

September 15, 2020  
File: PE4987-LET.01

**Surface Developments**  
88 Spadina Avenue  
Ottawa, Ontario  
K1Y 1P7

Attention: **Mr. Jakub Ulak**

Subject: **Phase II - Environmental Site Assessment**  
**1619 Carling Avenue**  
**Ottawa, Ontario**

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Dear Sir,

Further to your request and authorization, Paterson Group (Paterson) carried out a Phase II - Environmental Site Assessment (ESA) at the aforementioned site. The results of the Phase II – ESA are summarized in the following report.

## 1.0 Background Information

The subject site is centrally located on the north side of the Carling Avenue approximately 40m west of Churchill Avenue North, in the City of Ottawa, Ontario. The subject site is occupied by a one-storey commercial building. The remainder of the site is asphalt covered and used for vehicular parking. The neighbouring properties are utilized for a combination of residential and commercial purposes including a Shell retail fuel outlet immediately to the east.

## 2.0 Previous Reports

- “Phase III – ESA and Groundwater Treatment Program, 1619 Carling Avenue, Ottawa, Ontario”, prepared by A & A Consultants, dated July 30, 2018.

The A & A report details petroleum hydrocarbon impacted groundwater beneath a significant portion of the subject site. A & A indicate that the groundwater flows in a westward direction.

A groundwater pumping and subsequent oxidant injection program was completed from March to June of 2018. Groundwater sampling in June 2018 indicate that the water complied with the MECP Table 7 standards. It was recommended that further groundwater testing be completed to confirm the results of the testing program.

Based on test results provided, it appears that two (2) additional groundwater testing events were completed in November and December of 201, when eight (8) and six (6) wells were tested, respectively. The test results were all reported as non-detected.

Paterson was subsequently requested to resample existing wells, however all of the wells had been destroyed or paved over. As a result, Paterson completed a Phase II – ESA, the results of which are detailed below.

### **3.0 Subsurface Investigation**

Four (4) boreholes (BH1 – BH4) were placed on the subject property on August 17, 2020. The boreholes were completed using a low clearance track mounted drill rig under the full-time supervision of Paterson personnel.

Groundwater monitoring wells were installed within each of the completed boreholes. The boreholes were initially sampled to depths ranging from 1.42 to 1.65m below ground surface (mgs). The boreholes were extended to depths ranging from 5.51m to 5.69m by means of rock coring to enable the installation of groundwater monitoring wells. The groundwater table was intercepted by the boreholes through bedrock coring procedures. The locations of the boreholes are illustrated on the enclosed Test Hole Location Plan. The depths at which the auger, split spoon and rock core samples were obtained from the test holes are shown as “**AU**”, “**SS**” and “**RC**” on the Soil Profile and Test Data sheets, attached to this report.

#### **Subsurface Profile**

The soil profile encountered consisted of a layer of asphaltic concrete underlain by a layer of brown silty sand and crushed stone, underlain by limestone bedrock. The specific details of the soil profile at the test hole locations are presented on the attached Soil Profile and Test Data sheets.

### **Monitoring Well Installation**

Groundwater monitoring wells were installed in BH1, BH2, BH3 and BH4; the locations of which can be seen on the attached Test Hole Location Plan. Typical monitoring well construction details are described below:

- Slotted 32 mm diameter PVC screen at base of borehole.
- 32 mm diameter PVC riser pipe from the top of the screen to ground surface.
- No.3 silica sand backfill within annular space around screen.
- Bentonite above sand pack to just below ground surface.
- Clean backfill from top of bentonite plug to the ground surface.

Refer to the Soil Profile and Test Data sheets attached for the actual well construction in these boreholes.

### **Soil Sampling Protocol**

Eight (8) soil samples were recovered by means of stainless-steel split spoon or auger sampling from the boreholes. Upon recovery, all samples were immediately sealed in appropriate containers to facilitate a preliminary screening procedure. No unusual visual or olfactory observations were made regarding the soil samples obtained from the boreholes.

### **Soil Sample Headspace Analysis**

The technical protocol was obtained from Appendix C of the MECP document titled "Interim Guidelines for the Remediation of Petroleum Contamination at Operating Retail and Private Fuel Outlets in Ontario", dated March 1992.

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

To measure the soil vapour concentrations, the analyser probe is inserted into the nominal headspace above the soil sample. A PID calibrated to hexane was used for this purpose. 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 vapour readings were found to range from negligible to 2.2 ppm in the soil samples obtained. The results do not indicate the potential for significant contamination from lighter petroleum hydrocarbons. Results of the vapour survey are available on the Soil Profile & Test Data sheets, appended to this report.

## **Groundwater**

Water levels and groundwater samples from BH1, BH2, BH3, and BH4 were collected on August 25 and 26, 2020. The obtained groundwater levels in BH1, BH2, BH3 and BH4 were 2.23, 2.69, 2.06 and 1.71 m below the existing ground surface, respectively. The water levels were present within the bedrock deposit.

It should be noted that groundwater levels are expected to fluctuate throughout the year with seasonal variations. No unusual visual or olfactory observations were noted regarding the groundwater samples obtained.

## **4.0 Analytical Test Results**

The soil and groundwater standards for the subject site were obtained from Table 7 of the document entitled "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the *Environmental Protection Act*", dated April 15, 2011. The MECP Standards are based on the following considerations:

- Coarse grained soil conditions.
- Shallow soils condition (less than 2 m of overburden).
- Non-potable groundwater situation.
- Residential land use.

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

## **Soil**

Three (3) soil samples were submitted to Paracel Laboratories for petroleum hydrocarbons PHCs (Fractions 1 to 4) and benzene, toluene, ethylbenzene, and xylenes (BTEX) analyses. The results of the analytical testing, and the selected soil standards, are presented in Table 1. A copy of the laboratory certificate of analysis is attached to this report.

<b>TABLE 1. Analytical Test Results Soil – BTEX and PHCs F<sub>1</sub>-F<sub>4</sub></b>					
Parameter	MDL (µg/g)	Soil Samples (µg/g) August 17, 2020			MECP Table 7 Residential Standards (µg/g) Coarse Grain
		BH1-AU1	BH2-SS2	BH3-SS2	
Benzene	0.02	nd	nd	nd	0.21
Ethylbenzene	0.05	nd	nd	nd	2
Toluene	0.05	nd	nd	nd	2.3
Xylenes	0.05	nd	nd	nd	3.1
PHC F <sub>1</sub>	7	nd	nd	nd	55
PHC F <sub>2</sub>	4	nd	nd	nd	98
PHC F <sub>3</sub>	8	<b><u>311</u></b>	27	nd	300
PHC F <sub>4</sub>	6	<b><u>701</u></b>	37	nd	2800
PHC F <sub>4</sub> (gravimetric)	50	938	n/a	n/a	2800

Notes:

- MDL – Method Detection Limit
- nd – not detected above the MDL
- 1 - GC-FID signal did not return to baseline by C50
- Bold and Underlined** – value exceeds selected standard

No detectable BTEX concentrations were identified in the soil samples analyzed. The detected PHCs (F3 and F4) concentrations identified in the analysed soil samples BH1-AU1 and BH2-SS2 comply with the MECP Table 7 standards with the exception of the F3 concentration in sample BH1-AU1. It should be noted that the concentrations of PHCs (F3 and F4) in BH1-AU1 exceed the MECP Table 1 standards and will require disposal at an accredited waste disposal facility during development.

### Groundwater

Groundwater samples were recovered from the monitoring wells installed in BH1, BH2, BH3 and BH4 on August 25 and 26, 2020. The water samples were submitted for PHC and VOC analysis. The results of the analytical testing, and the selected MECP standards are presented in Tables 2 and 3.

<b>TABLE 2. Analytical Test Results Groundwater – BTEX and PHCs F<sub>1</sub> to F<sub>4</sub></b>						
Parameter	MDL (µg/L)	Water Samples (µg/L) August 25/26, 2020				MECP Table 7 Residential Standards (µg/gL) Coarse Grain
		BH1- GW1	BH2- GW1	BH3- GW1	BH4 – GW1	
Benzene	0.5	nd	<b><u>5.8</u></b>	<b><u>3.8</u></b>	nd	0.5
Ethylbenzene	0.5	nd	nd	0.5	1.7	54
Toluene	0.5	nd	nd	nd	nd	320
Xylenes	0.5	nd	1.5	0.6	1.4	72
PHC F <sub>1</sub>	25	nd	84	41	nd	420
PHC F <sub>2</sub>	100	nd	<b><u>1890</u></b>	nd)	nd	150
PHC F <sub>3</sub>	100	nd	<b><u>1690</u></b>	nd)	nd	500
PHC F <sub>4</sub>	100	nd	nd	nd	nd	500
Notes:						
<input type="checkbox"/> MDL – Method Detection Limit <input type="checkbox"/> nd – not detected above the MDL <input type="checkbox"/> <b><u>Bold and Underlined</u></b> – value exceeds selected standard						

PHC concentrations were identified in two (2) of the groundwater samples analysed. Elevated PHC (F2 and F3) concentrations were detected in BH2-GW1, as well as elevated benzene concentrations in BH2-GW1 as well as BH3-GW1. The remaining PHC, BTEX and VOC parameters analysed were either non-detectable or in compliance with the MECP Table 7 standards.

<b>TABLE 3. Analytical Test Results Groundwater – VOCs</b>						
Parameter	MDL (µg/L)	Water Samples (µg/L) August 25/26, 2020				MECP Table 7 Residential Standards (µg/L) Coarse Grain
		BH1- GW1	BH2 - GW1	BH3 - GW1	BH4 - GW1	
Acetone	5.0	nd	nd	nd	nd	100000
Bromodichloromethane	0.5	nd	nd	nd	nd	67000
Bromoform	0.5	nd	nd	nd	nd	5
Bromomethane	0.5	nd	nd	nd	nd	0.89
Carbon Tetrachloride	0.2	nd	nd	nd	nd	0.2
Chlorobenzene	0.5	nd	nd	nd	nd	140
Chloroform	0.5	nd	nd	nd	nd	2
Dibromochloromethane	0.5	nd	nd	nd	nd	65000
Dichlorodifluoromethane	1.0	nd	nd	nd	nd	3500
1,2-Dichlorobenzene	0.5	nd	nd	nd	nd	150
1,3-Dichlorobenzene	0.5	nd	nd	nd	nd	7600
1,4-Dichlorobenzene	0.5	nd	nd	nd	nd	0.5
1,1-Dichloroethane	0.5	nd	nd	nd	nd	11
1,2-Dichloroethane	0.5	nd	nd	nd	nd	0.5
1,1-Dichloroethylene	0.5	nd	nd	nd	nd	0.5
cis-1,2-Dichloroethylene	0.5	nd	nd	nd	nd	1.6
trans-1,2-Dichloroethylene	0.5	nd	nd	nd	nd	1.6
1,2-Dichloropropane	0.5	nd	nd	nd	nd	0.58
cis-1,3-Dichloropropylene	0.5	nd	nd	nd	nd	
trans-1,3-Dichloropropylene	0.5	nd	nd	nd	nd	
1,3-Dichloropropene, total	0.5	nd	nd	nd	nd	0.5
Ethylene dibromide (dibromoethane, 1,2-)	0.2	nd	nd	nd	nd	0.2
Hexane	1.0	nd	nd	nd	nd	5
Methyl Ethyl Ketone (2-Butanone)	5.0	nd	nd	nd	nd	21000
Methyl Isobutyl Ketone	5.0	nd	nd	nd	nd	5200
Methyl tert-butyl ether	2.0	nd	nd	nd	nd	15
Methylene Chloride	5.0	nd	nd	nd	nd	26
Styrene	0.5	nd	nd	nd	nd	43
1,1,1,2-Tetrachloroethane	0.5	nd	nd	nd	nd	1.1
1,1,2,2-Tetrachloroethane	0.5	nd	nd	nd	nd	0.5
Tetrachloroethylene	0.5	nd	nd	nd	nd	0.5
1,1,1-Trichloroethane	0.5	nd	nd	nd	nd	23
1,1,2-Trichloroethane	0.5	nd	nd	nd	nd	0.5
Trichloroethylene	0.5	nd	nd	nd	nd	0.5
Trichlorofluoromethane	1.0	nd	nd	nd	nd	2000
Vinyl Chloride	0.5	nd	nd	nd	nd	0.5

Notes:

- MDL – Method Detection Limit
- nd – not detected above the MDL
- value exceeds selected standards

All VOC concentrations aside from the previously mentioned benzene concentrations were non-detectable.

## **5.0 Assessment and Recommendations**

### **Assessment**

A Phase II - Environmental Site Assessment was carried out for the subject site in order to assess the effectiveness of a previous remediation program and the potential impact from an adjacent retail fuel outlet to the east.

#### **Soil**

Four (4) boreholes (BH1 – BH4) were placed on the subject property on August 17, 2020. Three (3) soil samples were submitted for BTEX and PHC analysis. No detectable BTEX concentrations were identified in the soil samples analysed. The detected PHCs (F3 and F4) concentrations identified in the analysed soil samples BH1-AU1 and BH2-SS2 comply with the MECP Table 7 standards with the exception of the F3 concentration in sample BH1-AU1. It should be noted that concentrations of PHCs (F3 and F4) in BH1-AU1 exceed the MECP Table 1 standards which are used to classify soil for offsite disposal.

#### **Groundwater**

Groundwater samples were recovered from the monitoring wells installed in BH1, BH2, BH3 and BH4 on August 25 and 26, 2020. The water samples were submitted for PHC and VOC analysis. PHC concentrations were identified in two (2) of the groundwater samples analysed. PHC (F3 and F4) concentrations in excess of the selected standards were detected in BH2-GW1, as well as Benzene concentrations in BH2-GW1 and BH3-GW1. The remaining PHC and VOC parameters analysed were either non-detectable or in compliance with the MECP Table 7 standards.

While the source of the groundwater contaminants has not been definitively determined, it is suspected that the adjacent retail fuel outlet is likely a source.



## **Recommendations**

### **Soil**

All of the collected soil samples were in compliance with the MECP Table 7 standards, however, concentrations of PHCs (F3 and F4) in BH1-AU1 exceed the MECP Table 1 standards. During future development of the subject site all soil with contaminant concentrations in excess of Table 1 standards will have to be disposed of at an approved waste disposal facility at a premium charge. At this time, it is unknown how much soil will have to be disposed of as impacted during future site development. Based on our current information, the total volumes of overburden on site is estimated to be 1,600 m<sup>3</sup>.

Based on our site observations, in conjunction with our more analytical test results, the PHC impacted soil on-site is expected to be limited in volume and isolated within the southern corner of the property.

It is recommended that the identified impacted material be brought to a registered waste disposal facility at the time of excavation activities. The most practical methodology would be to transfer the PHC impacted soil to a registered waste disposal facility under the guidance of a member of this firm. The cost to remediate the contaminated soil is estimated to be approximately \$50,000.

### **Groundwater**

The benzene concentrations identified in groundwater samples BH2-GW1 and BH3-GW1 as well as the PHC (F2 and F3) in BH2-GW1 were in excess of the MECP Table 7 Standards. Based on the groundwater data, the impacted groundwater appears to be predominantly along the eastern portion of the subject site. The groundwater was identified within the upper portion of the bedrock at depths ranging from 1.7 to 2.7m.

Until the site is redeveloped, it is recommended that an annual groundwater testing program be implemented to monitor the contaminant concentrations (and any degradation trends).

It is our understanding that the subject site is to be redeveloped with three (3) levels underground. Based on the depth of the impacted groundwater, which is suspected to reside above 6m, the groundwater below the base of the excavation is not anticipated to be impacted with petroleum hydrocarbon concentrations.

The impacted groundwater on site and any such water entering the future excavations will have to be removed from site by a licensed pumping contractor or treated on site by means of a portable granular activated carbon system. This system would have to remain on site until groundwater concentrations comply with the MECP standards and/or the city of Ottawa sewer use criteria.

Given that the source of the impacted groundwater may be off-site to the east, it will be necessary to prevent further migration of this waste onto the site in order to comply with MECP standards and be able to acquire a record of site condition. To accomplish this, it is recommended that the perimeter rock walls of the excavation be covered with an impermeable elastomeric coating and the base of the excavation will be covered with a waterproofing membrane. To facilitate the placement of the membrane, a reinforced concrete slab will be constructed along the entire excavation bottom. The concrete base slab may be anchored to the bedrock and the foundation walls will be structurally reinforced to address hydrostatic pressure.

It is recommended that an annual groundwater testing program be implemented to monitor the contaminant concentrations (and any degradation trends).

### **Monitoring Wells**

It is recommended that all monitoring wells be maintained (not abandoned) in order to allow for potential future groundwater monitoring. If the monitoring wells are to be abandoned, it should be done according to the O.Reg 903. The monitoring wells will be registered with the MECP under this regulation. Further information can be provided upon request in this regard.

### **Statement of Limitations**

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

This report was prepared for the use of Surface Developments. Permission from Paterson and Surface Developments will be required to release this report to any other party.

We trust that this submission satisfies your current requirements. Should you have any questions please contact the undersigned.

**Paterson Group Inc.**



Samuel Berube, B.Eng.



Mark D'Arcy, P.Eng.

**Attachments:**

- Soil Profile and Test Data Sheets
- Analytical Test Results
- Test Hole Location Plan

**Report Distribution:**

- Surface Developments. (2 copies)
- Paterson Group (1 copy)

**DATUM** TBM - Top of grate of catch basin located near the northeast corner of subject site. Assumed elevation = 100.00m.

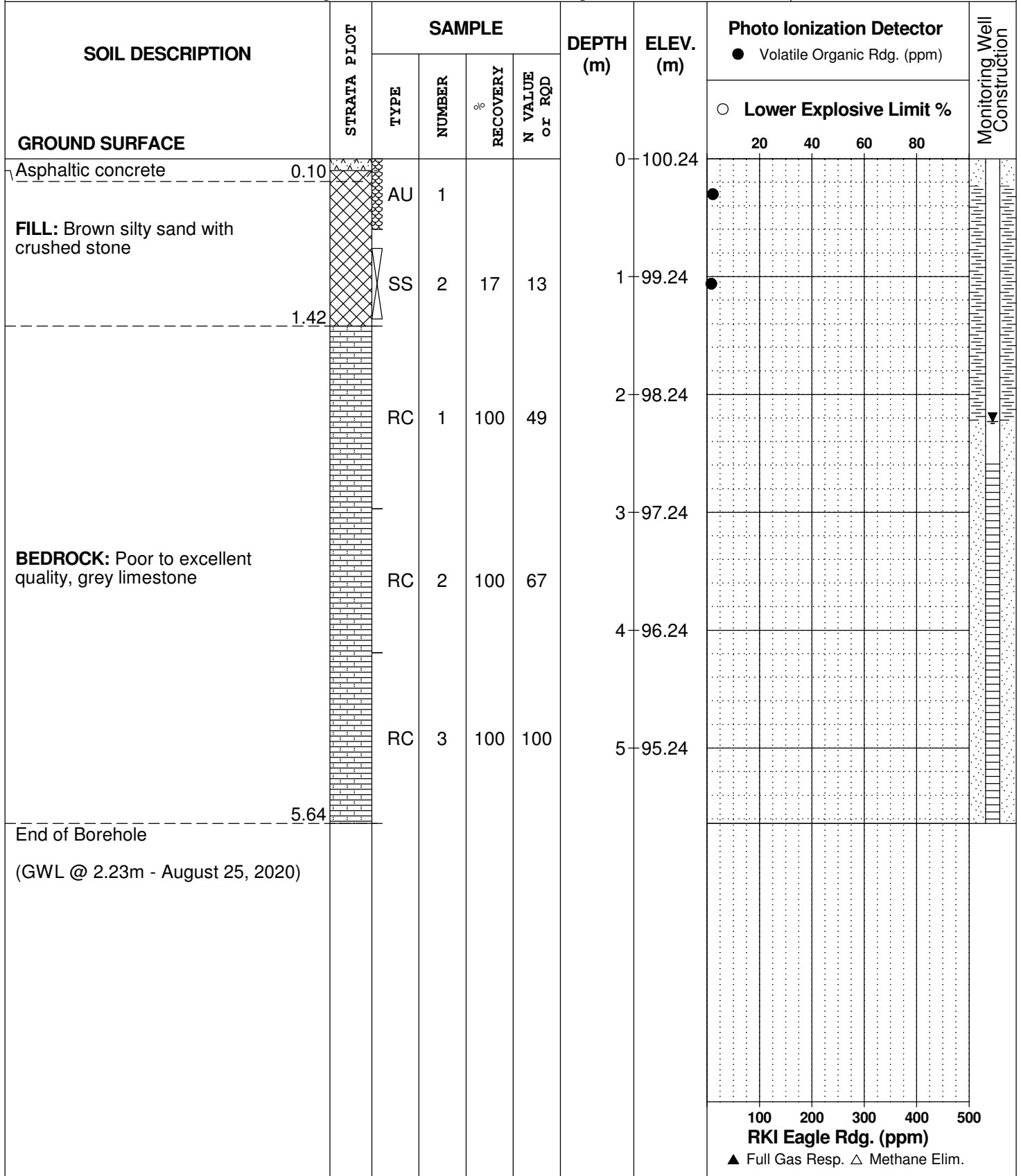
**REMARKS**

**FILE NO.** PE4987

**HOLE NO.** BH 1

**BORINGS BY** Track-Mount Power Auger

**DATE** August 17, 2020



**DATUM** TBM - Top of grate of catch basin located near the northeast corner of subject site. Assumed elevation = 100.00m.

**REMARKS**

**BORINGS BY** Track-Mount Power Auger

**DATE** August 17, 2020

**FILE NO.** PE4987

**HOLE NO.** BH 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction	
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm) ○ Lower Explosive Limit %					
<b>GROUND SURFACE</b>								20	40	60	80		
Asphaltic concrete	0.10					0	100.09						
<b>FILL:</b> Brown silty sand with crushed stone	0.59	AU	1										
<b>FILL:</b> Brown silty sand, some gravel and crushed stone	1.55	SS	2	38	8	1	99.09						
						2	98.09						
		RC	1	100	65								
						3	97.09						
<b>BEDROCK:</b> Fair to excellent quality, grey limestone						4	96.09						
		RC	2	82	38								
						5	95.09						
		RC	3	100	100								
End of Borehole (GWL @ 2.69m - August 25, 2020)	5.69												

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

**DATUM** TBM - Top of grate of catch basin located near the northeast corner of subject site. Assumed elevation = 100.00m.

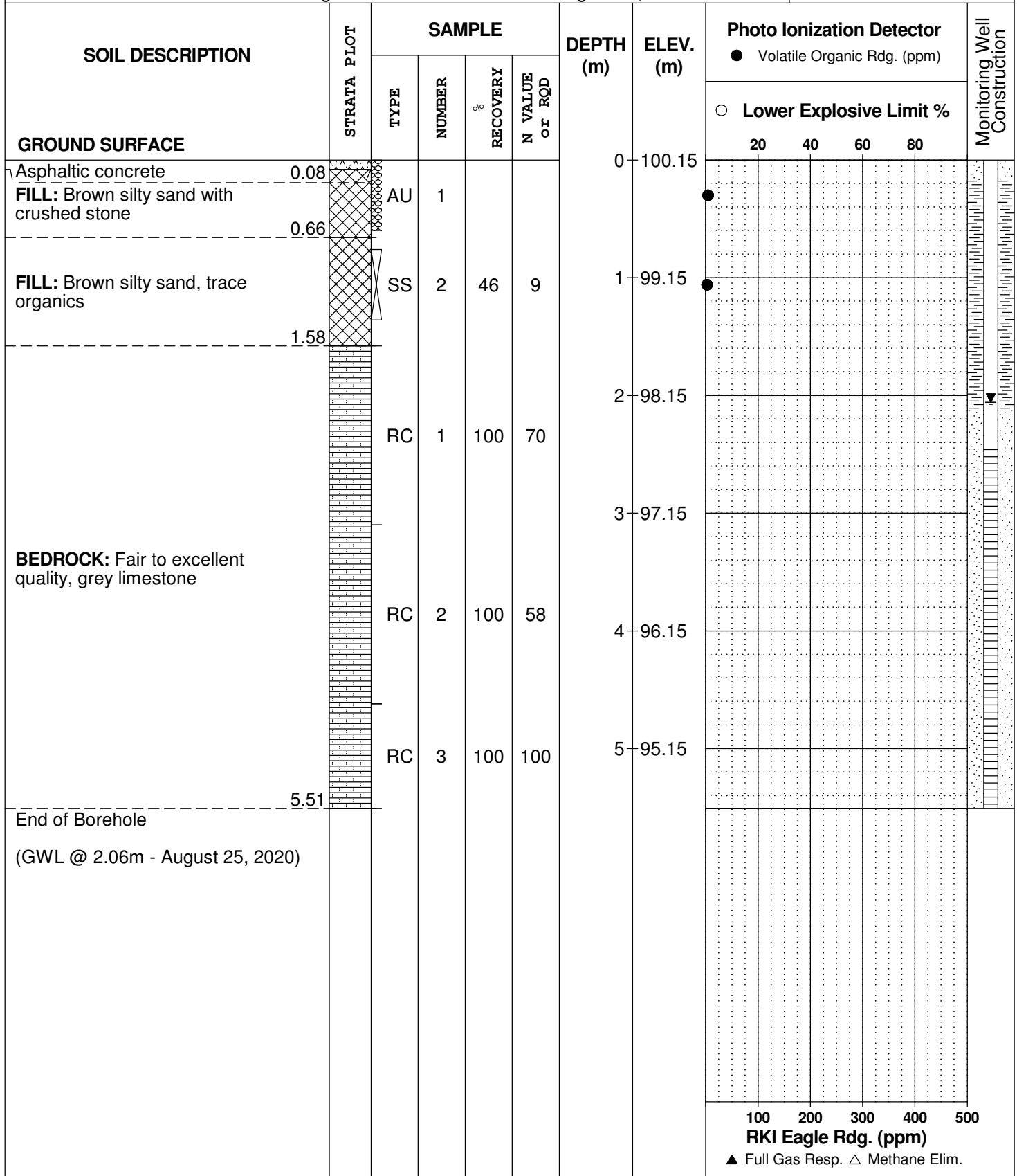
**REMARKS**

**FILE NO.** PE4987

**HOLE NO.** BH 3

**BORINGS BY** Track-Mount Power Auger

**DATE** August 17, 2020



**DATUM** TBM - Top of grate of catch basin located near the northeast corner of subject site. Assumed elevation = 100.00m.

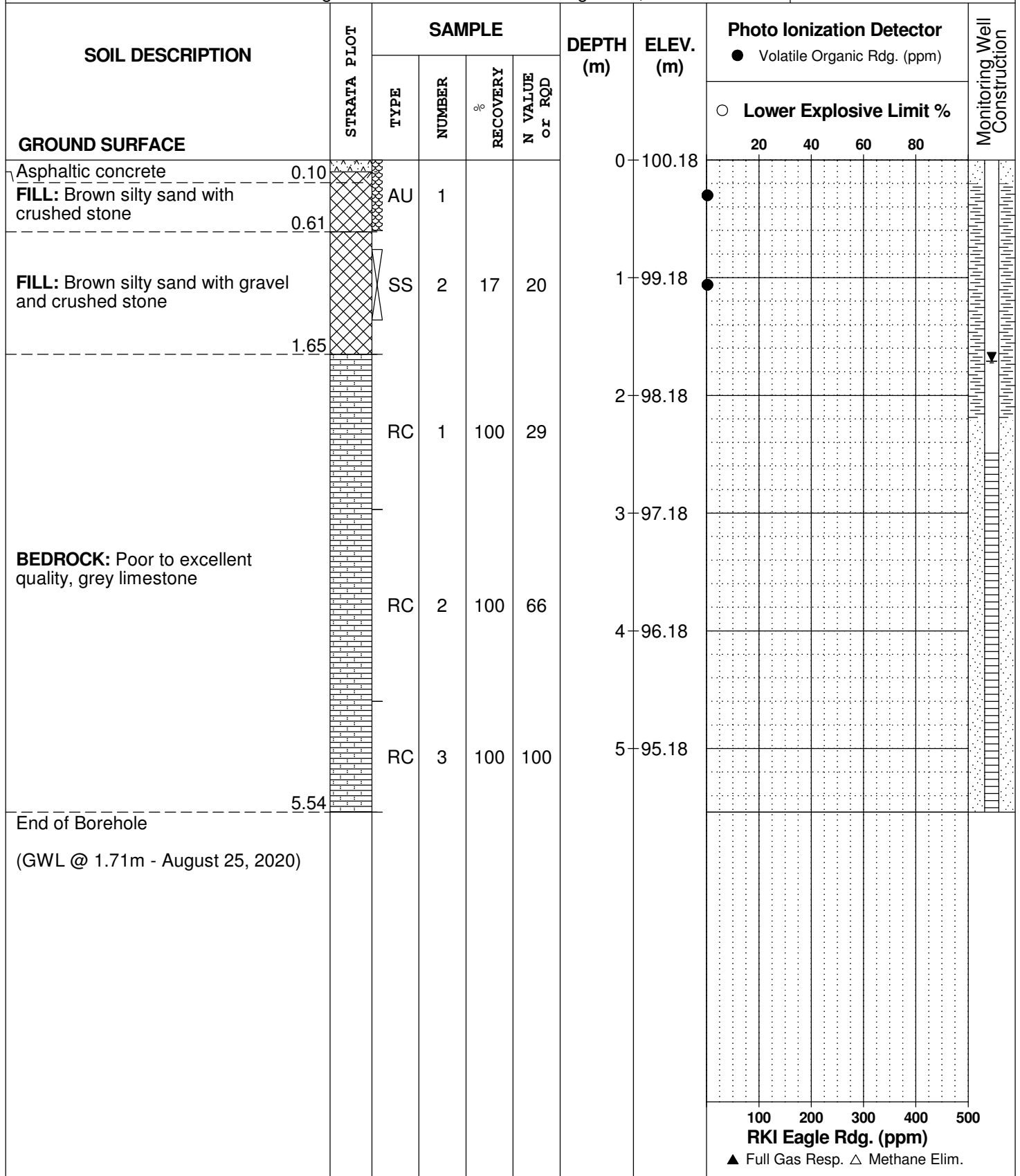
**REMARKS**

**BORINGS BY** Track-Mount Power Auger

**DATE** August 17, 2020

**FILE NO.** PE4987

**HOLE NO.** BH 4



## SYMBOLS AND TERMS

### SOIL DESCRIPTION

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

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

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

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

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

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



## SYMBOLS AND TERMS (continued)

### SOIL DESCRIPTION (continued)

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

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

### ROCK DESCRIPTION

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

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

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

### SAMPLE TYPES

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

## SYMBOLS AND TERMS (continued)

### GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic limit, % (water content above which soil behaves plastically)
PI	-	Plasticity index, % (difference between LL and PL)
Dxx	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D_{30})^2 / (D_{10} \times D_{60})$
Cu	-	Uniformity coefficient = $D_{60} / D_{10}$

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		Overconsolidation 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.
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## SYMBOLS AND TERMS (continued)

### STRATA PLOT



Topsoil



Asphalt



Fill



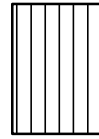
Peat



Sand



Silty Sand



Silt



Sandy Silt



Clay



Silty Clay



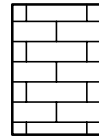
Clayey Silty Sand



Glacial Till



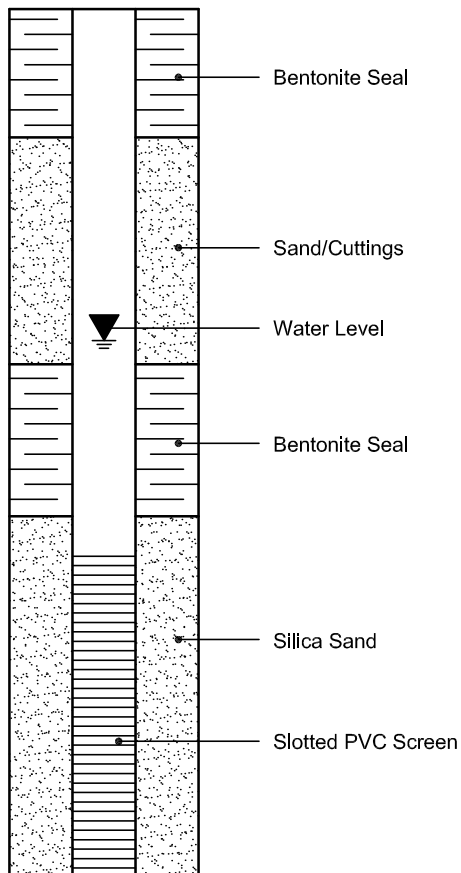
Shale



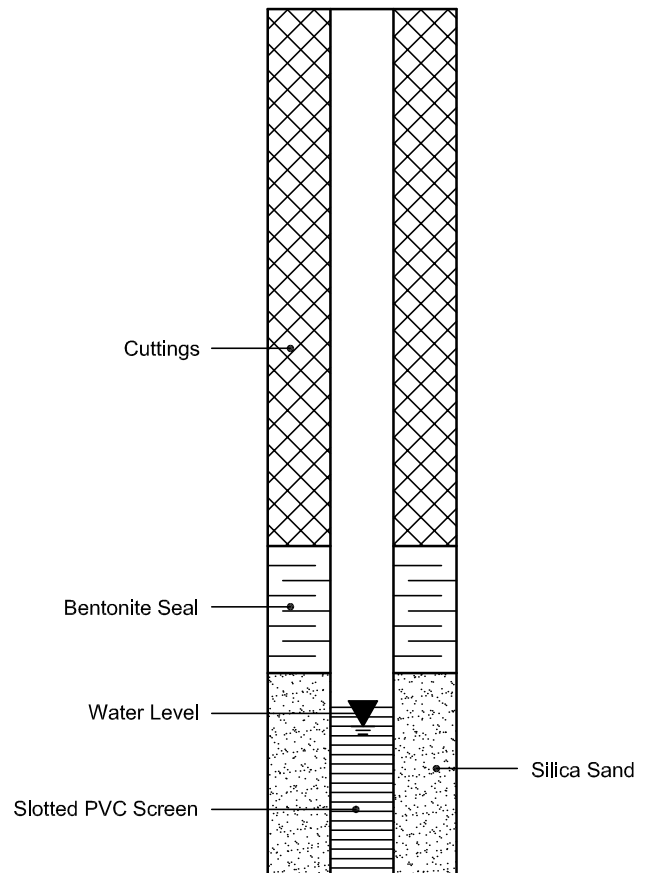
Bedrock

### MONITORING WELL AND PIEZOMETER CONSTRUCTION

#### MONITORING WELL CONSTRUCTION



#### PIEZOMETER CONSTRUCTION



## Certificate of Analysis

**Paterson Group Consulting Engineers**

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

Client PO: 30801  
Project: PE4987  
Custody: 128073

Report Date: 21-Aug-2020  
Order Date: 18-Aug-2020

**Order #: 2034167**

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

Parcel ID	Client ID
2034167-01	BH1-AU1
2034167-02	BH2-SS2
2034167-03	BH3-SS2

Approved By:



Dale Robertson, BSc  
Laboratory Director

Certificate of Analysis

Report Date: 21-Aug-2020

Client: Paterson Group Consulting Engineers

Order Date: 18-Aug-2020

Client PO: 30801

Project Description: PE4987

**Analysis Summary Table**

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	18-Aug-20	19-Aug-20
PHC F1	CWS Tier 1 - P&T GC-FID	18-Aug-20	19-Aug-20
PHC F4G (gravimetric)	CWS Tier 1 - Extraction Gravimetric	21-Aug-20	21-Aug-20
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	18-Aug-20	20-Aug-20
Solids, %	Gravimetric, calculation	19-Aug-20	19-Aug-20

Certificate of Analysis

Report Date: 21-Aug-2020

Client: Paterson Group Consulting Engineers

Order Date: 18-Aug-2020

Client PO: 30801

Project Description: PE4987

<b>Client ID:</b>	BH1-AU1	BH2-SS2	BH3-SS2	-
<b>Sample Date:</b>	17-Aug-20 09:00	17-Aug-20 09:00	17-Aug-20 09:00	-
<b>Sample ID:</b>	2034167-01	2034167-02	2034167-03	-
<b>MDL/Units</b>	Soil	Soil	Soil	-

**Physical Characteristics**

% Solids	0.1 % by Wt.	94.9	91.2	89.2	-
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**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	111%	111%	112%	-

**Hydrocarbons**

F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	-
F3 PHCs (C16-C34)	8 ug/g dry	311	27	<8	-
F4 PHCs (C34-C50)	6 ug/g dry	701 [1]	37	<6	-
F4G PHCs (gravimetric)	50 ug/g dry	938	-	-	-

Certificate of Analysis

Report Date: 21-Aug-2020

Client: Paterson Group Consulting Engineers

Order Date: 18-Aug-2020

Client PO: 30801

Project Description: PE4987

**Method Quality Control: Blank**

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
F4G PHCs (gravimetric)	ND	50	ug/g						
<b>Volatiles</b>									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	7.22		ug/g		90.2	50-140			

Certificate of Analysis

Report Date: 21-Aug-2020

Client: Paterson Group Consulting Engineers

Order Date: 18-Aug-2020

Client PO: 30801

Project Description: PE4987

**Method Quality Control: Duplicate**

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
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)	285	8	ug/g dry	311			8.8	30	
F4 PHCs (C34-C50)	591	6	ug/g dry	701			17.0	30	
<b>Physical Characteristics</b>									
% Solids	94.0	0.1	% by Wt.	94.3			0.3	25	
<b>Volatiles</b>									
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	10.6		ug/g dry		106	50-140			



Certificate of Analysis

Report Date: 21-Aug-2020

Client: Paterson Group Consulting Engineers

Order Date: 18-Aug-2020

Client PO: 30801

Project Description: PE4987

**Method Quality Control: Spike**

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	202	7	ug/g	ND	101	80-120			
F2 PHCs (C10-C16)	96	4	ug/g	ND	114	60-140			
F3 PHCs (C16-C34)	538	8	ug/g	311	110	60-140			
F4 PHCs (C34-C50)	862	6	ug/g	701	124	60-140			
F4G PHCs (gravimetric)	930	50	ug/g	ND	93.0	80-120			
<b>Volatiles</b>									
Benzene	4.61	0.02	ug/g	ND	115	60-130			
Ethylbenzene	4.49	0.05	ug/g	ND	112	60-130			
Toluene	4.45	0.05	ug/g	ND	111	60-130			
m,p-Xylenes	8.89	0.05	ug/g	ND	111	60-130			
o-Xylene	4.51	0.05	ug/g	ND	113	60-130			
Surrogate: Toluene-d8	7.65		ug/g		95.7	50-140			

Certificate of Analysis

Report Date: 21-Aug-2020

Client: Paterson Group Consulting Engineers

Order Date: 18-Aug-2020

Client PO: 30801

Project Description: PE4987

**Qualifier Notes:**

*Sample Qualifiers :*

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

**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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com

Parcel Order Number  
(Lab Use Only)

2034167

Chain Of Custody  
(Lab Use Only)

Nº 128073

Client Name: <b>Paterson</b>	Project Ref: <b>PE 4987</b>	Page <u>  </u> of <u>  </u>
Contact Name: <b>Mark D'Arcy</b>	Quote #:	Turnaround Time <input type="checkbox"/> 1 day <input type="checkbox"/> 3 day <input type="checkbox"/> 2 day <input checked="" type="checkbox"/> Regular
Address: <b>154 Coionnade road</b>	PO #: <b>30801</b>	
Telephone: <b>613 226 7381</b>	E-mail: <b>mdarcy @ paterson group.ca</b>	
Date Required: _____		

Regulation 153/04		Other Regulation		Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)		Required Analysis										
<input type="checkbox"/> Table 1	<input type="checkbox"/> Res/Park	<input type="checkbox"/> Med/Fine	<input type="checkbox"/> REG 558	<input type="checkbox"/> PWQO	Matrix	Air Volume	# of Containers	Sample Taken Date      Time		PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)
<input type="checkbox"/> Table 2	<input type="checkbox"/> Ind/Comm	<input type="checkbox"/> Coarse	<input type="checkbox"/> CCME	<input type="checkbox"/> MISA												
<input type="checkbox"/> Table 3	<input type="checkbox"/> Agri/Other		<input type="checkbox"/> SU - Sani	<input type="checkbox"/> SU - Storm												
<input checked="" type="checkbox"/> Table <u>7</u>	For RSC: <input type="checkbox"/> Yes <input type="checkbox"/> No		Mun: _____ <input type="checkbox"/> Other: _____													
Sample ID/Location Name				Matrix	Air Volume	# of Containers	Date	Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	
1	BH1 - A01			S		2	Aug 17 2020		✓							
2	BH2 - S52			S		2	Aug 17 2020		✓							
3	BH3 - S52			S		2	Aug 17 2020		✓							
4																
5																
6																
7																
8																
9																
10																

Comments: \_\_\_\_\_ Method of Delivery: **PARCEL COURIER**

Relinquished By (Sign): <b>G Pat</b>	Received By Driver/Depot: <b>A. FLOUSE</b>	Received at Lab: <b>Shreepam Dohmai</b>	Verified By: <b>[Signature]</b>
Relinquished By (Print): <b>Grant Paterson</b>	Date/Time: <b>18/08/20 10:32</b>	Date/Time: <b>Aug 18, 2020 11:06</b>	Date/Time: <b>Aug 18, 2020 11:20</b>
Date/Time: <b>Aug 18 2020</b>	Temperature: °C <b>AM</b>	Temperature: °C <b>8.3</b>	pH Verified: <input type="checkbox"/> By: _____

## Certificate of Analysis

**Paterson Group Consulting Engineers**

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

Client PO: 30377  
Project: PE4987  
Custody: 128110

Report Date: 2-Sep-2020  
Order Date: 27-Aug-2020

**Order #: 2035562**

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

Parcel ID	Client ID
2035562-01	BH1-GW1
2035562-02	BH2-GW1
2035562-03	BH3-GW1
2035562-04	BH4-GW1

Approved By:



Dale Robertson, BSc  
Laboratory Director

Certificate of Analysis

Report Date: 02-Sep-2020

Client: **Paterson Group Consulting Engineers**

Order Date: 27-Aug-2020

Client PO: 30377

Project Description: **PE4987**

**Analysis Summary Table**

Analysis	Method Reference/Description	Extraction Date	Analysis Date
PHC F1	CWS Tier 1 - P&T GC-FID	28-Aug-20	29-Aug-20
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	31-Aug-20	2-Sep-20
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	28-Aug-20	29-Aug-20

Certificate of Analysis

Report Date: 02-Sep-2020

Client: Paterson Group Consulting Engineers

Order Date: 27-Aug-2020

Client PO: 30377

Project Description: PE4987

	Client ID:	BH1-GW1	BH2-GW1	BH3-GW1	BH4-GW1
	Sample Date:	25-Aug-20 09:00	26-Aug-20 09:00	25-Aug-20 09:00	25-Aug-20 09:00
	Sample ID:	2035562-01	2035562-02	2035562-03	2035562-04
	MDL/Units	Water	Water	Water	Water
<b>Volatiles</b>					
Acetone	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Benzene	0.5 ug/L	<0.5	5.8	3.8	<0.5
Bromodichloromethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Bromoform	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Bromomethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Carbon Tetrachloride	0.2 ug/L	<0.2	<0.2	<0.2	<0.2
Chlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Chloroform	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Dichlorodifluoromethane	1.0 ug/L	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,3-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,2-Dichloropropane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,3-Dichloropropene, total	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	0.5 ug/L	<0.5	<0.5	0.5	1.7
Ethylene dibromide (dibromoethane, 1,2-)	0.2 ug/L	<0.2	<0.2	<0.2	<0.2
Hexane	1.0 ug/L	<1.0	<1.0	<1.0	<1.0
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Methyl tert-butyl ether	2.0 ug/L	<2.0	<2.0	<2.0	<2.0
Methylene Chloride	5.0 ug/L	<5.0	<5.0	<5.0	<5.0
Styrene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Tetrachloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Toluene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
1,1,1-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5

Certificate of Analysis

Report Date: 02-Sep-2020

Client: Paterson Group Consulting Engineers

Order Date: 27-Aug-2020

Client PO: 30377

Project Description: PE4987

	Client ID:	BH1-GW1	BH2-GW1	BH3-GW1	BH4-GW1
	Sample Date:	25-Aug-20 09:00	26-Aug-20 09:00	25-Aug-20 09:00	25-Aug-20 09:00
	Sample ID:	2035562-01	2035562-02	2035562-03	2035562-04
	MDL/Units	Water	Water	Water	Water
1,1,2-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Trichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	1.0 ug/L	<1.0	<1.0	<1.0	<1.0
Vinyl chloride	0.5 ug/L	<0.5	<0.5	<0.5	<0.5
m,p-Xylenes	0.5 ug/L	<0.5	0.8	0.6	1.4
o-Xylene	0.5 ug/L	<0.5	0.7	<0.5	<0.5
Xylenes, total	0.5 ug/L	<0.5	1.5	0.6	1.4
4-Bromofluorobenzene	Surrogate	110%	112%	111%	112%
Dibromofluoromethane	Surrogate	108%	110%	116%	113%
Toluene-d8	Surrogate	103%	104%	103%	103%

**Hydrocarbons**

F1 PHCs (C6-C10)	25 ug/L	<25	84	41	<25
F2 PHCs (C10-C16)	100 ug/L	<100	1890	<100	<100
F3 PHCs (C16-C34)	100 ug/L	<100	1690	<100	<100
F4 PHCs (C34-C50)	100 ug/L	<100	<100	<100	<100

Certificate of Analysis

Report Date: 02-Sep-2020

Client: Paterson Group Consulting Engineers

Order Date: 27-Aug-2020

Client PO: 30377

Project Description: PE4987

**Method Quality Control: Blank**

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
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						
<b>Volatiles</b>									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane, 1,2-	ND	0.2	ug/L						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
Methyl Isobutyl Ketone	ND	5.0	ug/L						
Methyl tert-butyl ether	ND	2.0	ug/L						
Methylene Chloride	ND	5.0	ug/L						
Styrene	ND	0.5	ug/L						
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L						
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L						
Tetrachloroethylene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
1,1,1-Trichloroethane	ND	0.5	ug/L						
1,1,2-Trichloroethane	ND	0.5	ug/L						
Trichloroethylene	ND	0.5	ug/L						
Trichlorofluoromethane	ND	1.0	ug/L						
Vinyl chloride	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: 4-Bromofluorobenzene	89.0		ug/L		111	50-140			
Surrogate: Dibromofluoromethane	71.0		ug/L		88.8	50-140			
Surrogate: Toluene-d8	85.5		ug/L		107	50-140			



Certificate of Analysis

Report Date: 02-Sep-2020

Client: Paterson Group Consulting Engineers

Order Date: 27-Aug-2020

Client PO: 30377

Project Description: PE4987

**Method Quality Control: Duplicate**

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	ND	25	ug/L	ND			NC	30	
<b>Volatiles</b>									
Acetone	ND	5.0	ug/L	ND			NC	30	
Benzene	ND	0.5	ug/L	ND			NC	30	
Bromodichloromethane	ND	0.5	ug/L	ND			NC	30	
Bromoform	ND	0.5	ug/L	ND			NC	30	
Bromomethane	ND	0.5	ug/L	ND			NC	30	
Carbon Tetrachloride	ND	0.2	ug/L	ND			NC	30	
Chlorobenzene	ND	0.5	ug/L	ND			NC	30	
Chloroform	ND	0.5	ug/L	ND			NC	30	
Dibromochloromethane	ND	0.5	ug/L	ND			NC	30	
Dichlorodifluoromethane	ND	1.0	ug/L	ND			NC	30	
1,2-Dichlorobenzene	ND	0.5	ug/L	ND			NC	30	
1,3-Dichlorobenzene	ND	0.5	ug/L	ND			NC	30	
1,4-Dichlorobenzene	ND	0.5	ug/L	ND			NC	30	
1,1-Dichloroethane	ND	0.5	ug/L	ND			NC	30	
1,2-Dichloroethane	ND	0.5	ug/L	ND			NC	30	
1,1-Dichloroethylene	ND	0.5	ug/L	ND			NC	30	
cis-1,2-Dichloroethylene	ND	0.5	ug/L	ND			NC	30	
trans-1,2-Dichloroethylene	ND	0.5	ug/L	ND			NC	30	
1,2-Dichloropropane	ND	0.5	ug/L	ND			NC	30	
cis-1,3-Dichloropropylene	ND	0.5	ug/L	ND			NC	30	
trans-1,3-Dichloropropylene	ND	0.5	ug/L	ND			NC	30	
Ethylbenzene	ND	0.5	ug/L	ND			NC	30	
Ethylene dibromide (dibromoethane, 1,2-	ND	0.2	ug/L	ND			NC	30	
Hexane	ND	1.0	ug/L	ND			NC	30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND			NC	30	
Methyl Isobutyl Ketone	ND	5.0	ug/L	ND			NC	30	
Methyl tert-butyl ether	ND	2.0	ug/L	ND			NC	30	
Methylene Chloride	ND	5.0	ug/L	ND			NC	30	
Styrene	ND	0.5	ug/L	ND			NC	30	
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L	ND			NC	30	
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L	ND			NC	30	
Tetrachloroethylene	ND	0.5	ug/L	ND			NC	30	
Toluene	ND	0.5	ug/L	ND			NC	30	
1,1,1-Trichloroethane	ND	0.5	ug/L	ND			NC	30	
1,1,2-Trichloroethane	ND	0.5	ug/L	ND			NC	30	
Trichloroethylene	ND	0.5	ug/L	ND			NC	30	
Trichlorofluoromethane	ND	1.0	ug/L	ND			NC	30	
Vinyl chloride	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: 4-Bromofluorobenzene	90.0		ug/L		112	50-140			
Surrogate: Dibromofluoromethane	78.4		ug/L		98.0	50-140			
Surrogate: Toluene-d8	83.1		ug/L		104	50-140			

Certificate of Analysis

Report Date: 02-Sep-2020

Client: Paterson Group Consulting Engineers

Order Date: 27-Aug-2020

Client PO: 30377

Project Description: PE4987

**Method Quality Control: Spike**

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Hydrocarbons</b>									
F1 PHCs (C6-C10)	1620	25	ug/L	ND	80.9	68-117			
F2 PHCs (C10-C16)	1570	100	ug/L	ND	98.1	60-140			
F3 PHCs (C16-C34)	4090	100	ug/L	ND	104	60-140			
F4 PHCs (C34-C50)	2980	100	ug/L	ND	120	60-140			
<b>Volatiles</b>									
Acetone	106	5.0	ug/L	ND	106	50-140			
Benzene	40.9	0.5	ug/L	ND	102	60-130			
Bromodichloromethane	31.7	0.5	ug/L	ND	79.2	60-130			
Bromoform	48.8	0.5	ug/L	ND	122	60-130			
Bromomethane	44.6	0.5	ug/L	ND	112	50-140			
Carbon Tetrachloride	33.9	0.2	ug/L	ND	84.8	60-130			
Chlorobenzene	39.1	0.5	ug/L	ND	97.6	60-130			
Chloroform	37.3	0.5	ug/L	ND	93.2	60-130			
Dibromochloromethane	35.3	0.5	ug/L	ND	88.3	60-130			
Dichlorodifluoromethane	50.0	1.0	ug/L	ND	125	50-140			
1,2-Dichlorobenzene	38.2	0.5	ug/L	ND	95.4	60-130			
1,3-Dichlorobenzene	38.0	0.5	ug/L	ND	95.1	60-130			
1,4-Dichlorobenzene	39.4	0.5	ug/L	ND	98.6	60-130			
1,1-Dichloroethane	32.0	0.5	ug/L	ND	80.1	60-130			
1,2-Dichloroethane	47.8	0.5	ug/L	ND	119	60-130			
1,1-Dichloroethylene	25.0	0.5	ug/L	ND	62.5	60-130			
cis-1,2-Dichloroethylene	35.2	0.5	ug/L	ND	87.9	60-130			
trans-1,2-Dichloroethylene	29.5	0.5	ug/L	ND	73.8	60-130			
1,2-Dichloropropane	39.3	0.5	ug/L	ND	98.2	60-130			
cis-1,3-Dichloropropylene	45.5	0.5	ug/L	ND	114	60-130			
trans-1,3-Dichloropropylene	47.0	0.5	ug/L	ND	118	60-130			
Ethylbenzene	41.4	0.5	ug/L	ND	104	60-130			
Ethylene dibromide (dibromoethane, 1,2-	28.6	0.2	ug/L	ND	71.4	60-130			
Hexane	39.0	1.0	ug/L	ND	97.5	60-130			
Methyl Ethyl Ketone (2-Butanone)	90.8	5.0	ug/L	ND	90.8	50-140			
Methyl Isobutyl Ketone	94.0	5.0	ug/L	ND	94.0	50-140			
Methyl tert-butyl ether	86.1	2.0	ug/L	ND	86.1	50-140			
Methylene Chloride	37.4	5.0	ug/L	ND	93.4	60-130			
Styrene	32.4	0.5	ug/L	ND	81.0	60-130			
1,1,1,2-Tetrachloroethane	37.5	0.5	ug/L	ND	93.7	60-130			
1,1,1,2-Tetrachloroethane	42.0	0.5	ug/L	ND	105	60-130			
Tetrachloroethylene	35.3	0.5	ug/L	ND	88.3	60-130			
Toluene	40.7	0.5	ug/L	ND	102	60-130			
1,1,1-Trichloroethane	30.3	0.5	ug/L	ND	75.8	60-130			
1,1,2-Trichloroethane	36.8	0.5	ug/L	ND	92.0	60-130			
Trichloroethylene	33.7	0.5	ug/L	ND	84.4	60-130			
Trichlorofluoromethane	36.4	1.0	ug/L	ND	91.1	60-130			
Vinyl chloride	36.8	0.5	ug/L	ND	92.0	50-140			
m,p-Xylenes	82.5	0.5	ug/L	ND	103	60-130			
o-Xylene	41.1	0.5	ug/L	ND	103	60-130			
Surrogate: 4-Bromofluorobenzene	90.8		ug/L		114	50-140			
Surrogate: Dibromofluoromethane	81.3		ug/L		102	50-140			
Surrogate: Toluene-d8	82.6		ug/L		103	50-140			

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 30377

Report Date: 02-Sep-2020

Order Date: 27-Aug-2020

Project Description: PE4987

**Qualifier Notes:**

*Login Qualifiers :*

Container(s) - Bottle and COC sample ID don't match - no date on coc

*Applies to samples: BH1-GW1, BH2-GW1, BH3-GW1, BH4-GW1*

**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.



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Parcel Order Number  
(Lab Use Only)

2035562

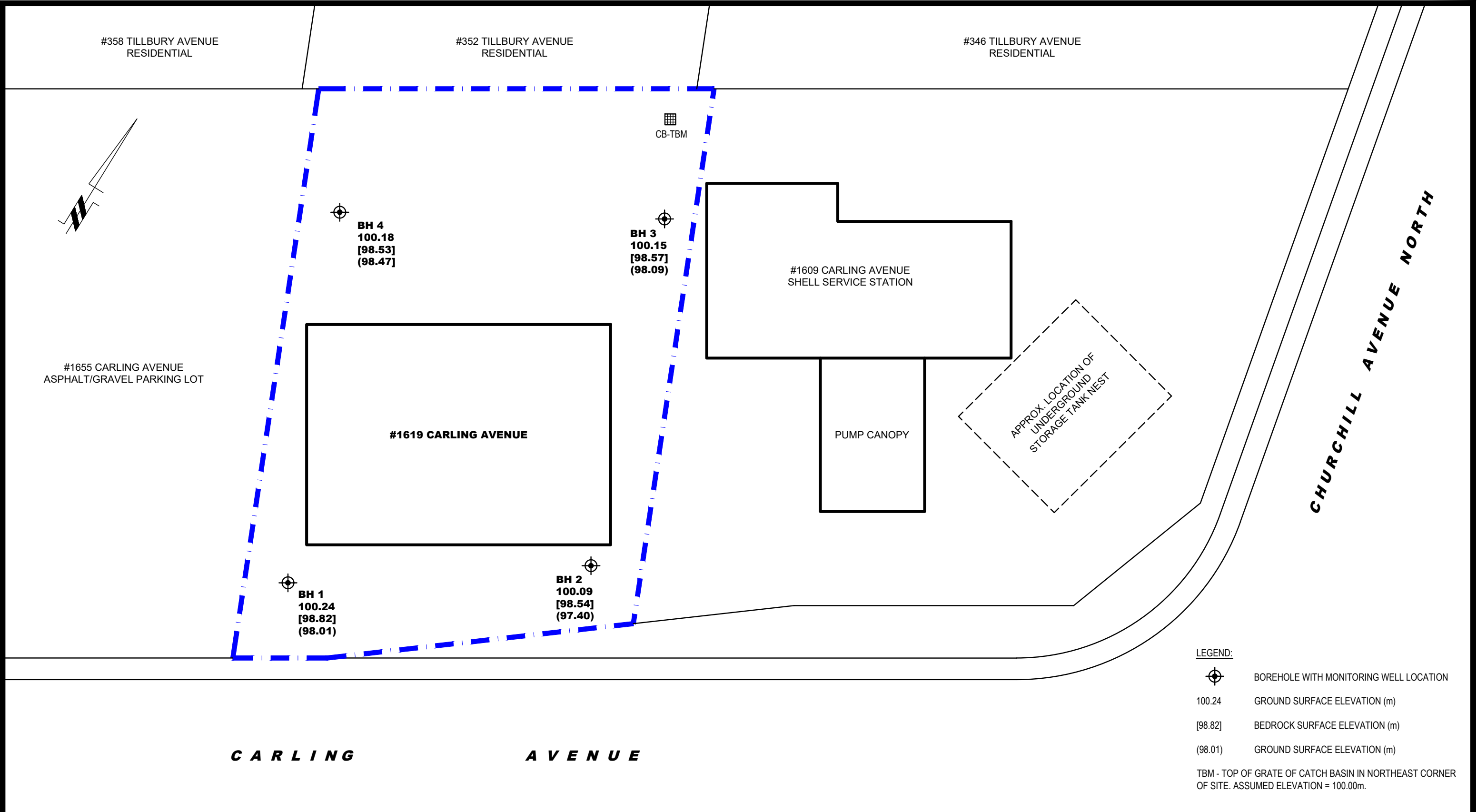
Chain Of Custody  
(Lab Use Only)

Nº 128110


Client Name: <u>Potterson</u>	Project Ref: <u>PE4987</u>	Page <u>1</u> of <u>1</u>
Contact Name: <u>Mark D'Arcy</u>	Quote #:	Turnaround Time <input type="checkbox"/> 1 day <input type="checkbox"/> 3 day <input type="checkbox"/> 2 day <input checked="" type="checkbox"/> Regular
Address:	PO #: <u>30377</u>	
Telephone: <u>226-7381</u>	E-mail:	
Date Required: _____		

Regulation 153/04		Other Regulation		Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)		Required Analysis										
<input type="checkbox"/> Table 1	<input type="checkbox"/> Res/Park	<input type="checkbox"/> Med/Fine	<input type="checkbox"/> REG 558	<input type="checkbox"/> PWQO	Matrix	Air Volume	# of Containers	Sample Taken Date      Time		PHCs F1-F4	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)
<input type="checkbox"/> Table 2	<input type="checkbox"/> Ind/Comm	<input type="checkbox"/> Coarse	<input type="checkbox"/> CCME	<input type="checkbox"/> MISA												
<input type="checkbox"/> Table 3	<input type="checkbox"/> Agri/Other		<input type="checkbox"/> SU - Sani	<input type="checkbox"/> SU - Storm												
<input checked="" type="checkbox"/> Table <u>7</u>	For RSC: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Mun: _____	<input type="checkbox"/> Other: _____												
Sample ID/Location Name																
1	<u>BH1 - GW</u>			<u>GW</u>		<u>3</u>	<u>Aug</u>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
2	<u>BH2 - GW</u>					<u>3</u>	<u>2020</u>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
3	<u>BH3 - GW</u>					<u>3</u>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
4	<u>BH4 - GW</u>					<u>3</u>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
5																
6																
7																
8																
9																
10																

Comments:			Method of Delivery: <u>PARCEL COURIER</u>		
Relinquished By (Sign): <u>[Signature]</u>	Received By Driver/Depot: <u>A. Drouse</u>	Received at Lab: <u>SCM</u>	Verification: <u>[Signature]</u>		
Relinquished By (Print): <u>Mark D'Arcy</u>	Date/Time: <u>27/08/20 3:20</u>	Date/Time: <u>AUG 27, 2020 17:15</u>	Date/Time: <u>28 Aug 2020 8:44</u>		
Date/Time: <u>Aug. 27, 2020</u>	Temperature: _____ °C <u>FD</u>	Temperature: <u>16.8</u> °C	pH Verified: <input type="checkbox"/> By: _____		



**LEGEND:**

-  BOREHOLE WITH MONITORING WELL LOCATION
- 100.24 GROUND SURFACE ELEVATION (m)
- [98.82] BEDROCK SURFACE ELEVATION (m)
- (98.01) GROUND SURFACE ELEVATION (m)

TBM - TOP OF GRATE OF CATCH BASIN IN NORTHEAST CORNER OF SITE. ASSUMED ELEVATION = 100.00m.

**patersongroup**  
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NO.	REVISIONS	DATE	INITIAL
0			

**SURFACE DEVELOPMENTS**  
**PHASE II - ENVIRONMENTAL SITE ASSESSMENT**  
**1619 CARLING AVENUE**

OTTAWA, ONTARIO

**TEST HOLE LOCATION PLAN**

Scale:	1:250	Date:	08/2020
Drawn by:	MPG	Report No.:	PE4987-1
Checked by:	MSD	Dwg. No.:	<b>PE4987-1</b>
Approved by:	MSD	Revision No.:	