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Phase II Environmental Site Assessment

1330 Carling Avenue and 815 Archibald Street
Ottawa, Ontario

Prepared For

1343678 Ontario Limited

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Report: PE4789-2R

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EXECUTIVE SUMMARY

Assessment

A Phase II ESA was conducted for the property addressed 1330 Carling Avenue and 815 Archibald Street, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address areas of potential environmental concerns (APECs) that were identifed on the Phase II Property during the Phase I ESA.

The Phase II ESA was carried out in conjunction with a Geotechnical Investigation and consisted of drilling six (6) boreholes across the Phase II Property, three (3) of which were constructed with groundwater monitoring well installations.

The soil profile generally consisted of an asphalt pavement, followed by fill material consisting of silty sand and granular material, underlain by native silty clay, followed by glacial till. Boreholes were terminated at depths ranging between 4.57 and 9.60 m below the ground surface. Soil samples were obtained from the boreholes and screened using combustible vapour measurements along with visual and olfactory observations.

Based on the screening results in combination with sample depth and location, six (6) soil samples were submitted for laboratory analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX), petroleum hydrocarbons (PHCs, F_1-F_4) or metals. All parameter concentrations in the soil samples analyzed were in compliance with the MECP Table 3 Residential Standards for coarse grain soils.

Groundwater samples from BH1 to BH3 were recovered and analyzed for BTEX and PHCs. No free-phase product was observed on the groundwater at any of the monitoring well locations during the groundwater sampling event. All parameter concentrations in the groundwater samples analyzed were in compliance with the MECP Table 3 Standards.

Recommendations

If the monitoring wells installed at the Phase II Property are not going to be used in the future, they should be abandoned according to Ontario Regulation 903. The monitoring wells will be registered with the MECP under this regulation. Further information can be provided up request in this regard

1.0 INTRODUCTION

At the request of 1343678 Ontario Limited, Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment for the properties addressed 1330 Carling Avenue and 815 Archibald Street, in the City of Ottawa, Ontario, herein referred to as the Phase II Property. The purpose of this Phase II ESA was to address areas of potential environmental concern (APECs) identified in the Phase I ESA conducted by Paterson in February of 2020.

1.1 Site Description

Address:	1330 Carling Avenue and 815 Archibald Street, Ottawa, Ontario
Legal Description:	Part of Block 8 on Plan 221; Lot 8 and Part of Lot 7 on Plan 529, in the City of Ottawa, Ontario
Property Identification Numbers:	04002-0008 and 04002-0009
Location:	The Phase II Property is located on the southeast corner of Archibald Street at Carling Avenue, in the City of Ottawa, Ontario. Refer to Figure 1 - Key Plan in the Figures section following the text.
Latitude and Longitude:	45° 23' 6.16" N, 75° 44' 7.00" W
Configuration:	Rectangular
Site Area:	1,968m^2 (approximately)

1.2 Property Ownership

The subject property is currently owned by 1343678 Ontario Limited. Paterson was retained by Mr. Kevin Mulligan of 1343678 Ontario Limited, to complete this Phase II ESA. Mr. Mulligan can be contacted by telephone at (613) 223-4040.

1.3 Current and Proposed Future Uses

The Phase II Property is currently used for commercial purposes: a used car lot and sales office. It is our understanding that the Phase II Property will be redeveloped with a multi-storey mixed-use building consisting of ground-floor commercial and residential units above.

The proposed residential development will constitute a change in land use to a more sensitive land use for residential purposes, and as such, will require a Record of Site Condition (RSC). It is our intention to file an RSC for the subject site prior to redevelopment**.**

1.4 Applicable Site Condition Standard

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

- ❒ Coarse-grained soil conditions;
- ❒ Full depth generic site conditions;
- ❒ Non-potable groundwater conditions; and
- ❒ Residential land use.

Section 35 of O.Reg. 153/04 does apply to the Phase II Property in that the property relies upon municipal drinking water.

Section 41 of O.Reg. 153/04 does not apply to the Phase II Property, as the property is not within 30m of an environmentally sensitive area.

Section 43.1 of O.Reg. 153/04 does not apply to the Phase II Property in that the property is not a Shallow Soil property and the property is not within 30m of a water body.

The intended use of the Phase II Property is residential; therefore, the Residential Standards have been selected for the purpose of this Phase II ESA.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II Property is located in an arterial main street zone, surrounded by various commercial buildings (retailers and offices) and residential buildings. The southern portion of the Phase II Property is occupied by a sales office and carwash bay. The remaining northern portion of the site is occupied by a paved car lot with car park barriers surrounding the northern and western property line and some light posts.

Site drainage typically occurs through sheet flow to an on-site catch basin located on the central portion of the lot, as well as to catch basins along the adjacent street (Archibald Street).

The site topography along the northern and southern sides of the property dip down towards the centre of the site and down towards Archibald Street. The regional topography slopes down in a northerly direction towards the Ottawa River.

2.2 Past Investigations

A Phase I-ESA was completed by Paterson in February of 2020 in general accordance with the Ontario Regulation (O.Reg.) 153/04. Based on the findings of the Phase I ESA, several historical potentially contaminating activities (PCAs) were considered to result in four (4) areas of potential environmental concern (APECs) on the Phase I Property, as shown in Table 1,

TABLE 1: Potentially Contaminating Activities and Areas of Potential Environmental Concern

Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern	Potentially Contaminating Activity	Location of PCA (on-site or off-site)	Contaminants of Potential Concern	Media Potentially Impacted (Groundwater and/or soil)
APEC 1 Resulting from former service centre	Central east portion of the Phase I Property	PCA 52 – Storage, maintenance, fuelling and repairing of equipment, vehicles, and materials used to maintain transportation systems	On-site	BTEX PHCs	Soil, Groundwater
APEC 2 Resulting from former USTs (circa 1957)	Central west portion of the Phase I Property	PCA 28 – Gasoline and Associated Products Storage in Fixed Tanks	On-site	BTEX PHCs	Soil, Groundwater
APEC 3 Resulting from former pump island	Northeast portion of the Phase I Property	PCA 28 – Gasoline and Associated Products Storage in Fixed Tanks	On-site	BTEX PHCs	Soil, Groundwater
APEC 4 Resulting from fill material used to backfill remediation excavation	1330 Carling Avenue portion of the Phase I Property	PCA 30 – Importation of Fill Material of Unknown Quality	On-site	BTEX PHCs Metals	Soil
APEC 5: Resulting from the former waste oil tank situated on the central east side of the Phase I Property	Central east side of the Phase I Property	PCA 28 – Gasoline and Associated Products Storage in Fixed Tanks	On-site	BTEX PHCs	Soil, Groundwater
APEC 6: Resulting from the former UST (1992) situated on the central portion of the Phase I Property	Central portion of the Phase I Property	PCA 28 – Gasoline and Associated Products Storage in Fixed Tanks	On-site	BTEX PHCs	Soil, Groundwater
APEC 7: Resulting from the historical contamination off-site along the northern property boundary	Northern portion of the Phase I Property	PCA Other – Off-site contamination	Off-site	BTEX PHCs	Soil, Groundwater

A Phase II ESA was recommended to address the aforementioned APECs. The APECs are outlined on Drawing PE4789-1R– Site Plan, appended to the Phase I ESA report.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation was carried out for the Phase II Property in conjunction with a Geotechnical Investigation on February 5 and 6, 2020. The field program consisted of drilling six (6) boreholes across the Phase II Property. The boreholes were completed to depths ranging from approximately 4.57 to 6.1m below ground surface (mbgs). Three (3) of the boreholes were completed with monitoring well installations in order to access the groundwater table.

3.2 Media Investigated

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

As noted in Table 1 in Section 2.2, CPCs for soil and/or groundwater include benzene, toluene, ethylbenzene and xylenes (BTEX), petroleum hydrocarbons (PHCs, fractions F_1-F_4) and metals (including mercury and hexavalent chromium).

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

Based on the 1992 Phase II-ESA, the reported stratigraphy for the Phase I Property consists of a pavement structure over fill material, underlain by native silty clay or glacial till. Bedrock was not encountered during the subsurface program.

According to the Geological Survey of Canada website, the bedrock in the area of the Phase I Property is reported to consist of interbedded limestone and dolomite of the Gull Formation. The overburden is reported to consist of Glacial Till of depths ranging from 5 to 10 m over the entire site.

The regional topography slopes down in a northerly direction towards the Ottawa River. The local groundwater flow beneath the Phase I Property is inferred to be in a north-westerly/northerly direction.

Water Bodies and Areas of Natural Significance

No natural water bodies or areas of natural significance are known to exist on the Phase I Property or within the Phase I Study Area.

Potable Water Well Records

No potable well records were identified for the Phase I Property.

Monitoring Well Records

No monitoring well records were identified for the Phase I Property. Three (3) monitoring well records were identified for the property across Carling Avenue were a couple of historical PCAs were identifed.

Existing Buildings and Structures

The southern portion of the Phase I Property is currently occupied by a semi-2 storey commercial building used as a car showroom with offices on the second level and a garage bay used for detailing and washing cars. The remaining lot is an asphaltic paved concrete car lot.

Subsurface Structures and Utilities

Historical subsurface structures on the Phase I Property include former USTs and ancillary equipment associated with the retail fuel outlet. Former subsurface infrastructure may have potentially contributed to the contaminant distribution at the Phase I Property.

Presently, underground services include natural gas, water and sewer services entering the west face of the subject building from Archibald Street. Electric services the subject site underground along the northern property boundary with overhead utilities along the western property boundary. Municipal water and sewer services enter the northern and southern portions of the site from Archibald Street. A storm water catchbasin is location on the central portion of the site from Archibald Street. It is not expected that the present-day underground utilities contribute to contaminant transport; however, it is expected that these utilities and underground structures will present limitations regarding the subsurface investigation.

Neighbouring Land Use

Neighbouring land use within the Phase I Study Area consists primarily of commercial offices and retailers along Carling Avenue and residential along the adjacent side streets.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As presented in Table 1 in Section 2.2 of this report, several historical PCAs are considered to have resulted in six (6) APECs on the Phase I Property.

Contaminants of Potential Concern

As noted in Table 1, the contaminants of potential concern (CPCs) in soil and/or groundwater, and associated with the APECs identified in this Phase I ESA include:

- Benzene, ethylbenzene, toluene and xylenes (BTEX);
- Petroleum hydrocarbons (PHCs, Fractions F_1-F_4); and
- Metals (including hexavalent chromium and mercury).

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of this Phase I-ESA is considered to be sufficient to conclude that there are historical on-site and off-site PCAs that have resulted in APECs on the Phase I Property. While several other historical and/or existing PCAs were identified within the study area during this assessment, they were not considered to generate areas of potential environmental concern to the Phase I Property.

A variety of independent sources were consulted as part of this assessment, and as such, the conclusions of this report are not affected by uncertainty which may be present with respect to the individual sources.

3.4 Deviations from Sampling and Analysis Plan

The Sampling and Analysis Plan for this project is included in Appendix 1 of this report. The field measurement of water quality parameters was not conducted at the time of the groundwater sampling events due to inclement weather conditions at the time. There were no other deviations from the Sampling and Analysis Plan.

3.5 Impediments

Underground and above ground service utilities (sewer and underground electricity) presented an issue with regard to the placement of the boreholes, particularly along the northern property boundary, as shown on the Drawing PE4789-3R – Test Hole Location Plan. No other physical impediments were encountered during the field portion of the Phase II ESA.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted on February 5 and 6, 2020. The drilling program consisted of drilling six (6) boreholes across the Phase II Property, three (3) of which were completed with monitoring well installations.

The boreholes were placed to address the aforementioned areas of potential environmental concern (APECs) and to provide coverage of the proposed building footprint. The boreholes were drilled with a truck mounted CME 55 power auger drill rig. The truck mounted drill rig was provided by George Downing Estate Drilling of Hawkesbury, Ontario. Borehole locations are shown on Drawing PE4789-3R – Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

A total of 42 soil samples were obtained from the boreholes by means of direct sampling from auger flights and split spoon sampling. The depths at which auger and split spoon samples were obtained from the boreholes are shown as "**AU**" and "**SS**" on the Soil Profile and Test Data Sheets, appended to this report.

Site soils consist of fill material underlain by native silty clay and/or silty sand, followed by glacial till. The fill material present beneath the pavement structure generally consisted of silty sand with gravel and extended to depths ranging from approximately 0.6 to 3.15m below grade. No deleterious materials or signs of potential contamination were identified in the fill material, which is primarily associated with the pavement structure and the decommissioning and removal of the former underground storage tanks and pump islands. The boreholes were terminated in glacial till at depths ranging from approximately 4.57 to 9.60m below grade.

4.3 Field Screening Measurements

A gastech, calibrated to Hexane, was used to measure the combustible vapour concentrations in the headspace of all soil samples obtained from the boreholes. The soil vapours were measured by inserting the analyzer probe into the nominal headspace above the soil sample. Samples were then agitated, and the peak readings recorded.

The combustible vapour readings were in the range of 5 to 140ppm in the soil samples obtained and are not necessarily considered to be indicative of potential hydrocarbon impacts. A petroleum hydrocarbon odour was noted at BH1-SS5 at approximately 3.00 m below the ground surface (mbgs). Obvious staining was observed in the soil sample BH2-SS4 at approximately 2.29 mgbs. These two (2) soil samples were submitted as worse-case scenario.

Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

4.4 Groundwater Monitoring Well Installation

Groundwater monitoring wells were installed in three (3) boreholes placed on the Phase II Property. The monitoring wells consisted of 51 mm diameter Schedule 40 threaded PVC risers and screens. Monitoring well construction details are listed below in Table 2 and are also presented on the Soil Profile and Test Data Sheets provided in Appendix 1.

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	73.20	4.57	1.57-4.57	1.22-4.57	0.30-1.22	Flushmount
BH2	73.26	5.18	2.18-5.18	1.22-5.18	0.30-1.22	Flushmount
BH3	73.39	5.18	2.15-5.18	1.22-5.18	0.30-1.22	Flushmount

4.5 Groundwater Sampling

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

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

4.6 Analytical Testing

Based on the guidelines outlined in the Sampling and Analysis Plan in Appendix 1, the soil and groundwater samples submitted for analytical testing are presented in Tables 3 and 4.

Table 3: Soil Samples Submitted

Sample ID	Sample Depth and Stratigraphic Unit	Parameters Analyzed			Rationale
		BTEX	PHC ($F_1 - F_4$)	Metals[1]	
February 5, 2020					
BH1-SS2	0.76-1.37m Fill			X	Sample selected to test the quality of fill material.
BH1-SS5	3.04-3.66m Till	X	X		Sample selected for analysis based on vapour reading and location just below the water table.
February 6, 2020					
BH2-SS2	0.76-1.37m Fill			X	Sample selected to test the quality of fill material.
BH2-SS4	2.32-2.92m Till	X	X		Sample selected based on location near water table (sample wet).
BH3-SS2	0.76-1.37m Fill			X	Sample selected to test the quality of fill material.
BH3-SS6	3.84-4.45m Till	X	X		Sample selected for analysis based on vapour reading and location just below the water table.

Note:
[1] Metals may include mercury (Hg) and hexavalent chromium (CrVI)

Table 4: Groundwater Samples Submitted				
Sample ID	Screened Interval and Stratigraphic Unit	Parameters Analyzed		Rationale
		BTEX	PHCs (F_1-F_4)	
February 13, 2020				
MW1-GW1	1.57-4.57m Till	X	X	Assessment of potential impacts on the western portion of the site from on and off-site retail fuel outlets.
MW2-GW1	2.18-5.18m Till	X	X	Assessment of potential impacts on the northern portion of the site from on and off-site retail fuel outlets.
MW3-GW1	2.15-5.18m Till	X	X	Assessment of potential impacts on the eastern portion of the site from on and off-site retail fuel outlets.
Note: MW1, MW2 and MW3 correspond to BH1, BH2 and BH3.				

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

4.7 Residue Management

All excavated soil, purge water and fluids from equipment cleaning were retained on-site.

4.8 Elevation Surveying

An elevation survey of all borehole locations was completed by Paterson at the time of the subsurface investigation. All borehole elevations are referenced to the south corner of the garage floor slab, with a geodetic elevation of 73.60 m.

4.9 Quality Assurance and Quality Control Measures

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

5.0 REVIEW AND EVALUATION

5.1 Geology

Site soils generally consist of a pavement structure over fill material, underlain by native silty clay and/or silty sand with gravel (till). Bedrock was not encountered during the subsurface program; however, refusal on inferred bedrock was encountered at 9.60m and 8.41m in BH4 and BH5, respectively by means of DCP testing.

Groundwater was encountered in the till material at depths ranging from approximately 2.21 to 2.28m below existing grade.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling event on February 13, 2020 using an electronic water level meter. Groundwater levels are summarized below in Table 5.

All measurements are relative to the slab-on-grad foundation of the southern side of the garage bay, with geodetic elevation of 100m,

Table 5: Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH1	73.20	2.21	70.99	February 13, 2020
BH2	73.26	2.23	71.03	February 13, 2020
BH3	73.39	2.28	71.11	February 13, 2020

Groundwater contour mapping was completed for groundwater levels measured on February 13, 2020. The groundwater contours are shown on Drawing PE4789-4 - Groundwater Contour Plan. Based on the contour mapping, groundwater beneath the Phase II Property appears to flow in a westerly direction. An average horizontal hydraulic gradient of approximately 0.005m/m was calculated.

5.3 Fine-Coarse Soil Texture

Based on field soil observations, fine-grained soil standards are not applicable to the Phase II Property.

5.4 Soil: Field Screening

The combustible vapour readings were generally less than 140ppm in the soil samples obtained and were not necessarily considered to be indicative of potential hydrocarbon impacts. A petroleum hydrocarbon odour was noted at BH1-SS5 at approximately 3.0 m below the ground surface (mbgs). Obvious staining was observed in soil sample retrieved from BH2 at approximately 2.29 mgbs (BH2-SS4).

Field screening results of each individual soil sample are provided on the Soil Profile and Test Data Sheets appended to this report.

5.5 Soil Quality

Based on the findings of the field screening, in combination with sample depth and location, a total of 6 soil samples were submitted for analysis of a combination of BTEX, PHC (F1-F4) and/or metals. The results of the analytical testing, and the selected soil standards, are presented in Tables 6, 7 and 8. The laboratory certificates of analysis are provided in Appendix 1.

Table 6: Analytical Test Results – Soil
BTEX and PHCs (Fractions 1 to 4)

Parameter	MDL (ug/g)	Soil Samples (µg/g)			MECP Table 3 Residential Standards (µg/g)
		February 5, 2020	February 6, 2020		
		BH1-SS5 (3.04-3.66m)	BH2-SS4 (2.32-2.92m)	BH3-SS6 (3.84-4.45m)	
Benzene	0.02	nd	nd	nd	0.2
Ethylbenzene	0.05	nd	nd	nd	2
Toluene	0.05	nd	nd	nd	2.3
Xylenes	0.05	nd	nd	nd	3.1
PHC F1	7	44	nd	nd	55
PHC F2	4	21	nd	nd	98
PHC F3	8	18	71	nd	300
PHC F4	6	nd	214	nd	2,800

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

No detectable BTEX concentrations were identified in the soil samples analyzed. PHC concentrations detected in the soil samples analyzed are in compliance with the MECP Table 3 Residential Standards. All soil samples comply with the selected MECP Standards.

Table 7: Analytical Test Results – Soil
Metals

Parameter	MDL (µg/g)	Soil Sample (µg/g)			MECP Table 3 Residential Standards (µg/g)
		February 5, 2020	February 6, 2020		
		BH1-SS2 (0.76-1.23m)	BH2-SS2 (0.76-1.23m)	BH3-SS2 (0.76-1.23m)	
Antimony	1.0	nd	nd	nd	7.5
Arsenic	1.0	2.1	1.8	3.9	18
Barium	1.0	72.9	48	236	390
Beryllium	1.0	nd	nd	0.7	4
Boron	1.0	8.8	6.8	6.2	120
Cadmium	0.5	nd	nd	nd	1.2
Chromium	1.0	13.8	11.8	70.1	160
Chromium VI	0.2	nd	nd	nd	8
Cobalt	1.0	5.8	4.4	19	22
Copper	1.0	17.1	11.9	24.8	140
Lead	1.0	6.8	3.8	12.5	120
Mercury	0.1	nd	nd	nd	0.27
Molybdenum	1.0	nd	nd	nd	6.9
Nickel	1.0	11.3	6.8	36.9	100
Selenium	1.0	nd	nd	nd	2.4
Silver	0.5	nd	nd	nd	20
Thallium	1.0	nd	nd	nd	1
Uranium	1.0	nd	nd	nd	23
Vanadium	1.0	24.2	19.1	72.9	86
Zinc	1.0	24.3	nd	80.9	340

Notes:
- ❒ MDL – Method Detection Limit
- ❒ nd – not detected above the MDL
- ❒ NA – Parameter not analyzed

Metal concentrations identified in the soil samples analyzed are in compliance with the MECP Table 3 Residential Standards.

The maximum concentrations of analyzed parameters in the soil at the Phase II Property are summarized below in Table 8.

Table 8: Maximum Concentrations – Soil			
Parameter	**Maximum Concentration (µg/g)**	**Borehole**	**Depth Interval (m BGS)**
PHC F1	44	BH1-SS5	3.04-3.66 Till
PHC F2	21		
PHC F3	71	BH2-SS4	2.32-2.92 Till
PHC F4	214		
Arsenic	3.9	BH3-SS2	0.76-1.23 Fill
Barium	236		
Beryllium	0.7		
Boron	8.8	BH1-SS2	0.76-1.23; Fill
Chromium	70.1	BH3-SS2	0.76-1.23 Till
Cobalt	19		
Copper	24.8		
Lead	12.5		
Nickel	36.9		
Vanadium	72.9		
Zinc	80.9		

All other parameter concentrations were undetectable above the laboratory detection limits.

5.6 Groundwater Quality

Groundwater samples from all of the monitoring wells installed on the Phase II Property were submitted for laboratory analysis of BTEX and PHCs (fraction F1-F4). The groundwater samples were obtained from the screened intervals noted on Table 2. The results of the analytical testing are presented below in Table 9. The laboratory certificates of analysis are provided in Appendix 1.

Table 9: Analytical Test Results – Groundwater
BTEX and PHCs (Fractions 1 to 4)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)			MECP Table 3 Standards (µg/L)
		February 13, 2020			
		MW1-GW1 (1.57-4.57m)	MW2-GW1 (2.18-5.18m)	MW3-GW1 (2.18-5.18m)	
Benzene	0.5	nd	nd	nd	44
Ethylbenzene	0.5	2.8	nd	nd	2,300
Toluene	0.5	nd	nd	nd	18,000
Xylenes	0.5	nd	nd	nd	4,200
PHC F1	25	140	nd	nd	750
PHC F2	100	nd	nd	nd	150
PHC F3	100	nd	nd	nd	500
PHC F4	100	nd	nd	nd	500

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- MW1, MW2 and MW3 correspond to BH1, BH2 and BH3.

BTEX and PHC concentrations identified in the groundwater samples analyzed are in compliance with the MECP Table 3 Standards.

The maximum concentrations of analyzed parameters in the groundwater at the Phase II Property are summarized below in Table 10.

Table 10: Maximum Concentrations – Groundwater

Parameter	Maximum Concentration (µg/L)	Monitoring Well	Depth Interval (m BGS)
Ethylbenzene	2.8	**BH1**	**1.57-4.57**
PHC F1	140		

All other parameter concentrations were undetectable above the laboratory detection limits.

5.7 Quality Assurance and Quality Control Results

All samples submitted as part of the February 2020 sampling events were handled in accordance with the Analytical Protocol with respect to preservation method, storage requirement, and container type.

As per the sampling and analysis plan, duplicate samples (DUP and DUP1) from BH2-SS4 and BH1-GW1, respectively, were obtained and analyzed for BTEX and PHC-F1 parameters.

The relative percent different (RPD) for the original and the duplicate soil sample for PHC-F1 concentration detected above the laboratory limit is 8.82%. The RDPs for the original and the duplicate groundwater sample for ethylbenzene and PHC-F1 concentrations detected above the laboratory limits are 3.36% and 10.53%, respectively.

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

5.8 Phase II Conceptual Site Model

The following section has been prepared in accordance with the requirements of O.Reg. 153/04, as amended under the Environmental Protection Act. Conclusions and recommendations are discussed in a subsequent section.

Site Description

Potentially Contaminating Activity and Areas of Potential Environmental Concern

As per Table 1 in Section 2.2, the following on-site PCAs are considered to have resulted seven (7) APECs on the Phase II Property:

- PCA 52 Storage, maintenance, fuelling and repair of equipment, vehicles, and material used to maintain transportation systems," associated with a historical automotive service garage on the central east side of the Phase I Property (APEC 1);
- PCA 28 – "Gasoline and Associated Products Storage in Fixed Tanks," associated with 5 historical underground storage tanks situated along the central west side of the Phase I Property (APEC 2);
- PCA 28 – "Gasoline and Associated Products Storage in Fixed Tanks," associated with a historical pump island situated along the northeastern portion of the Phase I Property (APEC 3);
- PCA 30 – "Importation of Fill Material of Unknown quality," associated with infilling the remediation excavations at 1330 Carling Avenue (APEC 4);
- PCA 28 – "Gasoline and Associated Products Storage in Fixed Tanks," associated with a historical waste oil tank situated on the central east side of the Phase I Property (APEC 5);

- PCA 28 – "Gasoline and Associated Products Storage in Fixed Tanks," associated with a historical UST situated on the central portion of the Phase I Property (APEC 6); and
- PCA Other – "Off-site contamination," associated with the historical contamination along the northern property boundary (APEC 7).

Contaminants of Potential Concern

Contaminants of potential environmental concern associated with the aforementioned APECs on the Phase II Property include the following:

- Benzene, ethylbenzene, toluene and xylenes (BTEX);
- Petroleum hydrocarbons (PHCs, Fractions F_1-F_4); and
- Metals (including hexavalent chromium and mercury).

Subsurface Structures and Utilities

Historical subsurface structures on the Phase I Property include former USTs and ancillary equipment associated with the retail fuel outlet. Former subsurface infrastructure may have potentially contributed to the contaminant distribution at the Phase I Property.

Presently, underground services include natural gas, water and sewer services entering the west face of the subject building from Archibald Street. Electric services the subject site underground along the northern property boundary with overhead utilities along the western property boundary. Municipal water and sewer services enter the northern and southern portions of the site from Archibald Street.

A storm water catchbasin is location on the central portion of the site from Archibald Street. It is not expected that the present-day underground utilities contribute to contaminant transport; however, it is expected that these utilities and underground structures will present limitations regarding the subsurface investigation.

Physical Setting

Site Stratigraphy

The site stratigraphy consists of the following:

- Pavement structure consisting of asphaltic concrete over crushed stone with silt and sand, extending to depths ranging from approximately 0.03 to 0.61m below grade.
- Fill material generally consisting of brown silty sand or coarse brown sand with some gravel was identified at each borehole location and extended to depths of approximately 1.52 to 3.15m below grade.
- Native silty clay with traces of gravel was encountered beneath the fill material in BH4, BH5 and BH6 and extended to depths of approximately 2.13 to 2.39m below grade.
- Glacial till primarily containing silty clay with some gravel was identified either beneath the fill material or native silty clay from approximately 4.57 to 6.40m below grade at each borehole location.
- Boreholes were terminated in the glacial till later at depths ranging from 4.57 to 9.60m below grade. Groundwater was identified in this stratigraphic unit.

Bedrock was inferred from DCP Test in BH4 and BH5 at 9.60 and 8.41 mbgs, respectively.

Hydrogeological Characteristics

Groundwater at the Phase II Property was encountered primarily within the fill layer. This unit is interpreted to function as the shallow aquifer at the subject site.

Water levels were measured at the Phase II Property on February 13, 2020. Groundwater levels ranged in depths from approximately 2.21 to 2.28 m below grade. Groundwater contour mapping was conducted for groundwater elevations identified during the February 2020 sampling event. Groundwater flow at the Phase II Property was in a westerly direction, with an average hydraulic gradient of approximately 0.005 m/m.

Approximate Depth to Bedrock

Bedrock was inferred from DCP Test in BH4 and BH5 at 9.60 and 8.41 mbgs, respectively.

Approximate Depth to Water Table

Depth to water table at the Phase II Property varies between approximately 2.21 and 2.28m below existing grade.

Sections 41 and 43.1 of the Regulation

Section 41 of the Regulation (Site Condition Standards, Environmentally Sensitive Areas) does not apply to the subject site as the Phase II Property is not within 30m of an environmentally sensitive area, and the pH of the surface soil is between 5 and 9, while the pH of the subsurface soil is between 5 and 11.

Section 43.1 of the Regulation does not apply to the subject site in that the subject site is not a Shallow Soil Property and is not within 30 m of a water body.

Fill Placement

Fill material was identified across the Phase II Property beneath the pavement structure and extending to depths of approximately 1.52 to 3.15m below grade. The fill material generally consists of silty sand, gravel with some crushed stone and trace of organics, and is considered to be associated with the pavement structure as well as backfill used post-remediation of the former retail fuel outlets.

No contamination was identified in the fill material.

Proposed Buildings and Other Structures

It is our understanding that the Phase II Property will be redeveloped with a multi-storey mixed-use building consisting of commercial on the ground floor and residential units above.

Existing Buildings and Structures

The site is occupied by a semi-2 storey slab-on-grade building that was constructed in 2000. The subject building is situated on the southeast corner with a garage entrance located on the west side of the building fronting Archibald Street.

The exterior is finished in light grey-to-white stucco with large glass windows that extend to the from the ground to second storey and a flat style tar and gravel roof. The subject building is heated with natural gas-fired equipment. No other buildings or structures are present on the Phase II Property.

Water Bodies and Areas of Natural Significance

There are no natural water bodies or areas of natural significance on or within 30m of the Phase II Property.

Environmental Condition

Areas Where Contaminants are Present

Based on the findings of the Phase II ESA, soil and groundwater beneath the Phase II Property is in compliance with MECP Table 3 Residential Standards, as shown on Drawings PE4789-5 – Analytical Testing Plan (Soil) and PE4789-6 – Analytical Testing Plan (Groundwater). There are no contaminants on the Phase II Property.

Types of Contaminants

Based on the findings of the Phase II ESA, soil and groundwater is in compliance with MECP Table 3 Residential Standards. There are no contaminants of concern on the Phase II Property.

Contaminated Media

Soil and groundwater analyses conducted as part of the Phase II ESA were in compliance with MECP Table 3 Residential Standards. No contaminated media is present on the Phase II Property.

What Is Known About Areas Where Contaminants Are Present

Contaminants are not present in the soil or in the groundwater beneath the Phase II Property.

Distribution and Migration of Contaminants

Based on the findings of the Phase II ESA, there has been no distribution or migration of contaminants on the Phase II Property.

Discharge of Contaminants

Based on the findings of the Phase II ESA, contaminants have not been discharged to the Phase II Property.

Climatic and Meteorological Conditions

In general, climatic and meteorological conditions have the potential to affect contaminant distribution. Two (2) ways by which climatic and meteorological conditions may affect contaminant distribution include the downward leaching of contaminants by means of the infiltration of precipitation, and the migration of contaminants via groundwater levels and/or flow, which may fluctuate seasonally.

Soil and groundwater beneath the Phase II Property are in compliance with MECP Table 3 Residential Standards. Therefore, climatic and meteorological conditions are not considered to have affected contaminant distribution at the Phase II Property.

Potential for Vapour Intrusion

The potential for vapour intrusion does not exist at the Phase II Property.

6.0 CONCLUSIONS

A Phase II ESA was conducted for the property addressed 1330 Carling Avenue and 815 Archibald Street, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address areas of potential environmental concerns (APECs) that were identifed on the Phase II Property during the Phase I ESA.

The Phase II ESA was carried out in conjunction with a Geotechnical Investigation and consisted of drilling six (6) boreholes across the Phase II Property, three (3) of which were constructed with groundwater monitoring well installations.

The soil profile generally consisted of an asphalt pavement, followed by fill material consisting of silty sand and granular material, underlain by native silty clay, followed by glacial till. Boreholes were terminated at depths ranging between 4.57 and 9.60 m below the ground surface. Soil samples were obtained from the boreholes and screened using combustible vapour measurements along with visual and olfactory observations.

Based on the screening results in combination with sample depth and location, six (6) soil samples were submitted for laboratory analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX), petroleum hydrocarbons (PHCs, F_1-F_4) or metals. All parameter concentrations in the soil samples analyzed were in compliance with the MECP Table 3 Residential Standards for coarse grain soils.

Groundwater samples from BH1 to BH3 were recovered and analyzed for BTEX and PHCs. No free-phase product was observed on the groundwater at any of the monitoring well locations during the groundwater sampling event. All parameter concentrations in the groundwater samples analyzed were in compliance with the MECP Table 3 Standards.

Recommendations

If the monitoring wells installed at the Phase II Property are not going to be used in the future, they should be abandoned according to Ontario Regulation 903. The monitoring wells will be registered with the MECP under this regulation. Further information can be provided up request in this regard.

7.0 STATEMENT OF LIMITATIONS

This Phase II - Environmental Site Assessment report has been prepared in general accordance with O.Reg. 153/04 as amended by the Environmental Protection Act and meets the requirements of CSA Z769-00. The conclusions presented herein are based on information gathered from a limited sampling and testing program. The test results represent conditions at specific test locations at the time of the field program.

The client should be aware that any information pertaining to soils and all test hole logs are furnished as a matter of general information only and test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those of the test holes themselves.

Should any conditions be encountered at the subject site and/or historical information that differ from our findings, we request that we be notified immediately in order to allow for a reassessment.

This report was prepared for the sole use of 1343678 Ontario Limited. Notification from 1343678 Ontario Limited and Paterson Group will be required to release this report to any other party.

Paterson Group Inc.

Mandy Witteman, B.Eng., M.A.Sc.

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

Report Distribution:

- ❒ 1343678 Ontario Limited
- ❒ Paterson Group

FIGURES

FIGURE 1 – KEY PLAN

Drawing PE4789-3 - Test Hole Location Plan

Drawing PE4789-4– Groundwater Contour Plan

Drawing PE4789-5 – Analytical Testing Plan – Soil

Drawing PE4789-6 – Analytical Testing Plan – Groundwater

Drawing PE4789- 7 –Cross section A-A' – Soil

Drawing PE4789- 8 –Cross section A-A' –Groundwater

Drawing PE4789- 9 –Cross section B-B' – Soil

Drawing PE4789- 10 –Cross section B-B' –Groundwater

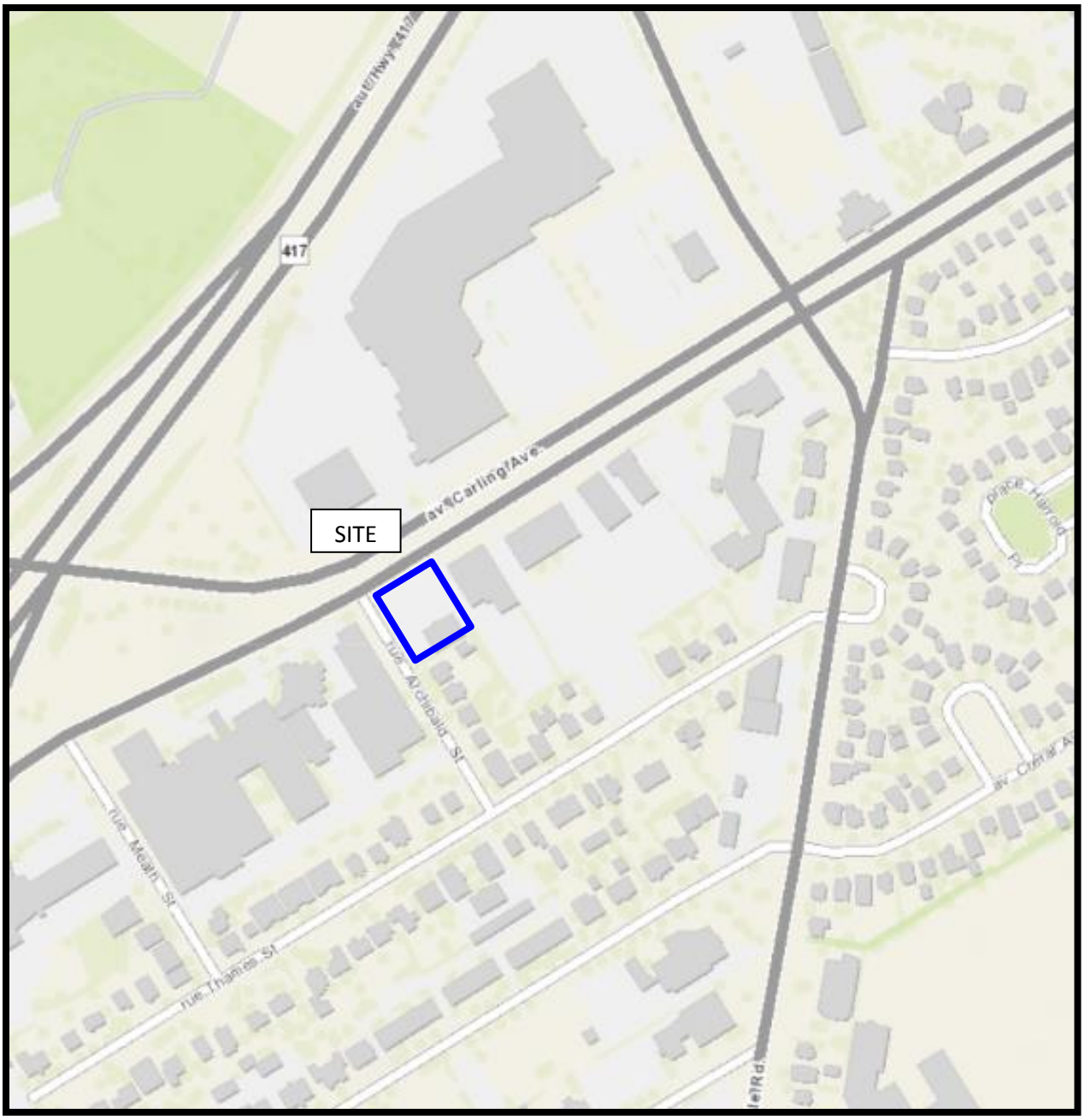

FIGURE 1

KEY PLAN

1320 CARLING AVENUE
REFERRAL MORTGAGES

MOUNTED LIGHT POLE
BILLBOARD SIGN
MOUNTED LIGHT POLE
MOUNTED LIGHT POLE
FORMER WASTE OIL ABOVEGROUND STORAGE TANK
ASPHALTIC CONCRETE PARKING LOT
BH 6
73.30
BH 3
73.39
(71.11)
BH 2
73.26
(71.03)
1330 CARLING AVENUE
2ND CHANCE
AUTO SALES
APPROXIMATE LOCATION OF FORMER SERVICE STATION (GREASING)
815 ARCHIBALD STREET
WASH / RETAILING BAY
819 ARCHIBALD STREET
RESIDENTIAL DWELLING
821 ARCHIBALD STREET
RESIDENTIAL DWELLING
1335 CARLING AVENUE
SPORTS AND SPINAL INJURY CLINIC
FORMER PUMP
APPROXIMATE LOCATION OF FORMER PUMP ISLAND
FORMER PUMP
FORMER SHELL SERVICE STATION
MOUNTED LIGHT POLE
FORMER UNDERGROUND STORAGE TANK
71.075
71.05
71.05
71.025
(0.005m/m)
CB
CONCRETE PARKING BLOCKS
ASPHALTIC CONCRETE PARKING LOT
BH 4
73.40
BH 1
73.20
(70.99)
APPROXIMATE LOCATION OF FORMER UNDERGROUND STORAGE TANKS
BH 5
73.25
FLOOR SLAB - TBM
MOUNTED LIGHT POLE
MOUNTED LIGHT POLE
MOUNTED LIGHT POLE
MOUNTED LIGHT POLE
A
A'
B
B'
CARLING AVENUE
ARCHIBALD STREET

LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- 71.05 GROUNDWATER CONTOUR(m)
- (0.005m/m) APPROX. GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)
- 73.20 GROUND SURFACE ELEVATION (m)
- (70.99) GROUNDWATER SURFACE ELEVATION (m)

TBM-CONCRETE FLOOR SLAB LOCATED ON SOUTHERN CORNER OF EXISTING BUILDING. GEODETIC ELEVATION = 73.60m

SCALE: 1:250

0 1 2 3 4 5 10 15m

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NO.	REVISIONS	DATE	INITIAL

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1330 CARLING AVENUE & 815 ARCHIBALD STREET

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:250	Date: 08/2021
Drawn by: NFRV	Report No.: PE4789-1R
Checked by: MW	Dwg. No.: PE4789-3R
Approved by: MSD	Revision No.:

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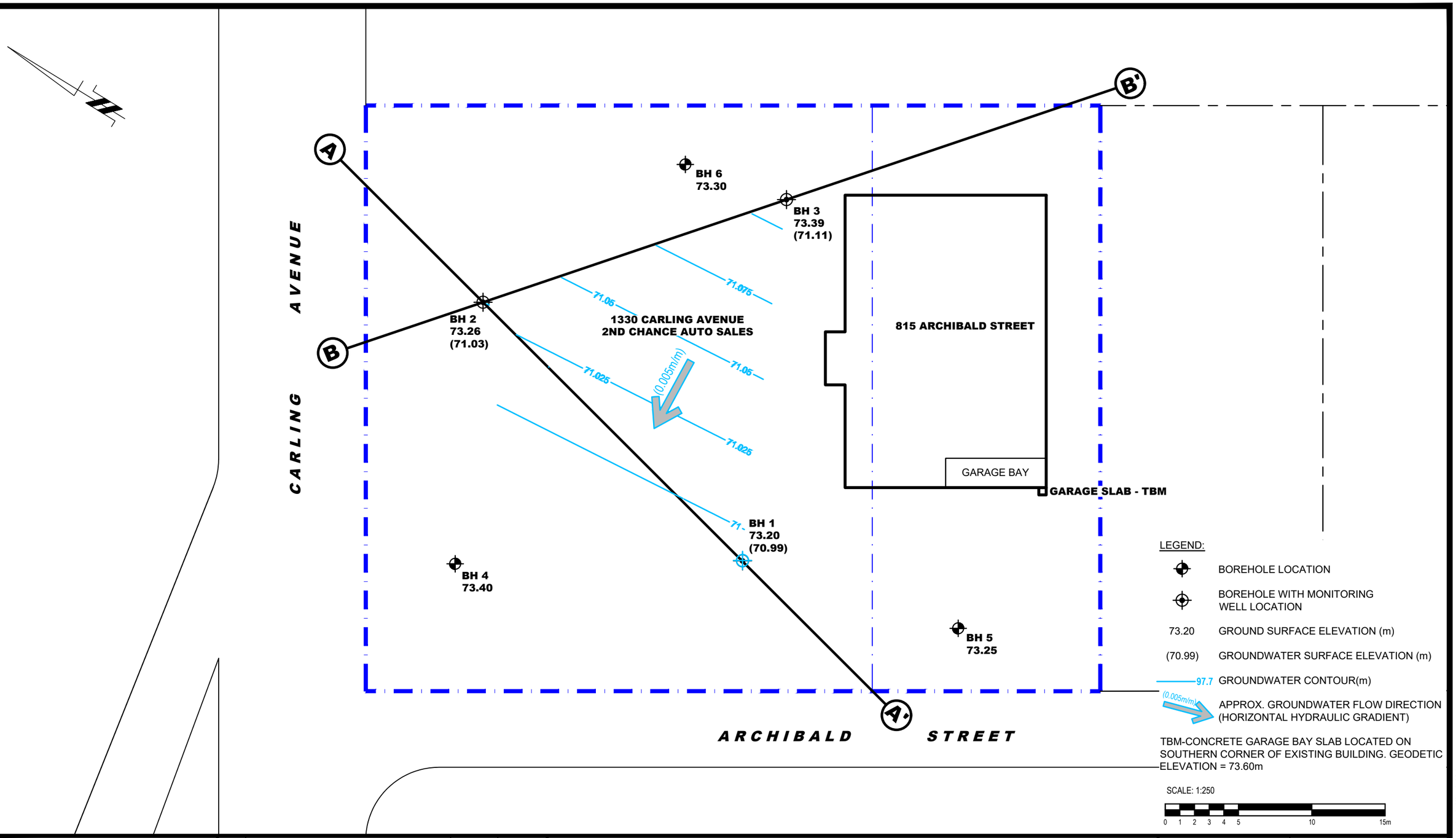

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1330 CARLING AVENUE & 815 ARCHIBALD STREET

OTTAWA, ONTARIO

Title:

GROUNDWATER CONTOUR PLAN

Scale: 1:250	Date: 02/2020
Drawn by: NFRV	Report No.: PE4789-2
Checked by: MW	Dwg. No.: PE4789-4
Approved by: MSD	Revision No.:

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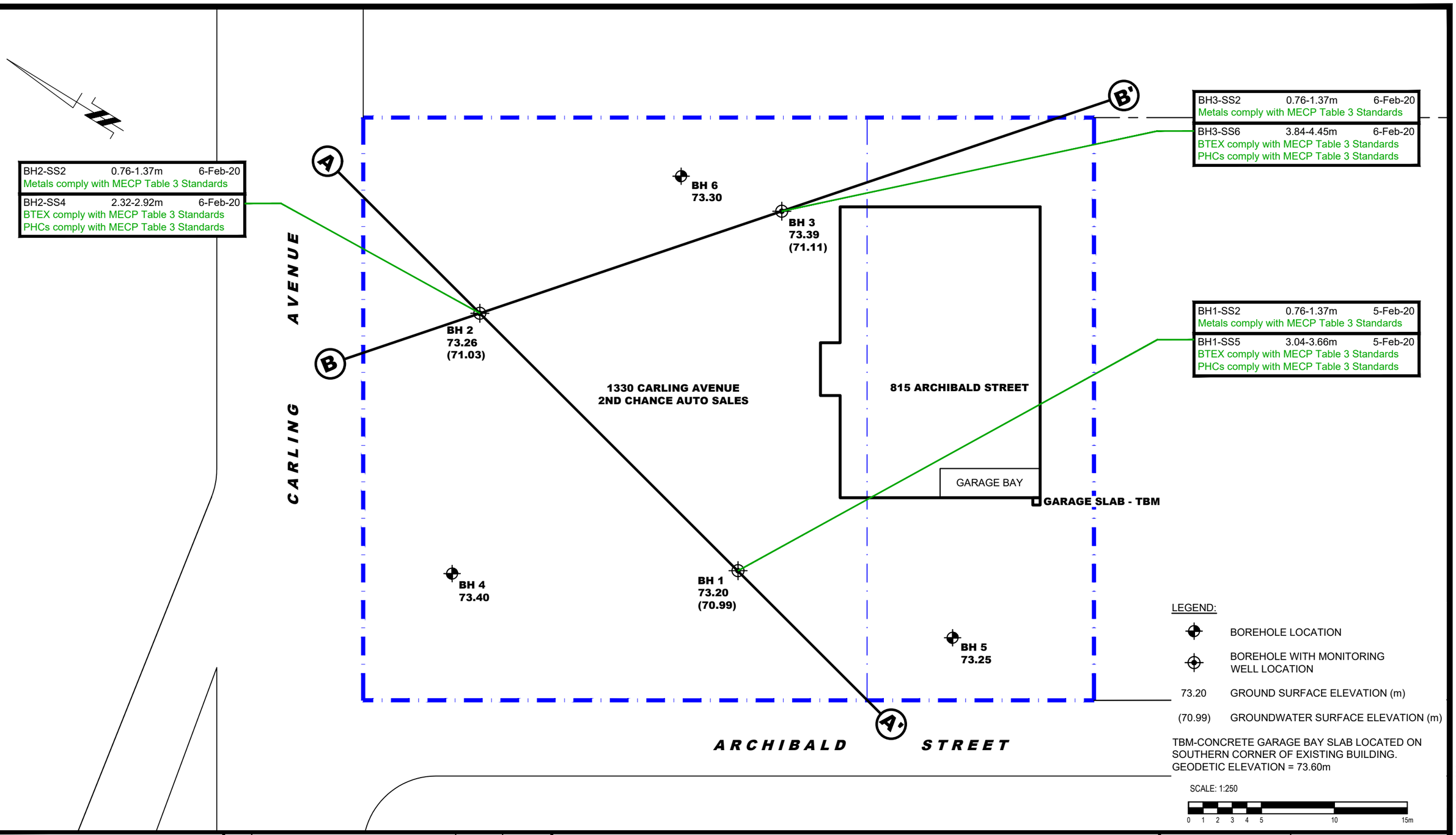

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1330 CARLING AVENUE & 815 ARCHIBALD STREET

OTTAWA, ONTARIO

Title:
ANALYTICAL TESTING PLAN - SOIL (BTEX, PHCs, METALS)

Scale: 1:250	Date: 02/2020
Drawn by: NFRV	Report No.: PE4789-2
Checked by: MW	Dwg. No.: PE4789-5
Approved by: MSD	Revision No.:

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BH3-GW1 2.18-5.18m 13-Feb-20
BTEX comply with MECP Table 3 Standards
PHCs comply with MECP Table 3 Standards

BH2-GW1 2.18-5.18m 13-Feb-20
BTEX comply with MECP Table 3 Standards
PHCs comply with MECP Table 3 Standards

BH1-GW1 1.57-4.57m 13-Feb-20
BTEX comply with MECP Table 3 Standards
PHCs comply with MECP Table 3 Standards

A
A'
B
B'

BH 6
73.30

BH 3
73.39
(71.11)

BH 2
73.26
(71.03)

1330 CARLING AVENUE
2ND CHANCE AUTO SALES

815 ARCHIBALD STREET

GARAGE BAY

GARAGE SLAB - TBM

BH 4
73.40

BH 1
73.20
(70.99)

BH 5
73.25

CARLING AVENUE

ARCHIBALD STREET

LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- 73.20 GROUND SURFACE ELEVATION (m)
- (70.99) GROUNDWATER SURFACE ELEVATION (m)

TBM-CONCRETE GARAGE BAY SLAB LOCATED ON SOUTHERN CORNER OF EXISTING BUILDING.
GEODETIC ELEVATION = 73.60m

SCALE: 1:250

0 1 2 3 4 5 10 15m

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1330 CARLING AVENUE & 815 ARCHIBALD STREET

OTTAWA, ONTARIO

Title:
ANALYTICAL TESTING PLAN - GROUNDWATER (BTEX, PHCs)

Scale: 1:250	Date: 02/2020
Drawn by: NFRV	Report No.: PE4789-2
Checked by: MW	Dwg. No.: PE4789-6
Approved by: MSD	Revision No.:

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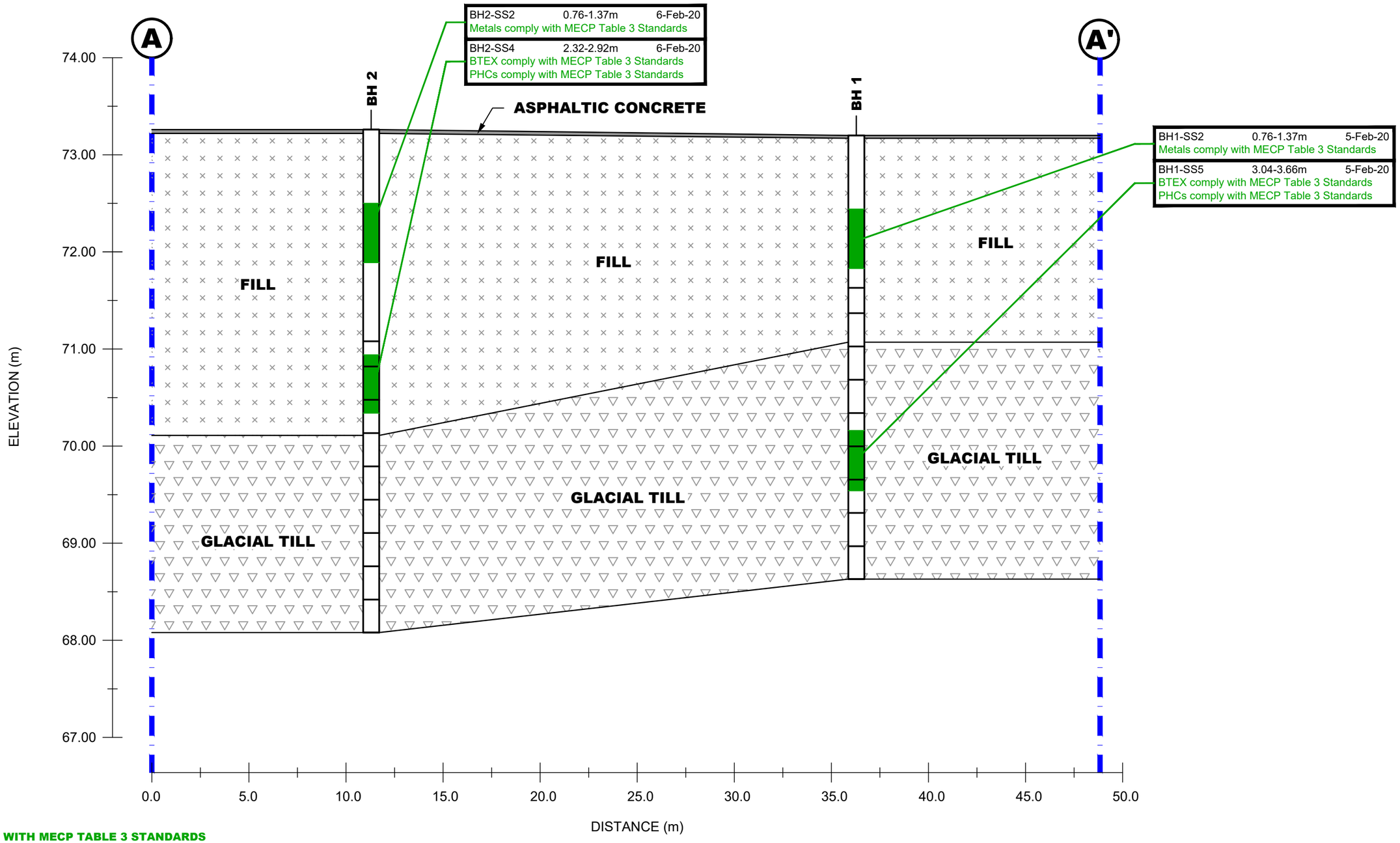

SOIL SAMPLES COMPLY WITH MECP TABLE 3 STANDARDS

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1330 CARLING AVENUE & 815 ARCHIBALD STREET

OTTAWA, ONTARIO

Title:

CROSS SECTION A-A' - SOIL (BTEX, PHCs, METALS)

Scale: AS SHOWN	Date: 02/2020
Drawn by: NFRV	Report No.: PE4789-2
Checked by: MW	Dwg. No.: PE4789-7
Approved by: MSD	Revision No.:

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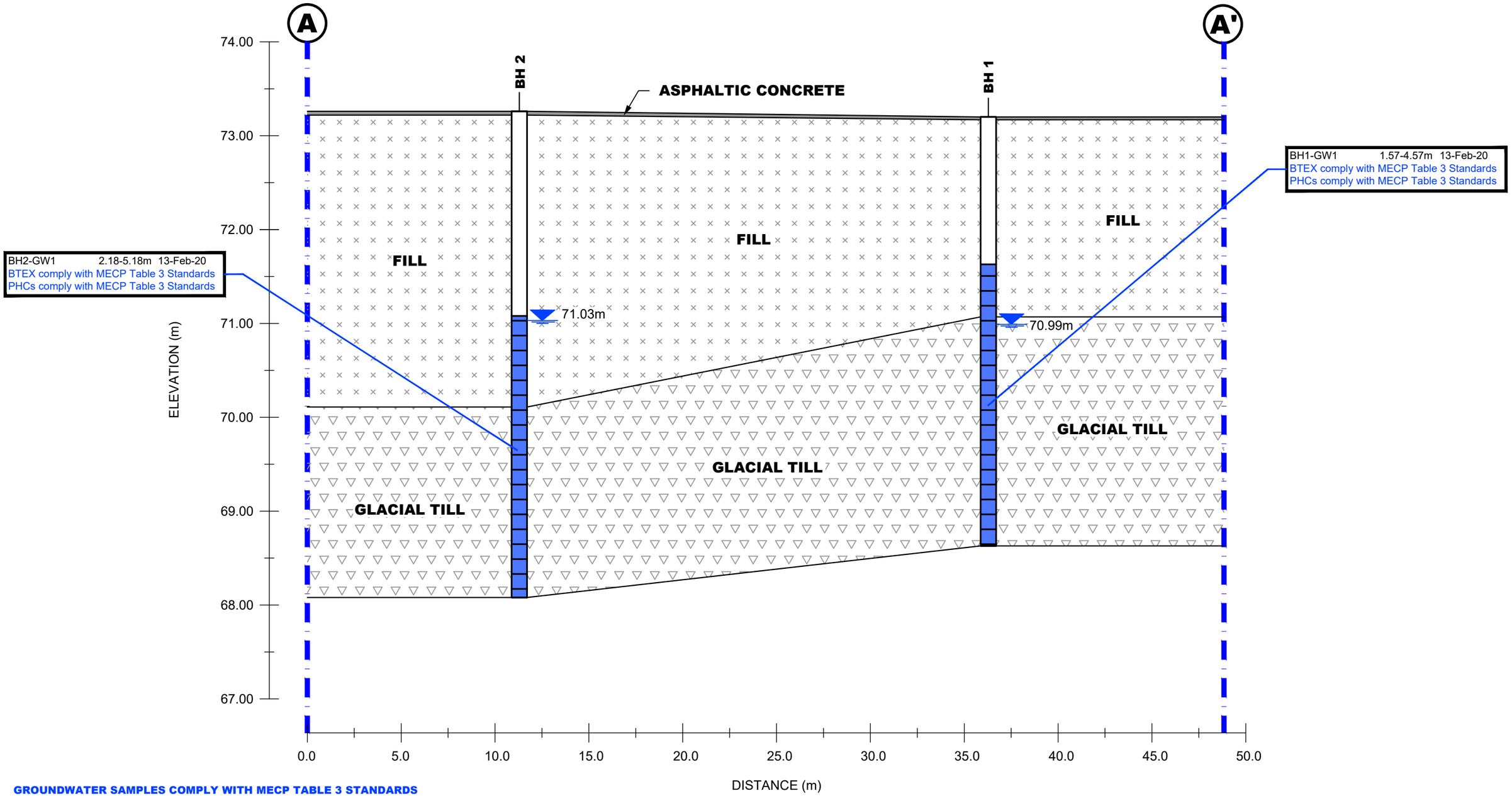

GROUNDWATER SAMPLES COMPLY WITH MECP TABLE 3 STANDARDS

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1330 CARLING AVENUE & 815 ARCHIBALD STREET

OTTAWA, ONTARIO

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

Scale: AS SHOWN	Date: 02/2020
Drawn by: NFRV	Report No.: PE4789-2
Checked by: MW	Dwg. No.: PE4789-8
Approved by: MSD	Revision No.:

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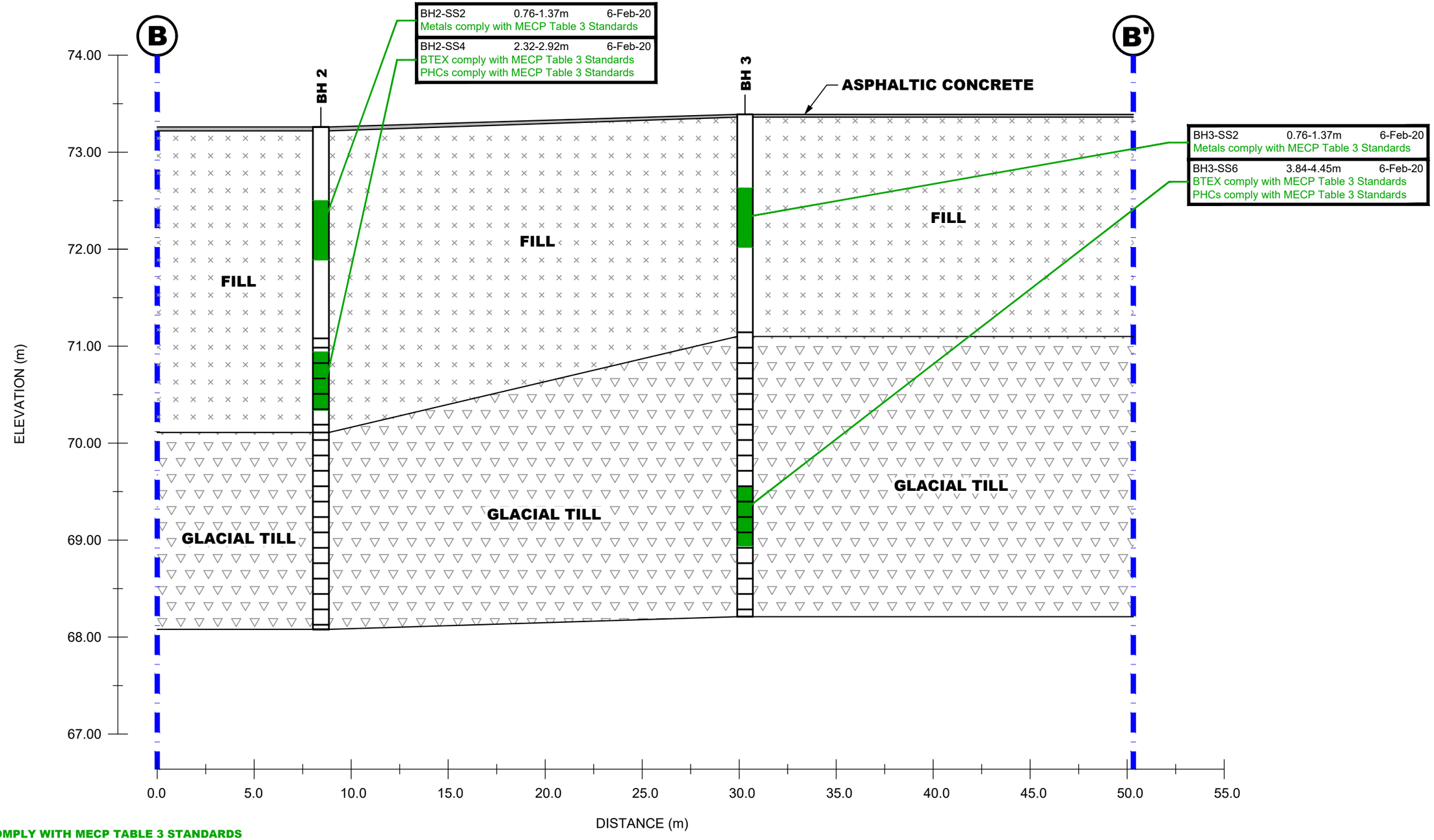

SOIL SAMPLES COMPLY WITH MECP TABLE 3 STANDARDS

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1330 CARLING AVENUE & 815 ARCHIBALD STREET
OTTAWA, ONTARIO

Title:
CROSS SECTION B-B' - SOIL (BTEX, PHCs, METALS)

Scale: AS SHOWN	Date: 02/2020
Drawn by: NFRV	Report No.: PE4789-2
Checked by: MW	Dwg. No.: PE4789-9
Approved by: MSD	Revision No.:

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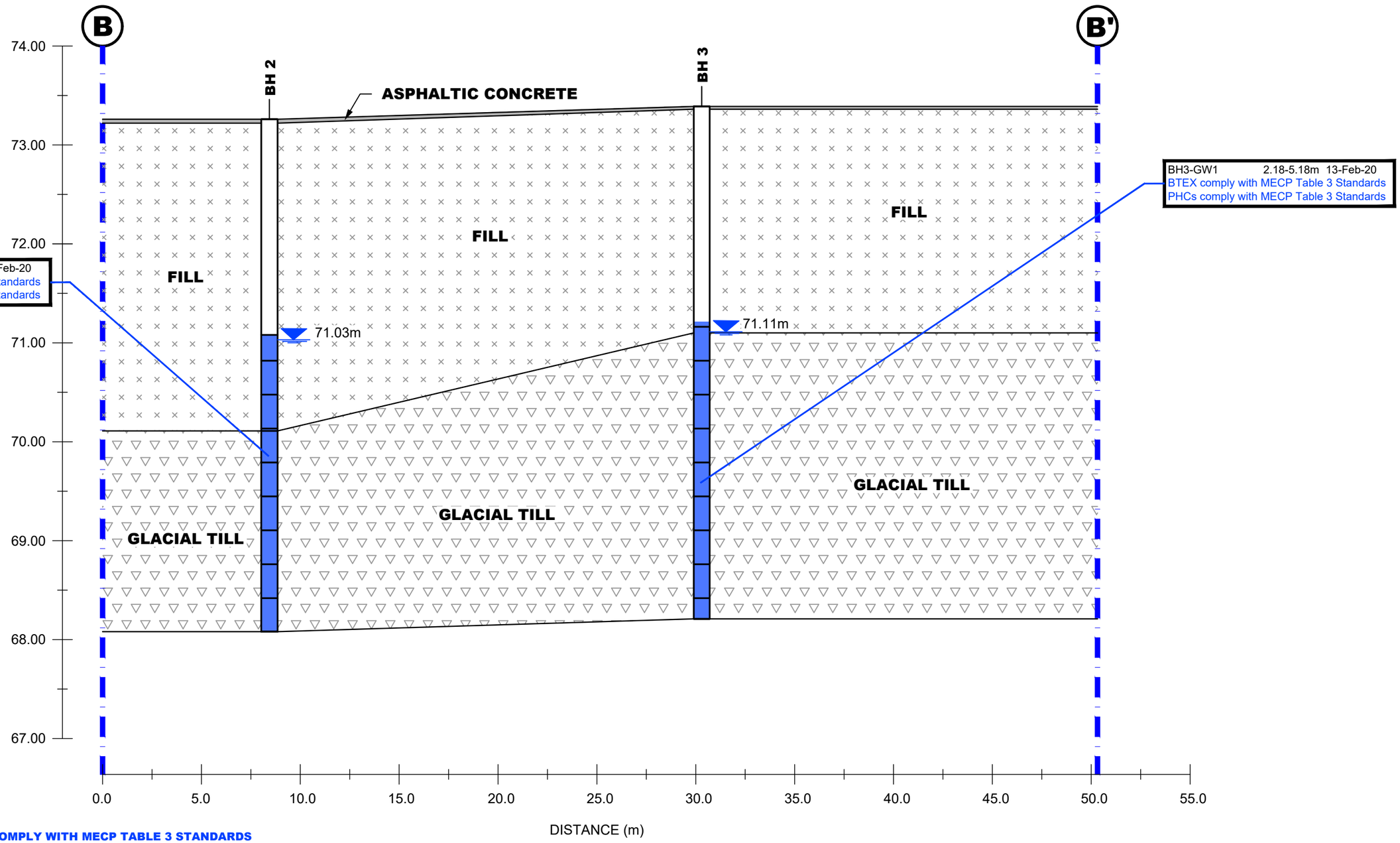

GROUNDWATER SAMPLES COMPLY WITH MECP TABLE 3 STANDARDS

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
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Title:

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

Scale: AS SHOWN	Date: 02/2020
Drawn by: NFRV	Report No.: PE4789-2
Checked by: MW	Dwg. No.: PE4789-10
Approved by: MSD	Revision No.:

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APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

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patersongroup

Sampling & Analysis Plan

Phase II Environmental Site Assessment
1330 Carling Avenue and 815 Archibald Street
Ottawa, Ontario

Prepared For

1343678 Ontario Limited

February 2020

Report: PE4789-SAP

TABLE OF CONTENTS

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by 1343678 Ontario Limited to conduct a Phase II Environmental Site Assessment (ESA) for the properties addressed 1330 Carling Avenue and 815 Archibald Street, in the City of Ottawa, Ontario. Based on the Phase I ESA conducted by Paterson, a subsurface investigation program, consisting of borehole drilling, was developed in conjunction with the Geotechnical Investigation.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1	Place borehole on the central west side of the Phase II Property to address the former UST nests and importation of fill material (APEC 2 and 4).	Drill to a depth of at least 2m to access groundwater table for monitoring well installation.
BH2	Place borehole on the northern portion of the Phase II Property to address the former pump island and importation of fill material (APEC 3 and 4).	Drill to a depth of at least 2m to access groundwater table for monitoring well installation.
BH3	Place borehole on the central east portion of the Phase II Property to address the former automotive garage and importation of fill material (APEC 1 and 4).	Drill to a depth of at least 2m to access groundwater table for monitoring well installation.
BH4	Place borehole for general coverage.	Drill until practical auger refusal is reached.
BH5	Place borehole for general coverage.	Drill until practical auger refusal is reached.
BH6	Place borehole for general coverage.	Drill until practical auger refusal is reached.

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

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

2.0 ANALYTICAL TESTING PROGRAM

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

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

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

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

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

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

Equipment

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

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

Determining Borehole Locations

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

After drilling is completed a plan with the borehole locations must be provided. Distances and orientations of boreholes with respect to site features (buildings, roadways, etc.) must be provided. Distances should be measured using a measuring tape or wheel rather than paced off. Ground surface elevations at each borehole were surveyed relative to the garage floor slab located on the south corner of the subject building, with geodetic elevation of 73.60m above sea level (asl).

Drilling Procedure

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

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

Spoon Washing Procedure

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

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

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

Screening Procedure

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

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

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

3.2 Monitoring Well Installation Procedure

Equipment

- ❒ 5’ x 2” [1.52 m x 50 mm] threaded sections of Schedule 40 PVC slotted well screen (5’ x 1 ¼” [1.52 m x 32 mm] if installing in cored hole in bedrock)
- ❒ 5’ x 2” [1.52 m x 50 mm] threaded sections of Schedule 40 PVC riser pipe (5’ x 1 ¼” [1.52 m x 32 mm] if installing in cored hole in bedrock)
- ❒ Threaded end-cap
- ❒ Slip-cap or J-plug
- ❒ Asphalt cold patch or concrete
- ❒ Silica Sand
- ❒ Bentonite chips (Holeplug)
- ❒ Steel flushmount casing

Procedure

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

3.3 Monitoring Well Sampling Procedure

Equipment

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

Sampling Procedure

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

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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

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

5.0 DATA QUALITY OBJECTIVES

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

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

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

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

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

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

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS TO SAMPLING & ANALYSIS PLAN

Physical impediments to the Sampling and Analysis plan may include:

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

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II ESA
1330 Carling Avenue and 815 Archibald Street
Ottawa, Ontario

DATUM Referenced to a TBM consisting of the southeast corner of the building slab. Geodetic: 73.60m

FILE NO. PE4789

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** 2020 February 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
UNDERSIDE OF FOOTING							
ASPHALTIC CONCRETE 0.03		AU	1			0	73.20
FILL: Brown silty sand with gravel and occasional cobbles, some clay		SS	2	67	19	1	72.20
2.13		SS	3	50	12	2	71.20
GLACIAL TILL: Grey silty clay with sand, gravel and occasional cobbles		SS	4	8	6	3	70.20
		SS	5	17	6		
4.57		SS	6	42	18	4	69.20
End of Borehole							
(GWL @ 2.21m depth - Feb. 13/2020)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II ESA
1330 Carling Avenue and 815 Archibald Street
Ottawa, Ontario

DATUM Referenced to a TBM consisting of the southeast corner of the building slab. Geodetic: 73.60m

REMARKS

FILE NO. PE4789

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** 2020 February 6

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
UNDERSIDE OF FOOTING									
ASPHALTIC CONCRETE 0.04		AU	1			0	73.26		
FILL: Brown sand with gravel		SS	2	67	17	1	72.26		
		SS	3	58	13	2	71.26		
2.39									
FILL: Brown-black silty clay with gravel, trace organics		SS	4	42	5	3	70.26		
3.15									
		SS	5	50	16				
GLACIAL TILL: Grey silty clay with sand, gravel and occasional cobbles		SS	6	33	9	4	69.26		
		SS	7	0	7	5	68.26		
5.18									
End of Borehole									
(GWL @ 2.23m depth - Feb. 13/2020)									

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II ESA
1330 Carling Avenue and 815 Archibald Street
Ottawa, Ontario

DATUM Referenced to a TBM consisting of the southeast corner of the building slab. Geodetic: 73.60m

FILE NO. PE4789

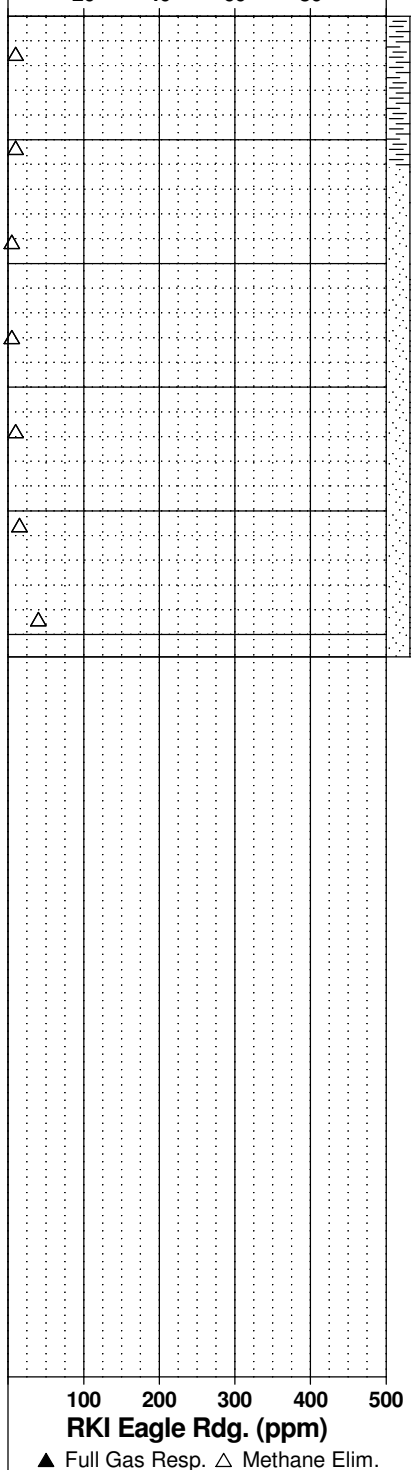
REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** 2020 February 6

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
UNDERSIDE OF FOOTING							
ASPHALTIC CONCRETE 0.03						0	73.39
FILL: Brown silty sand with gravel 0.61		AU	1				
FILL: Brown silty sand with gravel and clay 1.52		SS	2	42	11	1	72.39
FILL: Brown/grey silty clay with sand, gravel and occasional cobbles 2.29		SS	3	63	7	2	71.39
		SS	4	67	27		
GLACIAL TILL: Grey silty clay with sand, gravel and occasional cobbles		SS	5	13	11	3	70.39
		SS	6	63	6	4	69.39
		SS	7	29	15	5	68.39
5.18 End of Borehole							
(GWL @ 2.28m depth - Feb. 13/2020)							

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



Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II ESA
1330 Carling Avenue and 815 Archibald Street
Ottawa, Ontario

DATUM Referenced to a TBM consisting of the southeast corner of the building slab. Geodetic: 73.60m

FILE NO. PE4789

REMARKS

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** 2020 February 5

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
UNDERSIDE OF FOOTING									
ASPHALTIC CONCRETE 0.03		AU	1			0	73.40		
FILL: Brown silty sand with gravel		SS	2	50	20	1	72.40		
1.52									
Brown **SILTY CLAY**, trace gravel 2.13		SS	3	42	12	2	71.40		
		SS	4	50	8				
GLACIAL TILL: Grey silty clay with sand, gravel and occasional cobbles		SS	5	58	18	3	70.40		
		SS	6	75	8	4	69.40		
		SS	7	67	19	5	68.40		
		SS	8	75	31				
6.10						6	67.40		
Dynamic Cone Penetration Test commenced at 6.10m depth.						7	66.40		
						8	65.40		
						9	64.40		
9.60									
End of Borehole									
Practical refusal to DCPT @ 9.60m depth									

Photo Ionization Detector: ● Volatile Organic Rdg. (ppm)

○ Lower Explosive Limit %

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II ESA
1330 Carling Avenue and 815 Archibald Street
Ottawa, Ontario

DATUM Referenced to a TBM consisting of the southeast corner of the building slab. Geodetic: 73.60m

FILE NO. PE4789

REMARKS

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** 2020 February 5

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
UNDERSIDE OF FOOTING									
ASPHALTIC CONCRETE 0.03		AU	1			0	73.25		
FILL: Brown silty sand with gravel		SS	2	0	12	1	72.25		
1.52		SS	3	92	6	2	71.25		
Hard to stiff, brown **SILTY CLAY**									
-grey by 3m depth						3	70.25		
3.96		SS	4	92	15	4	69.25		
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders		SS	5	42	16	5	68.25		
5.49		SS	6	67	42				
GLACIAL TILL: Brown sand with silt, gravel and occasional cobbles 6.10						6	67.25		
Dynamic Cone Penetration Test commenced at 6.10m depth.						7	66.25		
						8	65.25		
8.41									
End of Borehole									
Practical refusal to DCPT @ 8.41 m depth									

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

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II ESA
1330 Carling Avenue and 815 Archibald Street
Ottawa, Ontario

DATUM Referenced to a TBM consisting of the southeast corner of the building slab. Geodetic: 73.60m

FILE NO. PE4789

REMARKS

HOLE NO. BH 6

BORINGS BY CME 55 Power Auger **DATE** 2020 February 6

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
UNDERSIDE OF FOOTING									
ASPHALTIC CONCRETE 0.05						0	73.30		
FILL: Brown silty sand with gravel 0.61		AU	1						
FILL: Brown silty sand, trace gravel		SS	2	67	8	1	72.30		
1.52									
FILL: Brown silty sand with gravel, some black sand		SS	3	13	12	2	71.30		
2.39									
		SS	4	67	8	3	70.30		
GLACIAL TILL: Grey silty clay with sand, gravel and occasional cobbles		SS	5	25	21				
		SS	6	42	18	4	69.30		
		SS	7	0	13	5	68.30		
		SS	8	13	7				
						6	67.30		
6.40									
End of Borehole									

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

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 relative strength of cohesionless soils is the compactness condition, 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. An SPT N value of "P" denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	'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 shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

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, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

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 NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, 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, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water 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 at which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

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

CONSOLIDATION TEST

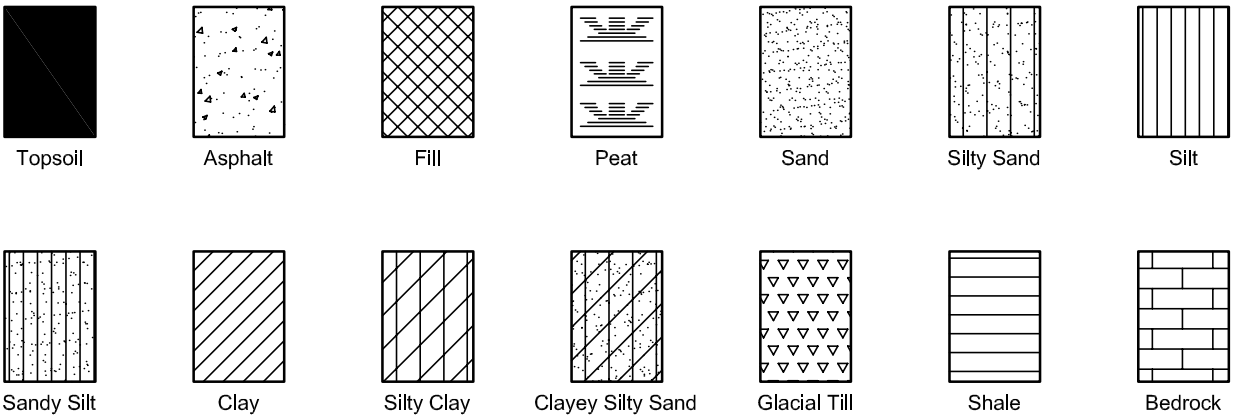
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

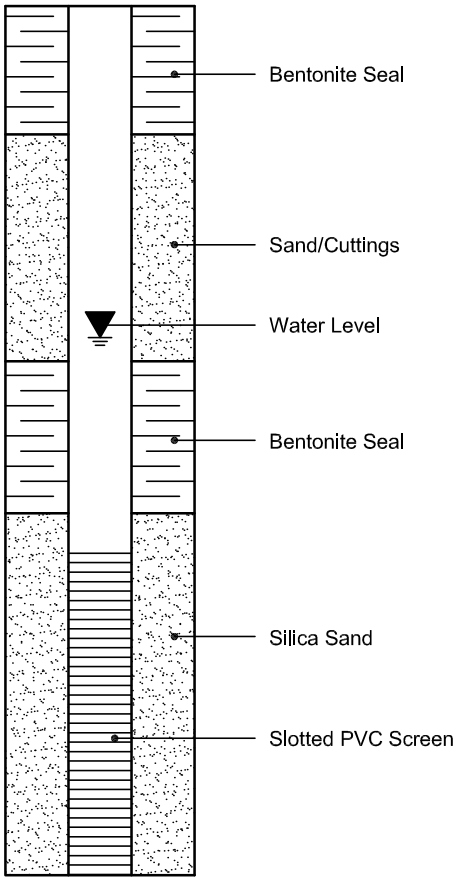
SYMBOLS AND TERMS (continued)

STRATA PLOT

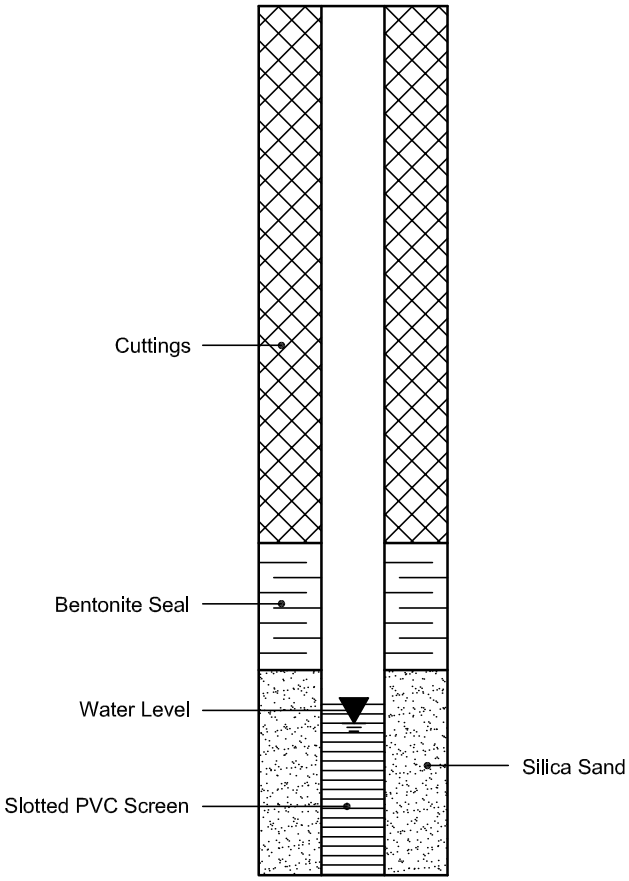


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Paterson Group Consulting Engineers

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Client PO: 29452
Project: PE4789
Custody: 126916

Report Date: 20-Feb-2020
Order Date: 7-Feb-2020

Revised Report

Order #: 2007020

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

Paracel ID	Client ID
2007020-01	BH1-SS2
2007020-02	BH1-SS5
2007020-03	BH2-SS2
2007020-04	BH2-SS4
2007020-05	BH3-SS2
2007020-06	BH3-SS6

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 20-Feb-2020

Client: Paterson Group Consulting Engineers

Order Date: 7-Feb-2020

Client PO: 29452

Project Description: PE4789

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	12-Feb-20	12-Feb-20
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	10-Feb-20	11-Feb-20
Mercury by CVAA	EPA 7471B - CVAA, digestion	11-Feb-20	11-Feb-20
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	18-Feb-20	19-Feb-20
PHC F1	CWS Tier 1 - P&T GC-FID	12-Feb-20	12-Feb-20
PHC F4G (gravimetric)	CWS Tier 1 - Extraction Gravimetric	12-Feb-20	12-Feb-20
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	10-Feb-20	11-Feb-20
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	11-Feb-20	11-Feb-20
Solids, %	Gravimetric, calculation	11-Feb-20	12-Feb-20

Certificate of Analysis

Report Date: 20-Feb-2020

Client: Paterson Group Consulting Engineers

Order Date: 7-Feb-2020

Client PO: 29452

Project Description: PE4789

	Client ID:	BH1-SS2	BH1-SS5	BH2-SS2	BH2-SS4
	Sample Date:	05-Feb-20 09:00	05-Feb-20 09:00	06-Feb-20 09:00	06-Feb-20 09:00
	Sample ID:	2007020-01	2007020-02	2007020-03	2007020-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	95.0	89.4	97.0	85.2
General Inorganics					
pH	0.05 pH Units	7.75	7.65	-	-
Metals					
Antimony	1.0 ug/g dry	<1.0	-	<1.0	-
Arsenic	1.0 ug/g dry	2.1	-	1.8	-
Barium	1.0 ug/g dry	72.9	-	48.0	-
Beryllium	0.5 ug/g dry	<0.5	-	<0.5	-
Boron	5.0 ug/g dry	8.8	-	6.8	-
Cadmium	0.5 ug/g dry	<0.5	-	<0.5	-
Chromium	5.0 ug/g dry	13.8	-	11.8	-
Chromium (VI)	0.2 ug/g dry	<0.2	-	<0.2	-
Cobalt	1.0 ug/g dry	5.8	-	4.4	-
Copper	5.0 ug/g dry	17.1	-	11.9	-
Lead	1.0 ug/g dry	6.8	-	3.8	-
Mercury	0.1 ug/g dry	<0.1	-	<0.1	-
Molybdenum	1.0 ug/g dry	<1.0	-	<1.0	-
Nickel	5.0 ug/g dry	11.3	-	8.6	-
Selenium	1.0 ug/g dry	<1.0	-	<1.0	-
Silver	0.3 ug/g dry	<0.3	-	<0.3	-
Thallium	1.0 ug/g dry	<1.0	-	<1.0	-
Uranium	1.0 ug/g dry	<1.0	-	<1.0	-
Vanadium	10.0 ug/g dry	24.2	-	19.1	-
Zinc	20.0 ug/g dry	24.3	-	<20.0	-
Volatiles					
Benzene	0.02 ug/g dry	-	<0.02	-	<0.02
Ethylbenzene	0.05 ug/g dry	-	<0.05	-	<0.05
Toluene	0.05 ug/g dry	-	<0.05	-	<0.05
m,p-Xylenes	0.05 ug/g dry	-	<0.05	-	<0.05
o-Xylene	0.05 ug/g dry	-	<0.05	-	<0.05
Xylenes, total	0.05 ug/g dry	-	<0.05	-	<0.05
Toluene-d8	Surrogate	-	102%	-	112%
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	-	44	-	<7
F2 PHCs (C10-C16)	4 ug/g dry	-	27	-	<4

Certificate of Analysis

Report Date: 20-Feb-2020

Client: Paterson Group Consulting Engineers

Order Date: 7-Feb-2020

Client PO: 29452

Project Description: PE4789

	Client ID:	BH1-SS2	BH1-SS5	BH2-SS2	BH2-SS4
	Sample Date:	05-Feb-20 09:00	05-Feb-20 09:00	06-Feb-20 09:00	06-Feb-20 09:00
	Sample ID:	2007020-01	2007020-02	2007020-03	2007020-04
	MDL/Units	Soil	Soil	Soil	Soil
F3 PHCs (C16-C34)	8 ug/g dry	-	18	-	71
F4 PHCs (C34-C50)	6 ug/g dry	-	<6	-	214 [1]
F4G PHCs (gravimetric)	50 ug/g dry	-	-	-	508

Certificate of Analysis

Report Date: 20-Feb-2020

Client: **Paterson Group Consulting Engineers**

Order Date: 7-Feb-2020

Client PO: **29452**

Project Description: **PE4789**

	Client ID:	BH3-SS2	BH3-SS6	-	-
	Sample Date:	06-Feb-20 09:00	06-Feb-20 09:00	-	-
	Sample ID:	2007020-05	2007020-06	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	76.6	93.5	-	-
Metals					
Antimony	1.0 ug/g dry	<1.0	-	-	-
Arsenic	1.0 ug/g dry	3.9	-	-	-
Barium	1.0 ug/g dry	236	-	-	-
Beryllium	0.5 ug/g dry	0.7	-	-	-
Boron	5.0 ug/g dry	6.2	-	-	-
Cadmium	0.5 ug/g dry	<0.5	-	-	-
Chromium	5.0 ug/g dry	70.1	-	-	-
Chromium (VI)	0.2 ug/g dry	<0.2	-	-	-
Cobalt	1.0 ug/g dry	19.0	-	-	-
Copper	5.0 ug/g dry	24.8	-	-	-
Lead	1.0 ug/g dry	12.5	-	-	-
Mercury	0.1 ug/g dry	<0.1	-	-	-
Molybdenum	1.0 ug/g dry	<1.0	-	-	-
Nickel	5.0 ug/g dry	36.9	-	-	-
Selenium	1.0 ug/g dry	<1.0	-	-	-
Silver	0.3 ug/g dry	<0.3	-	-	-
Thallium	1.0 ug/g dry	<1.0	-	-	-
Uranium	1.0 ug/g dry	<1.0	-	-	-
Vanadium	10.0 ug/g dry	72.9	-	-	-
Zinc	20.0 ug/g dry	80.9	-	-	-
Volatiles					
Benzene	0.02 ug/g dry	-	<0.02	-	-
Ethylbenzene	0.05 ug/g dry	-	<0.05	-	-
Toluene	0.05 ug/g dry	-	<0.05	-	-
m,p-Xylenes	0.05 ug/g dry	-	<0.05	-	-
o-Xylene	0.05 ug/g dry	-	<0.05	-	-
Xylenes, total	0.05 ug/g dry	-	<0.05	-	-
Toluene-d8	Surrogate	-	112%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	-	<7	-	-
F2 PHCs (C10-C16)	4 ug/g dry	-	<4	-	-
F3 PHCs (C16-C34)	8 ug/g dry	-	<8	-	-
F4 PHCs (C34-C50)	6 ug/g dry	-	<6	-	-

Certificate of Analysis

Report Date: 20-Feb-2020

Client: Paterson Group Consulting Engineers

Order Date: 7-Feb-2020

Client PO: 29452

Project Description: PE4789

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
F4G PHCs (gravimetric)	ND	50	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (VI)	ND	0.2	ug/g						
Chromium	ND	5.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	5.0	ug/g						
Lead	ND	1.0	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	5.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	10.0	ug/g						
Zinc	ND	20.0	ug/g						
Volatiles									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	*3.73*		*ug/g*		*117*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
pH	7.54	0.05	pH Units	7.50			0.5	2.3	
Hydrocarbons									
F1 PHCs (C6-C10)	38	7	ug/g dry	44			14.5	40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND			NC	30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND			NC	30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND			NC	30	
Metals									
Antimony	2.1	1.0	ug/g dry	ND			NC	30	
Arsenic	1.9	1.0	ug/g dry	2.1			9.8	30	
Barium	61.7	1.0	ug/g dry	72.9			16.6	30	
Beryllium	0.8	0.5	ug/g dry	ND			NC	30	
Boron	8.8	5.0	ug/g dry	8.8			0.5	30	
Cadmium	ND	0.5	ug/g dry	ND			NC	30	
Chromium (VI)	ND	0.2	ug/g dry	ND			NC	35	
Chromium	12.1	5.0	ug/g dry	13.8			13.0	30	
Cobalt	5.2	1.0	ug/g dry	5.8			9.6	30	
Copper	15.2	5.0	ug/g dry	17.1			11.7	30	
Lead	6.3	1.0	ug/g dry	6.8			8.0	30	
Mercury	ND	0.1	ug/g dry	ND			NC	30	
Molybdenum	ND	1.0	ug/g dry	ND			NC	30	
Nickel	10.3	5.0	ug/g dry	11.3			9.4	30	
Selenium	ND	1.0	ug/g dry	ND			NC	30	
Silver	ND	0.3	ug/g dry	ND			NC	30	
Thallium	ND	1.0	ug/g dry	ND			NC	30	
Uranium	ND	1.0	ug/g dry	ND			NC	30	
Vanadium	20.2	10.0	ug/g dry	24.2			18.0	30	
Zinc	22.1	20.0	ug/g dry	24.3			9.6	30	
Physical Characteristics									
% Solids	82.8	0.1	% by Wt.	86.7			4.6	25	
Volatiles									
Benzene	ND	0.02	ug/g dry	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g dry	ND			NC	50	
Toluene	ND	0.05	ug/g dry	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g dry	ND			NC	50	
o-Xylene	ND	0.05	ug/g dry	ND			NC	50	
Surrogate: Toluene-d8	*3.72*		*ug/g dry*		*104*	*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)	178	7	ug/g	ND	88.9	80-120			
F2 PHCs (C10-C16)	96	4	ug/g	ND	105	60-140			
F3 PHCs (C16-C34)	251	8	ug/g	ND	112	60-140			
F4 PHCs (C34-C50)	169	6	ug/g	ND	119	60-140			
F4G PHCs (gravimetric)	820	50	ug/g	ND	82.0	80-120			
Metals									
Antimony	49.5	1.0	ug/g	ND	98.8	70-130			
Arsenic	47.5	1.0	ug/g	ND	93.3	70-130			
Barium	80.1	1.0	ug/g	29.2	102	70-130			
Beryllium	51.9	0.5	ug/g	ND	104	70-130			
Boron	52.4	5.0	ug/g	ND	97.8	70-130			
Cadmium	50.6	0.5	ug/g	ND	101	70-130			
Chromium (VI)	0.1	0.2	ug/g	ND	60.0	70-130			QM-05
Chromium	56.9	5.0	ug/g	5.5	103	70-130			
Cobalt	51.5	1.0	ug/g	2.3	98.4	70-130			
Copper	56.2	5.0	ug/g	6.8	98.8	70-130			
Lead	51.3	1.0	ug/g	2.7	97.2	70-130			
Mercury	1.70	0.1	ug/g	ND	113	70-130			
Molybdenum	51.6	1.0	ug/g	ND	103	70-130			
Nickel	53.4	5.0	ug/g	ND	97.7	70-130			
Selenium	47.1	1.0	ug/g	ND	94.0	70-130			
Silver	51.9	0.3	ug/g	ND	104	70-130			
Thallium	44.5	1.0	ug/g	ND	89.0	70-130			
Uranium	47.2	1.0	ug/g	ND	94.0	70-130			
Vanadium	59.2	10.0	ug/g	ND	99.1	70-130			
Zinc	57.8	20.0	ug/g	ND	96.2	70-130			
Volatiles									
Benzene	3.60	0.02	ug/g	ND	89.9	60-130			
Ethylbenzene	3.91	0.05	ug/g	ND	97.6	60-130			
Toluene	3.71	0.05	ug/g	ND	92.8	60-130			
m,p-Xylenes	8.21	0.05	ug/g	ND	103	60-130			
o-Xylene	4.34	0.05	ug/g	ND	108	60-130			
Surrogate: Toluene-d8	*3.13*		*ug/g*		*97.7*	*50-140*			

Certificate of Analysis

Report Date: 20-Feb-2020

Client: Paterson Group Consulting Engineers

Order Date: 7-Feb-2020

Client PO: 29452

Project Description: PE4789

Qualifier Notes:

Sample Qualifiers :

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

QC Qualifiers :

QM-05 : The spike recovery was outside acceptance limits for the matrix spike due to matrix interference.

Sample Data Revisions

None

Work Order Revisions / Comments:

Revision 1 This report includes an updated parameter list.

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.
NC: Not Calculated

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.
- When reported, data for F4G has been processed using a silica gel cleanup.

PARAC LABORATORIES

Paracel ID: 2007020

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Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2007020	Nº 126916

Client Name: Paterson Group	Project Ref: PE4789	Page __ of __
Contact Name: Mandy Witteman / Mark D'Arcy	Quote #:	Turnaround Time
Address: 154 Colonnade Rd. S.	PO #: 29452	☐ 1 day ☐ 3 day
	E-mail:	☐ 2 day ☒ Regular
Telephone: (613) 226-7381	mwitteman@patersongroup.ca	Date Required:

Regulation 153/04	Other Regulation
☐ Table 1 ☐ Res/Park ☐ Med/Fine	☐ REG 558 ☐ PWQO
☐ Table 2 ☐ Ind/Comm ☐ Coarse	☐ CCME ☐ MISA
☒ Table 3 ☐ Agri/Other	☐ SU - Sani ☐ SU - Storm
☐ Table ___	Mun:
For RSC: ☐ Yes ☐ No	☐ Other:

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

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)						
1	BH1-SS2	S		1	Feb 5/20	AM				X	X	X							
2	BH1-SS5	S		2	↓	↓	X												
3	BH1-SS6	S		2	↓	↓	X			X	X	X		ignore. (HOLD)					
4	BH2-SS2	S		1	Feb 6/20					X	X	X							
5	BH2-SS4	S		2	↓		X												
6	BH3-SS2	S		1	↓					X	X	X		ID extend	2'6 - 4'6				
7	BH3-SS6	S		2	↓		X							"	12'6 - 14'6				
8																			
9																			
10																			

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received By Driver/Depot:	Received at Lab: BFerm	Verified By: DLam
Relinquished By (Print): Mandy Witteman	Date/Time:	Date/Time: 07/Feb/2020 16:30	Date/Time: 10-Feb-2020 10:08
Date/Time: Feb 7, 2020	Temperature: °C	Temperature: 9.2 °C	pH Verified: ☐ By: NA

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 29529
Project: PE4789
Custody: 126934

Report Date: 20-Feb-2020
Order Date: 14-Feb-2020

Order #: 2007643

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

Paracel ID	Client ID
2007643-01	Dup

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 20-Feb-2020

Client: Paterson Group Consulting Engineers

Order Date: 14-Feb-2020

Client PO: 29529

Project Description: PE4789

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	19-Feb-20	20-Feb-20
PHC F1	CWS Tier 1 - P&T GC-FID	19-Feb-20	20-Feb-20
Solids, %	Gravimetric, calculation	19-Feb-20	20-Feb-20

Certificate of Analysis

Report Date: 20-Feb-2020

Client: Paterson Group Consulting Engineers

Order Date: 14-Feb-2020

Client PO: 29529

Project Description: PE4789

	Client ID:	Dup	-	-	-
	Sample Date:	06-Feb-20 09:00	-	-	-
	Sample ID:	2007643-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	82.7	-	-	-
Volatiles					
Benzene	0.02 ug/g dry	<0.02	-	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	-	-	-
Toluene	0.05 ug/g dry	<0.05	-	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	-	-	-
o-Xylene	0.05 ug/g dry	<0.05	-	-	-
Xylenes, total	0.05 ug/g dry	<0.05	-	-	-
Toluene-d8	Surrogate	107%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	10	-	-	-

Certificate of Analysis

Report Date: 20-Feb-2020

Client: Paterson Group Consulting Engineers

Order Date: 14-Feb-2020

Client PO: 29529

Project Description: PE4789

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						
Volatiles									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	*3.36*		*ug/g*		*105*	*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			NC	40	
Physical Characteristics									
% Solids	91.2	0.1	% by Wt.	90.0			1.4	25	
Volatiles									
Benzene	ND	0.02	ug/g dry	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g dry	ND			NC	50	
Toluene	ND	0.05	ug/g dry	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g dry	ND			NC	50	
o-Xylene	ND	0.05	ug/g dry	ND			NC	50	
Surrogate: Toluene-d8	*4.01*		*ug/g dry*		*113*	*50-140*			

Certificate of Analysis

Report Date: 20-Feb-2020

Client: Paterson Group Consulting Engineers

Order Date: 14-Feb-2020

Client PO: 29529

Project Description: PE4789

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	ND	83.2	80-120			
Volatiles									
Benzene	2.46	0.02	ug/g	ND	61.5	60-130			
Ethylbenzene	3.29	0.05	ug/g	ND	82.3	60-130			
Toluene	3.16	0.05	ug/g	ND	78.9	60-130			
m,p-Xylenes	6.81	0.05	ug/g	ND	85.1	60-130			
o-Xylene	3.59	0.05	ug/g	ND	89.8	60-130			
Surrogate: Toluene-d8	*2.87*		*ug/g*		*89.5*	*50-140*			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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.
- When reported, data for F4G has been processed using a silica gel cleanup.

PARACEL LABORATORIES LTD.

Paracel ID: 2007643

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2007643	Nº 126934

Client Name: Paterson Group
Contact Name: Mark D'Arcy; Mandy Witteman
Address: 154 Colonnade Road
Telephone: 613-226-7381

Project Ref: PE4784
Quote #:
PO #: 29529
E-mail: mdarcy@patersongroup.ca
mwitteman@patersongroup.ca

Page 1 of 1

Turnaround Time
☐ 1 day ☐ 3 day
☐ 2 day ☒ Regular
Date Required:

Regulation 153/04
☐ Table 1 ☐ Res/Park ☐ Med/Fine
☐ Table 2 ☐ Ind/Comm ☐ Coarse
☒ Table 3 ☐ Agri/Other
☐ Table
For RSC: ☐ Yes ☐ No

Other Regulation
☐ REG 558 ☐ PWQO
☐ CCME ☐ MISA
☐ SU - Sani ☐ SU - Storm
Mun:
☐ Other:

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

Required Analysis

	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)	BTEX/F1
1	Dup	S		2	Feb 6/2020									X
2														
3														
4														
5														
6														
7														
8														
9														
10														

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received By Driver/Depot: T. HOUSE	Received at Lab:	Verified By:
Relinquished By (Print): Nicholas Dauphinette	Date/Time: 14/02/20 2:15	Date/Time: Feb/14/2020 16:45	Date/Time: Feb/14/2020 17:27
Date/Time: Feb 14th 2020 / 2:20	Temperature: °C PM	Temperature: 7.6 °C	pH Verified: ☐ By:

Chain of Custody (Env.) xlsx

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1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 29526
Project: PE4789
Custody: 126930

Report Date: 20-Feb-2020
Order Date: 13-Feb-2020

Order #: 2007563

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

Paracel ID	Client ID
2007563-01	MW1-GW1
2007563-02	MW2-GW1
2007563-03	MW3-GW1
2007563-04	Dup 1

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 20-Feb-2020

Client: Paterson Group Consulting Engineers

Order Date: 13-Feb-2020

Client PO: 29526

Project Description: PE4789

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	15-Feb-20	15-Feb-20
PHC F1	CWS Tier 1 - P&T GC-FID	14-Feb-20	15-Feb-20
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	18-Feb-20	18-Feb-20

Certificate of Analysis

Report Date: 20-Feb-2020

Client: Paterson Group Consulting Engineers

Order Date: 13-Feb-2020

Client PO: 29526

Project Description: PE4789

	Client ID:	MW1-GW1	MW2-GW1	MW3-GW1	Dup 1
	Sample Date:	13-Feb-20 09:00	13-Feb-20 09:40	13-Feb-20 10:30	13-Feb-20 09:00
	Sample ID:	2007563-01	2007563-02	2007563-03	2007563-04
	MDL/Units	Water	Water	Water	Water
Volatiles					
Benzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	0.5 ug/L	2.8	<0.5	<0.5	2.7
Toluene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
o-Xylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Xylenes, total	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Toluene-d8	Surrogate	88.3%	87.5%	88.2%	91.1%
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	140	<25	<25	126
F2 PHCs (C10-C16)	100 ug/L	<100	<100	<100	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	<100	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	<100	-

Certificate of Analysis

Report Date: 20-Feb-2020

Client: Paterson Group Consulting Engineers

Order Date: 13-Feb-2020

Client PO: 29526

Project Description: PE4789

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	*71.6*		*ug/L*		*89.5*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND			NC	30	
Volatiles									
Benzene	ND	0.5	ug/L	ND			NC	30	
Ethylbenzene	ND	0.5	ug/L	ND			NC	30	
Toluene	ND	0.5	ug/L	ND			NC	30	
m,p-Xylenes	ND	0.5	ug/L	ND			NC	30	
o-Xylene	ND	0.5	ug/L	ND			NC	30	
Surrogate: Toluene-d8	*69.3*		*ug/L*		*86.6*	*50-140*			

Certificate of Analysis

Report Date: 20-Feb-2020

Client: Paterson Group Consulting Engineers

Order Date: 13-Feb-2020

Client PO: 29526

Project Description: PE4789

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1960	25	ug/L	ND	98.0	68-117			
F2 PHCs (C10-C16)	1630	100	ug/L	ND	102	60-140			
F3 PHCs (C16-C34)	4120	100	ug/L	ND	105	60-140			
F4 PHCs (C34-C50)	2480	100	ug/L	ND	99.8	60-140			
Volatiles									
Benzene	28.1	0.5	ug/L	ND	70.2	60-130			
Ethylbenzene	35.0	0.5	ug/L	ND	87.6	60-130			
Toluene	27.7	0.5	ug/L	ND	69.3	60-130			
m,p-Xylenes	72.9	0.5	ug/L	ND	91.2	60-130			
o-Xylene	38.2	0.5	ug/L	ND	95.6	60-130			
Surrogate: Toluene-d8	*66.7*		*ug/L*		*83.4*	*50-140*			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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.
- When reported, data for F4G has been processed using a silica gel cleanup.

PARACEL LABORATORIES LTD.

Paracel ID: 2007563

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2007563	Nº 126930

Page 1 of 1

Client Name: Paterson Group
Contact Name: Mark D'Arcy; Mandy Witteman
Address: 154 Colonnade Road
Telephone: 613-226-7381

Project Ref: PE4789
Quote #:
PO #: 29526
E-mail: mdarcy@patersongrp.ca
mwitteman@patersongrp.ca

Turnaround Time
☐ 1 day ☐ 3 day
☐ 2 day ☒ Regular
Date Required:

Regulation 153/04	Other Regulation
☐ Table 1 ☐ Res/Park ☐ Med/Fine	☐ REG 558 ☐ PWQO
☐ Table 2 ☐ Ind/Comm ☐ Coarse	☐ CCME ☐ MISA
☒ Table 3 ☐ Agri/Other	☐ SU - Sani ☐ SU - Storm
☐ Table ___	Mun: ___
For RSC: ☒ Yes ☐ No	☐ Other:

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

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)
1	MW1-GW1	GW		3	Feb 13/2020	9.00 AM	X						
2	MW2-GW1	GW		3		9.40 AM	X						
3	MW3-GW1	GW		3		10.30 AM	X						
4	Dup 1	GW		2		9.00 AM	X						
5													
6													
7													
8													
9													
10													

Comments:

Method of Delivery: Swift

Relinquished By (Sign):
Relinquished By (Print):
Date/Time:

Received By Driver/Depot:
Date/Time:
Temperature: °C

Received at Lab:
Date/Time: Feb 13/2020 5:05p
Temperature: 14.3 °C

Verified By:
Date/Time: Feb 14/2020 10:46
pH Verified: ☐ By: N/A

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