Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

patersongroup

Phase II-Environmental Site Assessment

112 Nelson Street
Ottawa, Ontario

Prepared For

Domicile Developments

November 24, 2017

Report: PE4122-2

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

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

TABLE OF CONTENTS

List of Figures

Appendix 1

EXECUTIVE SUMMARY

Assessment

A Phase II - Environmental Site Assessment (ESA) was conducted for 112 Nelson Street, in the City of Ottawa, Ontario. The purpose of the Phase II-ESA was to address potentially contaminating activities which were considered to have created areas of potential environmental concern on the subject property. These included an existing transformer substation, a former automotive garage, a former substation, a former dry cleaners and a former printers.

Soil

Three (3) boreholes were placed on the subject property on November 2, 2017. All three boreholes were instrumented with groundwater monitoring wells.

Four (4) soil samples were submitted for analysis of metals, volatile organic compounds, petroleum hydrocarbons, polycyclic aromatic hydrocarbons and polychlorinated biphenyls. All soil results were found to be in compliance with Ministry of the Environment and Climate Change (MOECC) standards for the subject property.

Groundwater

Paterson collected groundwater samples from the groundwater monitoring wells on November 9, 2017. Groundwater samples were submitted for analysis of volatile organic compounds, petroleum hydrocarbons, polycyclic aromatic hydrocarbons and polychlorinated biphenyls. None of the analytical test parameters were detected above the laboratory detection limits. All analytical test results were in compliance with the MOECC standards for the subject property.

Recommendations

If the construction depth of the proposed building does not extend below the groundwater monitoring wells, then the wells must be decommissioned according to Ontario Regulation 903, in conjunction with, or prior to, site redevelopment.

1.0 INTRODUCTION

At the request of Domicile Developments, Paterson Group Inc. (Paterson) conducted a Phase II - Environmental Site Assessment (ESA) of the property located at 112 Nelson Street, in the City of Ottawa, Ontario. The purpose of the Phase II-ESA was to address the areas of potential environmental concern (APEC) identified in the Phase I-ESA conducted by Paterson in November 2017.

This report has been prepared specifically and solely for the above noted project which is described herein. It contains all of our findings and results of the environmental conditions at this site.

1.1 Site Description

Address:	112 Nelson Street, Ottawa, Ontario.
Parcel Identification Number:	15396-0000
Legal Description:	Carleton Condominium Plan 396, Level 1, City of Ottawa.

Site Description:

Configuration/Area:	2,949 m^2 (approximate).
Zoning:	General Industrial - IG1
Current Use:	The subject property is currently used primarily as office spaces on the first and second floors. One unit is used as a warehouse for a local restaurant and part of the basement is used as rented storage space.
Services:	The subject site is serviced with municipal sanitary and drinking water services.

1.2 Property Ownership

The registered owner of the property is Carleton Condominium Corporation 396, however they are represented by Domicile Developments Inc. Paterson was engaged to conduct this Phase II – ESA by Mr. David Renfroe, of Domicile Developments.

1.3 Current and Proposed Future Uses

The site is occupied by a two storey commercial building with a basement below a portion of the building.

The proposed development will consist of a multi-storey residential building.

1.4 Applicable Site Condition Standard

The soil and groundwater standards for the subject property were obtained from Table 3 of the document entitled “Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act”, prepared by the Ontario Ministry of Environment (MOE), April 15, 2011. The MOECC Table 3 Standards are based on the following considerations:

- ❑ Coarse grained soil conditions.
- ❑ Full depth soil conditions
- ❑ Non-potable groundwater situation.
- ❑ Residential land use.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The subject building occupies the western and northwestern portions of the property, the remainder of the property is paved and used for parking, with the exception of a small landscaped island near the central corner of the property.

Sheet drainage on the parking lot leads to catch basins on the property, however several low spots and pot holes were noted to have ponded water. No signs of surficial staining were noted at the time of the site assessment.

The site topography is relatively flat The regional topography slopes down to the east. Regional groundwater is considered to flow in an northern direction towards the Ottawa River.

2.2 Past Investigations

In early November 2017, Paterson completed a Phase I-ESA on the subject property, which identified the presence of a hydro transformer substation adjacent to the west, a former substation to the south, a former automotive garage adjacent to the west, a dry cleaners further to the south and a printers to the east across Nelson Street all as potentially contaminating activities resulting in areas of potential environmental concern on the subject site.

Paterson has conducted several investigations within the study area, and as part of the Phase I-ESA for the subject property, Paterson reviewed reports by others which address the former coal gas plant further to the west, across King Edward Avenue. Based on a review of those reports, the plant was not considered to have impacted the subject site.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation was conducted on November 2, 2017, and consisted of the placement of three (3) boreholes (BH1 to BH3) within the parking lot. The boreholes were advanced using a truck mounted drill rig under the full time supervision of Paterson personnel. Each borehole was instrumented with a groundwater monitoring well. The borehole locations are illustrated on Drawing No. PE4122-3 -

Test Hole Location Plan in the Figures section following the text.

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 analysing these media is based on the Contaminants of Potential Concern (CPCs) identified during the Phase I-ESA: Volatile Organic Compounds (VOCs), and petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) in the soil and/or groundwater.

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

The Geological Survey of Canada website on the Urban Geology of the National Capital Area was consulted as part of this assessment. Based on the information from Natural Resources Canada, bedrock in the area of the site consists of interbedded limestone and shale of the Verulam Formation, with overburden thickness between 5 and 15 m, consisting of off-shore marine sediment.

Contaminants of Potential Concern

The following CPCs were identified at the time of the Phase I-ESA:

- Volatile Organic Compounds (VOCs) - This suite of parameters includes solvents such as trichloroethylene and tetrachloroethylene associated with drycleaning products, as well as benzene, toluene, ethylbenzene, and xylenes, which are generally associated with automotive garages and fuels. These parameters were selected as CPCs for the Phase I-ESA property due to the former presence of a drycleaners to the south and former service garage to the west. VOCs may be present in the soil matrix or in the dissolved phase in the groundwater system.

- Petroleum Hydrocarbons, fractions 1 through 4 (PHCs F_1-F_4) - PHCs (F_1-F_4) were selected as CPCs for the Phase I-ESA property due to the former presence of a service garage adjacent to the west. PHCs may be present in the soil matrix, sorbed to soil particles, as well as in free or dissolved phase in the groundwater system.

- Polycyclic Aromatic Hydrocarons (PAH) - this suite of parameters encompasses various complex hydrocarbons, commonly associated with coal and/or combustion.

PAHs were selected as a CPC for the property based on the former and current transformer substations to the west. PAHs may be present in the soil matrix or dissolved in site groundwater.

- Polychlorinated Biphenyls (PCBs) - PCBs have been used as coolants and lubricants in transformers and other electrical components from the 1920's until the 1970's. PCBs were chosen as a contaminant of potential concern due to the proximity of the substation to the west, and the former substation to the south. PCBs may be present in the soil matrix, sorbed to soil particles, as well as in free or dissolved phase in the groundwater system.

The mechanisms of contaminant transport within the groundwater system include advection, dispersion and diffusion. Advection and dispersion will be the dominant mechanisms of contaminant transport in soils with higher hydraulic conductivities, such as sands, gravels, silts, some glacial till soils and highly fractured bedrock, whereas diffusion will dominate in soils with lower hydraulic conductivity, such as clays and more competent bedrock.

Existing Buildings and Structures

The subject property is occupied by a two storey commercial building with a single storey slab on grade wing to the north.

Water Bodies

There are no water bodies on the subject site.

Areas of Natural and Scientific Interest (ANSI)

According to the Ministry of Natural Resources' (MNR) electronic mapping website, the subject property is not listed as an area of natural and scientific interest. Properties located within the 250 m Phase I-ESA study area are also not identified as ANSIs.

Drinking Water Wells

No drinking water wells are located at the subject site or within the Phase I study area.

Groundwater Monitoring Wells

A search of the MOECC's web site for all drilled well records within 250 m of the subject site was conducted on October 6, 2017. Search results indicated that there are

17 records in the study area, none of which are on the subject site. The majority of the records pertained to groundwater monitoring wells on the adjacent properties to the west (333 and 351 King Edward Avenue) as well as the property at 231 Friel Street.

Neighbouring Land Use

Neighbouring lands in the Phase I-ESA study area are predominantly used for commercial and residential purposes, however the adjacent property to the west is industrial (transformer substation). Neighbouring land use within the Phase I-ESA study area is depicted on Drawing: PE4122-2 - Surrounding Land Use Plan, provided in the Phase I ESA (2017).

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As per Column A of Table 2 outlined in Ontario Regulation 153/04 as amended, Potentially Contaminating Activities (PCAs) were identified within the Phase I-ESA study area. Five of those PCAs were considered to have resulted in Areas of Potential Environmental Concern (APEC) on the subject property. Those include:

- ❏ APEC1 - Hydro Ottawa transformer substation; Item 55, Table 2, O.Reg. 153/04 as amended: “Transformer manufacturing, processing and use”
- ❏ APEC2 - Former Canadian National terminal and garage; Item 52, Table 2, O.Reg. 153/04 as amended: “Storage, maintenance, fuelling and repair of equipment, vehicles and material used to maintain transportation systems”
- ❏ APEC3 - Former Ottawa Electric Railway transformer substation; Item 55, Table 2, O.Reg. 153/04 as amended: “Transformer manufacturing, processing and use”
- ❏ APEC4 - Former Superior Cleaners and Dyers; Item 37, Table 2, O.Reg. 153/04 as amended: “Operation of Dry Cleaning Equipment (where chemicals are used)”
- ❏ APEC5 - Former Le Droit printers (no item number)

Other PCAs located within the study area were not considered to have created APECs due to their location down or cross-gradient with respect to groundwater flow direction, or, based on prior knowledge of those properties from previous subsurface investigations conducted by Paterson or others.

Table 1
Areas of Potential Environmental Concern

Area of Potential Environmental Concern (APEC)	Location of APEC on Phase One Property	Potentially Contaminating Activities (PCA)	Location of PCA	Contaminants of Potential concern (CPC)	Media Potentially Impacted (Groundwater Soil and/or Sediment)
Hydro Ottawa transformer substation (APEC1)	West-Southwest corner of property	Item 55 - "Transformer manufacturing, processing and use"	off-site, adjacent to the west	PHC F1-F4, PAH, PCB	Soil, Groundwater
Former Canadian National terminal and garage	West-Southwest corner of property	Storage, maintenance, fuelling and repair of equipment, vehicles and material used to maintain transportation systems	off-site, adjacent to the west	PHC F1-F4, BTEX	Soil, Groundwater
Former Ottawa Electric Railway transformer substation	10 m south of the subject property	Item 55: "Transformer manufacturing, processing and use"	Off-site	PHC F1-F4, PAH, PCB	Soil, Groundwater
Former Superior Cleaners and Dyers	50 m south of subject property	Item 38: "Operation of drycleaning equipment (where chemicals are used)	Off-site	VOC	Soil, Groundwater
Former LeDroit printing opertaion	20 m southeast of the subject property	Printers	Off-site	VOC	Soil, Groundwater

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 sufficient to conclude that there are off-site potentially contaminating activity which has resulted in an area of potential environmental concern. The presence of potentially contaminating activities was confirmed by a variety of independent sources, including in some cases, observations made during the Phase I-ESA site visit.

3.4 Deviations from Sampling and Analysis Plan

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

3.5 Impediments

No impediments were encountered during the program, with the exception of lack of groundwater at borehole BH3.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted on November 2, 2017 and consisted of the placement of three (3) boreholes (BH1 to BH3) in the parking area of the property. Groundwater monitoring wells were installed in each of the boreholes. The borehole locations are illustrated on Drawing No. PE4122-3 - Test Hole Location Plan. The boreholes were advanced using a truck mounted drill rig under the full time supervision of Paterson personnel.

4.2 Soil Sampling

The boreholes were sampled to depths ranging from 9.1 m at borehole BH1, and 7.46 m in borehole BH2 and 9.75 in borehole BH3. Upon recovery, all samples were immediately sealed in appropriate containers to facilitate the preliminary screening procedure. The depths at which the auger and split spoon samples were obtained from the boreholes are shown as "**AU**" and "**SS**" respectively, on the Soil Profile and Test Data sheet in the Appendix.

Soil sampling protocols were followed using the MOECC document titled "Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario", dated May 1996.

The samples were recovered using a stainless steel split spoon, using protective gloves (changed after each sample). The samples were placed into plastic bags. If significant contamination was encountered, the samples were placed into glass jars. Sampling equipment was washed in soapy water and rinsed with methylhydrate after each split spoon to prevent cross contamination of the samples. Samples were stored in coolers to reduce analyte volatilization during transportation.

4.3 Field Screening Measurements

An MiniRae Photo Ionization Detector (PID) was used to measure the vapour concentrations in the headspace of the soil samples recovered from the boreholes. The instrument is calibrated regularly using hexane. The detection limit is 0.1 ppm, with a precision of +/- 0.1 ppm.

The soil samples recovered from the boreholes were placed immediately into airtight plastic bags with nominal headspace. All lumps of soil inside the bags were broken by hand, and the soil was allowed to come to room temperature prior to conducting the vapour survey, ensuring consistency of readings between samples.

To measure the soil vapours, the analyser probe was inserted into the nominal headspace above the soil sample. The sample was agitated/manipulated gently as the measurement was taken. The peak reading registered within the first 15 seconds was recorded as the vapour measurement. The parts per million (ppm) scale was used to measure concentrations of organic/combustible vapours.

The highest recorded reading was 2.6 ppm. Other readings were generally between 0 ppm and 1 ppm. Vapour readings cannot be used to identify the presence of heavier hydrocarbon products such as engine oil. The results of the vapour survey are presented on the Soil Profile and Test Data sheets appended to this report.

4.4 Groundwater Monitoring Well Installations

As part of the Phase II-ESA investigation, each borehole received a groundwater monitoring well, installed by Capital Cutting and Coring, of Ottawa, under the full-time supervision of Paterson personnel. All of the monitoring wells consisted of 50 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 in the borehole logs in the Appendix 1. A summary of monitoring well construction details is provided below in Table 2.

Table 2
Monitoring Well Construction Details

Well ID	Ground Surface Elevation	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
BH1	99.33	9.13	4.53 - 9.13	4.33 - 9.13	0.1 - 4.33	Flushmount
BH2	99.07	6	3.0 - 6.0	2.6 - 6.0	0.1 - 2.6	Flushmount
BH3	98.95	6	3.0 - 6.0	2.6 - 6.0	0.1 - 2.6	Flushmount

Notes: ❑ m BGS - metres below ground surface

4.5 Field Measurement of Water Quality Parameters

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

Table 3
Field Measurement of Water Quality Parameters (November 9, 2017)

Parameter	BH1	BH2	BH3
Temperature (°C)	11.6	11.4	Dry
Electrical Conductivity (µS/cm)	0.76	221	
pH	8.43	7.67	

4.6 Groundwater Sampling

Groundwater sampling protocols were followed using the MOECC document entitled “Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario”, dated May, 1996. Groundwater samples were obtained from the monitoring wells installed in BH1 and BH2 using dedicated sampling equipment as part of the Phase II-ESA. To ensure low sediment and non-stagnant water was sampled, when possible, approximately three (3) well volumes were purged prior to the collection of groundwater samples. The monitoring wells were also purged after installation, during the field drilling program. 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 the Appendix.

4.7 Analytical Testing

Paracel Laboratories (Paracel), of Ottawa, Ontario performed the laboratory analysis on the samples submitted for analytical testing as part of the current Phase II-ESA. Paracel is a member of the Standards Council of Canada/Canadian Association for Environmental Analytical Laboratories (SCC/CAEL). Paracel is accredited and certified by SCC/CAEL for specific tests registered with the association. Soil and groundwater samples submitted for analytical testing are presented in Tables 4 and 5.

Table 4
Soil Samples Submitted for Analytical Testing

Sample ID	Sample Depth/ Stratigraphic Unit or Screened Interval	Parameters Analyzed					Rationale
		PHC	VOC	PAH	Metals	PCBs	
BH1-AU1	0.1 - 0.6 m, fill				X		Assessment of fill material encountered during Phase II-ESA
BH1-SS6	3.8 - 4.4 m, silty clay			X			Assessment of soil in vicinity of transformer substation
BH2-SS6	3.73 - 4.4 m, silty clay			X		X	Assessment of soil in vicinity of transformer substation
BH2-SS7	4.5 - 5.2 m, silty clay	X	X				Assessment of soil in vicinity of former drycleaners and former garage
BH3-SS7	4.5 - 5.2 m, silty clay		X				Assessment of soil in vicinity of former printers

Table 5
Groundwater Samples Submitted for Analytical Testing

Sample ID	Sample Depth/ Stratigraphic Unit or Screened Interval	Parameters Analyzed				Rationale
		PHC	VOC	PAH	PCB	
BH1-GW1	4.5 - 9.1 m, silty clay			X		Assessment of groundwater in vicinity of transformer substation and former garage
BH2-GW1	3.0 - 6.0 m, silty clay	X	X	X	X	Assessment of groundwater in vicinity of transformer substation, former garage and former dry cleaners
DUP1	3.0 - 6.0 m, silty clay		X			Duplicate sample of BH2.

4.8 Residue Management

Soil cuttings, fluids from equipment cleaning and purge water resulting from Paterson's Phase II-ESA remained on-site.

4.9 Elevation Surveying

Borehole elevations were surveyed using a laser level. Elevations were surveyed relative to the top of the firehydrant spindle located on the subject property. The elevation of top of spindle was assumed to be 100 metres above sea level (m ASL). The location of the benchmark is shown on Drawing: PE4122-3 - Test Hole Location Plan.

4.10 Quality Assurance and Quality Control Measures

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

5.0 REVIEW AND EVALUATION

5.1 Geology

The soil profile encountered at the borehole locations consisted of asphalt over granular fill material, to depths ranging from 0.28 m to 0.36 m, followed by brown silty sand, then silty clay, then silty clay with traces of gravel (and possible cobbles). Boreholes were terminated between 6.0 and 9.1 m below surface. Bedrock was not encountered within these depths in any of the boreholes however a dynamic cone penetration test reached refusal at 11.73 m and 11.56 m below grade at boreholes BH1 and BH3, respectively. Specific details of the soil profile at the test hole locations can be seen on the Soil Profile and Test Data sheets in the Appendix.

5.2 Groundwater Elevations, Flow Direction and Hydraulic Gradient

Groundwater levels were measured on November 9, 2017, using an electronic water level meter. Elevations are relative to the top of the fire hydrant spindle. The top of the fire hydrant had an assumed elevation of 100 m. Groundwater elevations are summarized below in Table 6.

Table 6
Groundwater Level Measurements

Monitoring Well	Water Level (m below grade)	Water Level Elevation (m ASL)	Screened Interval (m below grade)	Date of Measurement
BH1	6.08	93.25	4.53 - 9.13	November 9, 2017
BH2	4.5	94.57	3.0 - 6.0	November 9, 2017
BH3	-	dry to 92.95	3.0 - 6.0	November 9, 2017

The above water level measurements were used to determine groundwater flow direction. Due to the fact that the groundwater monitoring well at borehole BH3 was dry at the time of sampling, a groundwater gradient below the subject property could not be established. Based on the water levels recorded, it is anticipated that the groundwater flow direction is in a northern to northeastern direction.

5.3 Soil Texture

Based on field soil observations, coarse-grained soil conditions are applicable to the subject site.

5.4 Soil Field Screening

A MiniRae Photoionization Detector was used to measure the vapour concentrations in the headspace of the soil samples recovered from the boreholes. The technical protocol was obtained from Appendix C of the MOECC document titled "Interim Guidelines for the Remediation of Petroleum Contamination at Operating Retail and Private Fuel Outlets in Ontario", dated March 1992.

Soil samples recovered at the time of sampling were placed immediately into airtight plastic bags with nominal headspace. All lumps of soil inside the bags were broken by hand, and the soil was allowed to come to room temperature prior to conducting the vapour survey, ensuring consistency of readings between samples. To measure the soil vapours, the analyser probe is inserted into the nominal headspace above the soil sample. The sample is agitated/manipulated gently as the measurement is taken. The peak reading registered within the first 15 seconds is recorded as the vapour measurement. The parts per million (ppm) scale is used to measure concentrations of combustible vapours.

Vapour readings of the soil samples were generally between 0 and 2.6 ppm and are not considered to be indicative of soil impacts. The results of the vapour survey are presented on the Soil Profile and Test Data sheets appended to this report.

5.5 Soil Quality

Four (4) soil samples were submitted for analysis as part of the Phase II-ESA. The results of all soil analyses are presented in Tables 7 to 11. Copies of the laboratory certificates of analysis are included in Appendix 1.

Table 7
Analytical Test Results - Soil
Volatile Organic Compounds (VOCs)

Parameter	MDL (µg/g)	Soil Samples (µg/g)		MOECC Table 3 Standards Residential Land Use (µg/g)
		November 2, 2017		
		BH2-SS7	BH3-SS7	
Acetone	0.5	nd	nd	16
Benzene	0.02	nd	nd	0.21
Bromodichloromethane	0.05	nd	nd	13
Bromoform	0.05	nd	nd	0.27

Notes:
- MDL - Method Detection Limit
- nd - Not Detected (< MDL)
- **Bold & Underline** values exceed selected MOECC Standards

Table 7 - Continued
Analytical Test Results - Soil
Volatile Organic Compounds (VOCs)

Parameter	MDL (µg/g)	Soil Samples (µg/g)		MOECC Table 3 Standards Residential Land Use (µg/g)
		November 2, 20176		
		BH2-SS7	BH3-SS7	
Bromomethane	0.05	nd	nd	0.05
Carbon Tetrachloride	0.05	nd	nd	0.05
Chlorobenzene	0.05	nd	nd	2.4
Chloroform	0.05	nd	nd	0.05
Dibromochloromethane	0.05	nd	nd	9.4
Dichlorodifluoromethane	0.05	nd	nd	16
1,2-Dichlorobenzene	0.05	nd	nd	3.4
1,3-Dichlorobenzene	0.05	nd	nd	4.8
1,4-Dichlorobenzene	0.05	nd	nd	0.083
1,1-Dichloroethane	0.05	nd	nd	3.5
1,2-Dichloroethane	0.05	nd	nd	0.05
1,1-Dichloroethylene	0.05	nd	nd	0.05
cis-1,2-Dichloroethylene	0.05	nd	nd	3.4
trans-1,2-Dichloroethylene	0.05	nd	nd	0.084
1,2-Dichloropropane	0.05	nd	nd	0.05
1,3-Dichloropropene	0.05	nd	nd	0.05
Ethylbenzene	0.05	nd	nd	2
Ethylene Dibromide	0.05	nd	nd	0.05
Hexane	0.05	nd	nd	2.8
Methyl Ethyl Ketone	0.50	nd	nd	16
Methyl Isobutyl Ketone	0.50	nd	nd	1.7
Methyl Tert-Butyl Ether	0.05	nd	nd	0.75
Methylene Chloride	0.05	nd	nd	0.1
Styrene	0.05	nd	nd	0.7
1,1,1,2-Tetrachloroethane	0.05	nd	nd	0.058
1,1,2,2-Tetrachloroethane	0.05	nd	nd	0.05
Tetrachloroethylene	0.05	nd	nd	0.28
Toluene	0.05	nd	nd	2.3
1,1,1-Trichloroethane	0.05	nd	nd	0.38
1,1,2-Trichloroethane	0.05	nd	nd	0.05

Notes:
- ❑ MDL - Method Detection Limit
- ❑ nd - Not Detected (< MDL)
- ❑ **Bold & Underline** values exceed selected MOECC Standards

Table 7 - Continued
Analytical Test Results - Soil
Volatile Organic Compounds (VOCs)

Parameter	MDL (µg/g)	Soil Samples (µg/g)		MOECC Table 3 Standards Residential Land Use (µg/g)
		November 2, 2017		
		BH2-SS7	BH3-SS7	
Trichloroethylene	0.05	nd	nd	0.061
Trichlorofluorometahne	0.05	nd	nd	4
Vinyl Chloride	0.02	nd	nd	0.02
Xylenes total	0.05	nd	nd	3.1

Notes:
- ❑ MDL - Method Detection Limit
- ❑ nd - Not Detected (< MDL)
- ❑ **Bold & Underline** values exceed selected MOECC Standards

No VOC parameters were detected in any of the samples. All concentrations were in compliance with the MOECC Table 3 standards.

Table 8
Analytical Test Results - Soil
Polycyclic Aromatic Hydrocarbons (PAHs)

Parameter	MDL (µg/g)	Soil Samples (µg/g)		MOECC Table 3 Standards Residential Land Use (µg/g)
		November 2, 2017		
		BH1-SS6	BH2-SS6	
Acenaphthene	0.02	nd	nd	7.9
Acenaphthylene	0.02	nd	nd	0.15
Anthracene	0.02	nd	nd	0.67
Benzo[a]anthracene	0.02	nd	nd	0.5
Benzo[a]pyrene	0.02	nd	nd	0.3
Benzo[b]fluoranthene	0.02	nd	nd	0.78
Benzo[g,h,i]perylene	0.02	nd	nd	6.6
Benzo[k]fluoranthene	0.02	nd	nd	0.78
Chrysene	0.02	nd	nd	7
Dibenzo[a,h]anthracene	0.02	nd	nd	0.1
Fluoranthene	0.02	nd	nd	0.69
Fluorene	0.02	nd	nd	62
Indeno[1,2,3-cd]pyrene	0.02	nd	nd	0.38
Methylnaphthalene (1&2)	0.04	nd	nd	0.99
Naphthalene	0.01	nd	nd	0.6
Phenanthrene	0.02	nd	nd	6.2
Pyrene	0.02	nd	nd	78

Notes:
- MDL - Method Detection Limit
- nd - Not Detected (< MDL)
- **Bold & Underline** values exceed selected MOECC Standards

None of the analytical test parameters were identified above the laboratory detection limits. All analytical parameters were in compliance with the MOECC Table 3 standards.

Table 9
Analytical Test Results - Soil
Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g)	MOECC Table 3 Standards Residential Land Use (µg/g)
		November 2, 2017	
		BH1-AU1	
Antimony	1.0	nd	7.5
Arsenic	1.0	nd	18
Barium	1.0	96.5	390
Beryllium	1.0	nd	4
Boron	1.0	22.7	120
Boron, Available	0.5	0.9	1.5
Cadmium	0.5	nd	1.2
Chromium	1.0	12.5	160
Chromium (VI)	0.2	nd	8
Cobalt	1.0	6.5	22
Copper	1.0	13.0	140
Lead	1.0	29.9	120
Mercury	0.1	nd	0.27
Molybdenum	1.0	nd	6.9
Nickel	1.0	12.5	100
Selenium	1.0	nd	2.4
Silver	0.5	nd	20
Thallium	1.0	nd	1
Uranium	1.0	nd	23
Vanadium	1.0	17.0	86
Zinc	1.0	18.0	340

Notes:
- MDL - Method Detection Limit
- nd - Not Detected (< MDL)
- **Bold & Underline** values exceed selected MOECC Standards

All analytical test parameters were found to be in compliance with the MOECC Table 3 standards.

Table 10
Analytical Test Results - Soil
Petroleum Hydrocarbons (PHCs)

Parameter	MDL (µg/g)	Soil Samples (µg/g)	MOECC Table 3 Standards Residential Land Use (µg/g)
		November 2, 2017	
		BH2-SS7	
PHC F1	7	nd	55
PHC F2	4	nd	98
PHC F3	8	nd	300
PHC F4	6	nd	2800

Notes:
- ❑ MDL - Method Detection Limit
- ❑ nd - Not Detected (< MDL)
- ❑ **Bold & Underline** values exceed selected MOECC Standards

None of the analytical test parameters were identified above the laboratory detection limits. All analytical parameters were in compliance with the MOECC Table 3 standards.

Table 11
Analytical Test Results - Soil
Polychlorinated Biphenyls (PCBs)

Parameter	MDL (µg/g)	Soil Samples (µg/g)	MOECC Table 3 Standards Residential Land Use (µg/g)
		November 2, 2017	
		BH2-SS6	
PCBs total	0.05	nd	0.35

Notes:
- ❑ MDL - Method Detection Limit
- ❑ nd - Not Detected (< MDL)
- ❑ **Bold & Underline** values exceed selected MOECC Standards

None of the analytical test parameters were identified above the laboratory detection limits. All analytical parameters were in compliance with the MOECC Table 3 standards.

Table 12
Maximum Concentrations - Soil

Parameter	Maximum Concentration (µg/g)	Sample	Depth Interval (m BGS)
Barium	96.5	BH1-AU1	0.1 - 0.6 m, fill
Boron	22.7	BH1-AU1	0.1 - 0.6 m, fill
Boron, Available	0.9	BH1-AU1	0.1 - 0.6 m, fill
Chromium	12.5	BH1-AU1	0.1 - 0.6 m, fill
Cobalt	6.5	BH1-AU1	0.1 - 0.6 m, fill
Copper	13.0	BH1-AU1	0.1 - 0.6 m, fill
Lead	29.9	BH1-AU1	0.1 - 0.6 m, fill
Nickel	12.5	BH1-AU1	0.1 - 0.6 m, fill
Vanadium	17.0	BH1-AU1	0.1 - 0.6 m, fill
Zinc	18.0	BH1-AU1	0.1 - 0.6 m, fill

Notes:
- ❑ **Bold & Underline** values exceed MOECC Table 3 Standards

All other analytical soil concentrations were below the laboratory method detection limits.

5.6 Groundwater Quality

Groundwater samples were collected from the monitoring wells installed in BH1 and BH2 on November 9, 2017. Groundwater samples were submitted for VOCs, PHCs, PAH and PCBs. The results of the analytical testing are presented in Tables 13 to 16. The laboratory reports are included in Appendix 1.

Table 13
Analytical Test Results - Groundwater
Volatile Organic Compounds (VOCs)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) November 9, 2017		MOECC Table 3 Standards Residential Land Use (µg/L)
		BH2-GW1	DUP1	
Acetone	5	nd	nd	130000
Benzene	0.5	nd	nd	44
Bromodichloromethane	0.5	nd	nd	85000
Bromoform	0.5	nd	nd	380
Bromomethane	0.5	nd	nd	5.6
Carbon Tetrachloride	0.2	nd	nd	0.79
Chlorobenzene	0.5	nd	nd	630
Chloroform	0.5	nd	nd	2.4
Dibromochloromethane	0.5	nd	nd	82000
Dichlorodifluoromethane	1	nd	nd	4400
1,2-Dichlorobenzene	0.5	nd	nd	4600
1,3-Dichlorobenzene	0.5	nd	nd	9600
1,4-Dichlorobenzene	0.5	nd	nd	8
1,1-Dichloroethane	0.5	nd	nd	320
1,2-Dichloroethane	0.5	nd	nd	1.6
1,1-Dichloroethylene	0.5	nd	nd	1.6
cis-1,2-Dichloroethylene	0.5	nd	nd	1.6
trans-1,2-Dichloroethylene	0.5	nd	nd	1.6
1,2-Dichloropropane	0.5	nd	nd	16
1,3-Dichloropropene	0.5	nd	nd	5.2
Ethylbenzene	0.5	nd	nd	2300
Ethylene dibromide	0.2	nd	nd	0.25

Notes:
- MDL - Method Detection Limit
- nd - not detected above the MDL
- N/V - no value provided by the MOE
- **Bold & Underline** values exceed selected MOECC Standards

Table 13 - Continued
Analytical Test Results - Groundwater
Volatile Organic Compounds (VOCs)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) November 9, 2017		MOECC Table 3 Standards Residential Land Use (µg/L)
		BH2-GW1	DUP1	
Hexane	1	nd	nd	51
Methyl Ethyl Ketone	5	nd	nd	470000
Methyl Isobutyl Ketone	5	nd	nd	140000
Methyl tert-butyl ketone	2	nd	nd	190
Methylene Chloride	5	nd	nd	610
Styrene	0.5	nd	nd	1300
1,1,1,2-Tetrachloroethane	0.5	nd	nd	3.3
1,1,2,2-Tetrachloroethane	0.5	nd	nd	3.2
Tetrachloroethylene	0.5	nd	nd	1.6
Toluene	0.5	nd	nd	18000
1,1,1-Trichloroethane	0.5	nd	nd	640
1,1,2-Trichloroethane	0.5	nd	nd	4.7
Trichloroethylene	0.5	nd	nd	1.6
Trichlorofluoromethane	1	nd	nd	2500
Vinyl chloride	0.5	nd	nd	0.5
Xylenes, total	0.5	nd	nd	4200

Notes:
- MDL - Method Detection Limit
- nd - not detected above the MDL
- N/V - no value provided by the MOE
- **Bold & Underline** values exceed selected MOECC Standards

No VOC parameters were detected above the laboratory detection limits. All parameters were in compliance with the MOECC Table 3 standards.

Table 14
Analytical Test Results - Groundwater
Petroleum Hydrocarbons (PHCs)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) November 9, 2017	MOECC Table 3 Standards Residential Land Use (µg/L)
		BH2-GW1	
PHC F1	25	nd	750
PHC F2	100	nd	150
PHC F3	100	nd	500
PHC F4	100	nd	500

Notes:
- ❑ MDL - Method Detection Limit
- ❑ nd - Not Detected (< MDL)
- ❑ **Bold & Underline** values exceed selected MOECC Standards

No PHC parameters were detected above the laboratory detection limits. All parameters were in compliance with the MOECC Table 3 standards.

Table 15
Analytical Test Results - Groundwater
Polycyclic Aromatic Hydrocarbons (PAHs)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) November 9, 2017		MOECC Table 3 Standards Residential Land Use (µg/L)
		BH1-GW1	BH2-GW1	
Acenaphthene	0.05	nd	nd	600
Acenaphthylene	0.05	nd	nd	1.8
Anthracene	0.01	nd	nd	2.4
Benzo[a]anthracene	0.01	nd	nd	4.7
Benzo[a]pyrene	0.01	nd	nd	0.81
Benzo[b]fluoranthene	0.05	nd	nd	0.75
Benzo[g,h,i]perylene	0.05	nd	nd	0.2
Benzo[k]fluoranthene	0.05	nd	nd	0.4
Chrysene	0.05	nd	nd	1
Dibenzo[a,h]anthracene	0.05	nd	nd	0.52
Fluoranthene	0.01	nd	nd	130
Fluorene	0.05	nd	nd	400
Indeno[1,2,3-cd]pyrene	0.05	nd	nd	0.2
Methylnaphthalene (1&2)	0.1	nd	nd	1800
Naphthalene	0.05	nd	nd	1400
Phenanthrene	0.05	nd	nd	580
Pyrene	0.01	nd	nd	68

Notes:
- ❑ MDL - Method Detection Limit
- ❑ nd - not detected above the MDL
- ❑ N/V - no value provided by the MOE
- ❑ **Bold & Underline** values exceed MOECC Table 3 Standards

No PAH parameters were detected above the laboratory detection limits. All parameters were in compliance with the MOECC Table 3 standards.

Table 16
Analytical Test Results - Groundwater
Polychlorinated Biphenyls (PCBs)

Parameter	MDL (µg/L)	Groundwater Sample (µg/L) November 9, 2017	MOECC Table 3 Standards Residential Land Use (µg/L)
		BH2-GW1	
PCBs, total	0.05	nd	7.8

Notes:
- ❑ MDL - Method Detection Limit
- ❑ nd - not detected above the MDL
- ❑ N/V - no value provided by the MOE
- ❑ **Bold & Underline** values exceed MOECC Table 3 Standards

No PCB parameters were detected above the laboratory detection limits. All parameters were in compliance with the MOECC Table 3 standards.

5.7 Quality Assurance and Quality Control Measures

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

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

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

5.8 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

The Phase II property is located on the west side of Nelson Street, north of Rideau Street, in the City of Ottawa, Ontario. The Phase II property has an area of approximately 2,949 m^2. At the time of the Phase II Environmental Site Assessment (ESA), the subject property was occupied by a two storey commercial building.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As per Column A of Table 2 outlined in Ontario Regulation 153/04 as amended, Potentially Contaminating Activities (PCAs) were identified in the Phase I-ESA study area. Five of those PCAs are considererd to have created APEC on the subject property:

- ❏ APEC1 - Hydro Ottawa transformer substation (adjacent to the west); Item 55, Table 2, O.Reg. 153/04 as amended: "Transformer manufacturing, processing and use"
- ❏ APEC2 - Former Canadian National Terminal and Garage (adjacent to the west); Item 52, Table 2, O.Reg. 153/04 as amended: "Storage, maintenance, fuelling and repair of equipment, vehicles, and material used to maintain transportation systems"
- ❏ APEC3 -Former Ottawa Electric Railway transformer substation (adjacent to the south); Item 55, Table 2, O.Reg. 153/04 as amended: "Transformer manufacturing, processing and use"
- ❏ APEC4 - Former Superior Dry Cleaners and Dyers (50 m south of subject site); Item 37, Table 2, O.Reg. 153/04 as amended: "Operation of dry cleaning equipment (where chemicals are used)"
- ❏ APEC5 - Former Le Droit printers (20 m southeast); No item

The APECs are outlined on Drawing PE4122-1 in the Phase I-ESA report. Other PCAs within the Phase I study area are not considered to pose an environmental concern to the Phase II property due to their separation distance and/or location downgradient or cross-gradient of the Phase II property, or due to Paterson's knowledge of the other PCAs.

Contaminants of Potential Concern (CPCs)

The following Contaminants of Potential Concern were identified with respect to the Phase II property:

- Volatile Organic Compounds (VOCs) – this suite of parameters includes solvents such as trichloroethylene and tetrachloroethylene associated with drycleaning products, as well as benzene, toluene, ethylbenzene and xylenes, which are generally associated with automotive garages and fuels. These parameters were selected as CPCs for the Phase I study area due to the former presence of a drycleaners and service garage in the study area. VOCs may be present in the soil matrix as well as in the dissolved phase in the groundwater system.

- 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 was selected as a CPC due to the presence of a repair garage to the west. PHCs may be present in the soil matrix, sorbed to soil particles, as well as in free or dissolved phase in the groundwater system.

- Polycyclic Aromatic Hydrocarbons (PAHs) - this suite of parameters encompasses various complex hydrocarbons, commonly associated with coal and/or combustion. PAHs were selected as a CPC for the property based on the former and current presence of transformer substations to the west and south. PAHs may be present in the soil matrix or dissolved in site groundwater.

- Polychlorinated Biphenyls (PCBs) – PCBs have been used as coolants and lubricants in transformer and other electrical equipment from the 1920's until the 1970's. PCBs were chosen as a contaminant of potential concern due to the proximity of the substation to the west, and the former substation to the south. PCBs may be present in the soil matrix, sorbed to soil particles, as well as in free or dissolved phase in the groundwater system.

Subsurface Structures and Utilities

Subsurface structures and utilities were located and marked prior to the subsurface investigation. Subsurface utilities included storm and sanitary sewer lines, a potable water line, electrical lines and telephone lines.

Potable Water Source

The subject property was serviced with municipal water, as are all properties within the Phase-II study area.

PHYSICAL SETTING

Site Stratigraphy

The soil profile encountered at the borehole locations consisted of asphalt over crushed stone, fill material (consisting of silty sand), native silty clay, then native glacial till. Specific details of the soil profile at the test hole location can be seen on the Soil Profile and Test Data sheets in the Appendix.

The site stratigraphy from the asphalt surface to the deepest aquifer investigated, is illustrated on Drawing PE4122-4 - Cross Section A-A' and Drawing PE4122-5 - Cross Section B-B'. The stratigraphy consists of the following:

- **Asphalt** was encountered at ground surface, to depths ranging from 0.08 m to 0.28 m below ground surface.

- **Fill material (crushed stone)** was encountered at each location, up to a depth of 0.41 m below ground surface.

- **Silty sand** was encountered up to a depth of 2.23 m below ground surface.

- **Grey Silty Clay**, was encountered in each borehole, extending to a maximum depth of 7.47 m below surface.

- **Grey silty clay with traces of gravel (potential glacial till)** was identified in boreholes BH1 and BH3, up to a depth of 9.75 m below grade.

Bedrock was not encountered at any of the borehole locations.

Hydrogeological Characteristics

Groundwater was encountered in the native clay/glacial till unit, which is interpreted to function as a local unconfined aquifer on the property. Groundwater monitoring wells were installed in grey silty clay at all borehole locations. Although groundwater was not encountered at the well in borehole BH3, the groundwater flow direction is considered to be in a northern or northeastern direction.

Approximate Depth to Bedrock

Bedrock was not confirmed at any of the borehole locations, however a Dynamic Cone Penetration Test was conducted at borehole locations BH1 and BH3 where refusal was encountered at 11.73 m and 11.56 m depth, respectively, on the inferred bedrock surface.

Approximate Depth to Water Table

Groundwater levels were encountered at 4.5 m and 6.08 m below grade.

Sections 41 and 43.1 of the Regulation

Sections 41 and 43.1 of the Regulation (Site Condition Standards, Environmentally Sensitive Areas) do not apply to the subject site.

Fill Placement

Fill placement has occurred at the subject site, consisting of a granular base (crushed stone) below the asphaltic surface, as well as silty sand fill below that. Based on analytical testing, the fill is not considered to be an environmental concern.

Proposed Buildings and Other Structures

The proposed development consists of a multi storey residential building with one level of underground parking.

Existing Buildings and Structures

The subject property is occupied by a two storey commercial building with one level of basement below the southern portion of the building.

The location of the subject structure is depicted on Drawing: PE4122-3 - Test Hole Location Plan.

Water Bodies

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

Areas of Natural Significance

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

Environmental Condition Prior to Remediation

Areas Where Contaminants Are Present

Based on analytical test results, the soil and groundwater at the subject property are in compliance with MOECC Table 3 site standards. Furthermore, the soils also comply with MOECC Table 1 standards, which represent typical background standards in Ontario.

6.0 CONCLUSIONS

Assessment

A Phase II - Environmental Site Assessment (ESA) was conducted for 112 Nelson Street, in the City of Ottawa, Ontario. The purpose of the Phase II-ESA was to address potentially contaminating activities which were considered to have created areas of potential environmental concern on the subject property. These included an existing transformer substation, a former automotive garage, a former substation, a former dry cleaners and a former printers.

Soil

Three (3) boreholes were placed on the subject property on November 2, 2017. All three boreholes were instrumented with groundwater monitoring wells.

Four (4) soil samples were submitted for analysis of metals, volatile organic compounds, petroleum hydrocarbons, polycyclic aromatic hydrocarbons and polychlorinated biphenyls. All soil results were found to be in compliance with Ministry of the Environment and Climate Change (MOECC) standards for the subject property.

Groundwater

Paterson collected groundwater samples from the groundwater monitoring wells on November 9, 2017. Groundwater samples were submitted for analysis of volatile organic compounds, petroleum hydrocarbons, polycyclic aromatic hydrocarbons and polychlorinated biphenyls. None of the analytical test parameters were detected above the laboratory detection limits. All analytical test results were in compliance with the MOECC standards for the subject property.

Recommendations

If the construction depth of the proposed building does not extend below the groundwater monitoring wells, then the wells must be decommissioned according to Ontario Regulation 903, in conjunction with, or prior to, site redevelopment.

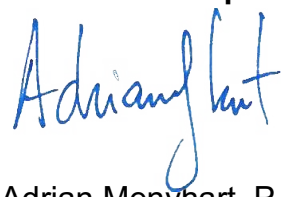
7.0 STATEMENT OF LIMITATIONS

This Phase II-ESA report has been prepared in general accordance with Ontario Regulation 269/11 amending O.Reg. 153/04 and meets the requirements of CSA Z768-00. 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. Should any conditions be encountered at the subject site that differ from our findings, we request that we be notified immediately in order to allow for a reassessment.

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 described by the test holes themselves.

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

Paterson Group Inc.



Adrian Menyhart, P.Eng.

Mark S. D'Arcy, P.Eng.

Report Distribution

- ❑ Domicile Developments (6 copies)
- ❑ Paterson Group (1 copy)

FIGURES

FIGURE 1 - KEY PLAN

DRAWING PE4122-3 - TEST HOLE LOCATION PLAN

DRAWING PE4122-4 - CROSS-SECTION A-A'

DRAWING: PE4122-5 - CROSS-SECTION B-B'

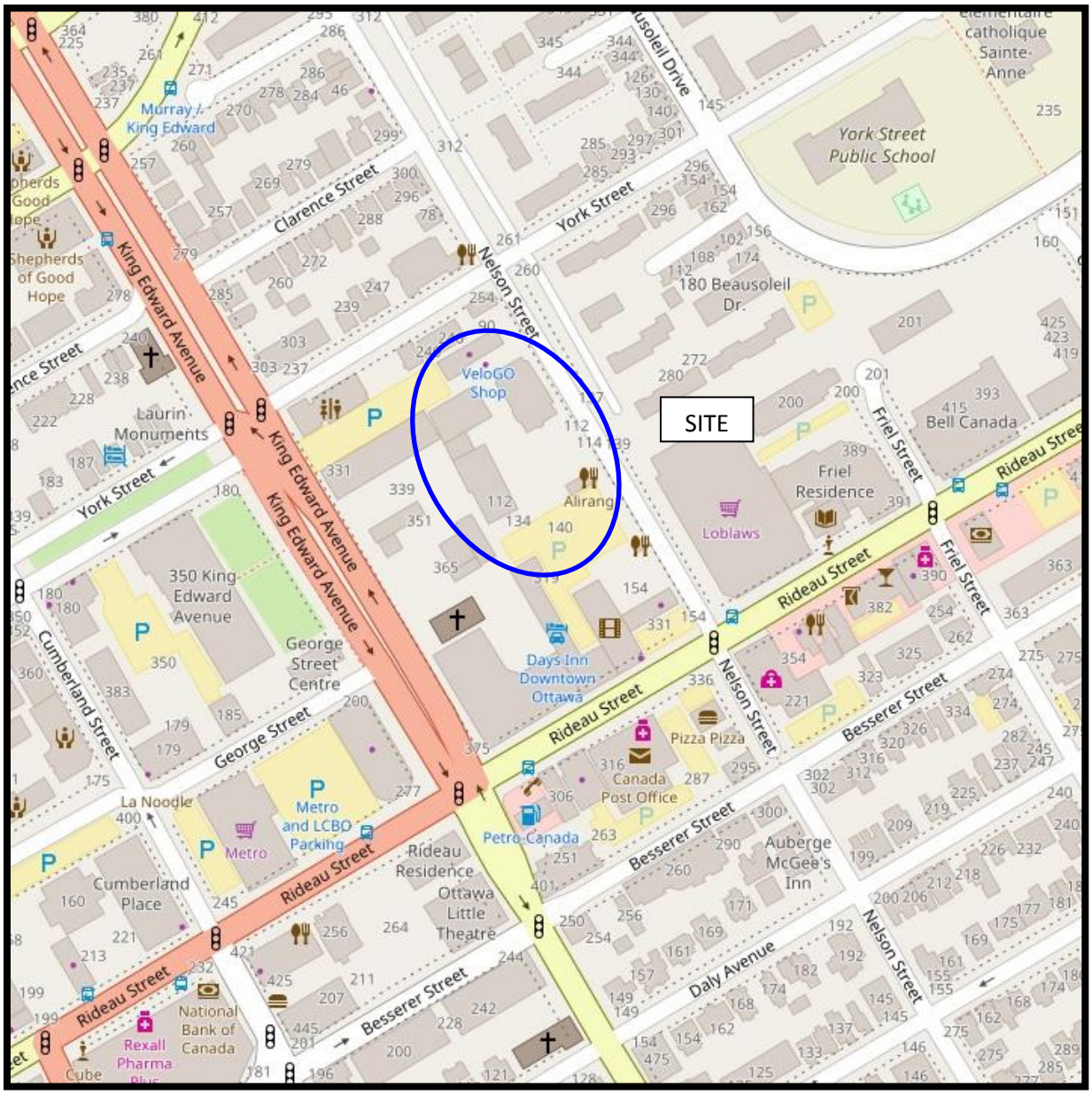
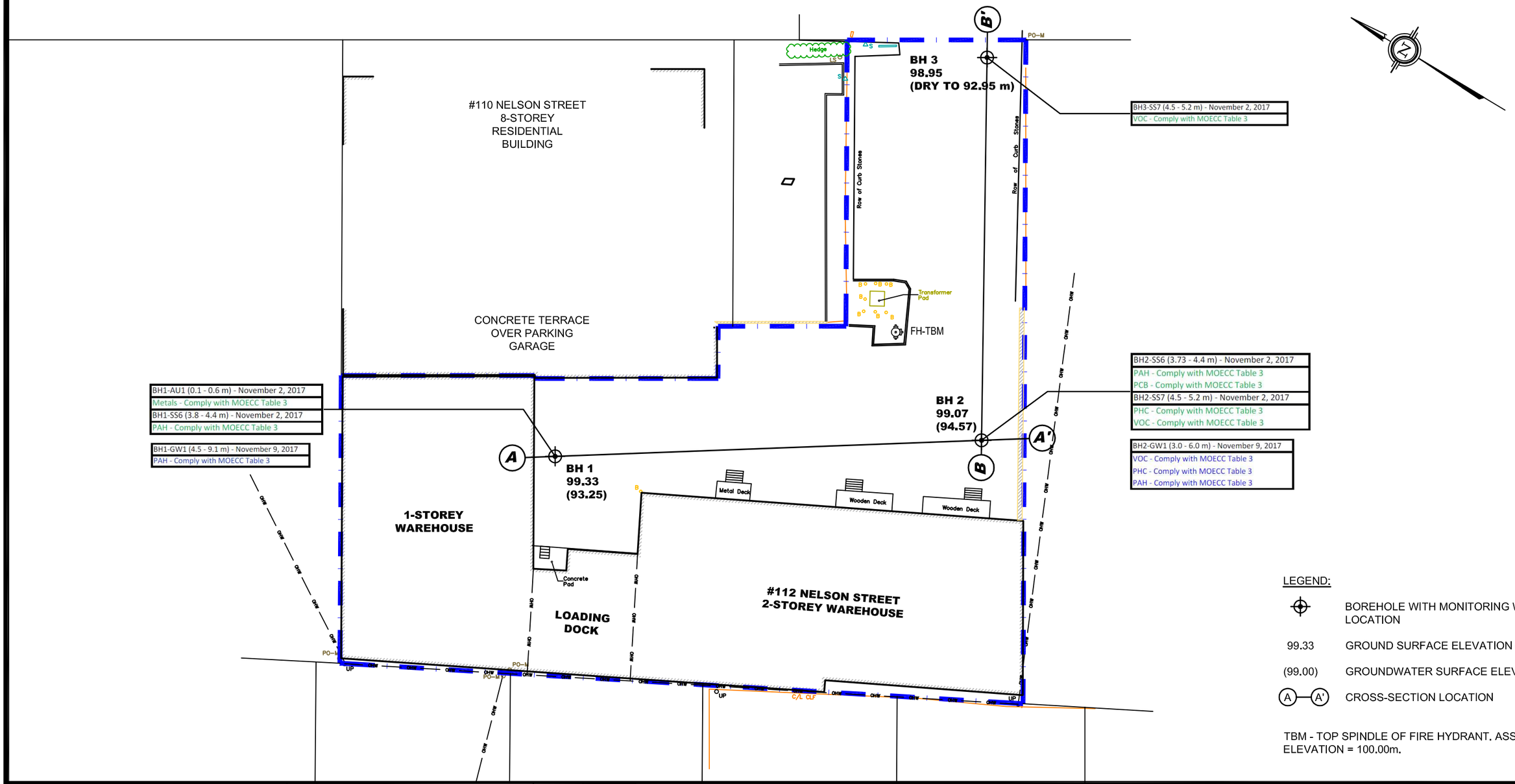


FIGURE 1

KEY PLAN



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

NO.	REVISIONS	DATE	INITIAL
0			

DOMICILE DEVELOPMENTS

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
112 NELSON STREET

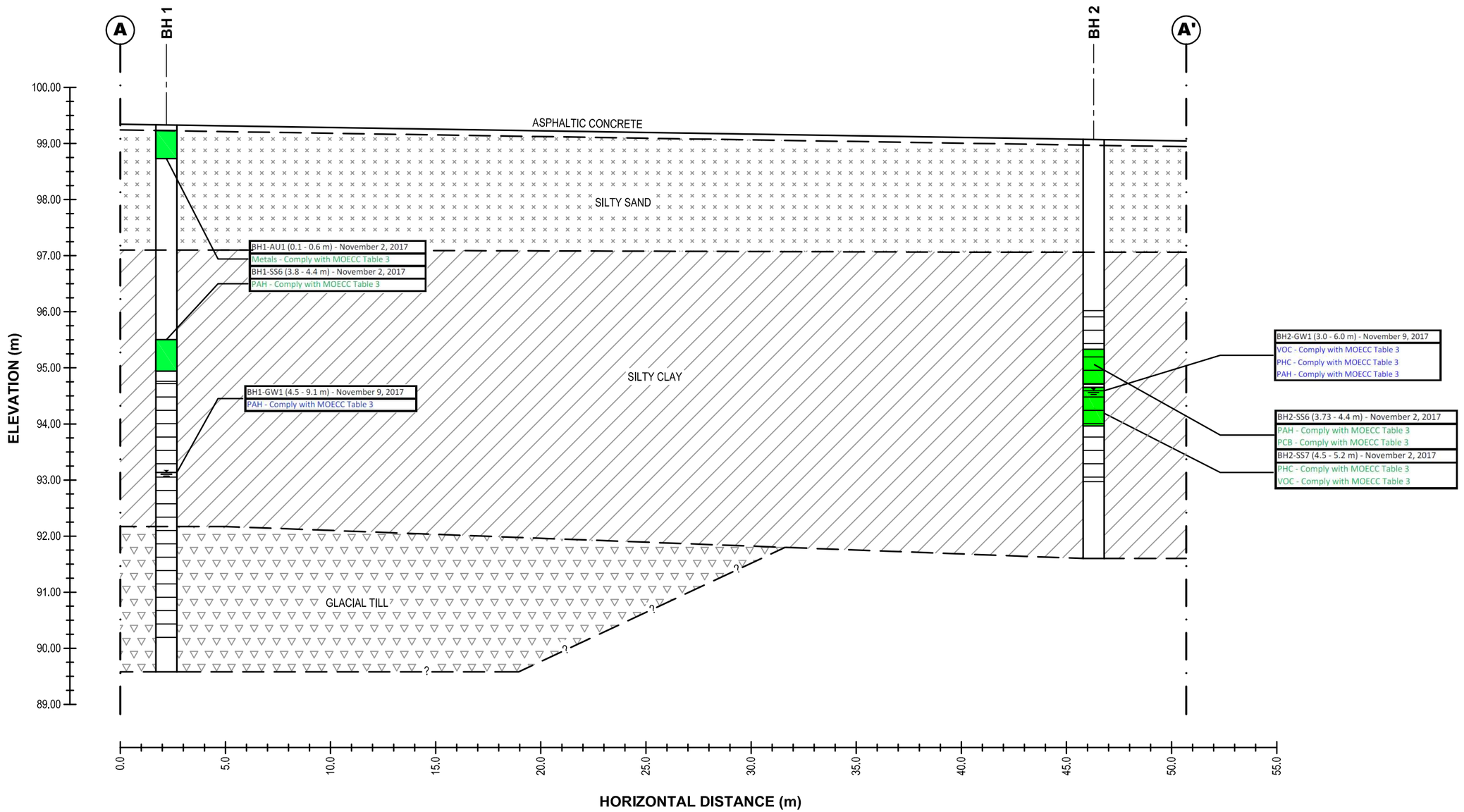
OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:400	Date: 11/2017
Drawn by: MPG	Report No.: PE4122-2
Checked by: AM	Dwg. No.: PE4122-3
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe41xx\pe4122\pe4122 phase 2.dwg



patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

DOMICILE DEVELOPMENTS

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
112 NELSON STREET

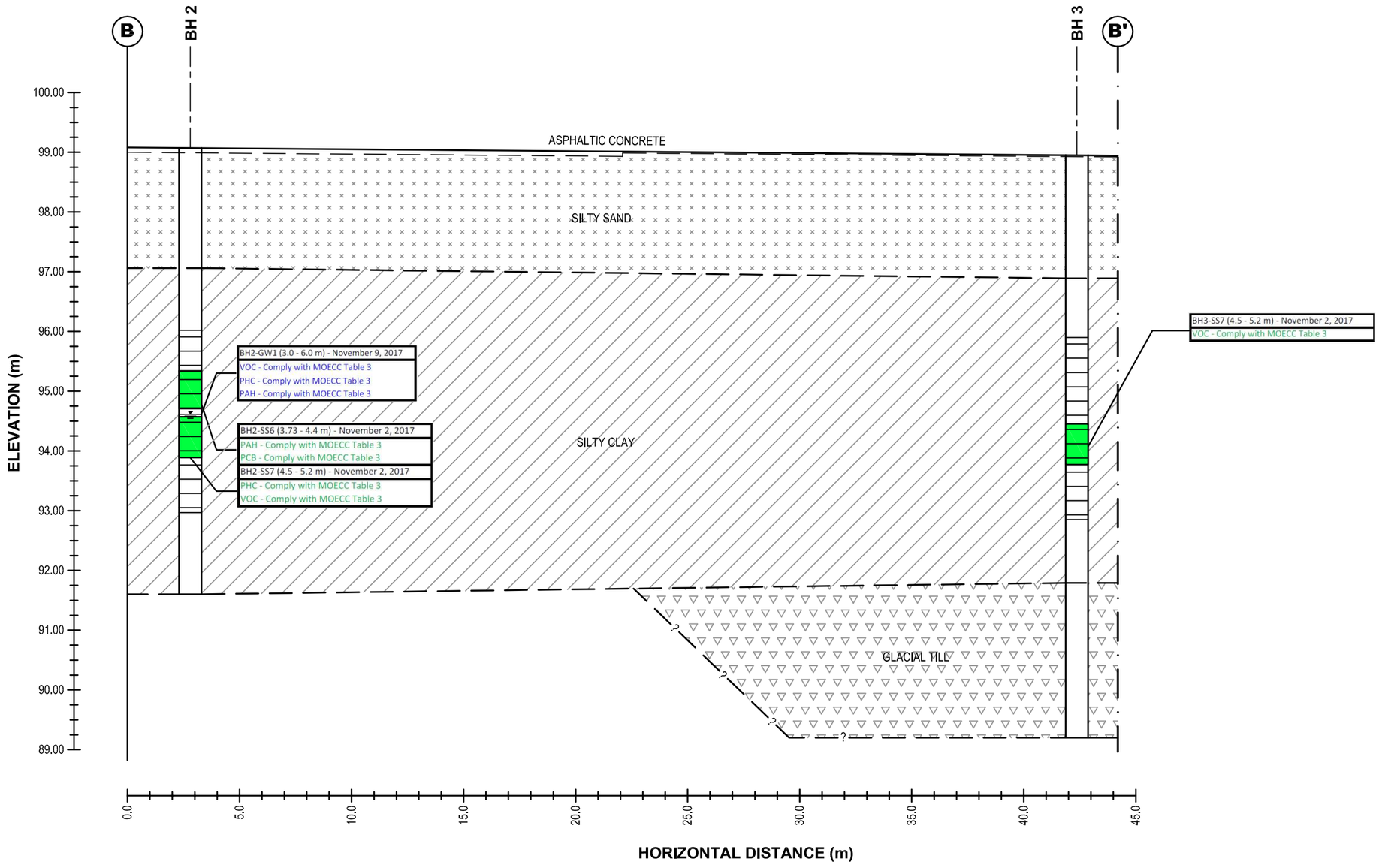
OTTAWA, ONTARIO

Title:

CROSS-SECTION A-A'

Scale: AS SHOWN	Date: 11/2017
Drawn by: MPG	Report No.: PE4122-2
Checked by: AM	Dwg. No.: PE4122-4
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe41xx\pe4122\pe4122 cross sections.dwg



patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

DOMICILE DEVELOPMENTS

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
112 NELSON STREET

OTTAWA, ONTARIO

Title:

CROSS-SECTION B-B'

Scale: AS SHOWN	Date: 11/2017
Drawn by: MPG	Report No.: PE4122-2
Checked by: AM	Dwg. No.: PE4122-5
Approved by: MSD	Revision No.: 0

p:\autocad drawings\environmental\pe41xx\pe4122\pe4122 cross sections.dwg

APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

Paterson Group Inc.

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

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

patersongroup

Sampling and Analysis Plan

112 Nelson Street
Ottawa, Ontario

Prepared For

Domicile Developments

October, 2017

Report: PE4122-SAP.01

Table of Contents

1.0 Sampling Program

Paterson Group (Paterson) was commissioned by Domicile Developments to conduct a Phase II ESA for the property located at 112 Nelson Street, in the City of Ottawa, Ontario.

The following subsurface investigation program was developed to identify and delineate the suspected contamination:

Test Hole	Location and Rationale	Proposed Depth and Rationale
BH1	Located in the northwest corner of the parking lot, to address off-site concerns related to the transformer substation, adjacent to the west.	Drilled to water table to install a monitoring well and recover groundwater samples
BH2	Located in the southwest corner of the parking lot, to address off-site concerns related to the transformer substation and former garage, adjacent to the west, the former transformer substation to the south, and the dry cleaners to the south.	Drilled to water table to install a monitoring well and recover groundwater samples
BH3	Located in the southeast corner of the parking lot, adjacent to Nelson Street, to address off-site concerns related to the former printers located to the southeast across Nelson Street.	Drilled to water table to install a monitoring well and recover groundwater samples

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

At each borehole, split spoon of overburden soils will be obtained at 0.76 m (2'6'') intervals until spoon refusal is encountered. Grab samples will be obtained from each stratigraphic unit encountered in the test pits. All soil samples will be retained, and samples will be selected for submission following a preliminary screening analysis.

If it is considered necessary to drill into bedrock to intercept the groundwater table, boreholes will be advanced into bedrock as required using diamond coring equipment. Rock core samples will be retained for review. Following borehole drilling, monitoring wells will be installed in selected boreholes for the measurement of water levels and the collection of groundwater samples.

2.0 Analytical Testing Program

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

- In borehole where there is visual or olfactory evidence of contamination, or where photoionization detector (PID) readings indicate the presence of contamination, the 'worst-case' sample from each test pit should be submitted for comparison with MOECC site condition standards.
- In boreholes with evidence of contamination as described above, a sample should be submitted from the stratigraphic unit below the 'worst-case' sample to determine whether the contaminant(s) have migrated vertically downward.
- At least one sample from each borehole should be submitted to delineate the horizontal extent of contamination across the site.
- Parameters analyzed should be consistent with the contaminants of potential concern identified in the Phase II-ESA.
- Samples will be submitted for analysis of VOC parameters.

3.0 Standard Operating Procedures

3.1 Environmental Drilling Procedure

Purpose

The purpose of environmental boreholes is to assess the soil conditions and facilitate the installation of groundwater monitoring wells.

Equipment

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

- Glass soil sample jars
- Plastic sample bags 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 and Test pit Locations

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

After drilling/excavation is completed a plan with the borehole/test pit locations must be provided. Distances and orientations of test pits 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. Sleeve samples are to be collected when utilizing GeoProbe direct push drill.
- 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. Sleeves are disposable and will not require washing.
- If obvious contamination is encountered, continue sampling until vertical extent of contamination is delineated.
- As a general rule, environmental boreholes should be deep enough to intercept the groundwater table (unless this is impossible/impractical - call project manager to discuss).
- If at all possible, soil samples should be submitted to a preliminary screening procedure on site, either using a RKI Eagle, PID, visual observations, etc. depending on type of suspected contamination.

Spoon Washing Procedure

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

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

The methyl hydrate eliminates any soap residue that may be on the spoon, and is especially important when dealing with suspected VOCs. The spoon-washing procedure may be bypassed if a GeoProbe direct-push drill rig with disposable plastic sampling tubes is used.

3.2 Monitoring Well Installation Procedure

Equipment

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

Procedure

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

- Backfill with holeplug until at least 0.3 m of holeplug is present above the top of the silica sand.
- Backfill remainder of borehole with holeplug or with auger cuttings (if contamination is not suspected).
- Install flushmount casing. Seal space between flushmount and borehole annulus with concrete, cold patch, or holeplug to match surrounding ground surface.

3.3 Monitoring Well Sampling Procedure

Equipment

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

Sampling Procedure

- Locate well and use socket wrench or Allan key to open metal flush mount protector cap. Remove plastic well cap.
- Measure water level, with respect to existing ground surface, using water level meter or interface probe. If using interface probe on suspected NAPL site, measure the thickness of free product.
- Measure total depth of well.
- Clean water level tape or interface probe using methanol and water. Change gloves between wells.
- Calculate volume of standing water within well and record.
- Insert polyethylene tubing into well and attach to peristaltic pump. Turn on peristaltic pump and purge into graduated bucket. Purge at least three well volumes of water from the well. Measure and record field chemistry. Continue to purge, measuring field chemistry after every well volume purged, until appearance or field chemistry stabilizes.

- Note appearance of purge water, including colour, opacity (clear, cloudy, silty), sheen, presence of LNAPL, and odour. Note any other unusual features (particulate matter, effervescence (bubbling) of dissolved gas, etc.).
- Fill required sample bottles. If sampling for metals, attach 75-micron filter to discharge tube and filter metals sample. If sampling for VOCs, use low flow rate to ensure continuous stream of non-turbulent flow into sample bottles. Ensure no headspace is present in VOC vials.
- Replace well cap and flushmount casing cap.

Instrument Washing Procedure

All sampling equipment (shovels, trowels, spatulas, 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 instrument with brush in soapy water, inside and out, including tip
- Rinse in clean water
- Apply a small amount of methyl hydrate to the exposed faces of the instrument. (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 equipment, 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.

4.0 Quality Assurance/Quality Control (QA/QC)

The QA/QC program for this subsurface investigation is as follows:

- All non-dedicated sampling equipment (shovels, split spoons, etc.) will be decontaminated according to the SOPs listed above.
- Approximately one field duplicate will be submitted for every ten samples submitted for laboratory analysis. A minimum of one field duplicate per project will be submitted. Field duplicates will be submitted for soil and groundwater samples where possible.
- Where multi-parameter analyzers are used to measure field chemistry, they will be calibrated on an approximately monthly basis, according to frequency of use.

5.0 Physical Impediments to Sampling and Analysis Plan

Physical impediments to the Sampling and Analysis plan may include:

- The location of underground utilities
- Shallow bedrock or limited presence of fill
- Insufficient groundwater volume for groundwater samples (if encountered)
- 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

- Mechanical Equipment breakdowns
- Winter conditions
- Other site-specific impediments

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
112 Nelson Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant (refer to Test Hole Location Plan for location. Assumed elevation = 100.00m.

FILE NO. PE4122

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** 2 November 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	99.33
Asphaltic concrete 0.10		AU	1				
FILL: Crushed stone with silt and sand 0.41							
FILL: Brown silty sand, some gravel and cobbles, trace boulders		SS	2	12	12	1	98.33
		SS	3	21	50+	2	97.33
-Concrete encountered at 1.8 m depth 2.23							
		SS	4	100	1	3	96.33
Stiff, grey **SILTY CLAY,** trace sand		SS	5	100	P		
		SS	6	83	P	4	95.33
- very stiff to stiff by 4.6m depth		SS	7	100	P	5	94.33
		SS	8	100	P		
		SS	9	83	P	6	93.33
7.16						7	92.33
GLACIAL TILL: Grey silty clay, trace gravel		SS	10	71	P	8	91.33
						9	90.33
9.75		SS	11	62	18		
Dynamic Cone Penetration commenced at 9.75m depth. Practical DCPT refusal at 11.73m depth							
(GWL @ 6.1 m depth - Nov. 9, 2017)							

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

20 40 60 80

100 200 300 400 500
RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
112 Nelson Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant (refer to Test Hole Location Plan for location. Assumed elevation = 100.00m.

FILE NO. PE4122

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** 2 November 2017

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									
Asphaltic concrete 0.08		AU	1			0	99.07		
FILL: Crushed stone with silt and sand 0.36									
Brown **SILTY SAND**, trace gravel and topsoil 1.07		SS	2	58	5	1	98.07		
Loose, brown **SILTY SAND** 2.01		SS	3	42	7	2	97.07		
		SS	4	83	P				
		SS	5	100	P	3	96.07		
		SS	6	75	P	4	95.07		
Stiff, grey **SILTY CLAY,** trace sand		SS	7	83	P	5	94.07		
		SS	8	83	P				
		SS	9	100	P	6	93.07		
7.47		SS	10	100	P	7	92.07		
End of Borehole									
(GWL @ 4.5 m depth - Nov. 9, 2017)									

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

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
112 Nelson Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant (refer to Test Hole Location Plan for location. Assumed elevation = 100.00m.

FILE NO. PE4122

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** 2 November 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
25mm Asphaltic concrete over crushed stone with silt and sand 0.28		AU	1			0	98.95
Loose, brown **SILTY SAND**		SS	2	42	8	1	97.95
2.06		SS	3	33	4	2	96.95
		SS	4	83	2		
Stiff, grey **SILTY CLAY,** trace sand		SS	5	79	P	3	95.95
		SS	6	100	P	4	94.95
- very stiff to stiff by 4.6m depth		SS	7	100	P	5	93.95
		SS	8	100	P		
		SS	9	100	P	6	92.95
7.16						7	91.95
		SS	10	58	P	8	90.95
GLACIAL TILL: Grey silty clay, trace gravel, cobbles and boulders						9	89.95
9.75		SS	11	4	4		
Dynamic Cone Penetration commenced at 9.75m depth. Practical DCPT refusal at 11.56m depth							
(BH Dry - Nov. 9, 2017)							

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

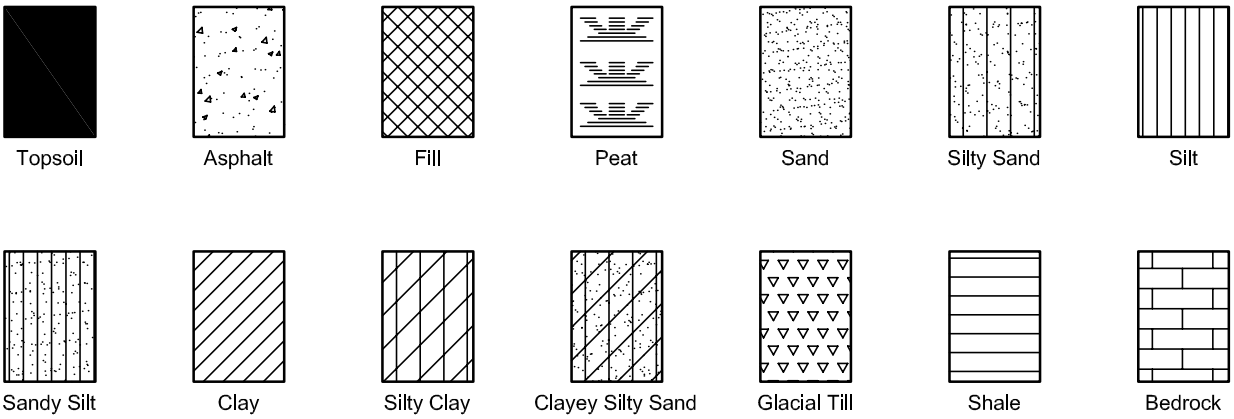
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

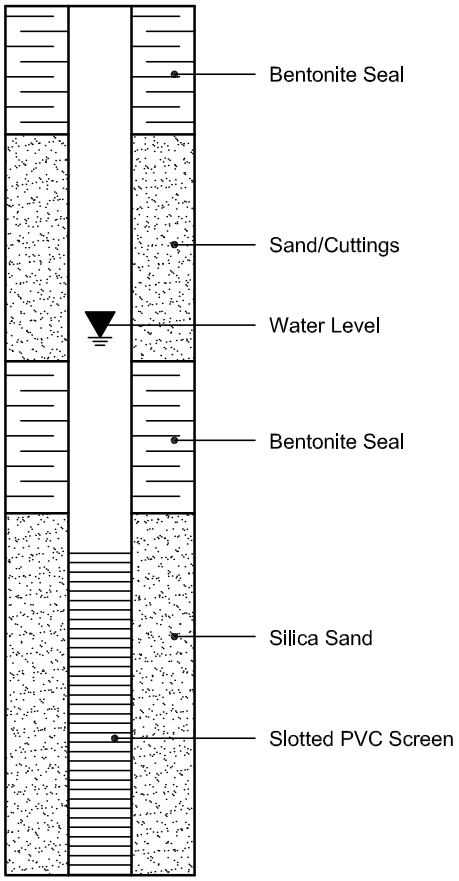
SYMBOLS AND TERMS (continued)

STRATA PLOT

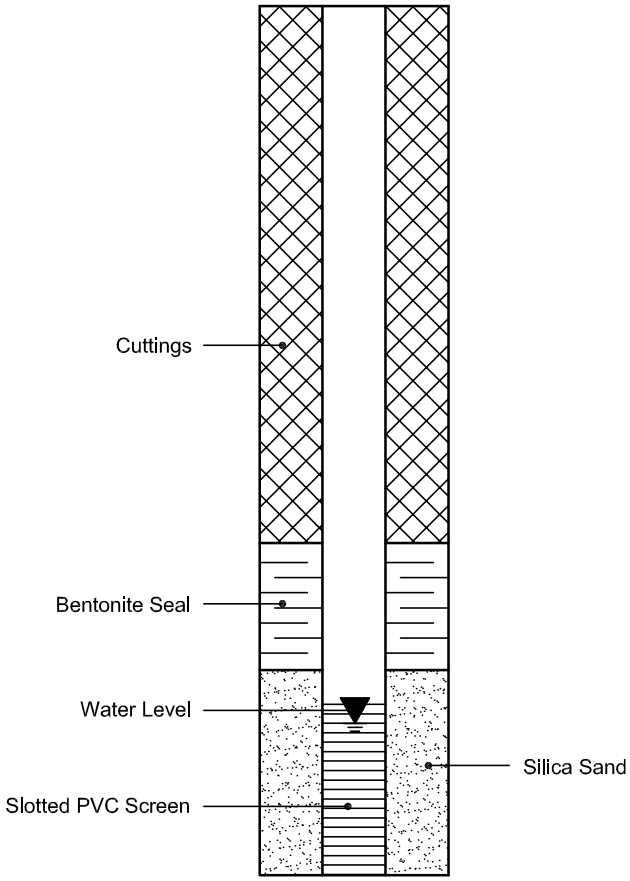


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



PARACEL LABORATORIES LTD.
TRUSTED. RESPONSIVE. RELIABLE.

300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 23038
Project: PE4122
Custody: 114236

Report Date: 9-Nov-2017
Order Date: 3-Nov-2017

Order #: 1744538

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

Paracel ID	Client ID
1744538-01	BH1-AU1
1744538-02	BH1-SS6
1744538-03	BH2-SS6
1744538-04	BH2-SS7
1744538-05	BH3-SS7

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23038

Report Date: 09-Nov-2017
Order Date: 3-Nov-2017
Project Description: PE4122

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Boron, available	MOE (HWE), EPA 200.7 - ICP-OES	9-Nov-17	9-Nov-17
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	6-Nov-17	7-Nov-17
Mercury by CVAA	EPA 7471B - CVAA, digestion	9-Nov-17	9-Nov-17
PCBs, total	SW846 8082A - GC-ECD	3-Nov-17	7-Nov-17
PHC F1	CWS Tier 1 - P&T GC-FID	7-Nov-17	8-Nov-17
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	3-Nov-17	7-Nov-17
REG 153: Metals by ICP/OES, soil	based on MOE E3470, ICP-OES	8-Nov-17	8-Nov-17
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	4-Nov-17	8-Nov-17
REG 153: VOCs by P&T GC/MS	EPA 8260 - P&T GC-MS	7-Nov-17	8-Nov-17
Solids, %	Gravimetric, calculation	8-Nov-17	8-Nov-17

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23038

Report Date: 09-Nov-2017
Order Date: 3-Nov-2017
Project Description: PE4122

	Client ID:	BH1-AU1	BH1-SS6	BH2-SS6	BH2-SS7
	Sample Date:	02-Nov-17	02-Nov-17	02-Nov-17	02-Nov-17
	Sample ID:	1744538-01	1744538-02	1744538-03	1744538-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	96.7	68.0	67.2	64.0
Metals					
Antimony	1.0 ug/g dry	<1.0	-	-	-
Arsenic	1.0 ug/g dry	<1.0	-	-	-
Barium	1.0 ug/g dry	96.5	-	-	-
Beryllium	1.0 ug/g dry	<1.0	-	-	-
Boron	1.0 ug/g dry	22.7	-	-	-
Boron, available	0.5 ug/g dry	0.9	-	-	-
Cadmium	0.5 ug/g dry	<0.5	-	-	-
Chromium	1.0 ug/g dry	12.5	-	-	-
Chromium (VI)	0.2 ug/g dry	<0.2	-	-	-
Cobalt	1.0 ug/g dry	6.5	-	-	-
Copper	1.0 ug/g dry	13.0	-	-	-
Lead	1.0 ug/g dry	29.9	-	-	-
Mercury	0.1 ug/g dry	<0.1	-	-	-
Molybdenum	1.0 ug/g dry	<1.0	-	-	-
Nickel	1.0 ug/g dry	12.5	-	-	-
Selenium	1.0 ug/g dry	<1.0	-	-	-
Silver	0.5 ug/g dry	<0.5	-	-	-
Thallium	1.0 ug/g dry	<1.0	-	-	-
Uranium	1.0 ug/g dry	<1.0	-	-	-
Vanadium	1.0 ug/g dry	17.0	-	-	-
Zinc	1.0 ug/g dry	18.0	-	-	-
Volatiles					
Acetone	0.50 ug/g dry	-	-	-	<0.50
Benzene	0.02 ug/g dry	-	-	-	<0.02
Bromodichloromethane	0.05 ug/g dry	-	-	-	<0.05
Bromoform	0.05 ug/g dry	-	-	-	<0.05
Bromomethane	0.05 ug/g dry	-	-	-	<0.05
Carbon Tetrachloride	0.05 ug/g dry	-	-	-	<0.05
Chlorobenzene	0.05 ug/g dry	-	-	-	<0.05
Chloroform	0.05 ug/g dry	-	-	-	<0.05
Dibromochloromethane	0.05 ug/g dry	-	-	-	<0.05
Dichlorodifluoromethane	0.05 ug/g dry	-	-	-	<0.05
1,2-Dichlorobenzene	0.05 ug/g dry	-	-	-	<0.05

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23038

Report Date: 09-Nov-2017
Order Date: 3-Nov-2017
Project Description: PE4122

	Client ID:	BH1-AU1	BH1-SS6	BH2-SS6	BH2-SS7
	Sample Date:	02-Nov-17	02-Nov-17	02-Nov-17	02-Nov-17
	Sample ID:	1744538-01	1744538-02	1744538-03	1744538-04
	MDL/Units	Soil	Soil	Soil	Soil
1,3-Dichlorobenzene	0.05 ug/g dry	-	-	-	<0.05
1,4-Dichlorobenzene	0.05 ug/g dry	-	-	-	<0.05
1,1-Dichloroethane	0.05 ug/g dry	-	-	-	<0.05
1,2-Dichloroethane	0.05 ug/g dry	-	-	-	<0.05
1,1-Dichloroethylene	0.05 ug/g dry	-	-	-	<0.05
cis-1,2-Dichloroethylene	0.05 ug/g dry	-	-	-	<0.05
trans-1,2-Dichloroethylene	0.05 ug/g dry	-	-	-	<0.05
1,2-Dichloropropane	0.05 ug/g dry	-	-	-	<0.05
cis-1,3-Dichloropropylene	0.05 ug/g dry	-	-	-	<0.05
trans-1,3-Dichloropropylene	0.05 ug/g dry	-	-	-	<0.05
1,3-Dichloropropene, total	0.05 ug/g dry	-	-	-	<0.05
Ethylbenzene	0.05 ug/g dry	-	-	-	<0.05
Ethylene dibromide (dibromoethan	0.05 ug/g dry	-	-	-	<0.05
Hexane	0.05 ug/g dry	-	-	-	<0.05
Methyl Ethyl Ketone (2-Butanone)	0.50 ug/g dry	-	-	-	<0.50
Methyl Isobutyl Ketone	0.50 ug/g dry	-	-	-	<0.50
Methyl tert-butyl ether	0.05 ug/g dry	-	-	-	<0.05
Methylene Chloride	0.05 ug/g dry	-	-	-	<0.05
Styrene	0.05 ug/g dry	-	-	-	<0.05
1,1,1,2-Tetrachloroethane	0.05 ug/g dry	-	-	-	<0.05
1,1,2,2-Tetrachloroethane	0.05 ug/g dry	-	-	-	<0.05
Tetrachloroethylene	0.05 ug/g dry	-	-	-	<0.05
Toluene	0.05 ug/g dry	-	-	-	<0.05
1,1,1-Trichloroethane	0.05 ug/g dry	-	-	-	<0.05
1,1,2-Trichloroethane	0.05 ug/g dry	-	-	-	<0.05
Trichloroethylene	0.05 ug/g dry	-	-	-	<0.05
Trichlorofluoromethane	0.05 ug/g dry	-	-	-	<0.05
Vinyl chloride	0.02 ug/g dry	-	-	-	<0.02
m,p-Xylenes	0.05 ug/g dry	-	-	-	<0.05
o-Xylene	0.05 ug/g dry	-	-	-	<0.05
Xylenes, total	0.05 ug/g dry	-	-	-	<0.05
4-Bromofluorobenzene	Surrogate	-	-	-	96.3%
Dibromofluoromethane	Surrogate	-	-	-	93.4%
Toluene-d8	Surrogate	-	-	-	97.0%
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	-	-	-	<7

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23038

Report Date: 09-Nov-2017
Order Date: 3-Nov-2017
Project Description: PE4122

	Client ID:	BH1-AU1	BH1-SS6	BH2-SS6	BH2-SS7
	Sample Date:	02-Nov-17	02-Nov-17	02-Nov-17	02-Nov-17
	Sample ID:	1744538-01	1744538-02	1744538-03	1744538-04
	MDL/Units	Soil	Soil	Soil	Soil
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
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	-	<0.02	<0.02	-
Acenaphthylene	0.02 ug/g dry	-	<0.02	<0.02	-
Anthracene	0.02 ug/g dry	-	<0.02	<0.02	-
Benzo [a] anthracene	0.02 ug/g dry	-	<0.02	<0.02	-
Benzo [a] pyrene	0.02 ug/g dry	-	<0.02	<0.02	-
Benzo [b] fluoranthene	0.02 ug/g dry	-	<0.02	<0.02	-
Benzo [g,h,i] perylene	0.02 ug/g dry	-	<0.02	<0.02	-
Benzo [k] fluoranthene	0.02 ug/g dry	-	<0.02	<0.02	-
Chrysene	0.02 ug/g dry	-	<0.02	<0.02	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	-	<0.02	<0.02	-
Fluoranthene	0.02 ug/g dry	-	<0.02	<0.02	-
Fluorene	0.02 ug/g dry	-	<0.02	<0.02	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	-	<0.02	<0.02	-
1-Methylnaphthalene	0.02 ug/g dry	-	<0.02	<0.02	-
2-Methylnaphthalene	0.02 ug/g dry	-	<0.02	<0.02	-
Methylnaphthalene (1&2)	0.04 ug/g dry	-	<0.04	<0.04	-
Naphthalene	0.01 ug/g dry	-	<0.01	<0.01	-
Phenanthrene	0.02 ug/g dry	-	<0.02	<0.02	-
Pyrene	0.02 ug/g dry	-	<0.02	<0.02	-
2-Fluorobiphenyl	Surrogate	-	68.8%	69.6%	-
Terphenyl-d14	Surrogate	-	108%	112%	-
PCBs					
PCBs, total	0.05 ug/g dry	-	-	<0.05	-
Decachlorobiphenyl	Surrogate	-	-	134%	-

	Client ID:	BH3-SS7	-	-	-
	Sample Date:	02-Nov-17	-	-	-
	Sample ID:	1744538-05	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	66.1	-	-	-
Volatiles					
Acetone	0.50 ug/g dry	<0.50	-	-	-
Benzene	0.02 ug/g dry	<0.02	-	-	-
Bromodichloromethane	0.05 ug/g dry	<0.05	-	-	-
Bromoform	0.05 ug/g dry	<0.05	-	-	-
Bromomethane	0.05 ug/g dry	<0.05	-	-	-
Carbon Tetrachloride	0.05 ug/g dry	<0.05	-	-	-
Chlorobenzene	0.05 ug/g dry	<0.05	-	-	-
Chloroform	0.05 ug/g dry	<0.05	-	-	-
Dibromochloromethane	0.05 ug/g dry	<0.05	-	-	-
Dichlorodifluoromethane	0.05 ug/g dry	<0.05	-	-	-
1,2-Dichlorobenzene	0.05 ug/g dry	<0.05	-	-	-
1,3-Dichlorobenzene	0.05 ug/g dry	<0.05	-	-	-
1,4-Dichlorobenzene	0.05 ug/g dry	<0.05	-	-	-
1,1-Dichloroethane	0.05 ug/g dry	<0.05	-	-	-
1,2-Dichloroethane	0.05 ug/g dry	<0.05	-	-	-
1,1-Dichloroethylene	0.05 ug/g dry	<0.05	-	-	-
cis-1,2-Dichloroethylene	0.05 ug/g dry	<0.05	-	-	-
trans-1,2-Dichloroethylene	0.05 ug/g dry	<0.05	-	-	-
1,2-Dichloropropane	0.05 ug/g dry	<0.05	-	-	-
cis-1,3-Dichloropropylene	0.05 ug/g dry	<0.05	-	-	-
trans-1,3-Dichloropropylene	0.05 ug/g dry	<0.05	-	-	-
1,3-Dichloropropene, total	0.05 ug/g dry	<0.05	-	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	-	-	-
Ethylene dibromide (dibromoethar	0.05 ug/g dry	<0.05	-	-	-
Hexane	0.05 ug/g dry	<0.05	-	-	-
Methyl Ethyl Ketone (2-Butanone)	0.50 ug/g dry	<0.50	-	-	-
Methyl Isobutyl Ketone	0.50 ug/g dry	<0.50	-	-	-
Methyl tert-butyl ether	0.05 ug/g dry	<0.05	-	-	-
Methylene Chloride	0.05 ug/g dry	<0.05	-	-	-
Styrene	0.05 ug/g dry	<0.05	-	-	-
1,1,1,2-Tetrachloroethane	0.05 ug/g dry	<0.05	-	-	-
1,1,2,2-Tetrachloroethane	0.05 ug/g dry	<0.05	-	-	-

	Client ID:	BH3-SS7	-	-	-
	Sample Date:	02-Nov-17	-	-	-
	Sample ID:	1744538-05	-	-	-
	MDL/Units	Soil	-	-	-
Tetrachloroethylene	0.05 ug/g dry	<0.05	-	-	-
Toluene	0.05 ug/g dry	<0.05	-	-	-
1,1,1-Trichloroethane	0.05 ug/g dry	<0.05	-	-	-
1,1,2-Trichloroethane	0.05 ug/g dry	<0.05	-	-	-
Trichloroethylene	0.05 ug/g dry	<0.05	-	-	-
Trichlorofluoromethane	0.05 ug/g dry	<0.05	-	-	-
Vinyl chloride	0.02 ug/g dry	<0.02	-	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	-	-	-
o-Xylene	0.05 ug/g dry	<0.05	-	-	-
Xylenes, total	0.05 ug/g dry	<0.05	-	-	-
4-Bromofluorobenzene	Surrogate	116%	-	-	-
Dibromofluoromethane	Surrogate	94.9%	-	-	-
Toluene-d8	Surrogate	95.7%	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	1.0	ug/g						
Boron, available	ND	0.5	ug/g						
Boron	ND	1.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (VI)	ND	0.2	ug/g						
Chromium	ND	1.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	1.0	ug/g						
Lead	ND	1.0	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	1.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.5	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	1.0	ug/g						
Zinc	ND	1.0	ug/g						
PCBs									
PCBs, total	ND	0.05	ug/g						
Surrogate: Decachlorobiphenyl	*0.0720*		*ug/g*		*72.0*	*60-140*			
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.12*		*ug/g*		*84.2*	*50-140*			
Surrogate: Terphenyl-d14	*1.63*		*ug/g*		*122*	*50-140*			
Volatiles									
Acetone	ND	0.50	ug/g						
Benzene	ND	0.02	ug/g						
Bromodichloromethane	ND	0.05	ug/g						
Bromoform	ND	0.05	ug/g						
Bromomethane	ND	0.05	ug/g						

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Carbon Tetrachloride	ND	0.05	ug/g						
Chlorobenzene	ND	0.05	ug/g						
Chloroform	ND	0.05	ug/g						
Dibromochloromethane	ND	0.05	ug/g						
Dichlorodifluoromethane	ND	0.05	ug/g						
1,2-Dichlorobenzene	ND	0.05	ug/g						
1,3-Dichlorobenzene	ND	0.05	ug/g						
1,4-Dichlorobenzene	ND	0.05	ug/g						
1,1-Dichloroethane	ND	0.05	ug/g						
1,2-Dichloroethane	ND	0.05	ug/g						
1,1-Dichloroethylene	ND	0.05	ug/g						
cis-1,2-Dichloroethylene	ND	0.05	ug/g						
trans-1,2-Dichloroethylene	ND	0.05	ug/g						
1,2-Dichloropropane	ND	0.05	ug/g						
cis-1,3-Dichloropropylene	ND	0.05	ug/g						
trans-1,3-Dichloropropylene	ND	0.05	ug/g						
1,3-Dichloropropene, total	ND	0.05	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Ethylene dibromide (dibromoethane	ND	0.05	ug/g						
Hexane	ND	0.05	ug/g						
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g						
Methyl Isobutyl Ketone	ND	0.50	ug/g						
Methyl tert-butyl ether	ND	0.05	ug/g						
Methylene Chloride	ND	0.05	ug/g						
Styrene	ND	0.05	ug/g						
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g						
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g						
Tetrachloroethylene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
1,1,1-Trichloroethane	ND	0.05	ug/g						
1,1,2-Trichloroethane	ND	0.05	ug/g						
Trichloroethylene	ND	0.05	ug/g						
Trichlorofluoromethane	ND	0.05	ug/g						
Vinyl chloride	ND	0.02	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: 4-Bromofluorobenzene	*8.33*		*ug/g*		*104*	*50-140*			
Surrogate: Dibromofluoromethane	*6.64*		*ug/g*		*83.1*	*50-140*			
Surrogate: Toluene-d8	*7.57*		*ug/g*		*94.6*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	300	8	ug/g dry	269			10.6	30	
F4 PHCs (C34-C50)	348	6	ug/g dry	348			0.1	30	
Metals									
Antimony	2.35	1.0	ug/g dry	ND			0.0	30	
Arsenic	18.0	1.0	ug/g dry	17.7			1.5	30	
Barium	108	1.0	ug/g dry	108			0.2	30	
Beryllium	ND	1.0	ug/g dry	ND			0.0	30	
Boron, available	ND	0.5	ug/g dry	ND			0.0	35	
Boron	14.3	1.0	ug/g dry	14.3			0.2	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium (VI)	ND	0.2	ug/g dry	ND				35	
Chromium	24.3	1.0	ug/g dry	24.5			1.0	30	
Cobalt	10.0	1.0	ug/g dry	10.2			1.8	30	
Copper	20.4	1.0	ug/g dry	20.3			0.5	30	
Lead	9.80	1.0	ug/g dry	10.3			5.1	30	
Mercury	ND	0.1	ug/g dry	ND			0.0	30	
Molybdenum	ND	1.0	ug/g dry	ND			0.0	30	
Nickel	17.2	1.0	ug/g dry	17.0			1.2	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	0.53	0.5	ug/g dry	0.55			3.4	30	
Thallium	1.52	1.0	ug/g dry	ND			0.0	30	
Uranium	ND	1.0	ug/g dry	ND				30	
Vanadium	37.0	1.0	ug/g dry	37.1			0.4	30	
Zinc	38.4	1.0	ug/g dry	39.6			3.1	30	
PCBs									
PCBs, total	ND	0.05	ug/g dry	ND				40	
Surrogate: Decachlorobiphenyl	*0.103*		*ug/g dry*		*74.0*	*60-140*			
Physical Characteristics									
% Solids	76.5	0.1	% by Wt.	76.2			0.4	25	
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g dry	ND				40	
Acenaphthylene	ND	0.02	ug/g dry	ND				40	
Anthracene	ND	0.02	ug/g dry	ND				40	
Benzo [a] anthracene	ND	0.02	ug/g dry	ND				40	
Benzo [a] pyrene	ND	0.02	ug/g dry	ND				40	
Benzo [b] fluoranthene	ND	0.02	ug/g dry	ND				40	
Benzo [g,h,i] perylene	ND	0.02	ug/g dry	ND				40	
Benzo [k] fluoranthene	ND	0.02	ug/g dry	ND				40	
Chrysene	ND	0.02	ug/g dry	ND			0.0	40	
Dibenzo [a,h] anthracene	ND	0.02	ug/g dry	ND				40	
Fluoranthene	ND	0.02	ug/g dry	ND				40	
Fluorene	ND	0.02	ug/g dry	ND				40	
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g dry	ND				40	
1-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
2-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
Naphthalene	ND	0.01	ug/g dry	ND			0.0	40	
Phenanthrene	ND	0.02	ug/g dry	ND				40	
Pyrene	ND	0.02	ug/g dry	ND				40	
Surrogate: 2-Fluorobiphenyl	*1.29*		*ug/g dry*		*76.5*	*50-140*			
Surrogate: Terphenyl-d14	*1.91*		*ug/g dry*		*113*	*50-140*			
Volatiles									
Acetone	ND	0.50	ug/g dry	ND				50	
Benzene	ND	0.02	ug/g dry	ND				50	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Bromodichloromethane	ND	0.05	ug/g dry	ND				50	
Bromoform	ND	0.05	ug/g dry	ND				50	
Bromomethane	ND	0.05	ug/g dry	ND				50	
Carbon Tetrachloride	ND	0.05	ug/g dry	ND				50	
Chlorobenzene	ND	0.05	ug/g dry	ND				50	
Chloroform	ND	0.05	ug/g dry	ND				50	
Dibromochloromethane	ND	0.05	ug/g dry	ND				50	
Dichlorodifluoromethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,3-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,4-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
1,2-Dichloropropane	ND	0.05	ug/g dry	ND				50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Ethylene dibromide (dibromoethane	ND	0.05	ug/g dry	ND				50	
Hexane	ND	0.05	ug/g dry	ND				50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g dry	ND				50	
Methyl Isobutyl Ketone	ND	0.50	ug/g dry	ND				50	
Methyl tert-butyl ether	ND	0.05	ug/g dry	ND				50	
Methylene Chloride	ND	0.05	ug/g dry	ND				50	
Styrene	ND	0.05	ug/g dry	ND				50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
Tetrachloroethylene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
1,1,1-Trichloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2-Trichloroethane	ND	0.05	ug/g dry	ND				50	
Trichloroethylene	ND	0.05	ug/g dry	ND				50	
Trichlorofluoromethane	ND	0.05	ug/g dry	ND				50	
Vinyl chloride	ND	0.02	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: 4-Bromofluorobenzene	*8.98*		*ug/g dry*		*111*	*50-140*			
Surrogate: Dibromofluoromethane	*6.68*		*ug/g dry*		*82.3*	*50-140*			
Surrogate: Toluene-d8	*8.24*		*ug/g dry*		*101*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	166	7	ug/g		83.2	80-120			
F2 PHCs (C10-C16)	101	4	ug/g	ND	98.6	60-140			
F3 PHCs (C16-C34)	478	8	ug/g	269	98.7	60-140			
F4 PHCs (C34-C50)	506	6	ug/g	348	112	60-140			
Metals									
Antimony	320		ug/L	ND	128	70-130			
Arsenic	672		ug/L	355	127	70-130			
Barium	2410		ug/L	2160	101	70-130			
Beryllium	269		ug/L	5.69	105	70-130			
Boron, available	4.72	0.5	ug/g	ND	94.3	70-122			
Boron	557		ug/L	286	108	70-130			
Cadmium	258		ug/L	6.76	101	70-130			
Chromium (VI)	4.3	0.2	ug/g	ND	81.5	70-130			
Chromium	714		ug/L	490	89.5	70-130			
Cobalt	426		ug/L	205	88.5	70-130			
Copper	665		ug/L	407	103	70-130			
Lead	416		ug/L	206	83.8	70-130			
Mercury	1.42	0.1	ug/g	ND	94.8	70-130			
Molybdenum	233		ug/L	ND	93.3	70-130			
Nickel	574		ug/L	340	93.7	70-130			
Selenium	224		ug/L	7.33	86.7	70-130			
Silver	257		ug/L	11.0	98.4	70-130			
Thallium	195		ug/L	ND	78.0	70-130			
Uranium	309		ug/L	ND	124	70-130			
Vanadium	986		ug/L	742	97.4	70-130			
Zinc	1780		ug/L	1590	76.3	70-130			
PCBs									
PCBs, total	0.186	0.05	ug/g	ND	134	60-140			
Surrogate: Decachlorobiphenyl	*0.103*		*ug/g*		*74.0*	*60-140*			
Semi-Volatiles									
Acenaphthene	0.258	0.02	ug/g	ND	122	50-140			
Acenaphthylene	0.223	0.02	ug/g	ND	105	50-140			
Anthracene	0.128	0.02	ug/g	ND	60.6	50-140			
Benzo [a] anthracene	0.138	0.02	ug/g	ND	65.1	50-140			
Benzo [a] pyrene	0.168	0.02	ug/g	ND	79.6	50-140			
Benzo [b] fluoranthene	0.206	0.02	ug/g	ND	97.5	50-140			
Benzo [g,h,i] perylene	0.215	0.02	ug/g	ND	102	50-140			
Benzo [k] fluoranthene	0.205	0.02	ug/g	ND	96.9	50-140			
Chrysene	0.187	0.02	ug/g	ND	88.5	50-140			
Dibenzo [a,h] anthracene	0.234	0.02	ug/g	ND	111	50-140			
Fluoranthene	0.206	0.02	ug/g	ND	97.4	50-140			
Fluorene	0.202	0.02	ug/g	ND	95.7	50-140			
Indeno [1,2,3-cd] pyrene	0.226	0.02	ug/g	ND	107	50-140			
1-Methylnaphthalene	0.178	0.02	ug/g	ND	84.1	50-140			
2-Methylnaphthalene	0.201	0.02	ug/g	ND	95.2	50-140			
Naphthalene	0.240	0.01	ug/g	ND	113	50-140			
Phenanthrene	0.211	0.02	ug/g	ND	99.6	50-140			
Pyrene	0.211	0.02	ug/g	ND	99.9	50-140			
Volatiles									
Acetone	11.9	0.50	ug/g		119	50-140			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Benzene	3.63	0.02	ug/g		90.9	60-130			
Bromodichloromethane	3.12	0.05	ug/g		78.0	60-130			
Bromoform	3.62	0.05	ug/g		90.6	60-130			
Bromomethane	5.00	0.05	ug/g		125	50-140			
Carbon Tetrachloride	3.25	0.05	ug/g		81.2	60-130			
Chlorobenzene	3.90	0.05	ug/g		97.6	60-130			
Chloroform	3.38	0.05	ug/g		84.5	60-130			
Dibromochloromethane	3.85	0.05	ug/g		96.1	60-130			
Dichlorodifluoromethane	4.88	0.05	ug/g		122	50-140			
1,2-Dichlorobenzene	4.02	0.05	ug/g		100	60-130			
1,3-Dichlorobenzene	3.38	0.05	ug/g		84.5	60-130			
1,4-Dichlorobenzene	4.05	0.05	ug/g		101	60-130			
1,1-Dichloroethane	3.66	0.05	ug/g		91.6	60-130			
1,2-Dichloroethane	3.54	0.05	ug/g		88.4	60-130			
1,1-Dichloroethylene	3.06	0.05	ug/g		76.4	60-130			
cis-1,2-Dichloroethylene	3.12	0.05	ug/g		77.9	60-130			
trans-1,2-Dichloroethylene	3.08	0.05	ug/g		77.1	60-130			
1,2-Dichloropropane	3.75	0.05	ug/g		93.9	60-130			
cis-1,3-Dichloropropylene	3.51	0.05	ug/g		87.7	60-130			
trans-1,3-Dichloropropylene	3.34	0.05	ug/g		83.6	60-130			
Ethylbenzene	3.93	0.05	ug/g		98.1	60-130			
Ethylene dibromide (dibromoethane	3.67	0.05	ug/g		91.7	60-130			
Hexane	3.95	0.05	ug/g		98.8	60-130			
Methyl Ethyl Ketone (2-Butanone)	9.07	0.50	ug/g		90.7	50-140			
Methyl Isobutyl Ketone	13.9	0.50	ug/g		139	50-140			
Methyl tert-butyl ether	7.29	0.05	ug/g		72.9	50-140			
Methylene Chloride	3.73	0.05	ug/g		93.2	60-130			
Styrene	3.04	0.05	ug/g		76.1	60-130			
1,1,1,2-Tetrachloroethane	3.97	0.05	ug/g		99.3	60-130			
1,1,2,2-Tetrachloroethane	4.67	0.05	ug/g		117	60-130			
Tetrachloroethylene	3.82	0.05	ug/g		95.4	60-130			
Toluene	4.33	0.05	ug/g		108	60-130			
1,1,1-Trichloroethane	2.97	0.05	ug/g		74.4	60-130			
1,1,2-Trichloroethane	3.45	0.05	ug/g		86.4	60-130			
Trichloroethylene	3.05	0.05	ug/g		76.2	60-130			
Trichlorofluoromethane	3.90	0.05	ug/g		97.5	50-140			
Vinyl chloride	4.66	0.02	ug/g		116	50-140			
m,p-Xylenes	8.25	0.05	ug/g		103	60-130			
o-Xylene	4.04	0.05	ug/g		101	60-130			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

CCME PHC additional information:

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

Paracel ID: 1744538

PARACEL LABORATORIES LTD.

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

Chain of Custody (Lab Use Only)
№ 114236

Page 1 of 1

Client Name: PATERSON GROUP
Contact Name: ADRIAN MENYHART
Address: 154 COLONNADE RD. S
Telephone: 613-226-7381

Project Reference: PE4122
Quote #:
PO #: 23038
Email Address: amenyhart@patersongroup.ca

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

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

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

Paracel Order Number: 1744538

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Date	Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	METALS (MOE)	PCB	
1	BH1-AU1	S		1	Nov 2 '17									✓		250mL
2	BH1-SS6	S		1	Nov 2 '17				✓						✓	↓
3	BH2-SS6	S		1	Nov 2 '17				✓							
4	BH2-SS7	S		2	Nov 2 '17		✓	✓								120mL + 1 vial
5	BH3-SS7	S		2	Nov 2 '17			✓								↓
6																
7																
8																
9																
10																

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): Adrian	Received by Driver/Depot: M. Drouse	Received at Lab: [illegible]	Verified By: Rachel Subject
Relinquished By (Print): ADRIAN	Date/Time: 03/11/17 3:30 PM	Date/Time: Nov 03, 2017 05:00	Date/Time: Nov 3/17 5:18
Date/Time: Nov 3 2017	Temperature: °C	Temperature: 18.5 °C	pH Verified [X] By: N/A

PARACEL LABORATORIES LTD.
TRUSTED. RESPONSIVE. RELIABLE.

300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 23092
Project: PE4122
Custody: 114223

Report Date: 17-Nov-2017
Order Date: 10-Nov-2017

Order #: 1746023

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

Paracel ID	Client ID
1746023-01	BH1-GW1
1746023-02	BH2-GW1
1746023-03	DUP1

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23092

Report Date: 17-Nov-2017
Order Date: 10-Nov-2017
Project Description: PE4122

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
PCBs, total	EPA 608 - GC-ECD	16-Nov-17	16-Nov-17
PHC F1	CWS Tier 1 - P&T GC-FID	16-Nov-17	16-Nov-17
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	13-Nov-17	14-Nov-17
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	15-Nov-17	15-Nov-17
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	16-Nov-17	16-Nov-17

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23092

Report Date: 17-Nov-2017
Order Date: 10-Nov-2017
Project Description: PE4122

	Client ID:	BH1-GW1	BH2-GW1	DUP1	-
	Sample Date:	09-Nov-17	09-Nov-17	09-Nov-17	-
	Sample ID:	1746023-01	1746023-02	1746023-03	-
	MDL/Units	Water	Water	Water	-
Volatiles					
Acetone	5.0 ug/L	-	<5.0	<5.0	-
Benzene	0.5 ug/L	-	<0.5	<0.5	-
Bromodichloromethane	0.5 ug/L	-	<0.5	<0.5	-
Bromoform	0.5 ug/L	-	<0.5	<0.5	-
Bromomethane	0.5 ug/L	-	<0.5	<0.5	-
Carbon Tetrachloride	0.2 ug/L	-	<0.2	<0.2	-
Chlorobenzene	0.5 ug/L	-	<0.5	<0.5	-
Chloroform	0.5 ug/L	-	<0.5	<0.5	-
Dibromochloromethane	0.5 ug/L	-	<0.5	<0.5	-
Dichlorodifluoromethane	1.0 ug/L	-	<1.0	<1.0	-
1,2-Dichlorobenzene	0.5 ug/L	-	<0.5	<0.5	-
1,3-Dichlorobenzene	0.5 ug/L	-	<0.5	<0.5	-
1,4-Dichlorobenzene	0.5 ug/L	-	<0.5	<0.5	-
1,1-Dichloroethane	0.5 ug/L	-	<0.5	<0.5	-
1,2-Dichloroethane	0.5 ug/L	-	<0.5	<0.5	-
1,1-Dichloroethylene	0.5 ug/L	-	<0.5	<0.5	-
cis-1,2-Dichloroethylene	0.5 ug/L	-	<0.5	<0.5	-
trans-1,2-Dichloroethylene	0.5 ug/L	-	<0.5	<0.5	-
1,2-Dichloropropane	0.5 ug/L	-	<0.5	<0.5	-
cis-1,3-Dichloropropylene	0.5 ug/L	-	<0.5	<0.5	-
trans-1,3-Dichloropropylene	0.5 ug/L	-	<0.5	<0.5	-
1,3-Dichloropropene, total	0.5 ug/L	-	<0.5	<0.5	-
Ethylbenzene	0.5 ug/L	-	<0.5	<0.5	-
Ethylene dibromide (dibromoethan	0.2 ug/L	-	<0.2	<0.2	-
Hexane	1.0 ug/L	-	<1.0	<1.0	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	-	<5.0	<5.0	-
Methyl Isobutyl Ketone	5.0 ug/L	-	<5.0	<5.0	-
Methyl tert-butyl ether	2.0 ug/L	-	<2.0	<2.0	-
Methylene Chloride	5.0 ug/L	-	<5.0	<5.0	-
Styrene	0.5 ug/L	-	<0.5	<0.5	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	-	<0.5	<0.5	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	-	<0.5	<0.5	-
Tetrachloroethylene	0.5 ug/L	-	<0.5	<0.5	-
Toluene	0.5 ug/L	-	<0.5	<0.5	-
1,1,1-Trichloroethane	0.5 ug/L	-	<0.5	<0.5	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23092

Report Date: 17-Nov-2017
Order Date: 10-Nov-2017
Project Description: PE4122

	Client ID:	BH1-GW1	BH2-GW1	DUP1	-
	Sample Date:	09-Nov-17	09-Nov-17	09-Nov-17	-
	Sample ID:	1746023-01	1746023-02	1746023-03	-
	MDL/Units	Water	Water	Water	-
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	-	117%	116%	-
Dibromofluoromethane	Surrogate	-	124%	126%	-
Toluene-d8	Surrogate	-	90.1%	90.6%	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	-	<25	-	-
F2 PHCs (C10-C16)	100 ug/L	-	<100	-	-
F3 PHCs (C16-C34)	100 ug/L	-	<100	-	-
F4 PHCs (C34-C50)	100 ug/L	-	<100	-	-
Semi-Volatiles					
Acenaphthene	0.05 ug/L	<0.05	<0.05	-	-
Acenaphthylene	0.05 ug/L	<0.05	<0.05	-	-
Anthracene	0.01 ug/L	<0.01	<0.01	-	-
Benzo [a] anthracene	0.01 ug/L	<0.01	<0.01	-	-
Benzo [a] pyrene	0.01 ug/L	<0.01	<0.01	-	-
Benzo [b] fluoranthene	0.05 ug/L	<0.05	<0.05	-	-
Benzo [g,h,i] perylene	0.05 ug/L	<0.05	<0.05	-	-
Benzo [k] fluoranthene	0.05 ug/L	<0.05	<0.05	-	-
Chrysene	0.05 ug/L	<0.05	<0.05	-	-
Dibenzo [a,h] anthracene	0.05 ug/L	<0.05	<0.05	-	-
Fluoranthene	0.01 ug/L	<0.01	<0.01	-	-
Fluorene	0.05 ug/L	<0.05	<0.05	-	-
Indeno [1,2,3-cd] pyrene	0.05 ug/L	<0.05	<0.05	-	-
1-Methylnaphthalene	0.05 ug/L	<0.05	<0.05	-	-
2-Methylnaphthalene	0.05 ug/L	<0.05	<0.05	-	-
Methylnaphthalene (1&2)	0.10 ug/L	<0.10	<0.10	-	-
Naphthalene	0.05 ug/L	<0.05	<0.05	-	-
Phenanthrene	0.05 ug/L	<0.05	<0.05	-	-
Pyrene	0.01 ug/L	<0.01	<0.01	-	-
2-Fluorobiphenyl	Surrogate	64.8%	69.6%	-	-
Terphenyl-d14	Surrogate	97.5%	100%	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23092

Report Date: 17-Nov-2017
Order Date: 10-Nov-2017
Project Description: PE4122

	Client ID:	BH1-GW1	BH2-GW1	DUP1	-
	Sample Date:	09-Nov-17	09-Nov-17	09-Nov-17	-
	Sample ID:	1746023-01	1746023-02	1746023-03	-
	MDL/Units	Water	Water	Water	-
PCBs					
PCBs, total	0.05 ug/L	-	<0.05	-	-
Decachlorobiphenyl	Surrogate	-	107%	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23092

Report Date: 17-Nov-2017
Order Date: 10-Nov-2017
Project Description: PE4122

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						
PCBs									
PCBs, total	ND	0.05	ug/L						
Surrogate: Decachlorobiphenyl	*0.505*		*ug/L*		*101*	*60-140*			
Semi-Volatiles									
Acenaphthene	ND	0.05	ug/L						
Acenaphthylene	ND	0.05	ug/L						
Anthracene	ND	0.01	ug/L						
Benzo [a] anthracene	ND	0.01	ug/L						
Benzo [a] pyrene	ND	0.01	ug/L						
Benzo [b] fluoranthene	ND	0.05	ug/L						
Benzo [g,h,i] perylene	ND	0.05	ug/L						
Benzo [k] fluoranthene	ND	0.05	ug/L						
Chrysene	ND	0.05	ug/L						
Dibenzo [a,h] anthracene	ND	0.05	ug/L						
Fluoranthene	ND	0.01	ug/L						
Fluorene	ND	0.05	ug/L						
Indeno [1,2,3-cd] pyrene	ND	0.05	ug/L						
1-Methylnaphthalene	ND	0.05	ug/L						
2-Methylnaphthalene	ND	0.05	ug/L						
Methylnaphthalene (1&2)	ND	0.10	ug/L						
Naphthalene	ND	0.05	ug/L						
Phenanthrene	ND	0.05	ug/L						
Pyrene	ND	0.01	ug/L						
Surrogate: 2-Fluorobiphenyl	*13.9*		*ug/L*		*69.3*	*50-140*			
Surrogate: Terphenyl-d14	*21.5*		*ug/L*		*108*	*50-140*			
Volatiles									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane	ND	0.2	ug/L						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
Methyl Isobutyl Ketone	ND	5.0	ug/L						
Methyl tert-butyl ether	ND	2.0	ug/L						

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
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	*94.8*		*ug/L*		*118*	*50-140*			
Surrogate: Dibromofluoromethane	*98.4*		*ug/L*		*123*	*50-140*			
Surrogate: Toluene-d8	*72.3*		*ug/L*		*90.4*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
Volatiles									
Acetone	ND	5.0	ug/L	ND				30	
Benzene	ND	0.5	ug/L	ND				30	
Bromodichloromethane	ND	0.5	ug/L	ND				30	
Bromoform	ND	0.5	ug/L	ND				30	
Bromomethane	ND	0.5	ug/L	ND				30	
Carbon Tetrachloride	ND	0.2	ug/L	ND				30	
Chlorobenzene	ND	0.5	ug/L	ND				30	
Chloroform	ND	0.5	ug/L	ND				30	
Dibromochloromethane	ND	0.5	ug/L	ND				30	
Dichlorodifluoromethane	ND	1.0	ug/L	ND				30	
1,2-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,3-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,4-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,1-Dichloroethane	ND	0.5	ug/L	ND				30	
1,2-Dichloroethane	ND	0.5	ug/L	ND				30	
1,1-Dichloroethylene	ND	0.5	ug/L	ND				30	
cis-1,2-Dichloroethylene	ND	0.5	ug/L	ND				30	
trans-1,2-Dichloroethylene	ND	0.5	ug/L	ND				30	
1,2-Dichloropropane	ND	0.5	ug/L	ND				30	
cis-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
trans-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Ethylene dibromide (dibromoethane	ND	0.2	ug/L	ND				30	
Hexane	ND	1.0	ug/L	ND				30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND				30	
Methyl Isobutyl Ketone	ND	5.0	ug/L	ND				30	
Methyl tert-butyl ether	ND	2.0	ug/L	ND				30	
Methylene Chloride	ND	5.0	ug/L	ND				30	
Styrene	ND	0.5	ug/L	ND				30	
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
Tetrachloroethylene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
1,1,1-Trichloroethane	ND	0.5	ug/L	ND				30	
1,1,2-Trichloroethane	ND	0.5	ug/L	ND				30	
Trichloroethylene	ND	0.5	ug/L	ND				30	
Trichlorofluoromethane	ND	1.0	ug/L	ND				30	
Vinyl chloride	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: 4-Bromofluorobenzene	*93.0*		*ug/L*		*116*	*50-140*			
Surrogate: Dibromofluoromethane	*96.7*		*ug/L*		*121*	*50-140*			
Surrogate: Toluene-d8	*70.4*		*ug/L*		*88.0*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	2020	25	ug/L		101	68-117			
F2 PHCs (C10-C16)	1680	100	ug/L		93.3	60-140			
F3 PHCs (C16-C34)	4220	100	ug/L		113	60-140			
F4 PHCs (C34-C50)	2860	100	ug/L		115	60-140			
PCBs									
PCBs, total	0.950	0.05	ug/L		95.0	60-140			
Surrogate: Decachlorobiphenyl	*0.504*		*ug/L*		*101*	*60-140*			
Semi-Volatiles									
Acenaphthene	6.09	0.05	ug/L		122	50-140			
Acenaphthylene	5.43	0.05	ug/L		109	50-140			
Anthracene	3.16	0.01	ug/L		63.2	50-140			
Benzo [a] anthracene	4.24	0.01	ug/L		84.8	50-140			
Benzo [a] pyrene	3.66	0.01	ug/L		73.2	50-140			
Benzo [b] fluoranthene	6.30	0.05	ug/L		126	50-140			
Benzo [g,h,i] perylene	4.64	0.05	ug/L		92.8	50-140			
Benzo [k] fluoranthene	6.39	0.05	ug/L		128	50-140			
Chrysene	5.33	0.05	ug/L		107	50-140			
Dibenzo [a,h] anthracene	4.95	0.05	ug/L		98.9	50-140			
Fluoranthene	5.36	0.01	ug/L		107	50-140			
Fluorene	5.34	0.05	ug/L		107	50-140			
Indeno [1,2,3-cd] pyrene	4.94	0.05	ug/L		98.9	50-140			
1-Methylnaphthalene	4.20	0.05	ug/L		84.1	50-140			
2-Methylnaphthalene	4.72	0.05	ug/L		94.5	50-140			
Naphthalene	5.29	0.05	ug/L		106	50-140			
Phenanthrene	5.11	0.05	ug/L		102	50-140			
Pyrene	5.44	0.01	ug/L		109	50-140			
Volatiles									
Acetone	73.7	5.0	ug/L		73.7	50-140			
Benzene	43.6	0.5	ug/L		109	60-130			
Bromodichloromethane	34.2	0.5	ug/L		85.5	60-130			
Bromoform	24.0	0.5	ug/L		60.0	60-130			
Bromomethane	23.9	0.5	ug/L		59.7	50-140			
Carbon Tetrachloride	32.7	0.2	ug/L		81.7	60-130			
Chlorobenzene	33.2	0.5	ug/L		83.1	60-130			
Chloroform	43.0	0.5	ug/L		107	60-130			
Dibromochloromethane	25.0	0.5	ug/L		62.5	60-130			
Dichlorodifluoromethane	36.0	1.0	ug/L		90.0	50-140			
1,2-Dichlorobenzene	36.1	0.5	ug/L		90.4	60-130			
1,3-Dichlorobenzene	34.0	0.5	ug/L		85.1	60-130			
1,4-Dichlorobenzene	35.7	0.5	ug/L		89.2	60-130			
1,1-Dichloroethane	41.0	0.5	ug/L		102	60-130			
1,2-Dichloroethane	42.9	0.5	ug/L		107	60-130			
1,1-Dichloroethylene	45.3	0.5	ug/L		113	60-130			
cis-1,2-Dichloroethylene	42.4	0.5	ug/L		106	60-130			
trans-1,2-Dichloroethylene	44.2	0.5	ug/L		111	60-130			
1,2-Dichloropropane	37.1	0.5	ug/L		92.8	60-130			
cis-1,3-Dichloropropylene	30.7	0.5	ug/L		76.7	60-130			
trans-1,3-Dichloropropylene	28.5	0.5	ug/L		71.2	60-130			
Ethylbenzene	31.1	0.5	ug/L		77.7	60-130			
Ethylene dibromide (dibromoethane	30.7	0.2	ug/L		76.8	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hexane	29.9	1.0	ug/L		74.6	60-130			
Methyl Ethyl Ketone (2-Butanone)	92.2	5.0	ug/L		92.2	50-140			
Methyl Isobutyl Ketone	64.6	5.0	ug/L		64.6	50-140			
Methyl tert-butyl ether	79.3	2.0	ug/L		79.3	50-140			
Methylene Chloride	41.0	5.0	ug/L		102	60-130			
Styrene	29.5	0.5	ug/L		73.7	60-130			
1,1,1,2-Tetrachloroethane	26.2	0.5	ug/L		65.4	60-130			
1,1,2,2-Tetrachloroethane	26.4	0.5	ug/L		65.9	60-130			
Tetrachloroethylene	31.0	0.5	ug/L		77.5	60-130			
Toluene	29.7	0.5	ug/L		74.2	60-130			
1,1,1-Trichloroethane	34.1	0.5	ug/L		85.2	60-130			
1,1,2-Trichloroethane	38.2	0.5	ug/L		95.6	60-130			
Trichloroethylene	41.0	0.5	ug/L		103	60-130			
Trichlorofluoromethane	37.7	1.0	ug/L		94.2	60-130			
Vinyl chloride	23.1	0.5	ug/L		57.8	50-140			
m,p-Xylenes	65.4	0.5	ug/L		81.7	60-130			
o-Xylene	30.3	0.5	ug/L		75.7	60-130			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

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

PARACEL LABORATORIES LTD.

TRUSTED . RESPONSIVE . RELIABLE .

Paracel ID: 1746023

Chain of Custody
(Lab Use Only)
№ 114223

Page 1 of 1

Client Name: Paterson Group	Project Reference: PE4122	**Turnaround Time:**	
Contact Name: ADRIAN MENYHART	Quote #	☐ 1 Day	☐ 3 Day
Address: 154 COLONNADE RD S	PO # 23092	☐ 2 Day	☑ Regular
Telephone: 613-226-7381	Email Address: amenyhart@patersongroup.ca	Date Required:	

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

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

Required Analyses

Paracel Order Number: 1746023

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	PCB
1	BH1-GW1	GW		1	Nov 9 '17	10			✓					
2	BH2-GW1 ✓	✓		5 ~~7~~	✓	1030	✓	✓	✓					✓
3	DUP1	✓		2	✓	1030		✓						
4														
5														
6														
7														
8														
9														
10														

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received by Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): ADRIAN	Date/Time: 10/11/17 3 00 pm	Date/Time: NOV 10 2017 04:35	Date/Time: 11/13/17 10:21
Date/Time: Nov 10 2017	Temperature: °C	Temperature: 16.1 °C	pH Verified [ ] By: