 and 2.44 m, while in BH3 a thin layer of PHC impacted fill was identified between 3.28 and 3.38 m below ground surface.

Groundwater samples were obtained from the monitoring wells at BH1 and BH2, and submitted for analysis of PHCs and volatile organic compounds (VOCs). None of the analytical parameters were found to exceed the selected MOE Table 7 standards.

Recommendations

Metal and PHC concentrations in some soils are present at the subject site in concentrations in excess of the selected MOE Table 7 standards. The presence of

metals impacted fill beneath the commercial building and petroleum impacts in the former tank nest area are not considered to represent an immediate risk to the current use of the subject site. It is understood that, the site is being considered for redevelopment, at which time further delineation and a remediation of contaminated materials would be practical.

Soil

Any impacted soil removed from the site during redevelopment will require disposal at an approved waste disposal facility. It is recommended that Paterson personnel be present onsite during the soil excavation program to direct excavation activities in the areas where impacted material has been identified or is expected to exist. Additional testing may be required to effectively identify and delineate the impacted fill on the subject site. If any soil is to remain on-site, it is recommended that confirmatory soil samples be collected upon completion of the soil remediation program to ensure that the site is in compliance with the MOE Table 7 Standards.

Groundwater

Groundwater impacts previously identified in 2008 may persist on the northern portion of the subject site. Impacted groundwater was identified in BH6, located to the north of the commercial building and it was inferred in BH4, located in the former pump island location. Consideration should also be given to retesting all groundwater monitoring wells prior to redevelopment activities.

Depending upon the volume of impacted groundwater encountered during future site development, several options may be available to treat the groundwater. The removal of impacted groundwater from the site by a licensed pumping contractor would be a feasible option for smaller volumes, while an on-site treatment system would likely be more economical for larger volumes over a longer period of time. An on-site treatment system would discharge to the City of Ottawa sewer system. Prior to discharging treated groundwater to the municipal sewer system, a Sanitary Sewer Agreement will be required from the City of Ottawa's Sewer Use Program. Additional groundwater monitoring wells may be required following the completion of the site remediation program to ensure that the site meets the MOE Table 7 Standards.

1.0 INTRODUCTION

At the request of the Estate of Carson Unsworth, Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment of the properties addressed 320 McRae Avenue, 1976 Scott Street, 311 and 315 Tweedsmuir Avenue, in the City of Ottawa, Ontario. The purpose of this Phase II ESA was to address concerns identified in the Phase I ESA conducted concurrently with this assessment by Paterson.

1.1 Site Description

Address:	1976 Scott Street, 320 McRae Avenue, 311 and 315 Tweedsmuir Avenue, Ottawa, Ontario, hereafter referred to as 320 McRae Avenue.
Legal Description:	Lots 12 to 19, Registered Plan 273 and Lots 23, 24 and 25, Registered Plan 263. Part of Lot 31 and 32, Concession 1, Nepean Township, Ottawa Front.
Property Identification Numbers:	04021-0013, 04021-0014, 04021-0015, 04021-0021, 04021-0022, 04021-0023, 04021-0024, 04021-0025, 04021-0026.
Location:	The subject site is located west of McRae Avenue, south of Scott Street and east of Tweedsmuir Avenue, 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' 45" N, 75° 45' 02" W.
Configuration:	Irregular.
Site Area:	0.51 hectares (approximate).

1.2 Property Ownership

The subject property is currently owned by the Estate of Carson Unsworth. Paterson was retained to complete this Phase II ESA by Ms. Carol Morris-Unsworth.

1.3 Current and Proposed Future Uses

The southeast portion of the subject site is occupied by a commercial complex with two (2) garages, two (2) units used for office space, two (2) garage bays used for storage of landscaping equipment and self-storage space. The northwest portion of the subject site (311 and 315 Tweedsmuir Avenue) is occupied by two 2 storey residential dwellings. The northern portion of the subject site is utilized as a parking lot.

It is our understanding that the redevelopment of the property into a residential condominium complex is being considered.

1.4 Applicable Site Condition Standard

The site condition standards for the property were obtained from Table 7 of the document entitled “Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act”, prepared by the Ontario Ministry of the Environment (MOE), April 2011. The MOE Table 7 Standards are based on the following considerations:

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

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The subject site is located south of Scott Street, between McRae Avenue and Tweedsmuir Avenue, in the City of Ottawa. The site is occupied by two, 2 storey residential buildings on the west side of the subject site, a commercial structure with a partial second storey on the east side of the subject site and a vacant kiosk on the north side of the subject site. The commercial building is currently being utilized as two (2) automotive service garages, a landscaper's storage garage, a self storage complex and two (2) units are being used for office space. The ground cover in the area of the residences and to the north of the residences towards Scott Street, consists of grass and trees. The remainder of the subject site is asphaltic concrete parking, with two large gravel patches from former retail fuel outlet decommissioning work.

No drinking water wells or private sewage systems were observed on the subject property, nor are any expected to be present, as the site is located in a municipally-serviced area. No evidence of current or former railway or spur lines on the subject property was observed, at the time of the site inspection. There were no unidentified substances observed on the subject site.

2.2 Past Investigations

The following reports were available for review:

- "Soil Testing During Retail Gas Station Decommissioning, 1976 Scott Street, Ottawa, ON", prepared by SEACOR Environmental Inc. (SEACOR), dated September 2003.
- "Phase I-II - Environmental Site Assessment, 319 & 320 McRae Avenue, Ottawa, Ontario", prepared by Paterson, dated November 2008.
- Phase I – Environmental Site Assessment, Commercial and Residential Properties, 320 McRae Avenue, 1976 Scott Street and 311 Tweedsmuir Avenue, Ottawa, Ontario", prepared by Paterson, dated November 3, 2014.

The 2014 Phase I-ESA report, incorporated information from the previous two (2) reports and identified three (3) on-site potentially contaminating activities (PCAs) that are considered to represent areas of potential environmental concern (APECs) for the subject site. These on-site PCAs are as follows:

- The former use of the northern portion of the subject site (1976 Scott Street) as a retail fuel outlet, between 1971 and 2002.
- The former and continued use of various units within the commercial building on the southeast portion of the subject site, as various automotive service garages and autobody shops, since the 1940's.
- Possible importation of fill of unknown quality during the former landfilling activities in the area of the subject site, prior to 1928.

The report recommended that a Phase II-ESA be conducted to address the above concerns.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation conducted as a component of this Phase II ESA consisted of the drilling of three (3) boreholes at the subject property to supplement the Phase II-ESA conducted in 2008. Monitoring wells were installed in all of the boreholes. Boreholes were advanced to a maximum depth of 7.09 m below grade, some boreholes terminating within bedrock.

3.2 Media Investigated

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

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

Based on information from the Geological Survey of Canada mapping and the current and previous subsurface investigations, drift thickness in the area of the subject site is between 1.01 and 3.10 m. Overburden soils consist primarily of fill and silty sand. Bedrock in the area of the subject site is considered to be interbedded limestone and dolostone of the Gull River Formation. Groundwater in the monitoring wells onsite was encountered within the bedrock. Groundwater levels ranged from 3.00 to 6.20 m below grade.

Contaminants of Potential Concern

The following CPCs were identified with respect to the subject site:

- Petroleum Hydrocarbons Fractions 1 through 4 (PHCs F1-F4) – this suite of parameters encompasses gasoline (Fraction 1), diesel and fuel oil (Fraction 2), and heavy oils (Fractions 3 and 4). PHCs F1-F4 were selected as CPCs for the Phase I property based on the historical use of three (3) underground storage tanks at the former retail fuel outlet, and the historical and present use of new and waste oil ASTs, as well as, various mechanical activities at the automotive service garages. Heavy oils may be present in the form of lubricants and transmission or hydraulic fluids. PHCs may be present in the soil matrix, sorbed to soil particles, as well as in free or dissolved phase in the groundwater system. PHCs are generally considered to be LNAPLs – light non-aqueous phase liquids, indicating that when present in sufficient concentrations above the solubility limit, they will partition into a separate phase above the water table, due to their lower density.

- Metals – this suite of parameters encompasses various metals for which MOE standards exist. Metals may be present in the soil matrix or dissolved in site groundwater. Metals were selected as CPCs for the Phase I property based on the reported historical presence of a landfill in the area of the subject site and the former and current use of the subject site as various automotive service garages. While metals in groundwater are a potential CPC for the site, metals do not readily dissolve and therefore were not considered to be a priority contaminant that required assessment at this stage of the project.

- Volatile Organic Compounds (VOCs) – this suite of parameters includes chlorinated solvents (Tetrachloroethylene, Trichloroethylene, Dichloroethylenes, and Vinyl Chloride) associated with de-greasing and dry cleaning, as well as benzene, toluene, ethylbenzene, and xylenes (BTEX), associated with gasoline. These parameters were selected as CPCs for the Phase I study area based on the use of the eastern portion of the subject site as various automotive service garages and commercial autobody shops, as well as, the former use of the northern portion of the subject site as a retail fuel outlet. VOCs may be present in the soil matrix as well as in the dissolved phase in the groundwater system.

The mechanisms of contaminant transport within the site soils include physical transportation and leaching. Physical transport is not anticipated to be an issue at the subject site, given the partially developed nature of the site. Leaching is

anticipated to play a lesser role in the contaminant transportation, given the presence of an asphaltic concrete parking lot surface.

The mechanisms of contaminant transport within the groundwater system include advection, dispersion, and diffusion. Diffusion and advection will likely dominate in the fill where lower hydraulic conductivity is likely to be present.

Existing Buildings and Structures

The site is occupied by residential dwellings at 311 and 315 Tweedsmuir Avenue, by a vacant kiosk at 1976 Scott Street and the commercial complex (occupied two (2) automotive service garages, Westboro Self-storage, a landscaper for equipment storage and two (2) office units.) at 320 McRae Avenue.

Water Bodies

No water bodies are present within the Phase I study area. The closest body of water is the Ottawa River, located to the north and west of the subject site.

Areas of Natural Significance

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

Drinking Water Wells

Based on the availability of municipal water within the Phase I ESA study area, drinking water wells are not expected to be located on the subject property or neighbouring properties within the study area.

Neighbouring Land Use

Neighbouring land use in the Phase I study area is a mixture of residential, commercial and industrial properties.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

Various PCAs were identified with regard to the current and former use of properties within the Phase I study area, however, only the PCAs identified on the subject site were considered to represent APECs on the subject site. As discussed in detail in the Phase I-ESA report and in Section 2.2 of this report, these PCAs are associated with the potential former landfilling activities in the area of the subject site, the former use of the northern portion of the subject site

as a retail fuel outlet and the previous and continued use of the commercial structure on the southeast portion of the property as various automotive service garages and autobody shops.

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of the Phase I ESA is considered to be sufficient to conclude that there are areas of potential environmental concern on the subject site which have the potential to have impacted the subject site. The exact footprint of the reported former landfill site in the area of the subject site could not be confirmed. The presence of potentially contaminating activities was confirmed by a variety of independent sources, and as such, the conclusions of this report are not affected by uncertainty which may be present with respect to the individual sources.

3.4 Deviations from Sampling and Analysis Plan

The Sampling and Analysis Plan for this project is included in Appendix 1 of this report. Field parameters for groundwater stabilization were not measured during the groundwater purging and sampling event on October 15, 2014. A sufficient volume of groundwater was purged to suggest the well development was adequate. No other deviations from the sampling and analysis plan were noted.

3.5 Impediments

The presence of various utilities on the east and north sides of the property restrict borehole placement in these areas. General use of the subject site (automotive service garage; shuffling of vehicles and equipment) resulted in restricted locations for drilling, with several delays and interruptions. BH3 was not advanced to an adequate depth to intercept the groundwater table. No other physical impediments or denial of access were encountered during the Phase II Environmental Site Assessment.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted on October 8 and 9, 2014, and consisted of the drilling of three (3) boreholes on the subject site. The boreholes were placed in the garages and the former underground storage tank nest in order to assess the soil and groundwater conditions. The boreholes were

advanced using a portable drill rig. The drilling contractor was Coretech Environmental Drilling of Ottawa, Ontario. Borehole locations are shown on Drawing No. PE3391-3R – Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

A total of 11 soil samples were obtained from the boreholes by means of auger flight sampling and split spoon sampling. Split spoon samples were taken at approximate 0.61 m intervals. 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. A total of 18 rock core samples were also collected from BH1 and BH2 during the coring. These are shown as "**RC**" on the Soil Profile and Test Data Sheets.

Site soils consist of primarily of fill material (crushed stone over sandy material), with some silty sand identified in BH7, underlain by limestone bedrock. Concrete was encountered in the interior of the building (BH1 and BH2), while a gravel ground surface is present in the area of the former underground tank nest (BH3). In BH2 only crushed stone was identified between the concrete slab and shallow limestone bedrock.

Concrete encountered in BH1 and BH2 was 0.15 m thick, asphalt encountered in BH6, BH7 and BH8 was approximately 0.05 m thick. Fill was present in all boreholes in thicknesses varying between 0.96 to 3.38 m. Deleterious material including slag and metal pieces, was identified around 0.91 m and again around 2.44 m in BH1 and between 0.30 and 1.10 m in BH8. Black silty sand fill recovered from 3.28 to 3.38 m in BH3, was noted to exhibit a strong petroleum hydrocarbon odour (weathered gasoline). No other signs of hydrocarbon impacts or deleterious fill were encountered. Bedrock was confirmed at depths of 1.19 m to 2.44 m, and limestone bedrock (with calcite seams) was cored to a maximum depth of 7.87 m below grade.

4.3 Field Screening Measurements

Samples collected from site underwent a preliminary screening procedure which included visual screening for colour and evidence of deleterious fill. A MiniRae 2000 photoionization detector (PID) was used to determine the selection of samples to be submitted for analytical testing.

The soil vapours were measured by inserting the analyzer probe into the nominal headspace above the soil sample. Samples were then agitated and the peak

readings recorded. The vapour readings ranged from 0.2 to 242 ppm. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

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

4.4 Groundwater Monitoring Well Installation

Three (3) groundwater monitoring wells installed in 2014, on the subject property were done so by CoreTech Drilling Inc. of Ottawa, Ontario, under full-time supervision by Paterson personnel. The monitoring wells consisted of 32 mm diameter Schedule 40 threaded PVC risers and screens. A sand pack consisting of silica sand was placed around the screen, and a bentonite seal was placed above the screen to minimize cross-contamination. Monitoring well construction details are provided on the Soil Profile and Test Data Sheets in Appendix 1. A summary of monitoring well construction details is provided below in Table 1.

The groundwater monitoring wells were developed upon completion using a dedicated inertial lift pump. A minimum of three (3) well volumes were removed from the wells.

Table 1: Monitoring Well Construction Details

Well ID	Ground Surface Elevation	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
BH4	63.42	7.75	4.70 – 7.75	3.05 – 7.75	0.60 – 3.05	Flushmount
BH6	63.16	7.87	4.82 – 7.87	3.05 – 7.87	0.60 – 3.05	Flushmount
BH1	64.76	7.09	4.04 – 7.09	3.58 – 7.09	0.60 – 3.58	Flushmount
BH2	63.04	7.01	3.96 – 7.01	3.35 – 7.01	0.60 – 3.35	Flushmount
BH3	63.17	3.38	1.86 – 3.38	1.55- 3.38	0.60 - 1.55	Flushmount

4.5 Groundwater Sampling

Groundwater sampling protocols were followed using the MOE document entitled “Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario”, dated May 1996.

Groundwater samples were obtained from each monitoring well, using dedicated sampling equipment. Standing water was purged from each well prior to sampling. Samples were stored in coolers to reduce analyte volatilization during transportation. Details of our standard operating procedure for groundwater sampling are provided in the Sampling and Analysis Plan in Appendix 1.

4.7 Analytical Testing

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

Table 2: Soil Samples Submitted

Sample ID	Sample Depth/ Stratigraphic Unit	Parameters Analyzed			Rationale
		Metals	BTEX	PHCs (F1-F4)	
BH8-SS2	0.76-1.01 m; Fill	X		X	Assessment of suspect fill material on the east side of the commercial building.
BH1-SS3	1.37-1.83 m; Fill	X			Assessment of suspect fill material.
BH1-SS4	1.83-2.44 m; Fill		X	X	Assess of potential BTEX and PHC impacts in the soil beneath the automotive service garage.
BH3-SS6	3.05-3.38 m; Fill		X	X	To assess potential BTEX and PHC impacts in the former underground storage tank nest on 1976 Scott Street.

Table 3: Groundwater Samples Submitted

Sample ID	Screened Interval/ Stratigraphic Unit	Parameters Analyzed		Rationale
		PHCs (F1-F4)	VOC	
BH6-GW1	3.05 – 7.87 m; Bedrock	X	X	Assessment of potential PHC and VOC impacts in the groundwater in the vicinity of the commercial complex utilized as various automotive service garages and autobody shops. Placed on the north side of the building nearby the former in-ground hoist location.
BH1-GW1	4.04 – 7.09 m; Bedrock	X	X	Assessment of potential PHC and VOC impacts in the groundwater in the vicinity of the automotive service garages.
BH2-GW1	3.96 – 7.01 m; Bedrock	X	X	Assessment of potential PHC and VOC impacts in the groundwater in the vicinity of the automotive service garages.

Paracel Laboratories (Paracel), of Ottawa, Ontario, performed the laboratory analysis on the samples submitted for analytical testing. Paracel is a member of the Standards Council of Canada/Canadian Association for Laboratory

Accreditation (SCC/CALA). Paracel is accredited and certified by SCC/CALA for specific tests registered with the association.

4.8 Residue Management

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

4.9 Elevation Surveying

Ground surface elevations at the borehole locations were determined by Paterson personnel based on the geodetic elevation of the top of spindle of a fire hydrant (64.44 m) located on the west side of McRae Street, immediately south of Scott Street. The geodetic elevation was based on a Topographic Site Plan prepared by Stantec Geomatics Ltd. in 2008. The accuracy of the benchmark was not verified by Paterson.

4.10 Quality Assurance and Quality Control Measures

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

5.0 REVIEW AND EVALUATION

5.1 Geology

Site soils primarily consist of sandy fill material, with some silty sand (observed in BH7), atop predominantly limestone bedrock. The fill material consists of silty sand with gravel, some cobbles and possible boulders. Traces of slag and metal pieces were observed in BH1 at depths of 0.91 m and 2.44 m and in BH8 between 0.30 and 1.10 m. Bedrock was cored in BH1, BH2, BH4, BH6 and BH7 to depths ranging from 7.09 and 7.87 m below grade.

Groundwater monitoring wells were installed at BH1, BH2, BH3, BH4 and BH6. Site stratigraphy is shown on Drawing PE3391-4 - Cross-Section A-A'.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling event on October 15, 2014, using an electronic water level meter. Groundwater levels are summarized below in Table 4. All measurements are geodetic based on the topographic site plan prepared by Stantec Geomatics Ltd.

Table 4: Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH4	63.42	2.95	60.47	November 3, 2008
BH6	63.16	4.85	58.31	November 3, 2008
BH1	64.76	6.20	58.56	October 15, 2014
BH2	63.04	4.38	58.66	October 15, 2014
BH3	63.17	dry	-	October 15, 2014

Based on the limited groundwater data recovered from the November 3, 2008 and October 15, 2014 monitoring events, groundwater contour mapping could not be completed for the subject site. Based on the available groundwater elevation data, groundwater flow generally appears to be in a southerly direction. It is suspected that the water levels in the boreholes had not fully stabilized at the time of sampling, since groundwater flow direction in the area of the subject site is typically expected to be in a northerly direction, based on the presence of the Ottawa River further to the north of the subject site and data from previous assessments in the area of the subject site.

No free product was observed in the monitoring wells sampled at the subject site.

5.3 Fine-Medium Soil Texture

Based on field soil observations, fine-grained soil standards are not applicable to the subject site.

5.4 Soil: Field Screening

Field screening of the soil samples collected during drilling resulted in organic vapour readings of 0.2 ppm to 242 ppm. Field screening results of each individual soil sample are provided on the Soil Profile and Test Data Sheets appended to this report.

The organic vapour readings obtained from field screening of soil samples identified potential for PHC contamination in BH3-SS6 (242 ppm). It is noted that higher-fraction hydrocarbons may not be as readily detectable by combustible gas or PID detectors.

Visually, pieces of slag were observed in some of the fill samples from BH1.

5.5 Soil Quality

Three (3) soil samples from the 2014 Phase II-ESA were submitted for analysis of a combination of metals, BTEX and PHCs. The results of the analytical testing are presented below along with the test data from 2008. The laboratory certificates of analysis are provided in Appendix 1.

Table 5:
Analytical Test Results – Soil
Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g)		MOE Table 7 Residential Coarse Standards (µg/g)
		October 27, 2008	October 8, 2014	
		BH8-SS2	BH1-SS3	
Antimony	1.0	nd	nd	7.5
Arsenic	1.0	18	**113**	18
Barium	1.0	**720**	309	390
Beryllium	1.0	0.6	nd	4
Boron (total)	1.0	1.5	38.7	120
Cadmium	0.5	**4.8**	nd	1.2
Chromium (total)	1.0	89	22.1	160
Chromium VI	0.4	nd	na	8
Cobalt	1.0	13	8.7	22
Copper	1.0	90	55.7	140
Iron	200	41,900	nv	nv
Lead	1.0	**515**	67.4	120
Mercury	0.1	**0.3**	na	0.27
Molybdenum	1.0	2	4.3	6.9
Nickel	1.0	34	24.4	100
Selenium	1.0	1	nd	2.4
Silver	0.5	0.5	nd	20
Thallium	1.0	nd	nd	1
Uranium	1.0	na	nd	23
Vanadium	1.0	38	39.0	86
Zinc	1.0	**2720**	82.7	340

Notes:
- MDL – Method Detection Limit
- na – Not analyzed
- nd – Not detected above the MDL
- nv – No MOE value reported
- **Bold and underlined** – Value exceeds selected MOE Standard

Barium, cadmium, lead, mercury and zinc were identified in Sample BH8-SS2 (from October, 2008) in excess of the selected MOE Table 7 standards. Arsenic was indentified in Sample BH1-SS3 in excess of the MOE Table 7 standards. All other metals parameters were in compliance with the selected MOE standards.

Table 6:
Analytical Test Results – Soil
BTEX and PHCs

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MOE Table 7 Residential Coarse Standards (µg/g)
		October 27, 2008	October 8, 2014	October 9, 2014	
		BH8-SS2	BH1-SS4	BH3-SS6	
Benzene	0.02	na	nd	nd	0.21
Ethylbenzene	0.05	na	nd	nd	2
Toluene	0.05	na	nd	nd	2.3
Xylenes	0.05	na	nd	nd	3.1
PHC F1	7	nd	nd	**73**	55
PHC F2	4	33	nd	23	98
PHC F3	8	**409**	nd	nd	300
PHC F4	6	1,130	nd	nd	2,800

Notes:
- MDL – Method Detection Limit
- na – Not analyzed
- nd – Not detected above the MDL
- nv – No MOE value reported
- **Bold and underlined** – Value exceeds selected MOE standards

Petroleum hydrocarbon (PHC) fraction F3 was identified in the soil Sample BH8-SS2, in concentrations that exceed the MOE Table 7 standards. PHC F1 was identified in sample BH3-SS6 in excess of the selected MOE Table 7 standards. All other BTEX and PHC parameters are in compliance with MOE Table 7 standards.

The maximum concentrations of the analyzed parameters in the soil at the site are summarized below in Table 7.

Table 7:
Maximum Concentrations – Soil

Parameter	Maximum Concentration (µg/g)	Sample	Depth Interval (m BGS) / Stratigraphic Unit
Arsenic	**113**	BH1-SS3	1.37-1.83 m; Fill
Barium	**720**	BH8-SS2	0.76-1.01 m; Fill
Beryllium	0.6	BH8-SS2	0.76-1.01 m; Fill
Boron (total)	38.7	BH1-SS3	1.37-1.83 m; Fill
Cadmium	**4.8**	BH8-SS2	0.76-1.01 m; Fill
Chromium (total)	89	BH8-SS2	0.76-1.01 m; Fill
Cobalt	13	BH8-SS2	0.76-1.01 m; Fill
Copper	90	BH8-SS2	0.76-1.01 m; Fill
Iron	41,900	BH8-SS2	0.76-1.01 m; Fill
Mercury	**0.3**	BH8-SS2	0.76-1.01 m; Fill
Lead	**515**	BH8-SS2	0.76-1.01 m; Fill
Molybdenum	4.3	BH1-SS3	1.37-1.83 m; Fill
Nickel	34	BH8-SS2	0.76-1.01 m; Fill
Selenium	1	BH8-SS2	0.76-1.01 m; Fill
Silver	0.5	BH8-SS2	0.76-1.01 m; Fill
Vanadium	39.0	BH1-SS3	1.37-1.83 m; Fill
Zinc	**2720**	BH8-SS2	0.76-1.01 m; Fill
PHC F1	**73**	BH3-SS6	3.05-3.38 m; Fill
PHC F2	33	BH8-SS2	0.76-1.01 m; Fill
PHC F3	**409**	BH8-SS2	0.76-1.01 m; Fill
PHC F4	1130	BH8-SS2	0.76-1.01 m; Fill

Notes:
- **Bold and underlined** – Value exceeds MOE Table 7 standards

All other parameter concentrations were below laboratory detection limits.

5.6 Groundwater Quality

Groundwater samples from the monitoring wells at BH1 and BH2 were submitted for laboratory analysis of PHCs and VOCs as part of the 2014 program, while a groundwater sample from BH6 was analyzed for PHC and VOCs in 2008. The groundwater samples were obtained from the screened intervals noted on Table 1.

The results of the analytical testing are presented below in Tables 8 - 10. The laboratory certificates of analysis are provided in Appendix 1.

Table 8:
Analytical Test Results – Groundwater
VOCs

Parameter	MDL (µg/L)	Groundwater Sample (µg/L)			MOE Table 7 Coarse Standards (µg/L)
		November 3, 2008	October 15, 2014		
		BH6-GW1	BH1-GW1	BH2-GW1	
Acetone	5.0	na	219	22.2	100,000
Benzene	0.5	**1.7**	nd	nd	0.5
Bromodichloromethane	0.5	nd	nd	nd	67,000
Bromoform	0.5	nd	nd	nd	5
Bromomethane	0.5	nd	nd	nd	0.89
Carbon Tetrachloride	0.2	nd	nd	nd	0.2
Chlorobenzene	0.5	nd	nd	nd	140
Chloroethane	1.0	nd	na	na	nv
Chloroform	0.5	**2.6**	nd	1.3	2
Chloromethane	3.0	nd	na	na	nv
Dibromochloromethane	0.5	nd	nd	nd	65,000
Dichlorodifluoromethane	1.0	na	nd	nd	3,500
1,2-Dichlorobenzene	0.5	nd	nd	nd	150
1,3-Dichlorobenzene	0.5	nd	nd	nd	7,600
1,4-Dichlorobenzene	0.5	nd	nd	nd	0.5
1,1-Dichloroethane	0.5	nd	nd	nd	11
1,2-Dichloroethane	0.5	nd	nd	nd	0.5
1,1-Dichloroethylene	0.5	nd	nd	nd	0.5
cis-1,2-Dichloroethylene	0.5	nd	nd	nd	1.6
trans-1,2-Dichloroethylene	0.5	nd	nd	nd	1.6
1,2-Dichloropropane	0.5	nd	nd	nd	0.58
1,3-Dichloropropene	0.5	nd	nd	nd	0.5
Ethylbenzene	0.5	52.2	nd	nd	54
Ethylene Dibromide	0.2	nd	nd	nd	0.2
Hexane	1.0	na	nd	nd	5
Methyl Ethyl Ketone	5.0	na	nd	nd	21,000
Methyl Isobutyl Ketone	5.0	na	nd	nd	5,200
Methyl tert-butyl Ether	2.0	na	nd	nd	15
Methylene Chloride	5.0	nd	nd	nd	26
Styrene	0.5	nd	nd	nd	43
1,1,1,2-Tetrachloroethane	0.5	nd	nd	nd	1.1
1,1,2,2-Tetrachloroethane	0.5	nd	nd	nd	0.5
Tetrachloroethylene	0.5	nd	nd	nd	0.5
Toluene	0.5	**1,360**	nd	nd	320
1,1,1-Trichloroethane	0.5	nd	nd	nd	23
1,1,2-Trichloroethane	0.5	nd	nd	nd	0.5
Trichloroethylene	0.5	nd	nd	nd	0.5
Trichlorofluoromethane	1.0	nd	nd	nd	2,000
1,3,5-Trimethylbenzene	0.5	1.7	na	na	nv
Vinyl Chloride	0.5	nd	nd	nd	0.5
Xylenes	0.5	**288**	nd	nd	72

Notes:
- MDL – Method Detection Limit
- na – Not analyzed
- nd – Not detected above the MDL
- nv – No MOE value reported
- **Bold** – Value exceeds applicable MOE Standard

Benzene, chloroform, toluene and xylenes concentrations from the BH6 groundwater testing in November, 2008, exceed the selected MOE Table 7 standards. All other VOC parameters are in compliance with the selected MOE Table 7 standards.

Chloroform was identified in samples recovered from BH2 and BH6. The presence of chloroform is not considered to represent a significant environmental concern. It is considered to have been introduced in the groundwater via the use of municipally supplied water as corewater used to drill the borehole. It is suspected that these levels will drop once a sufficient stabilization period has elapsed. A more representative sample may be achieved following a greater stabilization period.

Table 9:
Analytical Test Results – Groundwater
PHCs

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)			MOE Table 7 Coarse Standards (µg/L)
		November 3, 2008	October 15, 2014		
		BH6-GW1	BH2-GW1	BH3-GW1	
PHCs F1	25	**870**	107	nd	420
PHCs F2	100	nd	nd	nd	150
PHCs F3	100	nd	nd	nd	500
PHCs F4	100	nd	nd	nd	500

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

Petroleum hydrocarbon faction 1 was identified in BH2-GW1 and BH6-GW1. The concentration of fraction 1 PHCs in the BH6 groundwater sample from November, 2008 exceeds the selected MOE Table 7 standards. All other PHC parameters comply with MOE Table 7 standards.

The maximum final concentrations of analyzed parameters in the groundwater at the site are summarized below in Table 10.

Table 10: Maximum Concentrations – Groundwater			
Parameter	**Maximum Concentration (µg/L)**	**Borehole**	**Screened Interval (m BGS)**
Acetone	219	BH1-GW1	4.04 – 7.09 m
Benzene	**1.7**	BH6-GW1	4.82 – 7.87 m
Chloroform	**2.6**	BH6-GW1	4.82 – 7.87 m
Ethylbenzene	52.2	BH6-GW1	4.82 – 7.87 m
Toluene	**1360**	BH6-GW1	4.82 – 7.87 m
1,3,5-Trimethylbenzene	1.7	BH6-GW1	4.82 – 7.87 m
Xylenes	**288**	BH6-GW1	4.82 – 7.87 m
PHC F1	**870**	BH6-GW1	4.82 – 7.87 m
Notes: ▪ **Bold** – Value exceeds MOE Table 7 standards			

All other parameter concentrations were below laboratory detection limits.

5.7 Phase II Conceptual Site Model

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

Site Description

Potentially Contaminating Activity and Areas of Potential Environmental Concern

As indicated in the Phase I-ESA report, potentially contaminating activities (PCAs) that are considered to represent areas of potential environmental concern (APECs) on the subject site consist of:

- The former use of the northern portion of the subject site (1976 Scott Street) as a retail fuel outlet, between 1971 and 2002.
- The former and continued use of various units within the commercial building on the southeast portion of the subject site, as various automotive service garages and autobody shops, since the 1940's.
- Possible importation of fill of unknown quality during the former landfilling activities in the area of the subject site, prior to 1928.

These activities are all considered to have had the potential to have introducted contamination to the soil and/or groundwater under the subject site.

Subsurface Structures and Utilities

Public and private underground service locates were completed for a 5 m radius around each borehole location, prior to the subsurface investigation. Various underground utilities including public sewers and private drainage lines were identified in the vicinity of the boreholes. No private potable water wells or septic systems are present on the subject site.

Physical Setting

Site Stratigraphy

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is illustrated on Drawing PE3391-4 - Cross-Section A-A'. Stratigraphy consists of:

- Concrete in BH1 and BH2 with a thickness of 0.15 m (interior of building). Asphalt in BH6, BH7 and BH8 with a thickness of 0.05 to 0.06 m.
- Fill, generally consisting of silty sand with gravel (with pieces of slag in BH1 and metal pieces in BH8), varying in thickness from 1.04 to 2.29 m, with deeper fill in the former underground storage tank nest location at BH3 (3.38 m). Groundwater was not observed in this stratigraphic unit.
- Silty sand with gravel, cobbles and possible boulders was identified in BH7 with a thickness of 1.58 m.
- Limestone bedrock - this unit was confirmed in BH1, BH2, BH4, BH6 and BH7 where bedrock was cored to depths between 1.19 to 7.87 m below grade. Groundwater was observed in this stratigraphic unit. This is the deepest unit investigated.

Hydrogeological Characteristics

Groundwater was encountered in the limestone bedrock at the subject site. The upper bedrock unit is interpreted to function as a local aquifer at the subject site.

Water levels were measured at the subject site on November 3, 2008 and on October 15, 2014. Water levels are summarized above in Section 6.2 of this report and are shown on the attached drawings.

Based on the orientation of the groundwater monitoring wells, groundwater contour mapping could not be completed. Based on the monitoring event,

groundwater flow at the subject site appeared to be in a southerly direction. It is possible that the groundwater within the monitoring wells was not stabilized.

Approximate Depth to Bedrock

Bedrock was confirmed in Boreholes BH1, BH2, BH4, BH6 and BH7, where rock was confirmed at depths of 1.19 and 3.10 m below grade.

Approximate Depth to Water Table

The depth to water table at the subject site varies between approximately 2.95 and 6.20 m below existing grade.

Sections 41 and 43.1 of the Regulation

Section 41 of the Regulation (Site Condition Standards, Environmentally Sensitive Areas) does not apply to the subject site.

Section 43.1 of the Regulation does apply to the subject site in that the subject site is a Shallow Soil Property; bedrock is estimated at depths less than 2 m below grade across more than two thirds (2/3) of the entire site. It is not located within 30 m of a water body.

Fill Placement

Fill material was identified at the subject site. As addressed in the Phase I-ESA, contaminated fill deposition was considered to be a potentially contaminating activity, associated with the reported former landfilling activities in the area the subject site.

Proposed Buildings and Other Structures

It is Paterson's understanding that the subject site will be developed with three (3) mixed use (commercial/residential) buildings.

Existing Buildings and Structures

The subject site is currently occupied by two, 2-storey residential dwellings (311 and 315 Tweedsmuir Avenue), a small vacant kiosk (1976 Scott Street) and a commercial building with a partial second storey (320 McRae Avenue). No other buildings or structures are present on the subject site.

Water Bodies

The Ottawa River is the closest body of water to the subject site, located generally to the north of the subject site, with the closest point approximately 800 m west.

Areas of Natural Significance

No areas of natural significance are present on the subject site.

Environmental Condition

Areas Where Contaminants are Present

Based on screening, visual observation and analytical results, suspect fill (pieces of slag) was present in BH1 at depths of 0.91 m and 2.44 m. BH1 is located in the southern portion of the commercial building on the east side of the subject site. The sample submitted from BH3 contained a PHC (F1) concentration above the selected MOE Table 7 standards. The sample recovered from BH3 is representative of a thin layer (approximately 0.10 m thick) of impacted fill in the bottom of the former underground storage tank nest on the northeastern portion of the subject site.

The previous subsurface investigation in 2008 PHC (F3), barium, cadmium, lead, mercury and zinc impacted soil was identified in a sample from BH8, on the east side of the commercial building. Groundwater impacts were identified in the sample recovered from the groundwater monitoring well BH6 in 2008. The sample recovered from BH6, on the north side of the commercial building, contained benzene, chloroform, toluene, xylenes and petroleum (F1) concentrations in excess of the selected MOE Table 7 standards.

The areas where contaminants are present in concentrations greater than the MOE Table 7 standards are shown on Drawing PE3391-3R and PE3391-4, and were encountered in the fill layer for soil and bedrock for groundwater.

Types of Contaminants

Based on the recent analytical testing, contaminants found at concentrations greater than the MOE Table 7 standards at the subject site consist of arsenic and petroleum hydrocarbons fraction 1 in soil. No contaminant concentrations that exceed the MOE Table 7 guidelines were identified in the recent groundwater samples.

Based on the former (2008) investigation, contaminants found at concentrations greater than the MOE Table 7 standards at the subject site consist of PHC (F3), barium, cadmium, lead, mercury and zinc for soil. Contaminants found at concentrations greater than the MOE Table 7 standards in the groundwater at the subject site consist of benzene, chloroform, toluene, xylenes and PHCs (F1).

Contaminated Media

Based on the results of the Phase II ESA, the contaminants of concern are present in the fill at various locations on the subject site. The previous Phase II-ESA identified contaminants in the fill material, as well as, in the groundwater in the northeast portion of the subject property.

What Is Known About Areas Where Contaminants Are Present

Contaminants are located in the vicinity of the commercial structure on the subject site and in the area of the former retail fuel outlet. Based on the nature of the contaminants and their locations, the contaminants are suspected to be from imported poor quality fill, the operation of automotive services garages, autobody shops on the eastern portion of the property and the former operation of the retail fuel outlet on northeastern portion of the subject site.

Distribution of Contaminants

The horizontal distribution of contaminants is shown on Drawing PE3391-3R. Vertically, the soil contaminants were observed in the fill strata in BH1, BH3 and BH8. Suspect fill (traces of slag and metal pieces) was identified in BH1 around 0.91 and 2.44 m below ground surface and in BH8 between 0.30 and 1.10 m. Black fill with a strong petroleum hydrocarbon odour was identified between 3.28 and 3.38 m in BH3.

Groundwater contamination was identified in the previous Phase II-ESA at BH6 and it was inferred that BH4 was contaminated, based on visual and olfactory observations during the 2008 drilling and groundwater monitoring events. The groundwater table was recorded in the 2008 monitoring wells at depths of 2.95 and 4.85 m below ground surface.

Discharge of Contaminants

The source of metal contaminants is considered to be associated with the former landfilling activities in the area of the subject site. The presence of PHC and BTEX contamination is considered to be associated with the use of the subject

site as various automotive service garages and autobody shops, as well as, the former use of the northern portion of the property as a retail fuel outlet. The presence of chloroform in the samples recovered from the monitoring wells is considered to be due to the use of municipally supplied water during drilling activities.

Migration of Contaminants

The migration of metals contaminants within the soil, or from the soil to groundwater, is expected to be limited due to the fact that the groundwater table was encountered primarily within the bedrock, and not within the fill above it. Furthermore, metals are not known to readily dissolve in groundwater.

PHC and BTEX impacts have a greater potential to migrate through the bedrock to the groundwater table and migrate with the groundwater flow. PHC and BTEX contaminants are typically light non-aqueous phase liquids (LNAPLs), which have a specific density less than water, which would mean they would sit atop the groundwater table.

The migration of contaminants within site groundwater is interpreted to be controlled primarily by groundwater flow at the subject site as well as seasonal fluctuations.

Climatic and Meteorological Conditions

In general, climatic and meteorological conditions have the potential to affect contaminant distribution. Two ways by which climatic and meteorological conditions may affect contaminant distribution include the downward leaching of contaminants by means of the infiltration of precipitation, and the migration of contaminants via groundwater levels and/or flow, which may fluctuate seasonally.

Based on analytical test results, it is not likely that downward leaching through the fill layer into the water table has occurred, primarily due to the layer of asphalt covering most of the parking lot and the buildings covering the remainder of the property. Furthermore, metals are not known to readily dissolve in groundwater.

Potential for Vapour Intrusion

The potential for vapour intrusion into the existing buildings is considered to be minimal. Only metals were identified in the soil from the boreholes drilled inside the commercial building.

6.0 CONCLUSIONS

Assessment

A Phase II ESA was conducted for the commercial and residential properties addressed 320 McRae Avenue, 1976 Scott Street, 311 and 315 Tweedsmuir Avenue, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the areas of potential environmental concern (APECs) identified during the Phase I ESA. The APECs included the potential former landfill in the area of the subject site, the former and continued use of the eastern portion of the subject site as various automotive service garages and autobody shops, as well as, the former use of the northern portion of the subject site as a retail fuel outlet.

During a previous investigation in 2008, petroleum hydrocarbon (PHC) fraction F3, barium, cadmium, lead mercury and zinc impacted fill was identified on the east side of the commercial building and impacted groundwater (benzene, chloroform, toluene, xylenes and PHC (F1)) was identified in BH6, on the north side of the commercial building. Field observations indicated the presence of impacted groundwater in BH4, in the former pump island area. This well was not found at the time of the current assessment and could not be assessed.

The 2014 subsurface investigation at the subject site was conducted on October 8 and 9, 2014 and consisted of the drilling of three (3) boreholes and the installation of three (3) groundwater monitoring wells.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. Three (3) soil samples were submitted for laboratory analysis of metals, BTEX and/or PHCs. Arsenic concentrations in BH1 and a petroleum hydrocarbon (PHC) fraction 1 (F1) concentration in BH3 were identified in excess of the selected MOE Table 7 standards. Metals impacted fill in BH1 was visually identified at depths of 0.91 and 2.44 m, while in BH3 a thin layer of PHC impacted fill was identified between 3.28 and 3.38 m below ground surface.

Groundwater samples were obtained from the monitoring wells at BH1 and BH2, and submitted for analysis of PHCs and volatile organic compounds (VOCs). None of the analytical parameters were found to exceed the selected MOE Table 7 standards.

Recommendations

Metal and PHC concentrations in some soils are present at the subject site in concentrations in excess of the selected MOE Table 7 standards. The presence of metals impacted fill beneath the commercial building and petroleum impacts in the former tank nest area are not considered to represent an immediate risk to the current use of the subject site. It is understood that, the site is being considered for redevelopment, at which time further delineation and a remediation of contaminated materials would be practical.

Soil

Any impacted soil removed from the site during redevelopment will require disposal at an approved waste disposal facility. It is recommended that Paterson personnel be present onsite during the soil excavation program to direct excavation activities in the areas where impacted material has been identified or is expected to exist. Additional testing may be required to effectively identify and delineate the impacted fill on the subject site. If any soil is to remain on-site, it is recommended that confirmatory soil samples be collected upon completion of the soil remediation program to ensure that the site is in compliance with the MOE Table 7 Standards.

Groundwater

Groundwater impacts previously identified in 2008 may persist on the northern portion of the subject site. Impacted groundwater was identified in BH6, located to the north of the commercial building and it was inferred in BH4, located in the former pump island location. Consideration should also be given to retesting all groundwater monitoring wells prior to redevelopment activities.

Depending upon the volume of impacted groundwater encountered during future site development, several options may be available to treat the groundwater. The removal of impacted groundwater from the site by a licensed pumping contractor would be a feasible option for smaller volumes, while an on-site treatment system would likely be more economical for larger volumes over a longer period of time. An on-site treatment system would discharge to the City of Ottawa sewer system. Prior to discharging treated groundwater to the municipal sewer system, a Sanitary Sewer Agreement will be required from the City of Ottawa's Sewer Use Program. Additional groundwater monitoring wells may be required following the completion of the site remediation program to ensure that the site meets the MOE Table 7 Standards.

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 the Estate of Carson Unsworth. Permission and notification from the Estate of Carson Unsworth and Paterson will be required to release this report to any other party.

Paterson Group Inc.

Adrian Menyhart, B.Eng.

Mark S. D'Arcy, P.Eng.

Report Distribution:

- The Estate of Carson Unsworth
- Paterson Group

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE3391-3R – TEST HOLE LOCATION PLAN

DRAWING PE3391-4 - CROSS-SECTION A-A’

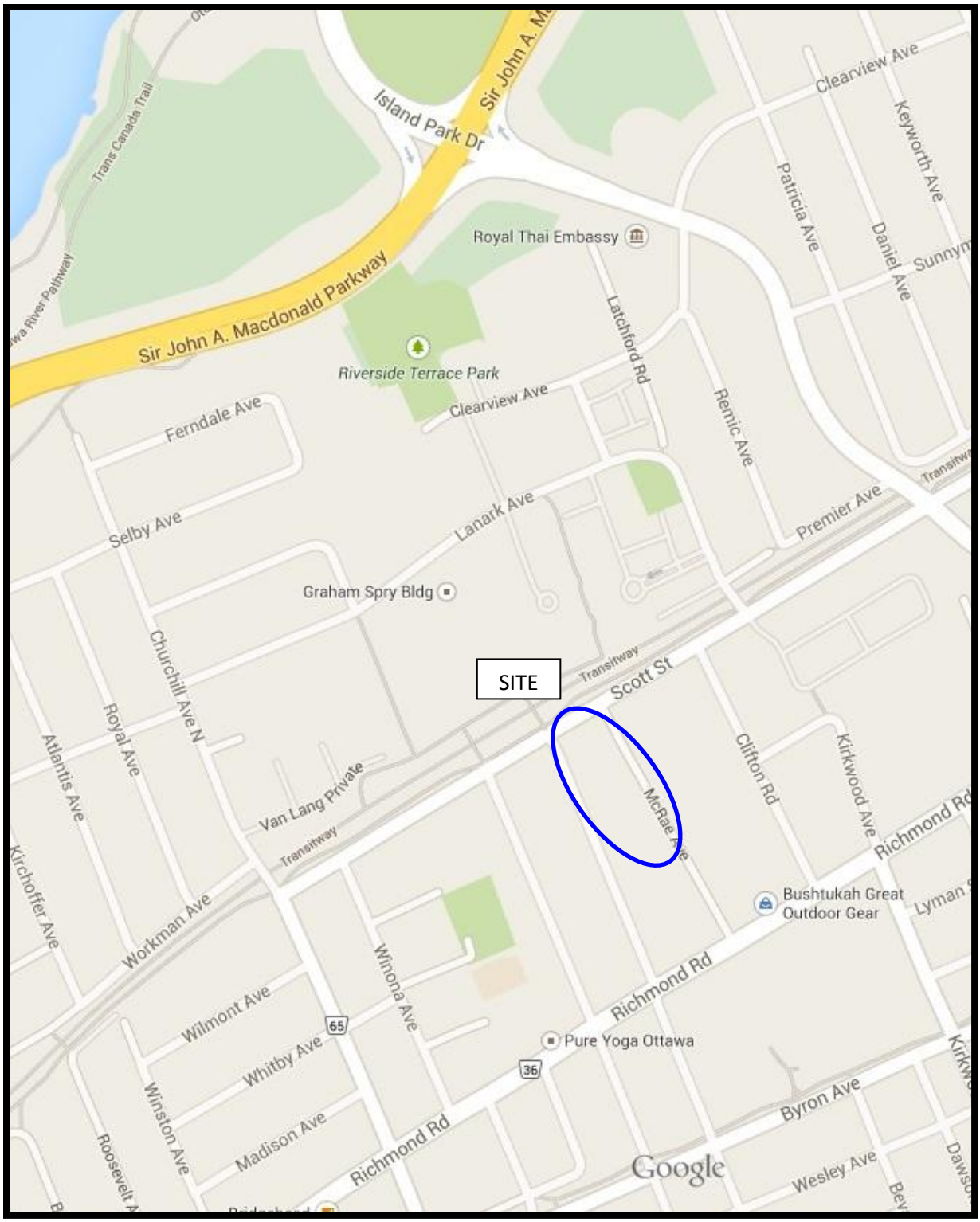
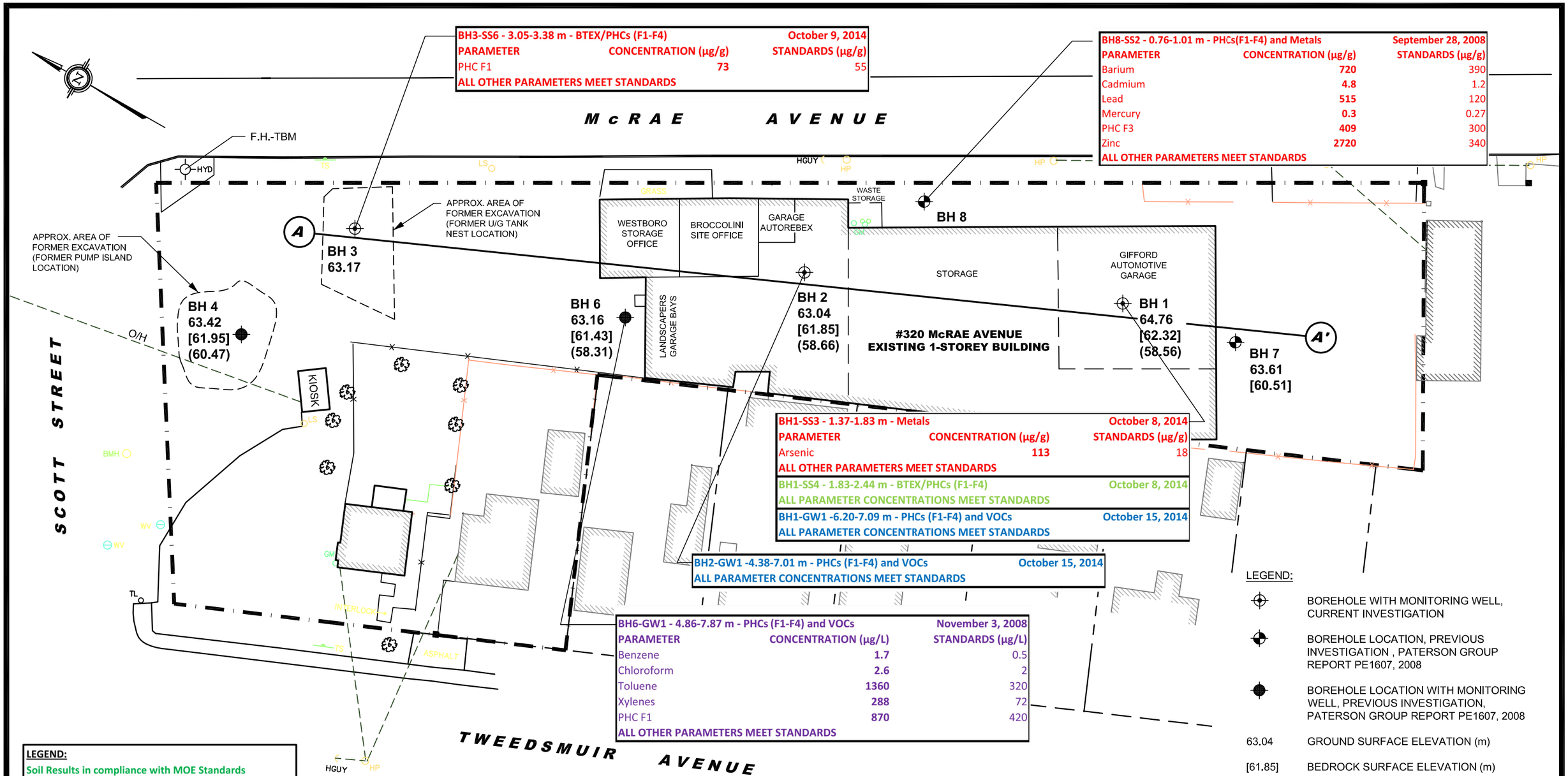


FIGURE 1

KEY PLAN



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NO.	REVISIONS	DATE	INITIAL

THE ESTATE OF CARSON UNSWORTH

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
320 McRAE AVE., 1976 SCOTT ST., 311 AND 315 TWEEDSMUIR AVE.

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:600	Date: 01/2016
Checked by: SM	Report No.: PE3391-2R
Approved by: MSD	Drawing No.: PE3391-3R
Drawn by: MPG	

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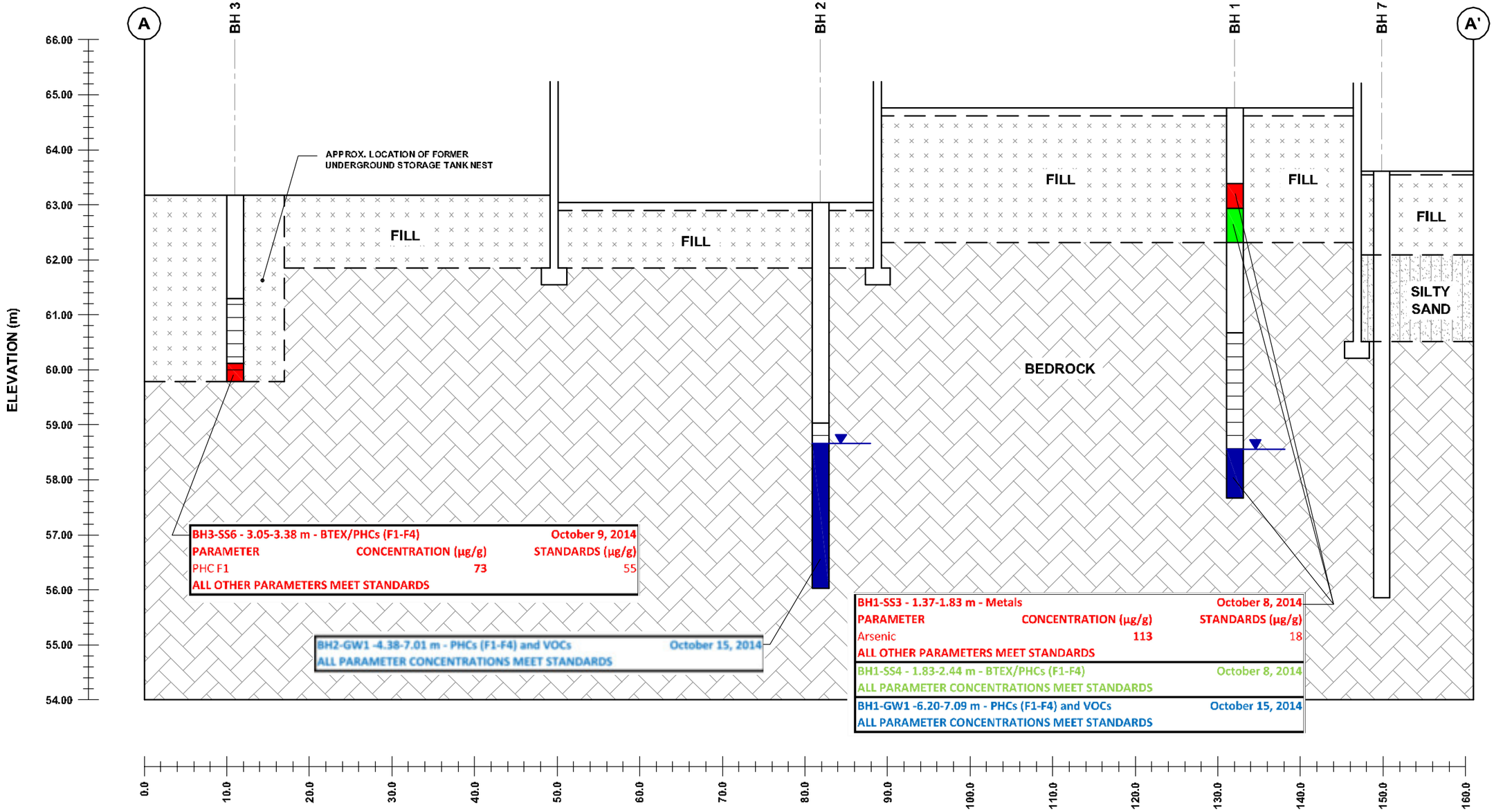

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NO.	REVISIONS	DATE	INITIAL

914168 ONTARIO INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
320 McRAE AVENUE

OTTAWA, ONTARIO

Title:

CROSS-SECTION A-A'

Scale: AS SHOWN	Date: 11/2014
Checked by: SM	Report No.: PE3391-2
Approved by: MSD	Drawing No.: PE3391-4
Drawn by: MPG	

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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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Sampling & Analysis Plan

Phase II ESA
Commercial and Residential Properties
320 McRae Avenue, 1976 Scott Street and
311 Tweedsmuir Avenue
Ottawa, Ontario

Prepared For

The Estate of Carson Unsworth

October 2014

Report: PE3391-SAP

Table of Contents

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by the Estate of Carson Unsworth to conduct a Phase II Environmental Site Assessment (ESA) for the property located at 320 McRae Avenue, 1976 Scott Street and 311 Tweedsmuir Avenue, in the City of Ottawa, Ontario. Based on the results of a 2008 Phase II ESA and the 2014 Phase I ESA completed by Paterson for the subject property, a subsurface investigation program, consisting of borehole drilling, was developed. A geotechnical investigation was conducted concurrently with the environmental subsurface investigation. The summary of the sampling program is provided below in Table 1.

Table 1: Sampling Program Summary

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1	Drill within Gifford Automotive garage in the vicinity of the oil/water separator. Drill and install groundwater monitoring well to assess potential PHC and VOC impacts on soil and/or groundwater.	Drilled to intercept water table for monitoring well installation. Coring bedrock will likely be necessary.
BH2	Drill within Autorebex garage in the vicinity of the oil/water separator. Drill and install groundwater monitoring well to assess potential PHC and VOC impacts on soil and/or groundwater.	Drilled to intercept water table for monitoring well installation. Coring bedrock will likely be necessary.
BH3	Drill within the former underground storage tank nest, on the northern portion of the subject site (1976 Scott Street). Provides general site coverage and assessment of potentially metal impacted fill.	Drilled to base of fill in former underground storage tank nest, intercept water table for monitoring well installation.

All boreholes are considered to be assessing the subject site for the potential presence of deleterious fill, to address the area of potential environmental concern associated with the reported former land-filling activities in the area of the subject site. Borehole locations are shown on the Test Hole Location Plan appended to the main report.

At each borehole, auger and split-spoon samples of overburden soils will be obtained at 0.6 m (2') intervals until approximately 2.0 m below the groundwater level, to intercept groundwater with monitoring wells. All soil samples will be retained, and samples will be selected for submission following a preliminary screening analysis.

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

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 MOE site condition standards.
- In boreholes with evidence of contamination as described above, a sample should be submitted from the stratigraphic unit below the 'worst-case' sample to determine whether the contaminant(s) have migrated downward.
- 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

- 5' x 2" [1.52 m x 50 mm] threaded sections of Schedule 40 PVC slotted well screen (5' x 1¼" [1.52 m x 32 mm] if installing in cored hole in bedrock)
- 5' x 2" [1.52 m x 50 mm] threaded sections of Schedule 40 PVC riser pipe (5' x 1¼" [1.52 m x 32 mm] if installing in cored hole in bedrock)
- Threaded end-cap
- Slip-cap or J-plug
- Asphalt cold patch or concrete
- Silica Sand
- Bentonite chips (Holeplug)
- Steel flushmount casing

Procedure

- Drill borehole to required depth, using drilling and sampling procedures described above.
- If borehole is deeper than required monitoring well, backfill with bentonite chips to required depth. This should only be done on wells where contamination is not suspected, in order to prevent downward migration of contamination.
- Only one monitoring well should be installed per borehole.

- Monitoring wells should not be screened across more than one stratigraphic unit to prevent potential migration of contaminants between units.
- Where LNAPLs are the suspected contaminants of concern, monitoring wells should be screened straddling the water table in order to capture any free product floating on top of the water table.
- Thread the end cap onto a section of screen. Thread second section of screen if required. Thread risers onto screen. Lower into borehole to required depth. Ensure slip-cap or J-plug is inserted to prevent backfill materials entering well.
- As drillers remove augers, backfill borehole annulus with silica sand until the level of sand is approximately 0.3 m above the top of the screen.
- Backfill with holeplug until at least 0.3 m of holeplug is present above the top of the silica sand.
- Backfill remainder of borehole with holeplug or with auger cuttings (if contamination is not suspected).
- Install flushmount casing. Seal space between flushmount and borehole annulus with concrete, cold patch, or holeplug to match surrounding ground surface.

3.3 Monitoring Well Sampling Procedure

Equipment

- Water level metre or interface probe on hydrocarbon/LNAPL sites
- Spray bottles containing water and methanol to clean water level tape or interface probe
- Peristaltic pump
- Polyethylene tubing for peristaltic pump
- Flexible tubing for peristaltic pump
- Latex or nitrile gloves (depending on suspected contaminant)
- Allen keys and/or 9/16” socket wrench to remove well caps

- Graduated bucket with volume measurements
- pH/Temperature/Conductivity combo pen
- Laboratory-supplied sample bottles

Sampling Procedure

- Locate well and use socket wrench or Allan key to open metal flush mount protector cap. Remove plastic well cap.
- Measure water level, with respect to existing ground surface, using water level meter or interface probe. If using interface probe on suspected NAPL site, measure the thickness of free product.
- Measure total depth of well.
- Clean water level tape or interface probe using methanol and water. Change gloves between wells.
- Calculate volume of standing water within well and record.
- Insert polyethylene tubing into well and attach to peristaltic pump. Turn on peristaltic pump and purge into graduated bucket. Purge at least three well volumes of water from the well. Measure and record field chemistry. Continue to purge, measuring field chemistry after every well volume purged, until appearance or field chemistry stabilizes.
- Note appearance of purge water, including colour, opacity (clear, cloudy, silty), sheen, presence of LNAPL, and odour. Note any other unusual features (particulate matter, effervescence (bubbling) of dissolved gas, etc.).
- Fill required sample bottles. If sampling for metals, attach 75-micron filter to discharge tube and filter metals sample. If sampling for VOCs, use low flow rate to ensure continuous stream of non-turbulent flow into sample bottles. Ensure no headspace is present in VOC vials.
- Replace well cap and flushmount casing cap.

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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

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

5.0 DATA QUALITY OBJECTIVES

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

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

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

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

For the purpose of calculating the RPD, it is desirable to select field duplicates from samples for which parameters are present in concentrations above laboratory detection limits, i.e. samples which are expected to be contaminated.

If parameters are below laboratory detection limits for selected samples or duplicates, the RPD may be calculated using a concentration equal to one half (0.5 x) the laboratory detection limit.

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

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS TO SAMPLING & ANALYSIS PLAN

Physical impediments to the Sampling and Analysis plan may include:

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

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

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
320 McRae Avenue
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the northwest corner of subject site. Geodetic elevation = 64.445m.

FILE NO. PE3391

REMARKS

HOLE NO. BH 1

BORINGS BY Portable Drill **DATE** October 8, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	64.76
Concrete slab 0.15		AU	1				
FILL: Crushed stone 0.36		SS	2	82			
		RC	1	10		1	63.76
FILL: Brown silty sand with gravel, some cobbles and boulders		SS	3	17			
		SS	4	50		2	62.76
2.44		RC	2	100	100		
		RC	3	67	33		
		RC	4	90	40	3	61.76
		RC	5	96	21		
						4	60.76
BEDROCK: Grey limestone		RC	6	100	58		
		RC	7	100	90	5	59.76
		RC	8	33	0		
						6	58.76
		RC	9	100	94		
7.09						7	57.76
End of Borehole							
(GWL @ 6.20m-October 15, 2014)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
320 McRae Avenue
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the northwest corner of subject site. Geodetic elevation = 64.445m.

REMARKS

FILE NO. PE3391

HOLE NO. BH 2

BORINGS BY Portable Drill **DATE** October 8, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	63.04
Concrete slab 0.15		AU	1				
FILL: Crushed stone		RC	1	11	0	1	62.04
1.19		RC	2	60	0		
		RC	3	69	44		
		RC	4	100	0	2	61.04
		RC	5	100	56		
		RC	6	90	87	3	60.04
BEDROCK: Grey limestone		RC	8	100	75	4	59.04
		RC	9	100	89	5	58.04
						6	57.04
7.01						7	56.04
End of Borehole							
(GWL @ 4.38m-October 15, 2014)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
320 McRae Avenue
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the northwest corner of subject site. Geodetic elevation = 64.445m.

REMARKS

FILE NO. PE3391

HOLE NO. BH 3

BORINGS BY Portable Drill **DATE** October 8, 2014

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	63.17		
		AU	1						
		SS	2	50		1	62.17		
FILL: Brown silty sand with gravel		SS	3	50					
		SS	4	100		2	61.17		
		SS	5	100					
		SS	6	92		3	60.17	242	
3.38									
End of Borehole									
(BH dry - October 15, 2014)									

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

Phase I-II Environmental Site Assessment
319 and 320 McRae Avenue
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant at the intersection of McRae Avenue and Scott Street, elevation = 64.445m.

FILE NO. PE1607

REMARKS

HOLE NO. BH 1

BORINGS BY CME 75 Power Auger **DATE** October 27, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	64.61
Asphaltic concrete 0.05							
FILL: Crushed stone 0.20							
FILL: Sand and gravel							
0.91							
		SS	1	27	45	1	63.61
GLACIAL TILL: Grey silty sand with gravel, cobbles, boulders		SS	2	33	50+		
		AU	3				
1.97						2	62.61
		RC	1	100	0		
						3	61.61
		RC	2	100	27		
						4	60.61
BEDROCK: Grey limestone							
		RC	3	95	85	5	59.61
						6	58.61
		RC	4	99	96		
						7	57.61
		RC	5	100	100		
7.80							
End of Borehole							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase I-II Environmental Site Assessment
319 and 320 McRae Avenue
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant at the intersection of McRae Avenue and Scott Street, elevation = 64.445m.

FILE NO. PE1607

REMARKS

HOLE NO. BH 2

BORINGS BY CME 75 Power Auger **DATE** October 27, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	64.34
FILL: Sand and gravel 0.08							
FILL: Crushed stone 0.20		AU	1				
FILL: Sand and gravel 0.91						1	63.34
GLACIAL TILL: Grey silty sand with gravel and rock fragments		SS	2	33	23		
		SS	3	25	50+		
1.98 End of Borehole							
Practical refusal to augering @ 1.98m 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 I-II Environmental Site Assessment
319 and 320 McRae Avenue
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant at the intersection of McRae Avenue and Scott Street, elevation = 64.445m.

FILE NO. PE1607

REMARKS

HOLE NO. BH 3

BORINGS BY CME 75 Power Auger **DATE** October 27, 2008

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: Crushed stone						0	64.42		
0.25									
FILL: Sand and gravel		AU	1						
0.91									
GLACIAL TILL: Brown silty sand with gravel, cobbles, boulders		SS	2	50	63	1	63.42		
1.52									
End of Borehole									
Practical refusal to augering @ 1.52m 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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SOIL PROFILE AND TEST DATA

Phase I-II Environmental Site Assessment
319 and 320 McRae Avenue
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant at the intersection of McRae Avenue and Scott Street, elevation = 64.445m.

FILE NO. PE1607

REMARKS

HOLE NO. BH 4

BORINGS BY CME 75 Power Auger **DATE** October 27, 2010

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	63.42
FILL: Sand and gravel		AU	1				
		SS	2	42	41	1	62.42
1.47							
		RC	1	89	77	2	61.42
		RC	2	97	83	3	60.42
BEDROCK: Grey limestone						4	59.42
		RC	3	93	87	5	58.42
		RC	4	98	83	6	57.42
		RC	5	78	78	7	56.42
7.75							
End of Borehole							
(GWL @ 2.95m-Nov. 3/08)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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SOIL PROFILE AND TEST DATA

Phase I-II Environmental Site Assessment
319 and 320 McRae Avenue
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant at the intersection of McRae Avenue and Scott Street, elevation = 64.445m.

FILE NO. PE1607

REMARKS

HOLE NO. BH 5

BORINGS BY CME 75 Power Auger **DATE** October 27, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	64.27
Asphaltic concrete 0.05							
FILL: Crushed stone 0.20		AU	1				
FILL: Sand and gravel							
0.91		SS	2		50+	1	63.27
Brown **SILTY SAND** , trace gravel							
1.58		RC	1	87	52	2	62.27
		RC	2	97	85	3	61.27
BEDROCK: Grey limestone						4	60.27
		RC	3	98	93	5	59.27
						6	58.27
		RC	4	95	95	7	57.27
		RC	5	100	92		
7.80							
End of Borehole							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase I-II Environmental Site Assessment
319 and 320 McRae Avenue
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant at the intersection of McRae Avenue and Scott Street, elevation = 64.445m.

FILE NO. PE1607

REMARKS

HOLE NO. BH 6

BORINGS BY CME 75 Power Auger **DATE** October 27, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	63.16
Asphaltic concrete 0.05							
FILL: Brown silty sand with gravel and crushed stone 0.46		AU	1				
FILL: Brown silty sand with cobbles and boulders		SS	2	12	50+	1	62.16
1.73		SS	3	17	50+		
		RC	1	78	42	2	61.16
		RC	2	100	85	3	60.16
BEDROCK: Grey limestone						4	59.16
		RC	3	100	95	5	58.16
						6	57.16
		RC	4	100	95		
						7	56.16
		RC	5	100	100		
7.87							
End of Borehole							
(GWL @ 4.85m-Nov. 3/08)							

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 I-II Environmental Site Assessment
319 and 320 McRae Avenue
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant at the intersection of McRae Avenue and Scott Street, elevation = 64.445m.

FILE NO. PE1607

REMARKS

HOLE NO. BH 7

BORINGS BY CME 75 Power Auger **DATE** October 27, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	63.61
Asphaltic concrete 0.06							
FILL: Crushed stone 0.20		AU	1				
FILL: Sand and gravel		SS	2	40	50+	1	62.61
1.52		SS	3	0	50+		
		AU	5			2	61.61
Grey-brown **SILTY SAND** with gravel, cobbles and boulders		SS	4	0	50+		
3.10		RC	1	92	92	3	60.61
						4	59.61
BEDROCK: Grey limestone		RC	2	100	80	5	58.61
						6	57.61
		RC	3	98	98		
						7	56.61
		RC	4	100	100		
7.75 End of Borehole							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase I-II Environmental Site Assessment
319 and 320 McRae Avenue
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant at the intersection of McRae Avenue and Scott Street, elevation = 64.445m.

FILE NO. PE1607

REMARKS

HOLE NO. BH 8

BORINGS BY CME 75 Power Auger **DATE** October 28, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
Asphaltic concrete 0.05							
FILL: Crushed stone 0.30		AU	1				
FILL: Brown sand and gravel with pieces of metal							
1.01		SS	2	21	50+	1	
End of Borehole							
Practical refusal to augering @ 1.01m 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

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

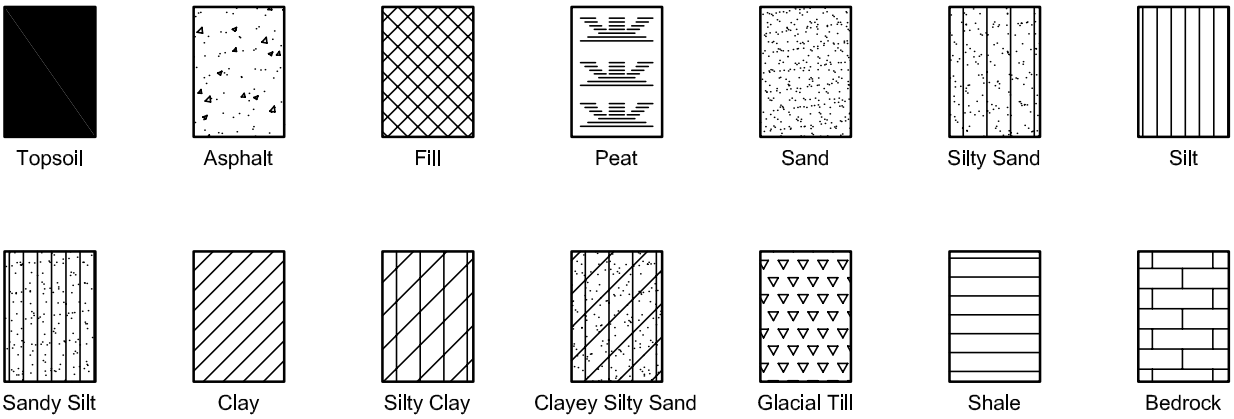
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

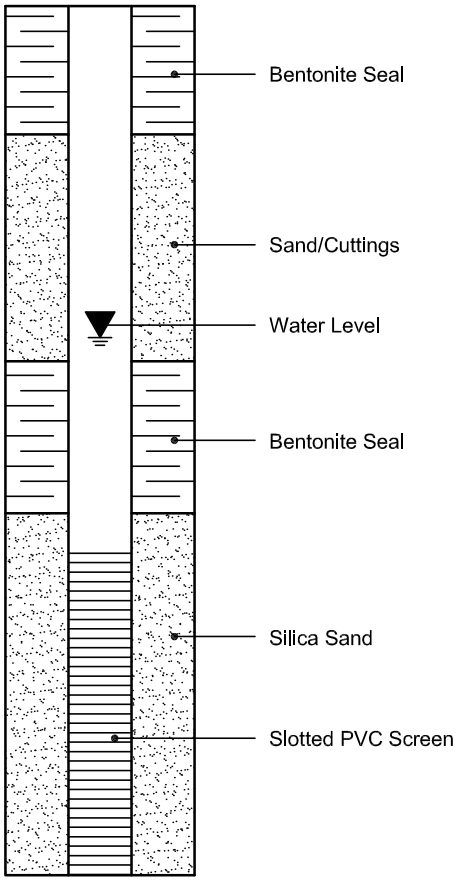
SYMBOLS AND TERMS (continued)

STRATA PLOT

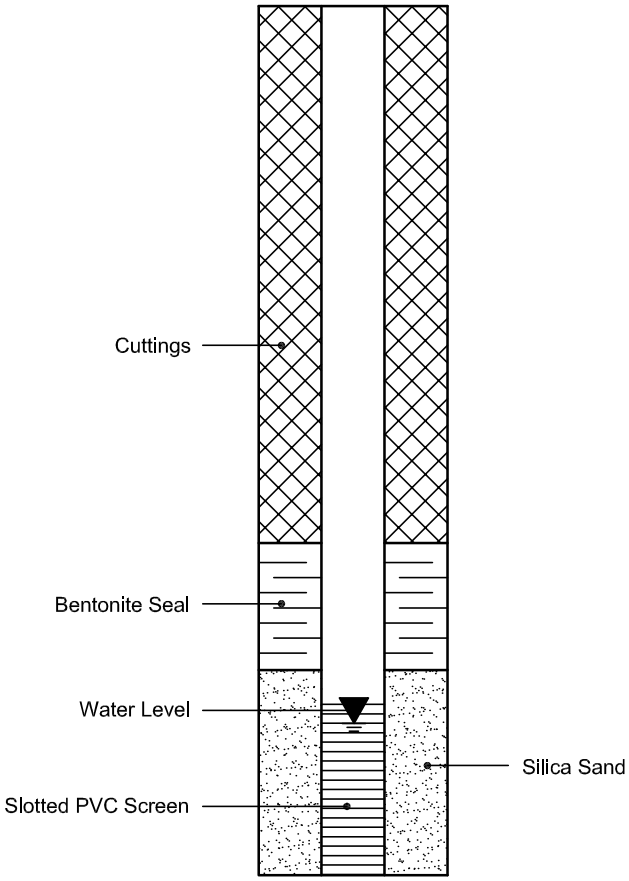


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

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

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

Client PO: 7289
Project: PE1607
Custody:

Report Date: 3-Nov-2008
Order Date: 29-Oct-2008
Order #: 0844088

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

Paracel ID	Client ID
0844088-01	BH1-SS1
0844088-02	BH8-SS2

Approved By: Mark Foto

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

PARACEL LABORATORIES LTD.

Order #: 0844088

Certificate of Analysis

Report Date: 03-Nov-2008
Order Date:29-Oct-2008

Client: **Paterson Group Consulting Engineers**

Client PO: 7289 Project Description: PE1607

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Boron, available	MOE (HWE), EPA 200.8 - ICP-MS	30-Oct-08	30-Oct-08
CCME PHC F1	CWS Tier 1 - P&T GC-FID	29-Oct-08	2-Nov-08
CCME PHC F2 - F4	CWS Tier 1 - GC-FID, extraction	31-Oct-08	1-Nov-08
Chromium, hexavalent	MOE E3056 - Extraction, colourimetric	30-Oct-08	30-Oct-08
Mercury	EPA 7471A - CVAA, digestion	30-Oct-08	30-Oct-08
Metals	EPA 6020 - Digestion - ICP-MS	30-Oct-08	30-Oct-08
Solids, %	Gravimetric, calculation	30-Oct-08	30-Oct-08

PARACEL LABORATORIES LTD.

Order #: 0844088

Certificate of Analysis

Report Date: 03-Nov-2008
Order Date:29-Oct-2008

Client: **Paterson Group Consulting Engineers**

Client PO: 7289 Project Description: PE1607

	Client ID:	BH1-SS1	BH8-SS2	-	-
	Sample Date:	27-Oct-08	27-Oct-08	-	-
	Sample ID:	0844088-01	0844088-02	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	91.7	81.4	-	-
Metals					
Antimony	1 ug/g dry	-	<1	-	-
Arsenic	1 ug/g dry	-	18	-	-
Barium	10 ug/g dry	-	720	-	-
Beryllium	0.5 ug/g dry	-	0.6	-	-
Boron, available	0.5 ug/g dry	-	1.5	-	-
Cadmium	0.5 ug/g dry	-	4.8	-	-
Chromium	5 ug/g dry	-	89	-	-
Chromium (VI)	0.4 ug/g dry	-	<0.4	-	-
Cobalt	5 ug/g dry	-	13	-	-
Copper	5 ug/g dry	-	90	-	-
Iron	200 ug/g dry	-	41900	-	-
Lead	1 ug/g dry	-	515	-	-
Mercury	0.1 ug/g dry	-	0.3	-	-
Molybdenum	1 ug/g dry	-	2	-	-
Nickel	5 ug/g dry	-	34	-	-
Selenium	1 ug/g dry	-	1	-	-
Silver	0.3 ug/g dry	-	0.5	-	-
Thallium	1 ug/g dry	-	<1	-	-
Vanadium	10 ug/g dry	-	38	-	-
Zinc	20 ug/g dry	-	2720	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	10 ug/g dry	12	<10	-	-
F2 PHCs (C10-C16)	10 ug/g dry	1330	33	-	-
F3 PHCs (C16-C34)	10 ug/g dry	809	409	-	-
F4 PHCs (C34-C50)	10 ug/g dry	63	1130 [1]	-	-

Certificate of Analysis

Report Date: 03-Nov-2008
Order Date:29-Oct-2008

Client: **Paterson Group Consulting Engineers**

Client PO: 7289 Project Description: PE1607

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	10	ug/g						
F2 PHCs (C10-C16)	ND	10	ug/g						
F3 PHCs (C16-C34)	ND	10	ug/g						
F4 PHCs (C34-C50)	ND	10	ug/g						
Metals									
Antimony	ND	1	ug/g						
Arsenic	ND	1	ug/g						
Barium	ND	10	ug/g						
Beryllium	ND	0.5	ug/g						
Boron, available	ND	0.5	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (VI)	ND	0.4	ug/g						
Chromium	ND	5	ug/g						
Cobalt	ND	5	ug/g						
Copper	ND	5	ug/g						
Iron	ND	200	ug/g						
Lead	ND	1	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1	ug/g						
Nickel	ND	5	ug/g						
Selenium	ND	1	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1	ug/g						
Vanadium	ND	10	ug/g						
Zinc	ND	20	ug/g						

PARACEL

Order #: 0844088

Certificate of Analysis

Report Date: 03-Nov-2008
Order Date:29-Oct-2008

Client: **Paterson Group Consulting Engineers**

Client PO: 7289 Project Description: PE1607

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	10	ug/g dry	ND				32	
F2 PHCs (C10-C16)	ND	10	ug/g dry	ND				50	
F3 PHCs (C16-C34)	ND	10	ug/g dry	ND				50	
F4 PHCs (C34-C50)	ND	10	ug/g dry	ND				50	
Metals									
Antimony	ND	1	ug/g dry	ND				26	
Arsenic	3.0	1	ug/g dry	3.2			6.5	35	
Barium	132	10	ug/g dry	140			5.3	34	
Beryllium	0.67	0.5	ug/g dry	0.65			3.7	25	
Boron, available	1.19	0.5	ug/g dry	1.08			9.3	35	
Cadmium	ND	0.5	ug/g dry	ND				33	
Chromium (VI)	ND	0.4	ug/g dry	ND				35	
Chromium	21.4	5	ug/g dry	22.4			4.6	32	
Cobalt	9.1	5	ug/g dry	9.5			5.3	32	
Copper	58.8	5	ug/g dry	62.9			6.6	32	
Iron	18900	200	ug/g dry	20000			5.6	32	
Lead	136	1	ug/g dry	145			6.2	44	
Mercury	0.402	0.1	ug/g dry	0.406			0.7	35	
Molybdenum	ND	1	ug/g dry	ND				29	
Nickel	20.2	5	ug/g dry	21.4			6.0	29	
Selenium	ND	1	ug/g dry	ND				28	
Silver	0.51	0.3	ug/g dry	0.53			3.6	28	
Thallium	ND	1	ug/g dry	ND				27	
Vanadium	27.3	10	ug/g dry	28.5			4.3	27	
Zinc	147	20	ug/g dry	150			2.3	27	
Physical Characteristics									
% Solids	91.2	0.1	% by Wt.	91.7			0.5	25	
Volatiles									
Benzene	ND	0.002	ug/g dry	ND				50	
Ethylbenzene	ND	0.002	ug/g dry	ND				34	
Toluene	ND	0.002	ug/g dry	ND				32	
m,p-Xylenes	ND	0.002	ug/g dry	ND				35	
o-Xylene	ND	0.002	ug/g dry	ND				50	
Surrogate: Toluene-d8	*0.156*		*ug/g dry*	*ND*	*108*	*76-118*			

Certificate of Analysis

Report Date: 03-Nov-2008
Order Date:29-Oct-2008

Client: **Paterson Group Consulting Engineers**

Client PO: 7289 Project Description: PE1607

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	102	10	ug/g	ND	102	80-120			
F2 PHCs (C10-C16)	80	10	ug/g	ND	100	61-129			
F3 PHCs (C16-C34)	250	10	ug/g	ND	125	61-129			
F4 PHCs (C34-C50)	150	10	ug/g	ND	125	61-129			
Metals									
Antimony	41.8		ug/L	ND	83.5	80-120			
Arsenic	47.4		ug/L	ND	94.7	80-120			
Barium	47.7		ug/L	ND	95.4	80-120			
Beryllium	44.3		ug/L	ND	88.5	80-120			
Boron, available	4.14	0.5	ug/g	1.08	61.1	70-122			QS-02
Cadmium	47.4		ug/L	ND	94.7	80-120			
Chromium (VI)	5.2	0.4	ug/g	ND	104	89-123			
Chromium	48.8		ug/L	ND	97.7	80-120			
Cobalt	48.2		ug/L	ND	96.3	80-120			
Copper	47.4		ug/L	ND	94.8	80-120			
Iron	1020		ug/L	ND	102	80-120			
Lead	45.8		ug/L	ND	91.7	80-120			
Mercury	1.80	0.1	ug/g	0.406	92.9	72-128			
Molybdenum	46.4		ug/L	ND	92.8	80-120			
Nickel	47.8		ug/L	ND	95.6	80-120			
Selenium	46.8		ug/L	ND	93.6	80-120			
Silver	46.9		ug/L	ND	93.8	80-120			
Thallium	48.2		ug/L	ND	96.3	80-120			
Vanadium	48.5		ug/L	ND	97.0	80-120			
Zinc	46.0		ug/L	ND	91.9	80-120			
Volatiles									
Benzene	0.0643	0.002	ug/g	ND	94.6	55-141			
Ethylbenzene	0.0575	0.002	ug/g	ND	84.6	61-139			
Toluene	0.0596	0.002	ug/g	ND	87.6	54-136			
m,p-Xylenes	0.103	0.002	ug/g	ND	75.6	61-139			
o-Xylene	0.0524	0.002	ug/g	ND	77.0	60-142			
Surrogate: Toluene-d8	*0.122*		*ug/g*		*89.9*	*76-118*			

PARACEL LABORATORIES LTD.

Order #: 0844088

Certificate of Analysis

Report Date: 03-Nov-2008
Order Date:29-Oct-2008

Client: **Paterson Group Consulting Engineers**

Client PO: 7289 Project Description: PE1607

Sample and QC Qualifiers Notes

1- ORG01 : FID signal did not return to baseline by C50

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

Sample Data Revisions

None

Work Order Revisions/Comments:

None

Other Report Notes:

n/a: not applicable

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 Record

№ 51990

Pg. 1 of 1

Company Name: Patterson Group
Contact Name: Mark D'Arcy
Address: Unit 1, 28 Concourse Gate
Tel: 613 226 7381 FAX: 226 6344
Email: MDarcy@Pattersongroup.ca

Project Ref: PE1607
PO# 7289
Quote # ____ ☑ Not Quoted

Preservative to be added by Paracel? ☐ Yes ☒ No

Date Required: ____

Turn Around Time: ☐ 1-day ☐ 2-day ☑ Regular

Regulatory/Guideline Requirements: MOE Table 1

Matrix Types: S-Soil/Sed GW-Ground Water SW-Surface Water SS-Storm/Sanitary Sewer A-Air O-Other RDW-Regulated Drinking Water

	Sample Information					Analysis Required													
	Paracel Order #: 08 44088 / Sample Identification	Matrix	Air Volume	# Containers	Date Sampled dd/mm/yy	PHCs (F_1-F_4)	BTEX	METALS											Hazardous? (Y/N)
1	BH 1 - SS1	S	X	1	Sept. 27 2008	✓	✓												
2	BH 8 - SS 2	S	X	1	SEPT. 28 2008	✓		✓											
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Comments: Combined Sample date o/b Oct. Not Sept.

Relinquished By	Received at Depot	Received at Lab	Verified By
Mark LAMONDE			M Bloom
Date: 29 Oct 08 Time: 1000.	Date: Time:	Date: 29/10/08 Time: 12:00	Date: 29/10/08 Time: 12:24

Please refer to the back page for Locations and Sample Preservation, Container and Hold Time Requirements.

WHITE - Lab Copy, PINK - Client Copy

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Certificate of Analysis

Paterson Group Consulting Engineers

28 Concourse Gate, Unit 1
Nepean, ON K2E 7T7
Attn: Dena Comley

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

Client PO: 6526
Project: PE1607
Custody: 51995

Report Date: 6-Nov-2008
Order Date: 3-Nov-2008
Order #: 0845027

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

Paracel ID	Client ID
0845027-01	BH6 GW1

Approved By: Mark Foto

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

PARACEL LABORATORIES LTD.

Order #: 0845027

Certificate of Analysis

Report Date: 06-Nov-2008
Order Date:3-Nov-2008

Client: **Paterson Group Consulting Engineers**

Client PO: 6526 Project Description: PE1607

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
CCME PHC F1	CWS Tier 1 - P&T GC-FID	3-Nov-08	4-Nov-08
CCME PHC F2 - F4	CWS Tier 1 - GC-FID, extraction	5-Nov-08	6-Nov-08
VOCs	EPA 624 - P&T GC-MS	3-Nov-08	4-Nov-08

PARACEL LABORATORIES LTD.

Order #: 0845027

Certificate of Analysis

Report Date: 06-Nov-2008
Order Date:3-Nov-2008

Client: **Paterson Group Consulting Engineers**

Client PO: 6526 Project Description: PE1607

	Client ID:	BH6 GW1	-	-	-
	Sample Date:	03-Nov-08	-	-	-
	Sample ID:	0845027-01	-	-	-
	MDL/Units	Water	-	-	-
Volatiles					
Benzene	0.5 ug/L	1.7	-	-	-
Bromodichloromethane	0.4 ug/L	<0.4	-	-	-
Bromoform	0.5 ug/L	<0.5	-	-	-
Bromomethane	0.7 ug/L	<0.7	-	-	-
Carbon Tetrachloride	0.5 ug/L	<0.5	-	-	-
Chlorobenzene	0.4 ug/L	<0.4	-	-	-
Chloroethane	1.0 ug/L	<1.0	-	-	-
Chloroform	0.5 ug/L	2.6	-	-	-
Chloromethane	3.0 ug/L	<3.0	-	-	-
Dibromochloromethane	0.5 ug/L	<0.5	-	-	-
1,2-Dibromoethane	1.0 ug/L	<1.0	-	-	-
1,2-Dichlorobenzene	0.4 ug/L	<0.4	-	-	-
1,3-Dichlorobenzene	0.4 ug/L	<0.4	-	-	-
1,4-Dichlorobenzene	0.4 ug/L	<0.4	-	-	-
1,1-Dichloroethane	0.5 ug/L	<0.5	-	-	-
1,2-Dichloroethane	0.5 ug/L	<0.5	-	-	-
1,1-Dichloroethylene	0.5 ug/L	<0.5	-	-	-
cis-1,2-Dichloroethylene	0.4 ug/L	<0.4	-	-	-
trans-1,2-Dichloroethylene	1.0 ug/L	<1.0	-	-	-
1,2-Dichloropropane	0.5 ug/L	<0.5	-	-	-
cis-1,3-Dichloropropylene	0.4 ug/L	<0.4	-	-	-
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	-	-	-
Ethylbenzene	0.5 ug/L	52.2	-	-	-
Methylene Chloride	4.0 ug/L	<4.0	-	-	-
Styrene	0.4 ug/L	<0.4	-	-	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	-	-	-
1,1,2,2-Tetrachloroethane	0.6 ug/L	<0.6	-	-	-
Tetrachloroethylene	0.5 ug/L	<0.5	-	-	-
Toluene	0.5 ug/L	1360	-	-	-
1,1,1-Trichloroethane	0.4 ug/L	<0.4	-	-	-
1,1,2-Trichloroethane	0.6 ug/L	<0.6	-	-	-

PARACEL LABORATORIES LTD.

Order #: 0845027

Certificate of Analysis

Report Date: 06-Nov-2008
Order Date:3-Nov-2008

Client: **Paterson Group Consulting Engineers**

Client PO: 6526 Project Description: PE1607

	Client ID:	BH6 GW1	-	-	-
	Sample Date:	03-Nov-08	-	-	-
	Sample ID:	0845027-01	-	-	-
	MDL/Units	Water	-	-	-
Trichloroethylene	0.4 ug/L	<0.4	-	-	-
Trichlorofluoromethane	1.0 ug/L	<1.0	-	-	-
1,3,5-Trimethylbenzene	0.5 ug/L	1.7	-	-	-
Vinyl chloride	0.4 ug/L	<0.4	-	-	-
m,p-Xylenes	0.5 ug/L	288	-	-	-
o-Xylene	0.5 ug/L	78.5	-	-	-
4-Bromofluorobenzene	Surrogate	101%	-	-	-
Dibromofluoromethane	Surrogate	95.4%	-	-	-
Toluene-d8	Surrogate	97.8%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	200 ug/L	870	-	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	-	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	-	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	-	-	-

Certificate of Analysis

Report Date: 06-Nov-2008
Order Date:3-Nov-2008

Client: **Paterson Group Consulting Engineers**

Client PO: 6526 Project Description: PE1607

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	200	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.4	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.7	ug/L						
Carbon Tetrachloride	ND	0.5	ug/L						
Chlorobenzene	ND	0.4	ug/L						
Chloroethane	ND	1.0	ug/L						
Chloroform	ND	0.5	ug/L						
Chloromethane	ND	3.0	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
1,2-Dibromoethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.4	ug/L						
1,3-Dichlorobenzene	ND	0.4	ug/L						
1,4-Dichlorobenzene	ND	0.4	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	0.4	ug/L						
trans-1,2-Dichloroethylene	ND	1.0	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.4	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Methylene Chloride	ND	4.0	ug/L						
Styrene	ND	0.4	ug/L						
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L						
1,1,2,2-Tetrachloroethane	ND	0.6	ug/L						
Tetrachloroethylene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
1,1,1-Trichloroethane	ND	0.4	ug/L						
1,1,2-Trichloroethane	ND	0.6	ug/L						
Trichloroethylene	ND	0.4	ug/L						
Trichlorofluoromethane	ND	1.0	ug/L						
1,3,5-Trimethylbenzene	ND	0.5	ug/L						
Vinyl chloride	ND	0.4	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Surrogate: 4-Bromofluorobenzene	*81.1*		*ug/L*		*101*	*83-134*			
Surrogate: Dibromofluoromethane	*76.6*		*ug/L*		*95.7*	*78-124*			
Surrogate: Toluene-d8	*75.8*		*ug/L*		*94.8*	*76-118*			

PARACEL LABORATORIES LTD.

Order #: 0845027

Certificate of Analysis

Report Date: 06-Nov-2008
Order Date:3-Nov-2008

Client: **Paterson Group Consulting Engineers**

Client PO: 6526 Project Description: PE1607

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	200	ug/L	ND				32	
Volatiles									
Benzene	ND	0.5	ug/L	ND				20	
Bromodichloromethane	ND	0.4	ug/L	ND				25	
Bromoform	ND	0.5	ug/L	ND				25	
Bromomethane	ND	0.7	ug/L	ND				25	
Carbon Tetrachloride	ND	0.5	ug/L	ND				25	
Chlorobenzene	ND	0.4	ug/L	ND				25	
Chloroethane	ND	1.0	ug/L	ND				25	
Chloroform	ND	0.5	ug/L	ND				19	
Chloromethane	ND	3.0	ug/L	ND				25	
Dibromochloromethane	ND	0.5	ug/L	ND				25	
1,2-Dibromoethane	ND	1.0	ug/L	ND				25	
1,2-Dichlorobenzene	ND	0.4	ug/L	ND				25	
1,3-Dichlorobenzene	ND	0.4	ug/L	ND				25	
1,4-Dichlorobenzene	ND	0.4	ug/L	ND				25	
1,1-Dichloroethane	ND	0.5	ug/L	ND				21	
1,2-Dichloroethane	ND	0.5	ug/L	ND				25	
1,1-Dichloroethylene	ND	0.5	ug/L	ND				21	
cis-1,2-Dichloroethylene	ND	0.4	ug/L	ND				20	
trans-1,2-Dichloroethylene	ND	1.0	ug/L	ND				25	
1,2-Dichloropropane	ND	0.5	ug/L	ND				25	
cis-1,3-Dichloropropylene	ND	0.4	ug/L	ND				25	
trans-1,3-Dichloropropylene	ND	0.5	ug/L	ND				25	
Ethylbenzene	ND	0.5	ug/L	ND				35	
Methylene Chloride	ND	4.0	ug/L	ND				25	
Styrene	ND	0.4	ug/L	ND				25	
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L	ND				25	
1,1,2,2-Tetrachloroethane	ND	0.6	ug/L	ND				25	
Tetrachloroethylene	ND	0.5	ug/L	ND				31	
Toluene	ND	0.5	ug/L	ND				30	
1,1,1-Trichloroethane	ND	0.4	ug/L	ND				25	
1,1,2-Trichloroethane	ND	0.6	ug/L	ND				25	
Trichloroethylene	ND	0.4	ug/L	ND				30	
Trichlorofluoromethane	ND	1.0	ug/L	ND				25	
1,3,5-Trimethylbenzene	ND	0.5	ug/L	ND				20	
Vinyl chloride	ND	0.4	ug/L	ND				25	
m,p-Xylenes	ND	0.5	ug/L	ND				34	
o-Xylene	ND	0.5	ug/L	ND				32	
Surrogate: 4-Bromofluorobenzene	*80.4*		*ug/L*	*ND*	*100*	*83-134*			
Surrogate: Dibromofluoromethane	*72.2*		*ug/L*	*ND*	*90.3*	*78-124*			
Surrogate: Toluene-d8	*76.5*		*ug/L*	*ND*	*95.6*	*76-118*			

Certificate of Analysis

Report Date: 06-Nov-2008
Order Date:3-Nov-2008

Client: **Paterson Group Consulting Engineers**

Client PO: 6526 Project Description: PE1607

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1980	200	ug/L	ND	98.8	68-117			
F2 PHCs (C10-C16)	1520	100	ug/L	ND	94.9	61-129			
F3 PHCs (C16-C34)	4560	100	ug/L	ND	114	61-129			
F4 PHCs (C34-C50)	2540	100	ug/L	ND	106	61-129			
Volatiles									
Benzene	40.3	0.5	ug/L	ND	101	55-141			
Bromodichloromethane	34.7	0.4	ug/L	ND	86.7	52-139			
Bromoform	37.2	0.5	ug/L	ND	93.0	52-170			
Bromomethane	23.6	0.7	ug/L	ND	59.1	32-138			
Carbon Tetrachloride	30.3	0.5	ug/L	ND	75.8	49-149			
Chlorobenzene	36.0	0.4	ug/L	ND	89.9	64-137			
Chloroethane	30.9	1.0	ug/L	ND	77.3	39-152			
Chloroform	37.0	0.5	ug/L	ND	92.6	58-138			
Chloromethane	28.8	3.0	ug/L	ND	72.0	24-163			
Dibromochloromethane	35.4	0.5	ug/L	ND	88.5	61-153			
1,2-Dibromoethane	40.6	1.0	ug/L	ND	101	61-145			
1,2-Dichlorobenzene	40.8	0.4	ug/L	ND	102	60-150			
1,3-Dichlorobenzene	40.4	0.4	ug/L	ND	101	62-149			
1,4-Dichlorobenzene	39.9	0.4	ug/L	ND	99.7	63-132			
1,1-Dichloroethane	33.7	0.5	ug/L	ND	84.2	51-156			
1,2-Dichloroethane	33.6	0.5	ug/L	ND	84.0	50-140			
1,1-Dichloroethylene	33.1	0.5	ug/L	ND	82.8	43-153			
cis-1,2-Dichloroethylene	39.1	0.4	ug/L	ND	97.7	58-145			
trans-1,2-Dichloroethylene	44.0	1.0	ug/L	ND	110	51-145			
1,2-Dichloropropane	37.1	0.5	ug/L	ND	92.7	56-136			
cis-1,3-Dichloropropylene	39.9	0.4	ug/L	ND	99.8	54-141			
trans-1,3-Dichloropropylene	40.0	0.5	ug/L	ND	100	61-140			
Ethylbenzene	35.0	0.5	ug/L	ND	87.6	61-139			
Methylene Chloride	34.9	4.0	ug/L	ND	87.3	58-149			
Styrene	39.7	0.4	ug/L	ND	99.2	63-143			
1,1,1,2-Tetrachloroethane	33.5	0.5	ug/L	ND	83.8	61-148			
1,1,2,2-Tetrachloroethane	44.7	0.6	ug/L	ND	112	50-157			
Tetrachloroethylene	35.7	0.5	ug/L	ND	89.2	51-145			
Toluene	42.8	0.5	ug/L	ND	107	54-136			
1,1,1-Trichloroethane	32.2	0.4	ug/L	ND	80.6	55-140			
1,1,2-Trichloroethane	45.6	0.6	ug/L	ND	114	63-144			
Trichloroethylene	35.8	0.4	ug/L	ND	89.4	52-135			
Trichlorofluoromethane	24.5	1.0	ug/L	ND	61.4	37-155			
1,3,5-Trimethylbenzene	40.8	0.5	ug/L	ND	102	61-151			
Vinyl chloride	23.1	0.4	ug/L	ND	57.7	31-159			
m,p-Xylenes	70.7	0.5	ug/L	ND	88.4	61-139			
o-Xylene	32.1	0.5	ug/L	ND	80.2	60-142			
Surrogate: 4-Bromofluorobenzene	*79.2*		*ug/L*		*99.0*	*83-134*			
Surrogate: Dibromofluoromethane	*71.1*		*ug/L*		*88.8*	*78-124*			
Surrogate: Toluene-d8	*79.0*		*ug/L*		*98.8*	*76-118*			

Certificate of Analysis

Report Date: 06-Nov-2008
Order Date:3-Nov-2008

Client: **Paterson Group Consulting Engineers**

Client PO: 6526 Project Description: PE1607

Sample Data Revisions

None

Work Order Revisions/Comments:

None

Other Report Notes:

n/a: not applicable

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

CCME PHC additional information:

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

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Chain of Custody Record

№ 51995

Pg 1 of 1

Company Name: [illegible]
Contact Name: [illegible]
Address: [illegible]
Tel: [illegible] Cell:
Email: [illegible]

Project Ref: [illegible]
PO#: [illegible]
Quote #: ☐ Not Quoted

Preservative to be added by Paracel? ☐ Yes ☐ No

Date Required:
Turn Around Time: [ ] 1-day [ ] 2-day [✓] Regular
Regulatory/Guideline Requirements: MOE Table 1

Matrix Types: S-Soil/Sed GW-Ground Water SW-Surface Water SS-Storm/Sanitary Sewer A-Air O-Other RDW-Regulated Drinking Water

Sample Information / **Analysis Required**

Paracel Order #: 0845007

	Sample Identification	Matrix	Air Volume	# Containers	Date Sampled dd/mm/yy	PHC F1-F4	VOCs	BTEX											Hazardous? (Y/N)
1	BH6 GW1	GW	1	3	04/11/05	✓	✓												
2	BH4 GW1 - HOLD.		1	3	"	✓		✓											
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Comments: LM to confirm sample date ?? please hold BH4 until further notice. Thanks.

Relinquished By: M. DESJ[illegible]	Received at Depot:	Received at Lab: [illegible]	Verified by: [illegible]
Date: Nov 30, 2008 Time: 4:20	Date: Time:	Date: Nov 3/08 Time: 4:20	Date: Nov 4/08 Time: 7:10

Please refer to the back page for Locations and Sample Preservation, Container and Hold Time Requirements.

WHITE - Lab Copy, PINK - Client Copy

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Certificate of Analysis

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

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

Client PO: 16609
Project: PE3391
Custody: 16365

Report Date: 16-Oct-2014
Order Date: 9-Oct-2014
Order #: 1441220

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

Paracel ID	Client ID
1441220-01	BH1-SS3
1441220-02	BH1-SS4

Approved By: 

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

Certificate of Analysis

Report Date: 16-Oct-2014
Order Date:9-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16609 Project Description: PE3391

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	10-Oct-14	12-Oct-14
MOE Metals by ICP-OES, soil Reg 153	based on MOE E3470, ICP-OES	15-Oct-14	15-Oct-14
PHC F1	CWS Tier 1 - P&T GC-FID	10-Oct-14	12-Oct-14
PHC F2 - F4	CWS Tier 1 - GC-FID, extraction	10-Oct-14	11-Oct-14
Solids, %	Gravimetric, calculation	10-Oct-14	10-Oct-14

Certificate of Analysis

Report Date: 16-Oct-2014
Order Date:9-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16609

Project Description: PE3391

	Client ID:	BH1-SS3	BH1-SS4	-	-
	Sample Date:	08-Oct-14	08-Oct-14	-	-
	Sample ID:	1441220-01	1441220-02	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	72.8	87.0	-	-
Metals					
Antimony	1.0 ug/g dry	<1.0	-	-	-
Arsenic	1.0 ug/g dry	113	-	-	-
Barium	1.0 ug/g dry	309	-	-	-
Beryllium	1.0 ug/g dry	<1.0	-	-	-
Boron	1.0 ug/g dry	38.7	-	-	-
Cadmium	0.5 ug/g dry	<0.5	-	-	-
Chromium	1.0 ug/g dry	22.1	-	-	-
Cobalt	1.0 ug/g dry	8.7	-	-	-
Copper	1.0 ug/g dry	55.7	-	-	-
Lead	1.0 ug/g dry	67.4	-	-	-
Molybdenum	1.0 ug/g dry	4.3	-	-	-
Nickel	1.0 ug/g dry	24.4	-	-	-
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	39.0	-	-	-
Zinc	1.0 ug/g dry	82.7	-	-	-
Volatiles					
Benzene	0.02 ug/g dry	-	<0.02	-	-
Ethylbenzene	0.05 ug/g dry	-	<0.05	-	-
Toluene	0.05 ug/g dry	-	<0.05	-	-
m,p-Xylenes	0.05 ug/g dry	-	<0.05	-	-
o-Xylene	0.05 ug/g dry	-	<0.05	-	-
Xylenes, total	0.05 ug/g dry	-	<0.05	-	-
Toluene-d8	Surrogate	-	99.0%	-	-
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	-	<8	-	-
F4 PHCs (C34-C50)	6 ug/g dry	-	<6	-	-

Certificate of Analysis

Report Date: 16-Oct-2014
Order Date:9-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16609 Project Description: PE3391

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	1.0	ug/g						
Boron	ND	1.0	ug/g						
Cadmium	ND	0.5	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						
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						
Volatiles									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	*7.73*		*ug/g*		*96.6*	*50-140*			

Certificate of Analysis

Report Date: 16-Oct-2014
Order Date:9-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16609 Project Description: PE3391

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	12	8	ug/g dry	24			70.1	30	QR-01
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Metals									
Antimony	ND	1.0	ug/g dry	ND				30	
Arsenic	120	10.0	ug/g dry	113			6.4	30	
Barium	311	10.0	ug/g dry	309			0.9	30	
Beryllium	ND	1.0	ug/g dry	ND			0.0	30	
Boron	39.7	1.0	ug/g dry	38.7			2.7	30	
Cadmium	ND	0.5	ug/g dry	ND				30	
Chromium	22.4	1.0	ug/g dry	22.1			1.3	30	
Cobalt	8.75	1.0	ug/g dry	8.70			0.6	30	
Copper	61.8	1.0	ug/g dry	55.7			10.4	30	
Lead	65.0	1.0	ug/g dry	67.4			3.6	30	
Molybdenum	4.54	1.0	ug/g dry	4.35			4.3	30	
Nickel	25.7	1.0	ug/g dry	24.4			5.1	30	
Selenium	ND	1.0	ug/g dry	ND				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	39.8	1.0	ug/g dry	39.0			1.9	30	
Zinc	86.7	1.0	ug/g dry	82.7			4.8	30	
Physical Characteristics									
% Solids	82.8	0.1	% by Wt.	82.1			0.8	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	*28.3*		*ug/g dry*	*ND*	*102*	*50-140*			

Certificate of Analysis

Report Date: 16-Oct-2014
Order Date:9-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16609 Project Description: PE3391

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	202	7	ug/g	ND	101	80-120			
F2 PHCs (C10-C16)	88	4	ug/g	ND	87.3	60-140			
F3 PHCs (C16-C34)	241	8	ug/g	24	105	60-140			
F4 PHCs (C34-C50)	148	6	ug/g	ND	107	60-140			
Metals									
Antimony	309		ug/L	ND	124	70-130			
Arsenic	287		ug/L	ND	115	70-130			
Barium	263		ug/L	ND	105	70-130			
Beryllium	232		ug/L	9.99	88.9	70-130			
Boron	979		ug/L	773	82.4	70-130			
Cadmium	236		ug/L	ND	94.4	70-130			
Chromium	632		ug/L	442	76.0	70-130			
Cobalt	367		ug/L	174	77.2	70-130			
Copper	1340		ug/L	1110	91.4	70-130			
Lead	736		ug/L	529	82.6	70-130			
Molybdenum	295		ug/L	87.0	83.1	70-130			
Nickel	673		ug/L	488	74.0	70-130			
Selenium	223		ug/L	ND	89.1	70-130			
Silver	195		ug/L	2.38	77.0	70-130			
Thallium	206		ug/L	ND	82.3	70-130			
Uranium	258		ug/L	ND	103	70-130			
Vanadium	973		ug/L	780	76.9	70-130			
Zinc	218		ug/L	ND	87.0	70-130			
Volatiles									
Benzene	3.50	0.02	ug/g	ND	87.5	60-130			
Ethylbenzene	3.68	0.05	ug/g	ND	91.9	60-130			
Toluene	3.96	0.05	ug/g	ND	99.1	60-130			
m,p-Xylenes	7.58	0.05	ug/g	ND	94.8	60-130			
o-Xylene	3.61	0.05	ug/g	ND	90.3	60-130			
Surrogate: Toluene-d8	*7.53*		*ug/g*		*94.1*	*50-140*			

Certificate of Analysis

Report Date: 16-Oct-2014
Order Date:9-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16609 Project Description: PE3391

Qualifier Notes:

QC Qualifiers :

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

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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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№ 16365

Page 1 of 1

Client Name: PATERSON GROUP INC.
Contact Name: SEAN MCGGRIDGE
Address: 154 COLONNADE ROAD SOUTH
Telephone: 613 226 7381

Project Reference: PE3391
Quote #
PO # 16609
Email Address: SMCGGRIDGE@PATERSONGROUP.CA

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

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

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

Required Analyses

Paracel Order Number: 1441220

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	Metals ICP-Scan	BTEX/PHC(F1-F4)									
1	BH1-SS3	S		1	Oct 8, 2014		X							120 ml			
2	BH1-SS4	S		2	"	"		X						120 ml + 1 Vial			
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Comments:

Method of Delivery: Paracel Courier

Relinquished By (Sign):	Received by Driver/Depot: T. VECOUSE	Received at Lab: SUNEEPORN DOKMAI	Verified By:
Relinquished By (Print): SEAN MCGGRIDGE	Date/Time: 09/10/14 10:25AM	Date/Time: OCT 09, 2014 11:55	Date/Time: Oct 9/14
Date/Time: OCT 8, 2014 ~5:30pm	Temperature: ____ °C	Temperature: ____ °C	pH Verified [ ] By: N/A

12:22p

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Certificate of Analysis

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

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

Client PO: 16610
Project: PE3391
Custody: 16366

Report Date: 17-Oct-2014
Order Date: 10-Oct-2014
Order #: 1441317

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

Paracel ID	Client ID
1441317-01	BH3-SS6

Approved By: Mark Foto

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

Certificate of Analysis

Report Date: 17-Oct-2014
Order Date:10-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16610 Project Description: PE3391

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	14-Oct-14	15-Oct-14
PHC F1	CWS Tier 1 - P&T GC-FID	14-Oct-14	15-Oct-14
PHC F2 - F4	CWS Tier 1 - GC-FID, extraction	15-Oct-14	15-Oct-14
Solids, %	Gravimetric, calculation	15-Oct-14	15-Oct-14

Certificate of Analysis

Report Date: 17-Oct-2014
Order Date:10-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16610

Project Description: PE3391

	Client ID:	BH3-SS6	-	-	-
	Sample Date:	09-Oct-14	-	-	-
	Sample ID:	1441317-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	87.6	-	-	-
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	94.2%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	73	-	-	-
F2 PHCs (C10-C16)	4 ug/g dry	23	-	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	-	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	-	-	-

Certificate of Analysis

Report Date: 17-Oct-2014
Order Date:10-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16610 Project Description: PE3391

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	*7.26*		*ug/g*		*90.8*	*50-140*			

Certificate of Analysis

Report Date: 17-Oct-2014
Order Date:10-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16610 Project Description: PE3391

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND				30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Physical Characteristics									
% Solids	54.6	0.1	% by Wt.	56.9			4.2	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	*11.5*		*ug/g dry*	*ND*	*97.4*	*50-140*			

Certificate of Analysis

Report Date: 17-Oct-2014
Order Date:10-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16610 Project Description: PE3391

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	202	7	ug/g	ND	101	80-120			
F2 PHCs (C10-C16)	107	4	ug/g	ND	107	60-140			
F3 PHCs (C16-C34)	270	8	ug/g	ND	131	60-140			
F4 PHCs (C34-C50)	188	6	ug/g	ND	137	60-140			
Volatiles									
Benzene	4.10	0.02	ug/g	ND	102	60-130			
Ethylbenzene	3.67	0.05	ug/g	ND	91.7	60-130			
Toluene	3.36	0.05	ug/g	ND	84.1	60-130			
m,p-Xylenes	7.58	0.05	ug/g	ND	94.7	60-130			
o-Xylene	3.71	0.05	ug/g	ND	92.9	60-130			
Surrogate: Toluene-d8	*7.85*		*ug/g*		*98.1*	*50-140*			

Certificate of Analysis

Report Date: 17-Oct-2014
Order Date:10-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16610 Project Description: PE3391

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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Page 1 of 1

Client Name: PATERSON GROUP INC.
Contact Name: SEAN MOGGRIDGE
Address: 154 COLONNADE ROAD SOUTH
Telephone: (613) 226-7381

Project Reference: PE 3391
Quote #
PO # 16610
Email Address: SMOGGRIDGE@PATERSONGROUP.CA

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

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

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

Paracel Order Number: 144137

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	BTEX/PHCs (F1-F4)	Required Analyses
1	BH3-SS6	S		2	Oct. 9/14	PM	X	- 120 ml + 1 vial
2								
3								
4								
5								
6								
7								
8								
9								
10								

Comments:

Method of Delivery: Paracel Courier

Relinquished By (Sign):	Received by Driver/Depot: T. Louise	Received at Lab: SUNEEP ORN DOKMAI	Verified By:
Relinquished By (Print): SEAN MOGGRIDGE	Date/Time: 10/10/14 12:20PM	Date/Time: OCT 10, 2014 03:33	Date/Time: Oct 10/14
Date/Time: Oct. 10, 2014 9am	Temperature: ___ °C	Temperature: 18.3 °C	pH Verified [ ] By: N/A

4:17pm

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Certificate of Analysis

Paterson Group Consulting Engineers

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

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

Client PO: 16778
Project: PE3391
Custody: 19355

Report Date: 20-Oct-2014
Order Date: 15-Oct-2014

Order #: 1442105

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

Paracel ID	Client ID
1442105-01	BH1-GW1
1442105-02	BH2-GW1

Approved By:

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

Certificate of Analysis

Report Date: 20-Oct-2014
Order Date:15-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16778 Project Description: PE3391

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
PHC F1	CWS Tier 1 - P&T GC-FID	15-Oct-14	16-Oct-14
PHC F2 - F4	CWS Tier 1 - GC-FID, extraction	16-Oct-14	16-Oct-14
REG 153 - VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	15-Oct-14	16-Oct-14

Certificate of Analysis

Report Date: 20-Oct-2014
Order Date:15-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16778

Project Description: PE3391

	Client ID:	BH1-GW1	BH2-GW1	-	-
	Sample Date:	15-Oct-14	15-Oct-14	-	-
	Sample ID:	1442105-01	1442105-02	-	-
	MDL/Units	Water	Water	-	-
Volatiles					
Acetone	5.0 ug/L	219	22.2	-	-
Benzene	0.5 ug/L	<0.5	<0.5	-	-
Bromodichloromethane	0.5 ug/L	<0.5	<0.5	-	-
Bromoform	0.5 ug/L	<0.5	<0.5	-	-
Bromomethane	0.5 ug/L	<0.5	<0.5	-	-
Carbon Tetrachloride	0.2 ug/L	<0.2	<0.2	-	-
Chlorobenzene	0.5 ug/L	<0.5	<0.5	-	-
Chloroform	0.5 ug/L	<0.5	1.3	-	-
Dibromochloromethane	0.5 ug/L	<0.5	<0.5	-	-
Dichlorodifluoromethane	1.0 ug/L	<1.0	<1.0	-	-
1,2-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	-	-
1,3-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	-	-
1,4-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	-	-
1,1-Dichloroethane	0.5 ug/L	<0.5	<0.5	-	-
1,2-Dichloroethane	0.5 ug/L	<0.5	<0.5	-	-
1,1-Dichloroethylene	0.5 ug/L	<0.5	<0.5	-	-
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	-	-
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	-	-
1,2-Dichloropropane	0.5 ug/L	<0.5	<0.5	-	-
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	-	-
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	-	-
1,3-Dichloropropene, total	0.5 ug/L	<0.5	<0.5	-	-
Ethylbenzene	0.5 ug/L	<0.5	<0.5	-	-
Ethylene dibromide (dibromoethan	0.2 ug/L	<0.2	<0.2	-	-
Hexane	1.0 ug/L	<1.0	<1.0	-	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	<5.0	-	-
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	<5.0	-	-
Methyl tert-butyl ether	2.0 ug/L	<2.0	<2.0	-	-
Methylene Chloride	5.0 ug/L	<5.0	<5.0	-	-
Styrene	0.5 ug/L	<0.5	<0.5	-	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	-	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	-	-
Tetrachloroethylene	0.5 ug/L	<0.5	<0.5	-	-

Certificate of Analysis

Report Date: 20-Oct-2014
Order Date:15-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16778

Project Description: PE3391

	Client ID:	BH1-GW1	BH2-GW1	-	-
	Sample Date:	15-Oct-14	15-Oct-14	-	-
	Sample ID:	1442105-01	1442105-02	-	-
	MDL/Units	Water	Water	-	-
Toluene	0.5 ug/L	<0.5	<0.5	-	-
1,1,1-Trichloroethane	0.5 ug/L	<0.5	<0.5	-	-
1,1,2-Trichloroethane	0.5 ug/L	<0.5	<0.5	-	-
Trichloroethylene	0.5 ug/L	<0.5	<0.5	-	-
Trichlorofluoromethane	1.0 ug/L	<1.0	<1.0	-	-
Vinyl chloride	0.5 ug/L	<0.5	<0.5	-	-
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	-	-
o-Xylene	0.5 ug/L	<0.5	<0.5	-	-
Xylenes, total	0.5 ug/L	<0.5	<0.5	-	-
4-Bromofluorobenzene	Surrogate	123%	117%	-	-
Dibromofluoromethane	Surrogate	105%	114%	-	-
Toluene-d8	Surrogate	105%	104%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	107	<25	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	<100	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	-	-
F1 + F2 PHCs	125 ug/L	<125	<125	-	-
F3 + F4 PHCs	200 ug/L	<200	<200	-	-

Certificate of Analysis

Report Date: 20-Oct-2014
Order Date:15-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16778 Project Description: PE3391

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane	ND	0.2	ug/L						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
Methyl Isobutyl Ketone	ND	5.0	ug/L						
Methyl tert-butyl ether	ND	2.0	ug/L						
Methylene Chloride	ND	5.0	ug/L						
Styrene	ND	0.5	ug/L						
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L						
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L						
Tetrachloroethylene	ND	0.5	ug/L						
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	*37.0*		*ug/L*		*116*	*50-140*			
Surrogate: Dibromofluoromethane	*30.1*		*ug/L*		*94.2*	*50-140*			
Surrogate: Toluene-d8	*36.0*		*ug/L*		*113*	*50-140*			

Certificate of Analysis

Report Date: 20-Oct-2014
Order Date:15-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16778 Project Description: PE3391

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	2.06	0.5	ug/L	ND			0.0	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	13.0	0.5	ug/L	1.37			162.0	30	QR-05
Dibromochloromethane	1.07	0.5	ug/L	ND			0.0	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	*35.8*		*ug/L*	*ND*	*112*	*50-140*			
Surrogate: Dibromofluoromethane	*37.7*		*ug/L*	*ND*	*118*	*50-140*			
Surrogate: Toluene-d8	*33.9*		*ug/L*	*ND*	*106*	*50-140*			

Certificate of Analysis

Report Date: 20-Oct-2014
Order Date:15-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16778 Project Description: PE3391

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1780	25	ug/L	ND	88.8	68-117			
F2 PHCs (C10-C16)	1740	100	ug/L	ND	96.4	60-140			
F3 PHCs (C16-C34)	4180	100	ug/L	ND	112	60-140			
F4 PHCs (C34-C50)	2700	100	ug/L	ND	109	60-140			
Volatiles									
Acetone	84.9	5.0	ug/L	ND	84.9	50-140			
Benzene	31.2	0.5	ug/L	ND	78.0	50-140			
Bromodichloromethane	37.6	0.5	ug/L	ND	94.0	50-140			
Bromoform	30.9	0.5	ug/L	ND	77.4	50-140			
Bromomethane	36.7	0.5	ug/L	ND	91.7	50-140			
Carbon Tetrachloride	31.1	0.2	ug/L	ND	77.7	50-140			
Chlorobenzene	28.6	0.5	ug/L	ND	71.5	50-140			
Chloroform	41.8	0.5	ug/L	1.37	101	50-140			
Dibromochloromethane	29.8	0.5	ug/L	ND	74.4	50-140			
Dichlorodifluoromethane	38.1	1.0	ug/L	ND	95.3	50-140			
1,2-Dichlorobenzene	34.0	0.5	ug/L	ND	85.0	50-140			
1,3-Dichlorobenzene	34.3	0.5	ug/L	ND	85.7	50-140			
1,4-Dichlorobenzene	37.3	0.5	ug/L	ND	93.2	50-140			
1,1-Dichloroethane	34.0	0.5	ug/L	ND	85.1	50-140			
1,2-Dichloroethane	35.0	0.5	ug/L	ND	87.6	50-140			
1,1-Dichloroethylene	30.9	0.5	ug/L	ND	77.2	50-140			
cis-1,2-Dichloroethylene	32.0	0.5	ug/L	ND	80.1	50-140			
trans-1,2-Dichloroethylene	33.3	0.5	ug/L	ND	83.2	50-140			
1,2-Dichloropropane	36.1	0.5	ug/L	ND	90.4	50-140			
cis-1,3-Dichloropropylene	31.2	0.5	ug/L	ND	78.0	50-140			
trans-1,3-Dichloropropylene	31.2	0.5	ug/L	ND	77.9	50-140			
Ethylbenzene	28.9	0.5	ug/L	ND	72.2	50-140			
Ethylene dibromide (dibromoethane	32.0	0.2	ug/L	ND	80.0	50-140			
Hexane	31.7	1.0	ug/L	ND	79.2	50-140			
Methyl Ethyl Ketone (2-Butanone)	98.8	5.0	ug/L	ND	98.8	50-140			
Methyl Isobutyl Ketone	95.3	5.0	ug/L	ND	95.3	50-140			
Methyl tert-butyl ether	98.2	2.0	ug/L	ND	98.2	50-140			
Methylene Chloride	33.4	5.0	ug/L	ND	83.4	50-140			
Styrene	27.9	0.5	ug/L	ND	69.6	50-140			
1,1,1,2-Tetrachloroethane	32.6	0.5	ug/L	ND	81.4	50-140			
1,1,2,2-Tetrachloroethane	33.8	0.5	ug/L	ND	84.5	50-140			
Tetrachloroethylene	28.4	0.5	ug/L	ND	71.0	50-140			
Toluene	27.8	0.5	ug/L	ND	69.6	50-140			
1,1,1-Trichloroethane	32.3	0.5	ug/L	ND	80.7	50-140			
1,1,2-Trichloroethane	38.1	0.5	ug/L	ND	95.2	50-140			
Trichloroethylene	31.6	0.5	ug/L	ND	79.0	50-140			
Trichlorofluoromethane	32.5	1.0	ug/L	ND	81.3	50-140			
Vinyl chloride	39.0	0.5	ug/L	ND	97.5	50-140			
m,p-Xylenes	57.9	0.5	ug/L	ND	72.4	50-140			
o-Xylene	32.3	0.5	ug/L	ND	80.8	50-140			
Surrogate: 4-Bromofluorobenzene	*25.0*		*ug/L*		*78.2*	*50-140*			

Certificate of Analysis

Report Date: 20-Oct-2014
Order Date:15-Oct-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16778 Project Description: PE3391

Qualifier Notes:

QC Qualifiers :

QR-05 : Duplicate RPDs higher than normally accepted. Remaing batch QA\QC was acceptable. May be sample effect.

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
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№ 19355

Page 1 of 1

Client Name: Paterson Group
Contact Name: Mark Darcy
Address: 154 Colonnade Road
Telephone: (613) 226-7381

Project Reference: PE3391
Quote #
PO # 16778
Email Address: mdarcy@patersongroup.ca

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

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

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

Paracel Order Number: 1442105

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4	VOCs									
1	BH1 - GW1	GW		3	15/10/14		X	X									
2	BH2 - GW2	GW		3	15/10/14		X	X									
3																	
4	↳ should be BH2 - GW1																
5	per mark. - mjc																
6																	
7																	
8																	
9																	
10																	

Comments:

Method of Delivery: Paracel Courier

Relinquished By (Sign):	Received by Driver/Depot: M. Krause	Received at Lab: SUNRE PORN OOK MM	Verified By: MJC
Relinquished By (Print): Mark D'Arcy	Date/Time: 15/10/14 2:07PM	Date/Time: OCT 15, 2014 09:45	Date/Time: Oct 15/14 13:04
Date/Time: Oct. 15/14 2:10pm.	Temperature: ___ C	Temperature: 21.8 C	pH Verified [ ] By: N/A