PATERSON GROUP

Phase II – Environmental Site Assessment

120 Lusk Street

Ottawa, Ontario

Prepared for Dr. Sandra Iroakazi

Report: PE5884-1
November 22, 2022

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EXECUTIVE SUMMARY

Assessment

Paterson Group was retained by Dr. Sandra Iroakazi to conduct a Phase II – Environmental Site Assessment (Phase II ESA) for the property addressed 120 Lusk Street, Ottawa, Ontario (Phase II Property). The purpose of the Phase II ESA was to assess the environmental condition of the Phase II Property as a result of the presence of fill material of unknown quality, present throughout the property.

The subsurface investigation for this assessment was conducted on November 8, 2022, and consisted of drilling five boreholes (BH1-22 to BH5-22) throughout the Phase II Property, of which three were equipped with groundwater monitoring wells (BH1-22, BH3-22, and BH4-22). The boreholes were advanced to depths ranging from approximately 3.45 m to 5.51 m below the existing ground surface.

In general, the subsurface soil profile encountered at the borehole locations consists of fill material (brown silty sand with gravel, crushed stone, trace organics, and trace topsoil) underlain by brown silty sand with gravel, cobbles, and boulders (glacial till). Bedrock was not encountered in any of the boreholes during the field drilling program, however, practical refusal to augering on inferred bedrock was measured at depths ranging from approximately 3.45 m to 5.51 m below ground surface. The water table generally encountered at an average depth of approximately 3.60 m below ground surface.

Four soil samples were submitted for laboratory analysis of BTEX, PHCs (F_1-F_4), metals, PAHs, and/or pH parameters. Based on the analytical test results, all detected parameter concentrations in the soil samples analyzed are in compliance with the selected MECP Table 3 Coarse-Grained Commercial Soil Standards.

One groundwater sample was submitted for laboratory analysis of BTEX and PHC (F_1-F_4) parameters. Based on the analytical test results, all detected parameter concentrations in the groundwater sample analyzed are in compliance with the selected MECP Table 3 Non-Potable Groundwater Standards.

Based on the findings of this assessment, the presence of fill material on the Phase II Property has not significantly impacted the environmental condition of the property. As a result, it is our opinion that **no further investigative work is required.**

Recommendations

Soil

During future development activities proposed for the Phase II Property, it is anticipated that a volume of excess soil will likely be generated during site excavation works. Excess soil must be handed in accordance with Ontario Regulation (O. Reg.) 406/19: On-Site and Excess Soil Management.

According to the laboratory analytical test results, the soil samples analyzed comply with the MECP Table 2.1 Excess Soil Quality Standards (ESQS) for off-site disposal.

Additional excess soil testing and reporting requirements may be required prior to future site excavation activities, in accordance with O. Reg. 406/19.

Monitoring Wells

It is recommended that the monitoring wells be maintained for future sampling purposes. The monitoring wells will be registered with the MECP under Ontario Regulation 903 (Ontario Water Resources Act). As such a time that the monitoring wells are no longer required, they must be decommissioned in accordance with O.Reg. 903.

1.0 INTRODUCTION

At the request of Dr. Sandra Iroakazi, Paterson Group (Paterson) conducted a Phase II – Environmental Site Assessment (Phase II ESA) for the property addressed 120 Lusk Street, in the City of Ottawa, Ontario (Phase II Property).

The purpose of the Phase II ESA has been to assess the environmental condition of the Phase II Property as a result of the presence of fill material of unknown quality, suspected to be present throughout the property.

1.1 Site Description

Address:	120 Lusk Street, Ottawa, Ontario.
Location:	The Phase II Property is located on the north side of Lusk Street, approximately 260 m west of Fallowfield Road, in the City of Ottawa, Ontario. Refer to Figure 1 – Key Plan, appended to this report.
Latitude and Longitude:	45° 16’ 27" N, 75° 47' 21" W

Site Description:

Configuration:	Irregular.
Area:	6,035 m^2 (approximately).
Zoning:	IP – Business Park Industrial Zone.
Current Use:	The Phase II Property is currently vacant.
Services:	The Phase II Property is not currently serviced, but is located within a municipally serviced area.

1.2 Property Ownership

The Phase II Property is currently owned by NECSA Holdings Corp. Paterson was retained to complete this Phase II ESA by Dr. Sandra Iroakazi, for due diligence purposes. Dr. Iroakazi can be contacted via telephone at 613-323-0749.

1.3 Applicable Site Condition Standard

The site condition standards for the subject property were obtained from Table 3 of the document entitled, *"Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act"*, prepared by the Ministry of the Environment, Conservation and Parks (MECP), and dated April 15, 2011. The selected MECP standards are based on the following considerations:

- ❒ Full depth soil conditions;
- ❒ Coarse-grained soil conditions;
- ❒ Non-potable groundwater conditions;
- ❒ Commercial land use.

Grain-size analysis was not conducted as part of this assessment, and as such, the coarse-grained soil standards were selected as a conservative approach.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II Property is currently vacant of any structures or buildings and consists predominantly of cleared land stripped of native vegetation, with some pockets of mature trees.

The site topography is relatively flat, while the regional topography appears to slope down towards the southeast, in the general direction of the Jock River.

Water drainage on the Phase I Property occurs primarily via infiltration throughout the property, as well as via surface run-off towards catch basins located on the adjacent street.

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation for this assessment was conducted on November 8, 2022 and consisted of drilling five boreholes (BH1-22 to BH5-22) across the Phase II Property.

The boreholes were advanced to depths ranging from approximately 3.45 m to 5.51 m below the existing ground surface and terminated within an overburden layer of dense brown silty sand and gravel (glacial till). Three boreholes (BH1-22, BH3-22, and BH4-22) were completed with groundwater monitoring well installations in order to access the groundwater table.

3.2 Media Investigated

During the course of this subsurface investigation, soil and groundwater samples were obtained from the Phase II Property and submitted for laboratory analysis. The rationale for sampling and analyzing these media is based on the contaminants of potential concern identified as a result of the presence of suspected fill material of unknown quality throughout the property.

The contaminants of potential concern for the soil and/or groundwater on the Phase II Property include the following:

- Benzene, Ethylbenzene, Toluene, and Xylenes (BTEX);
- Petroleum Hydrocarbons, fractions 1 – 4 (PHCs F_1-F_4);
- Metals (including Arsenic (As), Antimony (Sb), Selenium (Se));
- Polycyclic Aromatic Hydrocarbons (PAHs).

These CPCs have the potential to be present in the soil matrix beneath the Phase I Property.

3.3 Phase I ESA Conceptual Site Model

It should be noted that a formal Phase I ESA report had not been prepared for the Phase II Property prior to the commencement of this assessment. However, Paterson has conducted a cursory review of the existing and historical environmental conditions of the subject land, as well as a review of other Phase I ESA reports completed for properties in the immediate area, including the adjacent property to the west (140 Lusk Street).

Based on our knowledge of the area, the Phase II Property, and most of the immediately adjacent lands, have never been formally developed. Sometime in the late-1990's, an unknown volume of fill material of unknown quality was imported onto the Phase II Property.

Geological and Hydrogeological Setting

Based on the available mapping information, the bedrock beneath the Phase II Property generally consists of interbedded sandstone and dolomite of the March Formation, while the surficial geology consists largely of glacial till plains with an overburden ranging in thickness from approximately 5 m to 10 m.

Groundwater is anticipated to be encountered within the overburden and flow in a southerly direction towards the Jock River.

Water Bodies and Areas of Natural and Scientific Interest

No water bodies or areas of natural and scientific interest were identified within a 250 m radius of the Phase II Property. The nearest named water body with respect to the Phase II Property is the Jock River, located approximately 3 km to the south.

Drinking Water Wells

Based on the availability of municipal services, no drinking water wells are expected to be present within a 250 m radius of the Phase II Property.

Existing Buildings and Structures

The Phase II Property is currently vacant of any structures or buildings.

Neighbouring Land Use

The surrounding lands within a 250 m radius of the Phase II Property consist of a combination of residential, commercial, and parkland.

Current and Future Property Use

The Phase II Property is currently vacant of any buildings or structures.

It is our understanding that the Phase II Property is to be developed with a three-storey commercial office building.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

Based on our understanding of the existing and historical conditions of the Phase II Property and the surrounding area, one potentially contaminating activity (PCA) resulting in an area of potential environmental concern (APEC), was identified on the Phase II Property. This APEC includes:

- Fill material of unknown quality, located throughout the majority of the Phase II Property (APEC #1).

No off-site potentially contaminating activities were identified on any of the properties in the general vicinity of the Phase II Property.

Contaminants of Potential Concern

The contaminants of potential concern for the soil and/or groundwater on the Phase II Property include the following:

- Benzene, Ethylbenzene, Toluene, and Xylenes (BTEX);
- Petroleum Hydrocarbons, fractions 1 – 4 (PHCs F_1-F_4);
- Metals (including Arsenic (As), Antimony (Sb), Selenium (Se));
- Polycyclic Aromatic Hydrocarbons (PAHs).

These CPCs have the potential to be present in the soil matrix beneath the Phase I Property.

Assessment of Uncertainty and/or Absence of Information

The information available for review is considered to be sufficient to conclude that there are PCAs and APECs associated with the Phase II Property.

The presence of any PCAs was confirmed by a variety of independent sources, and as such, the conclusions of this report are not affected by uncertainty which may be present with respect to the individual sources.

3.4 Deviations from the Sampling and Analysis Plan

No deviations from the Sampling and Analysis were made during the course of this Phase II ESA, however, since no contaminants or deleterious substances were identified in the fill material during the field program, it was not deemed necessary to analyze the groundwater for metals or PAHs.

3.5 Physical Impediments

No physical impediments were encountered during the course of this Phase II ESA.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation for this assessment was conducted on November 8, 2022, and consisted of drilling five boreholes (BH1-22 to BH5-22) throughout the Phase II Property, of which three were equipped with groundwater monitoring wells (BH1-22, BH3-22, and BH4-22).

The boreholes were advanced to depths ranging from approximately 3.45 m to 5.51 m below the existing ground surface and terminated within an overburden layer of dense brown silty sand and gravel with practical refusal to augering. It is possible that each hole was terminated on the bedrock surface.

Under the full-time supervision of Paterson personnel, the boreholes were drilled using a low-clearance drill rig provided by George Downing Estate Drilling of Hawkesbury, Ontario. The locations of the boreholes are illustrated on "Drawing PE5884-1 – Test Hole Location Plan", appended to this report.

4.2 Soil Sampling

Soil 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.

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

A total of 29 soil samples were obtained from the boreholes by means of auger and split spoon sampling. The depths at which auger and split spoon samples were obtained from the boreholes are shown as "**AU**" and "**SS**", respectively, on the Soil Profile and Test Data Sheets, appended to this report.

4.3 Field Screening Measurements

All soil samples collected were subjected to a preliminary screening procedure, which included visual screening for colour and evidence of metals, as well as soil vapour screening with a Photo Ionization Detector.

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

The results of the vapour survey are presented on the Soil Profile and Test Data Sheets, appended to this report.

4.4 Groundwater Monitoring Well Installation

Three groundwater monitoring wells were installed on the Phase II Property as part of this assessment. These monitoring wells were constructed using 50 mm diameter Schedule 40 threaded PVC risers and screens. A sand pack consisting of silica sand was placed around the screen with a bentonite seal placed above to minimize cross-contamination.

The ground surface elevations of each borehole were subsequently surveyed with respect to a known geodetic elevation.

A summary of the monitoring well construction details are listed below in Table 1 as well as on the Soil Profile and Test Data Sheets provided in Appendix 1.

Table 1
Monitoring Well Construction Details

Well ID	Ground Surface Elevation (m ASL)	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
BH1-22	103.84	3.81	2.31-3.81	2.13-3.81	0.91-2.13	Stick-Up
BH3-22	103.61	4.27	1.27-4.27	0.91-1.27	0.31-0.91	Stick-Up
BH4-22	103.64	3.45	1.95-3.45	1.82-3.45	0.61-1.82	Stick-Up

4.5 Field Measurement of Water Quality Parameters

Groundwater monitoring and sampling was conducted at BH1-22, BH3-22, and BH4-22 on November 11, 2022. At this time, water quality parameters were measured in the field using a multi-parameter analyzer. Parameters measured in the field included temperature, pH and electrical conductivity. Field parameters were measured after each well volume purged.

Wells were purged prior to sampling until at least three well volumes had been removed or the field parameters were relatively stable. It should be noted that the monitoring wells installed in BH1-22 and BH4-22 were dry at the time of the field sampling program, and as a result, no water quality parameters could be measured at these locations. Stabilized field parameter values are summarized in Table 2.

Table 2
Measurement of Water Quality Parameters

Well ID	Temperature (˚C)	Conductivity (µS)	pH (Units)
BH1-22	N/A	N/A	N/A
BH3-22	13.1	1,086	7.49
BH4-22	N/A	N/A	N/A

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.

Standing water was purged from each monitoring well prior to the recovery of the groundwater samples using dedicated sampling equipment. The samples were then stored in coolers to reduce possible analyte volatilization during their transportation. Further details of our standard operating procedure for groundwater sampling are provided in the Sampling and Analysis Plan, appended to this report.

4.7 Analytical Testing

The following soil and groundwater samples were submitted for laboratory analysis:

Table 3
Testing Parameters for Submitted Soil Samples

Sample ID	Sample Depth & Stratigraphic Unit	Parameters Analyzed				Rationale
		BTEX	PHCs (F_1-F_4)	Metals	pH	
BH1-22-SS3	1.52 m – 2.13 m Fill Material	X	X	X		To assess for potential impacts resulting from the presence of fill material of unknown quality.
BH2-22-AU1	0.31 m – 0.61 m Fill Material	X	X	X	X	To assess for potential impacts resulting from the presence of fill material of unknown quality.
BH3-22-SS3	1.52 m – 2.13 m Fill Material	X	X	X		To assess for potential impacts resulting from the presence of fill material of unknown quality.
BH4-22-SS2	0.76 – 1.37 m Fill Material	X	X	X		To assess for potential impacts resulting from the presence of fill material of unknown quality.
DUP	0.31 m – 0.61 m Fill Material	X				For QA/QC purposes.

1 – Duplicate sample of BH2-22-AU1

Table 4
Testing Parameters for Submitted Groundwater Samples

Sample ID	Screened Interval & Stratigraphic Unit	Parameters Analyzed		Rationale
		BTEX	PHCs (F_1-F_4)	
BH3-22-GW1	1.27 m – 4.27 m Sandy Silt	X	X	For general coverage purposes.
BH2-22-GW1[1]	1.27 m – 4.27 m Sandy Silt	X	X	For laboratory QA/QC purposes.

1 – Duplicate sample of BH3-22-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) and is accredited and certified by the SCC/CALA for specific tests registered with the association.

4.8 Residue Management

All soil cuttings were removed from the site following the field program, while all purge water and equipment cleaning fluids were retained on-site.

4.9 Elevation Surveying

The ground surface elevations at each borehole location were surveyed using a GPS device by Paterson personnel and referenced to a geodetic datum.

4.10 Quality Assurance and Quality Control Measures

A summary of the quality assurance and quality control (QA/QC) measures, undertaken as part of this assessment, is provided in the Sampling and Analysis Plan in Appendix 1.

5.0 REVIEW AND EVALUATION

5.1 Geology

In general, the subsurface soil profile encountered at the borehole locations consists of fill material (brown silty sand with gravel, crushed stone, trace organics, and trace topsoil) underlain by brown silty sand with gravel, cobbles, and boulders (glacial till).

Bedrock was not confirmed in any of the boreholes during the field drilling program, however, practical refusal to augering on inferred bedrock was measured at depths ranging from approximately 3.45 m to 5.51 m below ground surface.

Site geology details are provided in the Soil Profile and Test Data Sheets in Appendix 1.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured using an electronic water level meter at BH1-22, BH3-22, and BH4-22 on November 11, 2022. The groundwater levels are summarized below in Table 5.

Table 5
Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH1-22	103.84	DRY	N/A	November 11, 2022
BH3-22	103.61	3.60	100.01	
BH4-22	103.64	DRY	N/A	

The groundwater at the Phase II Property was encountered within the overburden in BH3-22 at a depth of approximately 3.60 m below ground surface. It should be noted that at the time of the field sampling, the monitoring wells installed in BH1-22 and BH4-22 were dry, and thus a groundwater depth could not be measured at these locations.

No unusual visual observations were identified within the recovered groundwater samples. Due to the lack of groundwater measurements from BH1-22 and BH4-22, groundwater contour mapping could not be completed as part of this assessment.

It should be noted that groundwater levels are expected to fluctuate throughout the year with seasonal variations.

5.3 Fine/Coarse Soil Texture

Grain size analysis was not completed as part of this investigation. As a result, the coarse-grained soil standards were chosen as a conservative approach.

5.4 Field Screening

Field screening of the soil samples collected during the drilling program resulted in organic vapour readings ranging from 0.0 ppm to 2.3 ppm, indicating that there is a negligible potential for the presence of volatile substances. 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

Four soil samples were submitted for laboratory analysis of BTEX, PHCs (F_1-F_4), metals, PAHs, and/or pH parameters. The results of the analytical testing are presented below in Tables 6 to 9, as well as on the laboratory Certificates of Analysis included in Appendix 1.

Table 6
Analytical Test Results – Soil
BTEX & PHCs (F_1-F_4)

Parameter	MDL (µg/g)	Soil Samples (ug/g)				MECP Table 3 Coarse-Grained Commercial Soil Standards (µg/g)
		November 8, 2022				
		BH1-22-SS3	BH2-22-AU1	BH3-22-SS3	BH4-22-SS2	
		Sample Depth (m bgs)				
		1.52 – 2.13	0.31 – 0.61	1.52 – 2.13	0.76 – 1.37	
Benzene	0.02	nd	nd	nd	nd	0.32
Ethylbenzene	0.05	nd	nd	nd	nd	9.5
Toluene	0.05	nd	nd	nd	nd	68
Xylenes	0.05	nd	nd	nd	nd	26
PHCs F_1	7	nd	nd	nd	nd	55
PHCs F_2	4	nd	nd	nd	nd	230
PHCs F_3	8	nd	26	22	nd	1,700
PHCs F_4	6	nd	41	15	nd	3,300

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – value exceeds selected MECP standards

No BTEX parameter concentrations were detected above the laboratory method detection limits in the soil samples analyzed, while all detected PHC parameter concentrations in the soil samples analyzed comply with the selected MECP Table 3 Coarse-Grained Commercial Soil Standards.

The results also comply with the more stringent MECP Table 1 Background Standards.

Table 7
Analytical Test Results – Soil
Metals

Parameter	MDL (µg/g)	Soil Samples (ug/g)				MECP Table 3 Coarse-Grained Commercial Soil Standards (µg/g)
		November 8, 2022				
		BH1-22-SS3	BH2-22-AU1	BH3-22-SS3	BH4-22-SS2	
		Sample Depth (m bgs)				
		1.52 – 2.13	0.31 – 0.61	1.52 – 2.13	0.76 – 1.37	
Antimony	1.0	nd	nd	nd	nd	40
Arsenic	1.0	2.5	2.4	2.8	2.6	18
Barium	1.0	117	138	91.1	49.2	670
Beryllium	0.5	nd	nd	0.5	nd	8
Boron	5.0	5.8	7.7	nd	nd	120
Cadmium	0.5	nd	nd	nd	nd	1.9
Chromium	5.0	19.8	26.1	18.5	10.2	160
Cobalt	1.0	5.5	7.6	5.8	3.9	80
Copper	5.0	13.6	16.8	8.2	11.2	230
Lead	1.0	6.9	15.3	10.7	4.8	120
Molybdenum	1.0	nd	nd	nd	nd	40
Nickel	5.0	11.8	16.3	9.8	6.6	270
Selenium	1.0	nd	nd	nd	nd	5.5
Silver	0.3	nd	nd	nd	nd	40
Thallium	1.0	nd	nd	nd	nd	3.3
Uranium	1.0	nd	nd	nd	nd	33
Vanadium	10.0	26.3	32.2	30.7	16.7	86
Zinc	20.0	28.2	41.1	38.9	nd	340

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – value exceeds selected MECP standards

All detected metal parameter concentrations in the soil samples analysed comply with the MECP Table 3 Coarse-Grained Commercial Soil Standards.

The results also comply with the more stringent MECP Table 1 Background Standards.

Table 8
Analytical Test Results – Soil
PAHs

Parameter	MDL (µg/g)	Soil Samples (ug/g)				MECP Table 3 Coarse-Grained Commercial Soil Standards (µg/g)
		November 8, 2022				
		BH1-22-SS3	BH2-22-AU1	BH3-22-SS3	BH4-22-SS2	
		Sample Depth (m bgs)				
		1.52 – 2.13	0.31 – 0.61	1.52 – 2.13	0.76 – 1.37	
Acenaphthene	0.02	nd	nd	nd	nd	96
Acenaphthylene	0.02	nd	0.02	nd	nd	0.15
Anthracene	0.02	nd	0.03	nd	nd	0.67
Benzo[a]anthracene	0.02	nd	0.10	nd	nd	0.96
Benzo[a]pyrene	0.02	nd	0.11	nd	nd	0.3
Benzo[b]fluoranthene	0.02	nd	0.12	nd	nd	0.96
Benzo[g,h,i]perylene	0.02	nd	0.09	nd	nd	9.6
Benzo[k]fluoranthene	0.02	nd	0.07	nd	nd	0.96
Chrysene	0.02	nd	0.13	nd	nd	9.6
Dibenzo[a,h]anthracene	0.02	nd	0.02	nd	nd	0.1
Fluoranthene	0.02	nd	0.25	nd	nd	9.6
Fluorene	0.02	nd	nd	nd	nd	62
Indeno [1,2,3-cd] pyrene	0.02	nd	0.07	nd	nd	0.76
1-Methylnaphthalene	0.02	nd	nd	nd	nd	76
2-Methylnaphthalene	0.02	nd	nd	nd	nd	76
Methylnaphthalene (1&2)	0.04	nd	nd	nd	nd	76
Naphthalene	0.01	nd	nd	nd	nd	9.6
Phenanthrene	0.02	nd	0.12	nd	nd	12
Pyrene	0.02	nd	0.22	nd	nd	96

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – value exceeds selected MECP standards

All detected PAH parameter concentrations in the soil samples analyzed are in compliance with the selected MECP Table 3 Coarse-Grained Commercial Soil Standards.

The results also comply with the more stringent MECP Table 1 Background Standards.

Table 9
Analytical Test Results – Soil
pH

Parameter	MDL (units)	Soil Samples (ug/g)	MECP Table 3 Coarse-Grained Commercial Soil Standards (units)
		November 8, 2022	
		BH2-22-AU1	
		Sample Depth (m bgs)	
		0.31 – 0.61	
pH	0.05	7.65	5.00 – 11.00

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – value exceeds selected MECP standards

The pH value detected in the soil sample analyzed is in compliance with the selected MECP Table 3 Coarse-Grained Commercial Soil Standards.

The results also comply with the more stringent MECP Table 1 Background Standards.

Table 10
Maximum Concentrations – Soil

Parameter	Maximum Concentration (µg/g)	Sample ID	Depth Interval (m BGS)
PHCs F_3	26	BH2-22-AU1	0.31 – 0.61
PHCs F_4	41	BH2-22-AU1	0.31 – 0.61
Arsenic	2.8	BH3-22-SS3	1.52 – 2.13
Barium	138	BH2-22-AU1	0.31 – 0.61
Beryllium	0.5	BH3-22-SS3	1.52 – 2.13
Boron	7.7	BH2-22-AU1	0.31 – 0.61
Chromium	26.1	BH2-22-AU1	0.31 – 0.61
Cobalt	7.6	BH2-22-AU1	0.31 – 0.61
Copper	16.8	BH2-22-AU1	0.31 – 0.61
Lead	15.3	BH2-22-AU1	0.31 – 0.61
Nickel	16.3	BH2-22-AU1	0.31 – 0.61
Vanadium	32.2	BH2-22-AU1	0.31 – 0.61
Zinc	41.1	BH2-22-AU1	0.31 – 0.61
Acenaphthylene	0.02	BH2-22-AU1	0.31 – 0.61
Anthracene	0.03	BH2-22-AU1	0.31 – 0.61
Benzo[a]anthracene	0.10	BH2-22-AU1	0.31 – 0.61
Benzo[a]pyrene	0.11	BH2-22-AU1	0.31 – 0.61
Benzo[b]fluoranthene	0.12	BH2-22-AU1	0.31 – 0.61
Benzo[g,h,i]perylene	0.09	BH2-22-AU1	0.31 – 0.61
Benzo[k]fluoranthene	0.07	BH2-22-AU1	0.31 – 0.61
Chrysene	0.13	BH2-22-AU1	0.31 – 0.61
Dibenzo[a,h]anthracene	0.02	BH2-22-AU1	0.31 – 0.61
Fluoranthene	0.25	BH2-22-AU1	0.31 – 0.61
Indeno [1,2,3-cd] pyrene	0.07	BH2-22-AU1	0.31 – 0.61
Phenanthrene	0.12	BH2-22-AU1	0.31 – 0.61
Pyrene	0.22	BH2-22-AU1	0.31 – 0.61
pH	7.65	BH2-22-AU1	0.31 – 0.61

Notes:
- **Bold and Underlined** – value exceeds selected MECP standards

All other parameter concentrations analyzed were below the laboratory detection limits.

5.6 Groundwater Quality

One groundwater sample was submitted for laboratory analysis of BTEX and PHCs (F_1-F_4) parameters. The results of the analytical testing are presented below in Table 11, as well as on the laboratory Certificates of Analysis included in Appendix 1.

It should be noted that limited groundwater was available for sampling at the time of the field drilling program, however, this is not considered to have a material

effect on the conclusion of this report, since the only APEC identified was fill material (which upon testing was found to comply with the site specific MECP Table 3 Coarse-Grained Commercial Soil Standards as well as the more stringent MECP Table 1 Background Standards.

Table 10
Analytical Test Results – Groundwater
BTEX & PHCs (F_1-F_4)

Parameter	MDL (µg/L)	Groundwater Samples (ug/L)	MECP Table 3 Coarse-Grained Non-Potable Groundwater Standards (µg/L)
		November 11, 2022	
		BH3-22-GW1	
		Screening Interval (m bgs)	
		1.27 – 4.27 m	
Benzene	0.5	nd	44
Ethylbenzene	0.5	nd	2,300
Toluene	0.5	1.0	18,000
Xylenes	0.5	0.6	4,200
PHCs F_1	25	nd	750
PHCs F_2	100	nd	150
PHCs F_3	100	nd	500
PHCs F_4	100	nd	500

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – value exceeds selected MECP standards

No PHC parameter concentrations were detected above the laboratory method detection limits. All detected BTEX parameter concentrations in the groundwater sample analyzed are in compliance with the selected MECP Table 3 Non-Potable Groundwater Standards.

Table 11
Maximum Concentrations – Groundwater

Parameter	Maximum Concentration (µg/L)	Sample ID	Depth Interval (m BGS)
Toluene	1.0	BH3-22-GW1	1.27 – 4.27 m
Xylenes	0.6	BH3-22-GW1	1.27 – 4.27 m

Notes:
- **Bold and Underlined** – value exceeds selected MECP standards

All other parameter concentrations analyzed were below the laboratory detection limits. The laboratory certificates of analysis are provided in Appendix 1.

5.7 Quality Assurance and Quality Control Results

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

As per Subsection 47(3) of O. Reg. 153/04, as amended by the Environmental Protection Act, the certificates of analysis have been received for each sample submitted for laboratory analysis and have been appended to this report.

As per the Sampling and Analysis Plan, a duplicate soil sample was obtained from sample BH2-22-AU1 and submitted for laboratory analysis of BTEX and PHC parameters. The relative percent difference (RPD) calculations for the original and duplicate samples are provided below in Table 12.

Table 12
QA/QC Calculations – Soil

Parameter	MDL (µg/g)	BH2-22-AU1	DUP	RPD (%)	QA/QC Result (Target: <20% RPD)
Benzene	0.02	nd	nd	0	Meets Target
Ethylbenzene	0.05	nd	nd	0	Meets Target
Toluene	0.05	nd	nd	0	Meets Target
Xylenes	0.05	nd	nd	0	Meets Target
PHCs F_1	7	nd	nd	0	Meets Target
PHCs F_2	4	nd	nd	0	Meets Target
PHCs F_3	8	26	41	44.8	Does Not Meet Target
PHCs F_4	6	41	47	13.6	Meets Target

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

The relative percent difference (RPD) calculated for all parameters, with one exception, fell within of the acceptable range of 20%, and as such, is considered to meet the data quality objectives outlined in the Sampling and Analysis Plan, appended to this report.

A duplicate groundwater sample was obtained from sample BH3-22-GW1 and submitted for laboratory analysis of BTEX and PHC parameters. The relative percent difference (RPD) calculations for the original and duplicate samples are provided below in Table 13.

Table 13
QA/QC Calculations – Groundwater

Parameter	MDL (µg/L)	BH3-22-GW1	DUP	RPD (%)	QA/QC Result (Target: <20% RPD)
Benzene	0.5	nd	nd	0	Meets Target
Ethylbenzene	0.5	nd	nd	0	Meets Target
Toluene	0.5	1.0	0.9	10.5	Meets Target
Xylenes	0.5	0.6	0.6	0	Meets Target
PHCs F_1	25	nd	nd	0	Meets Target
PHCs F_2	100	nd	nd	0	Meets Target
PHCs F_3	100	nd	nd	0	Meets Target
PHCs F_4	100	nd	nd	0	Meets Target

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- **Bold and Underlined** – value exceeds selected MECP standards

The relative percent difference (RPD) calculated for all parameters fell within of the acceptable range of 20%, and as such, is considered to meet the data quality objectives outlined in the Sampling and Analysis Plan, appended to this report.

Based on the results of the QA/QC analysis, the quality of the field data collected during this Phase II ESA is considered to be sufficient to meet the overall objectives of this assessment.

5.8 Phase II Conceptual Site Model

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

Site Description

Potentially Contaminating Activity and Areas of Potential Environmental Concern

As described in Section 2.2 of this report, the following PCAs, as defined by Table 2 of O. Reg. 153/04, are considered to result in APECs on the Phase II Property:

Table 14
Areas of Potential Environmental Concern

Area of Potential Environmental Concern	Location of APEC on Phase I Property	Potentially Contaminating Activity (Table 2 – O. Reg. 153/04)	Location of PCA (On-Site or Off-Site)	Contaminants of Potential Concern	Media Potentially Impacted (Groundwater, Soil, and/or Sediment)
APEC #1 Fill Material of Unknown Quality	Entirety of Phase I Property	*"Item 30: Importation of Fill Material of Unknown Quality"*	On-Site	BTEX PHCs (F_1-F_4) Metals PAHs	Soil

Contaminants of Potential Concern (CPCs)

The contaminants of potential concern for the soil and/or groundwater on the Phase II Property include the following:

- Benzene, Ethylbenzene, Toluene, and Xylenes (BTEX);
- Petroleum Hydrocarbons, fractions 1 – 4 (PHCs F_1-F_4);
- Metals (including Arsenic (As), Antimony (Sb), Selenium (Se))
- Polycyclic Aromatic Hydrocarbons (PAHs);

These CPCs have the potential to be present in the soil matrix beneath the Phase II Property.

Subsurface Structures and Utilities

Underground service locates were completed prior to the subsurface investigation. No underground utilities were identified on the Phase II Property.

Physical Setting

Site Stratigraphy

The stratigraphy of the Phase II Property generally consists of:

- Fill material (brown silty sand with gravel, cobbles, crushed stone, as well as trace organics); extending to depths ranging from approximately 0.69 m to 1.52 m below ground surface.
- Fill material (brown silty sand to sandy silt, with some clay, gravel, and topsoil); extending to depths ranging from approximately 2.13 m to 2.29 m below ground surface.
- Glacial till (brown silty sand to sandy silt with gravel, cobbles, and boulders); extending to depths ranging from approximately 3.45 m to 5.52 m below ground surface (bottom of borehole).

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is provided in the Soil Profile and Test Data Sheets in Appendix 1.

Hydrogeological Characteristics

The groundwater at the Phase II Property was encountered within an overburden layer of glacial till in BH3-22 at a depth of approximately 3.60 m below ground surface.

Groundwater flow could not be calculated as part of this assessment, however, it is inferred to be in a southerly direction towards the Jock River.

Approximate Depth to Bedrock

Bedrock was not confirmed in any of the boreholes during the field drilling program, however, practical refusal to augering on inferred bedrock was measured at depths ranging from approximately 3.45 m to 5.51 m below ground surface.

Approximate Depth to Water Table

The depth to the water table is approximately 3.60 m below ground surface.

Sections 41 and 43.1 of Ontario Regulation 153/04

Section 41 of the Regulation does not apply to the Phase II Property, as the Phase II Property is not within 30 m of an environmentally sensitive area, the pH of the subsurface soil is between 5 and 9, and the pH of the subsurface soil is between 5 and 11.

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 and is not within 30 m of a water body.

Existing Buildings and Structures

The Phase I Property is currently vacant of any structures or buildings.

Environmental Condition

Areas Where Contaminants are Present

Based on the analytical test results, no areas of soil or groundwater contamination were identified on the Phase II Property.

Types of Contaminants

Based on the analytical test results, all detected parameter concentrations are in compliance with the selected MECP Table 3 Coarse-Grained Soil Standards as well as the MECP Table 3 Non-Potable Groundwater Standards.

Contaminated Media

Based on the findings of this assessment, no contaminated media is present on the Phase II Property.

What Is Known About Areas Where Contaminants Are Present

Based on the analytical test results, no areas of soil or groundwater contamination were identified on the Phase II Property.

Distribution and Migration of Contaminants

Based on the analytical test results, all detected parameter concentrations are in compliance with the selected MECP Table 3 Coarse-Grained Soil Standards as well as the MECP Table 3 Non-Potable Groundwater Standards.

Discharge of Contaminants

Based on the analytical test results, all detected parameter concentrations are in compliance with the selected MECP Table 3 Coarse-Grained Soil Standards as well as the MECP Table 3 Non-Potable Groundwater Standards.

Climatic and Meteorological Conditions

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

Based on the findings of this assessment, there is no possibility of downward leaching, since no contaminants were identified in the fill material.

Potential for Vapour Intrusion

Based on the analytical test results, all detected parameter concentrations are in compliance with the selected MECP Table 3 Coarse-Grained Soil Standards as well as the MECP Table 3 Non-Potable Groundwater Standards. As a result, there is no potential for future vapour intrusion on the Phase II Property.

6.0 CONCLUSIONS

Assessment

Paterson Group was retained by Dr. Sandra Iroakazi to conduct a Phase II – Environmental Site Assessment (Phase II ESA) for the property addressed 120 Lusk Street, Ottawa, Ontario (Phase II Property). The purpose of the Phase II ESA was to assess the environmental condition of the Phase II Property as a result of the presence of fill material of unknown quality, present throughout the property.

The subsurface investigation for this assessment was conducted on November 8, 2022, and consisted of drilling five boreholes (BH1-22 to BH5-22) throughout the Phase II Property, of which three were equipped with groundwater monitoring wells (BH1-22, BH3-22, and BH4-22). The boreholes were advanced to depths ranging from approximately 3.45 m to 5.51 m below the existing ground surface.

In general, the subsurface soil profile encountered at the borehole locations consists of fill material (brown silty sand with gravel, crushed stone, trace organics, and trace topsoil) underlain by brown silty sand with gravel, cobbles, and boulders (glacial till). Bedrock was not confirmed in any of the boreholes during the field drilling program, however, practical refusal to augering on inferred bedrock was measured at depths ranging from approximately 3.45 m to 5.51 m below ground surface. The water table was generally encountered at a depth of approximately 3.60 m below ground surface.

Four soil samples were submitted for laboratory analysis of BTEX, PHCs (F_1-F_4), metals, PAHs, and/or pH parameters. Based on the analytical test results, all detected parameter concentrations in the soil samples analyzed are in compliance with the selected MECP Table 3 Coarse-Grained Commercial Soil Standards.

One groundwater sample was submitted for laboratory analysis of BTEX and PHC (F_1-F_4) parameters. Based on the analytical test results, all detected parameter concentrations in the groundwater sample analyzed are in compliance with the selected MECP Table 3 Non-Potable Groundwater Standards.

Based on the findings of this assessment, the presence of fill material on the Phase II Property has not significantly impacted the environmental condition of the property. It is our opinion that **no further investigative work is required at this time.**

Recommendations

Soil

During future development activities proposed for the Phase II Property, it is anticipated that a volume of excess soil will likely be generated during site excavation works. Excess soil must be handed in accordance with Ontario Regulation (O. Reg.) 406/19: On-Site and Excess Soil Management.

According to the laboratory analytical test results, the soil samples analyzed comply with the MECP Table 1 Excess Soil Quality Standards (ESQS) for off-site disposal.

Additional excess soil testing and reporting requirements may be required prior to future site excavation activities, in accordance with O. Reg. 406/19.

Monitoring Wells

It is recommended that the monitoring wells be maintained for future sampling purposes. The monitoring wells will be registered with the MECP under Ontario Regulation 903 (Ontario Water Resources Act). At such a time that the monitoring wells are no longer required, they must be decommissioned in accordance with O.Reg. 903.

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 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 Phase II Property 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 Dr. Sandra Iroakazi. Permission and notification from Dr. Sandra Iroakazi and Paterson Group will be required prior to the release of this report to any other party.

Paterson Group Inc.

Nick Sullivan, B.Sc.

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

Report Distribution:

- Dr. Sandra Iroakazi
- Paterson Group Inc.

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE5884-1 – TEST HOLE LOCATION PLAN

DRAWING PE5884-2 – ANALYTICAL TESTING PLAN – SOIL

DRAWING PE5884-2A – CROSS SECTION A-A' – SOIL

DRAWING PE5884-2B – CROSS SECTION B-B' – SOIL

DRAWING PE5884-3 – ANALYTICAL TESTING PLAN – GROUNDWATER

DRAWING PE5884-3A – CROSS SECTION A-A' – GROUNDWATER

DRAWING PE5884-3B – CROSS SECTION B-B' – GROUNDWATER

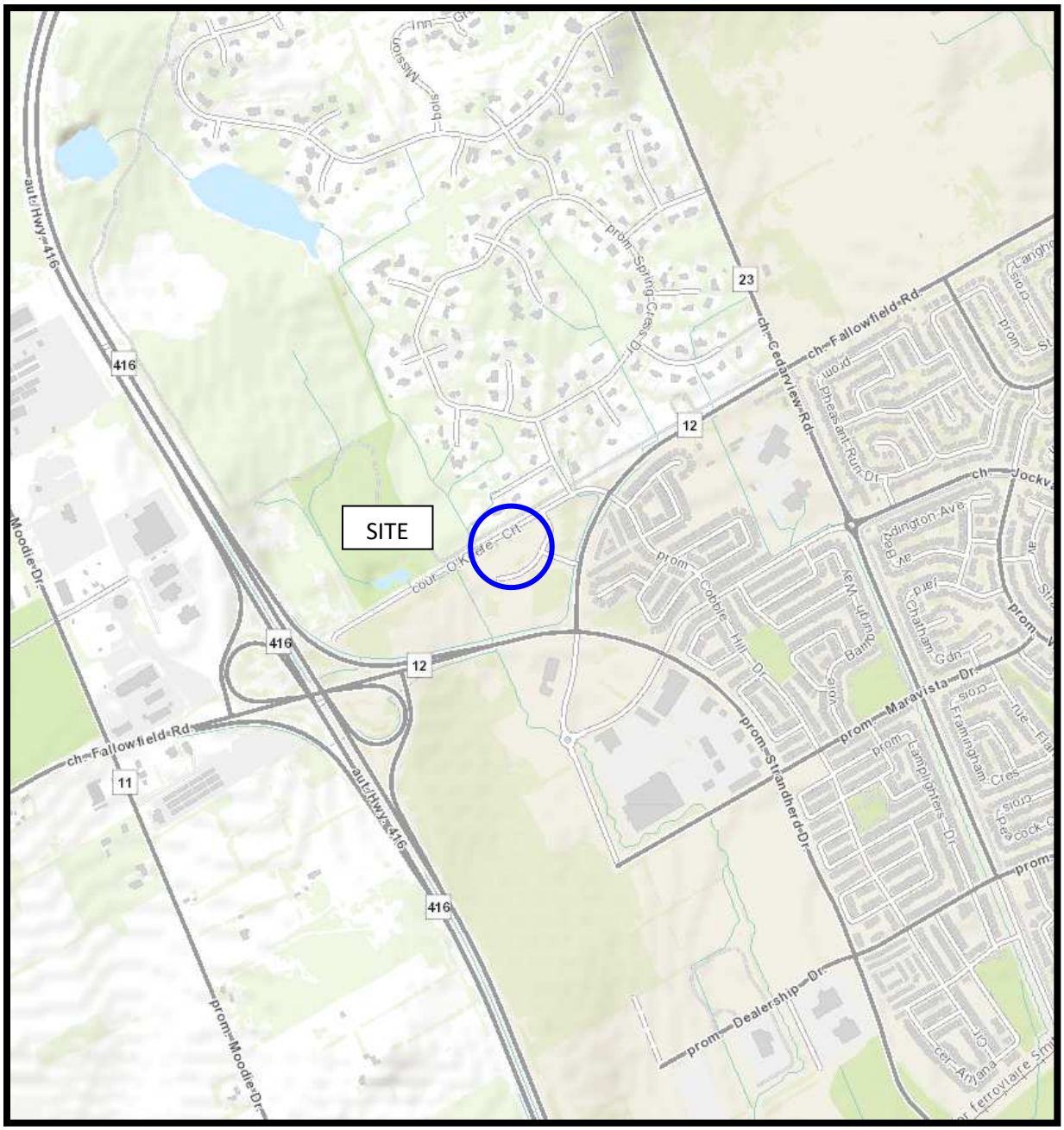
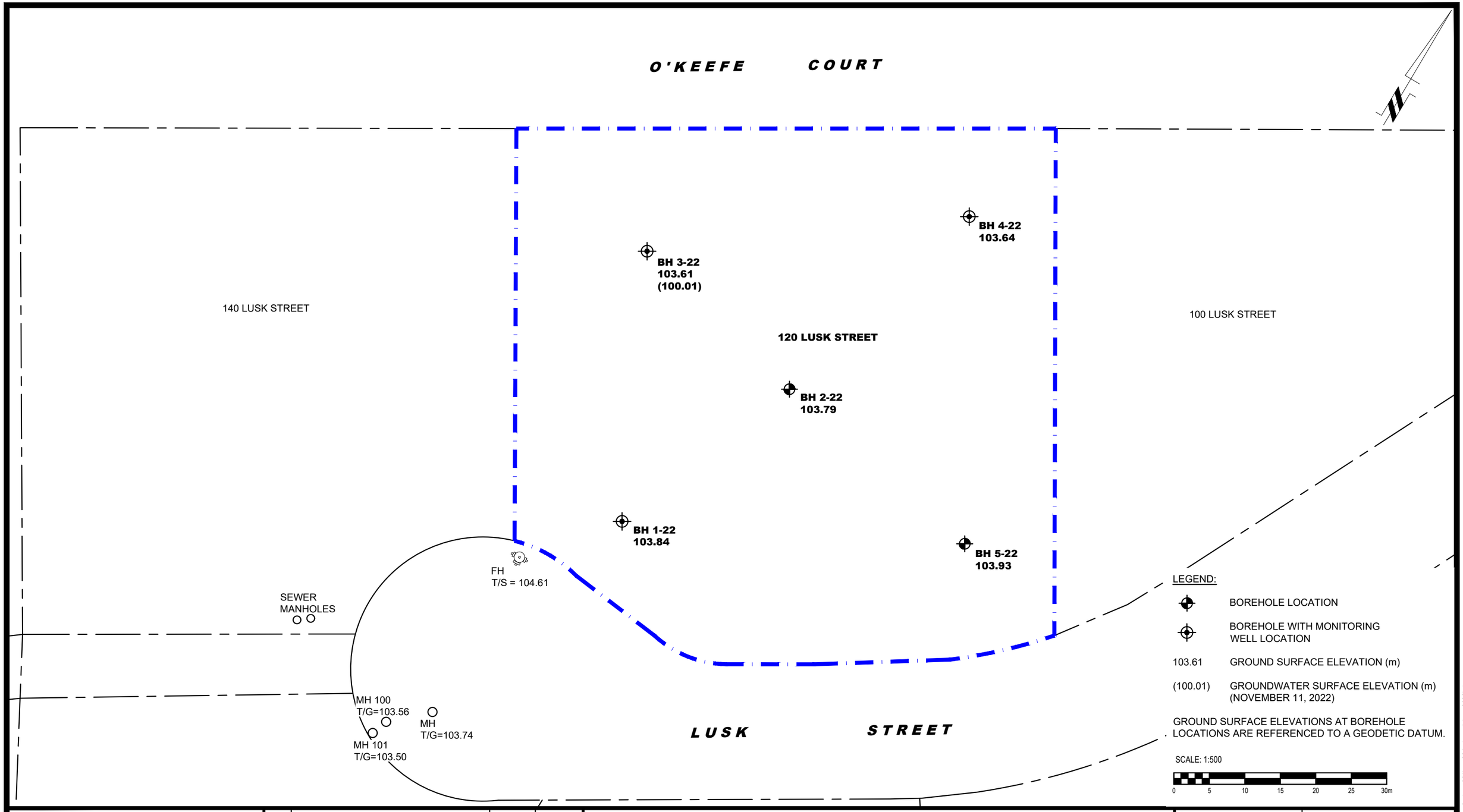


FIGURE 1

KEY PLAN

PATERSON GROUP



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NO.	REVISIONS	DATE	INITIAL

DR. SANDRA IROAKAZI

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
120 LUSK STREET

OTTAWA, ONTARIO

Title: TEST HOLE LOCATION PLAN

Scale: 1:500	Date: 11/2022
Drawn by: YA	Report No.: PE5884-1
Checked by: NS	Dwg. No.: PE5884-1
Approved by: MSD	Revision No.:

11x17

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O'KEEFE COURT

BH3-22-SS3 1.52-2.13m Nov. 8. 2022
BTEX, PHCs, Metals, PAHs comply with MECP Table 3 Standards

BH2-22-AU1 0.31-0.61m Nov. 8. 2022
BTEX, PHCs, Metals, PAHs, pH comply with MECP Table 3 Standards

140 LUSK STREET

BH1-22-SS3 1.52-2.13m Nov. 8. 2022
BTEX, PHCs, Metals, PAHs comply with MECP Table 3 Standards

B

BH 3-22
103.61
(100.01)

A'

BH 4-22
103.64

120 LUSK STREET

BH 2-22
103.79

100 LUSK STREET

BH4-22-SS2 0.76-1.37m Nov. 8. 2022
BTEX, PHCs, Metals, PAHs comply with MECP Table 3 Standards

BH 1-22
103.84

A

BH 5-22
103.93

B'

FH
T/S = 104.61

SEWER
MANHOLES

MH 100
T/G=103.56

MH
T/G=103.74

MH 101
T/G=103.50

LUSK STREET

SOIL RESULT COMPLIES WITH MECP TABLE 3 STANDARDS

LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- 103.61 GROUND SURFACE ELEVATION (m)
- (100.01) GROUNDWATER SURFACE ELEVATION (m) (NOVEMBER 11, 2022)
- A—A CROSS SECTION

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

SCALE: 1:500

0 5 10 15 20 25 30m

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NO.	REVISIONS	DATE	INITIAL

DR. SANDRA IROAKAZI

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
120 LUSK STREET

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL

Scale: 1:500	Date: 11/2022
Drawn by: YA	Report No.: PE5884-1
Checked by: NS	Dwg. No.: PE5884-2
Approved by: MSD	Revision No.:

11x17

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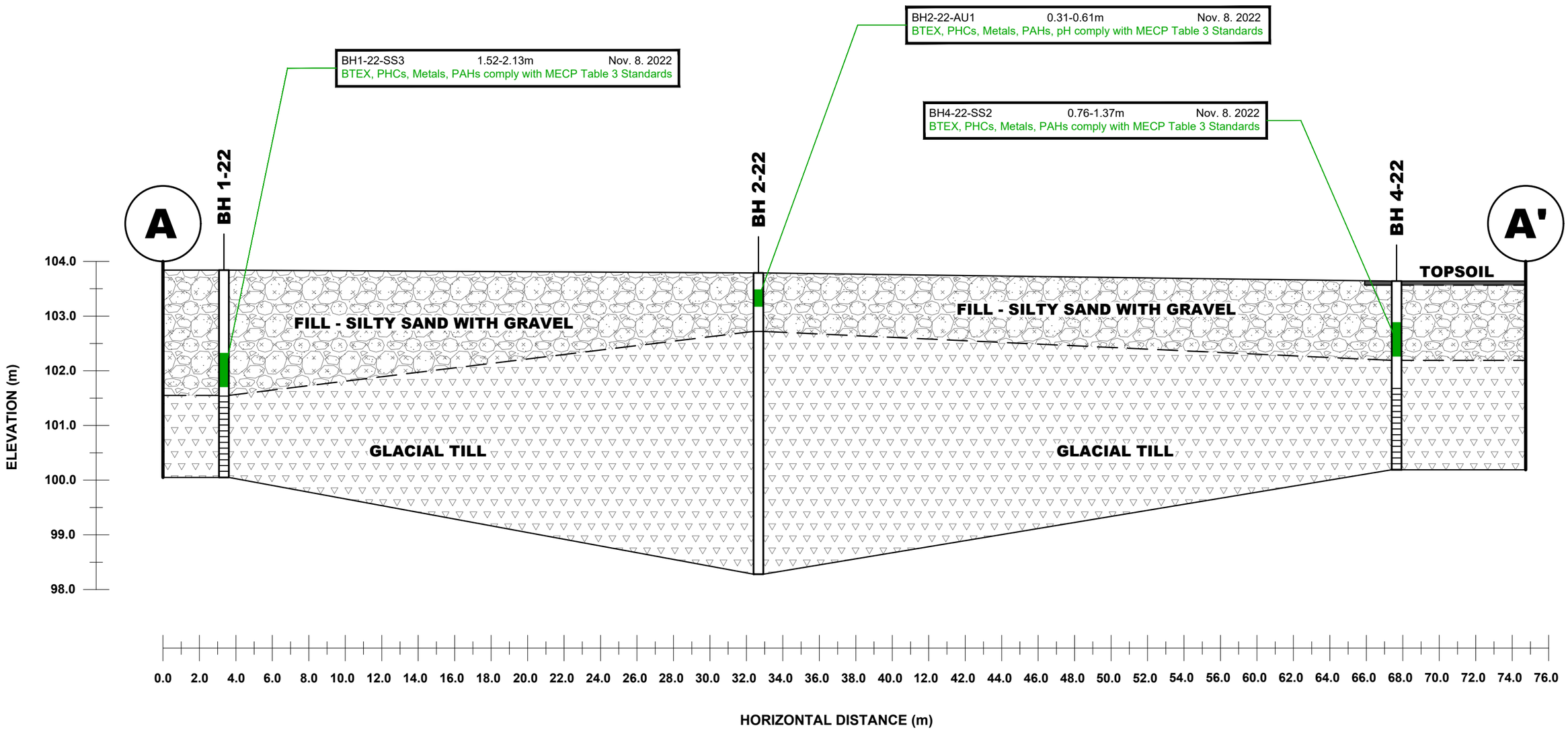

SOIL RESULT COMPLIES WITH MECP TABLE 3 STANDARDS

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DR. SANDRA IROAKAZI

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
120 LUSK STREET

OTTAWA, ONTARIO

Title:

CROSS SECTION A-A'- SOIL

Scale: AS SHOWN	Date: 11/2022
Drawn by: YA	Report No.: PE5884-1
Checked by: NS	Dwg. No.: PE5884-2A
Approved by: MSD	Revision No.:

11x17

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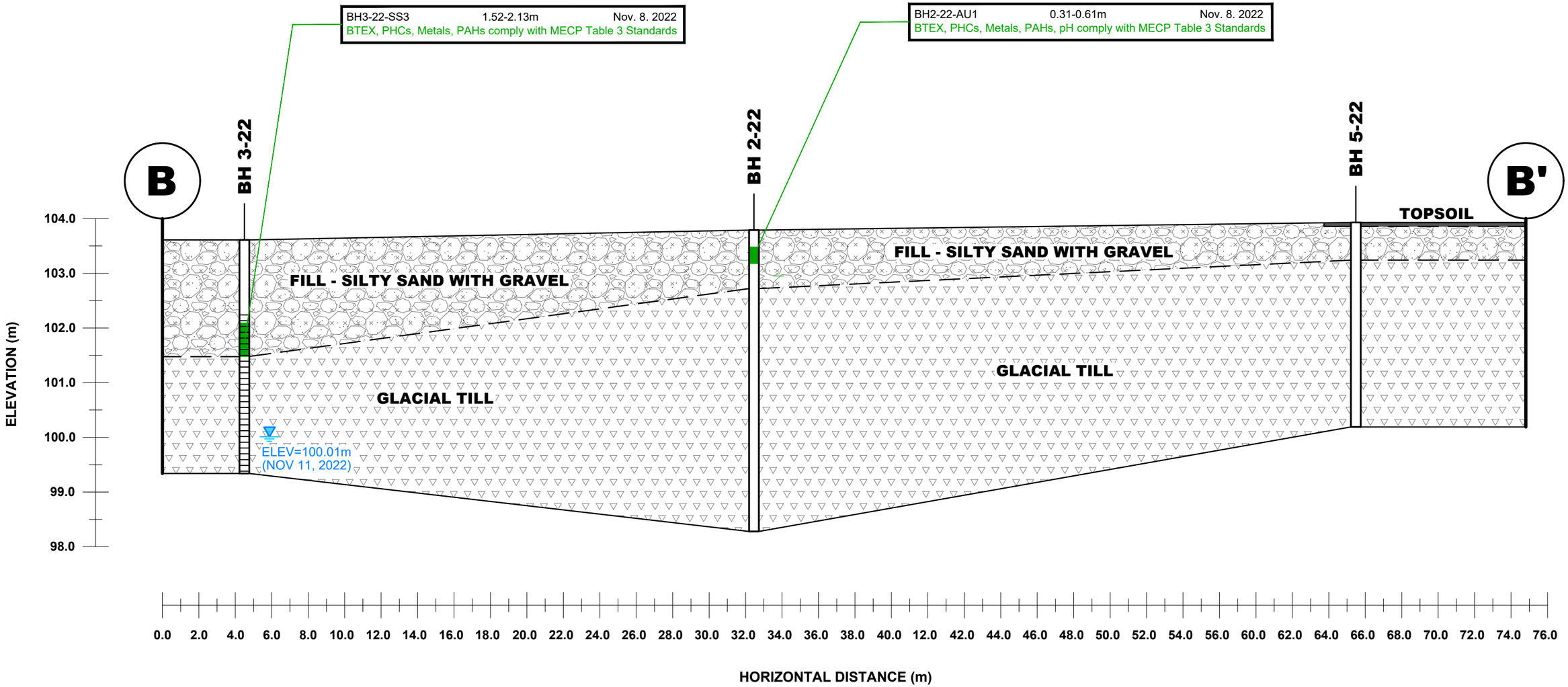

SOIL RESULT COMPLIES WITH MECP TABLE 3 STANDARDS

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NO.	REVISIONS	DATE	INITIAL

DR. SANDRA IROAKAZI

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
120 LUSK STREET

OTTAWA, ONTARIO

Title:

CROSS SECTION B-B'- SOIL

Scale: AS SHOWN	Date: 11/2022
Drawn by: YA	Report No.: PE5884-1
Checked by: NS	Dwg. No.: PE5884-2B
Approved by: MSD	Revision No.:

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O'KEEFE COURT

BH3-22-GW1 1.27-4.27m Nov. 11. 2022
BTEX and PHCs comply with MECP Table 3 Standards

140 LUSK STREET

120 LUSK STREET

100 LUSK STREET

B

BH 3-22
103.61
(100.01)

A'

BH 4-22
103.64

BH 2-22
103.79

A

BH 1-22
103.84

BH 5-22
103.93

B'

FH
T/S = 104.61

SEWER
MANHOLES

MH 100
T/G=103.56

MH 101
T/G=103.50

MH
T/G=103.74

LUSK STREET

GROUNDWATER RESULT COMPLIES WITH MECP TABLE 3 STANDARDS

LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- 103.61 GROUND SURFACE ELEVATION (m)
- (100.01) GROUNDWATER SURFACE ELEVATION (m) (NOVEMBER 11, 2022)
- A—A CROSS SECTION

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

SCALE: 1:500

0 5 10 15 20 25 30m

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NO.	REVISIONS	DATE	INITIAL

DR. SANDRA IROAKAZI

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
120 LUSK STREET

OTTAWA, ONTARIO

Title: ANALYTICAL TESTING PLAN - GROUNDWATER

Scale: 1:500	Date: 11/2022
Drawn by: YA	Report No.: PE5884-1
Checked by: NS	Dwg. No.: PE5884-3
Approved by: MSD	Revision No.:

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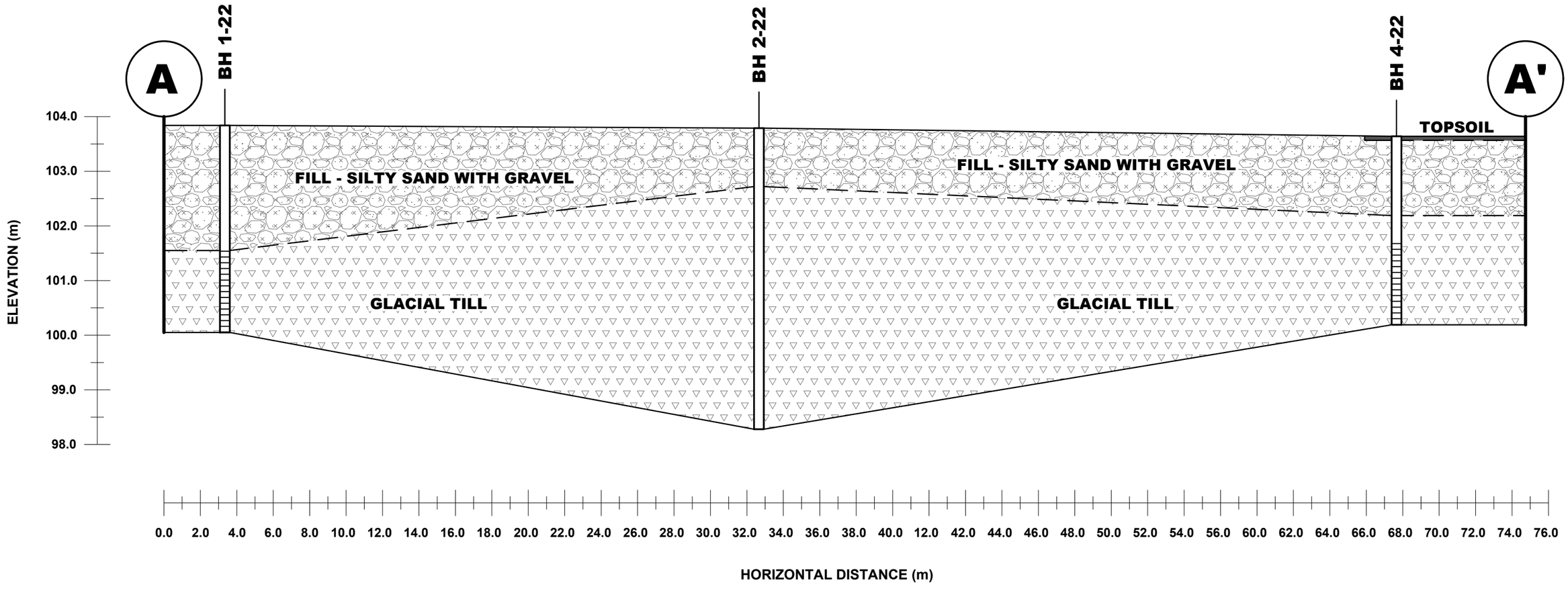

GROUNDWATER RESULT COMPLIES WITH MECP TABLE 3 STANDARDS

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NO.	REVISIONS	DATE	INITIAL

DR. SANDRA IROAKAZI

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
120 LUSK STREET

OTTAWA, ONTARIO

Title: CROSS SECTION A-A'- GROUNDWATER

Scale: AS SHOWN	Date: 11/2022
Drawn by: YA	Report No.: PE5884-1
Checked by: NS	Dwg. No.: PE5884-3A
Approved by: MSD	Revision No.:

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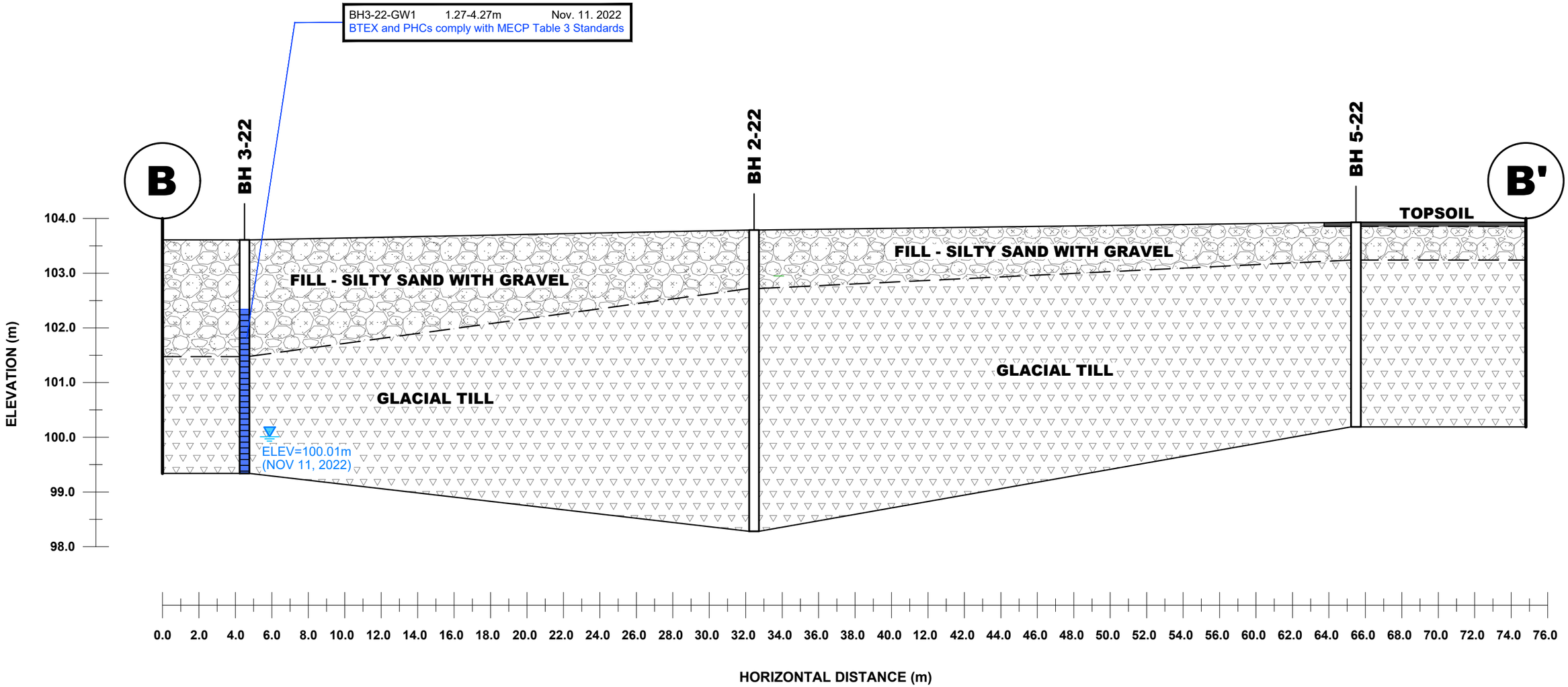

GROUNDWATER RESULT COMPLIES WITH MECP TABLE 3 STANDARDS

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NO.	REVISIONS	DATE	INITIAL

DR. SANDRA IROAKAZI

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
120 LUSK STREET

OTTAWA, ONTARIO

Title:

CROSS SECTION B-B'- GROUNDWATER

Scale: AS SHOWN	Date: 11/2022
Drawn by: YA	Report No.: PE5884-1
Checked by: NS	Dwg. No.: PE5884-3B
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 CERTIFICATES OF ANALYSIS

PATERSON GROUP

Sampling & Analysis Plan

120 Lusk Street

Ottawa, Ontario

Prepared for Dr. Sandra Iroakazi

Report: PE5884-SAP
November 1, 2022

TABLE OF CONTENTS

PAGE

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Dr. Sandra Iroakazi, to conduct a Phase II – Environmental Site Assessment (Phase II ESA) for the property addressed 120 Lusk Street, in the City of Ottawa, Ontario.

Based on the findings of the Phase I ESA, the following subsurface investigation program was developed.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1-22	Southwestern portion of the subject site; to assess the presence of fill material of unknown quality.	3-6 m; to intercept the groundwater table for the purpose of installing a monitoring well.
BH2-22	Central portion of the subject site; to assess the presence of fill material of unknown quality.	3-6 m; for general coverage purposes.
BH3-22	Northwestern portion of the subject site: to assess the presence of fill material of unknown quality.	3-6 m; to intercept the groundwater table for the purpose of installing a monitoring well.
BH4-22	Northeastern portion of the subject site; to assess the presence of fill material of unknown quality.	3-6 m; to intercept the groundwater table for the purpose of installing a monitoring well.
BH5-22	Southeastern portion of the subject site: to assess the presence of fill material of unknown quality.	3-6 m; for general coverage purposes.

Borehole locations are shown on Drawing PE5884-1 – Test Hole Location Plan, appended to the main report.

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

Following the borehole drilling, groundwater monitoring wells will be installed in all three boreholes to allow for the collection of groundwater samples.

2.0 ANALYTICAL TESTING PROGRAM

The analytical testing program for soil at the Phase I Property 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 soil at the Phase I Property is based on the following general considerations:

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

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

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

Equipment

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

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

Determining Borehole Locations

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

After drilling is completed a plan with the borehole locations must be provided. Distances and orientations of boreholes with respect to site features (buildings, roadways, etc.) must be provided. Distances should be measured using a measuring tape or wheel rather than paced off. Ground surface elevations at each borehole should be surveyed relative to a geodetic benchmark, if one is available, or a temporary site benchmark which can be tied in at a later date if necessary.

Drilling Procedure

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

- ❒ Continuous split spoon samples (every 0.6 m or 2') or semi-continuous (every 0.76 m or 2'6") are required.
- ❒ 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 F_1, a soil core from each soil sample, which may be analyzed, must be taken and placed in the laboratory-provided methanol vial.
- ❒ Note all and any odours or discolouration of samples.
- ❒ Split spoon samplers must be washed between samples.
- ❒ If obvious contamination is encountered, continue sampling until vertical extent of contamination is delineated.
- ❒ As a general rule, environmental boreholes should be deep enough to intercept the groundwater table (unless this is impossible/impractical - call project manager to discuss).
- ❒ If at all possible, soil samples should be submitted to a preliminary screening procedure on site, either using a RKI Eagle, PID, etc. depending on type of suspected contamination.

Spoon Washing Procedure

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

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

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

Screening Procedure

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

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

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

3.2 Monitoring Well Installation Procedure

Equipment

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

Procedure

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

3.3 Monitoring Well Sampling Procedure

Equipment

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

Sampling Procedure

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

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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

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

5.0 DATA QUALITY OBJECTIVES

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

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

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

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

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

Physical impediments to the Sampling and Analysis plan may include:

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

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

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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
120 Lusk Street
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5884

REMARKS

HOLE NO. BH 1-22

BORINGS BY CME-55 Low Clearance Drill **DATE** November 8, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.84
FILL: Brown silty sand with gravel, occasional cobbles and boulders		AU	1				
		SS	2	4	8	1	102.84
1.45							
FILL: Brown silty sand to sandy silt, some clay, gravel, trace topsoil		SS	3	67	13	2	101.84
2.29							
GLACIAL TILL: Dense to very dense, brown silty sand to sandy silt with gravel, cobbles and boulders		SS	4	67	41	3	100.84
		SS	5	75	50+		
3.81							
End of Borehole							
Practical refusal to augering at 3.81m depth.							
(BH dry - November 11, 2022)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
120 Lusk Street
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5884

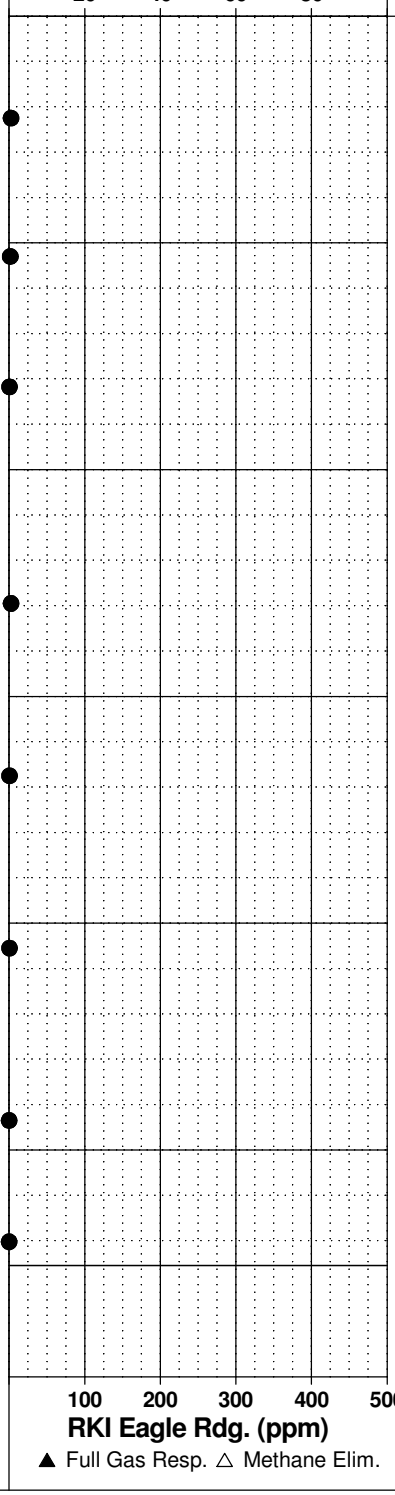
REMARKS

HOLE NO. BH 2-22

BORINGS BY CME-55 Low Clearance Drill **DATE** November 8, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.79
FILL: Brown silty sand with gravel and crushed stone		AU	1				
1.07		SS	2	75	37	1	102.79
		SS	3	44	50+		
GLACIAL TILL: Very dense, reddish brown silty sand to sandy silt with gravel, cobbles and boulders						2	101.79
- compact by 3.0m depth		SS	4	75	50+		
		SS	5	46	21	3	100.79
- brown by 3.7m depth							
		SS	6	75	14	4	99.79
		SS	7	67	15	5	98.79
5.51		SS	8	100	50+		
End of Borehole							
Practical refusal to augering at 5.51m depth.							

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



Monitoring Well Construction

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SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
120 Lusk Street
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5884

REMARKS

HOLE NO. BH 3-22

BORINGS BY CME-55 Low Clearance Drill **DATE** November 8, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.61
FILL: Brown silty sand with gravel and crushed stone, trace organics		AU	1				
		SS	2	100	50+	1	102.61
1.52							
FILL: Brown silty sand with topsoil, some gravel, trace wood		SS	3	67	12	2	101.61
2.13							
GLACIAL TILL: Compact to very dense, brown silty sand to sandy silt with gravel, cobbles and boulders		SS	4	75	23	3	100.61
		SS	5	62	50+		
		SS	6	19	50+	4	99.61
4.27							
End of Borehole Practical refusal to augering at 4.27m depth. (GWL @ 3.60m - Nov. 11, 2022)							

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

20 40 60 80

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

Monitoring Well Construction

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SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
120 Lusk Street
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5884

REMARKS

HOLE NO. BH 4-22

BORINGS BY CME-55 Low Clearance Drill **DATE** November 8, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.08						0	103.64
FILL: Brown silty sand with gravel, some to trace organics		AU	1				
		SS	2	67	31	1	102.64
1.45							
GLACIAL TILL: Dense to very dense, brown silty sand to sandy silt with gravel, cobbles and boulders		SS	3	92	42	2	101.64
		SS	4	83	44		
						3	100.64
		SS	5	53	50+		
3.45							
End of Borehole							
Practical refusal to augering at 3.45m depth.							
(BH dry - November 11, 2022)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
120 Lusk Street
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE5884

REMARKS

HOLE NO. BH 5-22

BORINGS BY CME-55 Low Clearance Drill **DATE** November 8, 2022

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.08							
FILL: Brown silty sand, some gravel and crushed stone, trace organics		AU	0.6			0	103.93
0.69							
		SS	0.6	50	29	1	102.93
GLACIAL TILL: Compact to very dense, brown silty sand to sandy silt with gravel, cobbles and boulders		SS	3	83	45	2	101.93
		SS	4	83	50+	3	100.93
		SS	4	92	50+		
3.89							
End of Borehole							
Practical refusal to augering at 3.89m depth.							

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

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

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 = $(D30)^2 / (D10 \times D60)$
Cu	-	Uniformity coefficient = D60 / D10

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

CONSOLIDATION TEST

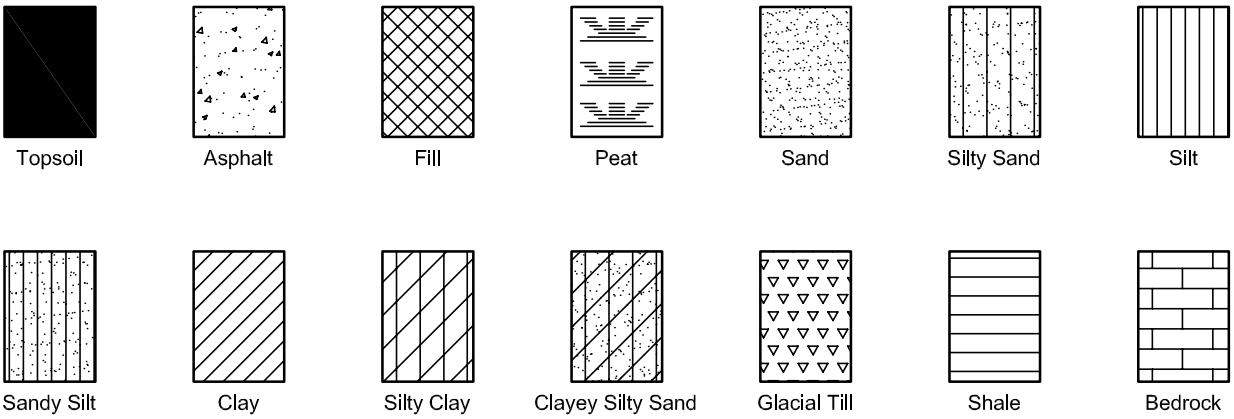
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

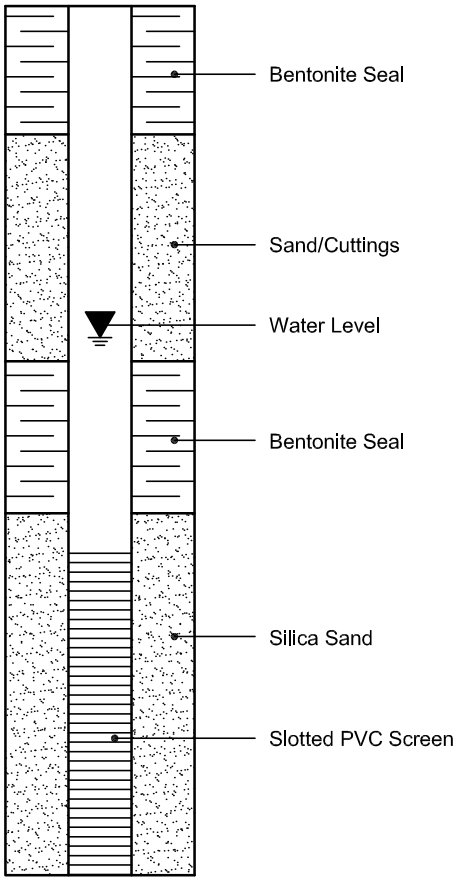
SYMBOLS AND TERMS (continued)

STRATA PLOT

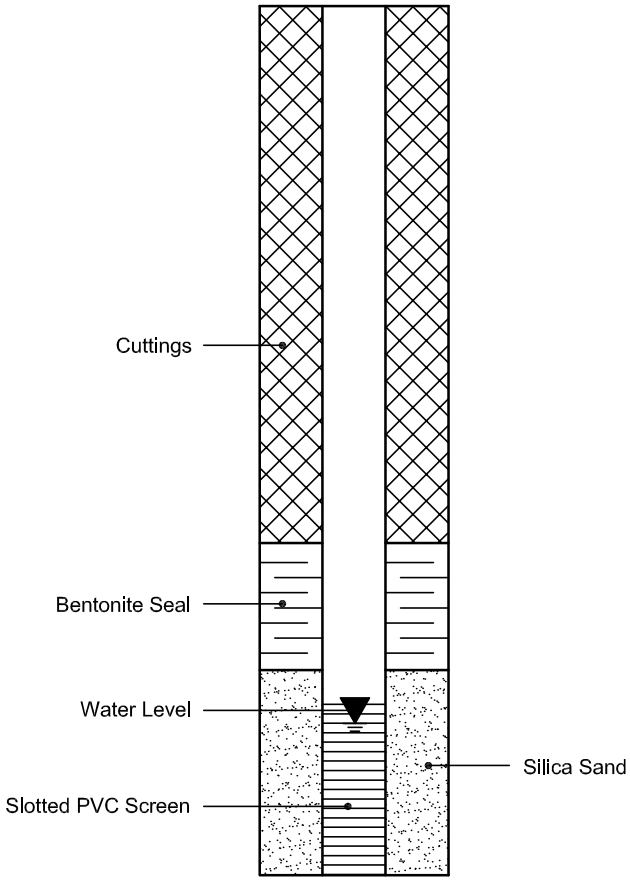


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

9 Auriga Drive
Ottawa, ON K2E 7T9
Attn: Mark D'Arcy

Client PO: 56199
Project: PE5884
Custody:

Report Date: 16-Nov-2022
Order Date: 10-Nov-2022

Order #: 2246513

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

Paracel ID	Client ID
2246513-01	BH1-22-S33
2246513-02	BH2-22-AU1
2246513-03	BH3-22-SS3
2246513-04	BH4-22-SS2
2246513-05	DUP

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	14-Nov-22	14-Nov-22
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	14-Nov-22	14-Nov-22
PHC F1	CWS Tier 1 - P&T GC-FID	14-Nov-22	14-Nov-22
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	11-Nov-22	14-Nov-22
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	15-Nov-22	15-Nov-22
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	14-Nov-22	16-Nov-22
Solids, %	CWS Tier 1 - Gravimetric	14-Nov-22	14-Nov-22

Certificate of Analysis

Report Date: 16-Nov-2022

Client: **Paterson Group Consulting Engineers**

Order Date: 10-Nov-2022

Client PO: **56199**

Project Description: PE5884

	Client ID:	BH1-22-S33	BH2-22-AU1	BH3-22-SS3	BH4-22-SS2
	Sample Date:	08-Nov-22 09:00	08-Nov-22 09:00	08-Nov-22 09:00	08-Nov-22 09:00
	Sample ID:	2246513-01	2246513-02	2246513-03	2246513-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	88.3	93.6	79.5	90.2
General Inorganics					
pH	0.05 pH Units	-	7.65	-	-
Metals					
Antimony	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Arsenic	1.0 ug/g dry	2.5	2.4	2.8	2.6
Barium	1.0 ug/g dry	117	138	91.1	49.2
Beryllium	0.5 ug/g dry	<0.5	<0.5	0.5	<0.5
Boron	5.0 ug/g dry	5.8	7.7	<5.0	<5.0
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Chromium	5.0 ug/g dry	19.8	26.1	18.5	10.2
Cobalt	1.0 ug/g dry	5.5	7.6	5.8	3.9
Copper	5.0 ug/g dry	13.6	16.8	8.2	11.2
Lead	1.0 ug/g dry	6.9	15.3	10.7	4.8
Molybdenum	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Nickel	5.0 ug/g dry	11.8	16.3	9.8	6.6
Selenium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Silver	0.3 ug/g dry	<0.3	<0.3	<0.3	<0.3
Thallium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Uranium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Vanadium	10.0 ug/g dry	26.3	32.2	30.7	16.7
Zinc	20.0 ug/g dry	28.2	41.1	38.9	<20.0
Volatiles					
Benzene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Ethylbenzene	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Toluene	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
m,p-Xylenes	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
o-Xylene	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Xylenes, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Toluene-d8	Surrogate	124%	117%	131%	123%
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	<8	26	22	<8
F4 PHCs (C34-C50)	6 ug/g dry	<6	41	15	<6

Certificate of Analysis

Report Date: 16-Nov-2022

Client: **Paterson Group Consulting Engineers**

Order Date: 10-Nov-2022

Client PO: **56199**

Project Description: PE5884

	Client ID:	BH1-22-S33	BH2-22-AU1	BH3-22-SS3	BH4-22-SS2
	Sample Date:	08-Nov-22 09:00	08-Nov-22 09:00	08-Nov-22 09:00	08-Nov-22 09:00
	Sample ID:	2246513-01	2246513-02	2246513-03	2246513-04
	MDL/Units	Soil	Soil	Soil	Soil
Semi-Volatiles					
Acenaphthene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	0.02 ug/g dry	<0.02	0.02	<0.02	<0.02
Anthracene	0.02 ug/g dry	<0.02	0.03	<0.02	<0.02
Benzo [a] anthracene	0.02 ug/g dry	<0.02	0.10	<0.02	<0.02
Benzo [a] pyrene	0.02 ug/g dry	<0.02	0.11	<0.02	<0.02
Benzo [b] fluoranthene	0.02 ug/g dry	<0.02	0.12	<0.02	<0.02
Benzo [g,h,i] perylene	0.02 ug/g dry	<0.02	0.09	<0.02	<0.02
Benzo [k] fluoranthene	0.02 ug/g dry	<0.02	0.07	<0.02	<0.02
Chrysene	0.02 ug/g dry	<0.02	0.13	<0.02	<0.02
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	0.02	<0.02	<0.02
Fluoranthene	0.02 ug/g dry	<0.02	0.25	<0.02	<0.02
Fluorene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	<0.02	0.07	<0.02	<0.02
1-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
2-Methylnaphthalene	0.02 ug/g dry	<0.02	<0.02	<0.02	<0.02
Methylnaphthalene (1&2)	0.04 ug/g dry	<0.04	<0.04	<0.04	<0.04
Naphthalene	0.01 ug/g dry	<0.01	<0.01	<0.01	<0.01
Phenanthrene	0.02 ug/g dry	<0.02	0.12	<0.02	<0.02
Pyrene	0.02 ug/g dry	<0.02	0.22	<0.02	<0.02
2-Fluorobiphenyl	Surrogate	121%	133%	60.9%	94.8%
Terphenyl-d14	Surrogate	136%	138%	80.6%	127%

Certificate of Analysis

Report Date: 16-Nov-2022

Client: Paterson Group Consulting Engineers

Order Date: 10-Nov-2022

Client PO: 56199

Project Description: PE5884

	Client ID:	DUP	-	-	-
	Sample Date:	08-Nov-22 09:00	-	-	-
	Sample ID:	2246513-05	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	93.6	-	-	-
Volatiles					
Benzene	0.02 ug/g dry	<0.02	-	-	-
Ethylbenzene	0.05 ug/g dry	<0.05	-	-	-
Toluene	0.05 ug/g dry	<0.05	-	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05	-	-	-
o-Xylene	0.05 ug/g dry	<0.05	-	-	-
Xylenes, total	0.05 ug/g dry	<0.05	-	-	-
Toluene-d8	Surrogate	118%	-	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	-	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	-	-	-
F3 PHCs (C16-C34)	8 ug/g dry	41	-	-	-
F4 PHCs (C34-C50)	6 ug/g dry	47	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium	ND	5.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	5.0	ug/g						
Lead	ND	1.0	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	5.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	10.0	ug/g						
Zinc	ND	20.0	ug/g						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	*1.18*		*ug/g*		*88.7*	*50-140*			
Surrogate: Terphenyl-d14	*1.39*		*ug/g*		*104*	*50-140*			
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	*3.61*		*ug/g*		*113*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
pH	7.05	0.05	pH Units	7.08			0.4	2.3	
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g	ND			NC	40	
F2 PHCs (C10-C16)	ND	4	ug/g	ND			NC	30	
F3 PHCs (C16-C34)	ND	8	ug/g	ND			NC	30	
F4 PHCs (C34-C50)	ND	6	ug/g	ND			NC	30	
Metals									
Antimony	ND	1.0	ug/g	ND			NC	30	
Arsenic	2.4	1.0	ug/g	2.2			6.0	30	
Barium	54.0	1.0	ug/g	48.9			10.0	30	
Beryllium	ND	0.5	ug/g	ND			NC	30	
Boron	6.1	5.0	ug/g	5.2			15.3	30	
Cadmium	ND	0.5	ug/g	ND			NC	30	
Chromium	11.2	5.0	ug/g	10.3			8.3	30	
Cobalt	4.1	1.0	ug/g	4.1			0.2	30	
Copper	11.5	5.0	ug/g	10.5			9.4	30	
Lead	24.5	1.0	ug/g	21.9			11.5	30	
Molybdenum	ND	1.0	ug/g	ND			NC	30	
Nickel	9.2	5.0	ug/g	8.3			10.3	30	
Selenium	ND	1.0	ug/g	ND			NC	30	
Silver	ND	0.3	ug/g	ND			NC	30	
Thallium	ND	1.0	ug/g	ND			NC	30	
Uranium	ND	1.0	ug/g	ND			NC	30	
Vanadium	21.1	10.0	ug/g	19.1			9.7	30	
Zinc	42.0	20.0	ug/g	37.5			11.3	30	
Physical Characteristics									
% Solids	74.9	0.1	% by Wt.	75.4			0.6	25	
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g	ND			NC	40	
Acenaphthylene	ND	0.02	ug/g	ND			NC	40	
Anthracene	ND	0.02	ug/g	ND			NC	40	
Benzo [a] anthracene	ND	0.02	ug/g	ND			NC	40	
Benzo [a] pyrene	ND	0.02	ug/g	ND			NC	40	
Benzo [b] fluoranthene	ND	0.02	ug/g	ND			NC	40	
Benzo [g,h,i] perylene	ND	0.02	ug/g	ND			NC	40	
Benzo [k] fluoranthene	ND	0.02	ug/g	ND			NC	40	
Chrysene	ND	0.02	ug/g	ND			NC	40	
Dibenzo [a,h] anthracene	ND	0.02	ug/g	ND			NC	40	
Fluoranthene	ND	0.02	ug/g	ND			NC	40	
Fluorene	ND	0.02	ug/g	ND			NC	40	
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g	ND			NC	40	
1-Methylnaphthalene	ND	0.02	ug/g	ND			NC	40	
2-Methylnaphthalene	ND	0.02	ug/g	ND			NC	40	
Naphthalene	ND	0.01	ug/g	ND			NC	40	
Phenanthrene	ND	0.02	ug/g	ND			NC	40	
Pyrene	ND	0.02	ug/g	ND			NC	40	
Surrogate: 2-Fluorobiphenyl	*1.75*		*ug/g*		*116*	*50-140*			
Surrogate: Terphenyl-d14	*1.98*		*ug/g*		*131*	*50-140*			
Volatiles									
Benzene	ND	0.02	ug/g	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g	ND			NC	50	
Toluene	ND	0.05	ug/g	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g	ND			NC	50	
o-Xylene	ND	0.05	ug/g	ND			NC	50	
Surrogate: Toluene-d8	*3.67*		*ug/g*		*115*	*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)	180	7	ug/g	ND	90.1	80-120			
F2 PHCs (C10-C16)	98	4	ug/g	ND	108	60-140			
F3 PHCs (C16-C34)	276	8	ug/g	ND	124	60-140			
F4 PHCs (C34-C50)	178	6	ug/g	ND	127	60-140			
Metals									
Antimony	37.9	1.0	ug/g	ND	75.5	70-130			
Arsenic	45.5	1.0	ug/g	ND	89.3	70-130			
Barium	64.6	1.0	ug/g	19.5	90.1	70-130			
Beryllium	46.1	0.5	ug/g	ND	92.0	70-130			
Boron	45.3	5.0	ug/g	ND	86.5	70-130			
Cadmium	41.4	0.5	ug/g	ND	82.6	70-130			
Chromium	48.2	5.0	ug/g	ND	88.1	70-130			
Cobalt	45.9	1.0	ug/g	1.6	88.5	70-130			
Copper	48.5	5.0	ug/g	ND	88.5	70-130			
Lead	52.1	1.0	ug/g	8.8	86.6	70-130			
Molybdenum	45.1	1.0	ug/g	ND	90.0	70-130			
Nickel	47.8	5.0	ug/g	ND	89.0	70-130			
Selenium	42.3	1.0	ug/g	ND	84.2	70-130			
Silver	41.5	0.3	ug/g	ND	82.8	70-130			
Thallium	47.0	1.0	ug/g	ND	93.8	70-130			
Uranium	45.2	1.0	ug/g	ND	90.0	70-130			
Vanadium	52.6	10.0	ug/g	ND	89.8	70-130			
Zinc	56.4	20.0	ug/g	ND	82.7	70-130			
Semi-Volatiles									
Acenaphthene	0.236	0.02	ug/g	ND	125	50-140			
Acenaphthylene	0.172	0.02	ug/g	ND	91.2	50-140			
Anthracene	0.173	0.02	ug/g	ND	91.6	50-140			
Benzo [a] anthracene	0.160	0.02	ug/g	ND	84.8	50-140			
Benzo [a] pyrene	0.233	0.02	ug/g	ND	124	50-140			
Benzo [b] fluoranthene	0.195	0.02	ug/g	ND	103	50-140			
Benzo [g,h,i] perylene	0.166	0.02	ug/g	ND	87.8	50-140			
Benzo [k] fluoranthene	0.173	0.02	ug/g	ND	91.6	50-140			
Chrysene	0.237	0.02	ug/g	ND	126	50-140			
Dibenzo [a,h] anthracene	0.158	0.02	ug/g	ND	83.8	50-140			
Fluoranthene	0.173	0.02	ug/g	ND	91.6	50-140			
Fluorene	0.205	0.02	ug/g	ND	109	50-140			
Indeno [1,2,3-cd] pyrene	0.166	0.02	ug/g	ND	87.8	50-140			
1-Methylnaphthalene	0.194	0.02	ug/g	ND	103	50-140			
2-Methylnaphthalene	0.229	0.02	ug/g	ND	122	50-140			
Naphthalene	0.210	0.01	ug/g	ND	111	50-140			
Phenanthrene	0.203	0.02	ug/g	ND	107	50-140			
Pyrene	0.167	0.02	ug/g	ND	88.7	50-140			
Surrogate: 2-Fluorobiphenyl	*1.79*		*ug/g*		*119*	*50-140*			
Surrogate: Terphenyl-d14	*2.06*		*ug/g*		*136*	*50-140*			
Volatiles									
Benzene	3.13	0.02	ug/g	ND	78.3	60-130			
Ethylbenzene	4.68	0.05	ug/g	ND	117	60-130			
Toluene	4.16	0.05	ug/g	ND	104	60-130			

Certificate of Analysis

Report Date: 16-Nov-2022

Client: Paterson Group Consulting Engineers

Order Date: 10-Nov-2022

Client PO: 56199

Project Description: PE5884

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
m,p-Xylenes	9.86	0.05	ug/g	ND	123	60-130			
o-Xylene	4.78	0.05	ug/g	ND	120	60-130			
Surrogate: Toluene-d8	*3.62*		*ug/g*		*113*	*50-140*			

Qualifier Notes:

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

CCME PHC additional information:

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

PARACEL LABORATORIES LTD.

Paracel ID: 2246513

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Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2246513	

Client Name: Paterson

Project Ref: PE5884

Contact Name: Mark D'Arcy

Quote #:

Address: 9 Auriga

PO #: 56199

Telephone: 613 226 7381

E-mail: MDarcy@Patersongroup.ca
NSullivan@Patersongroup.ca

Page __ of __

Turnaround Time

☐ 1 day ☐ 3 day
☐ 2 day ☒ Regular

Date Required:

☒ REG 153/04 ☐ REG 406/19

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)

Required Analysis

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	PH				
1	BH1-22-SS3	S		2	Nov 08 2022		X		X	X								
2	BH2-22-AU1	↓		↓	↓		X		X	X				X				
3	BH3-22-SS3	↓		↓	↓		X		X	X								
4	BH4-22-SS2	↓		↓	↓		X		X	X								
5	DUP	↓		↓	↓		X											
6																		
7																		
8																		
9																		
10																		

Comments:

Method of Delivery: Paracel Courier

Relinquished By (Sign): GPat	Received By Driver/Depot: M. Sicouie	Received at Lab: Sureepom Dohmai	Verified By: [signature]
Relinquished By (Print): Grant Paterson	Date/Time: 10/11/22 3:12	Date/Time: Nov 10, 2022 05:02	Date/Time: Nov 11 2022 1355
Date/Time: Nov 10 2022	Temperature: °C PH	Temperature: 18.8C	pH Verified: ☐ By:

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Certificate of Analysis

Paterson Group Consulting Engineers

9 Auriga Drive
Ottawa, ON K2E 7T9
Attn: Nick Sullivan

Client PO: 56215
Project: PE5884
Custody:

Report Date: 16-Nov-2022
Order Date: 11-Nov-2022

Order #: 2247018

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

Paracel ID	Client ID
2247018-01	BH2-22-GW1
2247018-02	BH3-22-GW1

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 56215

Report Date: 16-Nov-2022

Order Date: 11-Nov-2022

Project Description: PE5884

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	14-Nov-22	14-Nov-22
PHC F1	CWS Tier 1 - P&T GC-FID	14-Nov-22	14-Nov-22
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	15-Nov-22	15-Nov-22

Certificate of Analysis

Report Date: 16-Nov-2022

Client: Paterson Group Consulting Engineers

Order Date: 11-Nov-2022

Client PO: 56215

Project Description: PE5884

	Client ID:	BH2-22-GW1	BH3-22-GW1	-	-
	Sample Date:	11-Nov-22 09:00	11-Nov-22 09:00	-	-
	Sample ID:	2247018-01	2247018-02	-	-
	MDL/Units	Water	Water	-	-
Volatiles					
Benzene	0.5 ug/L	<0.5	<0.5	-	-
Ethylbenzene	0.5 ug/L	<0.5	<0.5	-	-
Toluene	0.5 ug/L	0.9	1.0	-	-
m,p-Xylenes	0.5 ug/L	0.6	0.6	-	-
o-Xylene	0.5 ug/L	<0.5	<0.5	-	-
Xylenes, total	0.5 ug/L	0.6	0.6	-	-
Toluene-d8	Surrogate	118%	118%	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	-	-
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: 16-Nov-2022

Client: Paterson Group Consulting Engineers

Order Date: 11-Nov-2022

Client PO: 56215

Project Description: PE5884

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	*93.5*		*ug/L*		*117*	*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	*93.3*		*ug/L*		*117*	*50-140*			

Certificate of Analysis

Report Date: 16-Nov-2022

Client: Paterson Group Consulting Engineers

Order Date: 11-Nov-2022

Client PO: 56215

Project Description: PE5884

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1980	25	ug/L	ND	99.0	68-117			
F2 PHCs (C10-C16)	1630	100	ug/L	ND	102	60-140			
F3 PHCs (C16-C34)	3710	100	ug/L	ND	94.8	60-140			
F4 PHCs (C34-C50)	2440	100	ug/L	ND	98.3	60-140			
Volatiles									
Benzene	29.4	0.5	ug/L	ND	73.6	60-130			
Ethylbenzene	42.3	0.5	ug/L	ND	106	60-130			
Toluene	40.9	0.5	ug/L	ND	102	60-130			
m,p-Xylenes	87.6	0.5	ug/L	ND	110	60-130			
o-Xylene	42.2	0.5	ug/L	ND	105	60-130			
Surrogate: Toluene-d8	*78.9*		*ug/L*		*98.6*	*50-140*			

Certificate of Analysis

Report Date: 16-Nov-2022

Client: Paterson Group Consulting Engineers

Order Date: 11-Nov-2022

Client PO: 56215

Project Description: PE5884

Qualifier Notes:

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.

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Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2247018	

Client Name: Paterson
Contact Name: Nick Sullivan
Address: 9 Auriga drive
Telephone: 613 226 7381

Project Ref: PE5884
Quote #:
PO #: [illegible]56215
E-mail: NSullivan@Patersongroup.ca
GPaterson@Patersongroup.ca

Page __ of __

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)					
		Required Analysis																
1	BH2-22 - GW1	GW		3	NOV 4 2022		X											
2	BH3-22 - GW1	〃		〃	〃		X											
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		

Comments:

Method of Delivery: PARACEL COURIER

Relinquished By (Sign):	Received By Driver/Depot:	Received at Lab:	Verified By:
GPat	[illegible] Louise	Sandra Demanins	
Relinquished By (Print): Grant Paterson	Date/Time: 11/11/22 3:43	Date/Time: Nov 11 4 '20	Date/Time: NOV/4 2022 10?
Date/Time: NOV 11 2022	Temperature: °C PH	Temperature: 18.3	pH Verified: ☑ DM

Chain of Custody (Blank).xlsx Revision 4.0