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Phase II Environmental Site Assessment

Part of 263 Greensway Avenue
Ottawa, Ontario

Prepared For

Manor Park Management

May 14, 2018

Report: PE4258-2

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EXECUTIVE SUMMARY

Assessment

A Phase II ESA was conducted for the part of the property addressed 263 Greensway Avenue, in the City of Ottawa, Ontario. The purposes of the Phase II ESA was to address potentially contaminating activities (PCAs) that were identified during the Phase I ESA and considered to result in areas of potential environmental concern (APECs) on the Phase I and Phase II Property. The subsurface investigation was carried out in conjunction with a Geotechnical Investigation and consisted of drilling seven (7) boreholes, four (4) of which were constructed with groundwater monitoring well installations.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. A total of eight (8) soil samples were submitted for laboratory analysis of a combination of volatile organic compounds (VOCs), benzene, toluene, ethylbenzene and xylenes (BTEX), petroleum hydrocarbons (PHCs, F_1-F_4), polycyclic aromatic hydrocarbons (PAHs) and metals. Several PAH and metal parameters exceeding MOECC Table 3 standards were identified in the fill material on the northern portion of the Phase II Property. Petroleum hydrocarbon fractions F1 and F2, BTEX and hexane were identified on the southeastern portion of the Phase II Property, at concentrations exceeding the MOECC Table 3 standards.

Groundwater samples from monitoring wells installed in BH1-18, BH3-18, BH4-18 and BH5-18, were recovered and analysed for a combination of VOC, PHC, PAH and metal parameters. With the exception of various metal parameters, no contaminant concentrations were identified above the laboratory method detection limits. Metal parameters identified in each of the groundwater samples were in compliance with the MOECC Table 3 standards.

Conclusion

Based on the findings of the Phase II ESA, fill material impacted with PAH and metal concentrations exceeding MOECC Table 3 standards, is present on the Phase II Property. Soil and weathered bedrock impacted with BTEX, hexane and PHC (F1 and F2) concentrations is also present on the Phase II Property. It is our understanding that the subject site is to be redeveloped with a multi-storey residential building with two (2) levels of underground parking.

It is our recommendation that an environmental site remediation program, involving the removal of all impacted fill material, be completed concurrently with the site redevelopment. Prior to offsite disposal at a licenced landfill site, a leachate analysis of a representative sample of contaminated soil must be conducted in accordance with Ontario Regulation 347/558.

It is also recommended that Paterson personnel be onsite during construction activities to direct the excavation and segregation of impacted soil and to conduct confirmatory sampling as required.

It is expected that groundwater monitoring wells will be abandoned in accordance with O.Reg.903, at the time of construction excavation.

1.0 INTRODUCTION

At the request of Manor Park Management, Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment for part of the property addressed 263 Greensway Avenue, in the City of Ottawa, Ontario. It should be noted that the Phase II Property forms part of a larger residential property; the adjacent residential apartment building has civic address 267 Greensway Avenue. The purpose of this Phase II ESA has been to address areas of potential environmental concern (APECs) identified on the Phase II Property, during the Phase I ESA conducted by Paterson in April of 2018.

1.1 Site Description

Address:	Part of 263 Greensway Avenue, Ottawa, Ontario.
Legal Description:	Part of Lots 4, 5 & 6, Block 1, Registered Plan 29, Formerly City of Vanier, City of Ottawa
Property Identification Number:	04236-0174
Location:	The subject site is located between Greensway Avenue and the Vanier Parkway, approximately 30m north of Montreal Road, in the City of Ottawa. The subject site is shown on Figure 1 - Key Plan following the body of this report.
Latitude and Longitude:	45° 26' 05" N, 75° 40' 01" W
Configuration:	Irregular
Site Area:	0.27 ha (approximate)

1.2 Property Ownership

The subject property is currently owned by Manor Park Management. Paterson was retained to complete this Phase II ESA by Mr. Anand Aggarwal of Manor Park Management. The Manor Park Management offices are located at 231 Brittany Drive, Suite D, in Ottawa, Ontario. Mr. Aggarwal can be contacted by telephone at 613-745-6881.

1.3 Current and Proposed Future Uses

The Phase II Property is currently occupied by a paved parking lot associated with the residential apartment building on the adjacent property to the west, as well as small landscaped areas. It is our understanding that the Phase II Property will be redeveloped with a multi-storey residential building with two (2) levels of underground parking.

1.4 Applicable Site Condition Standard

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

- Coarse-grained soil conditions
- Full depth generic site conditions
- Non-potable groundwater conditions
- Residential land use

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II Property is located in an urban area surrounded by various sized commercial and residential structures. Site topography slopes slightly down towards the north and west. The Phase II Property is at a similar grade as the adjacent properties. Site drainage consists primarily of sheet flow to a catch basin situated on the Phase II Property as well as some surficial infiltration within the landscaped areas. The Phase II Property is situated with a municipally serviced area.

2.2 Past Investigations

Paterson has previously completed a Phase I-Phase II ESA (2012) for the larger residential property, of which the current Phase II Property comprises the eastern portion. Based on the findings of the subsurface investigation, impacted fill material was identified beneath the subject land.

A Phase I ESA was more recently conducted by Paterson in April of 2018. Based on the findings of the Phase I ESA, several historical on- or off-site potentially contaminating activities (PCAs) were considered to result in areas of potential environmental concern (APECs) on the Phase I and Phase II Property, as presented in Table 1.

Table 1
Areas of Potential Environmental Concern

Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern with respect to Phase I Property	Potentially Contaminating Activity	Location of PCA (on-site or off-site)	Contaminants of Potential Concern	Media Potentially Impacted (Groundwater, Soil, and/or Sediment)
APEC 1	Potentially across the Phase I Area	Item 30 – Importation of Fill Material of Unknown Quality	On-site	BTEX PHCs (F_1-F_4) PAHs Metals	Soil, Groundwater
APEC 2	Southeastern portion of the Phase I Property	Other – previously identified BTEX/VOC and PHC impacts	On-site	BTEX VOCs PHCs (F_1-F_4)	Soil, Groundwater
APEC 3	Southern portion of the Phase I Property	Item 37 – Operation of Dry Cleaning Equipment (where chemicals are used)	Off-site	VOCs	Soil, Groundwater
APEC 4	Southern portion of the Phase I Property	Other: former industry (W.R. Cummings Feed Mill & Elevator) with coal storage along the northern property line	Off-site	PAHs Metals	Soil, Groundwater
APEC 5	Eastern portion of the Phase I Property	Item 46 – Rail Yards, Tracks and Spurs	Off-site	PAHs Metals	Soil, Groundwater

A Phase II ESA was recommended to address the aforementioned APECs.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation was conducted during the interim of April 10 through April 11, 2018, in conjunction with a Geotechnical Investigation. The field program consisted of drilling seven (7) boreholes, four (4) of which were completed with groundwater monitoring wells. Boreholes were drilled to depths ranging from approximately 3.8 to 8.6m below grade.

3.2 Media Investigated

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

Contaminants of concern for soil and groundwater include petroleum hydrocarbons (PHCs, fractions F_1-F_4), benzene, toluene, ethylbenzene and xylenes (BTEX), volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs), and metals (including mercury, chromium VI, and boron, available).

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

The Geological Survey of Canada website on the Urban Geology of the National Capital Area was consulted as part of this assessment. Based on this information, the bedrock in the area of the subject site consists of shale of the Billings Formation. Overburden soils are shown as glacial till, with a drift thickness on the order of 2 to 5 m. The findings of the 2012 subsurface investigation on the Phase I Property confirms the reported geological conditions.

The regional groundwater flow is expected to be towards to the west, towards the Rideau River.

Buildings and Structures

There are no buildings or structures on the Phase I Property. The majority of the Phase I Property consists of a paved parking lot, with landscaped areas along the north, east and southern property limits. The Phase I Property was previously occupied by a private parking garage structure, the footprint of which is depicted on Drawing PE4258-3 – Test Hole Location Plan, in the Figures section of this report.

Water Bodies

No water bodies or Areas of Natural Significance are present on the Phase I Property. The closest water body is the Rideau River, located approximately 300m west of the subject land.

Areas of Natural Significance

No areas of natural significance were identified on the site or in the Phase I ESA Study Area.

Drinking Water Wells

The MOECC online interactive well record mapping system was accessed on March 22, 2018. No well records were identified for the Phase I Property. One domestic potable well record, dated 1951, was identified for a property within the Phase I Study Area. Two commercial well records were identified for the former Eastview Theatre (air conditioning) and former Capital Carbon and Ribbon Co. (cooling plant). The wells were installed in 1949 and 1951 respectively. The aforementioned wells were installed within shale or limestone bedrock.

Monitoring Well Records

Records of 22 monitoring wells were identified for the following properties within the Phase I Study Area: 42 Montreal Road, 90 to 92 Montreal Road, 149 Montreal Road, 268 Durocher Street, 285 Palace Road, 307 Montgomery Street, River Road at Wayling Avenue, and an unnamed property. The monitoring wells were installed between 2004 and 2017 and were generally installed within till overburden or shale bedrock. These properties are not considered to pose a concern to the subject land based on their separation distances or orientations with respect to the Phase I Property.

Neighbouring Land Use

Neighbouring land use in the Phase I Study Area consists of residential and commercial land use.

Potentially Contaminating Activities (PCAs) and Areas of Potential Environmental Concern (APECs)

Existing or historical PCAs that are considered to have resulted in five (5) APECs on the Phase I Property, are presented in Table 1 above.

Other historical or existing off-site PCAs identified within the Phase I-ESA study area are presented on Drawing PE4258-2 – Surrounding Land Use Plan in the Phase I ESA. Based on their separation distances and/or orientations with respect to the Phase I Property, these PCAs are not considered to represent APECs on the Phase I Property.

Contaminants of Potential Concern (CPCs)

As presented in Table 1, CPCs associated with the APECs identified on the Phase I Property include BTEX, PHCs, VOCs, PAHs and metals (including hydride forming compounds, Hg and CrVI) in the soil and groundwater.

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of this Phase I-ESA is considered to be sufficient to conclude that there are PCAs on the Phase I Property and within the Phase I Study Area which may have impacted the subject site. The presence of PCAs was confirmed by a variety of independent sources, and as such, the conclusions of this report are not affected by uncertainty which may be present with respect to the individual sources.

3.4 Deviations from Sampling and Analysis Plan

The Sampling and Analysis Plan for this project is included in Appendix 1 of this report. There were no deviations from the Sampling and Analysis Plan.

3.5 Impediments

No 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 April 10 and April 11, 2018, in conjunction with Geotechnical Investigation, and consisted of drilling seven (7) boreholes on the Phase II Property. Four (4) of the boreholes were completed with groundwater monitoring well installations. Boreholes BH1-18 through BH5-18 were cored into the bedrock for geotechnical purposes and to access the groundwater table. 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 PE4258-3 – Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

A total of thirty-four (34) soil samples and eighteen (18) rock core samples were obtained from the boreholes by means of split spoon sampling. The depths at which split spoon samples and rock core samples were obtained from the boreholes are shown as "**SS**" and "**RC**" on the Soil Profile and Test Data Sheets, appended to this report.

Site soils consist of a pavement structure underlain by fill material, native silty clay and glacial till, followed by shaley limestone bedrock. The fill material present beneath the pavement structure generally consisted of silty sand with gravel and fragments of brick, concrete, glass, coal, ash and metal, and extended to depths ranging from approximately 1.45 to 2.9m below the ground surface. Boreholes BH6-18 and BH7-18 were terminated on practical refusal to augering, within the native glacial till or weathered shale. The underlying shaley limestone bedrock was cored at the remaining borehole locations to depths ranging from approximately 6.9 to 8.6m below grade.

4.3 Field Screening Measurements

All soil samples collected underwent a preliminary screening procedure, which included visual screening for colour and evidence of deleterious fill, as well as screening with a photo ionization detector (PID). The detection limit is 0.1 ppm, with a precision of +/- 2 ppm or 10% of the reading.

The soil vapours were measured by inserting the analyzer probe into the nominal headspace above the soil sample. Samples were then agitated and the peak readings recorded. The vapour readings were less than 5ppm for all soil samples. Soil samples were therefore selected for analysis based on a combination of visual appearance and location.

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

4.4 Groundwater Monitoring Well Installation

Four (4) groundwater monitoring wells were installed on the Phase II Property, in BH1-18, BH3-18, BH4-18 and BH5-18. The monitoring wells consisted of 32 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
BH1-18	56.08	8.46	5.46-8.46	4.66-8.46	0.30-4.66	Flushmount
BH3-18	56.25	8.56	5.56-8.56	4.66-8.56	0.30-4.66	Flushmount
BH4-18	56.09	8.13	5.13-8.13	4.73-5.13	0.30-4.73	Flushmount
BH5-18	56.25	6.86	3.86-6.86	3.46-3.86	0.30-3.46	Flushmount

4.5 Field Measurement of Water Quality Parameters

Groundwater sampling was conducted at BH1-18, BH3-18, BH4-18 and BH5-18 on April 20, 2018. At this time, water quality parameters were measured in the field using a multi-parameter analyzer. Parameters measured in the field included temperature, pH, electrical conductivity, and total dissolved solids.

Field parameters were measured after each well volume purged. Wells were purged prior to sampling until at least three well volumes had been removed or the field parameters were relatively stable. Stabilized field parameter values are summarized in Table 3.

Table 3
Field Measurement of Water Quality Parameters – Aug.31, 2017

Parameter	BH1-18	BH3-18	BH4-18	BH5-18
Temperature (°C)	11.5	13.4	8.8	12.6
pH	6.84	6.77	6.11	6.63
Electrical Conductivity (µS/cm)	6,970	10,400	6,430	12,140

4.6 Groundwater Sampling

Groundwater sampling protocols were followed using the MOECC document entitled "Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario", dated May 1996. Groundwater samples were obtained from each monitoring well, using dedicated sampling equipment. Standing water was purged from each well prior to sampling. Samples were stored in coolers to reduce analyte volatilization during transportation. Details of our standard operating procedure for groundwater sampling are provided in the Sampling and Analysis Plan in Appendix 1.

4.7 Analytical Testing

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

Table 4: Soil Samples Submitted

Sample ID	Sample Depth / Stratigraphic Unit	Parameters Analyzed					Rationale
		BTEX	PHCs (F_1-F_4)	VOCs	PAHs	Metals	
BH2-18-SS2	0.76-1.37m; Fill				X	X	Assessment of visually impacted fill material.
BH3-18-SS2	0.76-1.37m; Fill					X	Assessment of visually impacted fill material.
BH3-18-SS5	3.05-3.66m; Native Glacial Till			X			Assessment of potential VOC impacts in the soil resulting from a possible former cleaners to the south.
BH4-18-SS3	1.52-2.13m; Native Glacial Till				X	X	To confirm quality of native material underlying visually impacted fill material.
BH4-18-SS4	2.29-2.45m; Native Glacial Till	X	X		.		Delineation of previously identified VOC (including BTEX) and PHC concentrations.
BH5-18-SS4	2.29-2.90m; Silty Sand	X	X				Delineation of previously identified impacts and general coverage of the Phase II Property.
BH6-18-SS2	0.76-1.37m; Fill				X		Assessment of visually impacted fill material.
BH7-18-SS2	0.76-1.37m; Fill				X		Assessment of visually impacted fill material and potential impacts from the former rail lines to the east.

Table 5: Groundwater Samples Submitted

Sample ID	Screened Interval/ Stratigraphic Unit	Parameters Analyzed				Rationale
		PHCs (F_1-F_4)	VOCs	PAHs	Metals	
BH1-18-GW1	5.46-8.46m; Bedrock			X	X	Assessment of potential PAH and metal impacts in the groundwater from previously identified impacted fill material.
BH3-18-GW1	5.56-8.56m; Bedrock	X	X	X	X	Assessment of potential VOCs in the groundwater from a potential historical cleaners south of the Phase II Property. Assessment of potential PAH and metals impacts resulting from pockets of impacted fill material across the subject land.
BH4-18-GW1	5.13-8.13 m; Bedrock	X	X	X	X	Assessment of potential VOCs, PHCs, PAHs, and metals in the groundwater from historical off-site PCAs to the east and south, as well as from impacted fill material previously identified on the Phase II Property.
BH5-18-GW1	3.86-6.86m; Bedrock	X	X			Delineation of potential impacts identified in BH3-18 and BH4-18.

Note: VOC parameter group includes the BTEX parameter group (although VOCs not identified as CPC for all APECs, groundwater was tested for VOCs to cover both parameter groups)

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

4.8 Residue Management

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

4.9 Elevation Surveying

An elevation survey of all borehole locations was completed by Paterson at the time of the subsurface investigation. All borehole elevations are relative to a set magnetic nail and washer on a concrete curb on the northeastern portion of the Phase II Property, with geodetic elevation 56.296m above sea level (m asl), as provided by Fairhall, Moffett and Woodland.

4.10 Quality Assurance and Quality Control Measures

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

5.0 REVIEW AND EVALUATION

5.1 Geology

Site soils generally consist of a pavement structure over fill material, underlain by a layer of silty clay and/or glacial till, followed by weathered shale and/or competent shaley limestone bedrock. Site stratigraphy is shown on Drawing PE4258-7 – Cross-Section A-A' and Drawing PE4258-8 – Cross-Section B-B'.

Groundwater was encountered within the bedrock at depths ranging from approximately 3.66 to 3.82m below existing grade.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling event on April 20, 2018, using an electronic water level meter. Groundwater levels are summarized below in Table 6. All measurements are relative to set magnetic washer and nail in the concrete curb on the northeastern portion of the Phase II Property.

Table 6: Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH1-18	56.08	3.82	52.26	April 20, 2018
BH3-18	56.25	3.67	52.58	April 20, 2018
BH4-18	56.09	3.68	52.41	April 20, 2018
BH5-18	56.25	3.66	52.59	April 20, 2018

Based on the groundwater elevations measured during the April 2018 sampling event, groundwater contour mapping was completed. Groundwater contours are shown on Drawing PE4258-4 - Groundwater Contour Plan. Based on the contour mapping, groundwater flow beneath the Phase II Property appears to flow towards the northeast. A horizontal hydraulic gradient of approximately 0.008 m/m was calculated.

No free product was observed in the monitoring wells sample at the Phase II Property.

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

Field screening of the soil samples collected during drilling resulted in organic vapour readings of less than 5ppm. 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

A total of eight (8) soil samples were submitted for analysis of a combination of PHCs (F1-F4), BTEX, VOCs, PAHs and metals. The results of the analytical testing are presented below in Tables 7, 8, 9 and 10. The laboratory certificates of analysis are provided in Appendix 1. It should be noted that 2012 data has been included in the tables for information purposes.

Table 7: Analytical Test Results – Soil (BTEX and PHCs (F1-F4)

Parameter	MDL (µg/g)	Soil Samples (µg/g)			MOECC Table 3 Residential Standards (µg/g)
		April 20, 2012	April 11, 2018		
		BH2-SS5 (2.1-2.3m)	BH4-18-SS4 (2.29-2.90m)	BH5-18-SS4 (2.29-2.90)	
Benzene	0.02	**0.51**	nd	nd	0.21
Ethylbenzene	0.05	**6.15**	nd	nd	2.3
Toluene	0.05	**2.30**	0.14	nd	2
Xylenes (Total)	0.05	**26.9**	0.07	nd	3.1
PHC F1	7	**241**	16	nd	55
PHC F2	4	32	**116**	6	98
PHC F3	8	47	173	67	300
PHC F4	6	nd	53	83	2,800

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds MOECC Table 3 standards

Concentrations of BTEX and PHC F_1 exceeding MOECC Table 3 standards were identified in soil Sample BH2-SS5 (2012), while a concentration of PHC F_2 exceeding the MOECC Table 3 standard was identified in Sample BH4-18-SS4.

Other PHC fractions and BTEX parameters identified in the 2018 soil samples were in compliance with the respective Table 3 standard, or were not detected above the method detection limit.

Table 8: Analytical Test Results – Soil (VOCs)

Parameter	MDL (µg/g)	Soil Samples (µg/g)		MOECC Table 3 Residential Standards (µg/g)
		April 30, 2012	April 10, 2018	
		BH2-SS5 (2.1-2.3m)	BH3-18-SS5 (3.81-4.42m)	
Acetone	0.50	nd	nd	16
Benzene	0.02	**0.51**	nd	0.21
Bromodichloromethane	0.05	nd	nd	13
Bromoform	0.05	nd	nd	0.27
Bromomethane	0.05	nd	nd	0.05
Carbon Tetrachloride	0.05	nd	nd	0.05
Chlorobenzene	0.05	nd	nd	2.4
Chloroform	0.05	nd	nd	0.05
Dibromochloromethane	0.05	nd	nd	9.4
m-Dichlorobenzene	0.20	nd	nd	16
o-Dichlorobenzene	0.05	nd	nd	3.4
p-Dichlorobenzene	0.05	nd	nd	4.8
Dichlorodifluoromethane	0.05	nd	nd	0.083
1,1-Dichloroethane	0.05	nd	nd	3.5
1,2-Dichloroethane	0.05	nd	nd	0.05
1,1-Dichlroethylene	0.05	nd	nd	0.05
c-1,2-Dichloroethylene	0.05	nd	nd	3.4
t-1,2-Dichloroethylene	0.05	nd	nd	0.084
1,2-Dichloropropane	0.05	nd	nd	0.05
c-1,3-Dichloropropene	0.05	nd	nd	0.05
Ethylbenzene	0.05	**6.15**	nd	2
Ethylene Dibromide	0.05	nd	nd	0.05
Hexane	0.05	**12.3**	nd	2.8
Methyl Ethyl Ketone	0.5	nd	nd	16
Methyl Isobutyl Ketone	0.5	nd	nd	1.7
Methyl tert-Butyl Ether	0.05	nd	nd	0.75
Methylene Chloride	0.05	nd	nd	0.1
Styrene	0.05	nd	nd	0.7
1,1,1,2-Tetrachloroethane	0.50	nd	nd	0.058
1,1,2,2-Tetrachloroethane	0.05	nd	nd	0.05
Tetrachloroethylene	0.05	nd	nd	0.28
Toluene	0.05	2.3	nd	2.3
1,1,1-Trichloroethane	0.05	nd	nd	0.38
1,1,2-Trichloroethane	0.05	nd	nd	0.05
Trichloroethylene	0.05	nd	nd	0.061
Trichlorofluoromethane	0.05	nd	nd	4
Vinyl Chloride	0.02	nd	nd	0.02
Xylenes	0.05	**26.9**	nd	3.1

- MDL – Method Detection Limit; nd – not detected above the MDL
- **Bold and Underlined** – Value exceeds MOECC Table 3 standards

The benzene, ethylbenzene, xylenes and hexane concentrations identified in soil Sample BH2-SS5 (2012) exceed the MOECC Table 3 standards. No other VOCs were identified above the laboratory method detection limits in the 2012 sample. No VOC parameters were detected in the soil sample recovered from BH3-18.

Table 9
Analytical Test Results – Soil (PAHs)

Parameter	MDL (µg/g)	Soil Samples (µg/g)				MOECC Table 3 Residential (µg/g)
		April 10, 2018	April 11, 2018			
		BH2-18-SS2 (0.76-1.37m)	BH4-18-SS3 (2.29-2.89m)	BH6-18-SS2 (0.76-1.52m)	BH7-18-SS2 (0.76-1.52m)	
Acenaphthene	0.02	nd	nd	1.73	0.02	7.9
Acenaphthylene	0.02	nd	nd	**0.79**	0.05	0.15
Anthracene	0.02	0.04	nd	**3.08**	0.11	0.67
Benzo[a]anthracene	0.02	0.03	nd	**4.59**	0.17	0.5
Benzo[a]pyrene	0.02	0.04	nd	**4.23**	0.17	0.3
Benzo[b]fluoranthene	0.02	0.04	nd	**4.68**	0.19	0.78
Benzo[g,h,i]perylene	0.02	0.03	nd	2.49	0.10	6.6
Benzo[k]fluoranthene	0.02	0.03	nd	**3.67**	0.10	0.78
Chrysene	0.02	0.06	nd	4.30	0.22	7
Dibenzo[a,h]anthracene	0.02	nd	nd	**0.61**	0.03	0.1
Flouranthene	0.02	0.07	nd	**10.0**	0.39	0.69
Fluorene	0.02	nd	nd	1.62	0.06	62
Indeno[1,2,3-cd]pyrene	0.02	0.03	nd	**2.34**	0.09	0.38
1-Methylnaphthalene	0.02	nd	0.21	0.29	nd	0.99
2-Methylnaphthalene	0.02	nd	0.35	0.38	nd	0.99
Methylnaphthalene (1&2)	0.04	nd	0.56	0.67	nd	0.99
Naphthalene	0.01	nd	0.14	0.61	0.03	0.6
Phenanthrene	0.02	0.03	0.06	**12.4**	0.41	6.2
Pyrene	0.02	0.07	0.07	8.03	0.32	78

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold** – Value exceeds MOECC Table 3 standards

Concentrations of PAH parameters exceeding MOECC Table 3 standards were identified in soil Sample BH6-18-SS2. While PAH parameters were detected in soil Samples BH2-18-SS2, BH4-18-SS3 and BH7-18-SS2, they were in compliance with the MOECC Table 3 standards.

Table 10
Analytical Test Results – Soil (Metals)

Parameter	MDL (µg/g)	Soil Samples (µg/g)				MOECC Table 3 Residential Standards (µg/g)
		April 30, 2012	April 10, 2018			
		BH1-SS3 (1.6-2.2m)	BH2-18-SS2 (0.76-1.37m)	BH3-18-SS2 (0.76-1.37m)	BH4-18-SS3 (1.52-2.13m)	
Antimony	1.0	1	nd	nd	nd	7.5
Arsenic	1.0	4	16	2	2	18
Barium	1.0	303	145	153	56	390
Beryllium	1.0	0.9	0.8	nd	nd	4
Boron	1.0	nd	nd	5.2	5.7	120
Boron, available	0.5	nt	nd	1.0	nd	1.5
Cadmium	0.5	nd	nd	nd	nd	1.2
Chromium	1.0	18	19	21	12	160
Chromium (IV)	0.2	nd	nd	nd	nd	8
Cobalt	1.0	8	12	7	7	22
Copper	1.0	51	51	29	17	140
Lead	1.0	**270**	84	71	8	120
Mercury	0.1	**0.4**	0.2	0.2	nd	0.27
Molybdenum	1.0	1	4	1	1	6.9
Nickel	1.0	23	28	24	23	100
Selenium	1.0	1	nd	nd	nd	2.4
Silver	0.5	0.4	nd	nd	nd	20
Thallium	1.0	nd	nd	nd	nd	1
Uranium	1.0	2	nd	2	nd	23
Vanadium	1.0	18	40	22	20	86
Zinc	1.0	181	212	120	21	340

Notes:
- MDL – Method Detection Limit
- nt – not tested for this parameter
- nd – not detected above the MDL
- **Bold** – Value exceeds selected MOECC standards

Metal parameters were identified in each of the soil samples submitted for analytical testing. The concentrations of lead and mercury identified in soil Sample BH1-SS3, analyzed during the 2012 investigation, exceeded the MOECC Table 3 standards. The remaining parameters identified in this sample and the 2018 samples submitted for analytical testing were in compliance with the MOECC Table 3 standards.

The maximum concentrations of analyzed parameters in the soil at the site are summarized below in Table 11.

Table 11: Maximum Concentrations – Soil			
Parameter	**Maximum Concentration (µg/g)**	**Borehole**	**Depth Interval (m BGS)**
Benzene	**0.52**	BH2	2.1-2.3
Ethylbenzene	**6.15**	BH2	2.1-2.3
Toluene	**2.3**	BH2	2.1-2.3
Xylenes (Total)	**26.9**	BH2	2.1-2.3
PHC F1	**241**	BH2	2.1-2.3
PHC F2	**116**	BH4-18	1.5-2.13
PHC F3	173	BH4-18	1.5-2.13
PCH F4	83	BH5-18	2.29-2.90
Hexane	**12.3**	BH2	2.1-2.3
Acenaphthene	1.73	BH6-18	0.76-1.37
Acenaphthylene	**0.79**	BH6-18	0.76-1.37
Anthracene	**3.08**	BH6-18	0.76-1.37
Benzo[a]anthracene	**4.59**	BH6-18	0.76-1.37
Benzo[a]pyrene	**4.23**	BH6-18	0.76-1.37
Benzo[b]fluoranthene	**4.68**	BH6-18	0.76-1.37
Benzo[g,h,i]perylene	2.49	BH6-18	0.76-1.37
Benzo[k]fluoranthene	**3.67**	BH6-18	0.76-1.37
Chrysene	4.30	BH6-18	0.76-1.37
Dibenzo[a,h]anthracene	**0.61**	BH6-18	0.76-1.37
Flouranthene	**10.0**	BH6-18	0.76-1.37
Fluorene	1.62	BH6-18	0.76-1.37
Indeno[1,2,3-cd]pyrene	**2.34**	BH6-18	0.76-1.37
1-Methylnaphthalene	0.29	BH6-18	0.76-1.37
2-Methylnaphthalene	0.38	BH6-18	0.76-1.37
Methylnaphthalene (1&2)	0.67	BH6-18	0.76-1.37
Naphthalene	0.61	BH6-18	0.76-1.37
Phenanthrene	**12.4**	BH6-18	0.76-1.37
Pyrene	8.03	BH6-18	0.76-1.37
Arsenic	16	BH2-18	0.76-1.37
Barium	12	BH1	1.6-2.2
Boron	303	BH1	1.6-2.2
Boron, available	1.0	BH3-18	1.52-2.13
Chromium	21	BH3-18	1.52-2.13
Cobalt	8	BH2-18	1.6-2.2
Copper	51	BH1, BH2-18	0.76-2.2
Lead	**270**	BH1	1.6-2.2
Mercury	**0.4**	BH1	1.6-2.2
Molybdenum	4	BH2-18	0.76-1.37
Nickel	28	BH2-18	0.76-1.37
Uranium	2	BH1, BH3-18	1.52-2.2
Vanadium	40	BH2-18	0.76-1.37
Zinc	212	BH2-18	0.76-1.37

Notes:
- **Bold and Underlined** – Value exceeds MOECC Table 3 standards

All other parameter concentrations were below laboratory detection limits.

5.6 Groundwater Quality

Groundwater samples from monitoring wells installed in BH1-18, BH3-18, BH4-18 and BH5-18, were submitted for laboratory analysis of PHC, VOC, PAH and/or metal parameters. The groundwater samples were obtained from the screened intervals noted on Table 2. The results of the analytical testing are presented below in Tables 12, 13, 14 and 15. The laboratory certificates of analysis are provided in Appendix 1.

Table 12: Analytical Test Results – Groundwater (PHCs (F1-F4))

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) (April 20, 2018)			MOECC Table 3 Standards (µg/L)
		BH3-18-GW1	BH4-18-GW1	BH5-18-GW1	
PHC F1	25	nd	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

No PHC parameters were detected above the laboratory method detection limits in any of the groundwater samples submitted for analytical testing. The results are considered to be in compliance with the MOECC Table 3 standards.

It is our interpretation that the analyzed parameter concentrations do not indicate the potential presence of light non-aqueous phase liquids (LNAPLs). No free phase hydrocarbons were noted in the wells at the time of sampling.

Table 13: Analytical Test Results – Groundwater (VOCs)					
Parameter	**MDL (µg/L)**	**Groundwater Samples (µg/L) April 20, 2018**			**MOECC Table 3 Standards (µg/L)**
		BH3-13 GW1	**BH4-13-GW1**	**BH5-13-GW1**	
Acetone	5.0	nd	nd	nd	130,000
Benzene	0.5	nd	nd	nd	44
Bromodichloromethane	0.5	nd	nd	nd	85,000
Bromoform	0.5	nd	nd	nd	380
Bromomethane	0.5	nd	nd	nd	5.6
Carbon Tetrachloride	0.2	nd	nd	nd	0.79
Chlorobenzene	0.5	nd	nd	nd	630
Chloroethane	1.0	nd	nd	nd	nv
Chloroform	0.5	nd	nd	nd	2.4
Chloromethane	3.0	nd	nd	nd	nv
Dibromochloromethane	0.5	nd	nd	nd	82,000
Dichlorodifluoromethane	1.0	nd	nd	nd	4,400
1,2-Dibromoethane	0.2	nd	nd	nd	0.25
1,2-Dichlorobenzene	0.5	nd	nd	nd	4,600
1,3-Dichlorobenzene	0.5	nd	nd	nd	9,600
1,4-Dichlorobenzene	0.5	nd	nd	nd	8
1,1-Dichloroethane	0.5	nd	nd	nd	320
1,2-Dichloroethane	0.5	nd	nd	nd	1.6
1,1-Dichloroethylene	0.5	nd	nd	nd	1.6
cis-1,2-Dichloroethylene	0.5	nd	nd	nd	1.6
trans-1,2-Dichloroethylene	0.5	nd	nd	nd	1.6
1,2-Dichloropropane	0.5	nd	nd	nd	16
1,3-Dichloropropene	0.5	nd	nd	nd	5.2
Ethylbenzene	0.5	nd	nd	nd	2,300
Hexane	1.0	nd	nd	nd	51
Methyl Ethyl Ketone	5.0	nd	nd	nd	470,000
Methyl Butyl Ketone	10.0	nd	nd	nd	nv
Methyl Isobutyl Ketone	5.0	nd	nd	nd	140,000
Methyl tert-butyl Ether	2.0	nd	nd	nd	1900
Methylene Chloride	5.0	nd	nd	nd	610
Styrene	0.5	nd	nd	nd	1,300
1,1,1,2-Tetrachloroethane	0.5	nd	nd	nd	3.4
1,1,2,2-Tetrachloroethane	0.5	nd	nd	nd	3.2
Tetrachloroethylene	0.5	nd	nd	nd	1.6
Toluene	0.5	nd	nd	nd	18,000
1,1,1-Trichloroethane	0.5	nd	nd	nd	640
1,1,2-Trichloroethane	0.5	nd	nd	nd	4.7
Trichloroethylene	0.5	nd	nd	nd	1.6
Trichlorofluoromethane	1.0	nd	nd	nd	2,500
1,3,5-Trimethylbenzene	0.5	nd	nd	nd	nv
Vinyl Chloride	0.5	nd	nd	nd	0.5
Xylenes	0.5	nd	nd	nd	4,200

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

VOC parameters were not detected above the laboratory method detection limits in any of the groundwater samples analysed. The results are in compliance with the MOECC Table 3 standards.

Table 14: Analytical Test Results – Groundwater (PAHs)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) April 20, 2018			MOECC Table 3 Standards (µg/L)
		BH1-18-GW1	BH3-18-GW1	BH4-18-GW1	
Acenaphthene	0.05	nd	nd	nd	600
Acenaphthylene	0.05	nd	nd	nd	1.8
Anthracene	0.01	nd	nd	nd	2.4
Benzo[a]anthracene	0.01	nd	nd	nd	4.7
Benzo[a]pyrene	0.01	nd	nd	nd	0.81
Benzo[b]fluoranthene	0.05	nd	nd	nd	0.75
Benzo[g,h,i]perylene	0.05	nd	nd	nd	0.2
Benzo[k]fluoranthene	0.05	nd	nd	nd	0.4
Chrysene	0.05	nd	nd	nd	1
Dibenzo[a,h]anthracene	0.05	nd	nd	nd	0.52
Flouranthene	0.01	nd	nd	nd	130
Fluorene	0.05	nd	nd	nd	400
Indeno[1,2,3-cd]pyrene	0.05	nd	nd	nd	0.2
1-Methylnaphthalene	0.05	nd	nd	nd	1800
2-Methylnaphthalene	0.05	nd	nd	nd	
Naphthalene	0.05	nd	nd	nd	1400
Phenanthrene	0.05	nd	nd	nd	580
Pyrene	0.01	nd	nd	nd	68

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold** – Value exceeds MOECC Table 3 standards

PAH parameters were not identified in the groundwater samples recovered from BH1-18, BH3-18 and BH4-18. The results are in compliance with the MOECC Table 3 standards.

Table 15
Analytical Test Results – Groundwater (Metals)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) April 20, 2018			MOECC Table 3 Standards (µg/L)
		BH1-18-GW1	BH3-18-GW1	BH4-18-GW1	
Antimony	0.5	nd	nd	nd	20,000
Arsenic	1	nd	nd	nd	1,900
Barium	1	116	459	66	29,000
Beryllium	0.5	nd	nd	nd	67
Boron	10	103	153	38	45,000
Cadmium	0.1	nd	nd	nd	2.7
Chromium	1	nd	nd	nd	810
Chromium (VI)	10	nd	nd	nd	140
Cobalt	0.5	nd	nd	1.8	66
Copper	0.5	6.2	11.5	6.9	87
Lead	0.1	nd	nd	nd	25
Mercury	0.1	nd	nd	nd	0.29
Molybdenum	0.5	nd	nd	1.3	9,200
Nickel	1	5	7	20	490
Selenium	1	nd	nd	nd	63
Sodium	200	785,000	1,360,000	7,120	2,300,000
Silver	0.1	nd	nd	nd	1.5
Thallium	200	nd	nd	nd	510
Uranium	0.1	0.6	0.5	14.3	420
Vanadium	0.5	2.3	3.3	5.2	250
Zinc	5	nd	nd	nd	1,100

Notes:
- MDL – Method Detection Limit
- nt – not tested for this parameter
- nd – not detected above the MDL

All of the detected parameters were in compliance with the MOECC Table 3 standards.

5.7 Quality Assurance and Quality Control Results

All samples submitted as part of the April 2018 sampling event were handled in accordance with the Analytical Protocol with respect to holding time, preservation method, storage requirement, and container type.

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

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

5.8 Phase II Conceptual Site Model

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

Site Description

Potentially Contaminating Activity and Areas of Potential Environmental Concern

As indicated in the Phase I-ESA report and Section 2.2 of this report, the following PCAs are considered to result in APECs on the Phase I and Phase II Property:

- Item 30 – Importation of Fill Material of Unknown Quality – based on a previous subsurface investigation, impacted fill material was identified on the southern portion of the Phase II Property. The potential for impacted fill material across the Phase II Property was considered to represent an APEC on the subject land.
- Item 37- the Operation of Dry Cleaning Equipment (where chemicals are used) – based on a potential dry cleaning operation formerly located at 101 Montreal Road, south of the subject land, along the north side of Montreal Road.
- Item 46 – Rail Yards, Tracks and Spurs – based on the location of former CNR rail and spur lines immediately east of the Phase II Property;
- Although not specified under Column A of Table 2 in O.Reg. 347/558 as amended, the former industrial operation “W.R Cummings Feed Mill and Elevator” and on-site coal storage, are considered to represent an APEC on the subject land; and
- Also not specified under Column A of Table 2 in O.Reg. 347/558 as amended, previously identified VOC (hexane), BTEX and PHC parameters on the southeastern portion of the site (2012) are considered to represent an APEC on the Phase II Property.

Contaminants of potential environmental concern associated with the aforementioned PCAs, include a combination of PHCs (F1-F4), BTEX, VOCs, PAHs and/or metals, in the soil and groundwater.

Subsurface Structures and Utilities

Underground service locates were completed prior to the subsurface investigation. A private storm sewer is present onsite, as well as underground telephone cable. Hydro in the vicinity of the Phase I Property is provided via overhead services. No private wells or septic systems are present on the Phase II Property or within the Phase I Study Area.

Physical Setting

Site Stratigraphy

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is illustrated on Drawings PE4258-7 and 8 - Cross-Section A-A' and B-B'. Stratigraphy consists of:

- Pavement structure consisting of approximately 0.02 to 0.04m of asphaltic concrete over crushed stone with silt and sand, extending to depths ranging from approximately 0.15 to 0.56m below grade. Approximately 0.08m of topsoil was encountered at BH7-18.
- Fill material generally consisting of brown silty sand and gravel with pieces of brick, concrete, metal, ash, coal and/or organic material, was identified at each borehole location, extending to depths ranging from 1.45 to 3.0m below grade.
- A thin layer of native brown silty clay was identified beneath the fill material at each borehole location, with the exception of BH3-18 and BH6-18. A layer of native sandy silt was identified beneath the fill material at BH3-18. The silty clay or sandy silt layers extended to depths ranging from 1.45 to 3.0m.
- Native glacial till material was identified at each borehole beneath the above noted silty clay, sandy silt or fill layers. The till material consisted of a brown silty clay with some sand, gravel and cobbles and extended to depths ranging from approximately 2.4 to 4.5m below grade.
- Weathered shale and/or a more competent shaley limestone bedrock was encountered beneath the overburden. Groundwater was identified in this stratigraphic unit.

Hydrogeological Characteristics

Groundwater at the Phase II Property was encountered within the bedrock. This unit is interpreted to function as a local aquifer at the subject site.

Water levels were measured at the subject site on April 20, 2018, at depths ranging from 3.66 to 3.82m below grade. Based on the groundwater elevations measured during this monitoring event, groundwater contour mapping was completed and the horizontal hydraulic gradient for the subject site was calculated. Groundwater flow at the subject site was in a northeasterly direction, with a hydraulic gradient of approximately 0.008 m/m.

Approximate Depth to Bedrock

Bedrock was encountered at depths ranging from approximately 2.4 to 4.5m below grade.

Approximate Depth to Water Table

Depth to water table at the subject site varies between approximately 3.66 and 3.86m below existing grade.

Sections 41 and 43.1 of the Regulation

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

Section 43.1 of the Regulation does not apply to the subject site in that the subject site is not a Shallow Soil Property.

Fill Placement

Fill material was identified across the Phase II Property beneath the pavement structure and extending to depths of approximately 1.45 to 3.0m below grade. The fill is suspected to have been placed on the subject site during at the time of original development in the 1950's. Fragments of brick, concrete, coal, metal, ash and/or organic material was identified in the fill across the majority of the site.

Proposed Buildings and Other Structures

It is our understanding that the site is to be redeveloped with a multi-storey residential building with two (2) levels of underground parking.

Existing Buildings and Structures

There are no buildings or structures currently present on the Phase II Property.

Water Bodies

There are no water bodies on the subject land or within the Phase I study area.

Areas of Natural Significance

No areas of natural significance are present on or within the vicinity of the Phase II Property.

Environmental Condition

Areas Where Contaminants are Present

Based on visual screening and analytical test results, metals and/or PAH impacted fill material is present across the majority of the Phase II Property. While test results indicated exceedances at BH1-18, BH2-18 and BH6-18, based on the nature of fill material, pockets of impacted fill material are anticipated across the majority of the Phase II Property. Concentrations of BTEX, hexane, PHC F1 and PHC F2 exceeding the MOECC Table 3 standards were identified in the native soil or upper levels of weathered shale bedrock on the southeastern portion of the Phase II Property. Groundwater was determined to be in compliance with the MOECC Table 3 standards. Analytical test results are shown on Drawings PE4258-5A through 5F and PE4258-6 – Analytical Testing Plans.

Types of Contaminants

Based on the PCAs resulting in APECs on the Phase II Property, as well as previous (2012) and current analytical testing, contaminants of concern in the soil include the following: BTEX, hexane, PHCs, F1 and F2, PAHs (acenaphthylene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, dibenzo[a,h]anthracene, fluoranthene, indeno[1,2,3-cd]pyrene, naphthalene and phenanthrene, lead and mercury.

As noted previously, the groundwater at the Phase II Property is clean; no contaminants of concern were detected above the laboratory method detection limits, with the exception of several metal parameters which are in compliance with MOECC Table 3 standards.

Contaminated Media

Based on the results of the Phase II ESA, the fill material on the northern portion of the site is impacted with metals and PAHs, while native soils on the southeastern portion of the site are impacted with BTEX, hexane and PHC F1 and F2 concentrations exceeding the MOECC Table 3 standards. Groundwater samples obtained from the Phase II Property were in compliance with the selected MOECC standards.

What Is Known About Areas Where Contaminants Are Present

It is considered likely that impacted fill material was imported to the Phase II Property at the time of development in the early 1950's. The metal and PAH impacts appear to be contained to the fill material based on analytical testing of the native soils. It is also anticipated that based on the non-homogeneous nature of the material, that impacted pockets will be present across the site, outside of the borehole locations. The native soil and weathered bedrock impacted with BTEX, hexane and PHCs appears to be contained to the southeastern portion of the Phase II Property. Analytical test results exceeding the MOECC Table 3 standards are presented on Drawings PE4258-5A-F Analytical Testing Plans (Soil).

Distribution and Migration of Contaminants

As previously noted, impacted fill material is present on the northern portion of the site and is anticipated to be present in pockets across the site outside of the borehole locations. Based on analytical testing of the native soil, their low solubilities and clean groundwater results, the PAH and metal impacts are considered to be contained to the fill material.

The BTEX, hexane and PHC impacts identified on the southeastern corner of the Phase II Property appear to extend to the upper weathered bedrock. The impacts are not considered to have vertically migrated through the more competent bedrock as no contaminant concentrations were identified in the groundwater recovered from BH4-18.

Please refer to Drawings PE4258-7 and PE4258-8 – Cross Sections A-A' and B-B' which depict the vertical distribution of contaminants based on the available information to date.

Discharge of Contaminants

Metal and PAH concentrations are considered to have been directly discharged to the soil through historical infilling or historical storage/management of coal (and resulting ash) for heating purposes.

The BTEX, hexane and PHC impacted soil is considered to have resulted from a direct on-site release, possibly from leaks or spills associated with vehicles stored within the parking structure.

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. Leaching is not considered an issue since the Phase II Property has always been primarily paved and previously covered with the parking structure. The fluctuation of groundwater levels is not considered to affect contaminant transport as the groundwater beneath the Phase II Property is in compliance with MOECC Table 3 standards.

Potential for Vapour Intrusion

There are no building structures currently present on the Phase II Property and therefore no potential for vapour intrusion. All soil will removed from the subject land in conjunction with future redevelopment and therefore no future potential for vapour intrusion exists.

6.0 CONCLUSIONS

Assessment

A Phase II ESA was conducted for part of the property addressed 263 Greensway Avenue, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address potentially contaminating activities (PCAs) that were identified during the Phase I ESA and considered to result in areas of potential environmental concern (APECs) on the Phase I and Phase II Property. The subsurface investigation was carried out in conjunction with a Geotechnical Investigation and consisted of drilling seven (7) boreholes, four (4) of which were constructed with groundwater monitoring well installations.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. A total of eight (8) soil samples were submitted for laboratory analysis of a combination of volatile organic compounds (VOCs), benzene, toluene, ethylbenzene and xylenes (BTEX), petroleum hydrocarbons (PHCs, F_1-F_4), polycyclic aromatic hydrocarbons (PAHs) and metals. Several PAH and metal parameters exceeding MOECC Table 3 standards were identified in the fill material on the northern portion of the Phase II Property. Petroleum hydrocarbon fractions F1 and F2, BTEX and hexane were identified on the southeastern portion of the Phase II Property, at concentrations exceeding the MOECC Table 3 standards.

Groundwater samples from monitoring wells installed in BH1-18, BH3-18, BH4-18 and BH5-18, were recovered and analysed for a combination of VOC, PHC, PAH and metal parameters. With the exception of various metal parameters, no contaminant concentrations were identified above the laboratory method detection limits. Metal parameters identified in each of the groundwater samples were in compliance with the MOECC Table 3 standards.

Conclusion

Based on the findings of the Phase II ESA, fill material impacted with PAH and metal concentrations exceeding MOECC Table 3 standards is present on the Phase II Property. Soil and weathered bedrock impacted with BTEX, hexane and/or PHC (F1 and F2) concentrations is also present on the Phase II Property. It is our understanding that the subject site is to be redeveloped with a multi-storey residential building with two (2) levels of underground parking.

It is our recommendation that an environmental site remediation program, involving the full delineation and removal of all impacted soil, be completed concurrently with the site redevelopment. Prior to offsite disposal at a licenced landfill site, a leachate analysis of a representative sample of contaminated soil must be conducted in accordance with Ontario Regulation 347/558.

It is also recommended that Paterson personnel be onsite during construction activities to direct the excavation and segregation of impacted soil and to conduct confirmatory sampling as required.

It is expected that groundwater monitoring wells will be abandoned in accordance with O.Reg.903, at the time of construction excavation.

7.0 STATEMENT OF LIMITATIONS

This Phase II - Environmental Site Assessment report has been prepared in general accordance with O.Reg. 153/04 as amended by O.Reg. 269/11, and meets the requirements of CSA Z769-00. The conclusions presented herein are based on information gathered from a limited sampling and testing program. The test results represent conditions at specific test locations at the time of the field program.

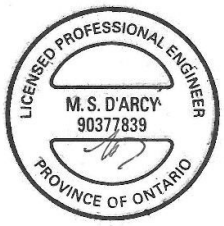
The client should be aware that any information pertaining to soils and all test hole logs are furnished as a matter of general information only and test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those of the test holes themselves.

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

This report was prepared for the sole use of Manor Park Management and notification from Manor Park Management and Paterson Group will be required to release this report to any other party.

Paterson Group Inc.

Karyn Munch, P.Eng.



Mark S. D'Arcy, P.Eng.

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- Paterson Group

FIGURES

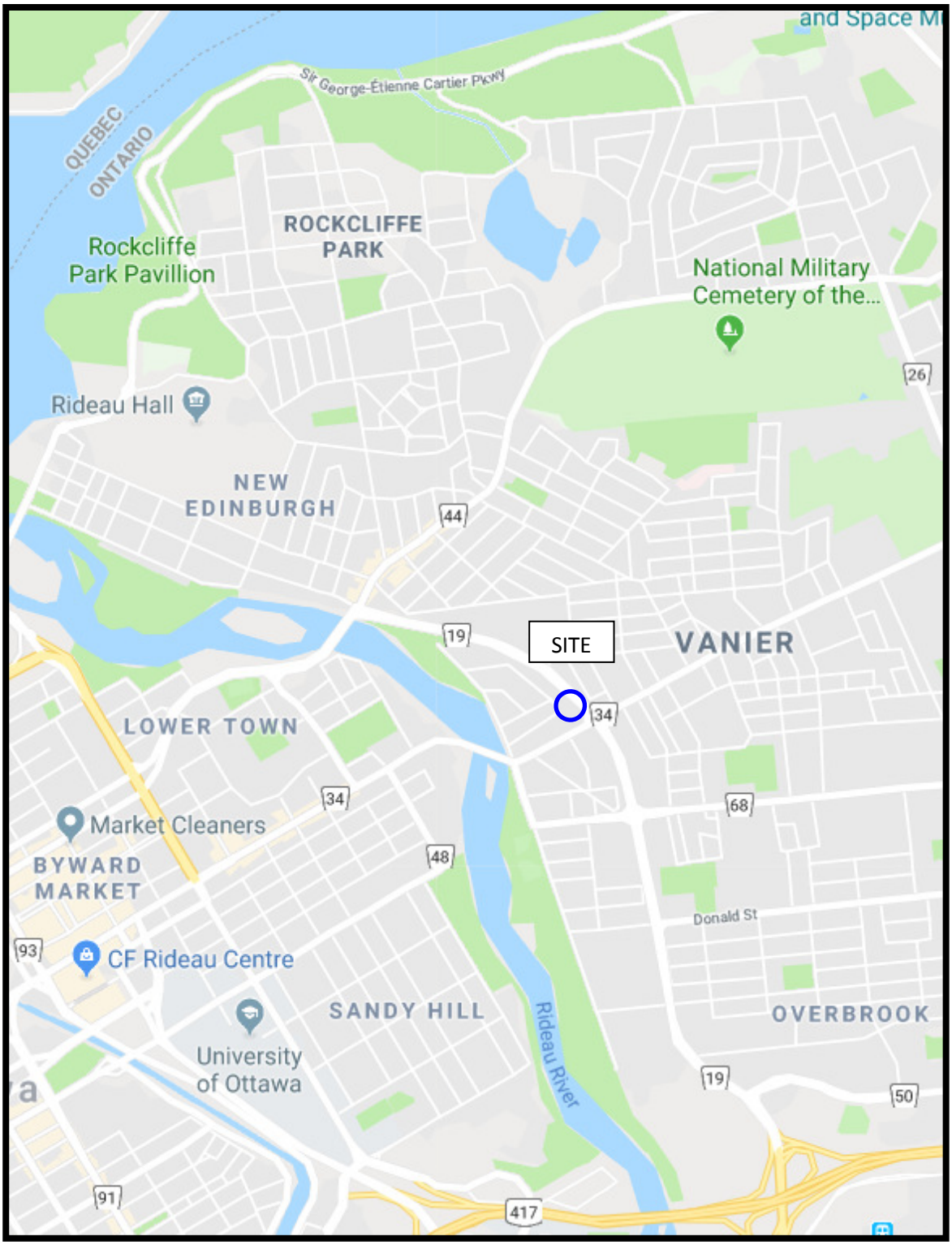
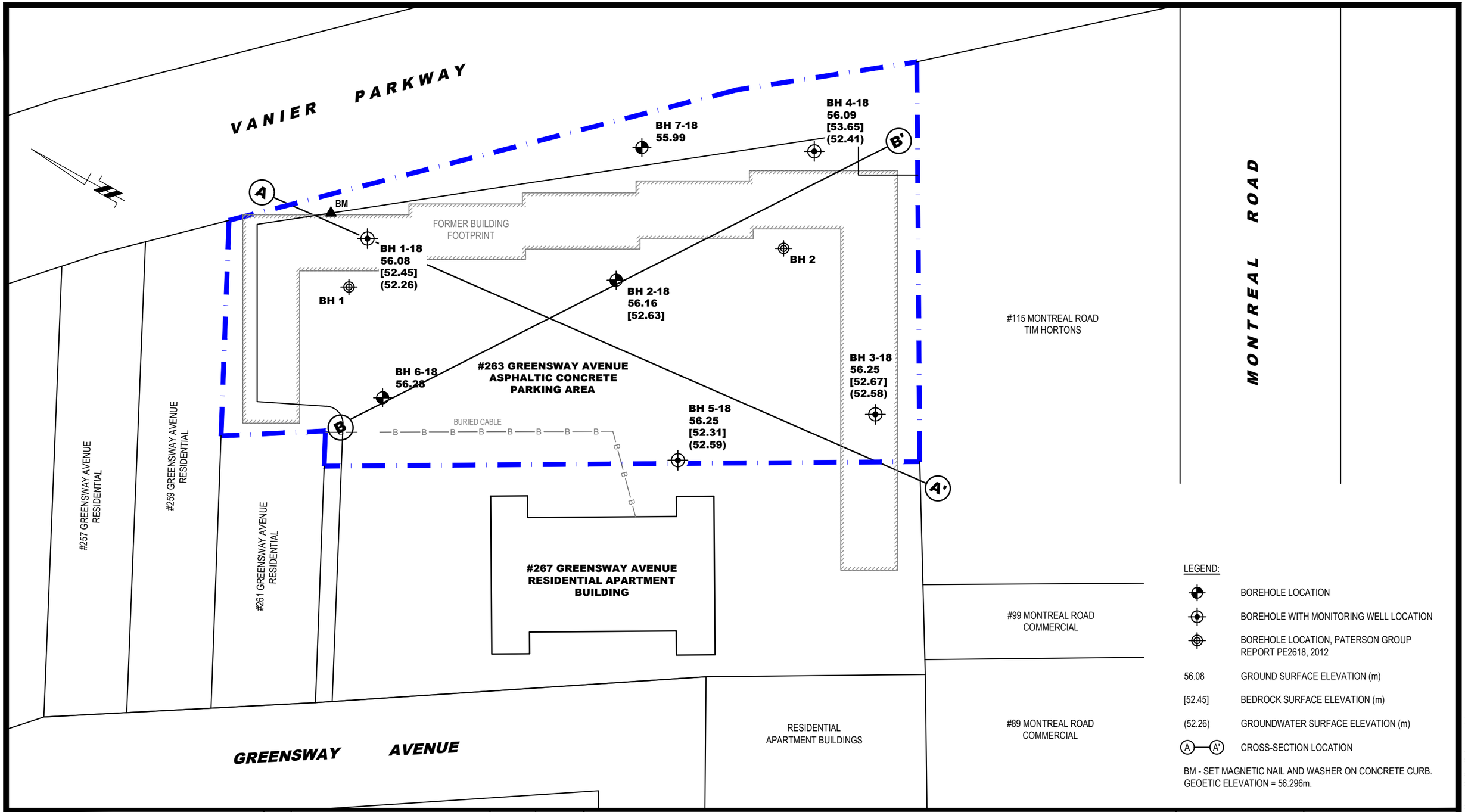


FIGURE 1

KEY PLAN



LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION, PATERSON GROUP REPORT PE2618, 2012
- 56.08 — GROUND SURFACE ELEVATION (m)
- [52.45] — BEDROCK SURFACE ELEVATION (m)
- (52.26) — GROUNDWATER SURFACE ELEVATION (m)
- A — A' — CROSS-SECTION LOCATION

BM - SET MAGNETIC NAIL AND WASHER ON CONCRETE CURB.
GEOETIC ELEVATION = 56.296m.

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0			

MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:400	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-3
Approved by: MSD	Revision No.: 0

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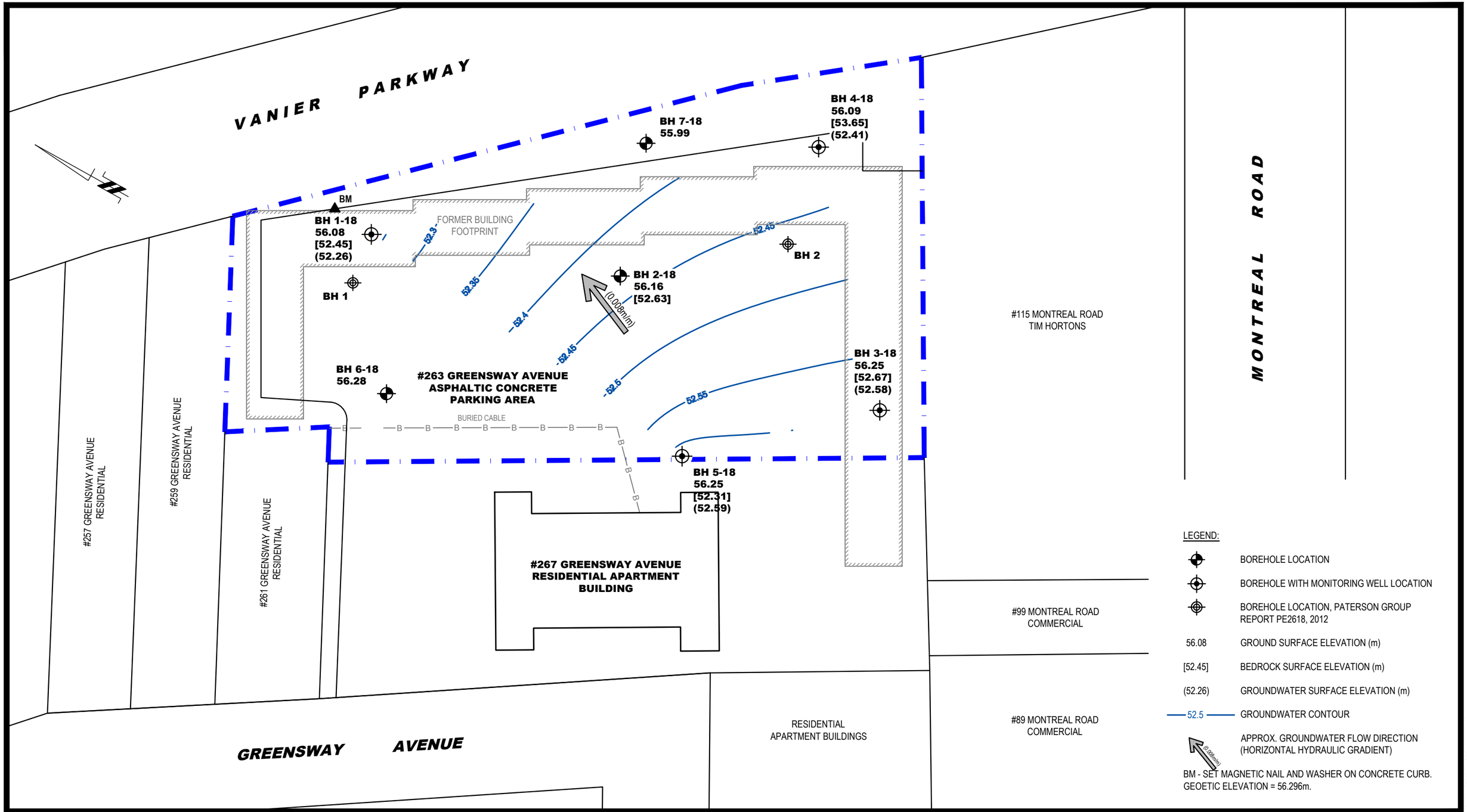

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

GROUNDWATER CONTOUR PLAN

Scale: 1:400	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-4
Approved by: MSD	Revision No.: 0

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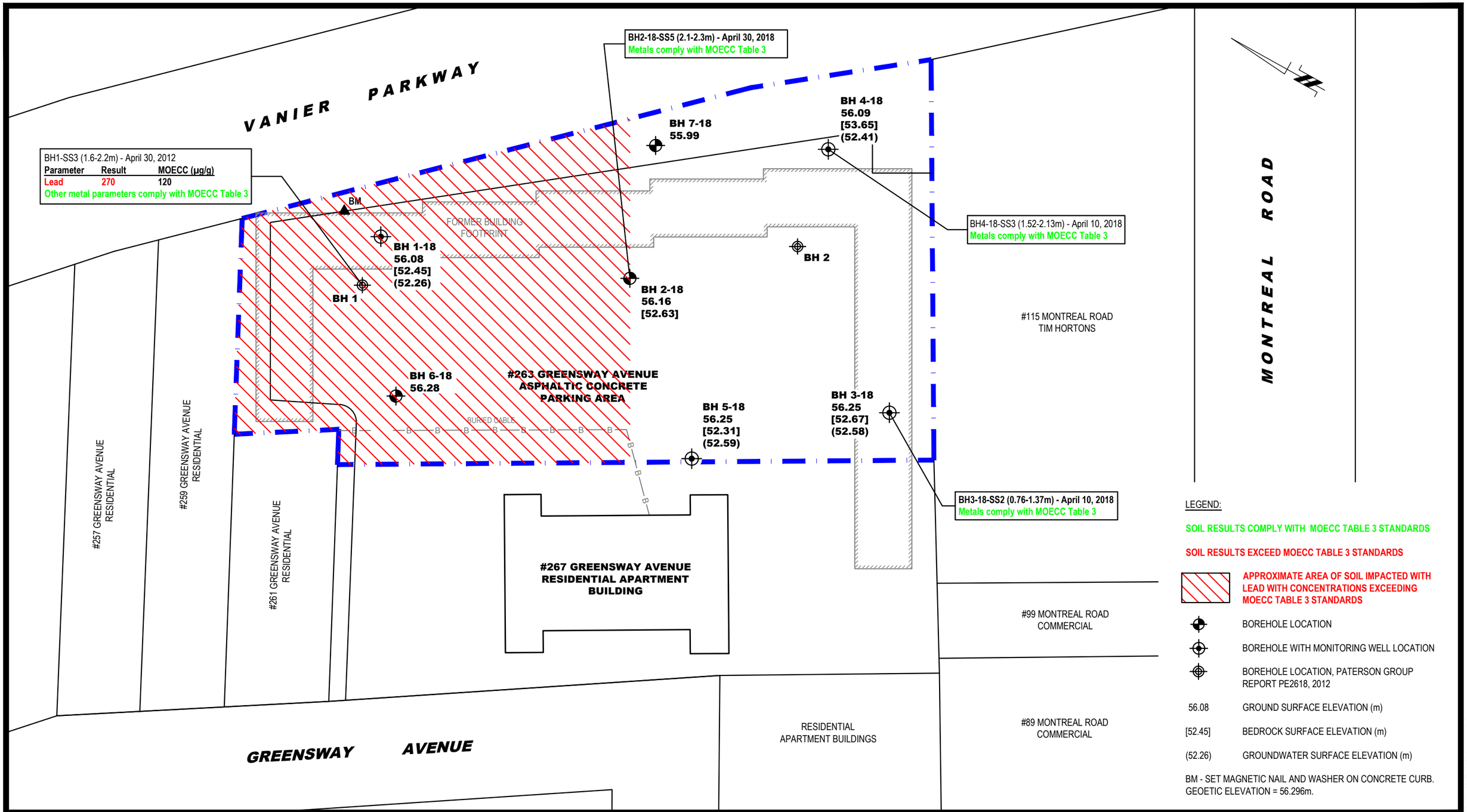

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (METALS)

Scale: 1:400	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-5A
Approved by: MSD	Revision No.: 0

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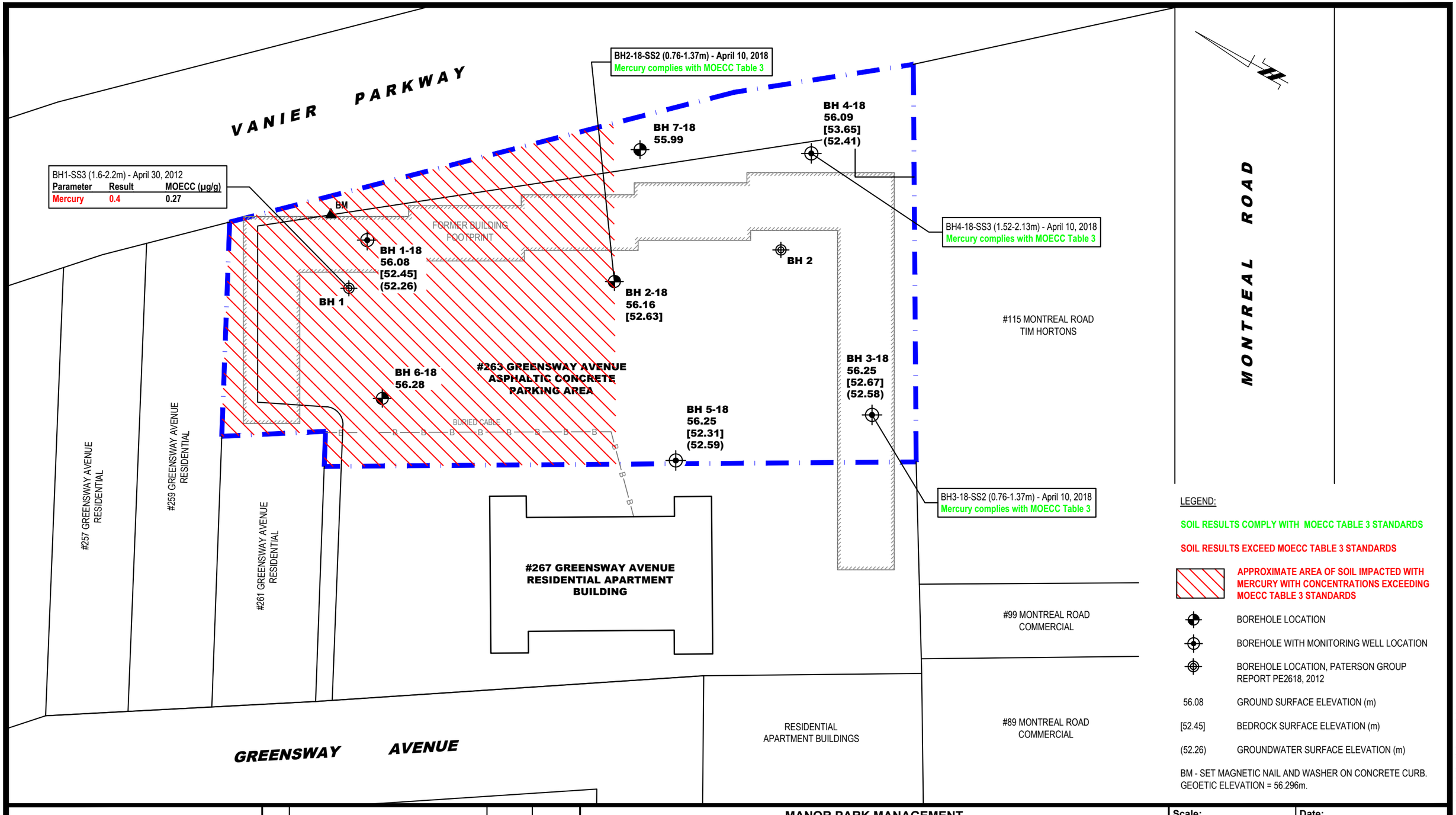

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (MERCURY)

Scale: 1:400	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-5B
Approved by: MSD	Revision No.: 0

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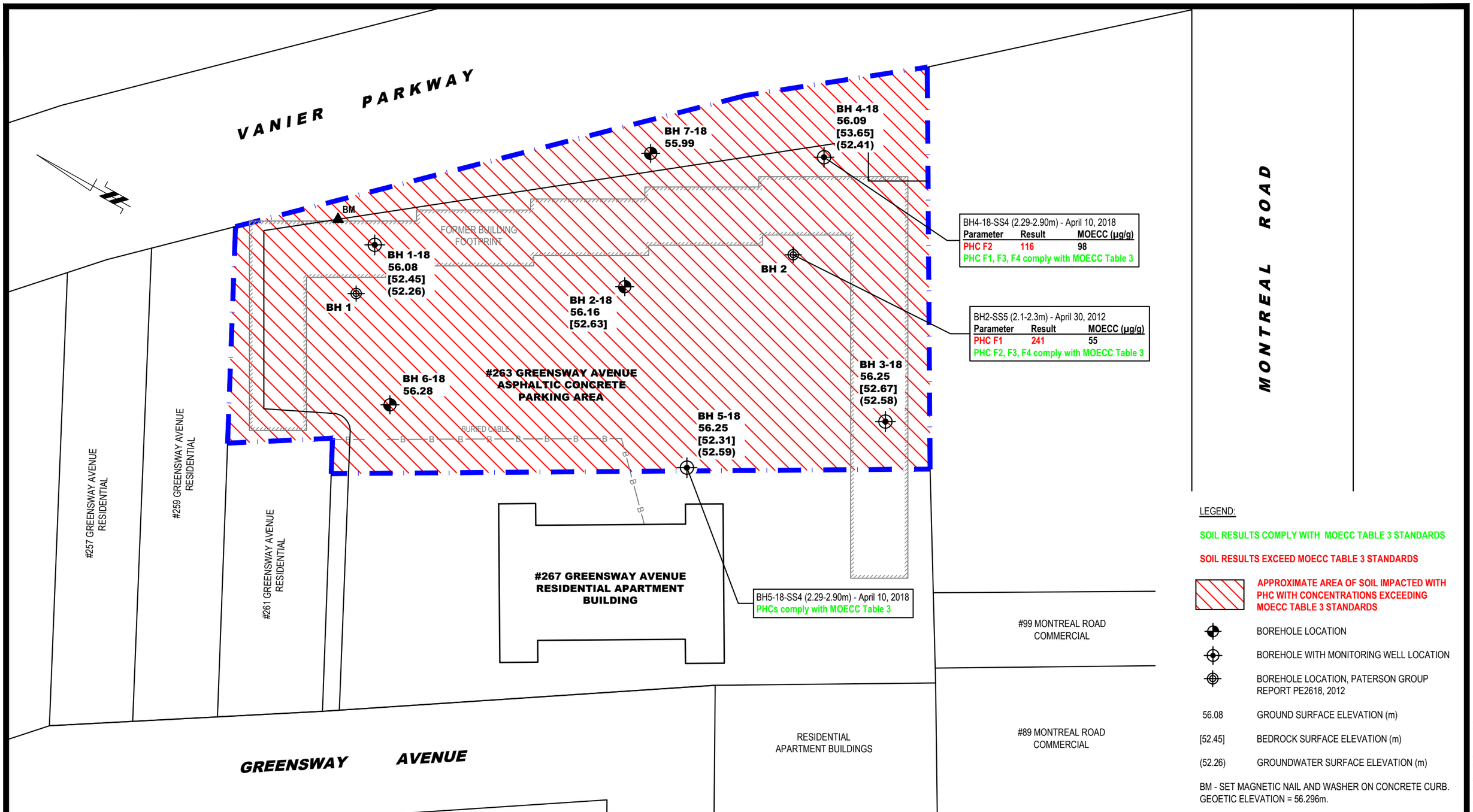

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (PHC)

Scale: 1:400	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-5C
Approved by: MSD	Revision No.: 0

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VANIER PARKWAY

MONTREAL ROAD

BH 4-18
56.09
[53.65]
(52.41)

BH 7-18
55.99

BM

FORMER BUILDING FOOTPRINT

BH 1-18
56.08
[52.45]
(52.26)

BH 1

BH 2

BH 2-18
56.16
[52.63]

BH 6-18
56.28

#263 GREENSWAY AVENUE
ASPHALTIC CONCRETE
PARKING AREA

BH 5-18
56.25
[52.31]
(52.59)

BH 3-18
56.25
[52.67]
(52.58)

BURIED CABLE

#115 MONTREAL ROAD
TIM HORTONS

BH2-SS5 (2.1-2.3m) - April 30, 2012

Parameter	Result	MOECC (µg/g)
Hexane	12.3	2.8

Other VOCs comply with MOECC Table 3

BH3-18-SS5 (3.05-3.66m) - April 30, 2018
VOCs comply with MOECC Table 3

#257 GREENSWAY AVENUE
RESIDENTIAL

#259 GREENSWAY AVENUE
RESIDENTIAL

#261 GREENSWAY AVENUE
RESIDENTIAL

#267 GREENSWAY AVENUE
RESIDENTIAL APARTMENT
BUILDING

#99 MONTREAL ROAD
COMMERCIAL

#89 MONTREAL ROAD
COMMERCIAL

RESIDENTIAL
APARTMENT BUILDINGS

GREENSWAY AVENUE

LEGEND:

SOIL RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS

SOIL RESULTS EXCEED MOECC TABLE 3 STANDARDS

APPROXIMATE AREA OF SOIL IMPACTED WITH HEXANE WITH CONCENTRATIONS EXCEEDING MOECC TABLE 3 STANDARDS

BOREHOLE LOCATION

BOREHOLE WITH MONITORING WELL LOCATION

BOREHOLE LOCATION, PATERSON GROUP REPORT PE2618, 2012

56.08 GROUND SURFACE ELEVATION (m)

[52.45] BEDROCK SURFACE ELEVATION (m)

(52.26) GROUNDWATER SURFACE ELEVATION (m)

BM - SET MAGNETIC NAIL AND WASHER ON CONCRETE CURB.
GEOETIC ELEVATION = 56.296m.

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (VOC)

Scale: 1:400	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-5D
Approved by: MSD	Revision No.: 0

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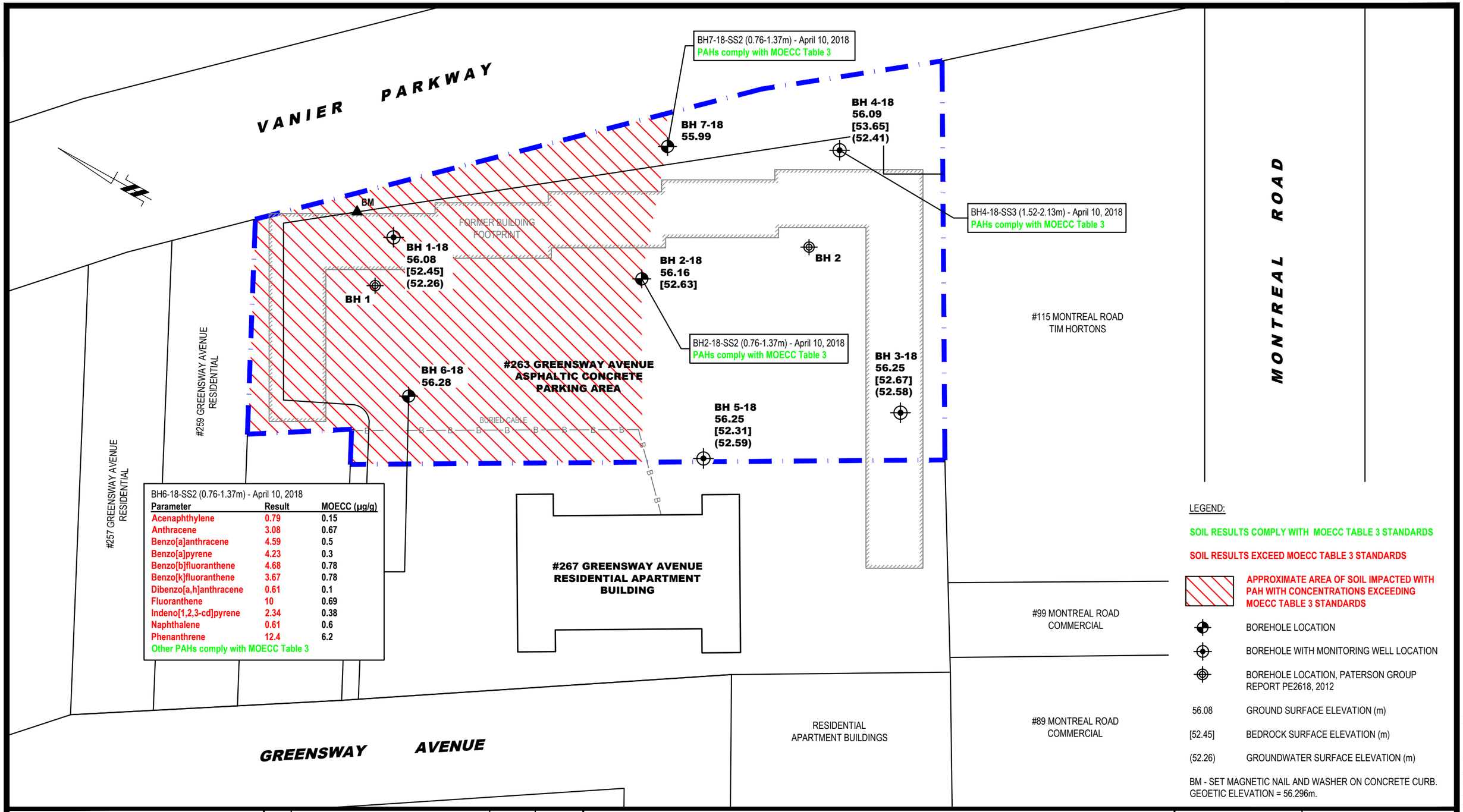

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (PAH)

Scale: 1:400	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-5E
Approved by: MSD	Revision No.: 0

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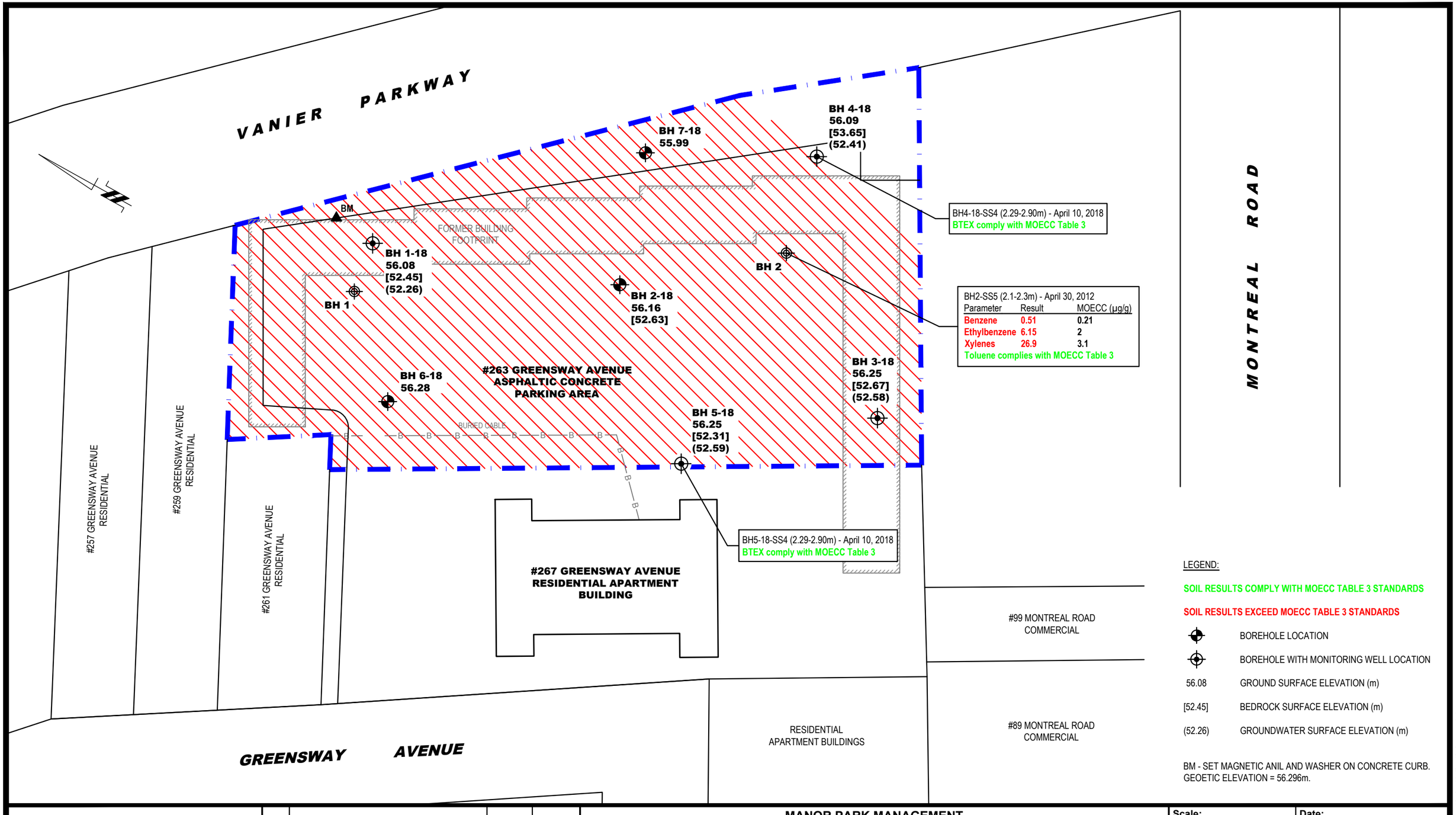

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (BTEX)

Scale: 1:400	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-5F
Approved by: MSD	Revision No.: 0

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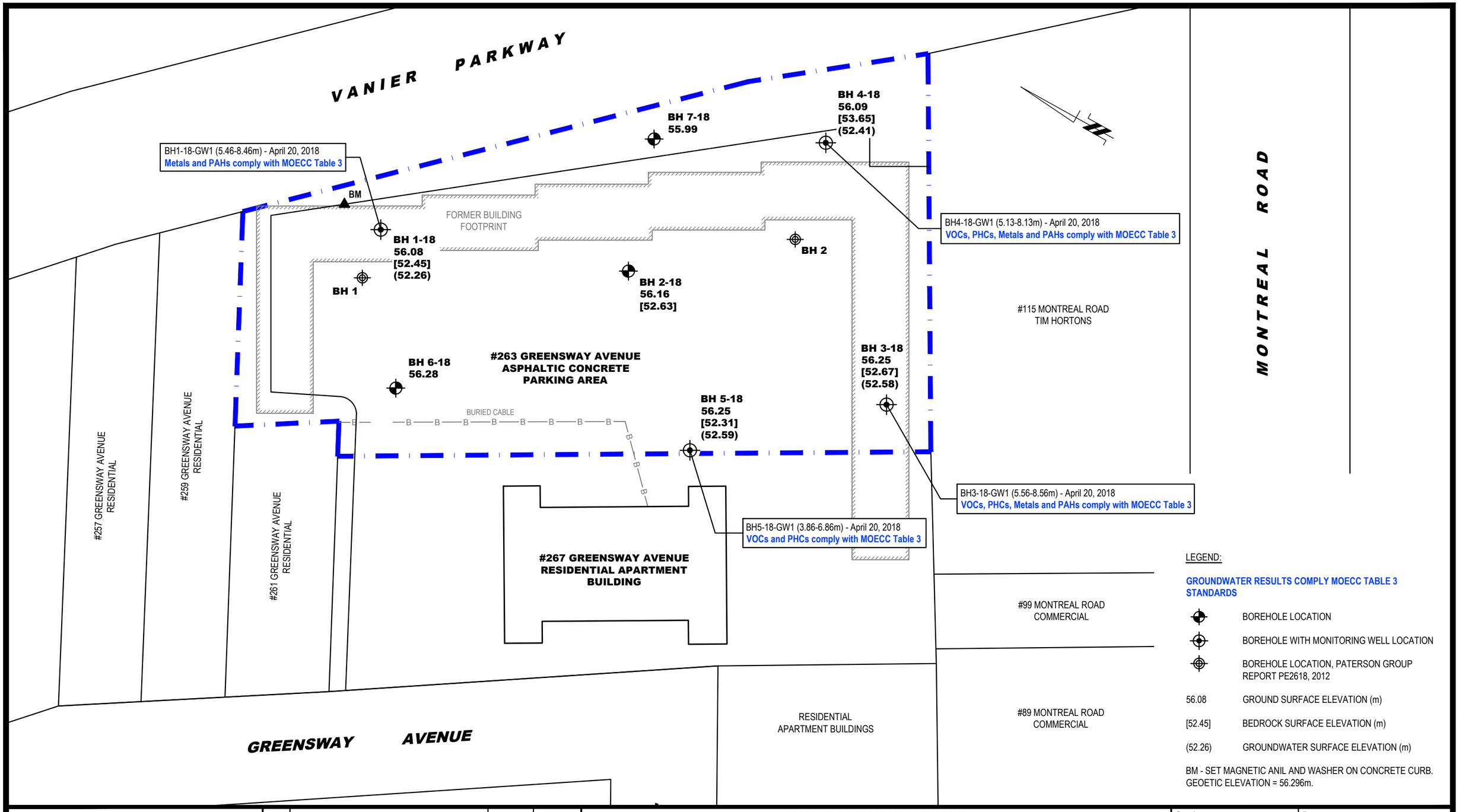

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - GROUNDWATER

Scale: 1:400	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-6
Approved by: MSD	Revision No.: 0

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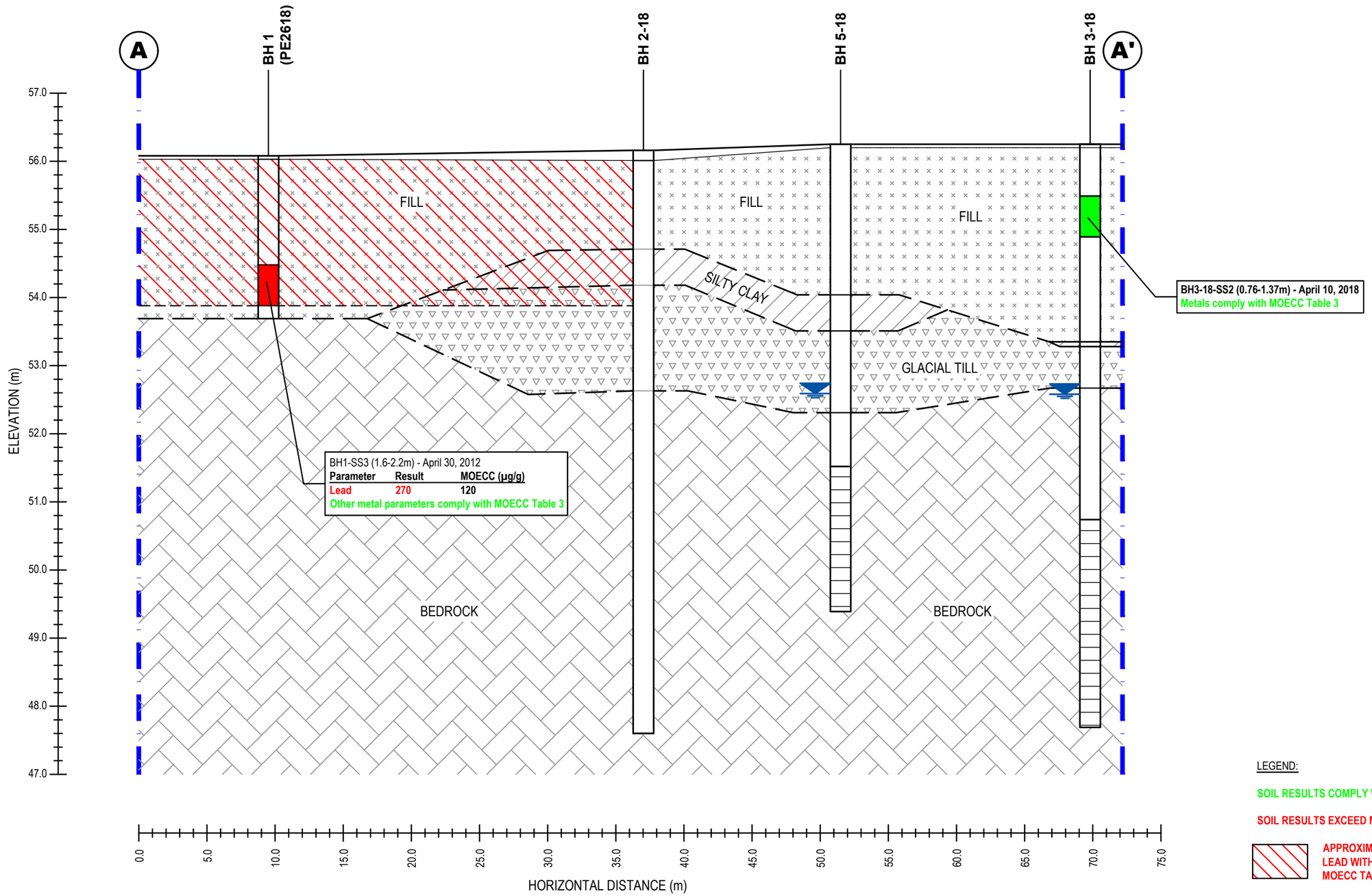

LEGEND:

SOIL RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS

SOIL RESULTS EXCEED MOECC TABLE 3 STANDARDS

APPROXIMATE AREA OF SOIL IMPACTED WITH LEAD WITH CONCENTRATIONS EXCEEDING MOECC TABLE 3 STANDARDS

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

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

Scale: AS SHOWN	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-7A
Approved by: MSD	Revision No.: 0

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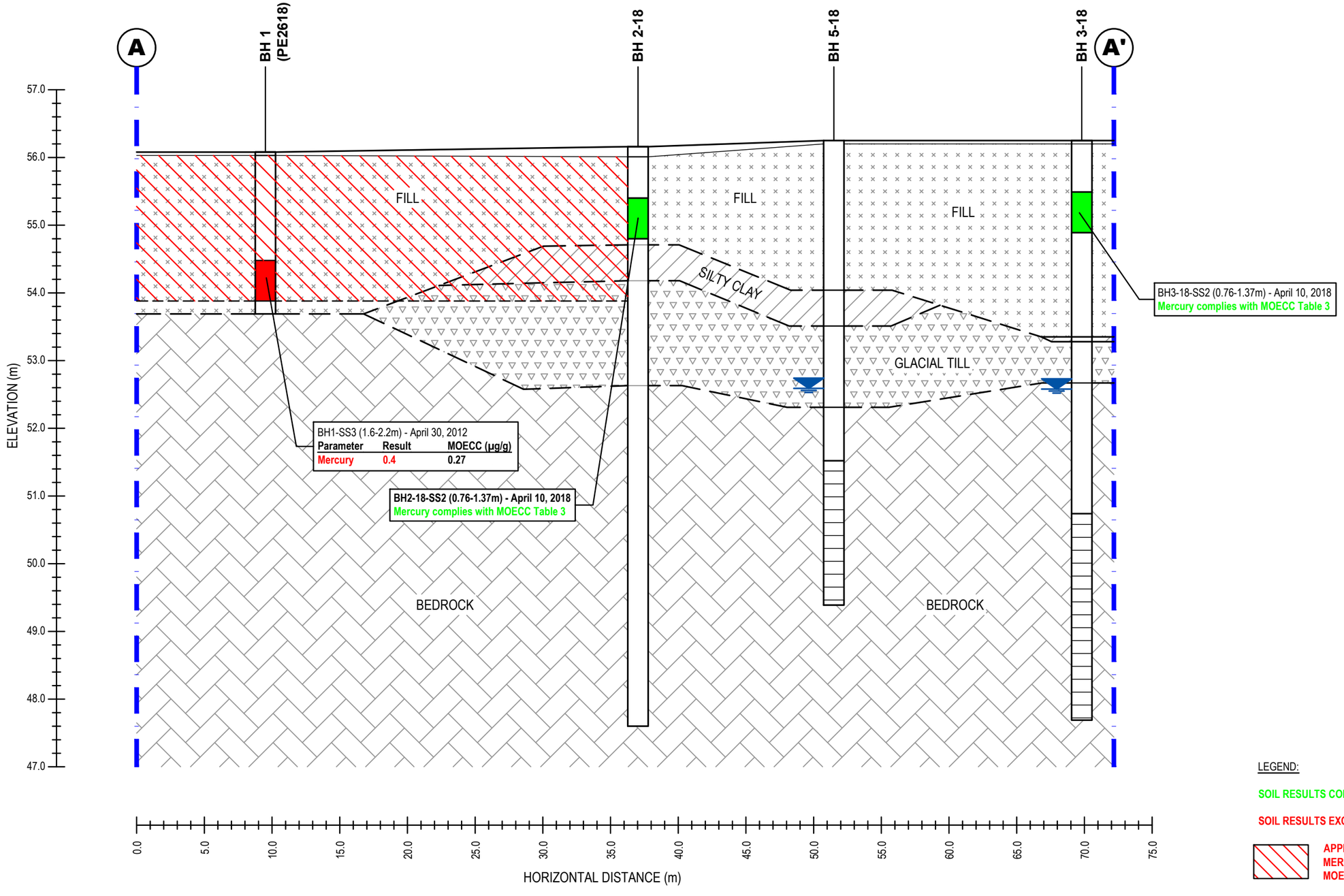

LEGEND:

SOIL RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS

SOIL RESULTS EXCEED MOECC TABLE 3 STANDARDS

APPROXIMATE AREA OF SOIL IMPACTED WITH MERCURY WITH CONCENTRATIONS EXCEEDING MOECC TABLE 3 STANDARDS

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

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

Scale: AS SHOWN	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-7B
Approved by: MSD	Revision No.: 0

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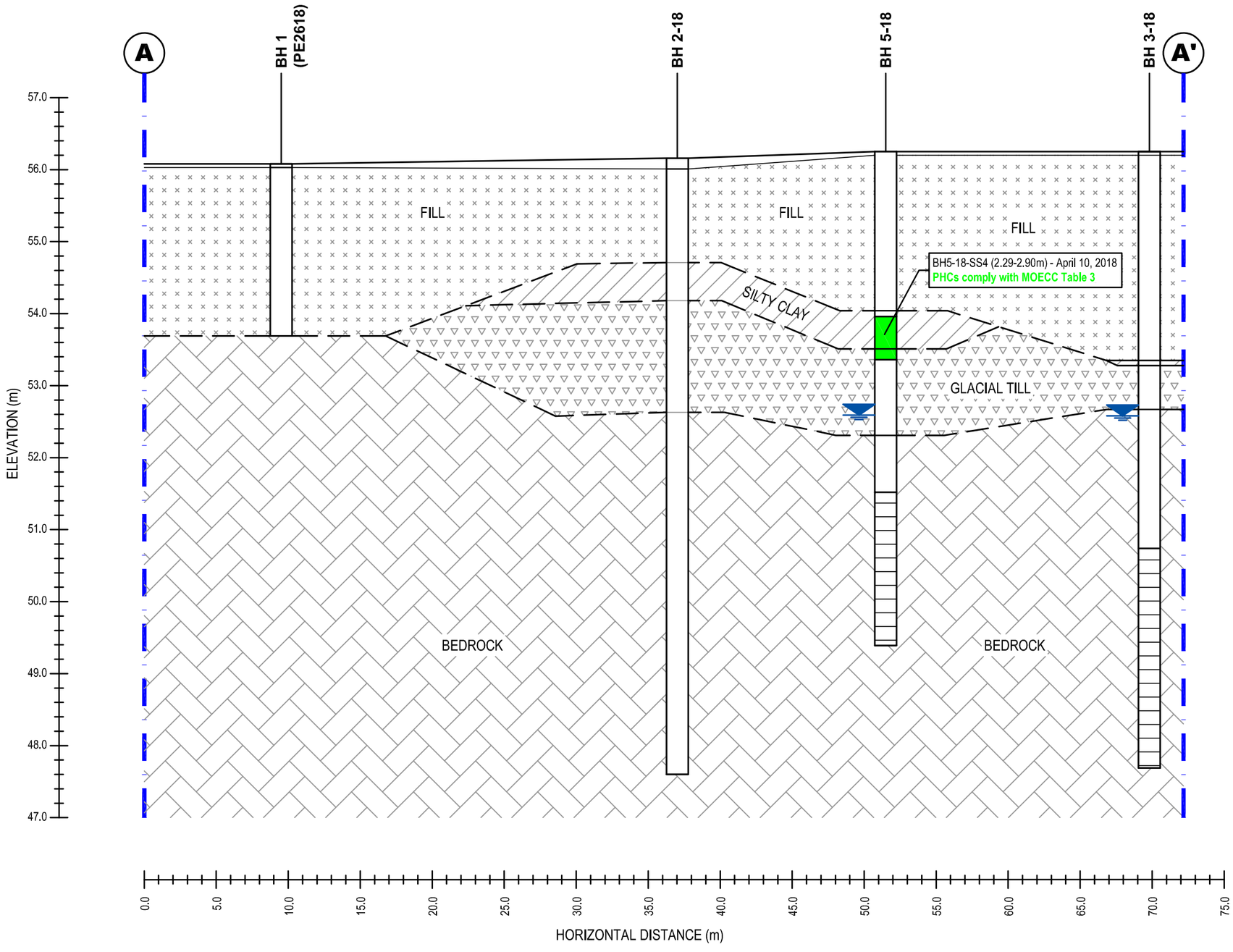

LEGEND:

SOIL RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS

SOIL RESULTS EXCEED MOECC TABLE 3 STANDARDS

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

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

Scale: AS SHOWN	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-7C
Approved by: MSD	Revision No.: 0

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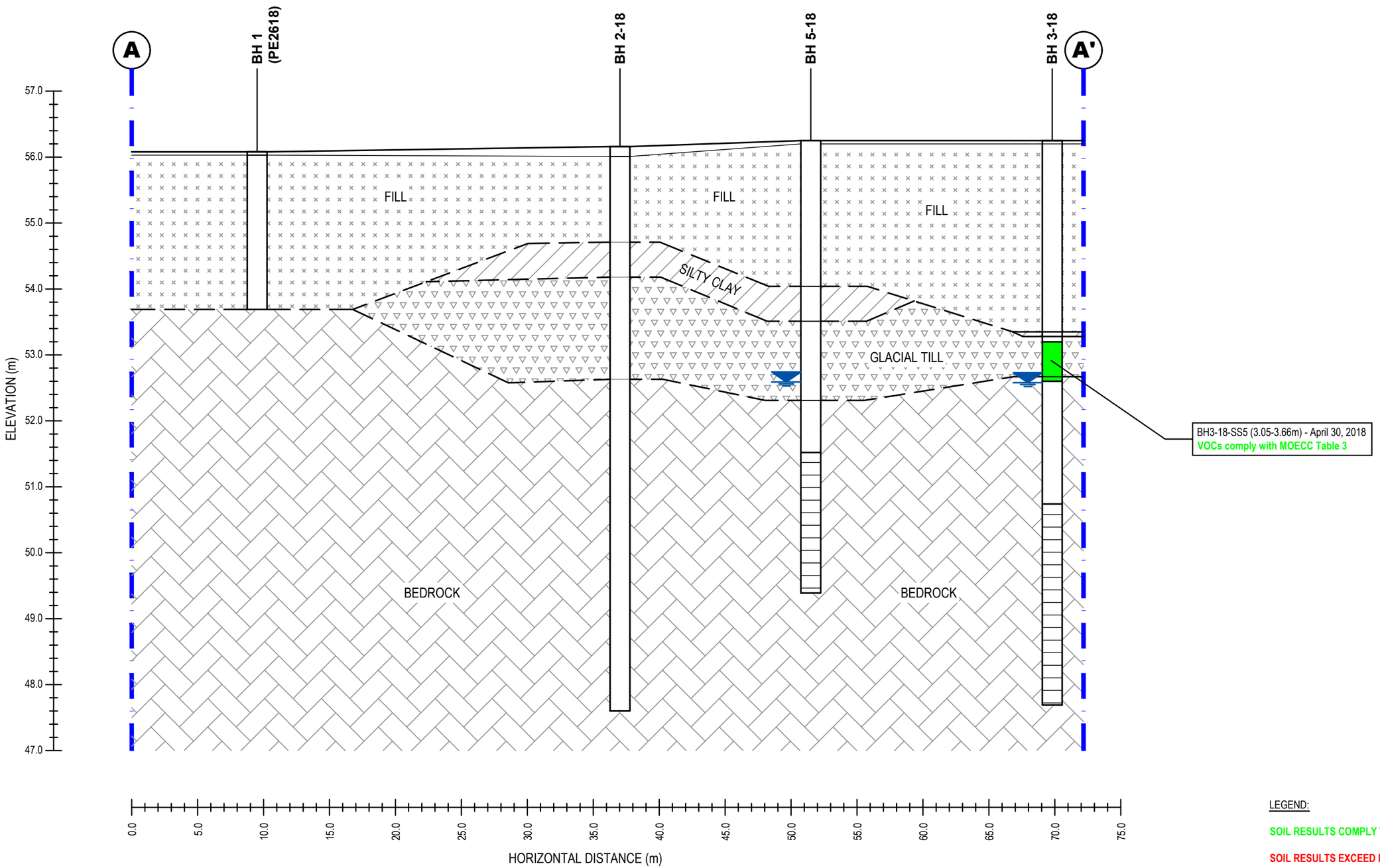

LEGEND:

SOIL RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS

SOIL RESULTS EXCEED MOECC TABLE 3 STANDARDS

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

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

Scale: AS SHOWN	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-7D
Approved by: MSD	Revision No.: 0

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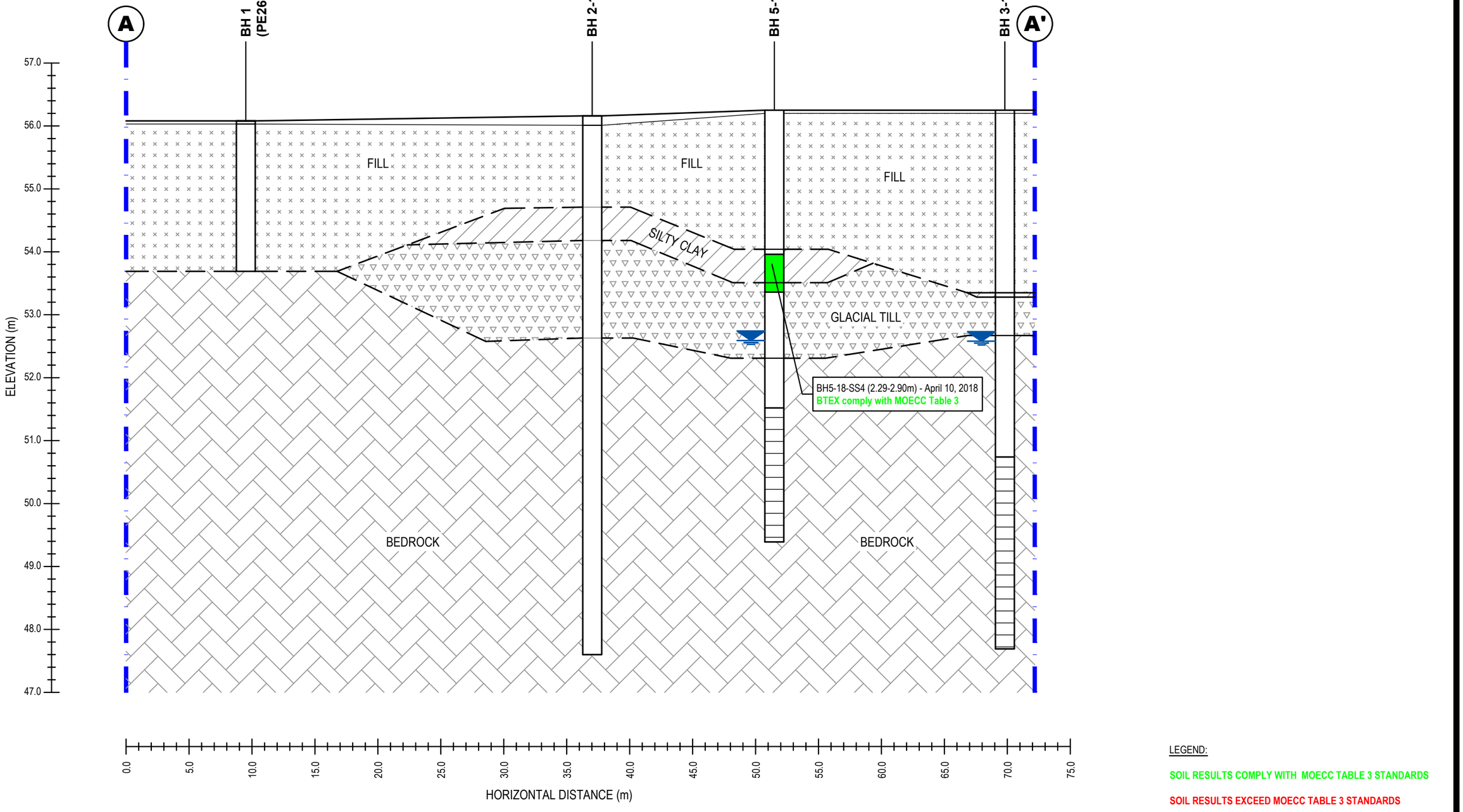

LEGEND:

SOIL RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS

SOIL RESULTS EXCEED MOECC TABLE 3 STANDARDS

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

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

Scale: AS SHOWN	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-7E
Approved by: MSD	Revision No.: 0

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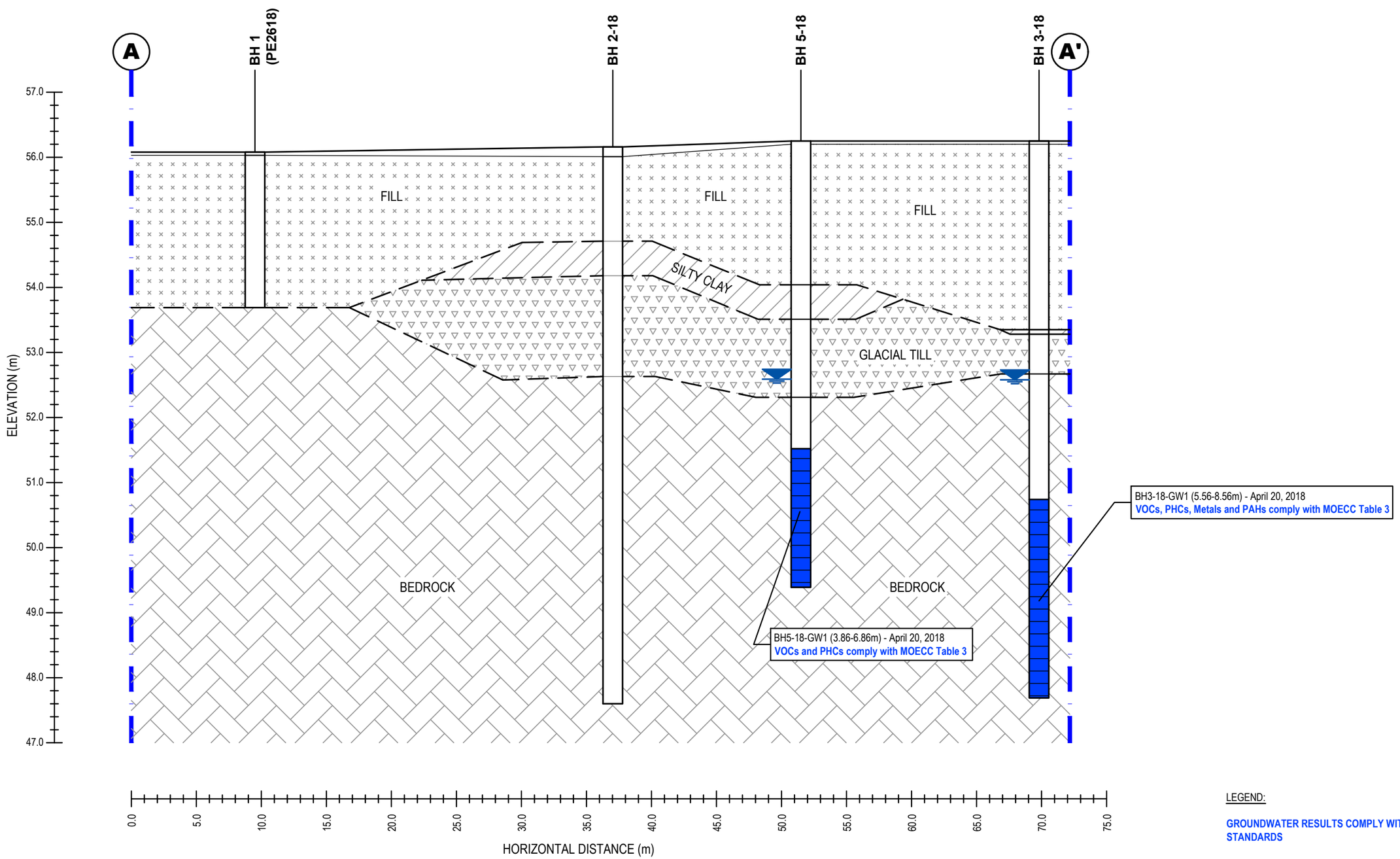

LEGEND:

GROUNDWATER RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

CROSS-SECTION A-A' - GROUNDWATER

Scale: AS SHOWN	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-7F
Approved by: MSD	Revision No.: 0

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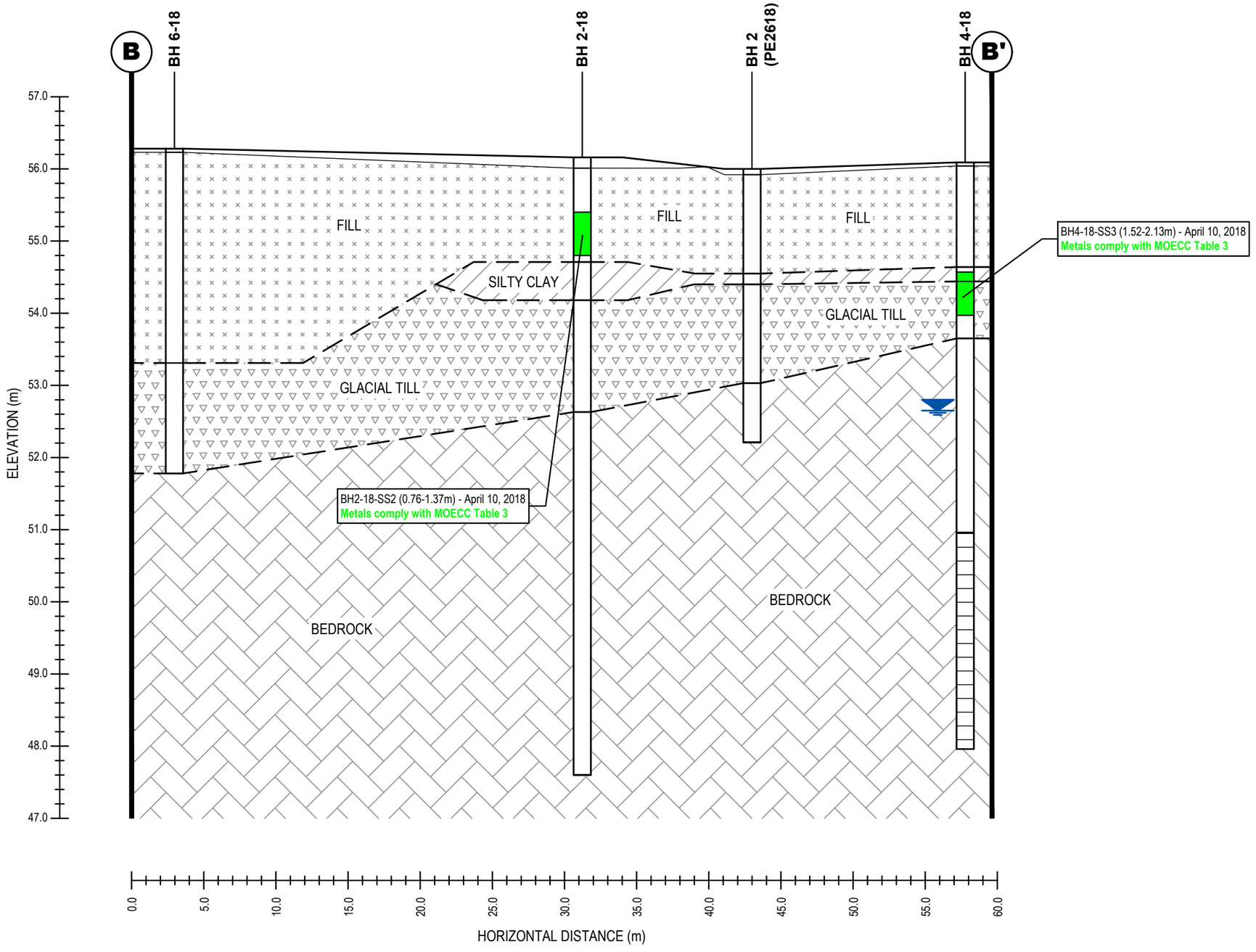

LEGEND:

SOIL RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS

SOIL RESULTS EXCEED MOECC TABLE 3 STANDARDS

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

CROSS-SECTION B-B - SOIL (METALS)

Scale: AS SHOWN	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-8A
Approved by: MSD	Revision No.: 0

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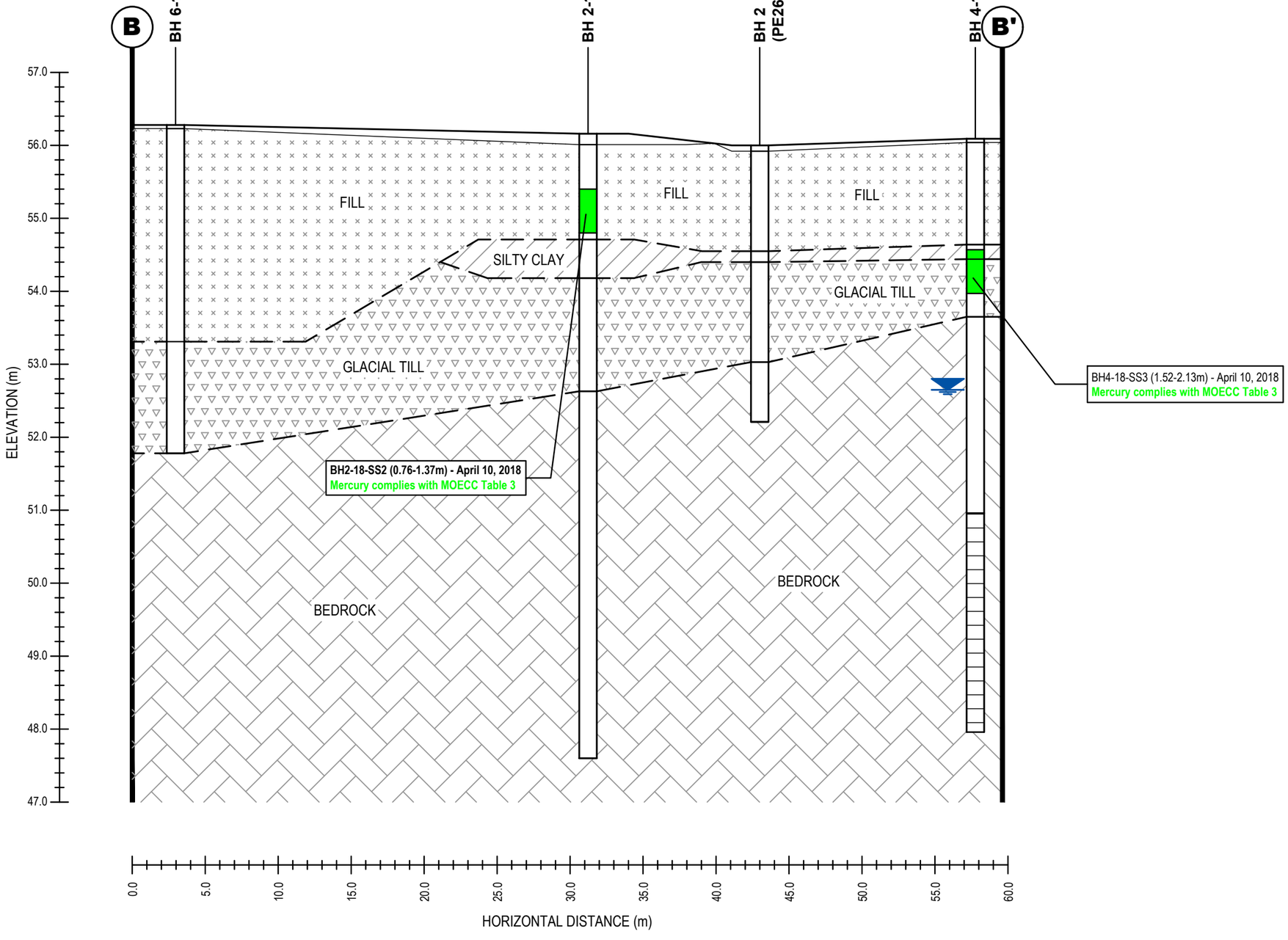

LEGEND:

SOIL RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS

SOIL RESULTS EXCEED MOECC TABLE 3 STANDARDS

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

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

Scale: AS SHOWN	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-8B
Approved by: MSD	Revision No.: 0

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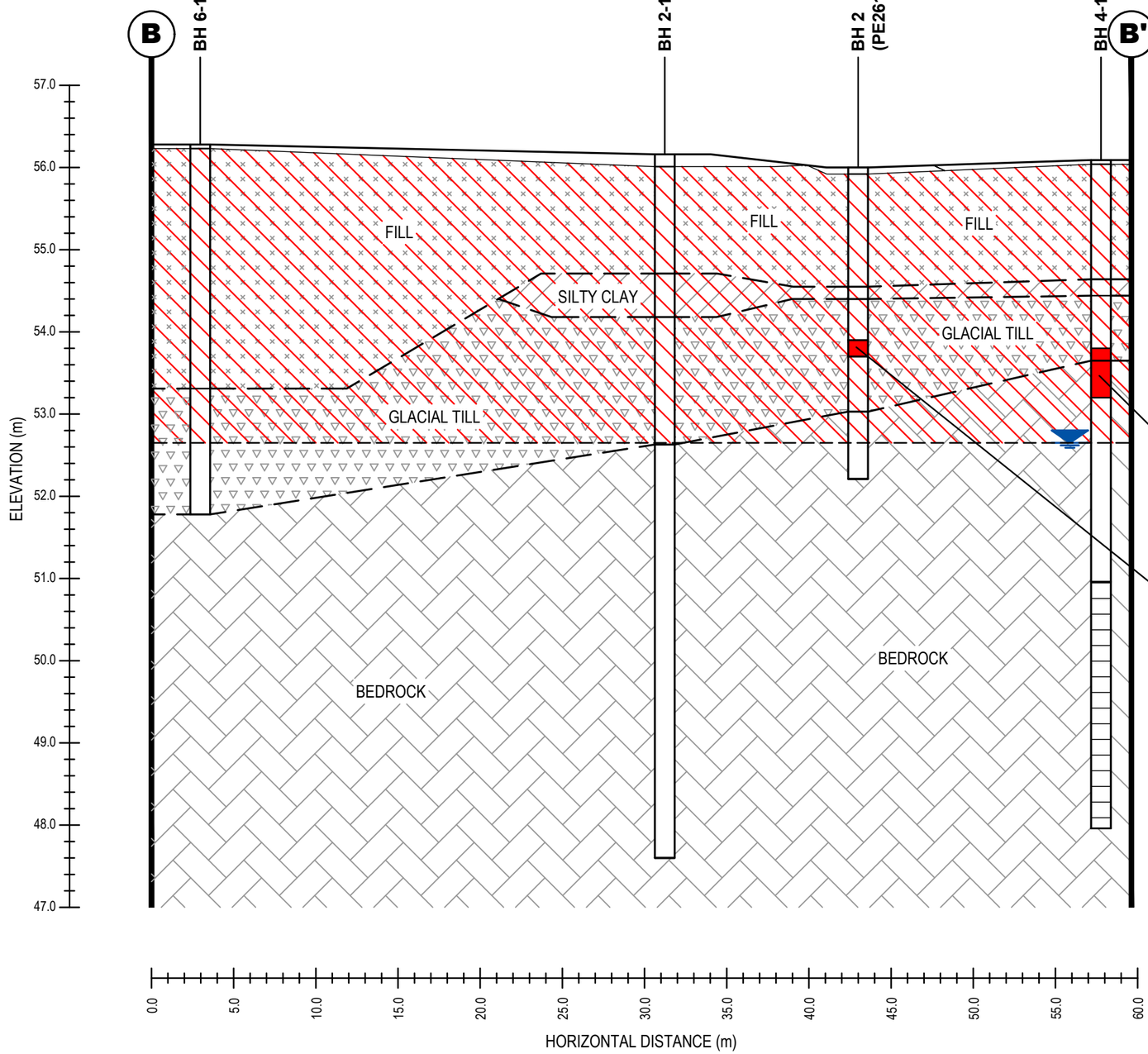

BH4-18-SS4 (2.29-2.90m) - April 10, 2018

Parameter	Result	MOECC (µg/g)
PHC F2	116	98

PHC F1, F3, F4 comply with MOECC Table 3

BH2-SS5 (2.1-2.3m) - April 30, 2012

Parameter	Result	MOECC (µg/g)
PHC F1	241	55

PHC F2, F3, F4 comply with MOECC Table 3

LEGEND:

SOIL RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS

SOIL RESULTS EXCEED MOECC TABLE 3 STANDARDS

APPROXIMATE AREA OF SOIL IMPACTED WITH PHC WITH CONCENTRATIONS EXCEEDING MOECC TABLE 3 STANDARDS

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

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

Scale: AS SHOWN	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-8C
Approved by: MSD	Revision No.: 0

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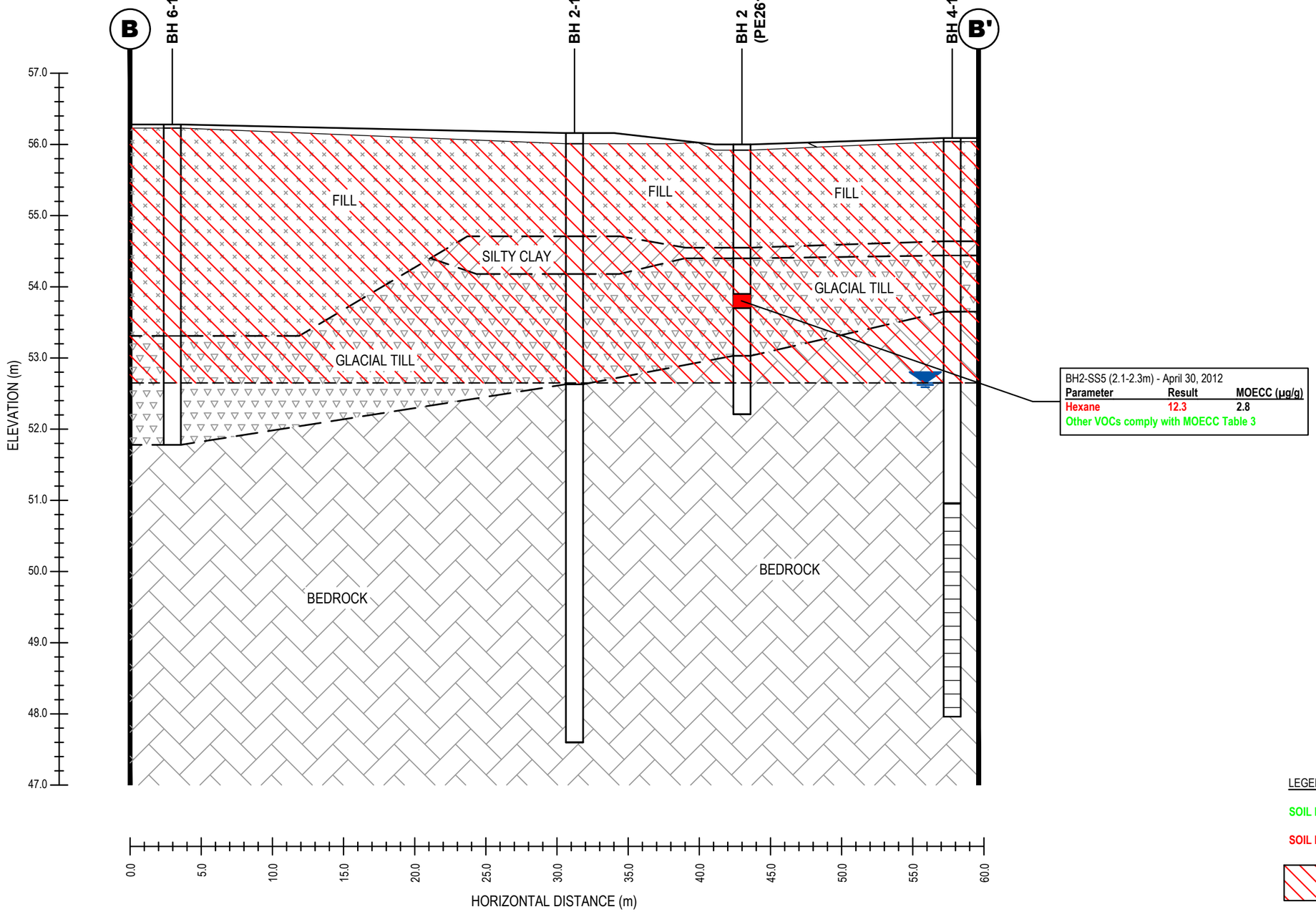

BH2-SS5 (2.1-2.3m) - April 30, 2012

Parameter	Result	MOECC (µg/g)
Hexane	12.3	2.8

Other VOCs comply with MOECC Table 3

LEGEND:

SOIL RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS

SOIL RESULTS EXCEED MOECC TABLE 3 STANDARDS

APPROXIMATE AREA OF SOIL IMPACTED WITH VOC WITH CONCENTRATIONS EXCEEDING MOECC TABLE 3 STANDARDS

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NO.	REVISIONS	DATE	INITIAL
0			

MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

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

Scale: AS SHOWN	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-8D
Approved by: MSD	Revision No.: 0

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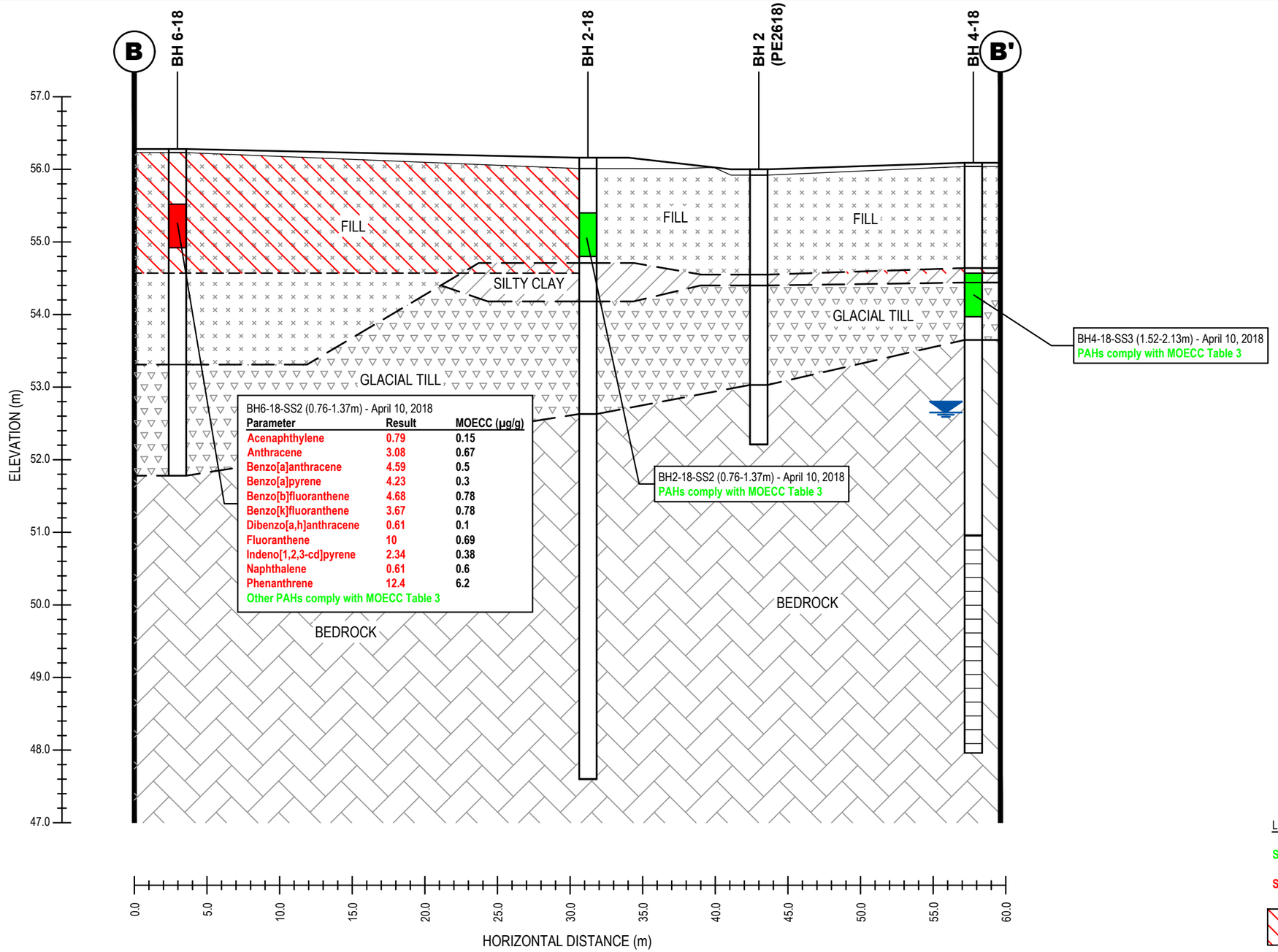

LEGEND:

SOIL RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS

SOIL RESULTS EXCEED MOECC TABLE 3 STANDARDS

APPROXIMATE AREA OF SOIL IMPACTED WITH PAH WITH CONCENTRATIONS EXCEEDING MOECC TABLE 3 STANDARDS

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

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

Scale: AS SHOWN	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-8E
Approved by: MSD	Revision No.: 0

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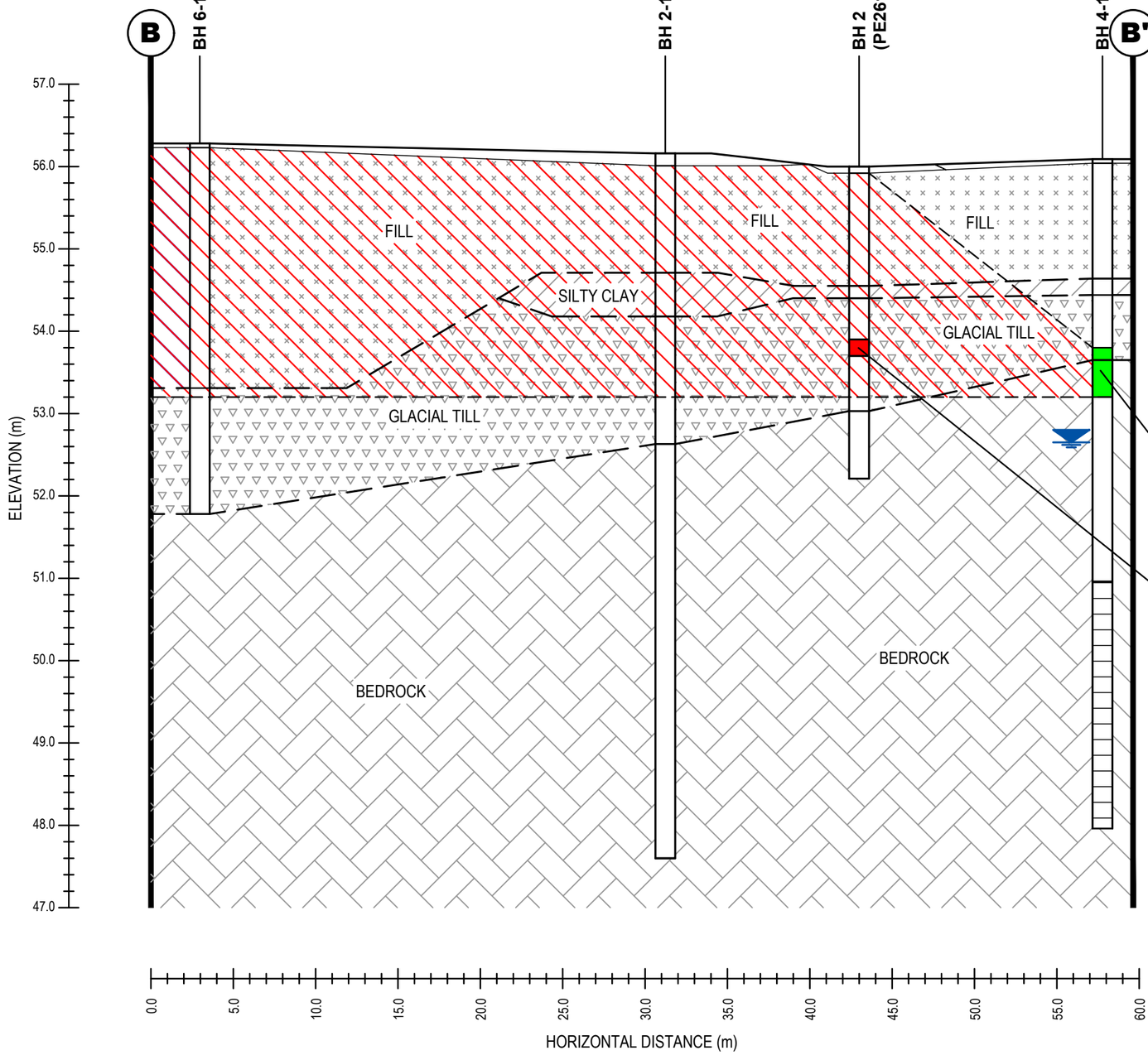

BH4-18-SS4 (2.29-2.90m) - April 10, 2018
BTEX comply with MOECC Table 3

BH2-SS5 (2.1-2.3m) - April 30, 2012

Parameter	Result	MOECC (µg/g)
Benzene	0.51	0.21
Ethylbenzene	6.15	2
Xylenes	26.9	3.1

Other BTEX comply with MOECC Table 3

LEGEND:

SOIL RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS

SOIL RESULTS EXCEED MOECC TABLE 3 STANDARDS

APPROXIMATE AREA OF SOIL IMPACTED WITH BTEX WITH CONCENTRATIONS EXCEEDING MOECC TABLE 3 STANDARDS

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

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

Scale: AS SHOWN	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-8F
Approved by: MSD	Revision No.: 0

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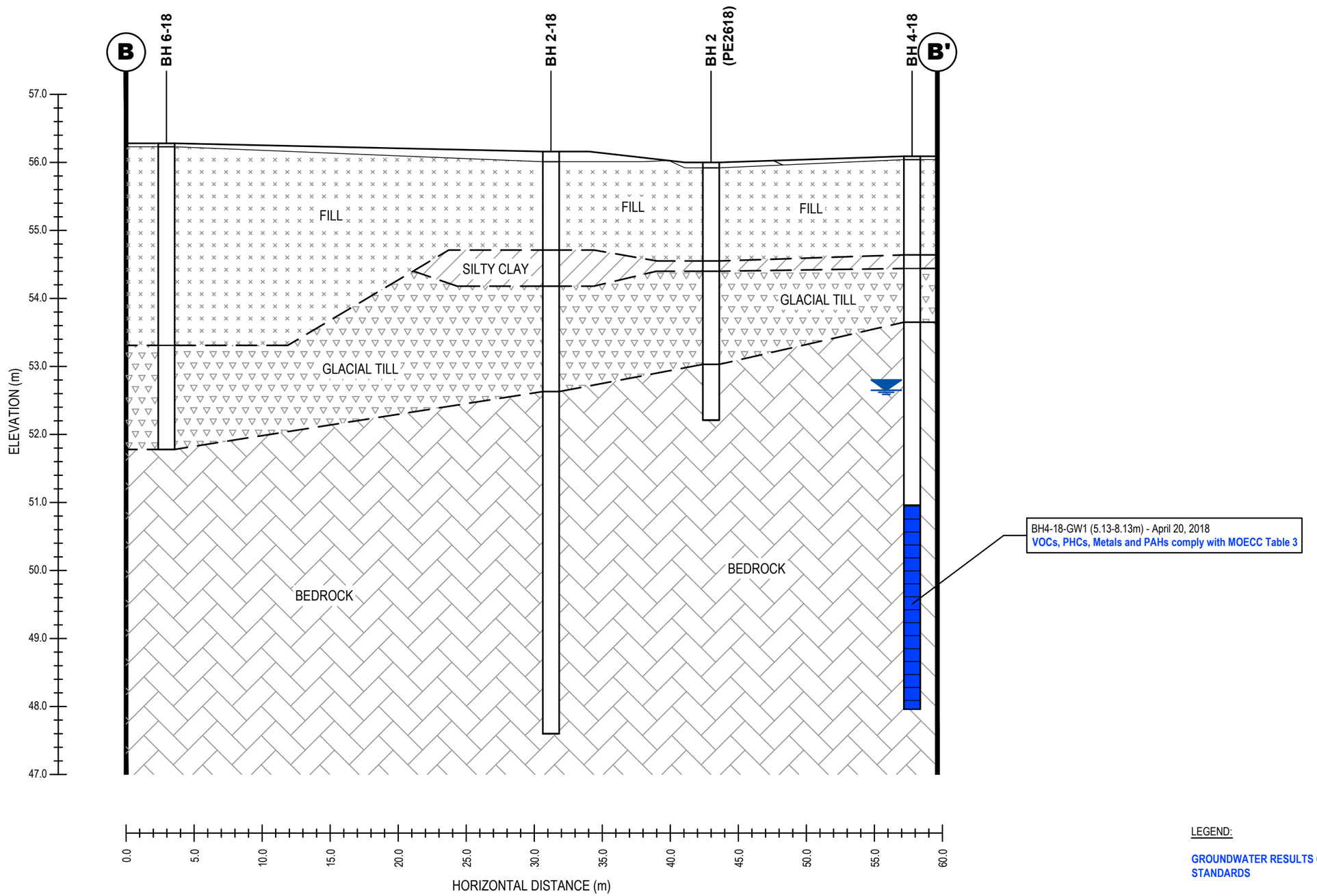

LEGEND:

GROUNDWATER RESULTS COMPLY WITH MOECC TABLE 3 STANDARDS

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MANOR PARK MANAGEMENT

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE

OTTAWA, ONTARIO

Title:

CROSS-SECTION B-B - GROUNDWATER

Scale: AS SHOWN	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-8G
Approved by: MSD	Revision No.: 0

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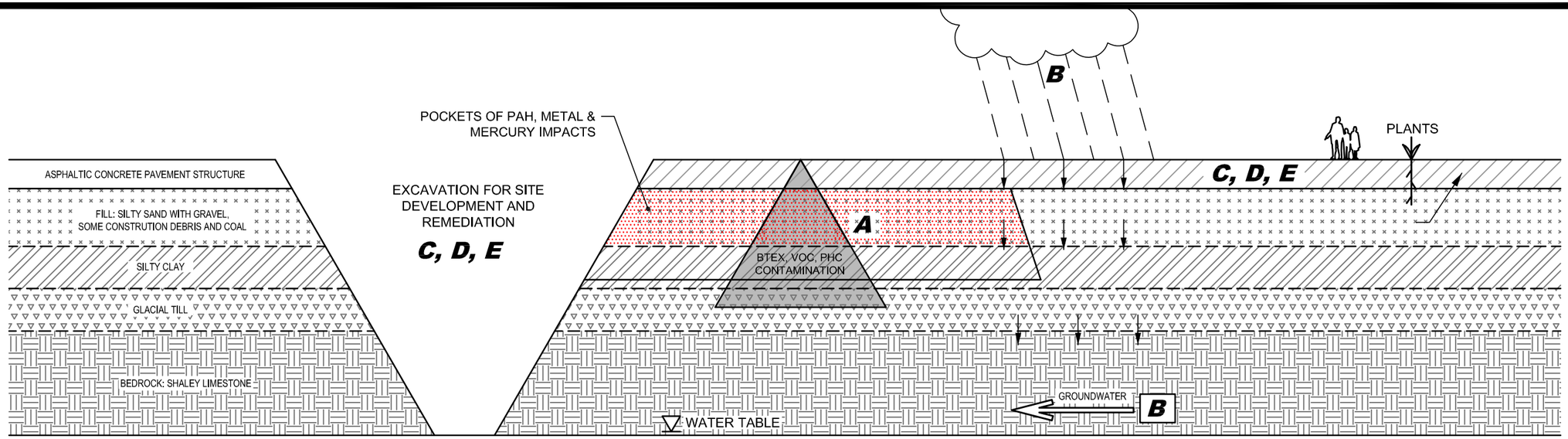

CONTAMINANT RELEASE MECHANISMS

A Fill material impacted with PAH and metal parameters exceeding MOECC Table 3 standards, was identifed on the northern portion of the Phase II Property and is expected to present in pockets, outside the borehole locations. Both metal and PAH impacts are considered to have been directly discharged to the subsurface through historical infilling or historical storage/management of coal (and resulting ash) for heating purposes. BTEX/VOC and PHC impacted soil is considered to have resulted from a direct on-site release, possibly from leaks or spills associated with vehicles stored within the former parking structures.

CONTAMINANT TRANSPORT PATHWAYS

B **PHYSICAL TRANSPORT** - A potential contaminant transport pathway is the physical transport from one location to another of contamined soil, either intentionally or unintentionally, by earth moving equipment, vehicle traffic, or pedestrian traffic. Based on observations during the Phase I and Phase II ESA, physical transport of contaminants on the Phase II Property is considered to be negligible.
PRECIPITATION/INFILTRATION/LEACHING - Due to the Phase II Property having been covered by asphaltic concrete or a building structure, precipitation and infiltration are no considered to have significantly contributed to the migration of the identified parameters beneath the subject land. Furthermore, metals and PAHs typically have low solubilities in water. Based on the findings of the Phase II ESA, the metal and PAH impacts are not considered to have migrated beyond the fill material. BTEX, VOC and PHC impacts are present within the native silty clay or glacial till and appear to extend to the upper layer of the weathered bedrock.
DIFFUSION AND DISPERSION - Upon entering the groundwater table, contaminants will move from an area of greater concentration toward an area where it is less concentration as long as a concentration gradient exists (diffusion). When groundwater travels through bedrock it moves at differenct velocities resulting in mixing and dilution of the contmainion at the advancing edge of flow (dispersion). These processes are not considered to have contributed to contaminant migration, as the groundwater beneath the Phase II Property was determined to be in compliance with the MOECC Table 3 standards.

HUMAN AND ECOLOGICAL RECEPTORS

C **HUMAN RECEPTORS** - Although the majority of the subjet site is open to the general public, it is covered in asphalt, which greatly reduces the chances for humans to act as receptors. Potential human receptors are limited to construction works and environmental professionals who may contact the soil during site remediation or redevelopment.
ECOLOGICAL RECEPTORS - Traditionally ecological receptors include plants and wildlife which may come into contact with the contaminated soil. The site is located in a residential area where ecological receptors are expected. The potential for off-site migration of contaminant concentrations, is considered negligible as the groundwater beneath the Phase II Property is in compliance with MOECC Table 3.

RECEPTOR EXPOSURE POINTS

D **HUMAN RECEPTORS** - Exposure points for humans consist of remedial excavation or excavation for redevelopment.
ECOLOGICAL RECEPTORS - Ecological receptor points may be present in the general vicinity of the site given the residential neighborhood to the north and west of the Phase II Property.

ROUTES OF EXPOSURE

E **HUMAN RECEPTORS** - Routes of exposure for human receptors (construction workers and environmental professionals) include dermal contact and accidental ingestion.
ECOLOGICAL RECEPTORS - Routes of exposure for ecological receptors include ingestion and dermal contact.

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NO.	REVISIONS	DATE	INITIAL
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MANOR PARK MANAGEMENT
PHASE II - ENVIRONMENTAL SITE ASSESSMENT
263 GREENSWAY AVENUE
OTTAWA, ONTARIO
Title:
CONTAMINANT DISTRIBUTION DIAGRAM

Scale: N.T.S.	Date: 04/2018
Drawn by: MPG	Report No.: PE4258-2
Checked by: KM	Dwg. No.: PE4258-9
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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Sampling & Analysis Plan

Phase II Environmental Site Assessment
Part of 263 Greensway Avenue
Ottawa, Ontario

Prepared For

Manor Park Management

April 2018

Report: PE4258-SAP

Table of Contents

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Manor Park Management to conduct a Phase II Environmental Site Assessment (ESA) for part of the property addressed 263 Greensway Avenue, in the City of Ottawa, Ontario. Based on a previous Phase I-II ESA (2012) and a more recent Phase I ESA (2018) previously completed by Paterson for the subject property, a subsurface investigation program, consisting of borehole drilling, was developed. A geotechnical investigation was conducted concurrently with the environmental subsurface investigation.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1-18	Place borehole in vicinity of BH1, to further address impacted fill material identified in the 2012 investigation.	Core into bedrock for monitoring well installation to address potential groundwater impacts.
BH2-18	Place borehole to provide general coverage of the site and delineation of previously identified impacts.	Sample overburden to bedrock surface.
BH3-18	Place borehole near southern property line to address possible historical dry cleaner at 101 Montreal Road.	Core into bedrock for monitoring well installation to address potential groundwater impacts.
BH4-18	Place borehole near southeastern corner of the Phase II Property to address potential historical off-site concerns to the south and east, and to delineate previously identified petroleum hydrocarbon impacts.	Core into bedrock for monitoring well installation to address potential groundwater impacts.
BH5-18	Place borehole to provide general coverage of the site and delineation of previously identified impacts.	Core into bedrock for monitoring well installation to address potential groundwater impacts.
BH6-18	Place borehole to provide general coverage of the site and delineation of previously identified impacts.	Sample overburden to bedrock surface.
BH7-18	Place borehole along east-central portion of the property to address potential historical off-site concerns to the east (former rail lines) and to delineate impacted fill material identified in 2012.	Sample overburden to bedrock surface.

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 should be surveyed relative to a fire hydrant located on south side of Lisgar Street (300 Lisgar Street), with geodetic elevation of 72.57m 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.

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SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
263 Greensway Avenue
Ottawa, Ontario

DATUM BM - Set magnetic nail and washer on concrete (refer to Test Hole Location Plan for location). Geodetic elevation = 56.296m.

FILE NO. PE4258

REMARKS

HOLE NO. BH 1-18

BORINGS BY CME 55 Power Auger **DATE** 10 April 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	56.08
Asphaltic concrete 0.04							
FILL: Crushed stone with silt and sand 0.28		AU	1				
FILL: Brown silty sand, trace gravel, cobbles, ash and coal		SS	2	33	5	1	55.08
1.45							
Brown **SILTY CLAY,** trace sand		SS	3	88	10	2	54.08
2.03							
GLACIAL TILL: Brown silty sand with gravel, cobbles and clay		SS	4	75	41		
		SS	5	86	50+	3	53.08
3.63		RC	1	100	69		
						4	52.08
		RC	2	91	67		
						5	51.08
BEDROCK: Shaley limestone						6	50.08
		RC	3	100	95		
						7	49.08
		RC	4	97	94		
						8	48.08
8.46							
End of Borehole							
(GWL @ 3.82m - April 20, 2018)							

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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SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
263 Greensway Avenue
Ottawa, Ontario

DATUM BM - Set magnetic nail and washer on concrete (refer to Test Hole Location Plan for location). Geodetic elevation = 56.296m.

FILE NO. PE4258

REMARKS

HOLE NO. BH 2-18

BORINGS BY CME 55 Power Auger **DATE** 10 April 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	56.16
25mm Asphaltic concrete over crushed stone with silt and sand 0.15		AU	1				
FILL: Brown silty sand, trace gravel, ash, coal and concrete tile		SS	2	33	2	1	55.16
1.45							
Brown **SILTY CLAY,** trace sand 1.98		SS	3	79	9	2	54.16
GLACIAL TILL: Brown silty sand, some clay, gravel, cobbles and boulders		SS	4	50	31		
		SS	5	50	50+	3	53.16
3.53							
		RC	1	100	42	4	52.16
		RC	2	100	96	5	51.16
BEDROCK: Shaley limestone						6	50.16
		RC	3	96	86	7	49.16
		RC	4	100	95	8	48.16
8.56							
End of Borehole							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
263 Greensway Avenue
Ottawa, Ontario

DATUM BM - Set magnetic nail and washer on concrete (refer to Test Hole Location Plan for location). Geodetic elevation = 56.296m.

FILE NO. PE4258

REMARKS

HOLE NO. BH 3-18

BORINGS BY CME 55 Power Auger **DATE** 10 April 2018

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE								
Asphaltic concrete	0.04						0	56.25
FILL: Crushed stone with silt and sand	0.43		AU	1				
			SS	2	42	7	1	55.25
FILL: Brown silty sand, trace gravel, cobbles, slag, clay, ash and rebar			SS	3	12	5	2	54.25
			SS	4	67	8		
	2.90						3	53.25
Grey **SANDY SILT**	2.97							
GLACIAL TILL: Brown silty clay, some sand, gravel, cobbles and boulders	3.58		SS	5	27	20		
			RC	1	89	29	4	52.25
			RC	2	100	97	5	51.25
BEDROCK: Shaley limestone							6	50.25
			RC	3	97	93	7	49.25
			RC	4	100	96	8	48.25
	8.56							
End of Borehole								
(GWL @ 3.67m - April 20, 2018)								

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

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
263 Greensway Avenue
Ottawa, Ontario

DATUM BM - Set magnetic nail and washer on concrete (refer to Test Hole Location Plan for location). Geodetic elevation = 56.296m.

FILE NO. PE4258

REMARKS

HOLE NO. BH 4-18

BORINGS BY CME 55 Power Auger **DATE** 11 April 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	56.09
Asphaltic concrete 0.05		AU	1				
FILL: Crushed stone with silt and sand 0.56							
FILL: Brown silty clay, some sand, trace gravel, cobbles and organics		SS	2	33	6	1	55.09
1.45							
Grey **SILTY CLAY,** trace sand 1.65		SS	3	86	21	2	54.09
GLACIAL TILL: Brown silty clay, some sand, gravel, cobbles and boulders 2.44		SS	4	86	50+		
BEDROCK: Weathered shale		SS	5	40	50+	3	53.09
3.30		RC	1	100	84	4	52.09
		RC	2	100	89	5	51.09
BEDROCK: Shaley limestone						6	50.09
		RC	3	95	75	7	49.09
		RC	4	99	99	8	48.09
8.13							
End of Borehole							
(GWL @ 3.68m - April 20, 2018)							

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

20 40 60 80

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

Monitoring Well Construction

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
263 Greensway Avenue
Ottawa, Ontario

DATUM BM - Set magnetic nail and washer on concrete (refer to Test Hole Location Plan for location). Geodetic elevation = 56.296m.

FILE NO. **PE4258**

REMARKS

HOLE NO. **BH 5-18**

BORINGS BY CME 55 Power Auger **DATE** 11 April 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: Volatile Organic Rdg. (ppm) / Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE									
Asphaltic concrete 0.06						0	56.25		
FILL: Crushed stone with silt and sand 0.17		AU	1						
FILL: Brown silty sand, trace clay, gravel, brick and ash		SS	2	100	13	1	55.25		
		SS	3	46	8	2	54.25		
2.21									
Grey **SILTY CLAY,** trace sand 2.74		SS	4	50	6	3	53.25		
GLACIAL TILL: Brown silty clay, some sand, gravel, cobbles and boulders		SS	5	38	15				
3.94		SS	6	80	50+	4	52.25		
		RC	1	100	91	5	51.25		
BEDROCK: Shaley limestone									
		RC	2	100	87	6	50.25		
6.86									
End of Borehole									
(GWL @ 3.66m - April 20, 2018)									

Photo Ionization Detector: 20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
263 Greensway Avenue
Ottawa, Ontario

DATUM BM - Set magnetic nail and washer on concrete (refer to Test Hole Location Plan for location). Geodetic elevation = 56.296m.

FILE NO. PE4258

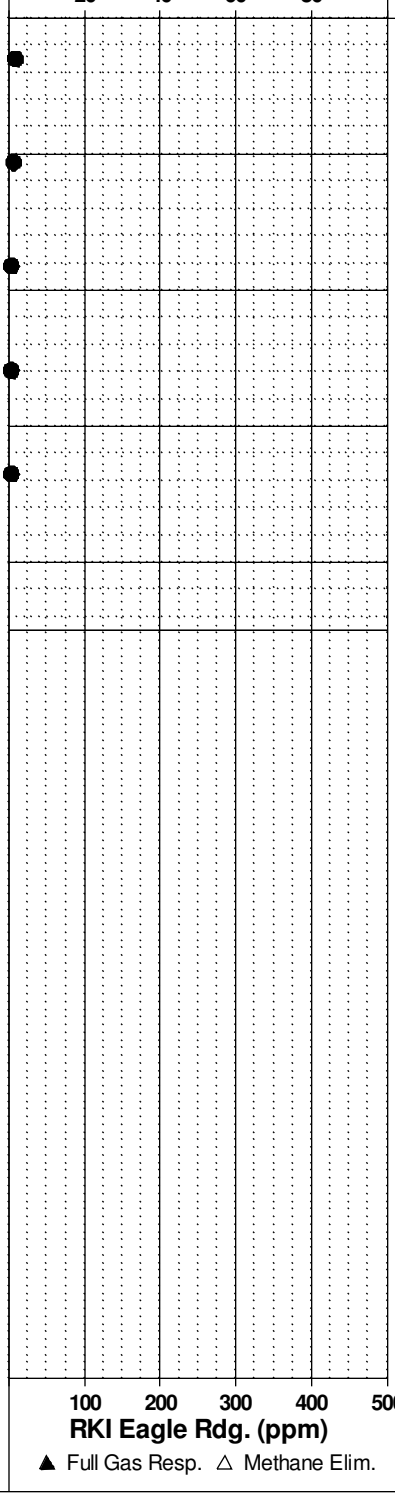
REMARKS

HOLE NO. BH 6-18

BORINGS BY CME 55 Power Auger **DATE** 11 April 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.04						0	56.28
FILL: Crushed stone with silt and sand 0.43		AU	1				
FILL: Brown silty sand, trace clay, gravel, organics, ash, glass		SS	2	75	14	1	55.28
		SS	3	67	5	2	54.28
2.21							
FILL: Brown silty clay, trace sand 2.59		SS	4	75	9		
FILL: Brown silty sand, trace gravel, cobbles and organics 2.97						3	53.28
GLACIAL TILL: Brown silty sand, some clay, gravel, cobbles and boulders		SS	5	67	18	4	52.28
4.50							
End of Borehole							
Practical refusal to augering at 4.50m depth							

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



Monitoring Well Construction

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
263 Greensway Avenue
Ottawa, Ontario

DATUM BM - Set magnetic nail and washer on concrete (refer to Test Hole Location Plan for location). Geodetic elevation = 56.296m.

FILE NO. PE4258

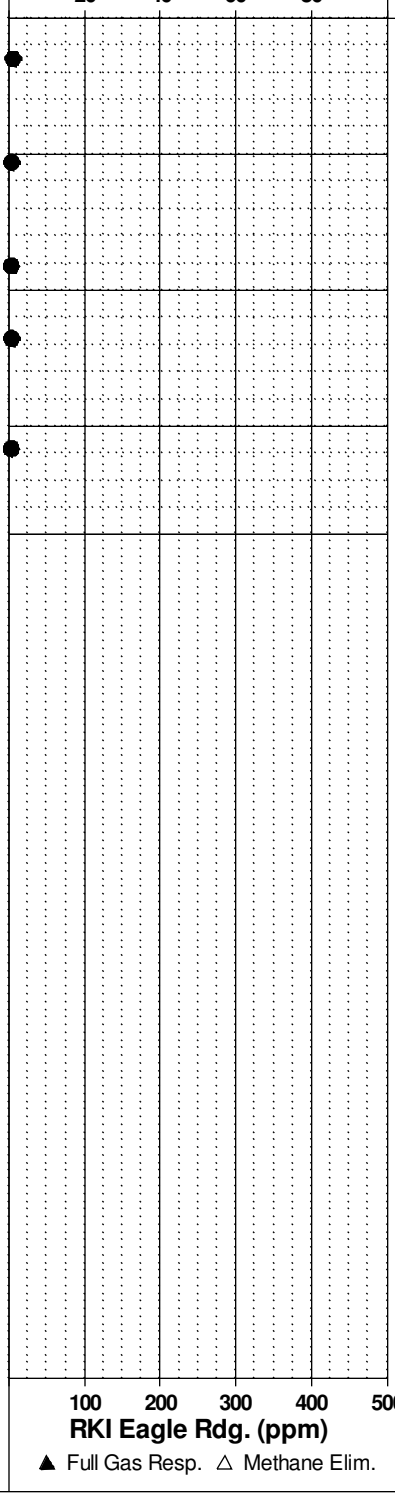
REMARKS

HOLE NO. BH 7-18

BORINGS BY CME 55 Power Auger **DATE** 11 April 2018

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.08		AU	1			0	55.99
FILL: Brown silty sand, trace gravel, cobbles, ash and coal		SS	2	17	2	1	54.99
1.45							
Brown **SILTY CLAY,** trace sand 1.60		SS	3	100	19	2	53.99
GLACIAL TILL: Brown silty sand, some clay, gravel, cobbles and boulders 2.74		SS	4	40			
		SS	5	78		3	52.99
BEDROCK: Weathered shale							
3.79 End of Borehole							
Practical refusal to augering at 3.79m depth							

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



Monitoring Well Construction

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

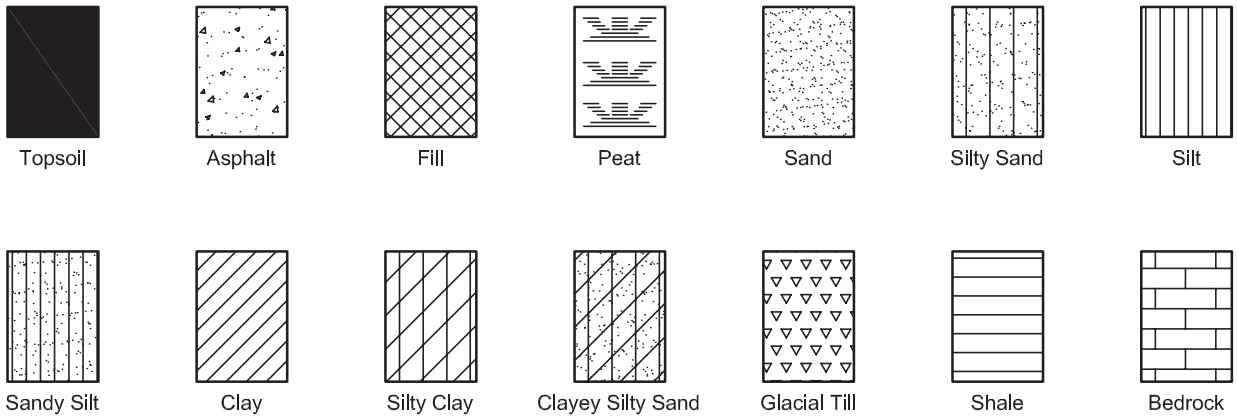
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

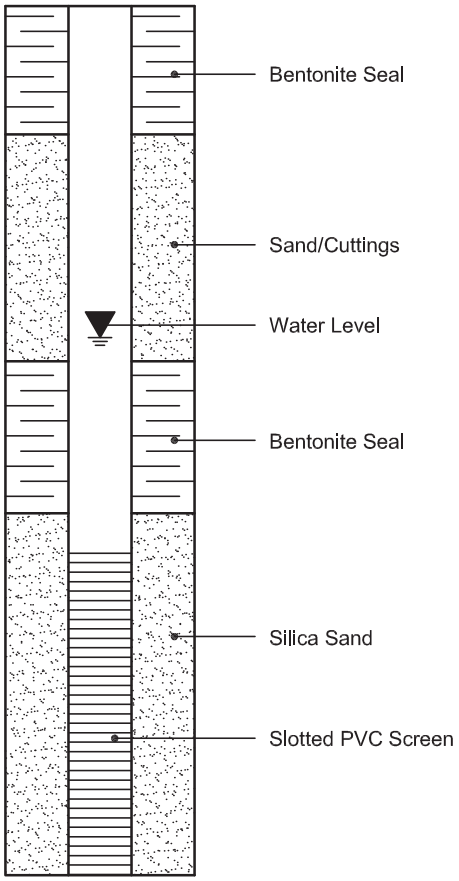
SYMBOLS AND TERMS (continued)

STRATA PLOT

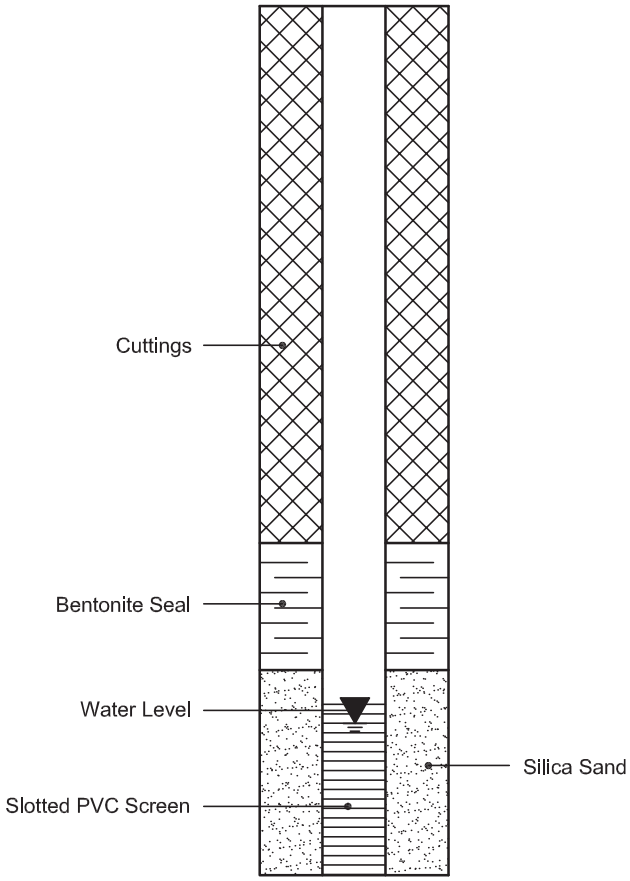


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 23715
Project: PE4258
Custody: 114215

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

Revised Report

Order #: 1815569

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

Paracel ID	Client ID
1815569-01	BH3-18-SS2
1815569-02	BH3-18-SS5
1815569-03	BH4-18-SS3
1815569-04	BH4-18-SS4
1815569-05	BH5-18-SS4
1815569-06	BH6-18-SS2
1815569-07	BH7-18-SS2

Approved By:

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23715

Report Date: 20-Apr-2018
Order Date: 13-Apr-2018
Project Description: PE4258

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Boron, available	MOE (HWE), EPA 200.7 - ICP-OES	19-Apr-18	19-Apr-18
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	17-Apr-18	18-Apr-18
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	13-Apr-18	17-Apr-18
Mercury by CVAA	EPA 7471B - CVAA, digestion	19-Apr-18	19-Apr-18
Metals, ICP-MS	EPA 6020 - Digestion - ICP-MS	19-Apr-18	19-Apr-18
PHC F1	CWS Tier 1 - P&T GC-FID	17-Apr-18	18-Apr-18
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	13-Apr-18	15-Apr-18
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	19-Apr-18	20-Apr-18
REG 153: VOCs by P&T GC/MS	EPA 8260 - P&T GC-MS	17-Apr-18	18-Apr-18
Solids, %	Gravimetric, calculation	18-Apr-18	18-Apr-18

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 23715

Report Date: 20-Apr-2018

Order Date: 13-Apr-2018

Project Description: PE4258

	Client ID:	BH3-18-SS2	BH3-18-SS5	BH4-18-SS3	BH4-18-SS4
	Sample Date:	04/10/2018 12:00	04/10/2018 12:00	04/11/2018 09:00	04/11/2018 09:00
	Sample ID:	1815569-01	1815569-02	1815569-03	1815569-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	82.3	90.4	90.5	91.4
Metals					
Antimony	1 ug/g dry	<1	-	<1	-
Arsenic	1 ug/g dry	2	-	2	-
Barium	1 ug/g dry	153	-	56	-
Beryllium	0.5 ug/g dry	<0.5	-	<0.5	-
Boron	5.0 ug/g dry	5.2	-	5.7	-
Boron, available	0.5 ug/g dry	1.0	-	<0.5	-
Cadmium	0.5 ug/g dry	<0.5	-	<0.5	-
Chromium	5 ug/g dry	21	-	12	-
Chromium (VI)	0.2 ug/g dry	<0.2	-	<0.2	-
Cobalt	1 ug/g dry	7	-	7	-
Copper	5 ug/g dry	29	-	17	-
Lead	1 ug/g dry	71	-	8	-
Mercury	0.1 ug/g dry	0.2	-	<0.1	-
Molybdenum	1 ug/g dry	1	-	1	-
Nickel	5 ug/g dry	24	-	23	-
Selenium	1 ug/g dry	<1	-	<1	-
Silver	0.3 ug/g dry	<0.3	-	<0.3	-
Thallium	1 ug/g dry	<1	-	<1	-
Uranium	1 ug/g dry	2	-	<1	-
Vanadium	10 ug/g dry	22	-	20	-
Zinc	20 ug/g dry	120	-	21	-
Volatiles					
Acetone	0.50 ug/g dry	-	<0.50	-	-
Benzene	0.02 ug/g dry	-	<0.02	-	-
Bromodichloromethane	0.05 ug/g dry	-	<0.05	-	-
Bromoform	0.05 ug/g dry	-	<0.05	-	-
Bromomethane	0.05 ug/g dry	-	<0.05	-	-
Carbon Tetrachloride	0.05 ug/g dry	-	<0.05	-	-
Chlorobenzene	0.05 ug/g dry	-	<0.05	-	-
Chloroform	0.05 ug/g dry	-	<0.05	-	-
Dibromochloromethane	0.05 ug/g dry	-	<0.05	-	-
Dichlorodifluoromethane	0.05 ug/g dry	-	<0.05	-	-
1,2-Dichlorobenzene	0.05 ug/g dry	-	<0.05	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 23715

Report Date: 20-Apr-2018

Order Date: 13-Apr-2018

Project Description: PE4258

	Client ID:	BH3-18-SS2	BH3-18-SS5	BH4-18-SS3	BH4-18-SS4
	Sample Date:	04/10/2018 12:00	04/10/2018 12:00	04/11/2018 09:00	04/11/2018 09:00
	Sample ID:	1815569-01	1815569-02	1815569-03	1815569-04
	MDL/Units	Soil	Soil	Soil	Soil
1,3-Dichlorobenzene	0.05 ug/g dry	-	<0.05	-	-
1,4-Dichlorobenzene	0.05 ug/g dry	-	<0.05	-	-
1,1-Dichloroethane	0.05 ug/g dry	-	<0.05	-	-
1,2-Dichloroethane	0.05 ug/g dry	-	<0.05	-	-
1,1-Dichloroethylene	0.05 ug/g dry	-	<0.05	-	-
cis-1,2-Dichloroethylene	0.05 ug/g dry	-	<0.05	-	-
trans-1,2-Dichloroethylene	0.05 ug/g dry	-	<0.05	-	-
1,2-Dichloropropane	0.05 ug/g dry	-	<0.05	-	-
cis-1,3-Dichloropropylene	0.05 ug/g dry	-	<0.05	-	-
trans-1,3-Dichloropropylene	0.05 ug/g dry	-	<0.05	-	-
1,3-Dichloropropene, total	0.05 ug/g dry	-	<0.05	-	-
Ethylbenzene	0.05 ug/g dry	-	<0.05	-	-
Ethylene dibromide (dibromoethan	0.05 ug/g dry	-	<0.05	-	-
Hexane	0.05 ug/g dry	-	<0.05	-	-
Methyl Ethyl Ketone (2-Butanone)	0.50 ug/g dry	-	<0.50	-	-
Methyl Isobutyl Ketone	0.50 ug/g dry	-	<0.50	-	-
Methyl tert-butyl ether	0.05 ug/g dry	-	<0.05	-	-
Methylene Chloride	0.05 ug/g dry	-	<0.05	-	-
Styrene	0.05 ug/g dry	-	<0.05	-	-
1,1,1,2-Tetrachloroethane	0.05 ug/g dry	-	<0.05	-	-
1,1,2,2-Tetrachloroethane	0.05 ug/g dry	-	<0.05	-	-
Tetrachloroethylene	0.05 ug/g dry	-	<0.05	-	-
Toluene	0.05 ug/g dry	-	<0.05	-	-
1,1,1-Trichloroethane	0.05 ug/g dry	-	<0.05	-	-
1,1,2-Trichloroethane	0.05 ug/g dry	-	<0.05	-	-
Trichloroethylene	0.05 ug/g dry	-	<0.05	-	-
Trichlorofluoromethane	0.05 ug/g dry	-	<0.05	-	-
Vinyl chloride	0.02 ug/g dry	-	<0.02	-	-
m,p-Xylenes	0.05 ug/g dry	-	<0.05	-	-
o-Xylene	0.05 ug/g dry	-	<0.05	-	-
Xylenes, total	0.05 ug/g dry	-	<0.05	-	-
4-Bromofluorobenzene	Surrogate	-	106%	-	-
Dibromofluoromethane	Surrogate	-	91.6%	-	-
Toluene-d8	Surrogate	-	109%	-	-
Benzene	0.02 ug/g dry	-	-	-	<0.02
Ethylbenzene	0.05 ug/g dry	-	-	-	<0.05

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 23715

Report Date: 20-Apr-2018

Order Date: 13-Apr-2018

Project Description: PE4258

	Client ID:	BH3-18-SS2	BH3-18-SS5	BH4-18-SS3	BH4-18-SS4
	Sample Date:	04/10/2018 12:00	04/10/2018 12:00	04/11/2018 09:00	04/11/2018 09:00
	Sample ID:	1815569-01	1815569-02	1815569-03	1815569-04
	MDL/Units	Soil	Soil	Soil	Soil
Toluene	0.05 ug/g dry	-	-	-	0.14
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	-	-	-	0.07
Toluene-d8	Surrogate	-	-	-	107%
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	-	-	-	16
F2 PHCs (C10-C16)	4 ug/g dry	-	-	-	116
F3 PHCs (C16-C34)	8 ug/g dry	-	-	-	173
F4 PHCs (C34-C50)	6 ug/g dry	-	-	-	53
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	-	-	<0.02	-
Acenaphthylene	0.02 ug/g dry	-	-	<0.02	-
Anthracene	0.02 ug/g dry	-	-	<0.02	-
Benzo [a] anthracene	0.02 ug/g dry	-	-	<0.02	-
Benzo [a] pyrene	0.02 ug/g dry	-	-	<0.02	-
Benzo [b] fluoranthene	0.02 ug/g dry	-	-	<0.02	-
Benzo [g,h,i] perylene	0.02 ug/g dry	-	-	<0.02	-
Benzo [k] fluoranthene	0.02 ug/g dry	-	-	<0.02	-
Chrysene	0.02 ug/g dry	-	-	<0.02	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	-	-	<0.02	-
Fluoranthene	0.02 ug/g dry	-	-	<0.02	-
Fluorene	0.02 ug/g dry	-	-	<0.02	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	-	-	<0.02	-
1-Methylnaphthalene	0.02 ug/g dry	-	-	0.21	-
2-Methylnaphthalene	0.02 ug/g dry	-	-	0.35	-
Methylnaphthalene (1&2)	0.04 ug/g dry	-	-	0.56	-
Naphthalene	0.01 ug/g dry	-	-	0.14	-
Phenanthrene	0.02 ug/g dry	-	-	0.06	-
Pyrene	0.02 ug/g dry	-	-	0.07	-
2-Fluorobiphenyl	Surrogate	-	-	90.6%	-
Terphenyl-d14	Surrogate	-	-	101%	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 23715

Report Date: 20-Apr-2018

Order Date: 13-Apr-2018

Project Description: PE4258

	Client ID:	BH5-18-SS4	BH6-18-SS2	BH7-18-SS2	-
	Sample Date:	04/11/2018 09:00	04/11/2018 12:00	04/11/2018 12:00	-
	Sample ID:	1815569-05	1815569-06	1815569-07	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	74.0	82.6	72.8	-
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	106%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	-	-	-
F2 PHCs (C10-C16)	4 ug/g dry	6	-	-	-
F3 PHCs (C16-C34)	8 ug/g dry	67	-	-	-
F4 PHCs (C34-C50)	6 ug/g dry	83	-	-	-
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	-	1.73	0.02	-
Acenaphthylene	0.02 ug/g dry	-	0.79	0.05	-
Anthracene	0.02 ug/g dry	-	3.08	0.11	-
Benzo [a] anthracene	0.02 ug/g dry	-	4.59	0.17	-
Benzo [a] pyrene	0.02 ug/g dry	-	4.23	0.17	-
Benzo [b] fluoranthene	0.02 ug/g dry	-	4.68	0.19	-
Benzo [g,h,i] perylene	0.02 ug/g dry	-	2.49	0.10	-
Benzo [k] fluoranthene	0.02 ug/g dry	-	3.67	0.10	-
Chrysene	0.02 ug/g dry	-	4.30	0.22	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	-	0.61	0.03	-
Fluoranthene	0.02 ug/g dry	-	10.0	0.39	-
Fluorene	0.02 ug/g dry	-	1.62	0.06	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	-	2.34	0.09	-
1-Methylnaphthalene	0.02 ug/g dry	-	0.29	<0.02	-
2-Methylnaphthalene	0.02 ug/g dry	-	0.38	<0.02	-
Methylnaphthalene (1&2)	0.04 ug/g dry	-	0.67	<0.04	-
Naphthalene	0.01 ug/g dry	-	0.61	0.03	-
Phenanthrene	0.02 ug/g dry	-	12.4	0.41	-
Pyrene	0.02 ug/g dry	-	8.03	0.32	-
2-Fluorobiphenyl	Surrogate	-	109%	77.6%	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 23715

Report Date: 20-Apr-2018

Order Date: 13-Apr-2018

Project Description: PE4258

	Client ID:	BH5-18-SS4	BH6-18-SS2	BH7-18-SS2	-
	Sample Date:	04/11/2018 09:00	04/11/2018 12:00	04/11/2018 12:00	-
	Sample ID:	1815569-05	1815569-06	1815569-07	-
	MDL/Units	Soil	Soil	Soil	-
Terphenyl-d14	Surrogate	-	118%	103%	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Metals									
Antimony	ND	1	ug/g						
Arsenic	ND	1	ug/g						
Barium	ND	1	ug/g						
Beryllium	ND	0.5	ug/g						
Boron, available	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (VI)	ND	0.2	ug/g						
Chromium	ND	5	ug/g						
Cobalt	ND	1	ug/g						
Copper	ND	5	ug/g						
Lead	ND	1	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1	ug/g						
Nickel	ND	5	ug/g						
Selenium	ND	1	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1	ug/g						
Uranium	ND	1	ug/g						
Vanadium	ND	10	ug/g						
Zinc	ND	20	ug/g						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.26*		*ug/g*		*94.6*	*50-140*			
Surrogate: Terphenyl-d14	*1.12*		*ug/g*		*83.9*	*50-140*			
Volatiles									
Acetone	ND	0.50	ug/g						
Benzene	ND	0.02	ug/g						
Bromodichloromethane	ND	0.05	ug/g						
Bromoform	ND	0.05	ug/g						
Bromomethane	ND	0.05	ug/g						
Carbon Tetrachloride	ND	0.05	ug/g						
Chlorobenzene	ND	0.05	ug/g						
Chloroform	ND	0.05	ug/g						
Dibromochloromethane	ND	0.05	ug/g						

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Dichlorodifluoromethane	ND	0.05	ug/g						
1,2-Dichlorobenzene	ND	0.05	ug/g						
1,3-Dichlorobenzene	ND	0.05	ug/g						
1,4-Dichlorobenzene	ND	0.05	ug/g						
1,1-Dichloroethane	ND	0.05	ug/g						
1,2-Dichloroethane	ND	0.05	ug/g						
1,1-Dichloroethylene	ND	0.05	ug/g						
cis-1,2-Dichloroethylene	ND	0.05	ug/g						
trans-1,2-Dichloroethylene	ND	0.05	ug/g						
1,2-Dichloropropane	ND	0.05	ug/g						
cis-1,3-Dichloropropylene	ND	0.05	ug/g						
trans-1,3-Dichloropropylene	ND	0.05	ug/g						
1,3-Dichloropropene, total	ND	0.05	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Ethylene dibromide (dibromoethane	ND	0.05	ug/g						
Hexane	ND	0.05	ug/g						
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g						
Methyl Isobutyl Ketone	ND	0.50	ug/g						
Methyl tert-butyl ether	ND	0.05	ug/g						
Methylene Chloride	ND	0.05	ug/g						
Styrene	ND	0.05	ug/g						
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g						
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g						
Tetrachloroethylene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
1,1,1-Trichloroethane	ND	0.05	ug/g						
1,1,2-Trichloroethane	ND	0.05	ug/g						
Trichloroethylene	ND	0.05	ug/g						
Trichlorofluoromethane	ND	0.05	ug/g						
Vinyl chloride	ND	0.02	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: 4-Bromofluorobenzene	*8.30*		*ug/g*		*104*	*50-140*			
Surrogate: Dibromofluoromethane	*7.64*		*ug/g*		*95.6*	*50-140*			
Surrogate: Toluene-d8	*7.58*		*ug/g*		*94.7*	*50-140*			
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	*7.58*		*ug/g*		*94.7*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	54	4	ug/g dry	77			34.2	30	QR-04
F3 PHCs (C16-C34)	58	8	ug/g dry	75			27.0	30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Metals									
Antimony	ND	1	ug/g dry	ND			0.0	30	
Arsenic	5.4	1	ug/g dry	5.5			1.4	30	
Barium	69.7	1	ug/g dry	72.8			4.3	30	
Beryllium	ND	0.5	ug/g dry	ND				30	
Boron, available	0.58	0.5	ug/g dry	0.63			6.8	35	
Boron	15.7	5.0	ug/g dry	13.8			13.4	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium (VI)	ND	0.2	ug/g dry	ND				35	
Chromium	20.2	5	ug/g dry	21.2			5.2	30	
Cobalt	8.6	1	ug/g dry	9.2			7.1	30	
Copper	16.7	5	ug/g dry	17.7			6.0	30	
Lead	12.1	1	ug/g dry	12.7			5.0	30	
Mercury	ND	0.1	ug/g dry	ND			0.0	30	
Molybdenum	2.1	1	ug/g dry	2.0			5.5	30	
Nickel	23.5	5	ug/g dry	25.4			7.7	30	
Selenium	ND	1	ug/g dry	ND			0.0	30	
Silver	ND	0.3	ug/g dry	ND			0.0	30	
Thallium	ND	1	ug/g dry	ND			0.0	30	
Uranium	1.1	1	ug/g dry	1.2			3.9	30	
Vanadium	30.3	10	ug/g dry	31.6			4.3	30	
Zinc	44.5	20	ug/g dry	46.2			3.8	30	
Physical Characteristics									
% Solids	82.7	0.1	% by Wt.	79.2			4.3	25	
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g dry	ND				40	
Acenaphthylene	ND	0.02	ug/g dry	ND				40	
Anthracene	ND	0.02	ug/g dry	ND				40	
Benzo [a] anthracene	ND	0.02	ug/g dry	ND			0.0	40	
Benzo [a] pyrene	ND	0.02	ug/g dry	ND				40	
Benzo [b] fluoranthene	ND	0.02	ug/g dry	ND			0.0	40	
Benzo [g,h,i] perylene	ND	0.02	ug/g dry	ND			0.0	40	
Benzo [k] fluoranthene	ND	0.02	ug/g dry	ND				40	
Chrysene	ND	0.02	ug/g dry	ND			0.0	40	
Dibenzo [a,h] anthracene	ND	0.02	ug/g dry	ND				40	
Fluoranthene	ND	0.02	ug/g dry	ND			0.0	40	
Fluorene	ND	0.02	ug/g dry	ND				40	
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g dry	ND				40	
1-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
2-Methylnaphthalene	ND	0.02	ug/g dry	ND				40	
Naphthalene	ND	0.01	ug/g dry	ND				40	
Phenanthrene	ND	0.02	ug/g dry	ND				40	
Pyrene	ND	0.02	ug/g dry	ND			0.0	40	
Surrogate: 2-Fluorobiphenyl	*1.35*		*ug/g dry*		*79.0*	*50-140*			
Surrogate: Terphenyl-d14	*1.11*		*ug/g dry*		*65.0*	*50-140*			
Volatiles									
Acetone	ND	0.50	ug/g dry	ND				50	
Benzene	ND	0.02	ug/g dry	ND				50	
Bromodichloromethane	ND	0.05	ug/g dry	ND				50	
Bromoform	ND	0.05	ug/g dry	ND				50	
Bromomethane	ND	0.05	ug/g dry	ND				50	
Carbon Tetrachloride	ND	0.05	ug/g dry	ND				50	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Chlorobenzene	ND	0.05	ug/g dry	ND				50	
Chloroform	ND	0.05	ug/g dry	ND				50	
Dibromochloromethane	ND	0.05	ug/g dry	ND				50	
Dichlorodifluoromethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,3-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,4-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
1,2-Dichloropropane	ND	0.05	ug/g dry	ND				50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Ethylene dibromide (dibromoethane	ND	0.05	ug/g dry	ND				50	
Hexane	ND	0.05	ug/g dry	ND				50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g dry	ND				50	
Methyl Isobutyl Ketone	ND	0.50	ug/g dry	ND				50	
Methyl tert-butyl ether	ND	0.05	ug/g dry	ND				50	
Methylene Chloride	ND	0.05	ug/g dry	ND				50	
Styrene	ND	0.05	ug/g dry	ND				50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
Tetrachloroethylene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
1,1,1-Trichloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2-Trichloroethane	ND	0.05	ug/g dry	ND				50	
Trichloroethylene	ND	0.05	ug/g dry	ND				50	
Trichlorofluoromethane	ND	0.05	ug/g dry	ND				50	
Vinyl chloride	ND	0.02	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: 4-Bromofluorobenzene	*6.42*		*ug/g dry*		*108*	*50-140*			
Surrogate: Dibromofluoromethane	*4.65*		*ug/g dry*		*78.3*	*50-140*			
Surrogate: Toluene-d8	*6.36*		*ug/g dry*		*107*	*50-140*			
Benzene	ND	0.02	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	ND				50	
o-Xylene	ND	0.05	ug/g dry	ND				50	
Surrogate: Toluene-d8	*6.36*		*ug/g dry*		*107*	*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)	192	7	ug/g		96.0	80-120			
F2 PHCs (C10-C16)	197	4	ug/g	77	113	60-140			
F3 PHCs (C16-C34)	345	8	ug/g	75	123	60-140			
F4 PHCs (C34-C50)	187	6	ug/g	ND	128	60-140			
Metals									
Antimony	39.1		ug/L	ND	78.2	70-130			
Arsenic	41.2		ug/L	2.2	78.0	70-130			
Barium	75.8		ug/L	29.1	93.3	70-130			
Beryllium	47.1		ug/L	ND	94.2	70-130			
Boron, available	3.49	0.5	ug/g	0.63	57.3	70-122			QM-07
Boron	50.1		ug/L	5.5	89.2	70-130			
Cadmium	38.0		ug/L	ND	76.0	70-130			
Chromium (VI)	4.7	0.2	ug/g		93.5	70-130			
Chromium	53.4		ug/L	8.5	89.8	70-130			
Cobalt	48.8		ug/L	3.7	90.2	70-130			
Copper	52.2		ug/L	7.1	90.2	70-130			
Lead	54.8		ug/L	5.1	99.5	70-130			
Mercury	1.43	0.1	ug/g	ND	95.1	70-130			
Molybdenum	39.1		ug/L	ND	76.6	70-130			
Nickel	54.3		ug/L	10.1	88.2	70-130			
Selenium	37.6		ug/L	ND	75.2	70-130			
Silver	39.2		ug/L	ND	78.5	70-130			
Thallium	50.0		ug/L	ND	99.6	70-130			
Uranium	51.1		ug/L	ND	101	70-130			
Vanadium	57.7		ug/L	12.6	90.2	70-130			
Zinc	54.9		ug/L	ND	72.9	70-130			
Semi-Volatiles									
Acenaphthene	0.207	0.02	ug/g	ND	97.2	50-140			
Acenaphthylene	0.159	0.02	ug/g	ND	74.6	50-140			
Anthracene	0.134	0.02	ug/g	ND	62.8	50-140			
Benzo [a] anthracene	0.132	0.02	ug/g	ND	61.7	50-140			
Benzo [a] pyrene	0.126	0.02	ug/g	ND	58.9	50-140			
Benzo [b] fluoranthene	0.150	0.02	ug/g	ND	70.4	50-140			
Benzo [g,h,i] perylene	0.124	0.02	ug/g	ND	58.1	50-140			
Benzo [k] fluoranthene	0.126	0.02	ug/g	ND	59.0	50-140			
Chrysene	0.172	0.02	ug/g	ND	80.7	50-140			
Dibenzo [a,h] anthracene	0.120	0.02	ug/g	ND	56.4	50-140			
Fluoranthene	0.290	0.02	ug/g	ND	136	50-140			
Fluorene	0.173	0.02	ug/g	ND	81.3	50-140			
Indeno [1,2,3-cd] pyrene	0.128	0.02	ug/g	ND	60.1	50-140			
1-Methylnaphthalene	0.154	0.02	ug/g	ND	72.3	50-140			
2-Methylnaphthalene	0.168	0.02	ug/g	ND	78.6	50-140			
Naphthalene	0.173	0.01	ug/g	ND	81.0	50-140			
Phenanthrene	0.155	0.02	ug/g	ND	72.7	50-140			
Pyrene	0.290	0.02	ug/g	ND	136	50-140			
Surrogate: 2-Fluorobiphenyl	*1.29*		*ug/g*		*75.7*	*50-140*			
Volatiles									
Acetone	11.8	0.50	ug/g		118	50-140			
Benzene	4.89	0.02	ug/g		122	60-130			
Bromodichloromethane	3.85	0.05	ug/g		96.2	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Bromoform	3.96	0.05	ug/g		99.0	60-130			
Bromomethane	3.69	0.05	ug/g		92.2	50-140			
Carbon Tetrachloride	4.59	0.05	ug/g		115	60-130			
Chlorobenzene	3.83	0.05	ug/g		95.8	60-130			
Chloroform	4.30	0.05	ug/g		107	60-130			
Dibromochloromethane	3.78	0.05	ug/g		94.5	60-130			
Dichlorodifluoromethane	4.40	0.05	ug/g		110	50-140			
1,2-Dichlorobenzene	4.38	0.05	ug/g		109	60-130			
1,3-Dichlorobenzene	4.66	0.05	ug/g		116	60-130			
1,4-Dichlorobenzene	3.93	0.05	ug/g		98.4	60-130			
1,1-Dichloroethane	4.20	0.05	ug/g		105	60-130			
1,2-Dichloroethane	4.71	0.05	ug/g		118	60-130			
1,1-Dichloroethylene	3.79	0.05	ug/g		94.7	60-130			
cis-1,2-Dichloroethylene	4.55	0.05	ug/g		114	60-130			
trans-1,2-Dichloroethylene	3.96	0.05	ug/g		99.0	60-130			
1,2-Dichloropropane	4.66	0.05	ug/g		116	60-130			
cis-1,3-Dichloropropylene	4.46	0.05	ug/g		111	60-130			
trans-1,3-Dichloropropylene	4.28	0.05	ug/g		107	60-130			
Ethylbenzene	4.32	0.05	ug/g		108	60-130			
Ethylene dibromide (dibromoethane	3.80	0.05	ug/g		95.0	60-130			
Hexane	3.74	0.05	ug/g		93.5	60-130			
Methyl Ethyl Ketone (2-Butanone)	12.2	0.50	ug/g		122	50-140			
Methyl Isobutyl Ketone	12.8	0.50	ug/g		128	50-140			
Methyl tert-butyl ether	8.91	0.05	ug/g		89.1	50-140			
Methylene Chloride	4.66	0.05	ug/g		116	60-130			
Styrene	4.42	0.05	ug/g		111	60-130			
1,1,1,2-Tetrachloroethane	3.87	0.05	ug/g		96.6	60-130			
1,1,2,2-Tetrachloroethane	3.95	0.05	ug/g		98.7	60-130			
Tetrachloroethylene	3.77	0.05	ug/g		94.2	60-130			
Toluene	3.98	0.05	ug/g		99.4	60-130			
1,1,1-Trichloroethane	4.57	0.05	ug/g		114	60-130			
1,1,2-Trichloroethane	4.15	0.05	ug/g		104	60-130			
Trichloroethylene	3.69	0.05	ug/g		92.3	60-130			
Trichlorofluoromethane	4.05	0.05	ug/g		101	50-140			
Vinyl chloride	4.45	0.02	ug/g		111	50-140			
m,p-Xylenes	7.93	0.05	ug/g		99.2	60-130			
o-Xylene	4.25	0.05	ug/g		106	60-130			
Benzene	4.89	0.02	ug/g		122	60-130			
Ethylbenzene	4.32	0.05	ug/g		108	60-130			
Toluene	3.98	0.05	ug/g		99.4	60-130			
m,p-Xylenes	7.93	0.05	ug/g		99.2	60-130			
o-Xylene	4.25	0.05	ug/g		106	60-130			

Qualifier Notes:

QC Qualifiers :

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

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

Sample Data Revisions

None

Work Order Revisions / Comments:

Revision 1 - This report includes additional PAH data.

Other Report Notes:

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

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

CCME PHC additional information:

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

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Paracel ID: 1815569

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49-1947
@paracellabs.com

Chain of Custody
(Lab Use Only)
№ 114215

Page 1 of 1

Client Name: Paterson Group Inc.	Project Reference: PE4258
Contact Name: Kaitlyn Munch	Quote #
Address: 154 Colonnade Rd. S	PO # 23715
Telephone: 613.226.7381	Email Address: kmunch@patersongroup.ca

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

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

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

Required Analyses

Paracel Order Number: 1815569

	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	BH3-SS2	S		1	Apr.10/18	pm				✓	✓	✓	✓							250 mL
2	BH3-SS5	S		2	Apr.10/18	pm		✓												250 mL + vial
3	BH4-SS3	S		1	Apr.11/18	am			✓	✓	✓	✓	✓							120 mL
4	BH4-SS4	S		2	↓	am	✓													120 mL + vial
5	BH5-SS4	S		2	↓	am	✓													120 mL + vial
6	BH6-SS2	S		1	↓	pm			✓											120 mL
7	BH7-SS2	S		1	↓	pm			✓											120 mL
8																				
9																				
10																				

Comments:
*note all samples are BH3-18-SS2, BH3-18-SS5.... as per sample bottles

Method of Delivery: Paracel

Relinquished By (Sign): KMunch	Received by Driver/Depot: M. Sause	Received at Lab:	Verified By:
Relinquished By (Print): KMunch	Date/Time: 13/04/18 3:50 PM	Date/Time: April 13,18 4:50	Date/Time: April 13,18 4:53
Date/Time: April 13,2018	Temperature: °C	Temperature: 23.3 °C	pH Verified ☐ By:

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 23854
Project: PE4258
Custody:

Report Date: 8-May-2018
Order Date: 2-May-2018

Order #: 1818389

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

Paracel ID	Client ID
1818389-01	BH2-18-SS2

Approved By:

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23854

Report Date: 08-May-2018
Order Date: 2-May-2018
Project Description: PE4258

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Boron, available	MOE (HWE), EPA 200.7 - ICP-OES	4-May-18	4-May-18
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	1-May-18	3-May-18
Mercury by CVAA	EPA 7471B - CVAA, digestion	8-May-18	8-May-18
Metals, ICP-MS	EPA 6020 - Digestion - ICP-MS	4-May-18	4-May-18
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	2-May-18	4-May-18
Solids, %	Gravimetric, calculation	4-May-18	4-May-18

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 23854

Report Date: 08-May-2018

Order Date: 2-May-2018

Project Description: PE4258

	Client ID:	BH2-18-SS2	-	-	-
	Sample Date:	04/10/2018 09:00	-	-	-
	Sample ID:	1818389-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	80.5	-	-	-
Metals					
Antimony	1 ug/g dry	<1	-	-	-
Arsenic	1 ug/g dry	16	-	-	-
Barium	1 ug/g dry	145	-	-	-
Beryllium	0.5 ug/g dry	0.8	-	-	-
Boron	5.0 ug/g dry	<5.0	-	-	-
Boron, available	0.5 ug/g dry	<0.5	-	-	-
Cadmium	0.5 ug/g dry	<0.5	-	-	-
Chromium	5 ug/g dry	19	-	-	-
Chromium (VI)	0.2 ug/g dry	<0.2	-	-	-
Cobalt	1 ug/g dry	12	-	-	-
Copper	5 ug/g dry	51	-	-	-
Lead	1 ug/g dry	84	-	-	-
Mercury	0.1 ug/g dry	0.2	-	-	-
Molybdenum	1 ug/g dry	4	-	-	-
Nickel	5 ug/g dry	28	-	-	-
Selenium	1 ug/g dry	<1	-	-	-
Silver	0.3 ug/g dry	<0.3	-	-	-
Thallium	1 ug/g dry	<1	-	-	-
Uranium	1 ug/g dry	<1	-	-	-
Vanadium	10 ug/g dry	40	-	-	-
Zinc	20 ug/g dry	212	-	-	-
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	-	-	-
Acenaphthylene	0.02 ug/g dry	<0.02	-	-	-
Anthracene	0.02 ug/g dry	0.04	-	-	-
Benzo [a] anthracene	0.02 ug/g dry	0.03	-	-	-
Benzo [a] pyrene	0.02 ug/g dry	0.04	-	-	-
Benzo [b] fluoranthene	0.02 ug/g dry	0.04	-	-	-
Benzo [g,h,i] perylene	0.02 ug/g dry	0.03	-	-	-
Benzo [k] fluoranthene	0.02 ug/g dry	0.03	-	-	-
Chrysene	0.02 ug/g dry	0.06	-	-	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	-	-	-
Fluoranthene	0.02 ug/g dry	0.07	-	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23854

Report Date: 08-May-2018
Order Date: 2-May-2018
Project Description: PE4258

	Client ID:	BH2-18-SS2	-	-	-
	Sample Date:	04/10/2018 09:00	-	-	-
	Sample ID:	1818389-01	-	-	-
	MDL/Units	Soil	-	-	-
Fluorene	0.02 ug/g dry	<0.02	-	-	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	0.03	-	-	-
1-Methylnaphthalene	0.02 ug/g dry	<0.02	-	-	-
2-Methylnaphthalene	0.02 ug/g dry	<0.02	-	-	-
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	-	-	-
Naphthalene	0.01 ug/g dry	<0.01	-	-	-
Phenanthrene	0.02 ug/g dry	0.03	-	-	-
Pyrene	0.02 ug/g dry	0.07	-	-	-
2-Fluorobiphenyl	Surrogate	109%	-	-	-
Terphenyl-d14	Surrogate	118%	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	ND	1	ug/g						
Arsenic	ND	1	ug/g						
Barium	ND	1	ug/g						
Beryllium	ND	0.5	ug/g						
Boron, available	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (VI)	ND	0.2	ug/g						
Chromium	ND	5	ug/g						
Cobalt	ND	1	ug/g						
Copper	ND	5	ug/g						
Lead	ND	1	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1	ug/g						
Nickel	ND	5	ug/g						
Selenium	ND	1	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1	ug/g						
Uranium	ND	1	ug/g						
Vanadium	ND	10	ug/g						
Zinc	ND	20	ug/g						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.37*		*ug/g*		*103*	*50-140*			
Surrogate: Terphenyl-d14	*1.67*		*ug/g*		*125*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	ND	1	ug/g dry	ND				30	
Arsenic	6.1	1	ug/g dry	6.8			10.6	30	
Barium	44.2	1	ug/g dry	47.0			6.3	30	
Beryllium	ND	0.5	ug/g dry	ND			0.0	30	
Boron, available	ND	0.5	ug/g dry	ND			0.0	35	
Boron	12.4	5.0	ug/g dry	12.6			1.3	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium (VI)	ND	0.2	ug/g dry	ND				35	
Chromium	9.7	5	ug/g dry	10.2			4.7	30	
Cobalt	4.1	1	ug/g dry	4.3			6.3	30	
Copper	13.8	5	ug/g dry	14.7			6.4	30	
Lead	8.5	1	ug/g dry	9.0			5.7	30	
Mercury	ND	0.1	ug/g dry	ND			0.0	30	
Molybdenum	2.8	1	ug/g dry	3.1			10.3	30	
Nickel	11.1	5	ug/g dry	12.4			10.9	30	
Selenium	ND	1	ug/g dry	ND			0.0	30	
Silver	1.32	0.3	ug/g dry	1.03			24.9	30	
Thallium	ND	1	ug/g dry	ND			0.0	30	
Uranium	ND	1	ug/g dry	ND				30	
Vanadium	20.5	10	ug/g dry	21.5			4.7	30	
Zinc	39.4	20	ug/g dry	42.4			7.3	30	
Physical Characteristics									
% Solids	88.1	0.1	% by Wt.	90.0			2.1	25	
Semi-Volatiles									
Acenaphthene	1.14	0.02	ug/g dry	1.62			34.9	40	
Acenaphthylene	0.112	0.02	ug/g dry	0.129			14.0	40	
Anthracene	ND	0.02	ug/g dry	ND				40	
Benzo [a] anthracene	ND	0.02	ug/g dry	0.677			0.0	40	
Benzo [a] pyrene	ND	0.02	ug/g dry	0.489			0.0	40	
Benzo [b] fluoranthene	ND	0.02	ug/g dry	0.615			0.0	40	
Benzo [g,h,i] perylene	ND	0.02	ug/g dry	0.280			0.0	40	
Benzo [k] fluoranthene	ND	0.02	ug/g dry	0.353			0.0	40	
Chrysene	ND	0.02	ug/g dry	0.757			0.0	40	
Dibenzo [a,h] anthracene	ND	0.02	ug/g dry	0.080			0.0	40	
Fluoranthene	0.049	0.02	ug/g dry	2.00			190.0	40	QR-04
Fluorene	0.442	0.02	ug/g dry	1.91			125.0	40	QR-04
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g dry	0.266			0.0	40	
1-Methylnaphthalene	9.19	0.02	ug/g dry	10.9			17.3	40	
2-Methylnaphthalene	13.8	0.02	ug/g dry	15.1			9.3	40	
Naphthalene	2.13	0.01	ug/g dry	1.62			27.5	40	
Phenanthrene	2.28	0.02	ug/g dry	6.66			97.8	40	QR-04
Pyrene	0.118	0.02	ug/g dry	1.44			170.0	40	QR-04
Surrogate: 2-Fluorobiphenyl	*1.64*		*ug/g dry*		*110*	*50-140*			
Surrogate: Terphenyl-d14	*1.67*		*ug/g dry*		*112*	*50-140*			

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23854

Report Date: 08-May-2018
Order Date: 2-May-2018
Project Description: PE4258

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	48.9		ug/L	ND	97.7	70-130			
Arsenic	58.4		ug/L	2.7	111	70-130			
Barium	73.9		ug/L	18.8	110	70-130			
Beryllium	42.4		ug/L	ND	84.5	70-130			
Boron, available	4.06	0.5	ug/g	ND	81.3	70-122			
Boron	43.4		ug/L	5.0	76.7	70-130			
Cadmium	43.0		ug/L	ND	85.9	70-130			
Chromium (VI)	4.5	0.2	ug/g		89.5	70-130			
Chromium	51.5		ug/L	ND	94.8	70-130			
Cobalt	46.7		ug/L	1.7	89.9	70-130			
Copper	51.2		ug/L	5.9	90.6	70-130			
Lead	45.8		ug/L	3.6	84.4	70-130			
Mercury	1.47	0.1	ug/g	ND	97.9	70-130			
Molybdenum	47.9		ug/L	1.3	93.4	70-130			
Nickel	50.5		ug/L	5.0	91.0	70-130			
Selenium	45.7		ug/L	ND	91.4	70-130			
Silver	42.8		ug/L	0.41	84.8	70-130			
Thallium	44.2		ug/L	ND	88.1	70-130			
Uranium	44.6		ug/L	ND	89.2	70-130			
Vanadium	57.5		ug/L	ND	97.7	70-130			
Zinc	63.2		ug/L	ND	92.5	70-130			
Semi-Volatiles									
Acenaphthene	0.192	0.02	ug/g		115	50-140			
Acenaphthylene	0.160	0.02	ug/g		96.1	50-140			
Anthracene	0.152	0.02	ug/g		91.2	50-140			
Benzo [a] anthracene	0.118	0.02	ug/g		70.6	50-140			
Benzo [a] pyrene	0.123	0.02	ug/g		74.1	50-140			
Benzo [b] fluoranthene	0.175	0.02	ug/g		105	50-140			
Benzo [g,h,i] perylene	0.136	0.02	ug/g		81.9	50-140			
Benzo [k] fluoranthene	0.152	0.02	ug/g		91.2	50-140			
Chrysene	0.153	0.02	ug/g		91.7	50-140			
Dibenzo [a,h] anthracene	0.144	0.02	ug/g		86.2	50-140			
Fluoranthene	0.154	0.02	ug/g		92.3	50-140			
Fluorene	0.171	0.02	ug/g		103	50-140			
Indeno [1,2,3-cd] pyrene	0.140	0.02	ug/g		84.2	50-140			
1-Methylnaphthalene	0.150	0.02	ug/g		89.8	50-140			
2-Methylnaphthalene	0.158	0.02	ug/g		95.1	50-140			
Naphthalene	0.172	0.01	ug/g		103	50-140			
Phenanthrene	0.140	0.02	ug/g		84.1	50-140			
Pyrene	0.160	0.02	ug/g		96.3	50-140			
Surrogate: 2-Fluorobiphenyl	*1.42*		*ug/g*		*107*	*50-140*			

Qualifier Notes:

Login Qualifiers :

Container(s) - Bottle and COC sample ID don't match -
Applies to samples: BH2-18-SS2

QC Qualifiers :

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

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

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

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Paracel ID: 1818389

e: paracel@paracellabs.com

Chain of Custody (Lab Use Only)

№ 116705

Page ___ of ___

Client Name: Paterson Group	Project Reference: PE4258.
Contact Name: Karyn Munch	Quote #
Address: 154 Colonnade Rd S.	PO # 23854
Telephone: (613) 226-7381	Email Address: kmunch@patersongroup.ca

Turnaround Time:

☐ 1 Day ☐ 3 Day

☐ 2 Day ☒ Regular

Date Required: ___

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

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

Required Analyses

Paracel Order Number: 1818389

	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	BH2-18-SS2.	S		1	Apr 10/18				✓	✓	✓	✓	✓	250 mL soil						
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments: Please let me know if Hg is expired! Thanks! OGIU

Lid Reads BH2-18-SS2. Report as BH2-18-SS1 SS2 Name on jar reads BH2-18-SS1

Method of Delivery: Paracel

Relinquished By (Sign): KMunch	Received by Driver/Depot: A. Deause	Received at Lab:	Verified By:
Relinquished By (Print): KMunch	Date/Time: 02/05/18 4:00 pm	Date/Time: May 2 2018 5pm	Date/Time: 05/02/18 8:04
Date/Time: May 2, 2018 2:50.	Temperature: ___ °C	Temperature: 21.2 °C	pH Verified [ ] By: ___

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 23719
Project: PE4258
Custody: 107023

Report Date: 27-Apr-2018
Order Date: 23-Apr-2018

Order #: 1817102

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

Paracel ID	Client ID
1817102-01	BH1-18-GW1
1817102-02	BH3-18-GW1
1817102-03	BH4-18-GW1
1817102-04	BH5-18-GW1

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23719

Report Date: 27-Apr-2018
Order Date: 23-Apr-2018
Project Description: PE4258

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Chromium, hexavalent - water	MOE E3056 - colourimetric	24-Apr-18	24-Apr-18
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	24-Apr-18	24-Apr-18
Metals, ICP-MS	EPA 200.8 - ICP-MS	25-Apr-18	25-Apr-18
PHC F1	CWS Tier 1 - P&T GC-FID	25-Apr-18	26-Apr-18
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	26-Apr-18	26-Apr-18
REG 153: PAHs by GC-MS	EPA 625 - GC-MS, extraction	26-Apr-18	26-Apr-18
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	25-Apr-18	26-Apr-18

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 23719

Report Date: 27-Apr-2018

Order Date: 23-Apr-2018

Project Description: PE4258

	Client ID:	BH1-18-GW1	BH3-18-GW1	BH4-18-GW1	BH5-18-GW1
	Sample Date:	04/20/2018 09:00	04/20/2018 09:00	04/20/2018 09:00	04/20/2018 09:00
	Sample ID:	1817102-01	1817102-02	1817102-03	1817102-04
	MDL/Units	Water	Water	Water	Water
Metals					
Mercury	0.1 ug/L	<0.1	<0.1	<0.1	-
Antimony	0.5 ug/L	<0.5	<0.5	<0.5	-
Arsenic	1 ug/L	<1	<1	<1	-
Barium	1 ug/L	116	459	66	-
Beryllium	0.5 ug/L	<0.5	<0.5	<0.5	-
Boron	10 ug/L	103	153	38	-
Cadmium	0.1 ug/L	<0.1	<0.1	<0.1	-
Chromium	1 ug/L	<1	<1	<1	-
Chromium (VI)	10 ug/L	<10	<10	<10	-
Cobalt	0.5 ug/L	<0.5	<0.5	1.8	-
Copper	0.5 ug/L	6.2	11.5	6.9	-
Lead	0.1 ug/L	<0.1	<0.1	<0.1	-
Molybdenum	0.5 ug/L	<0.5	<0.5	1.3	-
Nickel	1 ug/L	5	7	20	-
Selenium	1 ug/L	<1	<1	<1	-
Silver	0.1 ug/L	<0.1	<0.1	<0.1	-
Sodium	200 ug/L	785000	1360000	7120	-
Thallium	0.1 ug/L	<0.1	<0.1	<0.1	-
Uranium	0.1 ug/L	0.6	0.5	14.3	-
Vanadium	0.5 ug/L	2.3	3.3	5.2	-
Zinc	5 ug/L	<5	<5	<5	-
Volatiles					
Acetone	5.0 ug/L	-	<5.0	<5.0	<5.0
Benzene	0.5 ug/L	-	<0.5	<0.5	<0.5
Bromodichloromethane	0.5 ug/L	-	<0.5	<0.5	<0.5
Bromoform	0.5 ug/L	-	<0.5	<0.5	<0.5
Bromomethane	0.5 ug/L	-	<0.5	<0.5	<0.5
Carbon Tetrachloride	0.2 ug/L	-	<0.2	<0.2	<0.2
Chlorobenzene	0.5 ug/L	-	<0.5	<0.5	<0.5
Chloroform	0.5 ug/L	-	<0.5	<0.5	<0.5
Dibromochloromethane	0.5 ug/L	-	<0.5	<0.5	<0.5
Dichlorodifluoromethane	1.0 ug/L	-	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	0.5 ug/L	-	<0.5	<0.5	<0.5
1,3-Dichlorobenzene	0.5 ug/L	-	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	0.5 ug/L	-	<0.5	<0.5	<0.5

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 23719

Report Date: 27-Apr-2018

Order Date: 23-Apr-2018

Project Description: PE4258

	Client ID:	BH1-18-GW1	BH3-18-GW1	BH4-18-GW1	BH5-18-GW1
	Sample Date:	04/20/2018 09:00	04/20/2018 09:00	04/20/2018 09:00	04/20/2018 09:00
	Sample ID:	1817102-01	1817102-02	1817102-03	1817102-04
	MDL/Units	Water	Water	Water	Water
1,1-Dichloroethane	0.5 ug/L	-	<0.5	<0.5	<0.5
1,2-Dichloroethane	0.5 ug/L	-	<0.5	<0.5	<0.5
1,1-Dichloroethylene	0.5 ug/L	-	<0.5	<0.5	<0.5
cis-1,2-Dichloroethylene	0.5 ug/L	-	<0.5	<0.5	<0.5
trans-1,2-Dichloroethylene	0.5 ug/L	-	<0.5	<0.5	<0.5
1,2-Dichloropropane	0.5 ug/L	-	<0.5	<0.5	<0.5
cis-1,3-Dichloropropylene	0.5 ug/L	-	<0.5	<0.5	<0.5
trans-1,3-Dichloropropylene	0.5 ug/L	-	<0.5	<0.5	<0.5
1,3-Dichloropropene, total	0.5 ug/L	-	<0.5	<0.5	<0.5
Ethylbenzene	0.5 ug/L	-	<0.5	<0.5	<0.5
Ethylene dibromide (dibromoethan	0.2 ug/L	-	<0.2	<0.2	<0.2
Hexane	1.0 ug/L	-	<1.0	<1.0	<1.0
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	-	<5.0	<5.0	<5.0
Methyl Isobutyl Ketone	5.0 ug/L	-	<5.0	<5.0	<5.0
Methyl tert-butyl ether	2.0 ug/L	-	<2.0	<2.0	<2.0
Methylene Chloride	5.0 ug/L	-	<5.0	<5.0	<5.0
Styrene	0.5 ug/L	-	<0.5	<0.5	<0.5
1,1,1,2-Tetrachloroethane	0.5 ug/L	-	<0.5	<0.5	<0.5
1,1,2,2-Tetrachloroethane	0.5 ug/L	-	<0.5	<0.5	<0.5
Tetrachloroethylene	0.5 ug/L	-	<0.5	<0.5	<0.5
Toluene	0.5 ug/L	-	<0.5	<0.5	<0.5
1,1,1-Trichloroethane	0.5 ug/L	-	<0.5	<0.5	<0.5
1,1,2-Trichloroethane	0.5 ug/L	-	<0.5	<0.5	<0.5
Trichloroethylene	0.5 ug/L	-	<0.5	<0.5	<0.5
Trichlorofluoromethane	1.0 ug/L	-	<1.0	<1.0	<1.0
Vinyl chloride	0.5 ug/L	-	<0.5	<0.5	<0.5
m,p-Xylenes	0.5 ug/L	-	<0.5	<0.5	<0.5
o-Xylene	0.5 ug/L	-	<0.5	<0.5	<0.5
Xylenes, total	0.5 ug/L	-	<0.5	<0.5	<0.5
4-Bromofluorobenzene	Surrogate	-	105%	106%	113%
Dibromofluoromethane	Surrogate	-	83.6%	89.4%	85.8%
Toluene-d8	Surrogate	-	105%	96.2%	103%
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	-	<25	<25	<25
F2 PHCs (C10-C16)	100 ug/L	-	<100	<100	<100
F3 PHCs (C16-C34)	100 ug/L	-	<100	<100	<100

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 23719

Report Date: 27-Apr-2018

Order Date: 23-Apr-2018

Project Description: PE4258

	Client ID:	BH1-18-GW1	BH3-18-GW1	BH4-18-GW1	BH5-18-GW1
	Sample Date:	04/20/2018 09:00	04/20/2018 09:00	04/20/2018 09:00	04/20/2018 09:00
	Sample ID:	1817102-01	1817102-02	1817102-03	1817102-04
	MDL/Units	Water	Water	Water	Water
F4 PHCs (C34-C50)	100 ug/L	-	<100	<100	<100
Semi-Volatiles					
Acenaphthene	0.05 ug/L	<0.05	<0.05 [1]	<0.05 [1]	-
Acenaphthylene	0.05 ug/L	<0.05	<0.05 [1]	<0.05 [1]	-
Anthracene	0.01 ug/L	<0.01	<0.01 [1]	<0.01 [1]	-
Benzo [a] anthracene	0.01 ug/L	<0.01	<0.01 [1]	<0.01 [1]	-
Benzo [a] pyrene	0.01 ug/L	<0.01	<0.01 [1]	<0.01 [1]	-
Benzo [b] fluoranthene	0.05 ug/L	<0.05	<0.05 [1]	<0.05 [1]	-
Benzo [g,h,i] perylene	0.05 ug/L	<0.05	<0.05 [1]	<0.05 [1]	-
Benzo [k] fluoranthene	0.05 ug/L	<0.05	<0.05 [1]	<0.05 [1]	-
Chrysene	0.05 ug/L	<0.05	<0.05 [1]	<0.05 [1]	-
Dibenzo [a,h] anthracene	0.05 ug/L	<0.05	<0.05 [1]	<0.05 [1]	-
Fluoranthene	0.01 ug/L	<0.01	<0.01 [1]	<0.01 [1]	-
Fluorene	0.05 ug/L	<0.05	<0.05 [1]	<0.05 [1]	-
Indeno [1,2,3-cd] pyrene	0.05 ug/L	<0.05	<0.05 [1]	<0.05 [1]	-
1-Methylnaphthalene	0.05 ug/L	<0.05	<0.05 [1]	<0.05 [1]	-
2-Methylnaphthalene	0.05 ug/L	<0.05	<0.05 [1]	<0.05 [1]	-
Methylnaphthalene (1&2)	0.10 ug/L	<0.10	<0.10 [1]	<0.10 [1]	-
Naphthalene	0.05 ug/L	<0.05	<0.05 [1]	<0.05 [1]	-
Phenanthrene	0.05 ug/L	<0.05	<0.05 [1]	<0.05 [1]	-
Pyrene	0.01 ug/L	<0.01	<0.01 [1]	<0.01 [1]	-
2-Fluorobiphenyl	Surrogate	106%	-	-	-
Terphenyl-d14	Surrogate	123%	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Metals									
Mercury	ND	0.1	ug/L						
Antimony	ND	0.5	ug/L						
Arsenic	ND	1	ug/L						
Barium	ND	1	ug/L						
Beryllium	ND	0.5	ug/L						
Boron	ND	10	ug/L						
Cadmium	ND	0.1	ug/L						
Chromium (VI)	ND	10	ug/L						
Chromium	ND	1	ug/L						
Cobalt	ND	0.5	ug/L						
Copper	ND	0.5	ug/L						
Lead	ND	0.1	ug/L						
Molybdenum	ND	0.5	ug/L						
Nickel	ND	1	ug/L						
Selenium	ND	1	ug/L						
Silver	ND	0.1	ug/L						
Sodium	ND	200	ug/L						
Thallium	ND	0.1	ug/L						
Uranium	ND	0.1	ug/L						
Vanadium	ND	0.5	ug/L						
Zinc	ND	5	ug/L						
Semi-Volatiles									
Acenaphthene	ND	0.05	ug/L						
Acenaphthylene	ND	0.05	ug/L						
Anthracene	ND	0.01	ug/L						
Benzo [a] anthracene	ND	0.01	ug/L						
Benzo [a] pyrene	ND	0.01	ug/L						
Benzo [b] fluoranthene	ND	0.05	ug/L						
Benzo [g,h,i] perylene	ND	0.05	ug/L						
Benzo [k] fluoranthene	ND	0.05	ug/L						
Chrysene	ND	0.05	ug/L						
Dibenzo [a,h] anthracene	ND	0.05	ug/L						
Fluoranthene	ND	0.01	ug/L						
Fluorene	ND	0.05	ug/L						
Indeno [1,2,3-cd] pyrene	ND	0.05	ug/L						
1-Methylnaphthalene	ND	0.05	ug/L						
2-Methylnaphthalene	ND	0.05	ug/L						
Methylnaphthalene (1&2)	ND	0.10	ug/L						
Naphthalene	ND	0.05	ug/L						
Phenanthrene	ND	0.05	ug/L						
Pyrene	ND	0.01	ug/L						
Surrogate: 2-Fluorobiphenyl	*18.7*		*ug/L*		*93.3*	*50-140*			
Surrogate: Terphenyl-d14	*20.9*		*ug/L*		*105*	*50-140*			
Volatiles									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23719

Report Date: 27-Apr-2018
Order Date: 23-Apr-2018
Project Description: PE4258

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane	ND	0.2	ug/L						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
Methyl Isobutyl Ketone	ND	5.0	ug/L						
Methyl tert-butyl ether	ND	2.0	ug/L						
Methylene Chloride	ND	5.0	ug/L						
Styrene	ND	0.5	ug/L						
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L						
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L						
Tetrachloroethylene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
1,1,1-Trichloroethane	ND	0.5	ug/L						
1,1,2-Trichloroethane	ND	0.5	ug/L						
Trichloroethylene	ND	0.5	ug/L						
Trichlorofluoromethane	ND	1.0	ug/L						
Vinyl chloride	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: 4-Bromofluorobenzene	*91.5*		*ug/L*		*114*	*50-140*			
Surrogate: Dibromofluoromethane	*74.8*		*ug/L*		*93.6*	*50-140*			
Surrogate: Toluene-d8	*86.2*		*ug/L*		*108*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND				30	
Metals									
Mercury	ND	0.1	ug/L	ND			0.0	20	
Antimony	0.59	0.5	ug/L	ND			0.0	20	
Arsenic	ND	1	ug/L	ND			0.0	20	
Barium	52.9	1	ug/L	53.7			1.5	20	
Beryllium	ND	0.5	ug/L	ND			0.0	20	
Boron	20	10	ug/L	19			6.0	20	
Cadmium	ND	0.1	ug/L	ND			0.0	20	
Chromium (VI)	ND	10	ug/L	ND				20	
Chromium	7.9	1	ug/L	8.1			3.2	20	
Cobalt	0.78	0.5	ug/L	0.75			5.0	20	
Copper	43.2	0.5	ug/L	41.9			2.8	20	
Lead	91.0	0.1	ug/L	91.3			0.3	20	
Molybdenum	0.83	0.5	ug/L	0.68			19.9	20	
Nickel	8.6	1	ug/L	8.5			1.2	20	
Selenium	ND	1	ug/L	ND			0.0	20	
Silver	ND	0.1	ug/L	ND			0.0	20	
Sodium	44700	20000	ug/L	44200			1.3	20	
Thallium	ND	0.1	ug/L	ND			0.0	20	
Uranium	0.7	0.1	ug/L	0.7			2.7	20	
Vanadium	2.55	0.5	ug/L	2.60			2.0	20	
Zinc	185	5	ug/L	184			0.7	20	
Volatiles									
Acetone	ND	5.0	ug/L	ND				30	
Benzene	ND	0.5	ug/L	ND				30	
Bromodichloromethane	ND	0.5	ug/L	ND				30	
Bromoform	ND	0.5	ug/L	ND				30	
Bromomethane	ND	0.5	ug/L	ND				30	
Carbon Tetrachloride	ND	0.2	ug/L	ND				30	
Chlorobenzene	ND	0.5	ug/L	ND				30	
Chloroform	ND	0.5	ug/L	ND				30	
Dibromochloromethane	ND	0.5	ug/L	ND				30	
Dichlorodifluoromethane	ND	1.0	ug/L	ND				30	
1,2-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,3-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,4-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,1-Dichloroethane	ND	0.5	ug/L	ND				30	
1,2-Dichloroethane	ND	0.5	ug/L	ND				30	
1,1-Dichloroethylene	ND	0.5	ug/L	ND				30	
cis-1,2-Dichloroethylene	ND	0.5	ug/L	ND				30	
trans-1,2-Dichloroethylene	ND	0.5	ug/L	ND				30	
1,2-Dichloropropane	ND	0.5	ug/L	ND				30	
cis-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
trans-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Ethylene dibromide (dibromoethane	ND	0.2	ug/L	ND				30	
Hexane	ND	1.0	ug/L	ND				30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND				30	
Methyl Isobutyl Ketone	ND	5.0	ug/L	ND				30	
Methyl tert-butyl ether	ND	2.0	ug/L	ND				30	
Methylene Chloride	ND	5.0	ug/L	ND				30	
Styrene	ND	0.5	ug/L	ND				30	
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
Tetrachloroethylene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23719

Report Date: 27-Apr-2018
Order Date: 23-Apr-2018
Project Description: PE4258

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1,1,1-Trichloroethane	ND	0.5	ug/L	ND				30	
1,1,2-Trichloroethane	ND	0.5	ug/L	ND				30	
Trichloroethylene	ND	0.5	ug/L	ND				30	
Trichlorofluoromethane	ND	1.0	ug/L	ND				30	
Vinyl chloride	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: 4-Bromofluorobenzene	*85.4*		*ug/L*		*107*	*50-140*			
Surrogate: Dibromofluoromethane	*67.2*		*ug/L*		*84.0*	*50-140*			
Surrogate: Toluene-d8	*80.9*		*ug/L*		*101*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1960	25	ug/L		97.9	68-117			
F2 PHCs (C10-C16)	2020	100	ug/L		112	60-140			
F3 PHCs (C16-C34)	3630	100	ug/L		97.5	60-140			
F4 PHCs (C34-C50)	2500	100	ug/L		101	60-140			
Metals									
Mercury	3.06	0.1	ug/L	ND	102	70-130			
Antimony	42.7		ug/L	ND	84.8	80-120			
Arsenic	47.9		ug/L	ND	95.1	80-120			
Barium	95.5		ug/L	53.7	83.6	80-120			
Beryllium	47.2		ug/L	ND	94.0	80-120			
Boron	62		ug/L	19	86.0	80-120			
Cadmium	42.1		ug/L	0.10	84.1	80-120			
Chromium (VI)	203	10	ug/L	ND	102	70-130			
Chromium	52.2		ug/L	8.1	88.1	80-120			
Cobalt	44.8		ug/L	0.75	88.2	80-120			
Copper	82.2		ug/L	41.9	80.4	80-120			
Lead	132		ug/L	91.3	82.2	80-120			
Molybdenum	41.2		ug/L	0.68	81.1	80-120			
Nickel	50.6		ug/L	8.5	84.4	80-120			
Selenium	50.6		ug/L	ND	99.5	80-120			
Silver	38.1		ug/L	ND	76.2	80-120			QM-07
Sodium	955		ug/L		95.5	80-120			
Thallium	46.8		ug/L	ND	93.5	80-120			
Uranium	49.3		ug/L	0.7	97.3	80-120			
Vanadium	48.1		ug/L	2.60	91.1	80-120			
Zinc	43		ug/L	ND	83.1	80-120			
Semi-Volatiles									
Acenaphthene	4.28	0.05	ug/L		85.6	50-140			
Acenaphthylene	3.75	0.05	ug/L		74.9	50-140			
Anthracene	3.56	0.01	ug/L		71.1	50-140			
Benzo [a] anthracene	3.51	0.01	ug/L		70.2	50-140			
Benzo [a] pyrene	3.75	0.01	ug/L		75.1	50-140			
Benzo [b] fluoranthene	4.80	0.05	ug/L		95.9	50-140			
Benzo [g,h,i] perylene	3.65	0.05	ug/L		73.1	50-140			
Benzo [k] fluoranthene	5.09	0.05	ug/L		102	50-140			
Chrysene	4.24	0.05	ug/L		84.8	50-140			
Dibenzo [a,h] anthracene	3.75	0.05	ug/L		75.0	50-140			
Fluoranthene	3.84	0.01	ug/L		76.8	50-140			
Fluorene	4.03	0.05	ug/L		80.5	50-140			
Indeno [1,2,3-cd] pyrene	3.84	0.05	ug/L		76.7	50-140			
1-Methylnaphthalene	4.01	0.05	ug/L		80.2	50-140			
2-Methylnaphthalene	4.41	0.05	ug/L		88.3	50-140			
Naphthalene	3.98	0.05	ug/L		79.6	50-140			
Phenanthrene	3.72	0.05	ug/L		74.4	50-140			
Pyrene	4.04	0.01	ug/L		80.9	50-140			
Surrogate: 2-Fluorobiphenyl	*17.2*		*ug/L*		*85.9*	*50-140*			
Volatiles									
Acetone	99.3	5.0	ug/L		99.3	50-140			
Benzene	32.8	0.5	ug/L		82.1	60-130			
Bromodichloromethane	33.2	0.5	ug/L		83.1	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Bromoform	28.9	0.5	ug/L		72.2	60-130			
Bromomethane	28.8	0.5	ug/L		71.9	50-140			
Carbon Tetrachloride	33.0	0.2	ug/L		82.4	60-130			
Chlorobenzene	27.8	0.5	ug/L		69.6	60-130			
Chloroform	35.1	0.5	ug/L		87.7	60-130			
Dibromochloromethane	30.4	0.5	ug/L		76.1	60-130			
Dichlorodifluoromethane	35.5	1.0	ug/L		88.8	50-140			
1,2-Dichlorobenzene	29.9	0.5	ug/L		74.8	60-130			
1,3-Dichlorobenzene	31.5	0.5	ug/L		78.7	60-130			
1,4-Dichlorobenzene	29.4	0.5	ug/L		73.5	60-130			
1,1-Dichloroethane	35.0	0.5	ug/L		87.5	60-130			
1,2-Dichloroethane	34.2	0.5	ug/L		85.5	60-130			
1,1-Dichloroethylene	37.4	0.5	ug/L		93.6	60-130			
cis-1,2-Dichloroethylene	34.0	0.5	ug/L		85.1	60-130			
trans-1,2-Dichloroethylene	39.6	0.5	ug/L		99.1	60-130			
1,2-Dichloropropane	32.9	0.5	ug/L		82.3	60-130			
cis-1,3-Dichloropropylene	27.3	0.5	ug/L		68.3	60-130			
trans-1,3-Dichloropropylene	32.3	0.5	ug/L		80.7	60-130			
Ethylbenzene	30.6	0.5	ug/L		76.6	60-130			
Ethylene dibromide (dibromoethane	29.7	0.2	ug/L		74.2	60-130			
Hexane	32.6	1.0	ug/L		81.6	60-130			
Methyl Ethyl Ketone (2-Butanone)	97.7	5.0	ug/L		97.7	50-140			
Methyl Isobutyl Ketone	90.6	5.0	ug/L		90.6	50-140			
Methyl tert-butyl ether	68.7	2.0	ug/L		68.7	50-140			
Methylene Chloride	34.4	5.0	ug/L		86.1	60-130			
Styrene	29.1	0.5	ug/L		72.8	60-130			
1,1,1,2-Tetrachloroethane	30.7	0.5	ug/L		76.7	60-130			
1,1,2,2-Tetrachloroethane	31.2	0.5	ug/L		78.1	60-130			
Tetrachloroethylene	28.5	0.5	ug/L		71.2	60-130			
Toluene	29.0	0.5	ug/L		72.5	60-130			
1,1,1-Trichloroethane	31.4	0.5	ug/L		78.5	60-130			
1,1,2-Trichloroethane	33.5	0.5	ug/L		83.8	60-130			
Trichloroethylene	32.7	0.5	ug/L		81.8	60-130			
Trichlorofluoromethane	38.9	1.0	ug/L		97.4	60-130			
Vinyl chloride	32.1	0.5	ug/L		80.2	50-140			
m,p-Xylenes	64.6	0.5	ug/L		80.7	60-130			
o-Xylene	32.4	0.5	ug/L		80.9	60-130			

Qualifier Notes:

Sample Qualifiers :

1 : Surrogate recoveries not available.

QC Qualifiers :

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

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

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

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Paracel ID: 1817102

Chain of Custody (Lab Use Only)
№ 107023
Page __ of __

Client Name: Paterson Group Inc.	Project Reference: PE4258	TAT: [X] Regular [ ] 3 Day [ ] 2 Day [ ] 1 Day
Contact Name: Karyn Munch	Quote #	Date Required:
Address: 154 Colonnade Rd. S.	PO # 23719	
Telephone: 613-226-7381	Email Address: kmunch@patersongroup.ca	

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

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

Paracel Order Number: 1817102

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Date	Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)
1	BH1-18-GW1	GW		4	Apr.20/18		✓		✓	✓	✓	✓	
2	BH3-18-GW1	GW		7	↓		✓	✓	✓	✓	✓	✓	
3	BH4-18-GW1	GW		7	↓		✓	✓	✓	✓	✓	✓	
4	BH5-18-GW1	GW		3	↓		✓	✓		X	X	X	
5													
6													
7													
8													
9													
10													

→ received PHCs/VOCs containers only.
No ICP, Hg or CrVI required per Karyn! [initials] April 24, 18.

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): KMunch	Received by Driver/Depot: [signature]	Received at Lab: Sunteeporn Dan Mai	Verified By: MJC
Relinquished By (Print): KMunch	Date/Time: 23/04/18 4:30 PM	Date/Time: APR 23 2018 05.04	Date/Time: Apr 23/18 6:05
Date/Time: Apr.23.2018	Temperature: ___ °C	Temperature: 18.4 °C	pH Verified [✓] By: MJC