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Phase II Environmental Site Assessment

1155 Joseph Cyr Street and 1082 Cyrville Road
Ottawa, Ontario

Prepared For

TCU Development Corporation

July 22, 2020

Report: PE4967-2

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EXECUTIVE SUMMARY

Assessment

A Phase II ESA was conducted for the properties addressed 1155 Joseph Cyr Street and 1082 Cyrville Road, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the areas of environmental concern (APECs) that were identified on the Phase II Property during the Phase I ESA.

The Phase II ESA was carried out in conjunction with a Geotechnical Investigation and consisted of drilling four (4) boreholes on the Phase II Property. Three (3) of the four (4) boreholes were constructed with groundwater monitoring well installations.

The soil profile generally consisted of a fill material, followed by glacial till. The boreholes were terminated on inferred bedrock at 5.61 to 6.71m below the ground surface. Soil samples were obtained from the boreholes and screened using vapour measurements along with visual and olfactory observations. No visible contamination or odour was noted at the time of the field program.

Based on the screening results in combination with sample depth and location, six (6) soil samples were submitted for laboratory analysis of volatile organic compounds (VOCs) and metals. No detectable VOC concentrations were identified in any of the soil samples. Metal concentrations were detected in all of the soil samples analyzed, although non exceeded the selected MECP Standards. All soil samples are incompliance with the selected MECP Table 3 Residential Standards.

Groundwater samples were recovered and analyzed for VOCs. No free-phase product was observed on the groundwater at any of the monitoring well locations during the groundwater sampling events. No detectable VOC concentrations were identifed in the groundwater samples analyzed. All groundwater results are in compliance with the MECP Table 3 Standards.

Based on the findings of the Phase II ESA, no further work is required for the Phase II Property.

Recommendations

Monitoring Wells

It is recommended that the monitoring wells on-site be properly abandoned if they are not going to be used in the future. They should be abandoned according to Ontario Regulation 903. The wells will be registered with the MECP under this regulation.

1.0 INTRODUCTION

At the request of TCU Development Corporation, Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment for the properties addressed 1155 Joseph Cyr Street and 1082 Cyrville Road, in the City of Ottawa, Ontario, herein referred to as the Phase II Property. The purpose of this Phase II ESA was to address areas of potential environmental concern (APECs) identified on the Phase II Property, during the Phase I ESA conducted by Paterson.

1.1 Site Description

Address:	1155 Joseph Cyr Street and 1082 Cyrville Road, Ottawa, Ontario
Legal Description:	Part of Lot 27, Concession Gore, in the Township of Gloucester, now in the City of Ottawa.
Location:	The site is located on the south and east side of Cyrville Road and Joseph Cyr Street, respectively, in the City of Ottawa, Ontario. Refer to Figure 1 - Key Plan in the Figures section following the text.
Latitude and Longitude:	45° 25’ 27" N, 75° 38' 3.89" W
Zoning:	MC – Mixed-Use Centre Zone
Configuration:	Irregular
Area:	1,637m^2 (approximately)

1.2 Property Ownership

Paterson was retained to complete this Phase II ESA by ZW Project Management acting on behalf of TCU Development Corporation. The head office of TCU Development Corporation is located at 150 Isabella Street, Unit 1207, Ottawa, Ontario. Mr. Billy Triantafilos of TCU of can be reached by telephone at (613) 680-5582.

1.3 Current and Proposed Future Uses

The Phase II Property is occupied by a single-storey residential dwelling and a 2-storey residential dwelling addressed 1155 Joseph Cyr Street (southern portion) and 1082 Cyrville Road (northern portion), respectively. The dwelling situated on the northern portion of the site was constructed circa 1945, while the dwelling on the southern portion was constructed circa 1968.

It is our understanding that the proposed site redevelopment for the Phase II Property consists of a residential development. The footprint of the development will cover the majority of the site.

1.4 Applicable Site Condition Standard

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

- ❑ Coarse-grained soil conditions
- ❑ Full depth generic site condition
- ❑ Non-Potable groundwater conditions
- ❑ Residential land use

These standards were selected based on the future land use of the subject site. Coarse-grained soil standards, which are considered conservative, were chosen to represent the current site conditions of the Phase II Property.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II Property is situated in an area consisting of mixed commercial and residential land use. Adjacent and neighbouring properties consist of community to the south, commercial to the west and north, and vacant land to the east.

The site is relatively flat and slightly above the grade of Joseph Cyr Street and slopes slightly towards the north, such that the northern portion of the site is at the grade of Cyrville Road.

Site drainage consists of both sheet flow to catch basins located on the adjacent streets and infiltration in the gravelled and landscaped areas. The regional topography slopes down in southwesterly direction towards the Rideau River.

A depiction of the Phase II Property is shown on Drawing PE4967-1 – Site Plan, in the Phase I ESA report.

2.2 Past Investigations

A Phase I-ESA was conducted by Paterson in July of 2020 in general accordance with the Ontario Regulation (O.Reg.) 153/04, as amended. The Phase I ESA identified four (4) PCAs that resulted in areas of potential environmental concern (APECs) on the Phase I Property:

- APEC 1: Resulting from importation of fill material of unknown quality on the southeastern portion of the Phase I Property (PCA 30).
- APEC 2: Resulting from the former dry-cleaners at 1094 Cyrville Road (PCA 37).
- APEC 3: Resulting from the former dry-cleaners at 1097-1099 Cyrville Road (PCA 37).
- APEC 4: Resulting from the former dry-cleaners at 1157 Joseph Cyr Street (PCA 37).

These PCAs were verified through the historical review, an ERIS search, site visit and personal interview.

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

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation was conducted on July 8, 2020 in conjunction with a Geotechnical Investigation. The field program consisted of drilling four (4) boreholes, three (3) of which were instrumented with groundwater monitoring wells for environmental purposes. Boreholes were drilled to depths ranging from 5.56 to 6.70 m below the ground surface (mbgs).

3.2 Media Investigated

During the subsurface investigation, soil samples and groundwater samples were obtained and submitted for laboratory analysis. The rationale for sampling and analyzing this media is based on the Contaminants of Potential Concern (CPCs) identified in the Phase I ESA. These CPCs include volatile organic compounds (VOCs) and metals in soil and/or groundwater.

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

According to the Geological Survey of Canada website, the bedrock in the area of the Phase I Property is reported to consist of interbedded shale and limestone bedrock of the Carlsbad Spring Formation. The overburden thickness of ranges from 10 to 15 m and consists of erosional terraces.

Based on a domestic well record for the Phase I Property, the site stratigraphy consists of clay, underlain by limestone bedrock. Bedrock was encountered at approximately 5.5 mbgs.

Groundwater is expected to flow in a southwesterly direction towards the Rideau River.

Drinking Water Wells

One potable water well was identified on the Phase I Property during the well records search; although, the subject land and surrounding lands are serviced by municipal water.

Fill Placement

Based on the historical land use of the Phase I Property (residential), importation of fill material is not expected to have occurred on-site; however, based on the aerial photograph, the residence at 1155 Joseph Cyr Street had a former swimming pool on the southeastern corner of the lot, which was backfilled circa 1991. Based on our subsurface investigation, fill material of an unknown quality was identifed on the southeast portion of the Phase I Property and as such, represents an APEC on the Phase I Property.

Existing Buildings and Structures

The Phase I Property is occupied by a single-storey residential dwelling and a 2-storey residential dwelling with finished basement levels. The dwelling situated on the northern portion of the site was constructed circa 1945, while the dwelling on the southern portion was constructed circa 1968. Both of the buildings were constructed with poured concrete foundations, with exteriors finished in stone, brick with vinyl siding and sloped shingle style roofs.

Subsurface Structures and Utilities

The Phase I Property is situated in a municipally serviced area. Underground utility services on the property include natural gas, water and sewer services. Water and sewer services enter the Phase I Property from Cyrville Road and Joseph Cyr Street.

Water Bodies and Areas of Natural Significance

No areas of natural significance or water bodies were identified on the Phase I Property or within a 250 m search radius.

Neighbouring Land Use

The Phase I Study Area is situated in an area that consists primarily of commercial land use with some residential use.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As per Section 7.1 of the Phase I ESA report, four (4) PCAs are considered to result in APECs on the Phase I Property. These APECs are summarized in Table 1, along with their respective locations and contaminants of potential concern (CPCs) on the Phase I Property.

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

Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern	Potentially Contaminating Activity	Location of PCA (on-site or off-site)	Contaminants of Potential Concern	Media Potentially Impacted (Groundwater, Soil, and/or Sediment)
APEC 1: Resulting from importation of fill material of unknown quality	South eastern portion of the Phase I Property	PCA 30 - *"Importation of fill material of unknown quality,"*	On-site	Metals	Soil
APEC 2: Resulting from a former drycleaner at 1094 Cyrville Road	Eastern portion of the Phase I Property	PCA 37 - *"Operation of Dry Cleaning Equipment (where chemicals are used),"*	Off-site	VOCs	Soil and/or Groundwater
APEC 3: Resulting from a former drycleaner at 1097-1099 Cyrville Road	Northeastern portion of the Phase I Property	PCA 37 - *"Operation of Dry Cleaning Equipment (where chemicals are used),"*	Off-site	VOCs	Soil and/or Groundwater
APEC 4: Resulting from a former drycleaner at 1157 Joseph Cyr Street	Southeast corner of the Phase I Property	PCA 37 - *"Operation of Dry Cleaning Equipment (where chemicals are used),"*	Off-site	VOCs	Soil and/or Groundwater

As previously discussed in Section 7.1, the remaining off-site PCAs were determined not to represent APECs on the Phase I Property.

Contaminants of Potential Concern

As per the APECs identified in Section 7.1, the contaminants of potential concern (CPCs) in soil and/or groundwater include:

- ❒ Metals.
- ❒ Volatile Organic Compounds (VOCs).

The CPCs are expected to be present in the soil and/or groundwater of the Phase I Property.

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of this Phase I-ESA is considered to be sufficient to conclude that there are PCAs that have resulted in APECs on the Phase I Property.

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

3.4 Deviations from Sampling and Analysis Plan

The Sampling and Analysis Plan for this project is included in Appendix 1 of this report.

3.5 Impediments

No physical impediments were encountered during the Phase II ESA program, aside from existing buildings and utility structures.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted on July 8, 2020. The field program consisted of drilling four (4) boreholes (BHs) on the Phase II Property.

The boreholes were drilled to a maximum depth of 6.70 mbgs. Three (3) of the four (4) boreholes were completed as groundwater monitoring wells to access the groundwater table.

BH1 through BH4 were placed to address the aforementioned APECs as presented in Table 1, as well as gaining site coverage for geotechnical purposes. All boreholes were completed using a track mounted drill rig provided by Downing Drilling Ltd. of Ottawa, Ontario, under the full-time supervision of Paterson personnel. The borehole locations are indicated on the attached Drawing PE4967-3 – Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

A total of thirty-three (33) soil samples were obtained from the boreholes by means of grab sampling from auger flights and split spoon sampling. Split spoon samples were taken at approximate 0.76 m intervals. The depths at which auger samples and split spoon samples were obtained from the boreholes are shown as "**G**" and "**SS**" on the Soil Profile and Test Data Sheets appended to this report.

The soil stratigraphy at the borehole locations consisted of fill material, underlain by glacial till. Practical refusal was encountered in BH1 and BH2 at depths ranging from 7.42 and 5.56m below the existing grade. respectively.

Boreholes were terminated at depths ranging from 5.56 to 6.70 m below the existing grade.

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 MiniRAE 2000 Portable VOC Monitor.

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

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

The soil vapours were measured by inserting the analyzer probe into the nominal headspace above the soil sample. Samples were then agitated/manipulated gently as the measurements were taken. The peak reading registered within the first 15 seconds was recorded as the vapour measurement.

The vapour readings were found to range from 2.5 ppm to 54 ppm. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

No visible contamination or hydrocarbon odours were noted during the field program. Soil samples were selected based on a combination of the results of

the vapour screening, visual and olfactory screening, sample depth and/or sample location.

4.4 Groundwater Monitoring Well Installation

Three (3) groundwater monitoring wells were installed on the Phase II Property as part of the subsurface investigation. The monitoring wells consisted of 50 mm diameter, Schedule 40 threaded PVC risers and screens. Monitoring well construction details are listed below in Table 2 and are also presented on the Soil Profile and Test Data Sheets provided in Appendix 1. A summary of the monitoring well construction details is provided below in Table 2.

TABLE 2: Monitoring Well Construction Details

Well ID	Ground Surface Elevation	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
BH1	71.21	6.71	5.21-6.71	4.88-6.71	0.15-4.88	Flushmount
BH2	70.06	6.71	5.21-6.71	4.88-6.71	0.15-4.88	Flushmount
BH4	70.90	6.71	5.21-6.71	4.27-6.71	0.15-4.88	Flushmount

4.5 Field Measurement of Water Quality Parameters

Groundwater samples were collected on July 15, 2020. The water levels were the only parameter measured in the field during the sampling event.

4.6 Groundwater Sampling

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

Samples were stored in coolers to reduce analyte volatilization during transportation. Details of our standard operating procedure for groundwater sampling are provided in the Sampling and Analysis Plan in Appendix 1.

4.7 Analytical Testing

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

TABLE 3: Soil Samples Submitted and Analyzed Parameters

Sample ID	Sample Depth (m) and Stratigraphic Unit	Parameters Analyzed		Rationale
		VOCs	Metals	
July 8, 2020				
BH1-SS2	0.76-1.36 Fill		X	Assess the quality of the fill material.
BH1-SS7	4.57-5.18 Till	X		Assess the potential impact due to a former dry cleaner.
BH2-SS2	0.76-1.36 Fill		X	Assess the quality of the fill material.
BH3-SS6	3.18-4.42 Till	X		Assess the potential impact due to a former dry cleaner.
BH4-AU1	0.0-0.05 Fill		X	Assess the quality of the fill material.
BH4-SS6	3.18-4.42 Till	X		Assess the potential impact due to a former dry cleaner.

TABLE 4: Groundwater Samples Submitted and Analyzed Parameters

Sample ID	Screened Interval (m) and Stratigraphy Unit	Parameters Analyzed	Rationale
		VOCs	
July 15, 2020			
BH1-GW1	5.21-6.71 Till	X	Assess potential impact in the groundwater due to a former dry cleaner.
BH3-GW1	5.21-6.71 Till	X	Assess potential impact in the groundwater due to a former dry cleaner.
BH4-GW1	5.21-6.71 Till	X	Assess potential impact in the groundwater due to a former dry cleaner.

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

4.8 Residue Management

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

4.9 Elevation Surveying

The borehole locations were selected by Paterson for both environmental and geotechnical purposes. Boreholes were located and surveyed in the field by Paterson. All borehole elevations are geodetic.

The locations and elevations of the boreholes are presented on Drawing PE4967-3 – Test Hole Location Plan, appended to this report.

4.10 Quality Assurance and Quality Control Measures

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

5.0 REVIEW AND EVALUATION

5.1 Geology

Site soils generally consist of asphaltic concrete, topsoil or gravel, followed by fill material, underlain by native silty clay with sand and gravel. The boreholes were terminated at depths ranging from 5.61 to 6.71 mbgs.

Groundwater was encountered within the till at depths ranging from approximately 3.36 to 4.40 mbgs. Site geology details are provided in the Soil Profile and Test Data Sheets provided in Appendix 1.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling event on July 15, 2020, using an electronic water level meter. 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	71.21	4.40	66.81	July 15, 2020
BH3	70.06	3.36	66.70	July 15, 2020
BH4	70.90	4.17	66.73	July 15, 2020

Based on the groundwater elevations measured during the sampling event, a groundwater contour plan was completed. The groundwater contour mapping is shown on Drawing PE4967-3 – Groundwater Contour Plan. Based on the contour mapping, groundwater flow beneath the Phase II Property is in a north-easterly direction. A horizontal hydraulic gradient of approximately 0.003 m/m was calculated.

5.3 Fine-Coarse Soil Texture

No grain size analysis was completed for the subject site. Coarse grained standards were chosen.

5.4 Soil: Field Screening

Field screening of the soil samples collected resulted in vapour readings ranging from 2.5 ppm to 54 ppm.

No visible contamination or hydrocarbon odours were noted during the field program, although traces of brick material was found in BH1. Soil samples were selected based on a combination of the results of the vapour screening, visual and olfactory screening, sample depth and/or sample location.

5.5 Soil Quality

Six (6) soil samples were submitted for VOCs and metals analyses. The results of the analytical testing are presented in Tables 6 and 7. The laboratory certificate of analysis is provided in Appendix 1.

TABLE 6: Analytical Test Results – Soil – Metals

Parameters	MDL	Soil Samples (µg/g) July 8, 2020				MECP Table 3 Residential Standards (µg/g)
		BH1-SS7	BH3-SS6	BH4-SS6	DUP	
Acetone	0.50	nd	nd	nd	nd	16
Benzene	0.02	nd	nd	nd	nd	0.21
Bromodichloromethane	0.05	nd	nd	nd	nd	13
Bromoform	0.05	nd	nd	nd	nd	0.27
Bromomethane	0.05	nd	nd	nd	nd	0.05
Carbon Tetrachloride	0.05	nd	nd	nd	nd	0.05
Chlorobenzene	0.05	nd	nd	nd	nd	2.4
Chloroform	0.05	nd	nd	nd	nd	0.05
Dibromochloromethane	0.05	nd	nd	nd	nd	9.4
Dichlorodifluoromethane	0.05	nd	nd	nd	nd	16
1,2-Dichlorobenzene	0.05	nd	nd	nd	nd	3.4
1,3-Dichlorobenzene	0.05	nd	nd	nd	nd	4.8
1,4-Dichlorobenzene	0.05	nd	nd	nd	nd	0.083
1,1-Dichloroethane	0.05	nd	nd	nd	nd	3.5
1,2-Dichloroethane	0.05	nd	nd	nd	nd	0.05
1,1-Dichloroethylene	0.05	nd	nd	nd	nd	0.05
cis-1,2-Dichloroethylene	0.05	nd	nd	nd	nd	3.4
trans-1,2-Dichloroethylene	0.05	nd	nd	nd	nd	0.084
1,2-Dichloropropane	0.05	nd	nd	nd	nd	0.05
1,3-Dichloropropene, total	0.05	nd	nd	nd	nd	0.05
Ethylbenzene	0.05	nd	nd	nd	nd	2
Ethylene dibromide (dibromoethane, 1,2-)	0.05	nd	nd	nd	nd	0.05
Hexane	0.05	nd	nd	nd	nd	2.8
Methyl Ethyl Ketone (2-Butanone)	0.50	nd	nd	nd	nd	16
Methyl Isobutyl Ketone	0.50	nd	nd	nd	nd	1.7
Methyl tert-butyl ether	0.05	nd	nd	nd	nd	0.75
Methylene Chloride	0.05	nd	nd	nd	nd	0.1
Styrene	0.05	nd	nd	nd	nd	0.7
1,1,1,2-Tetrachloroethane	0.05	nd	nd	nd	nd	0.058
1,1,2,2-Tetrachloroethane	0.05	nd	nd	nd	nd	0.05
Tetrachloroethylene	0.05	nd	nd	nd	nd	0.28
Toluene	0.05	nd	nd	nd	nd	2.3
1,1,1-Trichloroethane	0.05	nd	nd	nd	nd	0.38
1,1,2-Trichloroethane	0.05	nd	nd	nd	nd	0.05
Trichloroethylene	0.05	nd	nd	nd	nd	0.061
Trichlorofluoromethane	0.05	nd	nd	nd	nd	4
Vinyl Chloride	0.02	nd	nd	nd	nd	0.02
Xylenes, total	0.05	nd	nd	nd	nd	3.1

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

No VOC concentrations were identified in the soil samples analyzed. All VOC test results comply with the selected MECP Table 3 Residential Standards.

TABLE 9: Analytical Test Results – Soil – Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g) July 8, 2020			MECP Table 3 Residential Standards (µg/g)
		BH1-SS2	BH2-SS2	BH4-AU1	
Antimony	1.0	nd	nd	nd	7.5
Arsenic	1.0	2.3	3.9	4.1	18
Barium	1.0	53.7	89.1	107	390
Beryllium	0.5	nd	nd	nd	4
Boron	5.0	nd	nd	nd	120
Cadmium	0.5	nd	nd	nd	1.2
Chromium	5.0	20.0	17.9	19.7	160
Cobalt	1.0	5.1	5.2	5.4	22
Copper	5.0	14.4	12.3	17.0	140
Lead	1.0	16.6	26.6	80.3	120
Molybdenum	1.0	nd	nd	1.0	6.9
Nickel	5.0	12.3	12.8	16.4	100
Selenium	1.0	nd	nd	nd	2.4
Silver	0.3	nd	nd	nd	20
Thallium	1.0	nd	nd	nd	1
Uranium	1.0	nd	nd	nd	23
Vanadium	10.0	22.6	22.0	22.0	86
Zinc	20.0	43.9	55.5	79.8	340

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- NA – Parameter not analyzed
- **Bold and underlined** – Parameter exceeds selected MECP Standards

The analytical results for VOCs and metals in soil with respect to borehole and locations are shown on Drawing PE4967-4- Analytical Testing Plan – Soil.

The maximum concentrations of analyzed parameters in the soil at the site are summarized in Table 8.

TABLE 8: Maximum Concentrations – Soil

Parameter	Maximum Concentration (µg/g)	Soil Sample	Depth Interval (m BGS)
Arsenic	4.1	BH4-AU1	0.0-0.5 Fill
Barium	107	BH4-AU1	
Chromium	20.0	BH1-SS2	0.76-1.37 Fill
Cobalt	5.4	BH4-AU1	0.0-0.5 Fill
Copper	17.0	BH4-AU1	
Lead	80.3	BH4-AU1	

TABLE 8: Maximum Concentrations – Soil			
Parameter	**Maximum Concentration (µg/g)**	**Soil Sample**	**Depth Interval (m BGS)**
Molybdenum	1.0	BH4-AU1	
Nickel	16.4	BH4-AU1	
Vanadium	22.6	BH1-SS2	0.76-1.37 Fill
Zinc	79.8	BH4-AU1	0.76-1.37 Fill

The maximum concentrations in the soil samples analyzed are in compliance with the selected MECP Table 3 Residential Standards. The remaining parameters were not detected above the laboratory method detection limits.

5.6 Groundwater Quality

Groundwater samples were submitted for laboratory analysis of VOC parameters. The groundwater samples were obtained from the screened intervals noted in Table 2.

The results of the analytical testing are presented in Table 9. The laboratory certificates of analysis are provided in Appendix 1.

TABLE 9: Analytical Test Results – Groundwater – VOC						
Parameter	**MDL (µg/L)**	**Groundwater Samples (µg/L)**				**MECP Table 3 Standards (µg/L)**
		July 15, 2020				
		BH1-GW1	**BH3-GW1**	**BH4-GW1**	**DUP**	
Acetone	5	nd	nd	nd	nd	130000
Benzene	0.5	nd	nd	nd	nd	44
Bromodichloromethane	0.5	nd	nd	nd	nd	85000
Bromoform	0.5	nd	nd	nd	nd	380
Bromomethane	0.5	nd	nd	nd	nd	5.6
Carbon Tetrachloride	0.2	nd	nd	nd	nd	0.79
Chlorobenzene	0.5	nd	nd	nd	nd	630
Chloroform	0.5	nd	nd	nd	nd	2.4
Dibromochloromethane	0.5	nd	nd	nd	nd	82000
Dichlorodifluoromethane	1	nd	nd	nd	nd	4400
1,2-Dichlorobenzene	0.5	nd	nd	nd	nd	4600
1,3-Dichlorobenzene	0.5	nd	nd	nd	nd	9600
1,4-Dichlorobenzene	0.5	nd	nd	nd	nd	8
1,1-Dichloroethane	0.5	nd	nd	nd	nd	320
1,2-Dichloroethane	0.5	nd	nd	nd	nd	1.6
1,1-Dichloroethylene	0.5	nd	nd	nd	nd	1.6
cis-1,2-Dichloroethylene	0.5	nd	nd	nd	nd	1.6

TABLE 9: Analytical Test Results – Groundwater – VOC

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) July 15, 2020				MECP Table 3 Standards (µg/L)
		BH1-GW1	BH3-GW1	BH4-GW1	DUP	
trans-1,2-Dichloroethylene	0.5	nd	nd	nd	nd	1.6
1,2-Dichloropropane	0.5	nd	nd	nd	nd	16
1,3-Dichloropropene, total	0.2	nd	nd	nd	nd	5.2
Ethylbenzene	1	nd	nd	nd	nd	2300
Ethylene dibromide (dibromoethane, 1,2-)	5	nd	nd	nd	nd	0.25
Hexane	5	nd	nd	nd	nd	51
Methyl Ethyl Ketone (2-Butanone)	2	nd	nd	nd	nd	470000
Methyl Isobutyl Ketone	5	nd	nd	nd	nd	140000
Methyl tert-butyl ether	0.5	nd	nd	nd	nd	190
Methylene Chloride	0.5	nd	nd	nd	nd	610
Styrene	0.5	nd	nd	nd	nd	1300
1,1,1,2-Tetrachloroethane	0.5	nd	nd	nd	nd	3.3
1,1,2,2-Tetrachloroethane	0.5	nd	nd	nd	nd	3.2
Tetrachloroethylene	0.5	nd	nd	nd	nd	1.6
Toluene	0.5	nd	nd	nd	nd	18000
1,1,1-Trichloroethane	0.5	nd	nd	nd	nd	640
1,1,2-Trichloroethane	1	nd	nd	nd	nd	4.7
Trichloroethylene	0.5	nd	nd	nd	nd	1.6
Trichlorofluoromethane	1	nd	nd	nd	nd	2500
Vinyl Chloride	0.5	nd	nd	nd	nd	0.5
Xylenes, total	0.5	nd	nd	nd	nd	4200

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

No VOC concentrations were identified in the groundwater samples analyzed. All VOC test results comply with the selected MECP Table 3 Standards. A duplicate groundwater sample (DUP) from BH1 was collected and analyzed as well. No detectable VOCs concentrations were identifed.

The analytical results for VOCs in groundwater with respect to borehole are shown on Drawing PE4967-5- Analytical Testing Plan –Groundwater.

5.7 Quality Assurance and Quality Control Results

All samples submitted as part of the July 8 to July 15, 2020 sampling events were handled in accordance with the Analytical Protocol with respect to preservation method, storage requirement, and container type.

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

5.8 Phase II Conceptual Site Model

The following section has been prepared in general accordance with the requirements of O.Reg. 153/04, as 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 indicated in Section 2.2 of this report, on and off-site PCAs were identified on and have resulted in APECs on the Phase II Property:

- APEC 1: Resulting from importation of fill material of unknown quality on the southeastern portion of the Phase I Property (PCA 30).
- APEC 2: Resulting from the former dry-cleaners at 1094 Cyrville Road (PCA 37).
- APEC 3: Resulting from the former dry-cleaners at 1097-1099 Cyrville Road (PCA 37).
- APEC 4: Resulting from the former dry-cleaners at 1157 Joseph Cyr Street (PCA 37).

Contaminants of Potential Concern

Based on the APECs identified on the Phase II Property, the contaminants of potential concern (CPCs) are:

- Metals.
- Volatile organic compounds (VOCs).

Subsurface Structures and Utilities

The Phase II Property is situated in a municipally serviced area. Underground utility services on the property include natural gas, water and sewer services. Water and sewer services enter the Phase II Property from Cyrville Road and Joseph Cyr Street.

Physical Setting

Site Stratigraphy

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is illustrated on Drawing PE4967-6–Cross-section A-A' – Soil and Groundwater. The site stratigraphy consists of:

- Fill material consisting of silty sand with some crushed stone and gravel was encountered in all of the boreholes, extending to depths ranging from 0.6 to 2.10 mbgs. Groundwater was not encountered in this layer.
- Glacial till consisting of silty sand, silty clay with gravel and cobble stones was encountered in all of the boreholes, extending to depths ranging from 5.56 to 6.70 mbgs. Groundwater was encountered in this layer.
- Shale bedrock was encountered at BH4 at 5.79 mbgs.

Hydrogeological Characteristics

Groundwater at the Phase II Property was generally encountered in the till at depths of approximately 3.36 to 4.40 mbgs. Groundwater flow was measured in a north-easterly direction with a hydraulic gradient of 0.003 m/m. Groundwater contours are shown on Drawing PE4967-3–Test Hole Location Plan.

Approximate Depth to Water Table

Depth to the water table at the subject site varies between approximately 3.36 to 4.40 mbgs.

Approximate Depth to Bedrock

Bedrock was inferred at depths ranging from 5.6 to 7.4 mbgs.

Sections 41 and 43.1 of the Regulation

Section 41 of the Regulation does not apply to the Phase II Property, in that the subject property is not within 30m of an environmentally sensitive area.

Section 43.1 of the Regulation does not apply to the Phase II Property as it is not a shallow soil property.

Fill Placement

Based on the findings of the subsurface investigation, the fill material encountered consisted of a mixture of silty sand, crushed stone and some gravel and clay, with a trace of brick in BH1. Some of the fill was reworked native soil.

Existing Buildings and Structures

The Phase II Property is occupied by a single-storey residential dwelling and a 2-storey residential dwelling with finished basement levels. The dwelling situated on the northern portion of the site was constructed circa 1945, while the dwelling on the southern portion was constructed circa 1968. Both of the buildings were constructed with poured concrete foundations, with exteriors finished in stone, brick with vinyl siding and sloped shingle style roofs.

Proposed Buildings and Other Structures

The proposed development for the Phase II Property includes a residential development. The footprint of the development will cover the majority of the site.

Drinking Water Wells

One potable water well was identified on the Phase II Property during the well records search; although, the subject land and surrounding lands are serviced by municipal water.

Water Bodies and Areas of Natural Significance

No water bodies or areas of natural significance were identifed on the Phase II Property or within the 250 m search radius.

Environmental Condition

Areas Where Contaminants are Present

Based on the analytical test results for soil and groundwater, there are no contaminants of concern on the Phase II Property.

Types of Contaminants

Based on the analytical test results for soil and groundwater, there are no contaminants of concern on the Phase II Property.

Contaminated Media

There are no contaminants of concern on and/or beneath the Phase II Property.

What Is Known About Areas Where Contaminants Are Present

There are no contaminants of concern on and/or beneath the Phase II Property.

Distribution and Migration of Contaminants

Based on the findings of the Phase II ESA, there are no signs of contaminant migration of distribution on-site, as there are no contaminants of concern present on the Phase II Property.

Discharge of Contaminants

There are no contaminants of concern on and/or beneath the Phase II Property and as such, discharge of contaminants is not a concern.

Climatic and Meteorological Conditions

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

Since no contaminants were identified in the groundwater or in the fill material, , climatic and meteorological conditions are not considered to have contributed to contaminant transport.

Potential for Vapour Intrusion

Based on the findings of the Phase II ESA, there is no potential for vapour intrusion on the Phase II Property.

6.0 CONCLUSIONS

Assessment

A Phase II ESA was conducted for the properties addressed 1155 Joseph Cyr Street and 1082 Cyrville Road in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address the areas of environmental concern (APECs) that were identified on the Phase II Property during the Phase I ESA.

The Phase II ESA was carried out in conjunction with a Geotechnical Investigation and consisted of drilling four (4) boreholes on the Phase II Property. Three (3) of the four (4) boreholes were constructed with groundwater monitoring well installations.

The soil profile generally consisted of a fill material, followed by glacial till. The boreholes were terminated on inferred bedrock at 5.61 to 6.71m below the ground surface. Soil samples were obtained from the boreholes and screened using vapour measurements along with visual and olfactory observations. No visible contamination or odour was noted at the time of the field program.

Based on the screening results in combination with sample depth and location, six (6) soil samples were submitted for laboratory analysis of volatile organic compounds (VOCs) and metals. No detectable VOC concentrations were identified in any of the soil samples. Metal concentrations were detected in all of the soil samples analyzed, although non exceeded the selected MECP Standards. All soil samples are in compliance with the selected MECP Table 3 Residential Standards.

Groundwater samples were recovered and analyzed for VOCs. No free-phase product was observed at any of the monitoring well locations during the groundwater sampling events. No detectable VOC concentrations were identifed in the groundwater samples analyzed. All groundwater results are in compliance with the MECP Table 3 Standards.

Based on the findings of the Phase II ESA, no further work is required for the Phase II Property.

Recommendations

Monitoring Wells

It is recommended that the monitoring wells on-site be properly abandoned if they are not going to be used in the future. They should be abandoned according to Ontario Regulation 903. The wells will be registered with the MECP under this regulation.

7.0 STATEMENT OF LIMITATIONS

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

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

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

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

Paterson Group Inc.

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

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

Report Distribution:

- TCU Development Corporation
- Paterson Group

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE4967-3 – TEST HOLE LOCATION PLAN AND GROUNDWATER CONTOUR PLAN

DRAWING PE4967-4 – ANALYTICAL TESTING PLAN – SOIL

DRAWING PE4967-5– ANALYTICAL TESTING PLAN –GROUNDWATER

DRAWING PE4967-6 – CROSS-SECTION A – A' – SOIL & GROUNDWATER

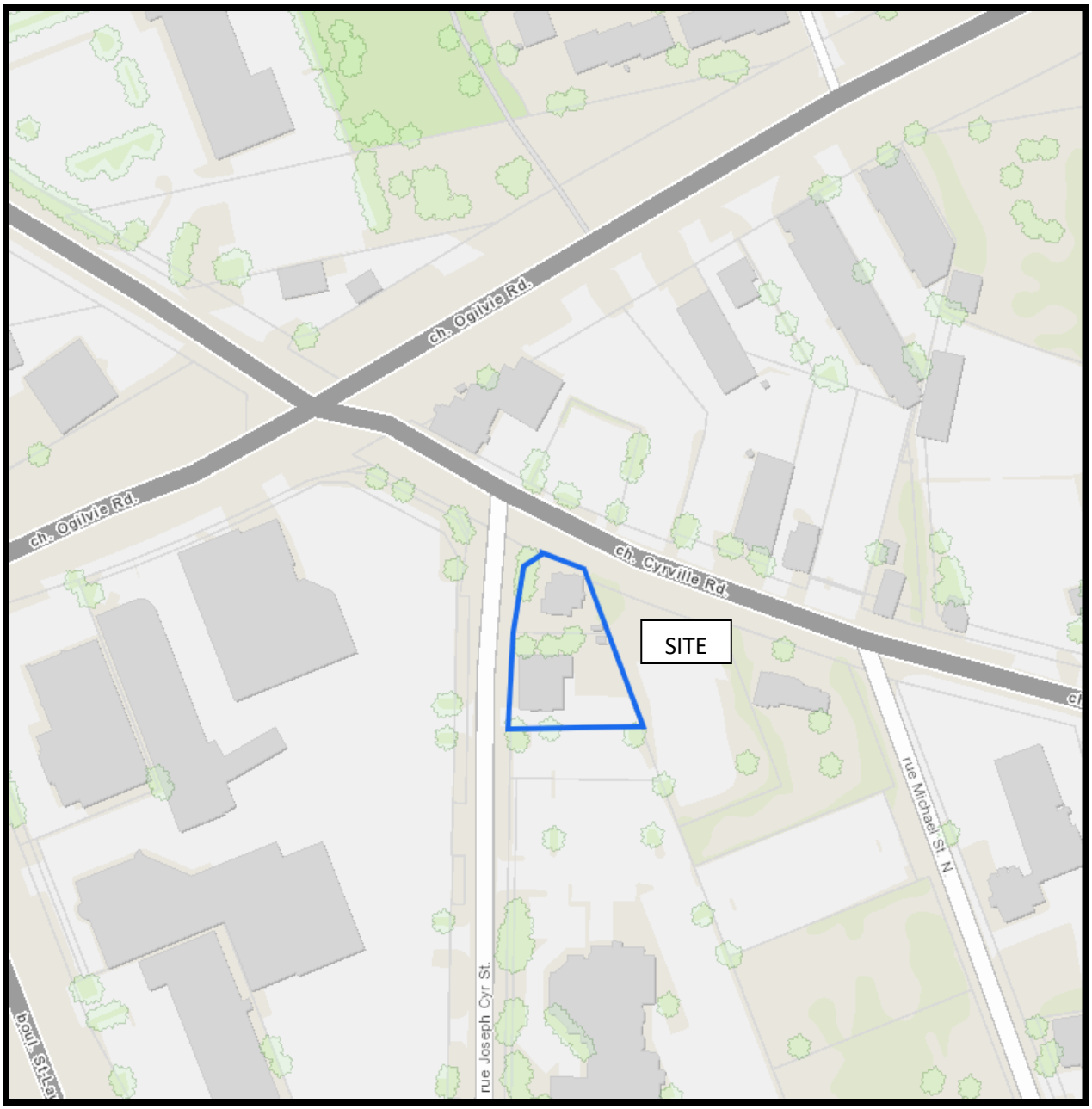
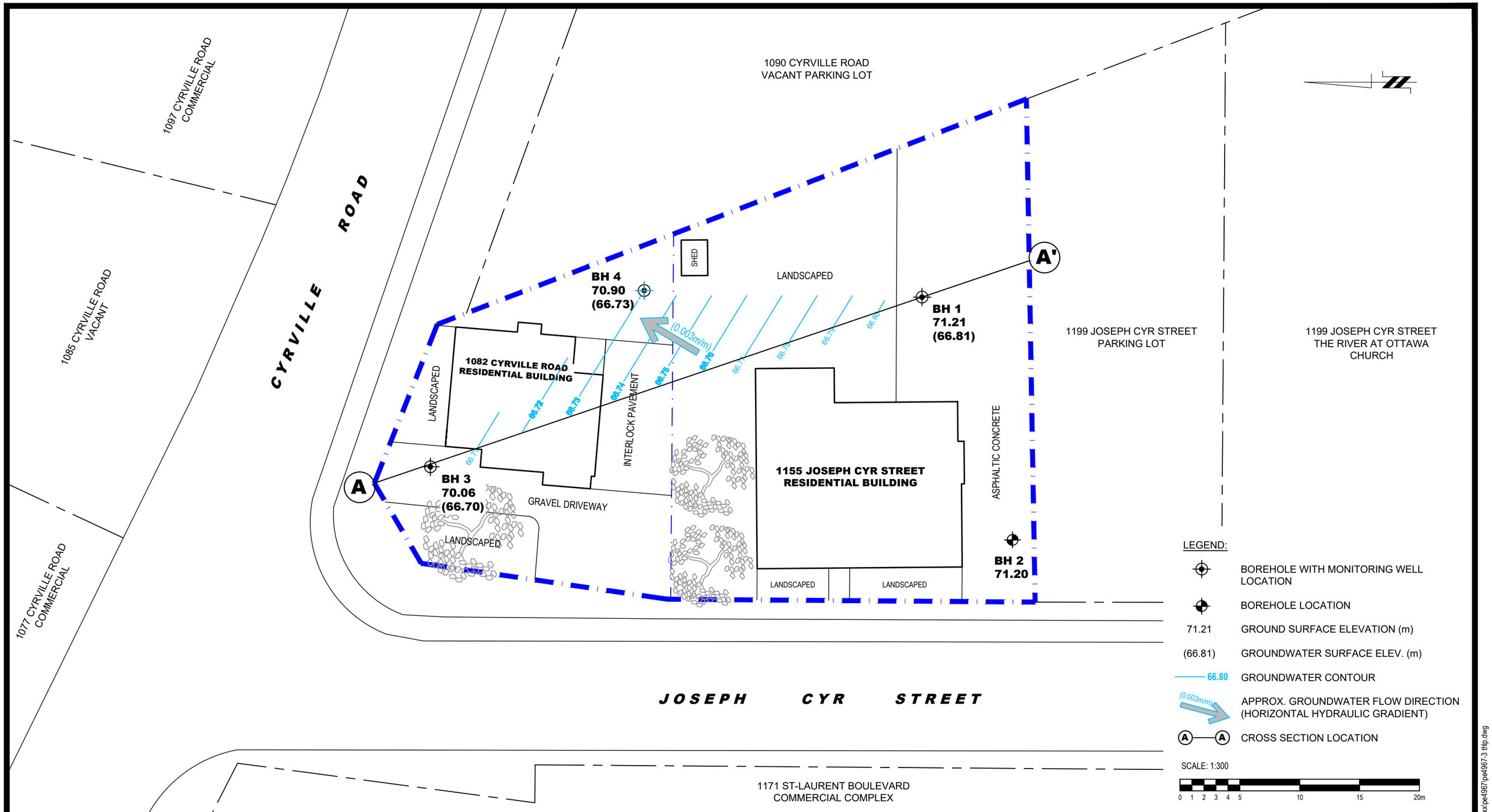


FIGURE 1

KEY PLAN



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NO.	REVISIONS	DATE	INITIAL

TCU DEVELOPMENT CORP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1155 JOSEPH CYR STREET AND 1082 CYRVILLE ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:300	Date: 07/2020
Drawn by: MPG	Report No.: PE4967-2
Checked by: MW	Dwg. No.: PE4967-3
Approved by: MSD	Revision No.:

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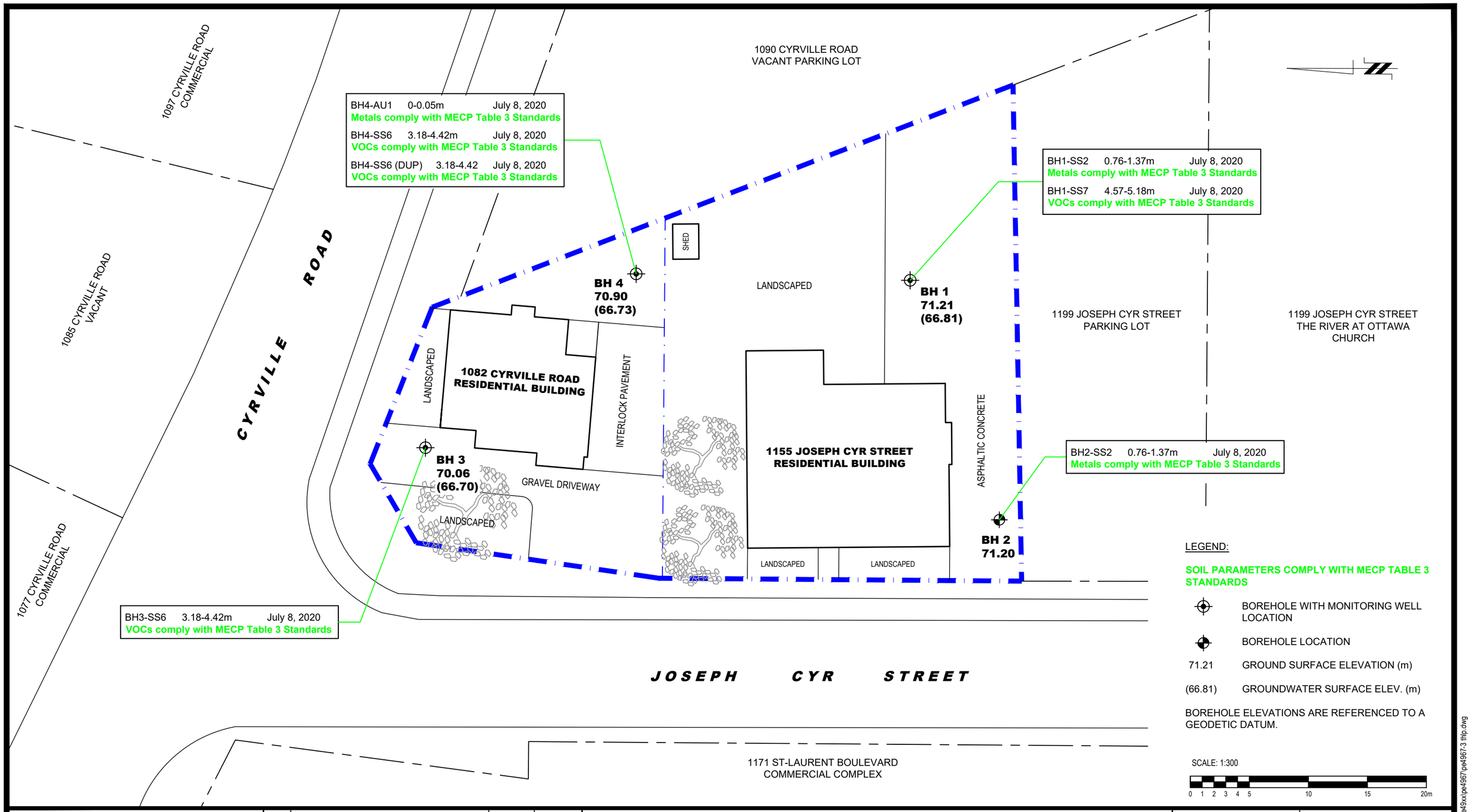

LEGEND:

SOIL PARAMETERS COMPLY WITH MECP TABLE 3 STANDARDS

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- 71.21 GROUND SURFACE ELEVATION (m)
- (66.81) GROUNDWATER SURFACE ELEV. (m)

BOREHOLE ELEVATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:300

0 1 2 3 4 5 10 15 20m

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NO.	REVISIONS	DATE	INITIAL

TCU DEVELOPMENT CORP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1155 JOSEPH CYR STREET AND 1082 CYRVILLE ROAD

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING - SOIL

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Checked by: MW	Dwg. No.: PE4967-4
Approved by: MSD	Revision No.:

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1097 CYRVILLE ROAD
COMMERCIAL

1085 CYRVILLE ROAD
VACANT

1077 CYRVILLE ROAD
COMMERCIAL

CYRVILLE ROAD

1090 CYRVILLE ROAD
VACANT PARKING LOT

BH4-GW1 5.21-6.71m July 15, 2020
VOCs comply with MECP Table 3 Standards

BH1-GW1 5.21-6.71m July 15, 2020
VOCs comply with MECP Table 3 Standards

BH3-GW1 5.21-6.71m July 15, 2020
VOCs comply with MECP Table 3 Standards

SHED

BH 4
70.90
(66.73)

LANDSCAPED

BH 1
71.21
(66.81)

1199 JOSEPH CYR STREET
PARKING LOT

1199 JOSEPH CYR STREET
THE RIVER AT OTTAWA
CHURCH

LANDSCAPED

1082 CYRVILLE ROAD
RESIDENTIAL BUILDING

INTERLOCK PAVEMENT

1155 JOSEPH CYR STREET
RESIDENTIAL BUILDING

ASPHALTIC CONCRETE

BH 3
70.06
(66.70)

GRAVEL DRIVEWAY

LANDSCAPED

BH 2
71.20

LANDSCAPED

LANDSCAPED

JOSEPH CYR STREET

1171 ST-LAURENT BOULEVARD
COMMERCIAL COMPLEX

LEGEND:

GROUNDWATER PARAMETERS COMPLY WITH MECP TABLE 3 STANDARDS

- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- 71.21 GROUND SURFACE ELEVATION (m)
- (66.81) GROUNDWATER SURFACE ELEV. (m)

BOREHOLE ELEVATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:300

0 1 2 3 4 5 10 15 20m

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NO.	REVISIONS	DATE	INITIAL

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1155 JOSEPH CYR STREET AND 1082 CYRVILLE ROAD
OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING - GROUNDWATER

Scale: 1:300	**Date:** 07/2020
Drawn by: MPG	**Report No.:** PE4967-2
Checked by: MW	**Dwg. No.:** PE4967-5
Approved by: MSD	**Revision No.:**

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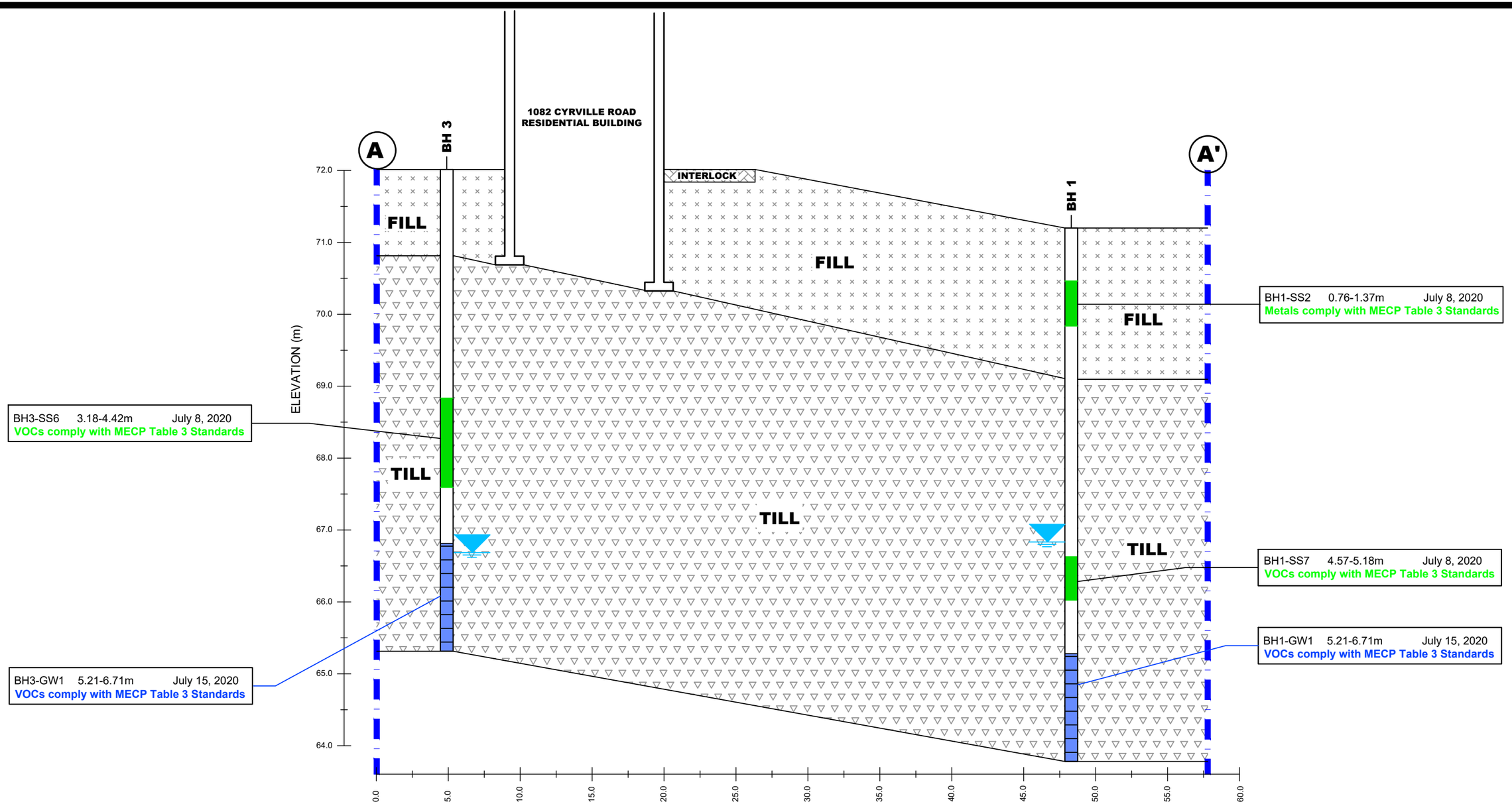

LEGEND:

SOIL RESULTS COMPLY WITH MECP TABLE 3 STANDARDS

GROUNDWATER RESULTS COMPLY WITH MECP TABLE 3 STANDARDS

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NO.	REVISIONS	DATE	INITIAL

TCU DEVELOPMENT CORP

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
1155 JOSEPH CYR STREET AND 1082 CYRVILLE ROAD
OTTAWA, ONTARIO

Title:

CROSS SECTION A-A'

Scale: AS SHOWN	Date: 07/2020
Drawn by: MPG	Report No.: PE4967-2
Checked by: MW	Dwg. No.: PE4967-6
Approved by: MSD	Revision No.:

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APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

patersongroup

Sampling & Analysis Plan

Phase II Environmental Site Assessment
1155 Joseph Cyr Street and 1082 Cyrville Road
Ottawa, Ontario

Prepared For

TCU Development Corporation

July 2020

Report: PE4967-SAP

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Table of Contents

1.0 SAMPLING PROGRAM

Paterson was retained by ZW Project Management acting on behalf of TCU Development Corporation, to conduct a Phase II Environmental Site Assessment (ESA) for the properties addressed 1155 Joseph Cyr Street and 1082 Cyrville Road, in the City of Ottawa, Ontario.

The Phase II ESA was carried out to address the areas of potential environmental concern on the Phase II Property. The following subsurface investigation program was developed. A Geotechnical Investigation was conducted concurrently with the environmental subsurface investigation.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1	Place on the south east corner of the Phase II Property to assess the potential impact due to APECs 1 and 2	Borehole to be advanced to approximately 6 mbgs to install monitoring well.
BH2	Place on the south west corner of the Phase II Property to assess the potential impact due to APEC 1.	Borehole to be advanced to approximately 6 mbgs.
BH3	Place on the north west side of the Phase II Property to assess the potential impact due to APECs 3 and 4.	Borehole to be advanced to approximately 6 mbgs to install monitoring well.
BH4	Place on the north east side of the Phase II Property to assess the potential impact due to APECs 2 and 3.	Borehole to be advanced to approximately 6 mbgs to install monitoring well.

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

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

2.0 ANALYTICAL TESTING PROGRAM

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

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

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

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

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

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

Equipment

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

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

Determining Borehole Locations

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

After drilling is completed a plan with the borehole locations must be provided. Distances should be measured using a measuring tape or wheel rather than paced off. Boreholes were located and surveyed in the field by Paterson. All borehole and test pit locations were measured at geodetic elevations.

Drilling Procedure

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

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

Spoon Washing Procedure

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

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

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

Screening Procedure

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

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

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

3.2 Monitoring Well Installation Procedure

Equipment

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

Procedure

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

3.3 Monitoring Well Sampling Procedure

Equipment

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

Sampling Procedure

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

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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

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

5.0 DATA QUALITY OBJECTIVES

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

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

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

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

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

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

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS TO SAMPLING & ANALYSIS PLAN

Physical impediments to the Sampling and Analysis plan may include:

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

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1155 Joseph Cyr Street and 1082 Cyrville Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE4967

REMARKS

HOLE NO. BH 1

BORINGS BY CME-55 Low Clearance Drill **DATE** July 8, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	71.21
FILL: Brown silty sand with crushed stone		AU	1				
0.51							
FILL: Brown silty sand, some gravel and brick		SS	2	21	12	1	70.21
1.52							
FILL: Brown silty clay, trace gravel		SS	3	75	6	2	69.21
2.13							
		SS	4	54	22		
		SS	5	79	11	3	68.21
GLACIAL TILL: Compact to loose, brown silty sand, some to trace gravel, cobbles and clay		SS	6	33	11	4	67.21
		SS	7	50	10	5	66.21
		SS	8	46	8	6	65.21
		SS	9	38	7		
6.70						7	64.21
Dynamic Cone Penetration Test commenced at 6.70m depth.							
Inferred **GLACIAL TILL** 7.42							
End of Borehole							
Practical DCPT refusal at 7.42m depth.							
(GWL @ 4.40m - July 15, 2020)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1155 Joseph Cyr Street and 1082 Cyrville Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE4967

REMARKS

HOLE NO. BH 2

BORINGS BY CME-55 Low Clearance Drill **DATE** July 8, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
Asphaltic concrete 0.08		AU	1			0	71.20
FILL: Brown silty sand, trace gravel		SS	2	58	27	1	70.20
1.52		SS	3	46	19	2	69.20
		SS	4	54	9		
GLACIAL TILL: Brown silty clay, trace gravel and cobbles		SS	5	62	14	3	68.20
		SS	6	42	9	4	67.20
		SS	7	33	9	5	66.20
5.56		SS	8	67	50+		
End of Borehole							
Practical refusal to augering at 5.56m 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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1155 Joseph Cyr Street and 1082 Cyrville Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE4967

REMARKS

HOLE NO. BH 3

BORINGS BY CME-55 Low Clearance Drill **DATE** July 8, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	70.06
FILL: Brown silty sand, trace gravel (0.46)		AU	1				
FILL: Brown clayey silt to silty clay, trace sand and gravel		SS	2	58	4	1	69.06
		SS	3	67	5	2	68.06
(2.13)		SS	4	79	10		
		SS	5	83	14	3	67.06
GLACIAL TILL: Brown silty sand, trace gravel and cobbles		SS	6	92	15	4	66.06
		SS	7	64	50+	5	65.06
(6.70)						6	64.06
End of Borehole							
(GWL @ 3.36m - July 15, 2020)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
1155 Joseph Cyr Street and 1082 Cyrville Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PE4967

REMARKS

HOLE NO. BH 4

BORINGS BY CME-55 Low Clearance Drill **DATE** July 8, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	70.90
FILL: Brown silty sand, some gravel		AU	1				
0.60							
TOPSOIL							
0.69		SS	2	21	7	1	69.90
		SS	3	50	7	2	68.90
		SS	4	58	22		
GLACIAL TILL: Brown silty clay, trace sand and gravel		SS	5	33	19	3	67.90
		SS	6	54	17	4	66.90
		SS	7	71	43	5	65.90
5.79		SS	8	46	24		
BEDROCK: Weathered shale		SS	9	100	50+	6	64.90
6.70							
End of Borehole							
(GWL @ 4.17m - July 15, 2020)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

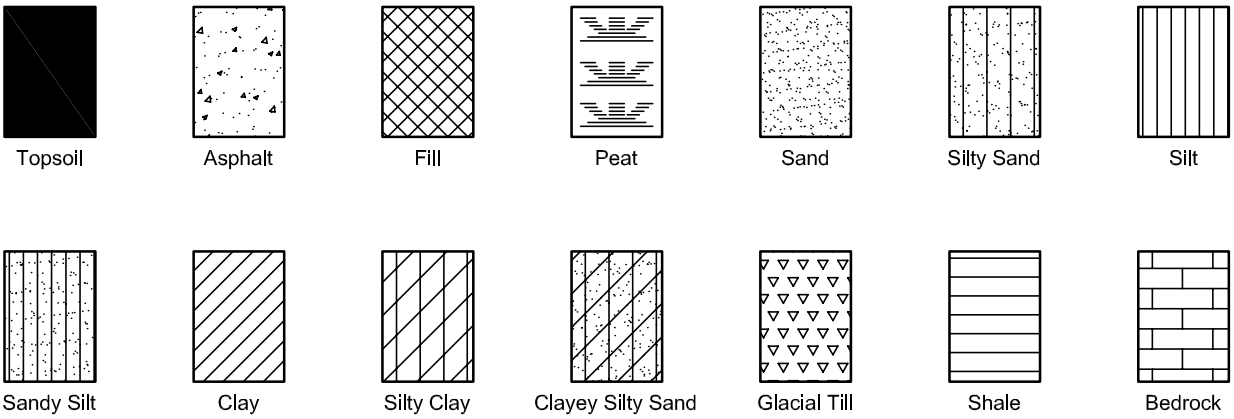
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

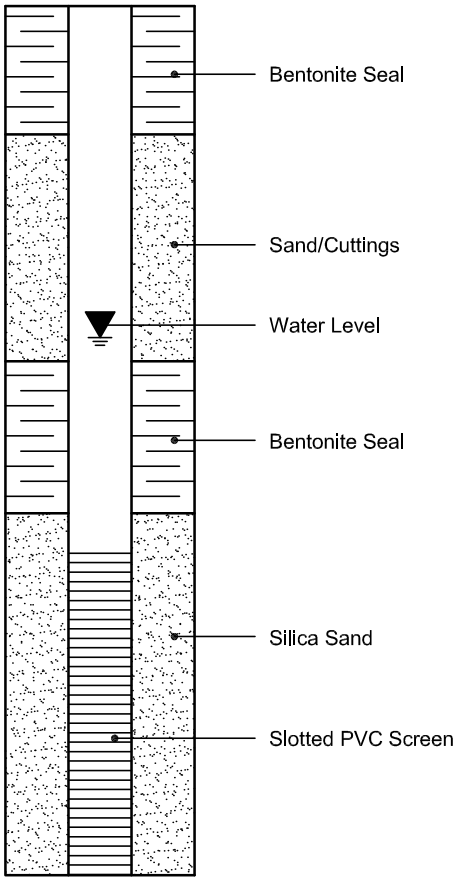
SYMBOLS AND TERMS (continued)

STRATA PLOT

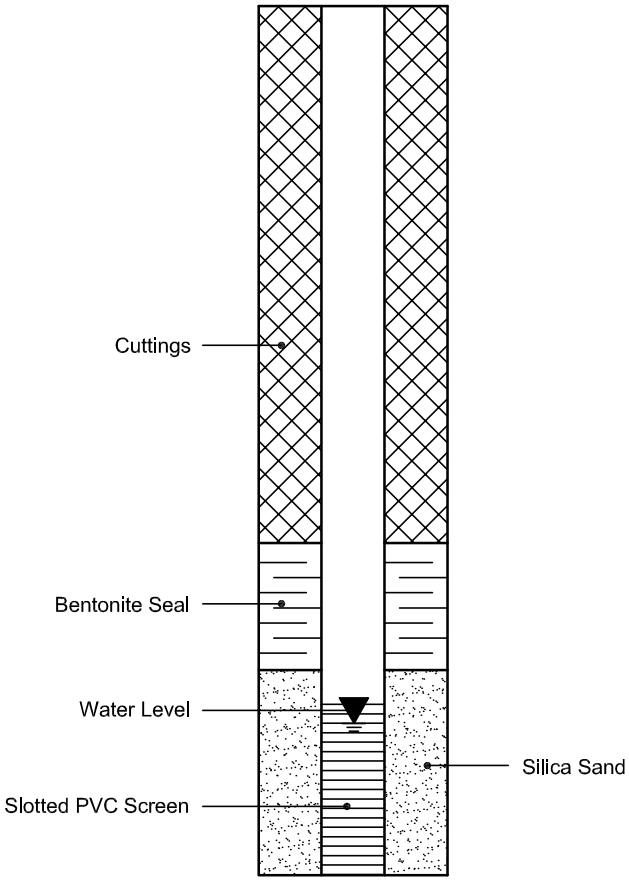


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 30359
Project: PE4967
Custody: 128439

Report Date: 17-Jul-2020
Order Date: 13-Jul-2020

Order #: 2029115

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

Paracel ID	Client ID
2029115-01	BH1-SS2
2029115-02	BH1-SS7
2029115-03	BH2-SS2
2029115-04	BH3-SS6
2029115-05	BH4-AU1
2029115-06	BH4-SS6
2029115-07	Dup

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 17-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 13-Jul-2020

Client PO: 30359

Project Description: PE4967

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	15-Jul-20	15-Jul-20
REG 153: VOCs by P&T GC/MS	EPA 8260 - P&T GC-MS	14-Jul-20	14-Jul-20
Solids, %	Gravimetric, calculation	17-Jul-20	17-Jul-20

Certificate of Analysis

Report Date: 17-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 13-Jul-2020

Client PO: 30359

Project Description: PE4967

	Client ID:	BH1-SS2	BH1-SS7	BH2-SS2	BH3-SS6
	Sample Date:	08-Jul-20 09:00	08-Jul-20 09:00	08-Jul-20 09:00	08-Jul-20 09:00
	Sample ID:	2029115-01	2029115-02	2029115-03	2029115-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	91.9	92.2	81.7	93.8
Metals					
Antimony	1.0 ug/g dry	<1.0	-	<1.0	-
Arsenic	1.0 ug/g dry	2.3	-	3.9	-
Barium	1.0 ug/g dry	53.7	-	89.1	-
Beryllium	0.5 ug/g dry	<0.5	-	<0.5	-
Boron	5.0 ug/g dry	<5.0	-	<5.0	-
Cadmium	0.5 ug/g dry	<0.5	-	<0.5	-
Chromium	5.0 ug/g dry	20.0	-	17.9	-
Cobalt	1.0 ug/g dry	5.1	-	5.2	-
Copper	5.0 ug/g dry	14.4	-	12.3	-
Lead	1.0 ug/g dry	16.6	-	26.6	-
Molybdenum	1.0 ug/g dry	<1.0	-	<1.0	-
Nickel	5.0 ug/g dry	12.3	-	12.8	-
Selenium	1.0 ug/g dry	<1.0	-	<1.0	-
Silver	0.3 ug/g dry	<0.3	-	<0.3	-
Thallium	1.0 ug/g dry	<1.0	-	<1.0	-
Uranium	1.0 ug/g dry	<1.0	-	<1.0	-
Vanadium	10.0 ug/g dry	22.6	-	22.0	-
Zinc	20.0 ug/g dry	43.9	-	55.5	-
Volatiles					
Acetone	0.50 ug/g dry	-	<0.50	-	<0.50
Benzene	0.02 ug/g dry	-	<0.02	-	<0.02
Bromodichloromethane	0.05 ug/g dry	-	<0.05	-	<0.05
Bromoform	0.05 ug/g dry	-	<0.05	-	<0.05
Bromomethane	0.05 ug/g dry	-	<0.05	-	<0.05
Carbon Tetrachloride	0.05 ug/g dry	-	<0.05	-	<0.05
Chlorobenzene	0.05 ug/g dry	-	<0.05	-	<0.05
Chloroform	0.05 ug/g dry	-	<0.05	-	<0.05
Dibromochloromethane	0.05 ug/g dry	-	<0.05	-	<0.05
Dichlorodifluoromethane	0.05 ug/g dry	-	<0.05	-	<0.05
1,2-Dichlorobenzene	0.05 ug/g dry	-	<0.05	-	<0.05
1,3-Dichlorobenzene	0.05 ug/g dry	-	<0.05	-	<0.05
1,4-Dichlorobenzene	0.05 ug/g dry	-	<0.05	-	<0.05
1,1-Dichloroethane	0.05 ug/g dry	-	<0.05	-	<0.05

Certificate of Analysis

Report Date: 17-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 13-Jul-2020

Client PO: 30359

Project Description: PE4967

	Client ID:	BH1-SS2	BH1-SS7	BH2-SS2	BH3-SS6
	Sample Date:	08-Jul-20 09:00	08-Jul-20 09:00	08-Jul-20 09:00	08-Jul-20 09:00
	Sample ID:	2029115-01	2029115-02	2029115-03	2029115-04
	MDL/Units	Soil	Soil	Soil	Soil
1,2-Dichloroethane	0.05 ug/g dry	-	<0.05	-	<0.05
1,1-Dichloroethylene	0.05 ug/g dry	-	<0.05	-	<0.05
cis-1,2-Dichloroethylene	0.05 ug/g dry	-	<0.05	-	<0.05
trans-1,2-Dichloroethylene	0.05 ug/g dry	-	<0.05	-	<0.05
1,2-Dichloropropane	0.05 ug/g dry	-	<0.05	-	<0.05
cis-1,3-Dichloropropylene	0.05 ug/g dry	-	<0.05	-	<0.05
trans-1,3-Dichloropropylene	0.05 ug/g dry	-	<0.05	-	<0.05
1,3-Dichloropropene, total	0.05 ug/g dry	-	<0.05	-	<0.05
Ethylbenzene	0.05 ug/g dry	-	<0.05	-	<0.05
Ethylene dibromide (dibromoethane, 1,2-)	0.05 ug/g dry	-	<0.05	-	<0.05
Hexane	0.05 ug/g dry	-	<0.05	-	<0.05
Methyl Ethyl Ketone (2-Butanone)	0.50 ug/g dry	-	<0.50	-	<0.50
Methyl Isobutyl Ketone	0.50 ug/g dry	-	<0.50	-	<0.50
Methyl tert-butyl ether	0.05 ug/g dry	-	<0.05	-	<0.05
Methylene Chloride	0.05 ug/g dry	-	<0.05	-	<0.05
Styrene	0.05 ug/g dry	-	<0.05	-	<0.05
1,1,1,2-Tetrachloroethane	0.05 ug/g dry	-	<0.05	-	<0.05
1,1,2,2-Tetrachloroethane	0.05 ug/g dry	-	<0.05	-	<0.05
Tetrachloroethylene	0.05 ug/g dry	-	<0.05	-	<0.05
Toluene	0.05 ug/g dry	-	<0.05	-	<0.05
1,1,1-Trichloroethane	0.05 ug/g dry	-	<0.05	-	<0.05
1,1,2-Trichloroethane	0.05 ug/g dry	-	<0.05	-	<0.05
Trichloroethylene	0.05 ug/g dry	-	<0.05	-	<0.05
Trichlorofluoromethane	0.05 ug/g dry	-	<0.05	-	<0.05
Vinyl chloride	0.02 ug/g dry	-	<0.02	-	<0.02
m,p-Xylenes	0.05 ug/g dry	-	<0.05	-	<0.05
o-Xylene	0.05 ug/g dry	-	<0.05	-	<0.05
Xylenes, total	0.05 ug/g dry	-	<0.05	-	<0.05
4-Bromofluorobenzene	Surrogate	-	101%	-	108%
Dibromofluoromethane	Surrogate	-	69.3%	-	64.8%
Toluene-d8	Surrogate	-	111%	-	108%

Certificate of Analysis

Report Date: 17-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 13-Jul-2020

Client PO: 30359

Project Description: PE4967

	Client ID:	BH4-AU1	BH4-SS6	Dup	-
	Sample Date:	08-Jul-20 09:00	08-Jul-20 09:00	08-Jul-20 09:00	-
	Sample ID:	2029115-05	2029115-06	2029115-07	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	91.4	91.8	93.1	-
Metals					
Antimony	1.0 ug/g dry	<1.0	-	-	-
Arsenic	1.0 ug/g dry	4.1	-	-	-
Barium	1.0 ug/g dry	107	-	-	-
Beryllium	0.5 ug/g dry	<0.5	-	-	-
Boron	5.0 ug/g dry	<5.0	-	-	-
Cadmium	0.5 ug/g dry	<0.5	-	-	-
Chromium	5.0 ug/g dry	19.7	-	-	-
Cobalt	1.0 ug/g dry	5.4	-	-	-
Copper	5.0 ug/g dry	17.0	-	-	-
Lead	1.0 ug/g dry	80.3	-	-	-
Molybdenum	1.0 ug/g dry	1.0	-	-	-
Nickel	5.0 ug/g dry	16.4	-	-	-
Selenium	1.0 ug/g dry	<1.0	-	-	-
Silver	0.3 ug/g dry	<0.3	-	-	-
Thallium	1.0 ug/g dry	<1.0	-	-	-
Uranium	1.0 ug/g dry	<1.0	-	-	-
Vanadium	10.0 ug/g dry	22.0	-	-	-
Zinc	20.0 ug/g dry	79.8	-	-	-
Volatiles					
Acetone	0.50 ug/g dry	-	<0.50	<0.50	-
Benzene	0.02 ug/g dry	-	<0.02	<0.02	-
Bromodichloromethane	0.05 ug/g dry	-	<0.05	<0.05	-
Bromoform	0.05 ug/g dry	-	<0.05	<0.05	-
Bromomethane	0.05 ug/g dry	-	<0.05	<0.05	-
Carbon Tetrachloride	0.05 ug/g dry	-	<0.05	<0.05	-
Chlorobenzene	0.05 ug/g dry	-	<0.05	<0.05	-
Chloroform	0.05 ug/g dry	-	<0.05	<0.05	-
Dibromochloromethane	0.05 ug/g dry	-	<0.05	<0.05	-
Dichlorodifluoromethane	0.05 ug/g dry	-	<0.05	<0.05	-
1,2-Dichlorobenzene	0.05 ug/g dry	-	<0.05	<0.05	-
1,3-Dichlorobenzene	0.05 ug/g dry	-	<0.05	<0.05	-
1,4-Dichlorobenzene	0.05 ug/g dry	-	<0.05	<0.05	-
1,1-Dichloroethane	0.05 ug/g dry	-	<0.05	<0.05	-

Certificate of Analysis

Report Date: 17-Jul-2020

Client: **Paterson Group Consulting Engineers**

Order Date: 13-Jul-2020

Client PO: **30359**

Project Description: PE4967

	Client ID:	BH4-AU1	BH4-SS6	Dup	-
	Sample Date:	08-Jul-20 09:00	08-Jul-20 09:00	08-Jul-20 09:00	-
	Sample ID:	2029115-05	2029115-06	2029115-07	-
	MDL/Units	Soil	Soil	Soil	-
1,2-Dichloroethane	0.05 ug/g dry	-	<0.05	<0.05	-
1,1-Dichloroethylene	0.05 ug/g dry	-	<0.05	<0.05	-
cis-1,2-Dichloroethylene	0.05 ug/g dry	-	<0.05	<0.05	-
trans-1,2-Dichloroethylene	0.05 ug/g dry	-	<0.05	<0.05	-
1,2-Dichloropropane	0.05 ug/g dry	-	<0.05	<0.05	-
cis-1,3-Dichloropropylene	0.05 ug/g dry	-	<0.05	<0.05	-
trans-1,3-Dichloropropylene	0.05 ug/g dry	-	<0.05	<0.05	-
1,3-Dichloropropene, total	0.05 ug/g dry	-	<0.05	<0.05	-
Ethylbenzene	0.05 ug/g dry	-	<0.05	<0.05	-
Ethylene dibromide (dibromoethane, 1	0.05 ug/g dry	-	<0.05	<0.05	-
Hexane	0.05 ug/g dry	-	<0.05	<0.05	-
Methyl Ethyl Ketone (2-Butanone)	0.50 ug/g dry	-	<0.50	<0.50	-
Methyl Isobutyl Ketone	0.50 ug/g dry	-	<0.50	<0.50	-
Methyl tert-butyl ether	0.05 ug/g dry	-	<0.05	<0.05	-
Methylene Chloride	0.05 ug/g dry	-	<0.05	<0.05	-
Styrene	0.05 ug/g dry	-	<0.05	<0.05	-
1,1,1,2-Tetrachloroethane	0.05 ug/g dry	-	<0.05	<0.05	-
1,1,2,2-Tetrachloroethane	0.05 ug/g dry	-	<0.05	<0.05	-
Tetrachloroethylene	0.05 ug/g dry	-	<0.05	<0.05	-
Toluene	0.05 ug/g dry	-	<0.05	<0.05	-
1,1,1-Trichloroethane	0.05 ug/g dry	-	<0.05	<0.05	-
1,1,2-Trichloroethane	0.05 ug/g dry	-	<0.05	<0.05	-
Trichloroethylene	0.05 ug/g dry	-	<0.05	<0.05	-
Trichlorofluoromethane	0.05 ug/g dry	-	<0.05	<0.05	-
Vinyl chloride	0.02 ug/g dry	-	<0.02	<0.02	-
m,p-Xylenes	0.05 ug/g dry	-	<0.05	<0.05	-
o-Xylene	0.05 ug/g dry	-	<0.05	<0.05	-
Xylenes, total	0.05 ug/g dry	-	<0.05	<0.05	-
4-Bromofluorobenzene	Surrogate	-	103%	102%	-
Dibromofluoromethane	Surrogate	-	58.3%	63.0%	-
Toluene-d8	Surrogate	-	109%	108%	-

Certificate of Analysis

Report Date: 17-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 13-Jul-2020

Client PO: 30359

Project Description: PE4967

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
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						
Volatiles									
Acetone	ND	0.50	ug/g						
Benzene	ND	0.02	ug/g						
Bromodichloromethane	ND	0.05	ug/g						
Bromoform	ND	0.05	ug/g						
Bromomethane	ND	0.05	ug/g						
Carbon Tetrachloride	ND	0.05	ug/g						
Chlorobenzene	ND	0.05	ug/g						
Chloroform	ND	0.05	ug/g						
Dibromochloromethane	ND	0.05	ug/g						
Dichlorodifluoromethane	ND	0.05	ug/g						
1,2-Dichlorobenzene	ND	0.05	ug/g						
1,3-Dichlorobenzene	ND	0.05	ug/g						
1,4-Dichlorobenzene	ND	0.05	ug/g						
1,1-Dichloroethane	ND	0.05	ug/g						
1,2-Dichloroethane	ND	0.05	ug/g						
1,1-Dichloroethylene	ND	0.05	ug/g						
cis-1,2-Dichloroethylene	ND	0.05	ug/g						
trans-1,2-Dichloroethylene	ND	0.05	ug/g						
1,2-Dichloropropane	ND	0.05	ug/g						
cis-1,3-Dichloropropylene	ND	0.05	ug/g						
trans-1,3-Dichloropropylene	ND	0.05	ug/g						
1,3-Dichloropropene, total	ND	0.05	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Ethylene dibromide (dibromoethane, 1,2	ND	0.05	ug/g						
Hexane	ND	0.05	ug/g						
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g						
Methyl Isobutyl Ketone	ND	0.50	ug/g						
Methyl tert-butyl ether	ND	0.05	ug/g						
Methylene Chloride	ND	0.05	ug/g						
Styrene	ND	0.05	ug/g						
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g						
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g						
Tetrachloroethylene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
1,1,1-Trichloroethane	ND	0.05	ug/g						
1,1,2-Trichloroethane	ND	0.05	ug/g						
Trichloroethylene	ND	0.05	ug/g						
Trichlorofluoromethane	ND	0.05	ug/g						
Vinyl chloride	ND	0.02	ug/g						
m,p-Xylenes	ND	0.05	ug/g						

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: 4-Bromofluorobenzene	*3.41*		*ug/g*		*106*	*50-140*			
Surrogate: Dibromofluoromethane	*2.13*		*ug/g*		*66.5*	*50-140*			
Surrogate: Toluene-d8	*3.73*		*ug/g*		*117*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	ND	1.0	ug/g dry	ND			NC	30	
Arsenic	2.2	1.0	ug/g dry	2.0			6.8	30	
Barium	12.2	1.0	ug/g dry	10.5			14.9	30	
Beryllium	ND	0.5	ug/g dry	ND			NC	30	
Boron	ND	5.0	ug/g dry	ND			NC	30	
Cadmium	ND	0.5	ug/g dry	ND			NC	30	
Chromium	10.7	5.0	ug/g dry	8.1			28.0	30	
Cobalt	2.8	1.0	ug/g dry	2.2			22.3	30	
Copper	ND	5.0	ug/g dry	ND			NC	30	
Lead	3.7	1.0	ug/g dry	3.5			5.8	30	
Molybdenum	ND	1.0	ug/g dry	ND			NC	30	
Nickel	5.3	5.0	ug/g dry	ND			NC	30	
Selenium	ND	1.0	ug/g dry	ND			NC	30	
Silver	ND	0.3	ug/g dry	ND			NC	30	
Thallium	ND	1.0	ug/g dry	ND			NC	30	
Uranium	ND	1.0	ug/g dry	ND			NC	30	
Vanadium	27.8	10.0	ug/g dry	16.0			NC	30	
Zinc	ND	20.0	ug/g dry	ND			NC	30	
Physical Characteristics									
% Solids	88.1	0.1	% by Wt.	91.9			4.2	25	
Volatiles									
Acetone	ND	0.50	ug/g dry	ND			NC	50	
Benzene	ND	0.02	ug/g dry	ND			NC	50	
Bromodichloromethane	ND	0.05	ug/g dry	ND			NC	50	
Bromoform	ND	0.05	ug/g dry	ND			NC	50	
Bromomethane	ND	0.05	ug/g dry	ND			NC	50	
Carbon Tetrachloride	ND	0.05	ug/g dry	ND			NC	50	
Chlorobenzene	ND	0.05	ug/g dry	ND			NC	50	
Chloroform	ND	0.05	ug/g dry	ND			NC	50	
Dibromochloromethane	ND	0.05	ug/g dry	ND			NC	50	
Dichlorodifluoromethane	ND	0.05	ug/g dry	ND			NC	50	
1,2-Dichlorobenzene	ND	0.05	ug/g dry	ND			NC	50	
1,3-Dichlorobenzene	ND	0.05	ug/g dry	ND			NC	50	
1,4-Dichlorobenzene	ND	0.05	ug/g dry	ND			NC	50	
1,1-Dichloroethane	ND	0.05	ug/g dry	ND			NC	50	
1,2-Dichloroethane	ND	0.05	ug/g dry	ND			NC	50	
1,1-Dichloroethylene	ND	0.05	ug/g dry	ND			NC	50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND			NC	50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND			NC	50	
1,2-Dichloropropane	ND	0.05	ug/g dry	ND			NC	50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND			NC	50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g dry	ND			NC	50	
Ethylene dibromide (dibromoethane, 1,2	ND	0.05	ug/g dry	ND			NC	50	
Hexane	ND	0.05	ug/g dry	ND			NC	50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g dry	ND			NC	50	
Methyl Isobutyl Ketone	ND	0.50	ug/g dry	ND			NC	50	
Methyl tert-butyl ether	ND	0.05	ug/g dry	ND			NC	50	
Methylene Chloride	ND	0.05	ug/g dry	ND			NC	50	
Styrene	ND	0.05	ug/g dry	ND			NC	50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g dry	ND			NC	50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g dry	ND			NC	50	
Tetrachloroethylene	ND	0.05	ug/g dry	ND			NC	50	
Toluene	ND	0.05	ug/g dry	ND			NC	50	
1,1,1-Trichloroethane	ND	0.05	ug/g dry	ND			NC	50	
1,1,2-Trichloroethane	ND	0.05	ug/g dry	ND			NC	50	
Trichloroethylene	ND	0.05	ug/g dry	ND			NC	50	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Trichlorofluoromethane	ND	0.05	ug/g dry	ND			NC	50	
Vinyl chloride	ND	0.02	ug/g dry	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g dry	ND			NC	50	
o-Xylene	ND	0.05	ug/g dry	ND			NC	50	
Surrogate: 4-Bromofluorobenzene	*3.63*		*ug/g dry*		*105*	*50-140*			
Surrogate: Dibromofluoromethane	*2.04*		*ug/g dry*		*58.8*	*50-140*			
Surrogate: Toluene-d8	*3.78*		*ug/g dry*		*109*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	41.1	1.0	ug/g	ND	81.4	70-130			
Arsenic	48.3	1.0	ug/g	ND	95.0	70-130			
Barium	49.2	1.0	ug/g	4.2	90.0	70-130			
Beryllium	48.7	0.5	ug/g	ND	97.1	70-130			
Boron	43.8	5.0	ug/g	ND	86.7	70-130			
Cadmium	44.3	0.5	ug/g	ND	88.6	70-130			
Chromium	50.6	5.0	ug/g	ND	94.8	70-130			
Cobalt	47.9	1.0	ug/g	ND	94.0	70-130			
Copper	47.5	5.0	ug/g	ND	91.8	70-130			
Lead	47.3	1.0	ug/g	1.4	91.9	70-130			
Molybdenum	46.3	1.0	ug/g	ND	92.4	70-130			
Nickel	47.7	5.0	ug/g	ND	91.8	70-130			
Selenium	46.8	1.0	ug/g	ND	93.5	70-130			
Silver	46.7	0.3	ug/g	ND	93.2	70-130			
Thallium	46.8	1.0	ug/g	ND	93.5	70-130			
Uranium	48.0	1.0	ug/g	ND	95.8	70-130			
Vanadium	58.2	10.0	ug/g	ND	104	70-130			
Zinc	48.4	20.0	ug/g	ND	89.1	70-130			
Volatiles									
Acetone	6.17	0.50	ug/g	ND	61.7	50-140			
Benzene	2.56	0.02	ug/g	ND	64.0	60-130			
Bromodichloromethane	2.54	0.05	ug/g	ND	63.6	60-130			
Bromoform	3.61	0.05	ug/g	ND	90.2	60-130			
Bromomethane	2.47	0.05	ug/g	ND	61.7	50-140			
Carbon Tetrachloride	2.52	0.05	ug/g	ND	63.1	60-130			
Chlorobenzene	3.37	0.05	ug/g	ND	84.2	60-130			
Chloroform	2.58	0.05	ug/g	ND	64.5	60-130			
Dibromochloromethane	3.44	0.05	ug/g	ND	86.0	60-130			
Dichlorodifluoromethane	2.76	0.05	ug/g	ND	69.1	50-140			
1,2-Dichlorobenzene	3.09	0.05	ug/g	ND	77.2	60-130			
1,3-Dichlorobenzene	2.90	0.05	ug/g	ND	72.5	60-130			
1,4-Dichlorobenzene	3.07	0.05	ug/g	ND	76.8	60-130			
1,1-Dichloroethane	2.95	0.05	ug/g	ND	73.8	60-130			
1,2-Dichloroethane	2.96	0.05	ug/g	ND	74.0	60-130			
1,1-Dichloroethylene	2.58	0.05	ug/g	ND	64.5	60-130			
cis-1,2-Dichloroethylene	2.52	0.05	ug/g	ND	63.1	60-130			
trans-1,2-Dichloroethylene	2.57	0.05	ug/g	ND	64.3	60-130			
1,2-Dichloropropane	2.45	0.05	ug/g	ND	61.2	60-130			
cis-1,3-Dichloropropylene	3.82	0.05	ug/g	ND	95.5	60-130			
trans-1,3-Dichloropropylene	2.42	0.05	ug/g	ND	60.5	60-130			
Ethylbenzene	3.38	0.05	ug/g	ND	84.4	60-130			
Ethylene dibromide (dibromoethane, 1,2	3.57	0.05	ug/g	ND	89.3	60-130			
Hexane	2.60	0.05	ug/g	ND	65.0	60-130			
Methyl Ethyl Ketone (2-Butanone)	10.8	0.50	ug/g	ND	108	50-140			
Methyl Isobutyl Ketone	6.63	0.50	ug/g	ND	66.3	50-140			
Methyl tert-butyl ether	6.44	0.05	ug/g	ND	64.4	50-140			
Methylene Chloride	2.49	0.05	ug/g	ND	62.3	60-130			
Styrene	3.05	0.05	ug/g	ND	76.3	60-130			

Certificate of Analysis

Report Date: 17-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 13-Jul-2020

Client PO: 30359

Project Description: PE4967

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1,1,1,2-Tetrachloroethane	3.38	0.05	ug/g	ND	84.4	60-130			
1,1,2,2-Tetrachloroethane	3.75	0.05	ug/g	ND	93.6	60-130			
Tetrachloroethylene	3.35	0.05	ug/g	ND	83.8	60-130			
Toluene	3.38	0.05	ug/g	ND	84.5	60-130			
1,1,1-Trichloroethane	2.56	0.05	ug/g	ND	64.1	60-130			
1,1,2-Trichloroethane	2.71	0.05	ug/g	ND	67.8	60-130			
Trichloroethylene	2.52	0.05	ug/g	ND	62.9	60-130			
Trichlorofluoromethane	2.67	0.05	ug/g	ND	66.7	50-140			
Vinyl chloride	2.56	0.02	ug/g	ND	64.0	50-140			
m,p-Xylenes	6.79	0.05	ug/g	ND	84.8	60-130			
o-Xylene	3.57	0.05	ug/g	ND	89.3	60-130			
Surrogate: 4-Bromofluorobenzene	*2.69*		*ug/g*		*84.0*	*50-140*			
Surrogate: Dibromofluoromethane	*3.37*		*ug/g*		*105*	*50-140*			
Surrogate: Toluene-d8	*2.97*		*ug/g*		*92.9*	*50-140*			

Qualifier Notes:

QC Qualifiers :

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

PARACEL LABORATORIES L

Paracel ID: 2029115

Blvd.
4J8
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Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2029115	Nº 128439

Client Name: Paterson Group	Project Ref: PE4967	Page 1 of 1
Contact Name: Mark D'Arcy	Quote #:	Turnaround Time
Address: 154 Colonnade Road South	PO #: 30359	☐ 1 day ☐ 3 day ☐ 2 day ☒ Regular
Telephone: 613-226-7381	E-mail: mdarcy@patersongroup.ca	Date Required:

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

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

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

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)
1	BH1-SS2	S		1	July 8.2020					X			
2	BH1-SS7			2				X					
3	BH2-SS2			1						X			
4	BH3-SS6			2				X					
5	BH4-AU1			1						X			
6	BH4-SS6			2				X					
7	DUP			2				X					
8													
9													
10													

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received By Driver/Depot: T. Fourie	Received at Lab: Sunreepam Dokmai	Verified By:
Relinquished By (Print): Mark St Pierre	Date/Time: 13/07/20 4:00	Date/Time: Jul 13, 2020 04.30	Date/Time: 14 July 2020
Date/Time: July.13.2020	Temperature: °C	Temperature: 18.5 °C	pH Verified: ☐ By:

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 30367
Project: PE4967
Custody: 52371

Report Date: 16-Jul-2020
Order Date: 15-Jul-2020

Order #: 2029306

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

Paracel ID	Client ID
2029306-01	BH1-GW1
2029306-02	BH3-GW1
2029306-03	BH4-GW1
2029306-04	Dup

Approved By:

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 16-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 15-Jul-2020

Client PO: 30367

Project Description: PE4967

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
REG 153: VOCs by P&T GC/MS	EPA 624 - P&T GC-MS	15-Jul-20	15-Jul-20

Certificate of Analysis

Report Date: 16-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 15-Jul-2020

Client PO: 30367

Project Description: PE4967

	Client ID:	BH1-GW1	BH3-GW1	BH4-GW1	Dup
	Sample Date:	15-Jul-20 11:00	15-Jul-20 11:00	15-Jul-20 11:00	15-Jul-20 11:00
	Sample ID:	2029306-01	2029306-02	2029306-03	2029306-04
	MDL/Units	Water	Water	Water	Water
Volatiles					
Acetone	5.0 ug/L	<5.0	<5.0	<5.0 [1]	<5.0
Benzene	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
Bromodichloromethane	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
Bromoform	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
Bromomethane	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
Carbon Tetrachloride	0.2 ug/L	<0.2	<0.2	<0.2 [1]	<0.2
Chlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
Chloroform	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
Dibromochloromethane	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
Dichlorodifluoromethane	1.0 ug/L	<1.0	<1.0	<1.0 [1]	<1.0
1,2-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
1,3-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
1,4-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
1,1-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
1,2-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
1,1-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
1,2-Dichloropropane	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
1,3-Dichloropropene, total	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
Ethylbenzene	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
Ethylene dibromide (dibromoethane, 1,2-)	0.2 ug/L	<0.2	<0.2	<0.2 [1]	<0.2
Hexane	1.0 ug/L	<1.0	<1.0	<1.0 [1]	<1.0
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	<5.0	<5.0 [1]	<5.0
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	<5.0	<5.0 [1]	<5.0
Methyl tert-butyl ether	2.0 ug/L	<2.0	<2.0	<2.0 [1]	<2.0
Methylene Chloride	5.0 ug/L	<5.0	<5.0	<5.0 [1]	<5.0
Styrene	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
Tetrachloroethylene	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
Toluene	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
1,1,1-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5

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Project Description: PE4967

	Client ID:	BH1-GW1	BH3-GW1	BH4-GW1	Dup
	Sample Date:	15-Jul-20 11:00	15-Jul-20 11:00	15-Jul-20 11:00	15-Jul-20 11:00
	Sample ID:	2029306-01	2029306-02	2029306-03	2029306-04
	MDL/Units	Water	Water	Water	Water
1,1,2-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
Trichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
Trichlorofluoromethane	1.0 ug/L	<1.0	<1.0	<1.0 [1]	<1.0
Vinyl chloride	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
o-Xylene	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
Xylenes, total	0.5 ug/L	<0.5	<0.5	<0.5 [1]	<0.5
4-Bromofluorobenzene	Surrogate	101%	104%	105% [1]	104%
Dibromofluoromethane	Surrogate	114%	115%	114% [1]	117%
Toluene-d8	Surrogate	96.8%	97.6%	96.6% [1]	97.3%

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Project Description: PE4967

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Volatiles									
Acetone	ND	5.0	ug/L						
Benzene	ND	0.5	ug/L						
Bromodichloromethane	ND	0.5	ug/L						
Bromoform	ND	0.5	ug/L						
Bromomethane	ND	0.5	ug/L						
Carbon Tetrachloride	ND	0.2	ug/L						
Chlorobenzene	ND	0.5	ug/L						
Chloroform	ND	0.5	ug/L						
Dibromochloromethane	ND	0.5	ug/L						
Dichlorodifluoromethane	ND	1.0	ug/L						
1,2-Dichlorobenzene	ND	0.5	ug/L						
1,3-Dichlorobenzene	ND	0.5	ug/L						
1,4-Dichlorobenzene	ND	0.5	ug/L						
1,1-Dichloroethane	ND	0.5	ug/L						
1,2-Dichloroethane	ND	0.5	ug/L						
1,1-Dichloroethylene	ND	0.5	ug/L						
cis-1,2-Dichloroethylene	ND	0.5	ug/L						
trans-1,2-Dichloroethylene	ND	0.5	ug/L						
1,2-Dichloropropane	ND	0.5	ug/L						
cis-1,3-Dichloropropylene	ND	0.5	ug/L						
trans-1,3-Dichloropropylene	ND	0.5	ug/L						
1,3-Dichloropropene, total	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Ethylene dibromide (dibromoethane, 1,2	ND	0.2	ug/L						
Hexane	ND	1.0	ug/L						
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L						
Methyl Isobutyl Ketone	ND	5.0	ug/L						
Methyl tert-butyl ether	ND	2.0	ug/L						
Methylene Chloride	ND	5.0	ug/L						
Styrene	ND	0.5	ug/L						
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L						
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L						
Tetrachloroethylene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
1,1,1-Trichloroethane	ND	0.5	ug/L						
1,1,2-Trichloroethane	ND	0.5	ug/L						
Trichloroethylene	ND	0.5	ug/L						
Trichlorofluoromethane	ND	1.0	ug/L						
Vinyl chloride	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: 4-Bromofluorobenzene	*83.1*		*ug/L*		*104*	*50-140*			
Surrogate: Dibromofluoromethane	*89.1*		*ug/L*		*111*	*50-140*			
Surrogate: Toluene-d8	*77.8*		*ug/L*		*97.2*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Volatiles									
Acetone	ND	5.0	ug/L	ND			NC	30	
Benzene	ND	0.5	ug/L	ND			NC	30	
Bromodichloromethane	ND	0.5	ug/L	4.72			NC	30	
Bromoform	ND	0.5	ug/L	ND			NC	30	
Bromomethane	ND	0.5	ug/L	ND			NC	30	
Carbon Tetrachloride	ND	0.2	ug/L	ND			NC	30	
Chlorobenzene	ND	0.5	ug/L	ND			NC	30	
Chloroform	1.87	0.5	ug/L	10.2			138.0	30	QR-07
Dibromochloromethane	ND	0.5	ug/L	ND			NC	30	
Dichlorodifluoromethane	ND	1.0	ug/L	ND			NC	30	
1,2-Dichlorobenzene	ND	0.5	ug/L	ND			NC	30	
1,3-Dichlorobenzene	ND	0.5	ug/L	ND			NC	30	
1,4-Dichlorobenzene	ND	0.5	ug/L	ND			NC	30	
1,1-Dichloroethane	ND	0.5	ug/L	ND			NC	30	
1,2-Dichloroethane	ND	0.5	ug/L	ND			NC	30	
1,1-Dichloroethylene	ND	0.5	ug/L	ND			NC	30	
cis-1,2-Dichloroethylene	ND	0.5	ug/L	ND			NC	30	
trans-1,2-Dichloroethylene	ND	0.5	ug/L	ND			NC	30	
1,2-Dichloropropane	ND	0.5	ug/L	ND			NC	30	
cis-1,3-Dichloropropylene	ND	0.5	ug/L	ND			NC	30	
trans-1,3-Dichloropropylene	ND	0.5	ug/L	ND			NC	30	
Ethylbenzene	ND	0.5	ug/L	ND			NC	30	
Ethylene dibromide (dibromoethane, 1,2	ND	0.2	ug/L	ND			NC	30	
Hexane	ND	1.0	ug/L	ND			NC	30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND			NC	30	
Methyl Isobutyl Ketone	ND	5.0	ug/L	ND			NC	30	
Methyl tert-butyl ether	ND	2.0	ug/L	ND			NC	30	
Methylene Chloride	ND	5.0	ug/L	ND			NC	30	
Styrene	ND	0.5	ug/L	ND			NC	30	
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L	ND			NC	30	
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L	ND			NC	30	
Tetrachloroethylene	ND	0.5	ug/L	ND			NC	30	
Toluene	ND	0.5	ug/L	ND			NC	30	
1,1,1-Trichloroethane	ND	0.5	ug/L	ND			NC	30	
1,1,2-Trichloroethane	ND	0.5	ug/L	ND			NC	30	
Trichloroethylene	ND	0.5	ug/L	ND			NC	30	
Trichlorofluoromethane	ND	1.0	ug/L	ND			NC	30	
Vinyl chloride	ND	0.5	ug/L	ND			NC	30	
m,p-Xylenes	ND	0.5	ug/L	ND			NC	30	
o-Xylene	ND	0.5	ug/L	ND			NC	30	
Surrogate: 4-Bromofluorobenzene	*82.3*		*ug/L*		*103*	*50-140*			
Surrogate: Dibromofluoromethane	*94.9*		*ug/L*		*119*	*50-140*			
Surrogate: Toluene-d8	*77.6*		*ug/L*		*97.0*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Volatiles									
Acetone	83.4	5.0	ug/L	ND	83.4	50-140			
Benzene	42.6	0.5	ug/L	ND	106	60-130			
Bromodichloromethane	37.6	0.5	ug/L	ND	94.1	60-130			
Bromoform	48.4	0.5	ug/L	ND	121	60-130			
Bromomethane	35.4	0.5	ug/L	ND	88.5	50-140			
Carbon Tetrachloride	36.8	0.2	ug/L	ND	92.0	60-130			
Chlorobenzene	37.7	0.5	ug/L	ND	94.4	60-130			
Chloroform	38.3	0.5	ug/L	ND	95.7	60-130			
Dibromochloromethane	37.3	0.5	ug/L	ND	93.3	60-130			
Dichlorodifluoromethane	45.0	1.0	ug/L	ND	113	50-140			
1,2-Dichlorobenzene	33.6	0.5	ug/L	ND	84.0	60-130			
1,3-Dichlorobenzene	32.7	0.5	ug/L	ND	81.6	60-130			
1,4-Dichlorobenzene	33.6	0.5	ug/L	ND	84.0	60-130			
1,1-Dichloroethane	35.8	0.5	ug/L	ND	89.5	60-130			
1,2-Dichloroethane	49.2	0.5	ug/L	ND	123	60-130			
1,1-Dichloroethylene	32.9	0.5	ug/L	ND	82.3	60-130			
cis-1,2-Dichloroethylene	40.3	0.5	ug/L	ND	101	60-130			
trans-1,2-Dichloroethylene	37.4	0.5	ug/L	ND	93.6	60-130			
1,2-Dichloropropane	43.2	0.5	ug/L	ND	108	60-130			
cis-1,3-Dichloropropylene	48.1	0.5	ug/L	ND	120	60-130			
trans-1,3-Dichloropropylene	48.7	0.5	ug/L	ND	122	60-130			
Ethylbenzene	38.2	0.5	ug/L	ND	95.5	60-130			
Ethylene dibromide (dibromoethane, 1,2	35.8	0.2	ug/L	ND	89.4	60-130			
Hexane	40.4	1.0	ug/L	ND	101	60-130			
Methyl Ethyl Ketone (2-Butanone)	111	5.0	ug/L	ND	111	50-140			
Methyl Isobutyl Ketone	117	5.0	ug/L	ND	117	50-140			
Methyl tert-butyl ether	94.8	2.0	ug/L	ND	94.8	50-140			
Methylene Chloride	36.5	5.0	ug/L	ND	91.2	60-130			
Styrene	39.0	0.5	ug/L	ND	97.5	60-130			
1,1,1,2-Tetrachloroethane	37.0	0.5	ug/L	ND	92.6	60-130			
1,1,2,2-Tetrachloroethane	42.4	0.5	ug/L	ND	106	60-130			
Tetrachloroethylene	37.3	0.5	ug/L	ND	93.2	60-130			
Toluene	38.6	0.5	ug/L	ND	96.4	60-130			
1,1,1-Trichloroethane	36.0	0.5	ug/L	ND	89.9	60-130			
1,1,2-Trichloroethane	41.8	0.5	ug/L	ND	105	60-130			
Trichloroethylene	39.8	0.5	ug/L	ND	99.5	60-130			
Trichlorofluoromethane	39.4	1.0	ug/L	ND	98.4	60-130			
Vinyl chloride	46.3	0.5	ug/L	ND	116	50-140			
m,p-Xylenes	77.3	0.5	ug/L	ND	96.6	60-130			
o-Xylene	38.9	0.5	ug/L	ND	97.4	60-130			
Surrogate: 4-Bromofluorobenzene	*82.0*		*ug/L*		*102*	*50-140*			
Surrogate: Dibromofluoromethane	*93.4*		*ug/L*		*117*	*50-140*			
Surrogate: Toluene-d8	*75.8*		*ug/L*		*94.7*	*50-140*			

Qualifier Notes:

Sample Qualifiers :

1 : Sample decanted prior to analysis due to sediments.

QC Qualifiers :

QR-07 : Duplicate result exceeds RPD limits due to non-homogeneity between multiple sample vials. Remainder of QA/QC is acceptable.

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

PARAC
LABORATORIE

Paracel ID: 2029306

Laurent Blvd.
io K1G 4J8
1947
racellabs.com
www.paracellabs.com

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2029306	No 52371

Client Name: Paterson	Project Ref: PE4967	Page 1 of 1
Contact Name: Mark D'Arcy	Quote #:	Turnaround Time
Address:	PO #: 30367	☑ 1 day ☐ 3 day
	E-mail:	☐ 2 day ☐ Regular
Telephone: 226-7381		Date Required:

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

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

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	Required Analysis: VOC's
1	BH1 - GW1	GW		2	July 15	10-11am	✓
2	BH3 - GW1	"		2	2020		✓
3	BH4 - GW1	"		2	"		✓
4	DUP	"		2	"		✓
5							
6							
7							
8							
9							
10							

Comments: Please have results to us by early Pat Ferroon - July 16 - as per discussion with Donna

Method of Delivery: DJB

Relinquished By (Sign):	Received By Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Mark D'Arcy	Date/Time:	Date/Time: 7-15-2014	Date/Time: 7-15-2014
Date/Time: July 15/2020	Temperature: °C	Temperature: 18.5 °C	pH Verified: ☐ By: