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Phase II Environmental Site Assessment

368 Tweedsmuir Avenue
Ottawa, Ontario

Prepared For

13098931 Canada Inc.

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Report: PE5429-2

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EXECUTIVE SUMMARY

Assessment

A Phase II ESA was conducted for 368 Tweedsmuir Avenue, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address two potentially contaminating activities (PCAs) that were identified during the Phase I ESA and were considered to result in areas of potential environmental concern (APECs) on the Phase II - Property. The subsurface investigation consisted of drilling three boreholes, all of which were completed as groundwater monitoring wells.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. Three soil samples including one duplicate, were submitted for laboratory analysis of petroleum hydrocarbons (PHCs) and benzene, toluene, ethylbenzene, xylene (BTEX). All BTEX and PHC, concentrations identified in the soil samples were in compliance with the applicable MECP Table 3 standards.

Six groundwater samples, including one duplicate sample, were obtained from the monitoring wells installed in BH1-21, BH2-21 and BH3-21 and were analyzed for PHCs and BTEX. All of the identified BTEX concentrations were in compliance with the applicable MECP Table 3 standards. Groundwater impacted with PHC fraction F_1 was identified in BH3-21, which is located in the southeastern portion of the Phase II – Property.

Based on the findings of the Phase II ESA, the soil on the Phase II – Property is in compliance with MECP Table 3 Standards. Groundwater impacted with PHC fraction F_1 was identified within BH3-21.

Recommendations

Monitoring Wells

It is expected that the groundwater monitoring wells will be abandoned in accordance with O.Reg.903, at the time of construction excavation. It is recommended that the integrity of the monitoring wells be maintained, prior to future construction, for possible further groundwater monitoring purposes.

Due Diligence Risk Assessment

Based on the findings, the PHC fraction F_1 impacted groundwater has migrated onto the property from an off-site source. Furthermore, it is expected that the groundwater quality is indicative of a regional groundwater plume and, as a result, it is not possible to remediate the subject property to generic standards. Given that a record of site condition is not required for the redevelopment of the property, it is recommended that a due diligence risk assessment be completed by a toxicology company to develop mitigative measures that may be warranted prior to the future redevelopment of the Phase II – Property. This assessment would address all potential risks associated with the PHC impacted water, including the potential for vapour intrusion.

1.0 INTRODUCTION

At the request of Honey Construction on behalf of 13098931 Canada Inc., Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment for 368 Tweedsmuir Avenue in the City of Ottawa, Ontario. The purpose of this Phase II ESA has been to address two areas of potential environmental concern (APECs) identified on the Phase II Property, during the Phase I ESA conducted by Paterson in September of 2021.

1.1 Site Description

Address:	368 Tweedsmuir Avenue, Ottawa, Ontario.
Legal Description:	Part of Lot 31, Concession 1; Nepean Township, in the City of Ottawa.
Location:	The Phase I - Property is located on the west side of Tweedsmuir Avenue, approximately 50 m north of the Tweedsmuir Avenue and Richmond Road intersection in the City of Ottawa, Ontario.
Latitude and Longitude:	45° 23' 39.41" N, 75° 45' 1.7" W
Site Description:	
Configuration:	Rectangular
Site Area:	0.05 ha (approximate)

1.2 Property Ownership

Paterson was engaged to conduct this Phase I – ESA by Mr. Matt Blasioli of Honey Construction. Mr. Blasioli can be contacted via his mailing address at 38 Antares Drive, Unit 500, Ottawa, Ontario, K2E 7V2.

1.3 Current and Proposed Future Uses

The Phase II – Property is occupied by a two-storey residential dwelling. The study area consists of a mixture of commercial and residential properties. It is our understanding that the subject site is to be developed for residential purposes.

1.4.1 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 Ministry of the Environment, Conservation and Parks (MECP), April 2011. The MECP selected Table 3 Standards are based on the following considerations:

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

The residential standards were selected based on the proposed future use of the Phase II - Property. Coarse-grained soil standards were chosen as a conservative approach. Grain size analysis was not completed.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II - Property is located in a mixed residential and commercial area and is situated on the west side of Tweedsmuir Avenue, approximately 50 m north of the Tweedsmuir Avenue and Richmond Road intersection, in the City of Ottawa, Ontario. The properties to the north consist of residential dwellings with commercial buildings located to the east and west along Richmond Road.

The general area of the Phase II – Property slopes significantly down towards the west/northwest in the general direction of the Ottawa River. Site drainage on the Phase I - Property consists primarily of sheet flow to manholes located along Tweedsmuir Avenue. No ponded water was observed on the Phase I – Property.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation was conducted on September 14, 2021.

The field program consisted of drilling three boreholes, all of which were instrumented with groundwater monitoring wells. The boreholes were drilled to a maximum depth of 8.21 m below the existing grade.

3.2 Media Investigated

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

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

The Geological Survey of Canada website on the Urban Geology of the National Capital Area was consulted as part of this assessment. Based on the information from NRCAN, bedrock in the area of the site consists of interbedded limestone and dolomite of the Gull River Formation. Based on the maps, the surficial geology consists of glacial till with an overburden thickness ranging from 3 to 5 m.

Contaminants of Potential Concern

The contaminants of potential concern resulting from the identified APECs are as follows:

- Petroleum Hydrocarbons (PHCs (F_1-F_4))
- Benzene, toluene, ethylbenzene, and xylene (BTEX)

Existing Buildings and Structures

The Phase I - Property is currently occupied by a two-storey residential dwelling located on the east side of the property. The south side of the property is occupied by an asphaltic concrete laneway and the western portion of the site exists as landscaped grass areas.

Water Bodies

The nearest named water body with respect to the Phase I - Property is the Ottawa River, located approximately 900 m west of the Phase I - Property.

Areas of Natural Significance

There are no areas of natural and scientific interest on the Phase I - Property or within the Phase I ESA study area.

Water Well Records

A search of the MECPs website for all drilled well records within a 250 m radius of the Phase I - Property was conducted as part of this assessment. The search identified 32 well records within the Phase I study area. These records pertain to wells installed between 1958 and 2020 and used for either domestic household or groundwater observation purposes. Based on the availability of municipal services, no drinking water wells are expected to be currently in use within the Phase I study area.

Several of the well records pertain to groundwater monitoring wells installed on the property addressed 255 Richmond Roa (15 m S). According to these well records, the overburden stratigraphy in the area of the Phase I - Property generally consists of brown sand and gravel fill material, underlain by grey silty clay.

Bedrock, consisting of grey limestone with occasional shale, was generally encountered at an average depth of approximately 2.0 m to 4.0 m below ground surface.

Neighbouring Land Use

Neighbouring land use in the Phase I study area consists primarily of residential and commercial properties.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

Based on the findings of the Phase I – ESA, two off-site PCAs were identified that are considered to represent APECs on the Phase I – Property and are listed below.

- A former automotive service garage and retail fuel outlet, located approximately 15 m south of the Phase I – Property (255 Richmond Road);
- An existing gasoline service station located approximately 75 m south of the Phase I - Property (256 Richmond Road).

Other off-site PCAs identified within the Phase I study area not considered to result in APECs on the Phase I - Property based on their separation distances, as well as their inferred down-gradient or cross-gradient orientation with respect to anticipated groundwater flow.

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 two PCAs that result in APECs on the subject site.

The presence of two APECs 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. No deviations from the sampling and analysis plan were identified during the Phase II ESA.

3.5 Impediments

Tree coverage and landscaping features such as gardens and a small storage shed were representative of physical impediments encountered during the drilling program. BH2-21 was placed further north of the southern property boundary because of the above-mentioned physical impediments.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted on September 14, 2021. The field program consisted of the drilling of three boreholes on the Phase II Property, all of which were completed with monitoring well installations.

The boreholes were placed to address the aforementioned areas of potential environmental concern (APECs) and general coverage for geotechnical purposes.

The boreholes were drilled with a low clearance track-mounted drill rig, operated by George Downing Estate Drilling of Hawkesbury, Ontario, under the full-time supervision of Paterson personnel. Borehole locations are shown on Drawing PE5429-3 – Test Hole Location Plan appended to this report.

4.2 Soil Sampling

A total of 12 soil samples were obtained from the boreholes by means of sampling from shallow auger flights and split spoon sampling.

The depths at which auger samples and split spoon samples were obtained from the boreholes are shown as "**AU**" and "**SS**" on the Soil Profile and Test Data Sheets, appended to this report.

Site soils generally consist of 0.23 m of topsoil or 0.08 m of asphaltic concrete in BH3-21 which was located in the existing laneway of the residential dwelling. The surficial covering of topsoil or asphaltic concrete was followed by potential native material consisting of brown silty sand with some gravel, crushed stone and boulders extending to depths between 2.29 to 2.44 m below the existing grade. Based on the observations made during the completion of the boreholes, it is possible that this fill layer is in fact native material. Given the characteristics of the fill material being consistent with that of the native glacial till encountered across the Phase II – Property, the material has been classified as reworked glacial till. Native glacial till extended to depths ranging from 2.46 to 3.09 m and was underlain by grey limestone bedrock extending to a maximum depth of 8.21 m. All boreholes were terminated within the bedrock.

4.3 Field Screening Measurements

Soil samples recovered at the time of sampling were placed immediately into airtight plastic bags with nominal headspace. All lumps of soil inside the bags were broken by hand, and the soil was allowed to come to room temperature prior to conducting the vapour survey. Allowing the samples to stabilize to room temperature ensures consistency of readings between samples.

To measure the soil vapours, the analyser probe is inserted into the nominal headspace above the soil sample. A photo ionization detector (PID) was used to measure the volatile organic vapour concentrations. The sample is agitated/manipulated gently as the measurement is taken. The peak reading registered within the first 15 seconds is recorded as the vapour measurement.

The PID readings were found to range from 0.3 to 1.2 ppm in the soil samples obtained. These results do not indicate the potential for significant contamination from volatile contaminants. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

4.4 Groundwater Monitoring Well Installation

Three groundwater monitoring wells were installed on the Phase II Property as part of the subsurface investigation).

The monitoring wells consisted of 32 mm diameter Schedule 40 threaded PVC risers and screens. Monitoring well construction details are listed below in Table 1 and are also presented on the Soil Profile and Test Data Sheets provided in Appendix 1.

Table 1: Monitoring Well Construction Details

Well ID	Ground Surface Elevation	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
BH1-21	65.48	8.21	5.21-8.21	4.2-8.21	0-4.2	Flush Mount
BH2-21	65.49	8.18	5.18-8.18	4.3-8.18	0-4.3	Flush Mount
BH3-21	65.48	8.21	5.21-8.21	4.2-8.21	0-4.2	Flush Mount

4.5 Field Measurement of Water Quality Parameters

Groundwater sampling was conducted on September 20, 2021. Based on low groundwater retrieval at the time of the sampling program, water quality parameters were not measured.

4.6 Groundwater Sampling

Groundwater sampling protocols were followed using the MECP document entitled “Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario,” dated May 1996. Groundwater samples were obtained from each monitoring well, using dedicated sampling equipment.

Standing water was purged from each well prior to sampling. Samples were stored in coolers to reduce analyte volatilization during transportation.

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

4.7 Analytical Testing

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

Table 2: Soil Samples Submitted

Sample ID	Screened Interval/ Stratigraphic Unit	Parameter Analyzed		Rationale
		PHCs (F_1-F_4)	BTEX	
BH2-21-SS4	2.44-3.07 m Native glacial till	X	X	Assess APECs 1 and 2 (former automotive service garage/retail fuel outlet and an existing gasoline service station)
BH3-21-SS4	2.29-2.46 m Native glacial till	X	X	Assess APECs 1 and 2 (former automotive service garage/retail fuel outlet and an existing gasoline service station)
DUP-1	2.29-2.46 m Native glacial till		X	Assess APECs 1 and 2 (former automotive service garage/retail fuel outlet and an existing gasoline service station)

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

Table 3: Groundwater Samples Submitted

Sample ID	Screened Interval/ Stratigraphic Unit	Parameters Analyzed		Rationale
		PHCs (F_1 – F_4)	BTEX	
BH1-21-GW1	5.21-8.21 Bedrock (grey limestone)	X	X	Down gradient of APECs 1 and 2
BH2-21–GW1	5.18-8.18 Bedrock (grey limestone)	X	X	Assess APECs 1 and 2 (former automotive service garage/retail fuel outlet and an existing gasoline service station)
BH2-21-GW2	5.18-8.18 Bedrock (grey limestone)	X	X	Assess APECs 1 and 2 (former automotive service garage/retail fuel outlet and an existing gasoline service station)
BH3-21-GW1	5.21-8.21 Bedrock (grey limestone)	X	X	Assess APECs 1 and 2 (former automotive service garage/retail fuel outlet and an existing gasoline service station)
BH3-21-GW2	5.21-8.21 Bedrock (grey limestone)	X	X	Assess APECs 1 and 2 (former automotive service garage/retail fuel outlet and an existing gasoline service station)

Table 3: Groundwater Samples Submitted

Sample ID	Screened Interval/ Stratigraphic Unit	Parameters Analyzed		Rationale
		PHCs ($F_1 – F_4$)	BTEX	
DUP1-GW1*	5.21-8.21 Bedrock (grey limestone)		X	QA/QC

- * - Duplicate of BH1-GW1

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

4.9 Elevation Surveying

Boreholes were surveyed to geodetic elevations by Paterson personnel.

4.10 Quality Assurance and Quality Control Measures

A summary of quality assurance and quality control (QA/QC) measures, including 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

The soil profile generally consists of between 2.29 to 2.44 m of potential native material, consisting of brown silty sand with some gravel, cobbles and boulders underlain by glacial till extending to depths ranging from 2.46 to 3.07 m. The fill material within BH3-21 also consisted of crushed stone. All of the boreholes were terminated in grey limestone bedrock that extended to depths ranging from 8.18 to 8.21 m.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling event on September 17, 2021, using an electronic water level meter. Groundwater levels are summarized below in Table 4. All elevations were acquired through a GPS survey completed at the time of the subsurface investigation.

Table 4: Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (Asl)	Date of Measurement
BH1-21	65.48	5.20	60.28	September 20, 2021
BH2-21	65.49	5.06	60.43	
BH3-21	65.48	3.92	61.56	

Based on the groundwater levels recorded, the groundwater appears to flow to the west. However, it is considered likely that the water level in BH3-21 had not stabilized.

5.3 Fine-Coarse Soil Texture

No grain size analysis was completed for the Phase II - Property. Coarse-grained standards were selected based on the observed stratigraphy.

5.4 Soil: Field Screening

Field screening of the soil samples collected during drilling resulted in vapour readings ranging from 0.3 to 1.2 ppm.

No visual or olfactory indications of potential contamination were identified in the soil samples at the time of the field program. The 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

Three soil samples including one duplicate were submitted for analysis of BTEX and PHCs (F_1-F_4). The results of the analytical testing are presented below in Table 5. The laboratory certificates of analysis are provided in Appendix 1. Analytical test results are shown on Drawing PE5429 - 4 – Analytical Testing Plan.

Table 5: Analytical Test Results – Soil – BTEX and PHCs (F_1-F_4)					
Parameter	MDL (µg/g)	Soil Samples (µg/g)			MECP Table 3 Residential Standards (µg/g)
		September 14, 2021			
		BH2-21-SS4	BH3-21-SS4	DUP-1*	
Benzene	0.02	nd	nd	nd	0.21
Ethylbenzene	0.05	nd	nd	nd	2
Toluene	0.05	nd	nd	nd	2.3
Xylenes, total	0.05	nd	nd	nd	3.1
F1 PHCs (C6-C10)	7	nd	nd	N/A	55
F2 PHCs (C10-C16)	4	nd	36	N/A	98
F3 PHCs (C16-C34)	8	nd	88	N/A	300
F4 PHCs (C34-C50)	6	nd	75	N/A	2800

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- NA – Parameter not analysed
- * - Duplicate of BH3-21-SS4
- **Bold and Underlined** – Results exceed the selected MECP standards

All of the analyzed PHC and BTEX parameters were non-detect with the exception of PHC fractions of F_2, F_3 and F_4 in BH3-21-SS4, which are in compliance with the applicable MECP Table 3 standards.

TABLE 6: Maximum Concentrations – Soil			
Parameter	Maximum Concentration (µg/g)	Soil Sample	Depth Interval (m BGS)
F2 PHCs (C10-C16)	36	BH3-21-SS4	2.29-2.46, Native
F3 PHCs (C16-C34)	88	BH3-21-SS4	2.29-2.46, Native
F4 PHCs (C34-C50)	75	BH3-21-SS4	2.29-2.46, Native

Notes:
- **Bold and Underlined** – Results exceed the selected MECP standards

All other analyzed parameters were non-detect.

5.6 Groundwater Quality

Groundwater samples from monitoring wells installed in BH1-21, BH2-21 and BH3-21 were submitted for laboratory analysis of PHCs (F_1-F_4) and BTEX.

The groundwater samples were obtained from the screened intervals noted in Table 1. The results of the analytical testing are presented below in Table 7.

The laboratory certificate of analysis is provided in Appendix 1. Analytical test results are shown on Drawing PE5429- 5 – Analytical Testing Plan – Groundwater.

Table 7: Analytical Test Results – Groundwater – BTEX and PHCs (F_1-F_4)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L)						MECP Table 3 Residential Standards (µg/L)
		September 20, 2021				October 22, 2021		
		BH1-21-GW1	BH2-21-GW1	BH3-21-GW1	DUP1-GW1	BH2-21-GW2	BH3-21-GW2	
Benzene	0.5	nd	6.3	10.0	nd	3.9	10.8	44
Ethylbenzene	0.5	nd	8.9	81.2	nd	6.3	70.0	2300
Toluene	0.5	nd	0.6	4.4	nd	0.5	1.9	18000
Xylenes, total	0.5	nd	9.5	147	nd	3.8	108	4200
F1 PHCs (C6-C10)	25	nd	311	434	N/A	247	**800**	750
F2 PHCs (C10-C16)	100	nd	nd	nd	N/A	nd	nd	150
F3 PHCs (C16-C34)	100	nd	nd	nd	N/A	nd	nd	500
F4 PHCs (C34-C50)	100	nd	nd	nd	N/A	nd	nd	500

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

All of the identified BTEX and PHC concentrations were in compliance with the applicable MECP Table 3 standards with one exception. Groundwater impacted with PHC fraction F_1 was identified in BH3-21.

TABLE 8: Maximum Concentrations – Groundwater			
Parameter	**Maximum Concentration (µg/L)**	**Groundwater Sample**	**Depth Interval (m BGS)**
Benzene	10.8	BH3-21-GW2	5.21-8.21 Bedrock (grey limestone)
Ethylbenzene	81.2	BH3-21-GW1	5.21-8.21 Bedrock (grey limestone)
Toluene	4.4	BH3-21-GW1	5.21-8.21 Bedrock (grey limestone)
Xylenes, total	147	BH3-21-GW1	5.21-8.21 Bedrock (grey limestone)
F1 PHCs (C6-C10)	**800**	BH3-21-GW2	25.21-8.21 Bedrock (grey limestone)

Notes:
- **Bold and Underlined** – Results exceed the selected MECP standards

5.7 Quality Assurance and Quality Control Results

All soil and groundwater samples 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, a Certificate of Analysis has been received for each sample submitted for analysis and all Certificates of Analysis are appended to this report.

As per the Sampling and Analysis Plan, a duplicate soil sample was obtained from sample BH3-21-SS4 and submitted for laboratory analysis of BTEX parameters. No BTEX concentrations were detected in the original or duplicate samples. Based on the non-detectable parameter concentrations identified in both samples, the results are considered to be acceptable.

A duplicate groundwater sample was obtained from the monitoring well installed in BH1-21 and submitted for laboratory analysis of BTEX parameters. No BTEX concentrations were detected in the original or duplicate sample.

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

5.8 Phase II Conceptual Site Model

The following section has been prepared in accordance with the requirements of O.Reg. 269/11 amended by the Environmental Protection Act. Conclusions and recommendations are discussed in a subsequent section.

Site Description

The Phase II Property is currently occupied by a two-storey residential dwelling located in the eastern portion of the Phase II - Property with landscaped grass areas and gardens in the western portion. An asphaltic concrete laneway is located to the south of the residential dwelling.

Potentially Contaminating Activity and Areas of Potential Environmental Concern

As indicated in the Phase I-ESA report, the following PCAs were considered to result in APECs on the Phase I/Phase II Property:

- Former automotive service garage and retail fuel outlet.
- Gasoline service station.

Contaminants of Potential Concern and Impacted Media

Contaminants of potential concern associated with the PCAs include PHCs (F_1-F_4) and BTEX in the soil and groundwater.

Subsurface Structures and Utilities

Underground service locates were completed prior to the subsurface investigation. Underground utilities on the Phase II - Property include private electrical, water and sewer services and gas lines.

Physical Setting

Site Stratigraphy

The site stratigraphy, from the ground surface to the deepest aquifer or aquitard investigated consists of:

Site soils generally consist of 0.23 m of topsoil or 0.08 m of asphaltic concrete in BH3-21 which was located in the existing laneway of the residential dwelling.

The surficial covering of topsoil or asphaltic concrete was followed by potentially native/reworked native material consisting of brown silty sand with some gravel, crushed stone and boulders extending to depths between 2.29 to 2.44 m below the existing grade. Native glacial extended to depths ranging from 2.46 to 3.09 m and was underlain by grey limestone bedrock extending to a maximum depth of 8.21 m. All boreholes were terminated within the bedrock.

- Topsoil from 0 to 0.23 m or asphaltic concrete (BH3-21) from 0 to 0.08 m overlaying reworked native material consisting of brown silty sand with gravel, crushed stone and boulders extending to depths ranging from 2.29 to 2.44 m.
- Native glacial till extending to depths ranging from 2.46 to 3.09 m
- Grey limestone bedrock extending to depths ranging from 8.18 to 8.21 m.

Hydrogeological Characteristics

Groundwater at the Phase II - Property was encountered within the bedrock.

Water levels were measured at the Phase II - Property on September 20, 2021, at depths ranging from 3.92 to 5.20 m below grade.

Based on the groundwater levels recorded, the groundwater appears to flow in a westerly direction. However, it is considered likely that the water level in BH3-21 had not stabilized.

Approximate Depth to Bedrock

Bedrock was encountered at an average depth of 2.67 m below the existing grade.

Approximate Depth to Water Table

Depth to the water table at the Phase II - Property varies between approximately 3.92 to 5.20 m below the 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 Phase II - Property.

Section 43.1 of the Regulation does not apply to the Phase II – Property in that the Phase II – Property is not a Shallow Soil Property.

Fill Placement

A surficial covering of topsoil or asphaltic concrete overlying potentially native/reworked native material ranging from 2.29 to 2.44 m and consisting of brown silty sand with gravel, crushed stone and boulders was identified in all of the boreholes.

Proposed Buildings and Other Structures

It is our understanding that the Phase II - Property is to be redeveloped for residential purposes.

Areas of Natural Significance and Water Bodies

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

There are no water bodies on the Phase II - Property, or within the Phase I ESA study area.

Environmental Condition

Areas Where Contaminants are Present

Groundwater impacted with PHC fraction F_1 was identified in BH3-21 which is located in the southeastern portion of the Phase II - Property.

Types of Contaminants

PHC fraction F_1 was identified in the groundwater sample BH3-21-GW2..

Contaminated Media

Based on the findings of this Phase II ESA, the soil on the Phase II – Property is in compliance with the MECP Table 3 standards. Groundwater impacted with PHC fraction F_1 was identified within BH3-21, located in the southeastern portion of the Phase II – Property.

What Is Known About Areas Where Contaminants Are Present

PHC fraction F_1 impacted groundwater was identified in the southeastern portion of the Phase II – Property in the location of BH3-21.

Distribution and Migration of Contaminants

PHC fraction F_1 impacted groundwater was identified in the southeastern portion of the Phase II – Property in the location of BH3-21. Based on the results of the Phase II – ESA, the PHC impact is limited to the groundwater, which is confined within the bedrock layer on the Phase II – Property. It is expected to have migrated onto the Phase II - Property from an off-site source located to the south/southeast.

Discharge of Contaminants

PHC fraction F_1 impacted groundwater was identified in the southeastern portion of the Phase II – Property. Based on the current and historical use of the Phase II – Property, the discharge of contaminants is not anticipated to result from on-site activities.

Migration of Contaminants

PHC fraction F_1 impacted groundwater was identified in the southeastern portion of the Phase II – Property. Based on the results of the Phase II – ESA, the PHC impact is limited to the groundwater in the southeastern portion of the property, which is confined within the bedrock layer. It is expected to have migrated onto the Phase II - Property from an off-site source located to the southeast.

Climatic and Meteorological Conditions

In general, climatic, and meteorological conditions have the potential to affect contaminant distribution. Two ways by which climatic and meteorological conditions may affect contaminant distribution include the downward leaching of contaminants by means of the infiltration of precipitation, and the migration of contaminants via groundwater levels and/or flow, which may fluctuate seasonally. It is our opinion that climatic and meteorological conditions have not influenced contaminant transport in the past.

Potential for Vapour Intrusion

Based on the findings of the Phase II ESA, the potential for vapour intrusion is considered to be low as the PHC impact was limited to the groundwater within BH3-21, which was intercepted within the bedrock.

6.0 CONCLUSIONS

Assessment

A Phase II ESA was conducted for 368 Tweedsmuir Avenue, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address two potentially contaminating activities (PCAs) that were identified during the Phase I ESA and were considered to result in areas of potential environmental concern (APECs) on the Phase II - Property. The subsurface investigation consisted of drilling three boreholes, all of which were completed as groundwater monitoring wells.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. Three soil samples including one duplicate, were submitted for laboratory analysis of petroleum hydrocarbons (PHCs) and benzene, toluene, ethylbenzene, xylene (BTEX). All BTEX and PHC, concentrations identified in the soil samples were in compliance with the applicable MECP Table 3 standards.

Six groundwater samples, including one duplicate sample, were obtained from the monitoring wells installed in BH1-21, BH2-21 and BH3-21 and were analyzed for PHCs and BTEX. All of the identified BTEX concentrations were in compliance with the applicable MECP Table 3 standards. Groundwater impacted with PHC fraction F_1 was identified in BH3-21, which is located in the southeastern portion of the Phase II – Property.

Based on the findings of the Phase II ESA, the soil on the Phase II – Property is in compliance with MECP Table 3 Standards. Groundwater impacted with PHC fraction F_1 was identified within BH3-21.

Recommendations

Monitoring Wells

It is expected that the groundwater monitoring wells will be abandoned in accordance with O.Reg.903, at the time of construction excavation. It is recommended that the integrity of the monitoring wells be maintained, prior to future construction, for possible further groundwater monitoring purposes.

Due Diligence Risk Assessment

Based on the findings, the PHC fraction F_1 impacted groundwater has migrated onto the property from an off-site source. Furthermore, it is expected that the groundwater quality is indicative of a regional groundwater plume and, as a result, it is not possible to remediate the subject property to generic standards. Given that a record of site condition is not required for the redevelopment of the property, it is recommended that a due diligence risk assessment be completed by a toxicology company to develop mitigative measures that may be warranted prior to the future redevelopment of the Phase II – Property. This assessment would address all potential risks associated with the PHC impacted water, including the potential for vapour intrusion.

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 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 13098931 Canada Inc. Notification from 13098931 Canada Inc and Paterson Group will be required to release this report to any other party.

Paterson Group Inc.

Samuel Berube, B.Eng.

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

Report Distribution:

- 13098931 Canada Inc.
- Paterson Group

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE5429-3 – TEST HOLE LOCATION PLAN

DRAWING PE5429-4 ANAYTICAL TESTING PLAN - SOIL (BTEX, PHCs)

DRAWING PE5429-4A – CROSS SECTION A-A' SOIL (BTEX, PHCs)

DRAWING PE5429-4B – CROSS SECTION B-B' SOIL (BTEX, PHCs)

DRAWING PE5429-5 – ANALTICAL TESTING PLAN - GROUNDWATER (BTEX, PHCs)

DRAWING PE5429-5A – CROSS SECTION A-A' GROUNDWATER (BTEX, PHCs)

DRAWING PE5429-5B – CROSS SECTION B-B' GROUNDWATER (BTEX, PHCs)

FIGURE 1

KEY PLAN

364 TWEEDSMUIR AVENUE
RESIDENTIAL

361 ATHLONE AVENUE
RESIDENTIAL

366 TWEEDSMUIR AVENUE
RESIDENTIAL

365 TWEEDSMUIR AVENUE
RESIDENTIAL

TWEEDSMUIR AVENUE

SIDEWALK

365 ATHLONE AVENUE
RESIDENTIAL

BH 1-21
65.48
[62.99]
(60.28)

B

60.3

LANDSCAPED

WOODEN
PATIO

368 TWEEDSMUIR AVENUE
RESIDENTIAL

LANDSCAPED

60.4
60.5
60.6
60.7
60.8
60.9
61.0
61.1
61.2
61.3
61.4

(0.09m/m)

A

BH 2-21
65.49
[62.42]
(60.43)

B'

INTERLOCKING
PAVEMENT

FENCE

BH 3-21
65.48
[63.02]
(61.56)

A'

ASPHALTIC
CONCRETE
DRIVEWAY

369 ATHLONE AVENUE
RESIDENTIAL

372 TWEEDSMUIR AVENUE
RESIDENTIAL

LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION
- 65.48 — GROUND SURFACE ELEVATION (m)
- [62.42] — BEDROCK SURFACE ELEVATION (m)
- (61.56) — GROUNDWATER SURFACE ELEVATION (m) (SEPTEMBER 20, 2021)
- A — A' — CROSS SECTION
- 60.4 — GROUNDWATER CONTOURS (m)
- (0.09m/m) — APPROX. GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:150

0 1 2 3 4 5 10m

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consulting engineers

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NO.	REVISIONS	DATE	INITIAL

HONEY CONSTRUCTION

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
368 TWEEDSMUIR AVENUE

OTTAWA, **ONTARIO**

Title:

TEST HOLE LOCATION PLAN

Scale: 1:150	Date: 10/2021
Drawn by: JM	Report No.: PE5429-2
Checked by: SB	Dwg. No.: PE5429-3
Approved by: MSD	Revision No.:

11x17

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364 TWEEDSMUIR AVENUE
RESIDENTIAL

361 ATHLONE AVENUE
RESIDENTIAL

366 TWEEDSMUIR AVENUE
RESIDENTIAL

365 TWEEDSMUIR AVENUE
RESIDENTIAL

TWEEDSMUIR AVENUE

SIDEWALK

365 ATHLONE AVENUE
RESIDENTIAL

BH 1-21
65.48
[62.99]
(60.28)

B

WOODEN
PATIO

LANDSCAPED

368 TWEEDSMUIR AVENUE
RESIDENTIAL

LANDSCAPED

BH3-21-SS4 2.29-2.46m 14-SEP-2021
BTEX and PHC(F1-F4) comply with MECP Table 3 Standards

DUP-1 2.29-2.46m 14-SEP-2021
BTEX complies with MECP Table 3 Standards

225 RICHMOND ROAD
RESIDENTIAL

A

BH 2-21
65.49
[62.42]
(60.43)

B'

INTERLOCKING
PAVEMENT

FENCE

BH 3-21
65.48
[63.02]
(61.56)

A'

ASPHALTIC
CONCRETE
DRIVEWAY

BH2-21-SS4 2.44-3.07m 14-SEP-2021
BTEX and PHC(F1-F4) comply with MECP Table 3 Standards

369 ATHLONE AVENUE
RESIDENTIAL

372 TWEEDSMUIR AVENUE
RESIDENTIAL

LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION
- 65.48 GROUND SURFACE ELEVATION (m)
- [62.42] BEDROCK SURFACE ELEVATION (m)
- (61.56) GROUNDWATER SURFACE ELEVATION (m) (SEPTEMBER 20, 2021)
- A — A' CROSS SECTION

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:150

0 1 2 3 4 5 10m

SOIL RESULT COMPLIES WITH MECP TABLE 3 STANDARDS

SOIL RESULT EXCEEDS MECP TABLE 3 STANDARDS

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consulting engineers

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HONEY CONSTRUCTION

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
368 TWEEDSMUIR AVENUE
OTTAWA, ONTARIO

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

Scale: 1:150	Date: 10/2021
Drawn by: YA	Report No.: PE5429-2
Checked by: SB	Dwg. No.: PE5429-4
Approved by: MSD	Revision No.:

11x17

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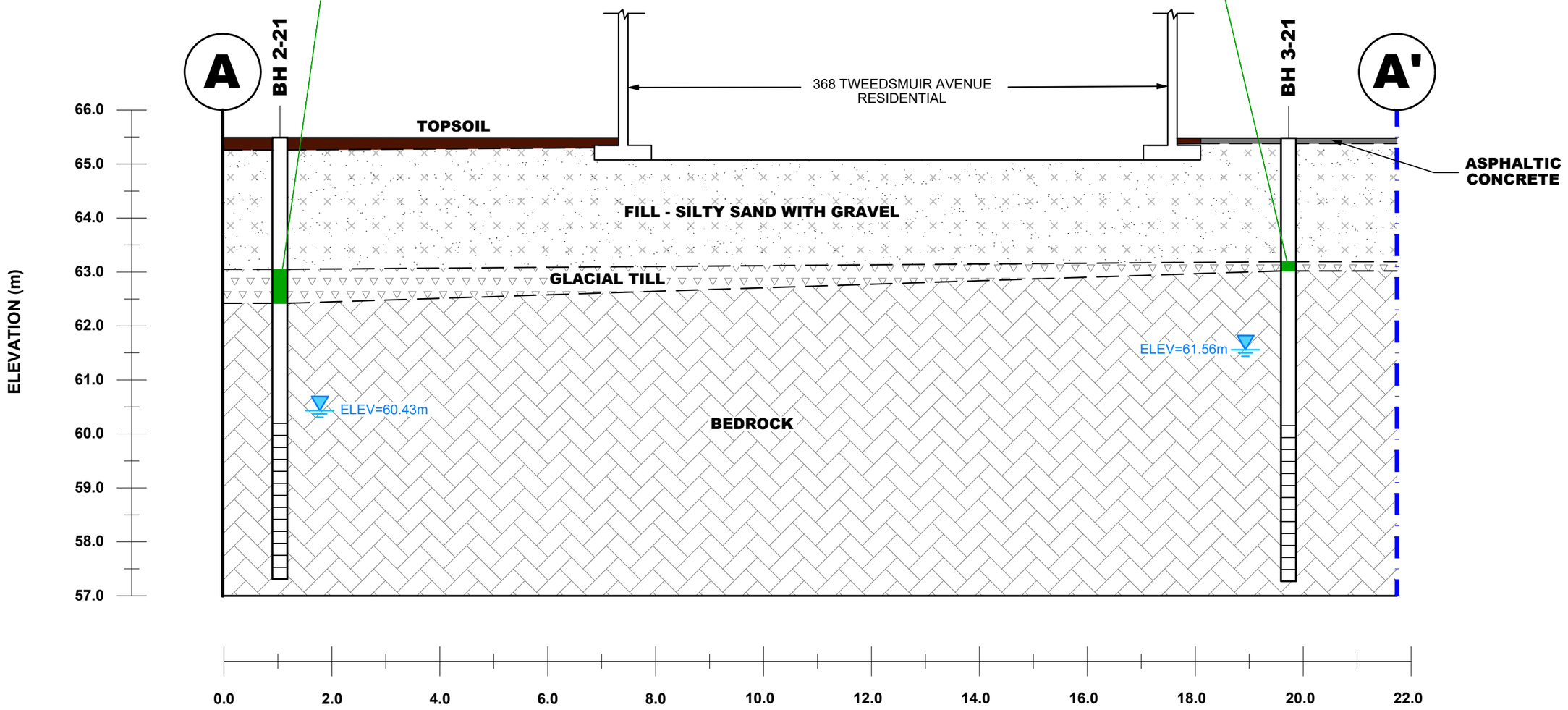
BH2-21-SS4 2.44-3.07m 14-SEP-2021
BTEX and PHC(F1-F4) comply with MECP Table 3 Standards

BH3-21-SS4 2.29-2.46m 14-SEP-2021
BTEX and PHC(F1-F4) comply with MECP Table 3 Standards

DUP-1 2.29-2.46m 14-SEP-2021
BTEX complies with MECP Table 3 Standards



SOIL RESULT COMPLIES WITH MECP TABLE 3 STANDARDS

SOIL RESULT EXCEEDS MECP TABLE 3 STANDARDS

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consulting engineers

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Ottawa, Ontario K2E 7J5
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HONEY CONSTRUCTION

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
368 TWEEDSMUIR AVENUE

OTTAWA, ONTARIO

Title:

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

Scale: AS SHOWN	Date: 10/2021
Drawn by: YA	Report No.: PE5429-2
Checked by: SB	Dwg. No.: PE5429-4A
Approved by: MSD	Revision No.:

11x17

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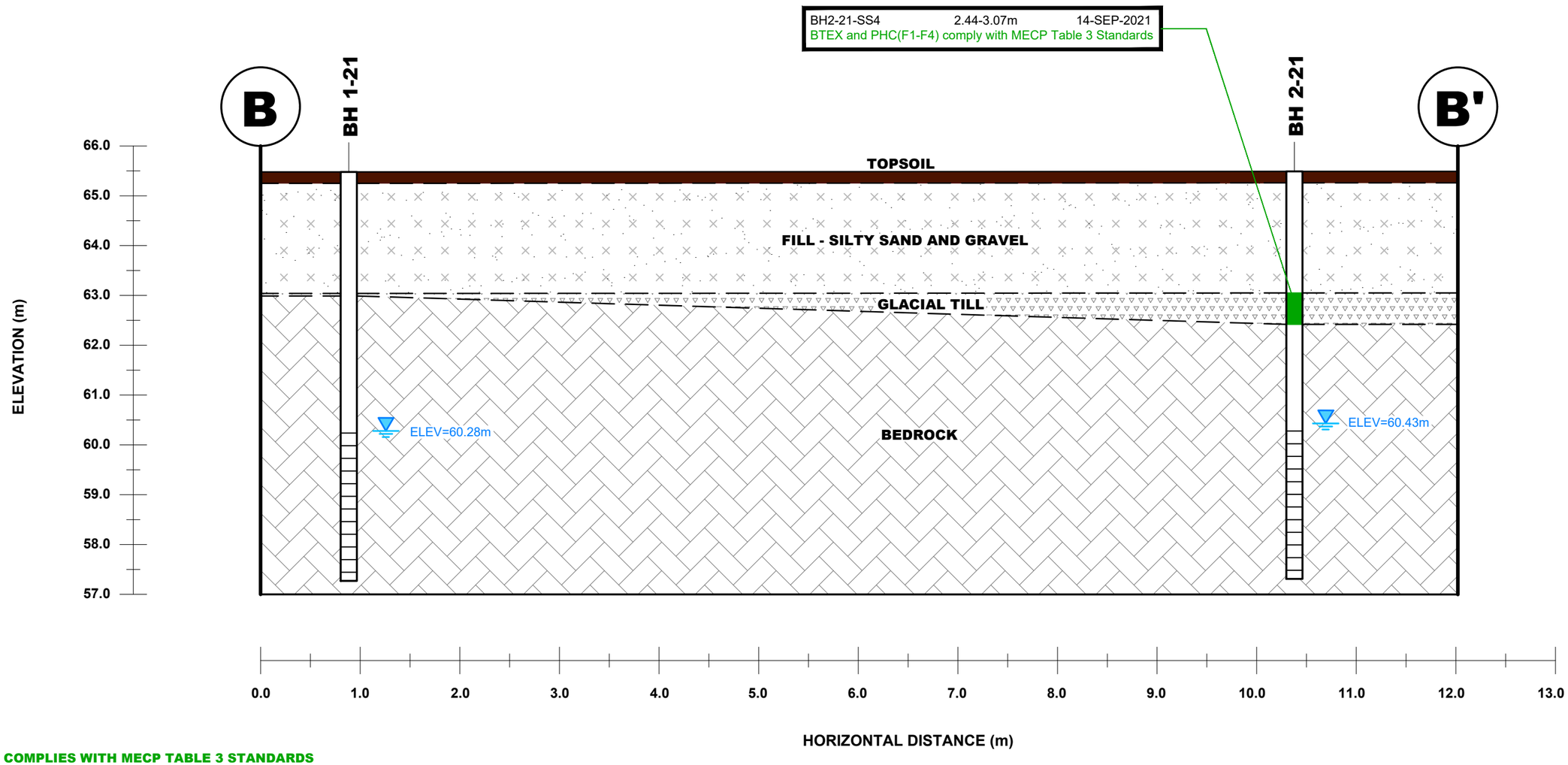

SOIL RESULT COMPLIES WITH MECP TABLE 3 STANDARDS

SOIL RESULT EXCEEDS MECP TABLE 3 STANDARDS

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HONEY CONSTRUCTION

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
368 TWEEDSMUIR AVENUE

OTTAWA, ONTARIO

Title:

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

Scale: AS SHOWN	Date: 10/2021
Drawn by: YA	Report No.: PE5429-2
Checked by: SB	Dwg. No.: PE5429-4B
Approved by: MSD	Revision No.:

11x17

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364 TWEEDSMUIR AVENUE
RESIDENTIAL

361 ATHLONE AVENUE
RESIDENTIAL

365 ATHLONE AVENUE
RESIDENTIAL

365 TWEEDSMUIR AVENUE
RESIDENTIAL

225 RICHMOND ROAD
RESIDENTIAL

372 TWEEDSMUIR AVENUE
RESIDENTIAL

TWEEDSMUIR AVENUE

SIDEWALK

WOODEN PATIO

LANDSCAPED

LANDSCAPED

**368 TWEEDSMUIR AVENUE
RESIDENTIAL**

INTERLOCKING PAVEMENT

ASPHALTIC CONCRETE DRIVEWAY

FENCE

**BH 1-21
65.48
[62.99]
(60.28)**

**BH 2-21
65.49
[62.42]
(60.43)**

**BH 3-21
65.48
[63.02]
(61.56)**

BH1-21-GW1	5.21-8.21m	20-Sep-2021
BTEX and PHC(F1-F4) comply with MECP Table 3 Standards		
DUP-GW1	5.21 -8.21m	20-Sep-2021
BTEX comply with MECP Table 3 Standards		

BH3-21-GW1	5.21-8.21m	20-Sep-2021
BTEX and PHC(F1-F4) comply with MECP Table 3 Standards		
BH3-21-GW2	5.21-8.21 m	22-Oct-2021
Parameter	Result(µg/L)	Standard(µg/L)
F1	808	750
Remaining PHCs comply with MECP Table 3 Standards		

BH2-21-GW1	5.18-8.18m	20-Sep-2021
BTEX and PHC(F1-F4) comply with MECP Table 3 Standards		
BH2-21-GW2	5.18-8.18 m	20-Sep-2021
PHCs and BTEX comply with MECP Table 3 Standards		

GROUNDWATER RESULT COMPLIES WITH MECP TABLE 3 STANDARDS

GROUNDWATER RESULT EXCEEDS MECP TABLE 3 STANDARDS

LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION
- 65.48 — GROUND SURFACE ELEVATION (m)
- [62.42] — BEDROCK SURFACE ELEVATION (m)
- (61.56) — GROUNDWATER SURFACE ELEVATION (m) (SEPTEMBER 20, 2021)
- A — A' — CROSS SECTION

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:150

0 1 2 3 4 5 10m

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NO.	REVISIONS	DATE	INITIAL

HONEY CONSTRUCTION

**PHASE II - ENVIRONMENTAL SITE ASSESSMENT
368 TWEEDSMUIR AVENUE**

OTTAWA, ONTARIO

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

Scale: 1:150	Date: 10/2021
Drawn by: YA	Report No.: PE5429-2
Checked by: SB	Dwg. No.: PE5429-5
Approved by: MSD	Revision No.:

11x17

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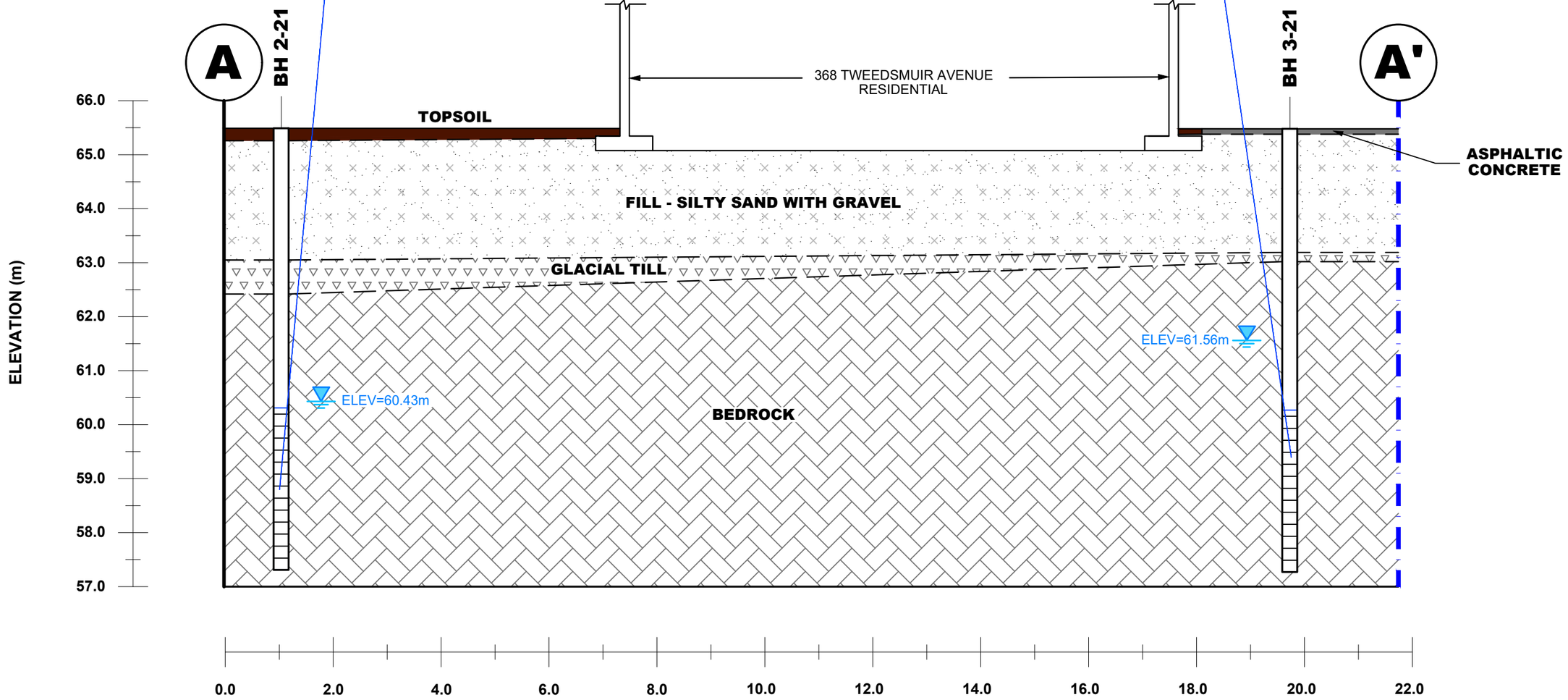
BH2-21-GW1	5.18-8.18m	20-Sep-2021
BTEX and PHC(F1-F4) comply with MECP Table 3 Standards		
BH2-21-GW2	5.18-8.18 m	20-Sep-2021
PHCs and BTEX comply with MECP Table 3 Standards		

BH3-21-GW1	5.21-8.21m	20-Sep-2021
BTEX and PHC(F1-F4) comply with MECP Table 3 Standards		
BH3-21-GW2	5.21-8.21 m	22-Oct-2021
Parameter	Result(µg/L)	Standard(µg/L)
F1	808	750
Remaining PHCs comply with MECP Table 3 Standards		



GROUNDWATER RESULT COMPLIES WITH MECP TABLE 3 STANDARDS

GROUNDWATER RESULT EXCEEDS MECP TABLE 3 STANDARDS

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NO.	REVISIONS	DATE	INITIAL

HONEY CONSTRUCTION

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
368 TWEEDSMUIR AVENUE

OTTAWA, ONTARIO

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

Scale: AS SHOWN	Date: 10/2021
Drawn by: YA	Report No.: PE5429-2
Checked by: SB	Dwg. No.: PE5429-5A
Approved by: MSD	Revision No.:

11x17

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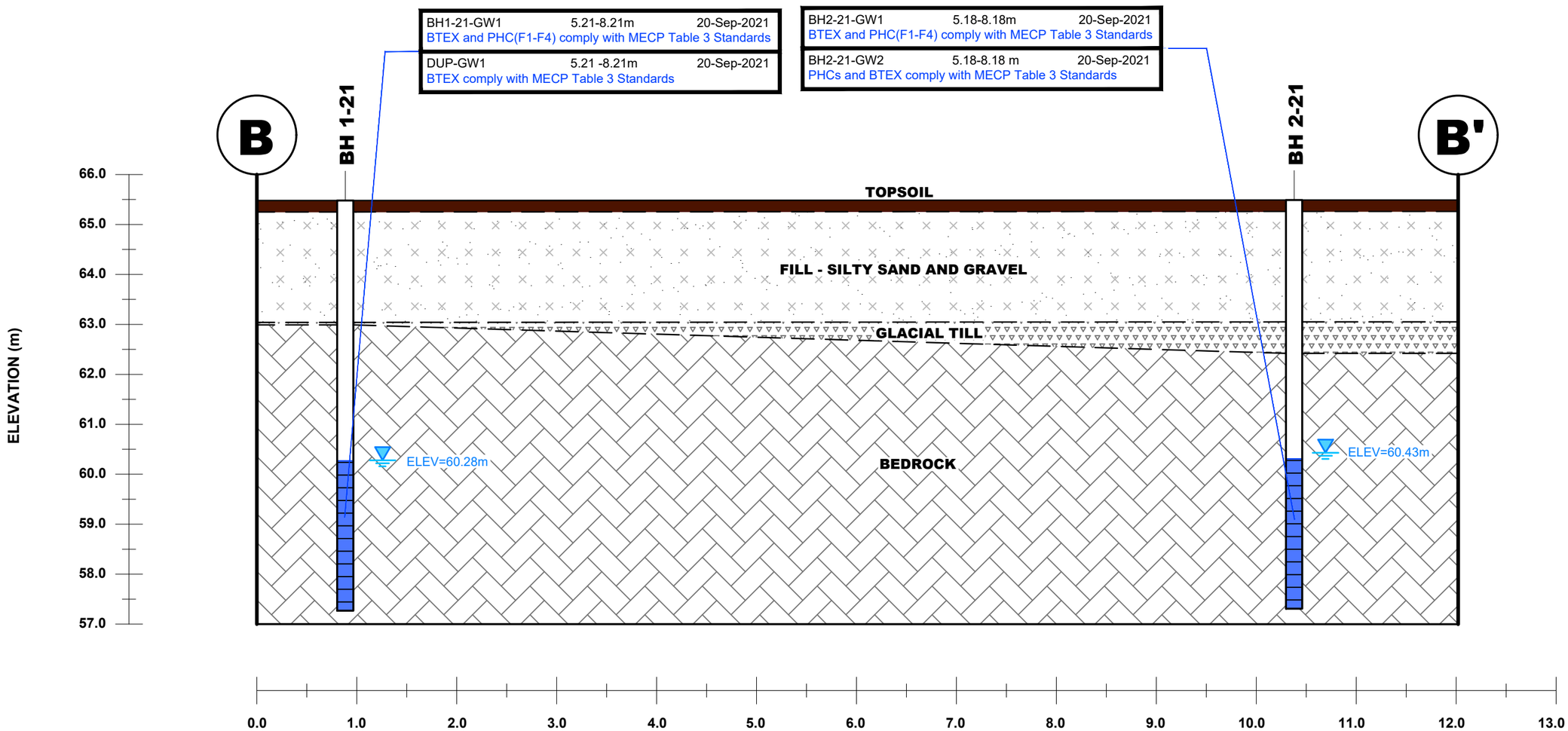
BH1-21-GW1	5.21-8.21m	20-Sep-2021	
BTEX and PHC(F1-F4) comply with MECP Table 3 Standards			
DUP-GW1	5.21 -8.21m	20-Sep-2021	
BTEX comply with MECP Table 3 Standards			

BH2-21-GW1	5.18-8.18m	20-Sep-2021
BTEX and PHC(F1-F4) comply with MECP Table 3 Standards		
BH2-21-GW2	5.18-8.18 m	20-Sep-2021
PHCs and BTEX comply with MECP Table 3 Standards		



GROUNDWATER RESULT COMPLIES WITH MECP TABLE 3 STANDARDS

GROUNDWATER RESULT EXCEEDS MECP TABLE 3 STANDARDS

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HONEY CONSTRUCTION

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
368 TWEEDSMUIR AVENUE

OTTAWA, ONTARIO

Title:

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

Scale: AS SHOWN	Date: 10/2021
Drawn by: YA	Report No.: PE5429-2
Checked by: SB	Dwg. No.: PE5429-5B
Approved by: MSD	Revision No.:

11x17

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APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATE OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

patersongroup

Sampling & Analysis Plan

Phase II Environmental Site Assessment
368 Tweedsmuir Avenue
Ottawa, Ontario

Prepared For
103098931 Canada Inc.

September 2021
Report: PE5429-SAP

Paterson Group Inc.

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

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TABLE OF CONTENTS

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by 103098931 Canada Inc. to conduct a Phase II Environmental Site Assessment (ESA) of 368 Tweedsmuir Avenue, Ottawa, Ontario. Based on our 2021 Phase I ESA completed for the subject property, a subsurface investigation program, consisting of borehole drilling, was developed.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1-21	General Coverage (Geotechnical purposes)	Borehole to be advanced to approximately 2m below the expected long-term groundwater table and install a monitoring well.
BH2-21	Assess APECs 1 and 2 (former automotive service garage/retail fuel outlet and an existing gasoline service station)	Borehole to be advanced to approximately 2m below the expected long-term groundwater table and install a monitoring well.
BH3-21	Assess APECs 1 and 2 (former automotive service garage/retail fuel outlet and an existing gasoline service station)	Borehole to be advanced to approximately 2m below the expected long-term groundwater table and install a monitoring well.

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.

Upon refusal, rock coring shall be undertaken to the required depth. Approximately every metre the well shall be purged by inertial pumping and the water level recorded to determine if groundwater water is entering the borehole.

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 MECP 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 the 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 catch basin of known geodetic elevation.

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 analysed 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 the 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 an RKI Eagle, PID, etc. depending on the 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 a brush in soapy water, inside and out, including the 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 the 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 the bag.
- ❒ Insert the probe into soil bag, creating a seal with your hand around the opening.
- ❒ Gently manipulate soil in the 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 the 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 a 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 a 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 the required depth, using drilling and sampling procedures described above.
- ❒ If the borehole is deeper than required monitoring well, backfill with bentonite chips to the 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 the screen. Thread the second section of the screen if required. Thread risers onto the screen. Lower into the borehole to the required depth. Ensure slip-cap or J-plug is inserted to prevent backfill materials from entering the 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 the 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 the 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 a socket wrench or Allan key to open metal flush mount protector cap. Remove plastic well cap.
- ❒ Measure water level, with respect to the existing ground surface, using water level meter or interface probe. If using an interface probe on suspected NAPL site, measure the thickness of the free product.
- ❒ Measure the total depth of well.
- ❒ Clean water level tape or interface probe using methanol and water. Change gloves between wells.
- ❒ Calculate the volume of standing water within well and record.
- ❒ Insert polyethylene tubing into well and attach to the peristaltic pump. Turn on the peristaltic pump and purge into the 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 the 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 the 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 a 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 the 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 the laboratory
- ❒ Drill rig breakdowns
- ❒ Winter conditions
- ❒ Other site-specific impediments

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
368 Tweedsmuir Avenue
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5429

REMARKS

HOLE NO. BH 1-21

BORINGS BY CME-55 Low Clearance Drill **DATE** September 14, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	65.48
TOPSOIL 0.23		AU	1				
FILL: Brown silty sand with gravel, cobbles and boulders		SS	2	33	24	1	64.48
		SS	3	25	34	2	63.48
2.44		SS	4	33	50+		
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders 2.49		RC	1	100	100	3	62.48
		RC	2	88	82	4	61.48
BEDROCK: Good to excellent quality, grey limestone		RC	3	100	90	5	60.48
		RC	4	100	100	6	59.48
		RC	5	100	100	7	58.48
8.21						8	57.48
End of Borehole							
(GWL @ 5.20m - Sept. 20, 2021)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
368 Tweedsmuir Avenue
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5429

REMARKS

HOLE NO. BH 2-21

BORINGS BY CME-55 Low Clearance Drill **DATE** September 14, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.23						0	65.49
		AU	1				
FILL: Brown silty sand, some gravel, occasional cobbles and boulders		SS	2	53	50+	1	64.49
		SS	3	67	50+	2	63.49
2.44							
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles and boulders		SS	4	75	40	3	62.49
3.07							
		RC	1	96	89	4	61.49
BEDROCK: Good to excellent quality, grey limestone						5	60.49
		RC	2	100	100		
- shale seam at 2.7 and 3.35m depths						6	59.49
		RC	3	100	97	7	58.49
		RC	4	100	96	8	57.49
8.18							
End of Borehole							
(GWL @ 5.06m - Sept. 20, 2021)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
368 Tweedsmuir Avenue
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5429

REMARKS

HOLE NO. BH 3-21

BORINGS BY CME-55 Low Clearance Drill **DATE** September 14, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.08						0	65.48
		AU	1				
FILL: Brown silty sand with crushed stone and gravel		SS	2	67	50+	1	64.48
		SS	3	67	50+	2	63.48
2.29							
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles and boulders 2.46		SS	4	100	50+		
		RC	1	100	100	3	62.48
		RC	2	88	73	4	61.48
BEDROCK: Excellent quality, grey limestone - shale seam at 4.3m depth		RC	3	100	97	5	60.48
						6	59.48
		RC	4	100	100	7	58.48
		RC	5	100	100	8	57.48
8.21							
End of Borehole (GWL @ 3.92m - Sept. 20, 2021)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm. An SPT N value of "P" denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

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

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their "sensitivity". The sensitivity, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

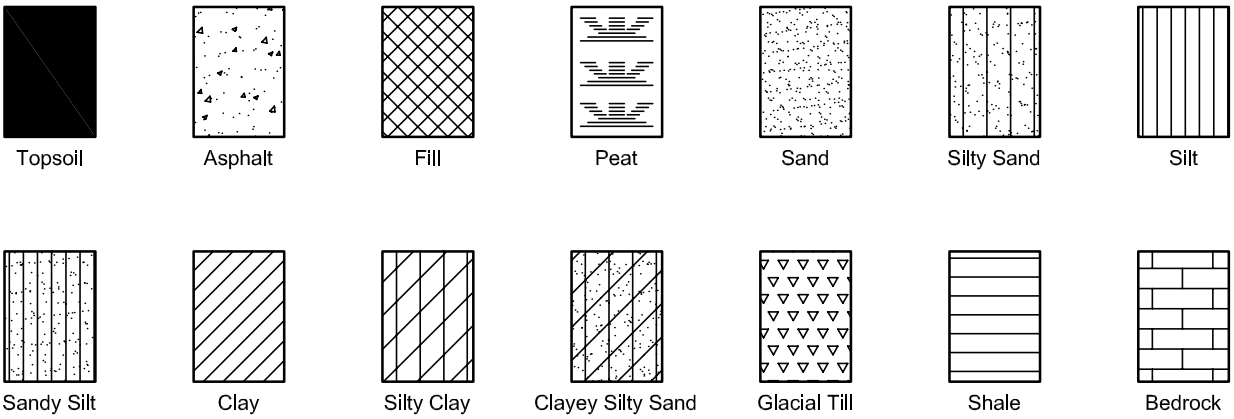
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

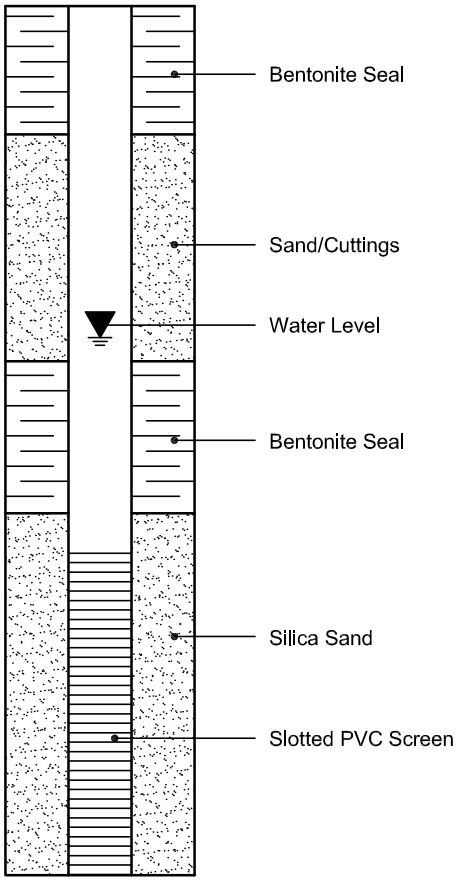
SYMBOLS AND TERMS (continued)

STRATA PLOT

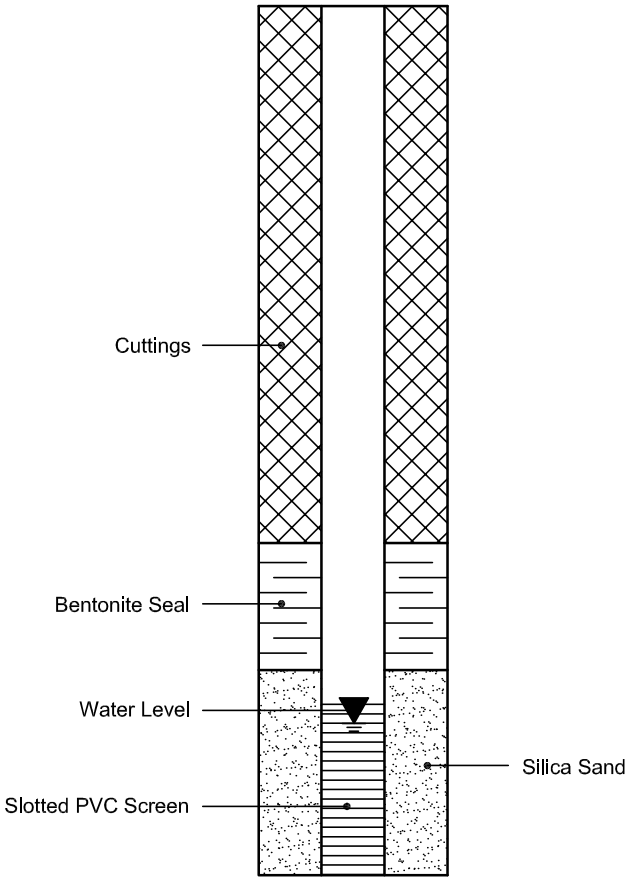


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Sam Berube

Client PO: 33143
Project: PE5429
Custody: 133108

Report Date: 17-Sep-2021
Order Date: 15-Sep-2021

Order #: 2138412

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

Paracel ID	Client ID
2138412-01	BH2-21-SS4
2138412-02	BH3-21-SS4
2138412-03	DUP-1

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Any use of these results implies your agreement that our total liabilty in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 33143

Report Date: 17-Sep-2021

Order Date: 15-Sep-2021

Project Description: PE5429

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	16-Sep-21	16-Sep-21
PHC F1	CWS Tier 1 - P&T GC-FID	16-Sep-21	16-Sep-21
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	14-Sep-21	17-Sep-21
Solids, %	Gravimetric, calculation	16-Sep-21	16-Sep-21

Certificate of Analysis

Report Date: 17-Sep-2021

Client: Paterson Group Consulting Engineers

Order Date: 15-Sep-2021

Client PO: 33143

Project Description: PE5429

	Client ID:	BH2-21-SS4	BH3-21-SS4	DUP-1	-
	Sample Date:	14-Sep-21 09:00	14-Sep-21 09:00	14-Sep-21 09:00	-
	Sample ID:	2138412-01	2138412-02	2138412-03	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	86.0	92.3	89.0	-
Volatiles					
Benzene	0.02 ug/g dry	<0.02	<0.02	<0.02	-
Ethylbenzene	0.05 ug/g dry	<0.05	<0.05	<0.05	-
Toluene	0.05 ug/g dry	<0.05	<0.05	<0.05	-
m,p-Xylenes	0.05 ug/g dry	<0.05	<0.05	<0.05	-
o-Xylene	0.05 ug/g dry	<0.05	<0.05	<0.05	-
Xylenes, total	0.05 ug/g dry	<0.05	<0.05	<0.05	-
Toluene-d8	Surrogate	125%	105%	99.6%	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	36	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	88	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	75	-	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 33143

Report Date: 17-Sep-2021

Order Date: 15-Sep-2021

Project Description: PE5429

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Volatiles									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	*3.42*		*ug/g*		*107*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND			NC	40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND			NC	30	
F3 PHCs (C16-C34)	22	8	ug/g dry	11			NC	30	
F4 PHCs (C34-C50)	39	6	ug/g dry	ND			NC	30	
Physical Characteristics									
% Solids	90.4	0.1	% by Wt.	92.4			2.2	25	
Volatiles									
Benzene	ND	0.02	ug/g dry	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g dry	ND			NC	50	
Toluene	ND	0.05	ug/g dry	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g dry	ND			NC	50	
o-Xylene	ND	0.05	ug/g dry	ND			NC	50	
Surrogate: Toluene-d8	*3.54*		*ug/g dry*		*106*	*50-140*			

Certificate of Analysis

Report Date: 17-Sep-2021

Client: Paterson Group Consulting Engineers

Order Date: 15-Sep-2021

Client PO: 33143

Project Description: PE5429

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	226	7	ug/g	ND	113	80-120			
F2 PHCs (C10-C16)	99	4	ug/g	ND	110	60-140			
F3 PHCs (C16-C34)	273	8	ug/g	11	119	60-140			
F4 PHCs (C34-C50)	174	6	ug/g	ND	124	60-140			
Volatiles									
Benzene	2.92	0.02	ug/g	ND	73.0	60-130			
Ethylbenzene	3.38	0.05	ug/g	ND	84.5	60-130			
Toluene	3.79	0.05	ug/g	ND	94.7	60-130			
m,p-Xylenes	7.05	0.05	ug/g	ND	88.1	60-130			
o-Xylene	3.69	0.05	ug/g	ND	92.3	60-130			
Surrogate: Toluene-d8	*2.97*		*ug/g*		*92.7*	*50-140*			

Qualifier Notes:

QC Qualifiers :

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

CCME PHC additional information:

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

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Chain Of Custody
(Lab Use Only)
№ 133108

Client Name: Paterson Group Inc.	Project Ref: PE5429	Page 1 of 1
Contact Name: Samuel Bérubé	Quote #:	Turnaround Time
Address: 154 Colonnade Rd S	PO #: 33143	☐ 1 day ☐ 3 day
	E-mail: sberube@patersongroup.ca	☐ 2 day ☒ ~~Regular~~
Telephone: 613-226-7381		Date Required:

☐ REG 153/04 ☐ REG 406/19	Other Regulation	Matrix Type: (S) Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)
☐ Table 1 ☐ Res/Park ☐ Med/Fine	☐ REG 558 ☐ PWQO	
☐ Table 2 ☐ Ind/Comm ☐ Coarse	☐ CCME ☐ MISA	
☑ Table 3 ☐ Agri/Other	☐ SU - Sani ☐ SU - Storm	
☐ Table	Mun:	
For RSC: ☐ Yes ☐ No	☐ Other:	

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	BTEX					
1	BH2-21-SS4	S		2	Sep. 14/21		✓												✓
2	BH3-21-SS4	↓		↓	↓		↓												✓
3	DUP-1	↓		↓	↓									✓					✓
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Comments:

Method of Delivery: PARACEL COURIER

Relinquished By (Sign):	Received By Driver/Depot: M. Jeouse	Received at Lab: Jurneepam Dakmai	Verified By:
Relinquished By (Print): Samuel Bérubé	Date/Time: 15/09/21 3:00	Date/Time: Sep 15, 2021 04.45	Date/Time: Sept 15 2021 5:31
Date/Time:	Temperature: °C	Temperature: 14.6 °C	pH Verified: ☐ By:

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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Sam Berube

Client PO: 33197
Project: PE5429
Custody: 133118

Report Date: 23-Sep-2021
Order Date: 20-Sep-2021

Order #: 2139178

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

Paracel ID	Client ID
2139178-01	BH1-21-GW1
2139178-02	BH2-21-GW1
2139178-03	BH3-21-GW1
2139178-04	DUP1-GW1

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Any use of these results implies your agreement that our total liabilty in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.

Certificate of Analysis

Report Date: 23-Sep-2021

Client: Paterson Group Consulting Engineers

Order Date: 20-Sep-2021

Client PO: 33197

Project Description: PE5429

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	22-Sep-21	22-Sep-21
PHC F1	CWS Tier 1 - P&T GC-FID	21-Sep-21	22-Sep-21
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	21-Sep-21	22-Sep-21

Certificate of Analysis

Report Date: 23-Sep-2021

Client: Paterson Group Consulting Engineers

Order Date: 20-Sep-2021

Client PO: 33197

Project Description: PE5429

	Client ID:	BH1-21-GW1	BH2-21-GW1	BH3-21-GW1	DUP1-GW1
	Sample Date:	20-Sep-21 09:00	20-Sep-21 09:00	20-Sep-21 09:00	20-Sep-21 09:00
	Sample ID:	2139178-01	2139178-02	2139178-03	2139178-04
	MDL/Units	Water	Water	Water	Water
Volatiles					
Benzene	0.5 ug/L	<0.5	6.3	10.0	<0.5
Ethylbenzene	0.5 ug/L	<0.5	8.9	81.2	<0.5
Toluene	0.5 ug/L	<0.5	0.6	4.4	<0.5
m,p-Xylenes	0.5 ug/L	<0.5	9.5	143	<0.5
o-Xylene	0.5 ug/L	<0.5	<0.5	3.7	<0.5
Xylenes, total	0.5 ug/L	<0.5	9.5	147	<0.5
Toluene-d8	Surrogate	88.8%	87.8%	89.4%	97.9%
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	311	434	-
F2 PHCs (C10-C16)	100 ug/L	<100	<100	<100	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	<100	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	<100	-

Certificate of Analysis

Report Date: 23-Sep-2021

Client: Paterson Group Consulting Engineers

Order Date: 20-Sep-2021

Client PO: 33197

Project Description: PE5429

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	*65.3*		*ug/L*		*81.6*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND			NC	30	
Volatiles									
Benzene	ND	0.5	ug/L	ND			NC	30	
Ethylbenzene	ND	0.5	ug/L	ND			NC	30	
Toluene	ND	0.5	ug/L	ND			NC	30	
m,p-Xylenes	ND	0.5	ug/L	ND			NC	30	
o-Xylene	ND	0.5	ug/L	ND			NC	30	
Surrogate: Toluene-d8	*66.8*		*ug/L*		*83.6*	*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)	1880	25	ug/L	ND	93.9	68-117			
F2 PHCs (C10-C16)	1440	100	ug/L	ND	90.0	60-140			
F3 PHCs (C16-C34)	3880	100	ug/L	ND	99.0	60-140			
F4 PHCs (C34-C50)	3080	100	ug/L	ND	124	60-140			
Volatiles									
Benzene	37.5	0.5	ug/L	ND	93.8	60-130			
Ethylbenzene	36.9	0.5	ug/L	ND	92.3	60-130			
Toluene	42.3	0.5	ug/L	ND	106	60-130			
m,p-Xylenes	64.8	0.5	ug/L	ND	81.0	60-130			
o-Xylene	42.0	0.5	ug/L	ND	105	60-130			
Surrogate: Toluene-d8	*56.8*		*ug/L*		*71.0*	*50-140*			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

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

PARACEL LABORATORIES LTD.

Paracel ID: 2139178

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2139178	№ 133118

Client Name: Paterson Group Inc. | Project Ref: PE5429 | Page 1 of 1

Contact Name: Samuel Bérubé | Quote #:

Address: 154 Colonnade Rd South | PO #: 33197

E-mail: sberube@patersongroup.ca

Telephone:

Turnaround Time: ☐ 1 day ☐ 3 day ☐ 2 day ☑ Regular

Date Required:

☐ REG 153/04 ☐ REG 406/19

☐ Table 1 ☐ Res/Park ☐ Med/Fine
☐ Table 2 ☐ Ind/Comm ☐ Coarse
☑ Table 3 ☐ Agri/Other
☐ Table

For RSC: ☐ Yes ☐ No

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

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

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	BTEX
1	BH1-21-GW1	GW		3	Sept 2080		✓							
2	BH2-21-GW1													
3	BH3-21-GW1													
4	DUP1-GW1													✓
5														
6														
7														
8														
9														
10														

Comments:

Method of Delivery: Drop box

Relinquished By (Sign):	Received By Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Samuel Bérubé	Date/Time:	Date/Time: Sept 20 2021 18:40	Date/Time: Sept 21, 2021 12:59
Date/Time:	Temperature: °C	Temperature: 10.0 °C	pH Verified: ☐ By:

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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Sam Berube

Client PO: 33317
Project: PE5429
Custody: 131541

Report Date: 27-Oct-2021
Order Date: 22-Oct-2021

Order #: 2143612

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

Paracel ID	Client ID
2143612-01	BH2-21
2143612-02	BH3-21

Approved By:

Dale Robertson, BSc
Laboratory Director

Any use of these results implies your agreement that our total liabilty in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 33317

Report Date: 27-Oct-2021

Order Date: 22-Oct-2021

Project Description: PE5429

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	26-Oct-21	26-Oct-21
PHC F1	CWS Tier 1 - P&T GC-FID	25-Oct-21	26-Oct-21
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	26-Oct-21	26-Oct-21

Certificate of Analysis

Report Date: 27-Oct-2021

Client: Paterson Group Consulting Engineers

Order Date: 22-Oct-2021

Client PO: 33317

Project Description: PE5429

	Client ID:	BH2-21	BH3-21	-	-
	Sample Date:	22-Oct-21 10:50	22-Oct-21 10:55	-	-
	Sample ID:	2143612-01	2143612-02	-	-
	MDL/Units	Water	Water	-	-
Volatiles					
Benzene	0.5 ug/L	3.9	10.8	-	-
Ethylbenzene	0.5 ug/L	6.3	70.0	-	-
Toluene	0.5 ug/L	0.5	1.9	-	-
m,p-Xylenes	0.5 ug/L	3.8	104	-	-
o-Xylene	0.5 ug/L	<0.5	3.7	-	-
Xylenes, total	0.5 ug/L	3.8	108	-	-
Toluene-d8	Surrogate	83.3%	82.6%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	247	808	-	-
F2 PHCs (C10-C16)	100 ug/L	<100	<100	-	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	-	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	-	-

Certificate of Analysis

Report Date: 27-Oct-2021

Client: Paterson Group Consulting Engineers

Order Date: 22-Oct-2021

Client PO: 33317

Project Description: PE5429

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
Volatiles									
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	*70.0*		*ug/L*		*87.5*	*50-140*			

Certificate of Analysis

Report Date: 27-Oct-2021

Client: Paterson Group Consulting Engineers

Order Date: 22-Oct-2021

Client PO: 33317

Project Description: PE5429

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND			NC	30	
Volatiles									
Benzene	ND	0.5	ug/L	ND			NC	30	
Ethylbenzene	ND	0.5	ug/L	ND			NC	30	
Toluene	ND	0.5	ug/L	ND			NC	30	
m,p-Xylenes	ND	0.5	ug/L	ND			NC	30	
o-Xylene	ND	0.5	ug/L	ND			NC	30	
Surrogate: Toluene-d8	*68.0*		*ug/L*		*85.1*	*50-140*			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 33317

Report Date: 27-Oct-2021

Order Date: 22-Oct-2021

Project Description: PE5429

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1780	25	ug/L	ND	89.2	68-117			
F2 PHCs (C10-C16)	1400	100	ug/L	ND	87.5	60-140			
F3 PHCs (C16-C34)	4660	100	ug/L	ND	119	60-140			
F4 PHCs (C34-C50)	3060	100	ug/L	ND	123	60-140			
Volatiles									
Benzene	41.8	0.5	ug/L	ND	105	60-130			
Ethylbenzene	30.4	0.5	ug/L	ND	76.0	60-130			
Toluene	34.2	0.5	ug/L	ND	85.6	60-130			
m,p-Xylenes	55.4	0.5	ug/L	ND	69.2	60-130			
o-Xylene	34.9	0.5	ug/L	ND	87.3	60-130			
Surrogate: Toluene-d8	*58.8*		*ug/L*		*73.6*	*50-140*			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

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

PARACEL LABORATORIES LTD

Paracel ID: 2143612

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Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2143612	№ 131541

Client Name: Paterson
Project Ref: PE 5429
Page __ of __

Contact Name: Sam Berube
Quote #:

Address: 154 Colonnade
PO #: 33317

E-mail: Sberube@Patersongroup.ca

Telephone: 613 226 7381

Turnaround Time
☐ 1 day ☐ 3 day
☐ 2 day ☑ Regular
Date Required: _____

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

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

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)						
1	BH2-21	GW		3	Oct 22 2021	10:50	✓												✓
2	BH3-21	↓		↓	↓	11:55	✓												✓
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Comments:

Method of Delivery: Drop Box

Relinquished By (Sign):	Received By Driver/Depot:	Received at Lab:	Verified By:
GPat		Jameeparn Bakmaji	C
Relinquished By (Print): Grant Paterson	Date/Time:	Date/Time: Oct 22, 2021 04:00	Date/Time: Oct 22 2021 7:16
Date/Time: Oct 22 2021	Temperature: °C	Temperature: 8.4 °C	pH Verified: ☐ By: