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Phase II-Environmental Site Assessment

384 Frank Street
Ottawa, Ontario

Prepared For

384 Frank Street Ltd.

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Report: PE4140-2R

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EXECUTIVE SUMMARY

Assessment

A Phase II ESA was conducted for the property at 384 Frank Street, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address a historical off-site potentially contaminating activity (PCA) that was identified during the Phase I ESA and considered to result in an area of potential environmental concern (APEC) on the Phase II Property. The subsurface investigation was carried out in conjunction with a Geotechnical Investigation and consisted of the drilling three (3) boreholes, all of which were constructed with groundwater monitoring well installations.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. A total of 6 soil samples were submitted for laboratory analysis of a combination of volatile organic compounds (VOCs) and metals. Lead and zinc exceeding MOECC Table 3 standards was identified in the fill material on the southern portion of the Phase II Property. Based on analytical testing of the underlying native silty sand at BH3, the lead and zinc impacts are expected to be contained to the fill material.

Groundwater samples obtained from three (3) monitoring wells, BH1, BH2 and BH3, were analysed for VOCs. Parameter concentrations were not identified above the method detection limits, with the exception of concentrations of tetrachloroethylene in BH1 and acetone and methyl ethyl ketone in BH2 at values below the MOECC Table 3 standards. The groundwater is considered to be in compliance with MOECC Table 3 standards.

Recommendations

Soil

Based on the findings of the Phase II ESA, fill material impacted with lead and zinc concentrations exceeding MOECC Table 3 standards, is present on the Phase II Property. It is our understanding that the subject site is to be redeveloped with a three-storey residential building with one basement level.

It is our recommendation that an environmental site remediation program, involving the removal of all impacted fill material, be completed concurrently with the site redevelopment.

Prior to offsite disposal at a licenced landfill site, a leachate analysis of a representative sample of contaminated soil must be conducted in accordance with Ontario Regulation 347/558.

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

Groundwater

Once groundwater monitoring wells are no longer required, they should be abandoned in accordance with O.Reg.903. Otherwise they can be abandoned in conjunction with the construction of the proposed development.

1.0 INTRODUCTION

At the request of 384 Frank Street Ltd., Paterson Group (Paterson) prepared a Phase II-Environmental Site Assessment (ESA) for the property located at 384 Frank Street, in the City of Ottawa, Ontario. The purpose of this Phase II ESA was to address concerns identified in the Phase I ESA prepared by Paterson in November of 2017.

1.1 Site Description

Address:	384 Frank Street, Ottawa, Ontario.
Legal Description:	Part of Lot E, Concession C (Rideau Front), Geographic Township of Nepean, Also Known as Part of Park Lot 51 of the By-Estate, City of Ottawa
Parcel Identification	
Number:	04119-0193 (LT)
Location:	The Phase I Property is located on the south side of Frank Street, approximately 25m east of Bank Street. The subject site is shown on Figure 1 - Key Plan following the body of this report.
Latitude and Longitude:	45° 24' 45" N, 75° 41' 36" W
Configuration:	Rectangular
Site Area:	0.021 hectares (approximate)

1.2 Property Ownership

The subject property is currently owned by 384 Frank Street Ltd. Paterson Group was retained to complete this Phase II-ESA by Mr. Fernando Matos with 384 Frank Street Ltd., located at 2277 Prospect Avenue, Ottawa, Ontario, K1H 7G2. Mr. Matos can be reached by telephone at 613-884-4425.

1.3 Current and Proposed Future Uses

The subject property is currently occupied by a 2-storey residential dwelling with a full basement. It is our understanding that the subject property will be redeveloped with a 3-storey residential building with a full basement level.

1.4 Applicable Site Condition Standard

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

- ❒ Fine-grained soil conditions;
- ❒ Full depth generic site conditions;
- ❒ Non-potable groundwater conditions; and
- ❒ Residential land use.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II Property is located in an urban area surrounded by various sized commercial and residential structures. Site topography slopes slightly down towards the north and west. The Phase II Property is at a similar grade as the adjacent properties, although the southeastern portion of the subject land appears to have been paved several times and is approximately 0.3m higher in elevation than the adjacent property to the east. Site drainage consists primarily of sheet flow to a catch basins along Frank Street. The Phase II Property is situated with a municipally serviced area.

2.2 Past Investigations

A Phase I ESA was conducted by Paterson in August of 2017. Based on the findings of the Phase I ESA, several historical on- and off-site potentially contaminating activities (PCAs) were considered to result in areas of potential environmental concern (APECs) on the Phase I and Phase II Property, as presented in Table 1.

Table 1: Areas of Potential Environmental Concern

Area of Potential Environmental Concern (APEC)	Location of APEC on Phase One Property	Potentially Contaminating Activities (PCA)	Location of PCA (on-site / off-site)	Contaminants of Potential Concern (CPC)	Media Potentially Impacted (Groundwater, Soil and/or Sediment)
APEC 1	Western portion of the Phase I Property	Item 37: Operation of Dry Cleaning Equipment (where chemicals are used)	Off-site	VOCs	Soil and Groundwater
APEC 2	Across the Phase I Property outside of the building footprint	Item 30: Importation of Fill Material of Unknown Quality	On-site	Metals	Soil (fill material)

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation conducted as a component of this Phase II ESA, consisted of drilling three (3) boreholes, all of which were completed with groundwater monitoring wells. Boreholes were drilled to depths of 7.3m below grade.

3.2 Media Investigated

During the subsurface investigation, soil samples and groundwater samples were obtained and submitted for laboratory analysis. Sediment, as defined by O.Reg 153/04 as amended, was not present at the subject property.

The rationale for sampling and analyzing these media, was based on the Contaminants of Potential Concern identified in the Phase I-ESA in combination with observations made at the time of the field program. Contaminants of potential concern for both soil and groundwater include volatile organic compounds (VOCs), while metals may be present in the fill material. The sampling rationale is presented in more detail in the Sampling and Analysis Plan appended to this report.

3.3 Phase I Conceptual Site Model

Existing Buildings and Structures

The subject site is occupied by a two-storey residential dwelling with a full basement level. No other structures are present on the Phase I Property.

Geological and Hydrogeological Setting

The Geological Survey of Canada website on the Urban Geology of the National Capital Area was consulted as part of this assessment. Based on this information, bedrock in the area of the site consists of shale of the Billings Formation. Overburden is reported to consist of offshore marine sediments with erosional terraces and a drift thickness ranging from 15 to 25 m.

Based on the regional topography, the groundwater flow is inferred to be in a northerly direction.

Water Bodies

There are no water bodies on the subject site or within the Phase I Study Area. The closest water body is the Ottawa River, located approximately 1.4km to the northwest.

Areas of Natural Significance

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

Water Well Records

No well records were identified for the Phase I Property. Records of 13 monitoring wells were identified for the following properties within the Phase I Study Area: 403, Bank Street, 408 Bank Street, 381 Kent Street, 21 James Street, 37 Flora Street and 356 MacLaren Street.

Records for two abandoned wells along Gladstone Avenue between Bank Street and O'Connor Street were also identified. No potable well records were identified for the properties within the Phase I Study Area.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As presented in Table 4 in Section 7.1 of the Phase I ESA, an historical off-site PCA is considered to have resulted in an APEC on the Phase I Property.

Contaminants of Potential Concern

As noted in Table 1, CPCs associated with the APECs identified in the Phase I ESA include VOCs in the soil and/or groundwater beneath the Phase I Property.

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of the Phase I ESA is considered to be sufficient to conclude that there are areas of potential environmental concern on the subject site.

The presence of potentially contaminating activities was confirmed by a variety of independent sources, and as such, the conclusions of the 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 field portion of the Phase II-ESA was conducted in general accordance with the Sampling and Analysis plan provided in the Appendix.

3.5 Impediments

Physical impediments on site included the presence of underground utilities. The sewer line, suspected to enter the property from Frank Street, bending toward the west wall of the subject structure, could not be accurately located. This prevented the placement of a borehole on the northern portion of the Phase II Property.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted in conjunction with a Geotechnical Investigation on November 10, 2017. The subsurface investigation consisted of drilling three (3) boreholes on the Phase II Property, all of which were completed with groundwater monitoring well installations. The boreholes were placed to address the aforementioned area of potential environmental concern and to provide general coverage of the site for geotechnical purposes. The boreholes were drilled under full-time supervision of Paterson personnel, with a Geoprobe drill rig provided by George Downing Estate Drilling of Hawkesbury, Ontario. Borehole locations are shown on Drawing PE4140-3 – Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

A total of 36 soil samples were obtained from the boreholes by means of split spoon sampling. The depths at which split spoon and auger flight samples were obtained from the boreholes are shown as "**SS**" on the Soil Profile and Test Data Sheets, appended to this report.

A pavement structure consisting of approximately 50 to 75 mm of asphalt over a granular base (sand and gravel) to depths ranging from 0.2 to 0.3 m below grade, was present across the site. Beneath the pavement structure, a fill material generally consisting of brown silty sand with gravel, was encountered to depths of approximately 0.76 to 1.2 m below ground surface. Traces of construction debris were noted in the fill material at each location. The fill material at BH2 and BH3 also appeared to be discoloured.

Native material underlying the fill consisted of silty brown sand to depths ranging from approximately 2.3 to 2.7m below grade. Silty clay was present beneath the silty sand. Based on a dynamic cone penetration test (DCPT) conducted at BH2 the inferred bedrock depth is 16.9m below grade.

Further details regarding the soil profile are provided on Soil Profile and Test Data Sheets in Appendix 1.

4.3 Field Screening Measurements

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

The soil vapours were measured by inserting the analyzer probe into the nominal headspace above the soil sample. Samples were then agitated and the peak readings recorded. The vapour readings ranged from 0.2ppm to 2.4ppm. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

Soil samples were selected for analysis based on and combination of visual appearance, location, and vapour readings.

4.4 Groundwater Monitoring Well Installation

Three (3) groundwater monitoring wells were installed during the drilling program. The monitoring wells consisted of 50 mm diameter Schedule 40 PVC risers and screens. A sand pack consisting of silica sand was placed around the screen, and a bentonite seal was placed above the screen. The well was finished with a flush-mount aluminium casing. Monitoring well construction details are provided on the Soil Profile and Test Data Sheets in Appendix 1. A summary of 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	71.02	7.3	4.3-7.3	4.0-7.3	0.3-4.0	Flushmount
BH2	71.33	7.3	4.3-7.3	4.0-7.3	0.3-4.0	Flushmount
BH3	71.09	7.3	4.3-7.3	4.0-7.3	0.3-4.0	Flushmount

The monitoring wells were developed and purged prior to sampling using a low density polyethylene tubing and a foot valve sampling device (Waterra) to remove standing water, filter pack water and to allow for the influx of fresh formation water. In accordance with standard operating procedures, all monitoring wells were purged dry and allowed to recover, or three well volumes were removed prior to stabilization.

4.5 Field Measurement of Water Quality Parameters

Groundwater sampling was conducted at BH1, BH2 and BH3 on November 17, 2017. At this time, water quality parameters were measured in the field using a multi-parameter analyzer. Parameters measured in the field included temperature, pH, electrical conductivity, and total dissolved solids.

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

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

Parameter	BH1	BH2	BH3
Temperature (°C)	9.2	6.7	9.8
pH	7.99	7.21	8.27
Electrical Conductivity (µS/cm)	13,070	13,530	12,590

4.6 Groundwater Sampling

Groundwater sampling protocols were followed using the MOECC document entitled “Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario”, dated May 1996. Groundwater samples were obtained from monitoring wells BH1A, BH3 and BH5 using dedicated sampling equipment. Standing water was purged from each well prior to sampling. Samples were stored in coolers to reduce analyte volatilization during transportation. Details of our standard operating procedure for groundwater sampling are provided in the Sampling and Analysis Plan in Appendix 1.

4.7 Analytical Testing

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

Table 4
Soil Samples Submitted

Sample ID	Sample Depth/ Stratigraphic Unit	Parameters Analyzed		Rationale
		VOCs	Metals	
BH1-SS1	0.2-0.6		X	Assess quality of fill material; based on visual observations.
BH1-SS8	4.3-4.8	X		Assess potential for VOC impacts; based on organic vapour readings and depth.
BH2-SS1	0.2-0.6		X	Assess quality of fill material; based on visual observations.
BH3-SS1	0.2-0.3		X	Assess quality of fill material; based on visual observations.
BH3-SS2	0.6-1.2		X	Assess quality of fill material; based on visual observations.
BH3-SS5	2.4-3.2	X		Assess potential for VOC impacts; based on organic vapour readings and depth.

Table 5
Groundwater Samples Submitted

Sample ID	Date	Screened Interval (mbgs)	Parameters Analyzed	Rationale
BH1-GW1	November 17, 2017	4.3-7.3	VOCs	Assess quality of groundwater in overburden.
BH2-GW1				
BH3-GW1				

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

4.8 Residue Management

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

4.9 Elevation Surveying

An elevation survey of all borehole locations was completed by Paterson at the time of the subsurface investigation. All borehole elevations are relative to the top spindle of a fire hydrant located on the north side of Frank Street, northwest of the Phase II Property. The geodetic elevation is 72.05m above sea level (asl) as provided by Annis, O'Sullivan, Vollebekk.

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 geology details are provided in the Soil Profile and Test Data Sheets in the Appendix. A pavement structure consisting of approximately 50 to 75 mm of asphalt over a granular base (sand and gravel) to depths ranging from 0.2 to 0.3 m below grade, was present across the site. Beneath the pavement structure a fill material generally consisting of brown silty sand with gravel, was encountered to depths of approximately 0.76 to 1.2 m below ground surface. Traces of construction debris were noted in the fill material at each location. The fill material at BH2 and BH3 also appeared to be discoloured.

Native material underlying the fill consisted of silty brown sand to depths ranging from approximately 2.3 to 2.7m below grade. Silty clay was present beneath the silty sand. Based on a dynamic cone penetration test (DCPT) conducted at BH2 the inferred bedrock depth is 16.9m below grade.

Site stratigraphy is shown on Drawings: PE4140-7 and -8, Cross Section A-A` and Cross Section B-B`.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling event on November 17, 2017, using an electronic water level meter. Groundwater levels are summarized in Table 6. All measurements are relative to the fire hydrant located at the northeast corner of the intersection of Frank Street and Bank Street.

Table 6
Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below grade)	Water Level Elevation (m ASL)	Date of Measurement
BH1	71.02	5.2	65.81	November 17, 2017
BH2	71.33	4.4	66.91	
BH3	71.09	6.1	64.98	

Based on the groundwater elevations from the November 17, 2017 monitoring event, groundwater contour mapping was completed for the upper unconfined aquifer. Based on the contour mapping, groundwater flow at the subject site is in a southerly direction. An average horizontal hydraulic gradient of 0.305 m/m was calculated.

5.3 Fine-Medium Soil Texture

Based on field soil observations, fine-grained soil standards are considered to be applicable to the subject site, however grain-size analyses have not been conducted for the Phase II Property.

5.4 Soil: Field Screening

All soil samples collected underwent a preliminary screening procedure, which included visual screening for colour and evidence of deleterious fill as well as screening using a MiniRae 2000 photoionization detector (PID).

Several samples of the fill material contained traces of building material fragments and appeared to be discoloured. No visual or olfactory evidence of contamination was noted in the native soil samples.

The organic vapour survey identified readings ranging from 0.2 to 2.4ppm in each of the soil samples recovered from the Phase II Property. These readings are considered to be negligible and representative of background conditions. Native soil samples were primarily selected based on their location, with consideration given to the vapour readings as well.

5.5 Soil Quality

A total of 6 soil samples were submitted for analysis for a combination of metals, and volatile organic compounds (VOCs). The results of the analytical testing are presented below in Tables 7 and 8. The laboratory certificates of analysis are provided in the Appendix.

Table 7
Analytical Test Results – Soil
Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g) (November 10, 2017)				MOECC Standards Table 3 Residential, Fine-Grained Soils
		BH1-SS1 (0.2-0.6m)	BH2-SS1 (0.2-0.6m)	BH3-SS1 (0.2-0.3m)	BH3-SS2 (0.6-1.2m)	
Antimony	1.0	nd	nd	nd	nd	7.5
Arsenic	1.0	12.4	11	8.1	nd	18
Barium	1.0	244	302	214	22.3	390
Beryllium	1.0	nd	nd	nd	nd	4
Boron	1.0	7.9	8.3	8.1	1.7	120
Cadmium	0.50	0.6	0.8	nd	nd	1.2
Chromium	1.0	20.5	30.6	24.3	13.1	160
Cobalt	1.0	5.7	4.9	6.4	3.2	22
Copper	1.0	55.9	56.9	51.4	5.3	180
Lead	1.0	**369**	**523**	**373**	9.3	120
Molybdenum	1.0	1.0	nd	1.0	nd	6.9
Nickel	1.0	15.2	13.9	17.1	8.4	130
Selenium	1.0	nd	nd	nd	nd	2.4
Silver	0.5	nd	nd	nd	nd	25
Thallium	1.0	nd	nd	nd	nd	1
Uranium	1.0	nd	nd	nd	nd	23
Vanadium	1.0	29.0	26.6	27.6	15.8	86
Zinc	1.0	**577**	**342**	246	18.8	340

Notes:
- MDL – Method Detection Limit
- nd – not detected above MDL
- **Bold** – Value exceeds selected MOECC Standard

Lead and zinc were identified at concentrations exceeding the MOECC Table 3 fine-grained standards selected for the site, at BH1 and BH2, while only the lead concentration at BH3 was above the MOECC Table 3 standard. Remaining metals parameters detected in each of the soil samples were in compliance with the Table 3 standards.

Table 8
Analytical Test Results – Soil
VOCs

Parameter	MDL (µg/g)	Soil Samples (µg/g) (November 10, 2017)		MOECC Standards Table 3 Residential Fine-grained Soil
		BH1-SS8 (4.3-4.8m)	BH3-SS5 (2.4-3.2m)	
Acetone	0.5	nd	nd	28
Benzene	0.02	nd	nd	0.17
Bromodichloromethane	0.05	nd	nd	13
Bromoform	0.05	nd	nd	0.26
Bromomethane	0.05	nd	nd	0.05
Carbon Tetrachloride	0.05	nd	nd	0.12
Chlorobenzene	0.05	nd	nd	2.7
Dibromochloromethane	0.05	nd	nd	3.4
Chloroform	0.05	nd	nd	0.18
1,2-Dibromoethane	0.05	nd	nd	NV
1,2-Dichlorobenzene	0.05	nd	nd	4.3
1,3-Dichlorobenzene	0.05	nd	nd	6
1,4-Dichlorobenzene	0.05	nd	nd	0.097
Dichlorodifluoromethane	0.05	nd	nd	25
1,1-Dichloroethane	0.05	nd	nd	11
1,2-Dichloroethane	0.05	nd	nd	0.05
1,1-Dichloroethylene	0.05	nd	nd	0.05
Cis-1,2-Dichlroethylene	0.05	nd	nd	30
Trans-1,2-Dichloroethylene	0.05	nd	nd	0.75
1,3-Dichloropropene	0.05	nd	nd	0.083
Methylene Chloride	0.05	nd	nd	0.96
1,2-Dichloropropane	0.05	nd	nd	0.085
Ethylbenzene	0.05	nd	nd	15
n-hexane	0.05	nd	nd	34
Methyl Ethyl Ketone	0.05	nd	nd	44
Methyl Isobutyl Ketone	0.05	nd	nd	4.3
Methyl tert-Butyl Ether	0.05	nd	nd	1.4
Styrene	0.05	nd	nd	2.2
1,1,1,2-Tetrachloroethane	0.05	nd	nd	0.05
1,1,2,2-Tetrachloroethane	0.05	nd	nd	0.05
Tetrachloroethylene	0.05	nd	nd	2.3
Toluene	0.05	nd	nd	6
1,1,1-Trichloroethane	0.05	nd	nd	3.4
1,1,2-Trichloroethane	0.05	nd	nd	0.05
Trichloroethylene	0.05	nd	nd	0.52
Trichlorofluoromethane	0.05	nd	nd	5.8
Vinyl Chloride	0.05	nd	nd	0.022
Xylene	0.05	nd	nd	2.5

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- n/v – no value provided by the MOECC

No VOC parameters were identified above the reporting detection limits in either of the soil samples submitted for analytical testing. The soil results are in compliance with the MOECC Table 3 standards.

Maximum soil concentrations identified on site are presented in Table 9. All other parameter concentrations were below laboratory detection limits.

Table 9
Maximum Concentrations – Soil

Parameter	Maximum Concentration (µg/g)	Borehole	Depth Interval (m BGS)
Arsenic	12.4	BH1 – SS1	0.2-0.6
Barium	302	BH2 – SS1	0.2-0.6
Boron	8.3	BH2 – SS1	0.2-0.6
Cadmium	0.8	BH2 – SS1	0.2-0.6
Chromium	30.6	BH2 – SS1	0.2-0.6
Cobalt	6.4	BH3 – SS1	0.2-0.6
Copper	56.9	BH2 – SS1	0.2-0.6
Lead	**523**	BH2 – SS1	0.2-0.6
Molybdenum	1.0	BH1-SS1/BH3-SS1	0.2-0.3
Nickel	17.4	BH3-SS1	0.2-0.3
Vanadium	29.0	BH1-SS1	0.2-0.6
Zinc	**577**	BH1-SS1	0.2-0.6

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

5.6 Groundwater Quality

Groundwater samples from the monitoring wells installed in BH1, BH2 and BH3 were submitted for laboratory analysis of VOCs. The groundwater samples were obtained from the screened intervals noted on Table 2, above. The results of the analytical testing are presented below in Table 10. Laboratory certificates of analysis are provided in the Appendix.

Table 10
Analytical Test Results – Groundwater
VOCs

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) (November 17, 2017)			MOECC Table 3 Residential Coarse (µg/L)
		BH1-GW1	BH2-GW2	BH3-GW3	
Acetone	2,700	nd	68.8	nd	130,000
Benzene	5	nd	nd	nd	430
Bromodichloromethane	16	nd	nd	nd	85,000
Bromoform	25	nd	nd	nd	770
Bromomethane	0.89	nd	nd	nd	56
Carbon Tetrachloride	0.79	nd	nd	nd	8.4
Chlorobenzene	30	nd	nd	nd	630
Dibromochloromethane	25	nd	nd	nd	82,000
Chloroform	22	nd	nd	nd	22
1,2-Dibromoethane	0.2	nd	nd	nd	NV
1,2-Dichlorobenzene	3	nd	nd	nd	9,600
1,3-Dichlorobenzene	59	nd	nd	nd	9,600
1,4-Dichlorobenzene	1	nd	nd	nd	67
Dichlorodifluoromethane	590	nd	nd	nd	4,400
1,1-Dichloroethane	5	nd	nd	nd	3,100
1,2-Dichloroethane	1.6	nd	nd	nd	12
1,1-Dichloroethylene	1.6	nd	nd	nd	17
Cis-1,2-Dichlroethylene	1.6	nd	nd	nd	17
Trans-1,2-Dichloroethylene	1.6	nd	nd	nd	17
1,3-Dichloropropene	0.5	nd	nd	nd	45
Methylene Chloride	50	nd	nd	nd	5,500
1,2-Dichloropropane	5	nd	nd	nd	140
Ethylbenzene	2.4	nd	nd	nd	2,300
n-hexane	51	nd	nd	nd	520
Methyl Ethyl Ketone	1,800	nd	24.8	nd	1,500,000
Methyl Isobutyl Ketone	640	nd	nd	nd	580,000
Methyl tert-Butyl Ether	15	nd	nd	nd	1,400
Styrene	5.4	nd	nd	nd	9,100
1,1,1,2-Tetrachloroethane	1.1	nd	nd	nd	28
1,1,2,2-Tetrachloroethane	1	nd	nd	nd	15
Tetrachloroethylene	1.6	2.3	nd	nd	17
Toluene	24	nd	nd	nd	18,000
1,1,1-Trichloroethane	200	nd	nd	nd	6,700
1,1,2-Trichloroethane	4.7	nd	nd	nd	30
Trichloroethylene	1.6	nd	nd	nd	17
Trichlorofluoromethane	150	nd	nd	nd	2,500
Vinyl Chloride	0.5	nd	nd	nd	1.7
Xylene	300	nd	nd	nd	4,200

Notes:
- MDL – Method Detection Limit
- n/d – not detected above the MDL
- N/V – no value provided by the MOECC

Tetrachloroethylene (2.3µg/L) was identified in BH1-GW1 at a concentration below the standard of 17 µg/L. Concentrations of acetone and methyl ethyl ketone were identified in BH2-GW1 at values less than those provided in MOECC Table 3. Remaining parameters in BH1-GW1 and BH2-GW1, as well all the parameters in BH3-GW1, were not detected above the laboratory method detection limits. The groundwater is in compliance with MOECC Table 3.

5.7 Quality Assurance and Quality Control Results

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

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

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

5.8 Phase II Conceptual Site Model

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

Site Description

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As per column A of Table 2, outlined in Ontario Regulation 153/04 and amended by O.Reg 279/11, potentially contaminating activities identified on the subject property and/or within the Phase I-ESA study area, with the potential to impact the site include the following:

- Item 37: Operation of Dry Cleaning Equipment (where chemicals are used), an off-site PCA (former dry cleaners at 429 Bank Street) resulting in APEC 1 on the western portion of the Phase II Property; and

- Item 30: Importation of Fill Material of Unknown Quality resulting in APEC 2 across the Phase I Property, outside of the building footprint.

Contaminants of potential concern identified in association with the aforementioned APECs include VOCs in the soil and groundwater and metals in the soil (fill material) only.

Subsurface Structures and Utilities

Underground utilities on the Phase II Property include telephone, natural gas, and municipal water and sewer services which enter the property from Frank Street. No other buried utilities are present on the Phase I Property. It should be noted that the sewer service could not be accurately located during the concurrent subsurface investigation.

There are no other known subsurface structures on the subject property.

Physical Setting

Site Stratigraphy

The site stratigraphy, from ground surface to the deepest aquifer or aquitard investigated, is illustrated on Drawings PE4140-6 - Cross-Section A-A' and PE4140-7 – Cross-Section B-B'. Stratigraphy consists of:

- Pavement structure ranging from 30 to 38mm in depth and consisting of asphaltic concrete underlain by a dark brown silty sand and gravel fill material.
- Fill ranging in depth from approximately 1.1 to 1.2 m below ground surface and generally consisting of brown silty sand with gravel. Construction debris (brick fragments) were noted at BH1 and BH2.
- Native silty sand was present beneath the fill material to depths ranging from approximately 2.3 to 2.7m below grade.
- Native silty clay extending to an inferred depth of 16.9m below grade, was present beneath the sand layer. This is the deepest unit investigated. Groundwater was encountered in this stratigraphic unit.

Hydrogeological Characteristics

Groundwater was encountered within the silty clay layer, which is interpreted to function as a local unconfined aquifer at the subject site.

Groundwater levels were measured at the subject site on November 17, 2017. Groundwater was encountered at depths between 4.4 and 6.1m at this time. Seasonal fluctuations in groundwater are expected to occur.

Based on the groundwater elevations, groundwater contour mapping was completed and the horizontal hydraulic gradient at the subject site was calculated. Groundwater flow at the subject site is in a southerly direction, with an average hydraulic gradient of 0.305 m/m.

Approximate Depth to Bedrock

A dynamic cone penetration test (DCPT) was conducted at BH2. The DCPT commenced at 7.32m depth and encountered practical refusal on inferred bedrock at approximately 16.9m below ground surface.

Approximate Depth to Water Table

Depth to the water table at the subject site varies between approximately 4.4 and 6.1 m below existing grade.

Sections 41 and 43.1 of the Regulation

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

Section 43.1 of the Regulation does not apply to the subject site in that the subject site is not within 30 m of a water body, and there is more than 2 m of overburden.

Fill Placement

Fill material was identified on the Phase II Property and generally consisted of silty sand and gravel to depths ranging from approximately 1.1 to 1.2m below grade. Fill material in BH1 and BH2 on the southwestern portion of the property was noted to contain fragments of demolition debris.

Proposed Buildings and Other Structures

It is our understanding that the Phase II Property is to be redeveloped with a 3-storey residential building with a full basement level.

Existing Buildings and Structures

The subject site is currently occupied by a two-storey residential dwelling with a full basement. No other buildings or structures are present on the Phase II Property.

Water Bodies

There are no water bodies on the subject site or within the Phase I Study Area.

Areas of Natural Significance

No areas of natural significance are present on or within the Phase I Study Area.

Environmental Condition

Areas Where Contaminants are Present

Based on analytical test results lead and zinc concentrations exceeding MOECC Table 3 standards were identified in the fill material. Groundwater beneath the site was determined to be in compliance with the MOECC Table 3 standards selected for the site. Analytical test results are presented on Drawings PE4140-4 and 5 – Analytical Testing Plans.

Types of Contaminants

The following parameters were identified in the fill material at concentrations exceeding the MOECC Table 3 standards:

- Metals – lead and zinc.

All other metal parameters detected in the fill material were in compliance with the MOECC Table 3 standards.

Contaminated Media

Based on the results of the Phase II ESA, some of the fill material is impacted with lead and zinc concentrations exceeding MOECC Table 3 standards. Groundwater on the subject site is considered to be in compliance with the MOECC Table 3 standards.

What Is Known About Areas Where Contaminants Are Present

Impacted fill is present on the southern portion of the property, although it is expected to also be present on the northern portion of the site, outside of the building footpring. As noted previously, this could not be confirmed based on the unknown location of the sanitary sewer. Analytical test results exceeding the MOECC Table 3 standards are presented on Drawings PE4140-4A, 7A and 8A.

Distribution and Migration of Contaminants

As previously noted, the metal impacts are considered to be limited to the fill material. Based on their low solubility in combination with the depth of the water table, well beneath the fill material, the potential for migration is considered to be negligible. Contaminant distribution is presented in both plan view and cross-section, on Drawings PE4140-4A, 7A and 8A.

Discharge of Contaminants

Metal concentrations are considered to have been directly deposited on site through historical infilling.

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.

Due to the Phase II Property having been covered largely by asphaltic concrete and building structures and the low solubility of metals, precipitation and infiltration are not considered to have contributed to the migration of the identified parameters. Lead and zinc impacts are considered to be confined to the fill material.

Potential for Vapour Intrusion

Given the low organic vapour readings, the potential for vapour intrusion within the existing dwelling is considered to be negligible.

6.0 CONCLUSIONS

Assessment

A Phase II ESA was conducted for the property at 384 Frank Street, in the City of Ottawa, Ontario. The purpose of the Phase II ESA was to address a historical off-site potentially contaminating activity (PCA) that was identified during the Phase I ESA and considered to result in an area of potential environmental concern (APEC) on the Phase II Property. The subsurface investigation was carried out in conjunction with a Geotechnical Investigation and consisted of the drilling three (3) boreholes, all of which were constructed with groundwater monitoring well installations.

Soil samples were obtained from the boreholes and screened using visual observations and organic vapour measurements. A total of 6 soil samples were submitted for laboratory analysis of a combination of volatile organic compounds (VOCs) and metals. Lead and zinc exceeding MOECC Table 3 standards was identified in the fill material on the southern portion of the Phase II Property. Based on analytical testing of the underlying native silty sand at BH3, the lead and zinc impacts are expected to be contained to the fill material.

Groundwater samples obtained from three (3) monitoring wells, BH1, BH2 and BH3, were analysed for VOCs. Parameter concentrations were not identified above the method detection limits, with the exception of concentrations of tetrachloroethylene in BH1 and acetone and methyl ethyl ketone in BH2 at values below the MOECC Table 3 standards. The groundwater is considered to be in compliance with MOECC Table 3 standards.

Recommendations

Soil

Based on the findings of the Phase II ESA, fill material impacted with lead and zinc concentrations exceeding MOECC Table 3 standards, is present on the Phase II Property. It is our understanding that the subject site is to be redeveloped with a three-storey residential building with one basement level.

It is our recommendation that an environmental site remediation program, involving the removal of all impacted fill material, be completed concurrently with the site redevelopment.

Prior to offsite disposal at a licenced landfill site, a leachate analysis of a representative sample of contaminated soil must be conducted in accordance with Ontario Regulation 347/558.

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

Groundwater

Once groundwater monitoring wells are no longer required, they should be abandoned in accordance with O.Reg.903. Otherwise they can be abandoned in conjunction with the construction of the proposed development.

7.0 STATEMENT OF LIMITATIONS

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

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

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

This report was prepared for the sole use of 384 Frank Street Ltd. and notification from 384 Frank Street Ltd. and Paterson will be required to release this report to any other party.

Paterson Group Inc.

Karyn Munch, P.Eng., QP_{ESA}

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

Report Distribution:

- ❒ 384 Frank Street Ltd. (6 copies)
- ❒ Paterson Group Inc. (1 copy)

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE4140-3 – TEST HOLE LOCATION PLAN

DRAWING PE4140-4A – ANALYTICAL TESTING PLAN-SOIL (METALS)

DRAWING PE4140-4B – ANALYTICAL TESTING PLAN-SOIL (VOCs)

DRAWING PE4140-5 – ANALYTICAL TESTING PLAN-GROUNDWATER (VOCs)

DRAWING PE4140-6 – GROUNDWATER CONTOUR PLAN

DRAWING PE4140-7A - CROSS-SECTION A-A'-SOIL (METALS)

DRAWING PE4140-7B – CROSS-SECTION A-A'-SOIL (VOCs)

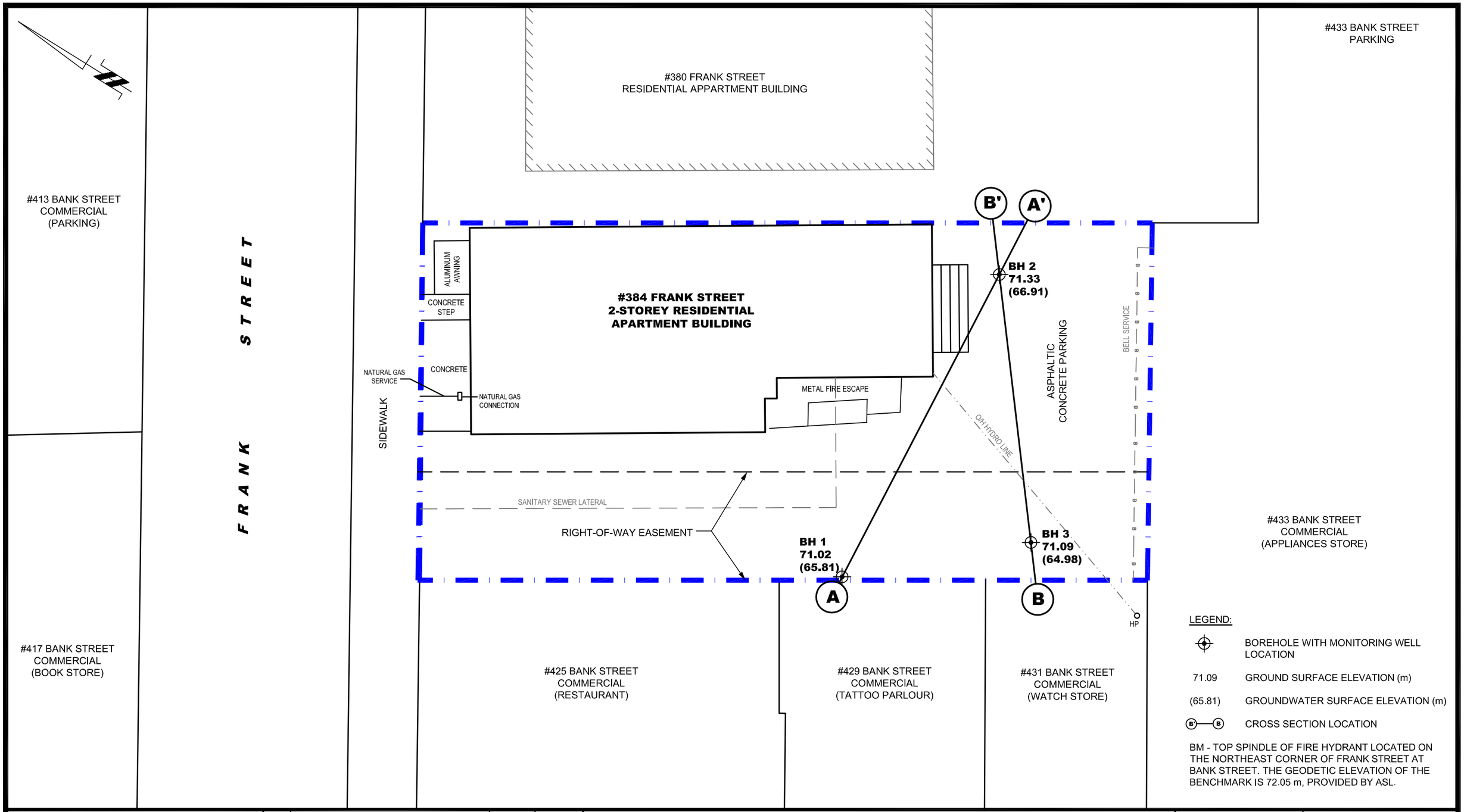
DRAWING PE4140-7C – CROSS-SECTION A-A`- GROUNDWATER (VOCs)

DRAWING PE4140-8A - CROSS-SECTION B-B'-SOIL (METALS)

DRAWING PE4140-8B – CROSS-SECTION B-B'-SOIL (VOCs)

DRAWING PE4140-8C – CROSS-SECTION B-B'-GROUNDWATER (VOCs)

DRAWING PE4140-9 – CONTAMINANT TRANSPORT DIAGRAM



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384 FRANK STREET INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
384 FRANK STREET

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:100	Date: 10/2017
Drawn by: RCG	Report No.: PE4140-1
Checked by: KM	Dwg. No.: PE4140-3
Approved by: MSD	Revision No.: 0

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BH3-SS1 (0.2-0.3m) - Nov.10, 2017

Parameter	Result (µg/L)	Standard(µg/L)
Lead	373	120

Other metals comply with MOECC Table 3 Standards

BH3-SS2 (0.6-1.2m) - Nov.17, 2017

Metals comply with MOECC Table 3 Standards

BH2-SS1 (0.2-0.6m) - Nov.10, 2017

Parameter	Result(µg/L)	MOECC(µg/L)
Lead	523	120
Zinc	342	340

Other metals comply with MOECC Table 3 Standards

BH1-SS1 (0.2-0.6m) - Nov.10, 2017

Parameter	Result(µg/L)	MOECC(µg/L)
Lead	369	120
Zinc	577	340

Other metals comply with MOECC Table 3 Standards

#413 BANK STREET
COMMERCIAL
(PARKING)

#380 FRANK STREET
RESIDENTIAL APPARTMENT BUILDING

F R A N K S T R E E T

SIDEWALK

ALUMINUM AWNING

CONCRETE STEP

CONCRETE

NATURAL GAS SERVICE

NATURAL GAS CONNECTION

#384 FRANK STREET
2-STOREY RESIDENTIAL
APARTMENT BUILDING

METAL FIRE ESCAPE

BH 2
71.33
(66.91)

ASPHALTIC CONCRETE PARKING

BELL SERVICE

OH HYDRO LINE

#433 BANK STREET
COMMERCIAL
(APPLIANCES STORE)

SANITARY SEWER LATERAL

RIGHT-OF-WAY EASEMENT

BH 1
71.02
(65.81)

BH 3
71.09
(64.98)

HP

#417 BANK STREET
COMMERCIAL
(BOOK STORE)

#425 BANK STREET
COMMERCIAL
(RESTAURANT)

#429 BANK STREET
COMMERCIAL
(TATTOO PARLOUR)

#431 BANK STREET
COMMERCIAL
(WATCH STORE)

LEGEND:

- BOREHOLE WITH MONITORING WELL INSTALLED LOCATION
- 71.09 GROUND SURFACE ELEVATION (m)
- (65.81) GROUNDWATER SURFACE ELEVATION (m)
- APPROXIMATE EXTENT OF FILL IMPACTED WITH METALS CONCENTRATIONS GREATER THAN THE MOECC TABLE 3 STANDARDS

BM - TOP SPINDLE OF FIRE HYDRANT LOCATED ON THE NORTHEAST CORNER OF FRANK STREET AT BANK STREET. THE GEODETIC ELEVATION OF THE BENCHMARK IS 72.05 m, PROVIDED BY ASL.

SOIL RESULT IS IN COMPLIANCE WITH MOECC TABLE 3 STANDARDS

SOIL RESULT EXCEEDS MOECC TABLE 3 STANDARDS

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consulting engineers

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Ottawa, Ontario K2E 7J5
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384 FRANK STREET INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
384 FRANK STREET

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (METALS)

Scale: 1:100	Date: 12/2017
Drawn by: RCG	Report No.: PE4140-2
Checked by: KM	Dwg. No.: PE4140-4A
Approved by: MSD	Revision No.: 0

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#413 BANK STREET
COMMERCIAL
(PARKING)

FRANK STREET

#380 FRANK STREET
RESIDENTIAL APPARTMENT BUILDING

#433 BANK STREET
PARKING

ALUMINUM AWNING

CONCRETE STEP

#384 FRANK STREET
2-STOREY RESIDENTIAL
APARTMENT BUILDING

NATURAL GAS SERVICE

CONCRETE

NATURAL GAS CONNECTION

SIDEWALK

METAL FIRE ESCAPE

BH 2
71.33
(66.91)

ASPHALTIC CONCRETE PARKING

BELL SERVICE

OIH HYDRO LINE

BH1-SS8 (4.3-4.8m) - Nov.10-2017
VOCs comply with MOECC Table 3 Standards

BH3-SS5 (2.4-3.2m) - Nov.10, 2017
VOCs comply with MOECC Table 3 Standards

#433 BANK STREET
COMMERCIAL
(APPLIANCES STORE)

SANITARY SEWER LATERAL

RIGHT-OF-WAY EASEMENT

BH 1
71.02
(65.81)

BH 3
71.09
(64.98)

HP

#417 BANK STREET
COMMERCIAL
(BOOK STORE)

#425 BANK STREET
COMMERCIAL
(RESTAURANT)

#429 BANK STREET
COMMERCIAL
(TATTOO PARLOUR)

#431 BANK STREET
COMMERCIAL
(WATCH STORE)

LEGEND:

⊕	BOREHOLE WITH MONITORING WELL INSTALLED LOCATION
71.09	GROUND SURFACE ELEVATION (m)
(65.81)	GROUNDWATER SURFACE ELEVATION (m)

BM - TOP SPINDLE OF FIRE HYDRANT LOCATED ON THE NORTHEAST CORNER OF FRANK STREET AT BANK STREET. THE GEODETIC ELEVATION OF THE BENCHMARK IS 72.05 m PROVIDED BY ASL.

SOIL RESULT IS IN COMPLIANCE WITH MOECC TABLE 3 STANDARDS

SOIL RESULT EXCEEDS MOECC TABLE 3 STANDARDS

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384 FRANK STREET INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
384 FRANK STREET

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - SOIL (VOCs)

Scale: 1:100	**Date:** 12/2017
Drawn by: RCG	**Report No.:** PE4140-2
Checked by: KM	**Dwg. No.:** PE4140-4B
Approved by: MSD	**Revision No.:** 0

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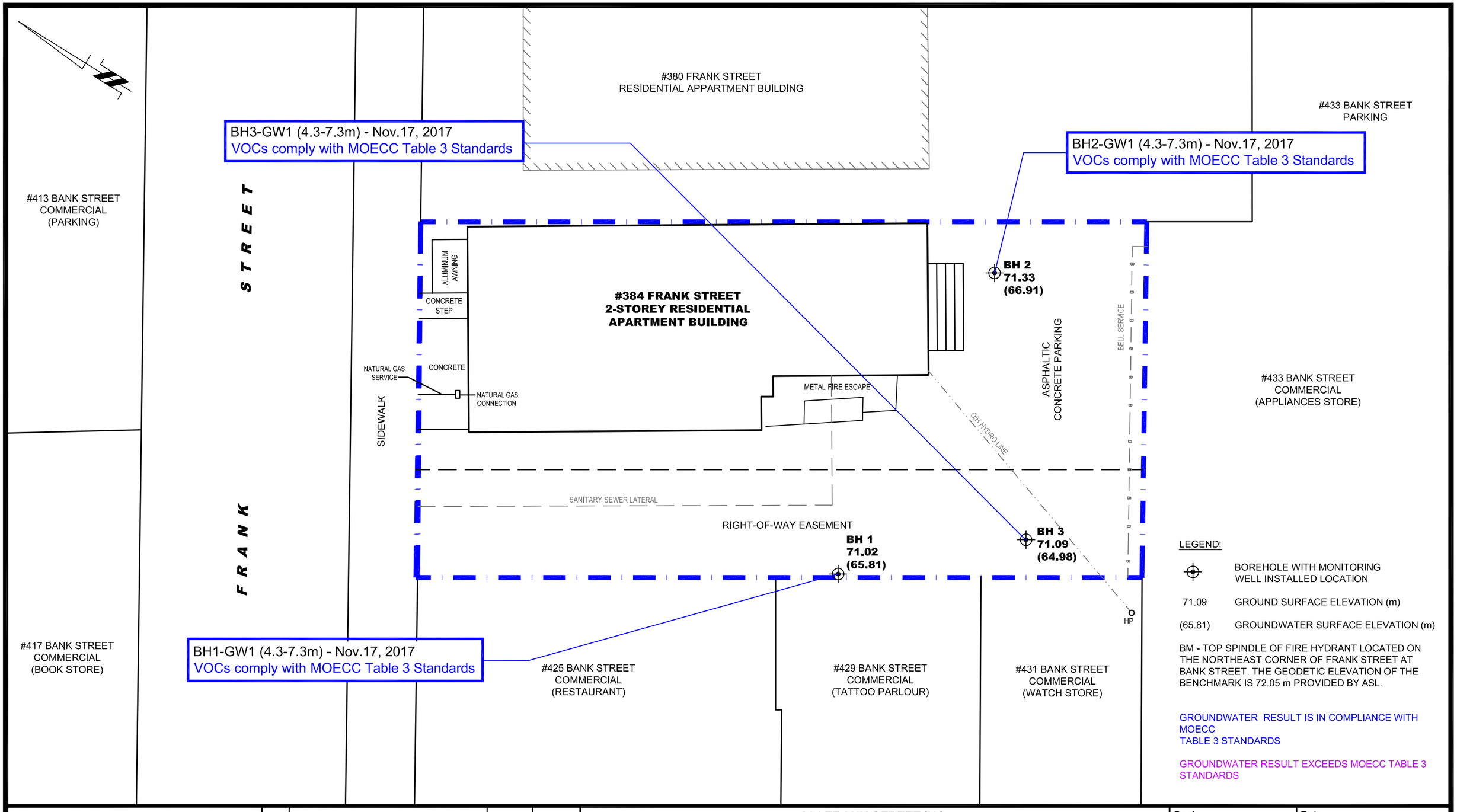

LEGEND:

⊕	BOREHOLE WITH MONITORING WELL INSTALLED LOCATION
71.09	GROUND SURFACE ELEVATION (m)
(65.81)	GROUNDWATER SURFACE ELEVATION (m)

BM - TOP SPINDLE OF FIRE HYDRANT LOCATED ON THE NORTHEAST CORNER OF FRANK STREET AT BANK STREET. THE GEODETIC ELEVATION OF THE BENCHMARK IS 72.05 m PROVIDED BY ASL.

GROUNDWATER RESULT IS IN COMPLIANCE WITH MOECC
TABLE 3 STANDARDS

GROUNDWATER RESULT EXCEEDS MOECC TABLE 3 STANDARDS

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
384 FRANK STREET

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN - GROUNDWATER

Scale: 1:100	Date: 10/2017
Drawn by: RCG	Report No.: PE4140-2
Checked by: KM	Dwg. No.: PE4140-5
Approved by: MSD	Revision No.: 0

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#380 FRANK STREET
RESIDENTIAL APPARTMENT BUILDING

#433 BANK STREET
PARKING

#413 BANK STREET
COMMERCIAL
(PARKING)

S T R E E T

F R A N K

#384 FRANK STREET
2-STOREY RESIDENTIAL
APARTMENT BUILDING

ALUMINUM AWNING

CONCRETE STEP

CONCRETE

NATURAL GAS SERVICE

NATURAL GAS CONNECTION

METAL FIRE ESCAPE

SIDEWALK

ASPHALTIC CONCRETE PARKING

BELL SERVICE

#433 BANK STREET
COMMERCIAL
(APPLIANCES STORE)

BH 2
71.33
(66.91)

66.7
66.5
66.3
66.1
65.9
65.7
65.5
65.3
65.1

DIH HYDRO LINE

(0.305m/m)

SANITARY SEWER LATERAL

RIGHT-OF-WAY EASEMENT

BH 1
71.02
(65.81)

BH 3
71.09
(64.98)

HP

#417 BANK STREET
COMMERCIAL
(BOOK STORE)

#425 BANK STREET
COMMERCIAL
(RESTAURANT)

#429 BANK STREET
COMMERCIAL
(TATTOO PARLOUR)

#431 BANK STREET
COMMERCIAL
(WATCH STORE)

LEGEND:

- BOREHOLE WITH MONITORING WELL INSTALLED LOCATION
- 71.09 — GROUND SURFACE ELEVATION (m)
- (65.81) — GROUNDWATER SURFACE ELEVATION (m)
- 65.1 — GROUNDWATER CONTOUR
- APPROX. GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)

BM - TOP SPINDLE OF FIRE HYDRANT LOCATED ON THE NORTHEAST CORNER OF FRANK STREET AT BANK STREET. THE GEODETIC ELEVATION OF THE BENCHMARK IS 72.05 m, PROVIDED BY ASL.

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OTTAWA, ONTARIO

Title:

GROUNDWATER CONTOUR PLAN

Scale: 1:100	Date: 12/2017
Drawn by: RCG	Report No.: PE4140-1
Checked by: KM	Dwg. No.: PE4140-6
Approved by: MSD	Revision No.: 0

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BH1-SS1 (0.2-0.6m) - Nov.10, 2017

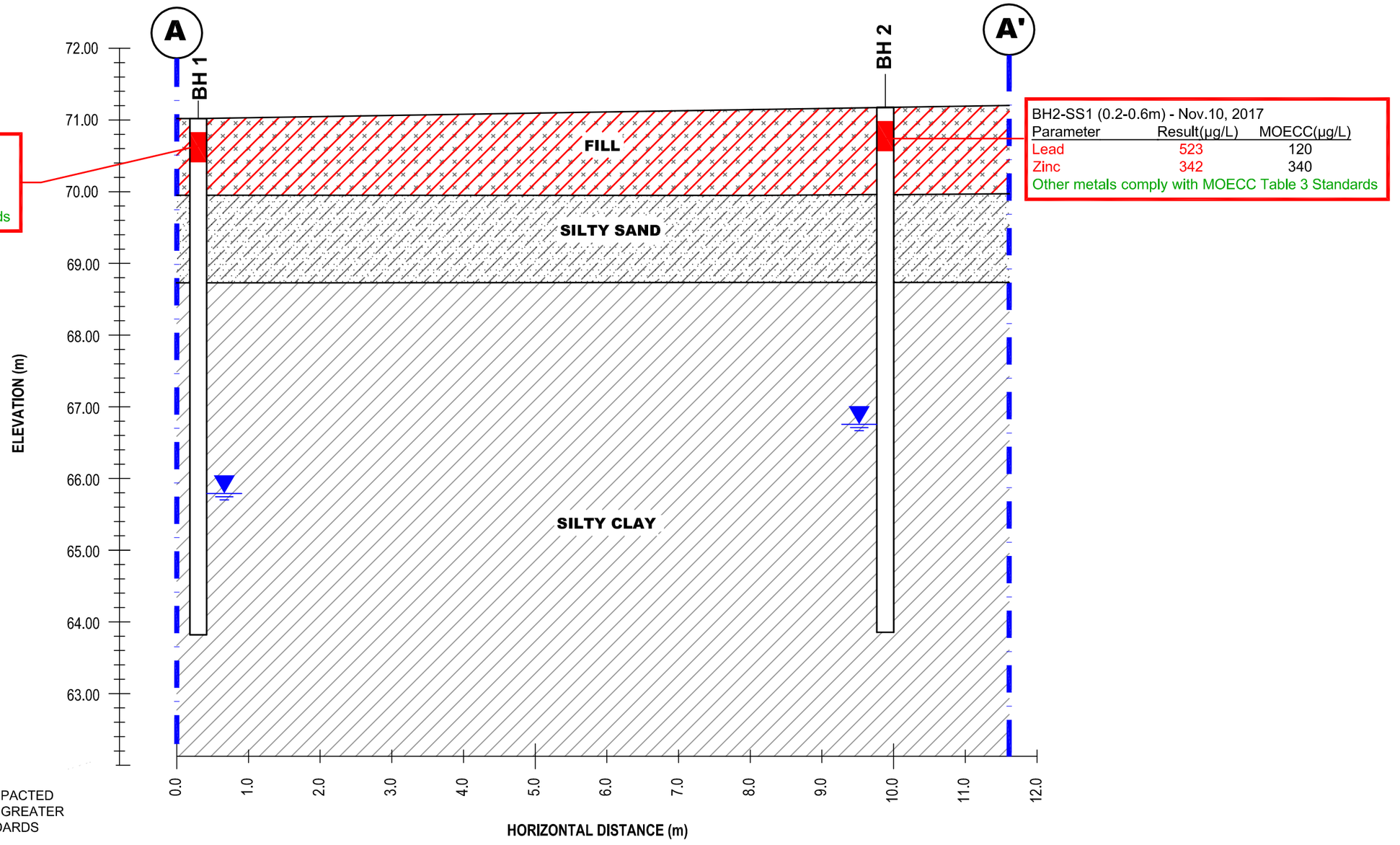
Parameter	Result(µg/L)	MOECC(µg/L)
Lead	369	120
Zinc	577	340

Other metals comply with MOECC Table 3 Standards

BH2-SS1 (0.2-0.6m) - Nov.10, 2017

Parameter	Result(µg/L)	MOECC(µg/L)
Lead	523	120
Zinc	342	340

Other metals comply with MOECC Table 3 Standards



LEGEND:

APPROXIMATE EXTENT OF FILL IMPACTED WITH METALS CONCENTRATIONS GREATER THAN THE MOECC TABLE 3 STANDARDS

SOIL RESULT IS IN COMPLIANCE WITH MOECC TABLE 3 STANDARDS

SOIL RESULT EXCEEDS MOECC TABLE 3 STANDARDS

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384 FRANK STREET INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
384 FRANK STREET

OTTAWA, ONTARIO

Title:

CROSS SECTION A-A' - SOIL (METALS)

Scale: AS SHOWN	Date: 12/2017
Drawn by: RCG	Report No.: PE4140-2
Checked by: KM	Dwg. No.: PE4140-7A
Approved by: MSD	Revision No.: 0

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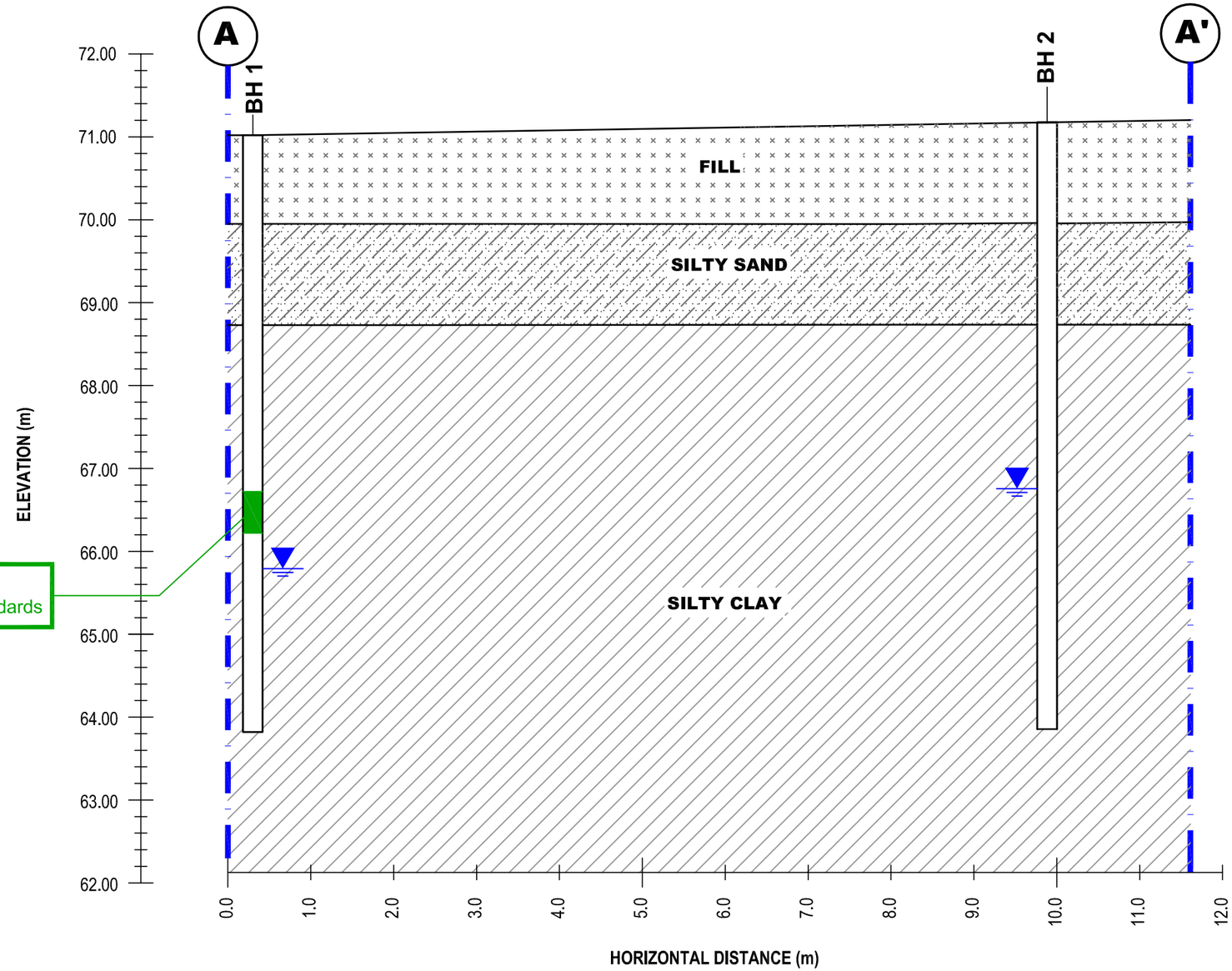

LEGEND:

SOIL RESULT IS IN COMPLIANCE WITH MOECC TABLE 3 STANDARDS

SOIL RESULT EXCEEDS MOECC TABLE 3 STANDARDS

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384 FRANK STREET INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
384 FRANK STREET

OTTAWA, ONTARIO

Title:

CROSS SECTION A-A' - SOIL (VOCs)

Scale: AS SHOWN	Date: 12/2017
Drawn by: RCG	Report No.: PE4140-2
Checked by: KM	Dwg. No.: PE4140-7B
Approved by: MSD	Revision No.: 0

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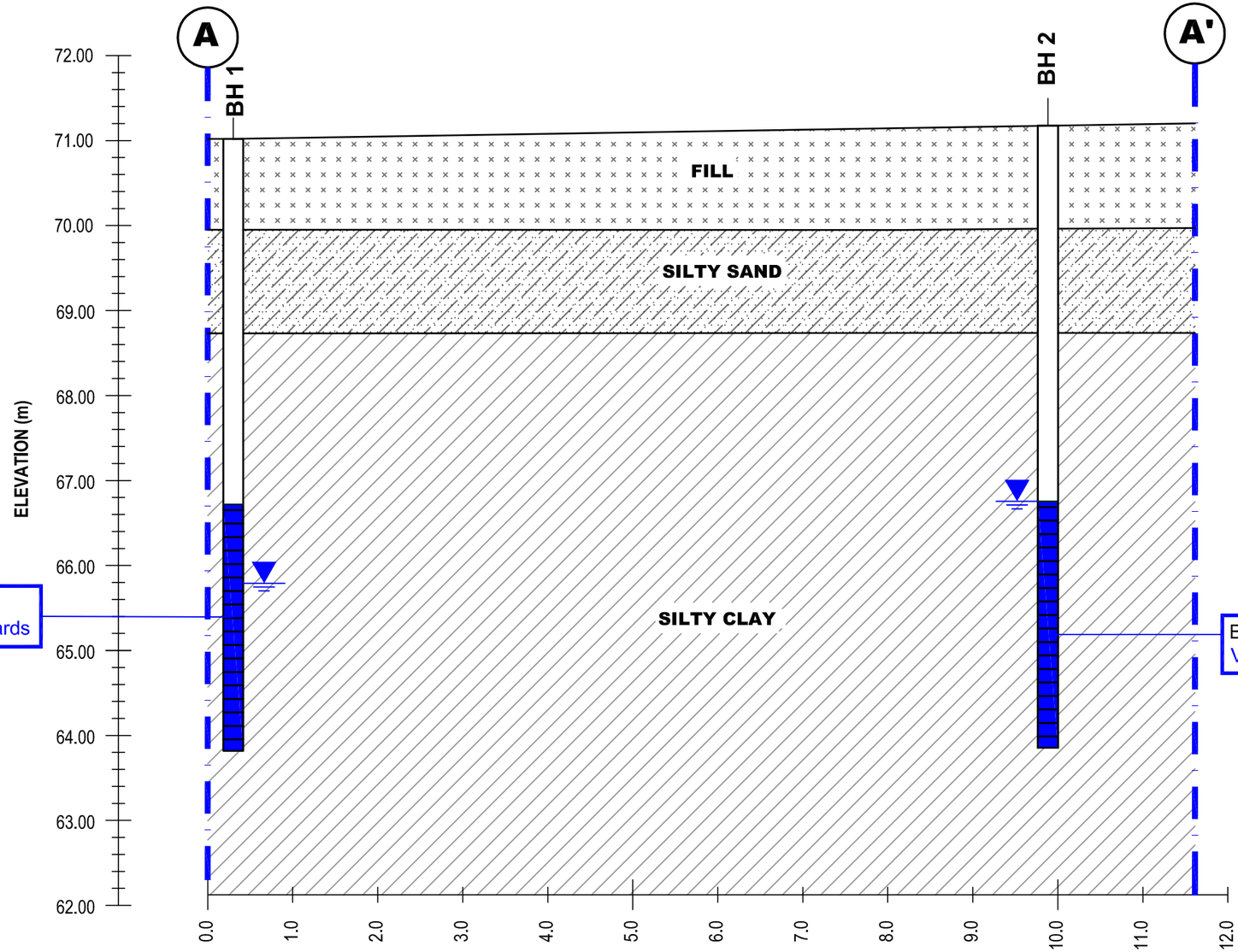

LEGEND:

GROUNDWATER RESULT IS IN COMPLIANCE WITH MOECC TABLE 3 STANDARDS

GROUNDWATER RESULT EXCEEDS MOECC TABLE 3 STANDARDS

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Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
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384 FRANK STREET INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
384 FRANK STREET

OTTAWA, ONTARIO

Title: **CROSS SECTION A-A' - GROUNDWATER**

Scale: AS SHOWN	Date: 12/2017
Drawn by: RCG	Report No.: PE4140-2
Checked by: KM	Dwg. No.: PE4140-7C
Approved by: MSD	Revision No.: 0

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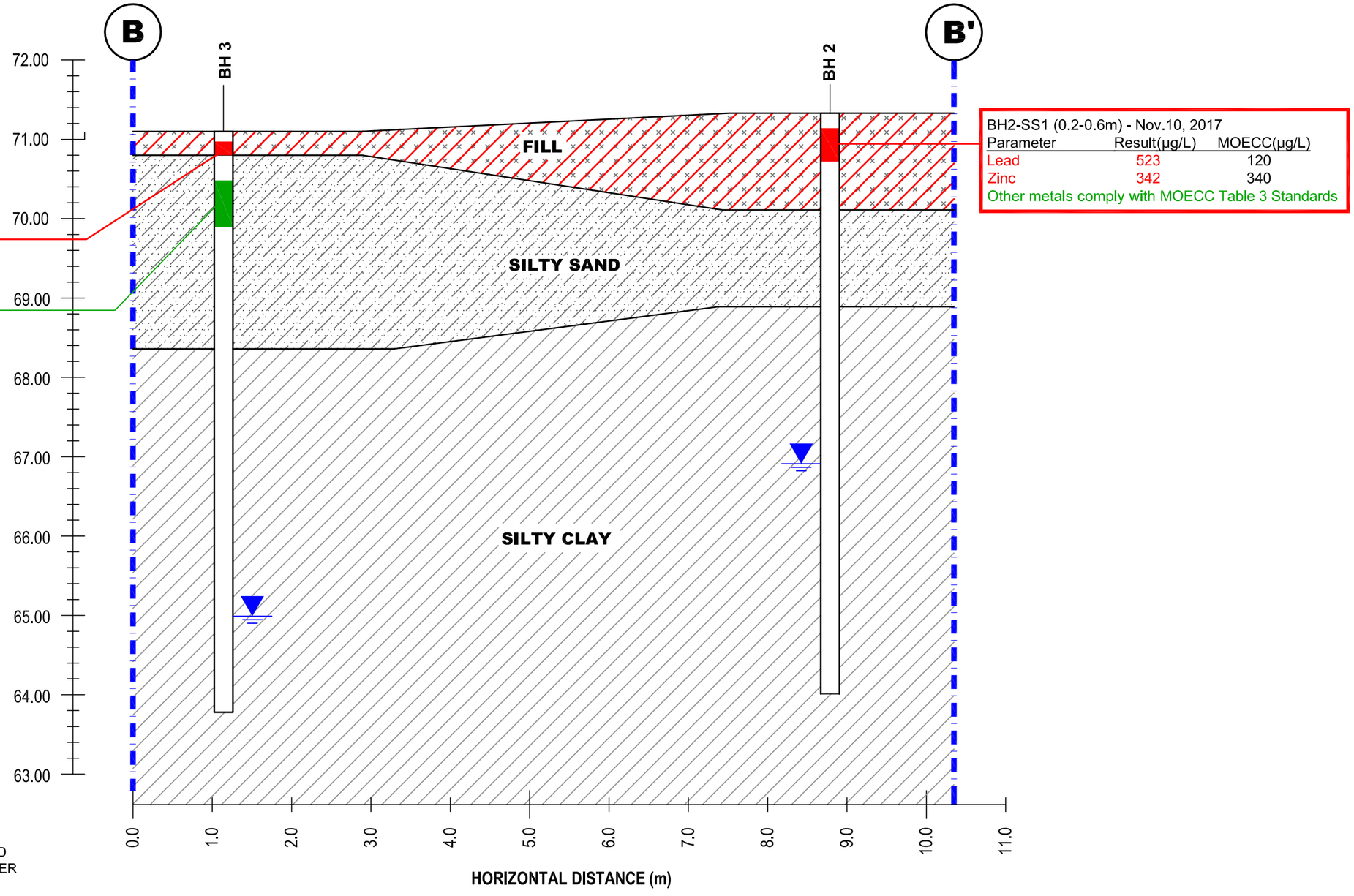

BH3-SS1 (0.2-0.3m) - Nov.10, 2017

Parameter	Result (µg/L)	Standard(µg/L)
Lead	373	120

Other metals comply with MOECC Table 3 Standards

BH3-SS2 (0.6-1.2m) - Nov.17, 2017
Metals comply with MOECC Table 3 Standards

BH2-SS1 (0.2-0.6m) - Nov.10, 2017

Parameter	Result(µg/L)	MOECC(µg/L)
Lead	523	120
Zinc	342	340

Other metals comply with MOECC Table 3 Standards

LEGEND:

APPROXIMATE EXTENT OF FILL IMPACTED WITH METALS CONCENTRATIONS GREATER THAN THE MOECC TABLE 3 STANDARDS

SOIL RESULT IS IN COMPLIANCE WITH MOECC TABLE 3 STANDARDS

SOIL RESULT EXCEEDS MOECC TABLE 3 STANDARDS

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NO.	REVISIONS	DATE	INITIAL
0			

384 FRANK STREET INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
384 FRANK STREET

OTTAWA, ONTARIO

Title:

CROSS SECTION B-B' - SOIL (METALS)

Scale: AS SHOWN	Date: 12/2017
Drawn by: RCG	Report No.: PE4140-2
Checked by: KM	Dwg. No.: PE4140-8A
Approved by: MSD	Revision No.: 0

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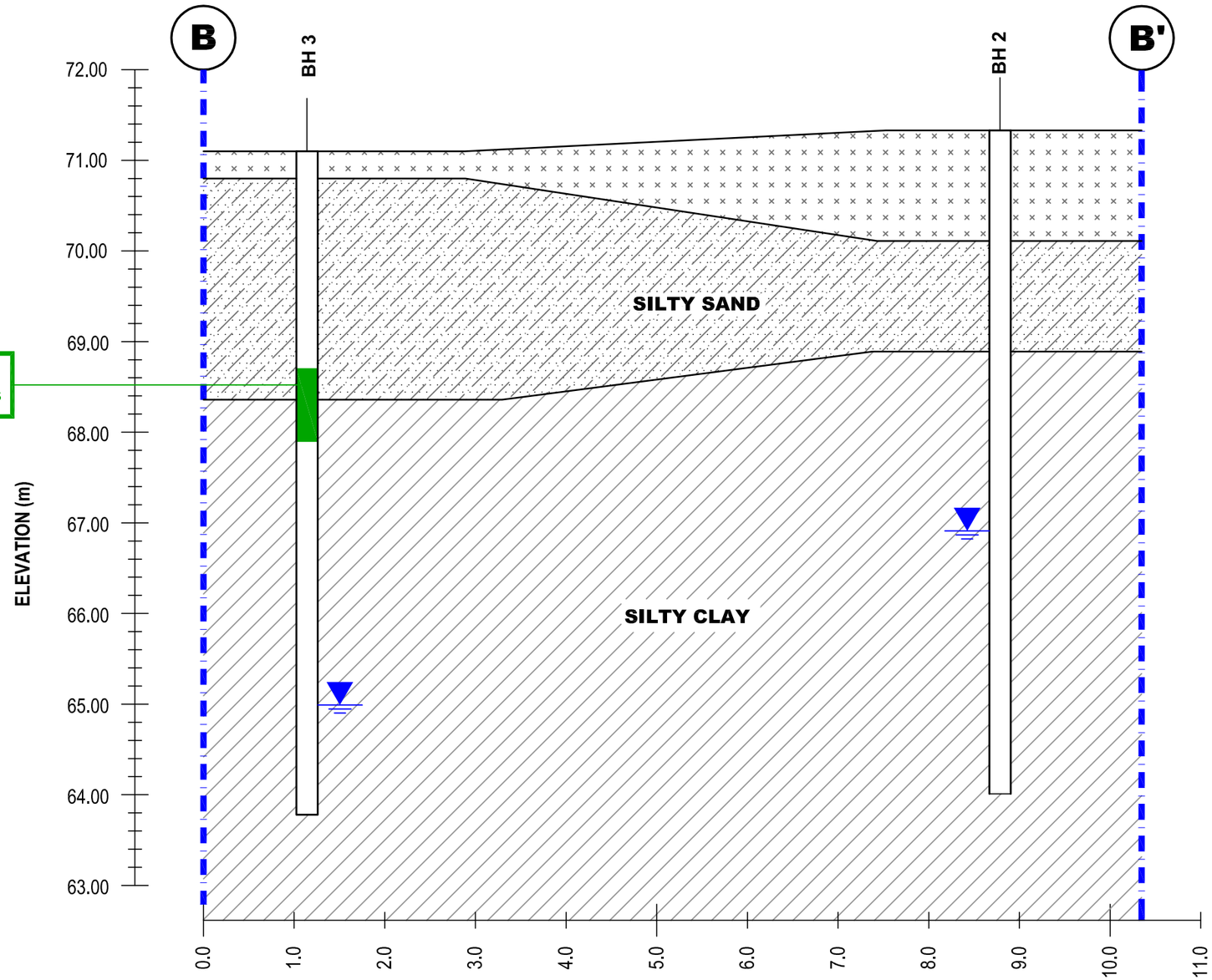

BH3-SS5 (2.4-3.2m) - Nov.10, 2017
VOCs comply with MOECC Table 3 Standards

LEGEND:

SOIL RESULT IS IN COMPLIANCE WITH MOECC TABLE 3 STANDARDS

SOIL RESULT EXCEEDS MOECC TABLE 3 STANDARDS

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NO.	REVISIONS	DATE	INITIAL
0			

384 FRANK STREET INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
384 FRANK STREET

OTTAWA, ONTARIO

Title: **CROSS SECTION B-B' - SOIL (BTEX,VOCs & PHCs)**

Scale: AS SHOWN	Date: 12/2017
Drawn by: RCG	Report No.: PE4140-2
Checked by: KM	Dwg. No.: PE4140-8B
Approved by: MSD	Revision No.: 0

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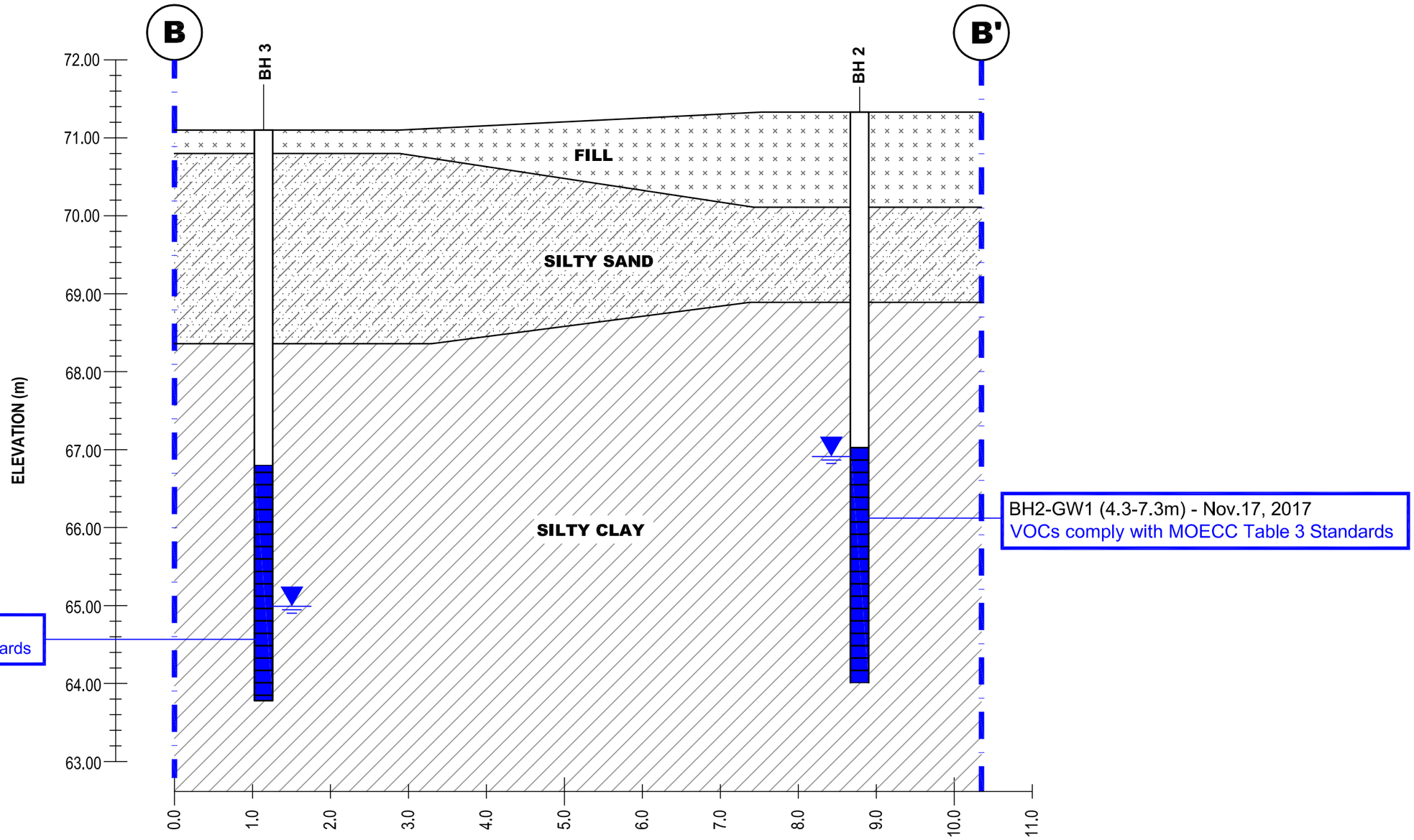

LEGEND:

GROUNDWATER RESULT IS IN COMPLIANCE WITH MOECC TABLE 3 STANDARDS

GROUNDWATER RESULT EXCEEDS MOECC TABLE 3 STANDARDS

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NO.	REVISIONS	DATE	INITIAL
0			

384 FRANK STREET INC.

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
384 FRANK STREET

OTTAWA, ONTARIO

Title:

CROSS SECTION B-B' - GROUNDWATER

Scale: AS SHOWN	Date: 12/2017
Drawn by: RCG	Report No.: PE4140-2
Checked by: KM	Dwg. No.: PE4140-8C
Approved by: MSD	Revision No.: 0

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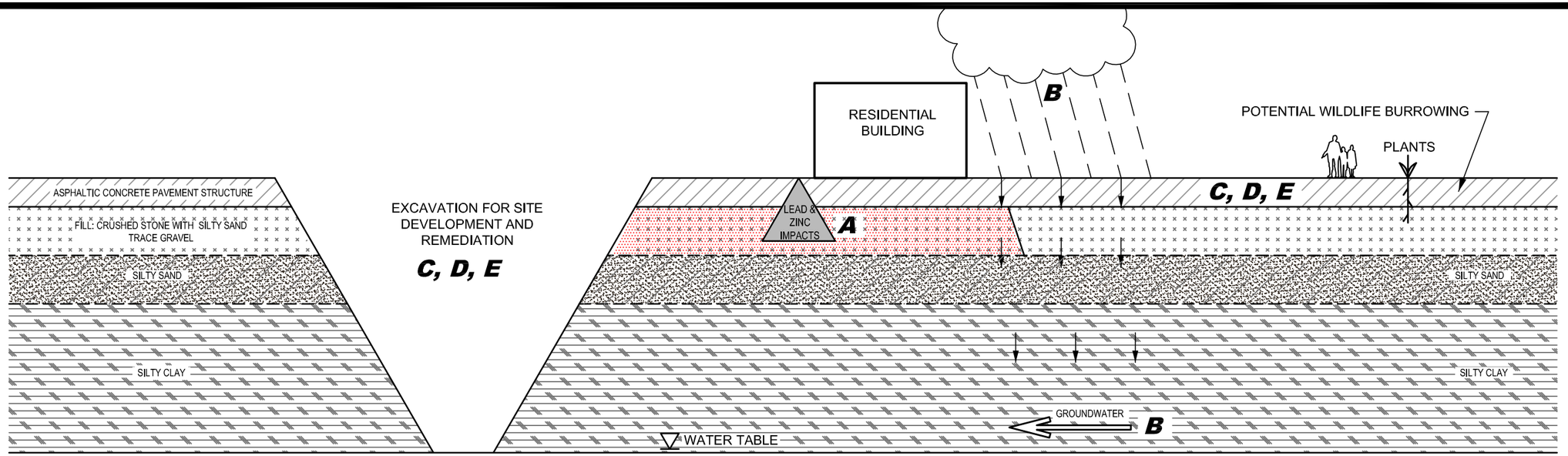

A CONTAMINANT RELEASE MECHANISMS

Fill material impacted with lead and zinc concentrations exceeding MOECC Table 3 standards, was identifed on the Phase II Property. Metals are considered to have been directly deposited on site through historical in-filling

B CONTAMINANT TRANSPORT PATHWAYS

PHYSICAL TRANSPORT - A potential contaminant transport pathway is the physical transport from one location to another of contamined soil, either intentionally or unintentionally, by earth moving equipment, vehicle traffic, or pedestrian traffic. Based on observations during the Phase I and Phase II ESA, physical transport of contaminants on the Phase II Property is considered to be negligible.
PRECIPITATION/INFILTRATION/LEACHING - Due to the Phase II Property having been covered largely by asphlatic concrete or a building structure, precipitation and infiltration are not considered to have significantly contributed to the migration of the identified parameters beneath the subject land. Based on the findings of the Phase II ESA, the impacts are not considered to have migrated beyond the fill material.
DIFFUSION AND DISPERSION - Upon entering the groundwater table, contaminants will move from an area of greater concentration toward an area where it is less concentrated as long as a concentration gradient exists (diffusion). When groundwater travels through bedrock it moves at different velocities resulting in mixing and dilution of the contamination at the advancing edge of flow (dispersion). These processes are not considered to have contributed to contaminant migration; as the groundwater beneath the Phase II Property was determined to be in compliance with the MOECC Table 3 standards for VOCs. Based on their low solubility in combination with the depth of the water table, well beneath the fill material, the potential for migration of metals is considered negligible.

C HUMAN AND ECOLOGICAL RECEPTORS

HUMAN RECEPTORS - The subject site is open to the general public, it is covered by a building structure and asphalt, which greatly reduces the chances for humans to act as receptors. Potential human receptors are limited to construction workers and environmental professionals who may contact the soil during site remediation or redevelopment.
ECOLOGICAL RECEPTORS - Traditionally ecological receptors include plants and wildlife which may come into contact with the contaminated soil. Given the location of the subject site in a built-up area, there are limited ecological receptors in the general vicinity of the site.

D RECEPTOR EXPOSURE POINTS

HUMAN RECEPTORS - Exposure points for humans consist of remedial excavation or excavation for redevelopment.
ECOLOGICAL RECEPTORS - Given the location of the subject site in a built-up area, there are limited ecological receptor points in the general vicinity of the site.

E ROUTES OF EXPOSURE

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

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NO.	REVISIONS	DATE	INITIAL
0			

384 FRANK STREET INC.
PHASE II - ENVIRONMENTAL SITE ASSESSMENT
384 FRANK STREET
OTTAWA, ONTARIO
Title: CONTAMINANT DISTRIBUTION DIAGRAM

Scale: N.T.S.	Date: 12/2017
Drawn by: RCG	Report No.: PE4140-2
Checked by: KM	Dwg. No.: PE4140-9
Approved by: MSD	Revision No.:

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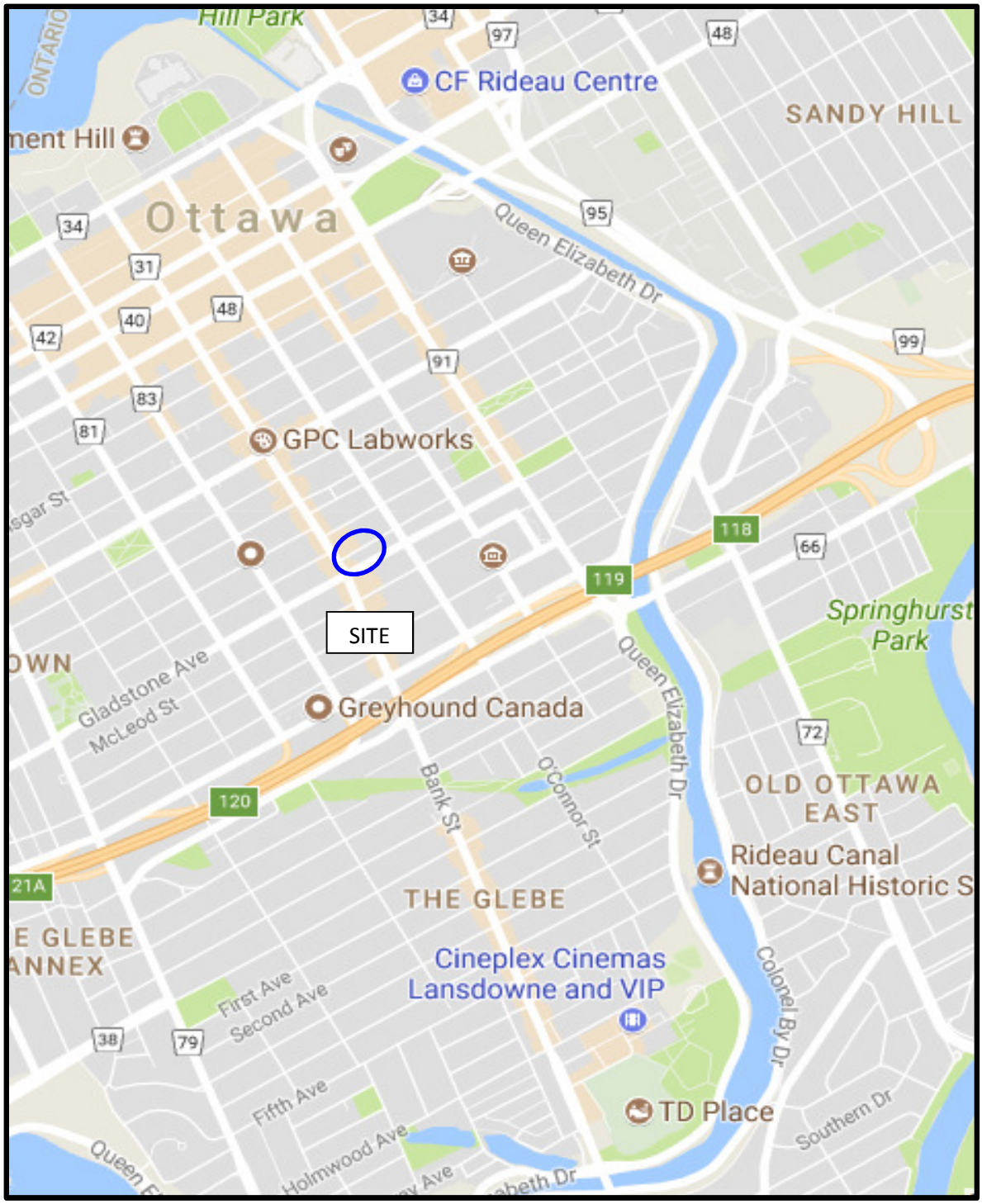

FIGURE 1

KEY PLAN

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

Paterson Group Inc.

Consulting Engineers
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patersongroup

Sampling & Analysis Plan

Phase II-Environmental Site Assessment,
384 Frank Street
Ottawa, Ontario

Prepared For

384 Frank Street Ltd.

November 6, 2017

Report: PE4140-SAP

Table of Contents

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by 384 Frank Street Inc., to conduct a Phase II-Environmental Site Assessment (ESA) for the property addressed 384 Frank Street, Ottawa, Ontario. Based on findings from the Phase I-ESA conducted by Paterson in November of 2017, a subsurface investigation, consisting of borehole drilling, was developed. It should be noted that the Phase II-ESA will be conducted in conjunction with a Geotechnical Investigation.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1	Located to address potential soil and groundwater impacts from the historical dry cleaner on the adjacent property to the west and to provide general coverage of the site for geotechnical purposes.	Intercept groundwater table for installation of monitoring well.
BH2	Located to provide triangulation to calculate groundwater flow direction and to provide general coverage of the site for geotechnical purposes.	Intercept groundwater table for installation of monitoring well.
BH3	Located to address potential soil and groundwater impacts from the historical dry cleaner on the adjacent property to the west and to provide general coverage of the site for geotechnical purposes.	Intercept groundwater table for installation of monitoring well.

Borehole locations are shown on the Test Hole Location Plan appended to the main report.

At each borehole, split-spoon samples of overburden soils will be obtained every 0.6 m per 0.8 m interval for the first 6.0 m, followed by 0.6 m per 1.5 m interval to the completion of the borehole. 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 3 of 4 boreholes (as above).

2.0 ANALYTICAL TESTING PROGRAM

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

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

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

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

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

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

Equipment

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

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

Determining Borehole Locations

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

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

Drilling Procedure

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

- ❒ Continuous split spoon samples (every 0.6 m or 2') or semi-continuous (every 0.76 m or 2'6") are required.
- ❒ Make sure samples are well sealed in plastic bags with no holes prior to screening and are kept cool but unfrozen.
- ❒ If sampling for VOCs, BTEX, or PHCs 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 phosphate free detergent to one bucket.
- ❒ Scrub spoons with brush in soapy water, inside and out, including tip.
- ❒ Rinse in 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

- ❒ 1.5 m x 50 mm threaded sections of Schedule 40 PVC slotted well screen (1.5 m x 31 mm if installing in cored hole in bedrock)
- ❒ 1.5 m x 50 mm threaded sections of Schedule 40 PVC riser pipe (1.5 m x 31 mm if installing in cored hole in bedrock)
- ❒ Threaded end-cap
- ❒ Slip-cap or J-plug
- ❒ Asphalt cold patch or concrete
- ❒ Silica Sand
- ❒ Bentonite chips (Holeplug)

- ❒ Steel flushmount casing

Procedure

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

3.3 Monitoring Well Sampling Procedure

Equipment

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

- ❒ pH/Temperature/Conductivity combo pen
- ❒ Laboratory-supplied sample bottles

Sampling Procedure

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

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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

- ❒ All non-dedicated sampling equipment (split spoons) will be decontaminated according to the SOPs listed above.

- ❒ All groundwater sampling equipment is dedicated (polyethylene and flexible peristaltic tubing is replaced for each well).

- ❒ Where groundwater samples are to be analyzed for VOCs, one laboratory-provided trip blank will be submitted for analysis with every laboratory submission.

- ❒ Approximately one (1) field duplicate will be submitted for every ten (10) samples submitted for laboratory analysis. A minimum of one (1) field duplicate per project will be submitted. Field duplicates will be submitted for soil and groundwater samples

- ❒ Where combo pens are used to measure field chemistry, they will be calibrated on an approximately monthly basis, according to frequency of use.

5.0 DATA QUALITY OBJECTIVES

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

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

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

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

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

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

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS TO SAMPLING & ANALYSIS PLAN

Physical impediments to the Sampling and Analysis plan may include:

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

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

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SOIL PROFILE AND TEST DATA

Environmental Investigation
384 Frank Street
Ottawa, Ontario

DATUM Top of spindle of the fire hydrant located at the northeast corner of Frank Street and Bank Street. Geodetic Elevation: 72.05 m

FILE NO. PE4140

REMARKS

HOLE NO. BH 1-17

BORINGS BY Geoprobe **DATE** 10 November 2017

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE								
ASPHALTIC CONCRETE	0.08						0	71.02
FILL: Crushed stone with silty sand	0.38		SS	1	39			
FILL: Dark brown silty sand, trace topsoil, gravel and brick fragments	1.07		SS	2	50	6	1	70.02
Compact, brown **SILTY SAND**	1.83		SS	3	50	10		
Compact, brown **SILTY SAND** trace gravel	2.29		SS	4	54	12	2	69.02
Stiff, brown **SILTY CLAY** -grey by 2.4m depth			SS	5	25	2		
			SS	6	100	P	3	68.02
			SS	7	100	P		
			SS	8	100	P	4	67.02
			SS	9	100	P		
			SS	10	67	P	5	66.02
			SS	11	100	P		
			SS	12	0	P	6	65.02
	7.32						7	64.02
End of Borehole								
(GWL @ 5.21m depth - Nov 17-2017)								

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

Environmental Investigation
384 Frank Street
Ottawa, Ontario

DATUM Top of spindle of the fire hydrant located at the northeast corner of Frank Street and Bank Street. Geodetic Elevation: 72.05 m

FILE NO. PE4140

REMARKS

HOLE NO. BH 2-17

BORINGS BY Geoprobe **DATE** 10 November 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: Volatile Organic Rdg. (ppm) / Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE									
ASPHALTIC CONCRETE 0.05						0	71.33		
FILL: Crushed stone with silty sand 0.23		SS	1	0	2				
FILL: Dark brown silty sand, trace gravel, clay and brick fragments 1.22		SS	2	8	5	1	70.33		
Loose, brown **SILTY SAND**		SS	3	17	4				
2.29		SS	4	38	4	2	69.33		
Brown**SILTY SAND** trace gravel 2.44		SS	5	100	2				
Stiff, grey **SILTY CLAY**		SS	6	33	P	3	68.33		
		SS	7	75	P	4	67.33		
		SS	8	83	P				
		SS	9	100	P	5	66.33		
		SS	10	100	P				
		SS	11	100	P	6	65.33		
		SS	12	100	P	7	64.33		
7.32									
Dynamic Cone Penetration Test commenced at 7.32m depth.						8	63.33		
						9	62.33		
						10	61.33		

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.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Environmental Investigation
384 Frank Street
Ottawa, Ontario

DATUM Top of spindle of the fire hydrant located at the northeast corner of Frank Street and Bank Street. Geodetic Elevation: 72.05 m

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REMARKS

HOLE NO. BH 2-17

BORINGS BY Geoprobe **DATE** 10 November 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector: Volatile Organic Rdg. (ppm) / Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE									
						10	61.33		
						11	60.33		
						12	59.33		
						13	58.33		
						14	57.33		
						15	56.33		
						16	55.33		
16.87									
End of Borehole Practical DCPT refusal at 16.87m depth (GWL @ 4.42m depth - Nov 17-2017)									

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.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Environmental Investigation
384 Frank Street
Ottawa, Ontario

DATUM Top of spindle of the fire hydrant located at the northeast corner of Frank Street and Bank Street. Geodetic Elevation: 72.05 m

FILE NO. PE4140

REMARKS

HOLE NO. BH 3-17

BORINGS BY Geoprobe **DATE** 10 November 2017

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Photo Ionization Detector ● Volatile Organic Rdg. (ppm) / ○ Lower Explosive Limit %	Monitoring Well Construction
GROUND SURFACE										
ASPHALTIC CONCRETE	0.08									
FILL: Dark brown silty sand and gravel	0.30		SS	1	6	4				
Loose, brown **SILTY SAND**			SS	2	8	4	1	70.09		
			SS	3	50	6				
	1.83						2	69.09		
Loose, brown **SILTY SAND**, trace gravel	2.44		SS	4	8	9				
Loose, brown **SILTY SAND**	2.74		SS	5	54	4				
Stiff, grey **SILTY CLAY**							3	68.09		
			SS	6	100	P				
			SS	7	100	P	4	67.09		
			SS	8	100	P				
			SS	9	100	P	5	66.09		
			SS	10	100	P				
			SS	11	100	P	6	65.09		
			SS	12	100	P	7	64.09		
	7.32									
End of Borehole										
(GWL @ 6.11m depth-Nov 17-2017)										

Photo Ionization Detector: ○ Lower Explosive Limit % — 20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

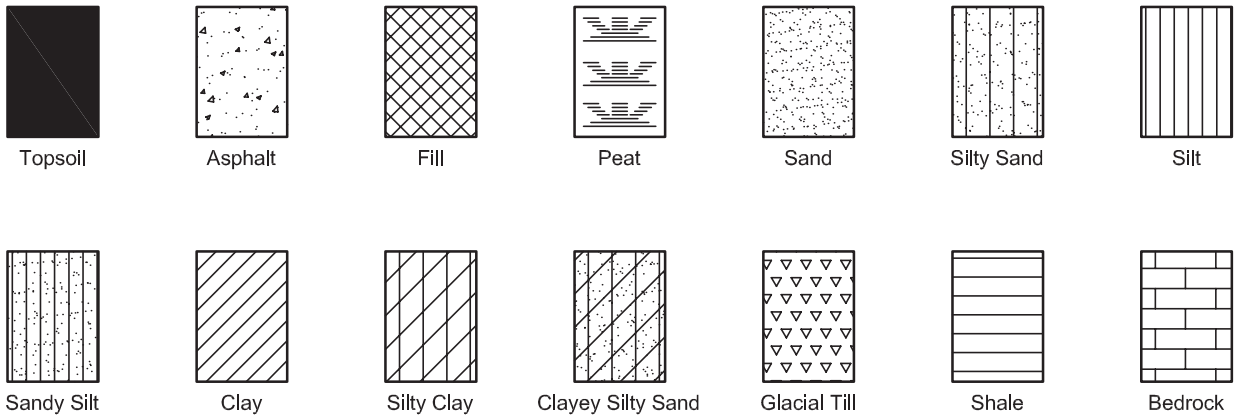
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

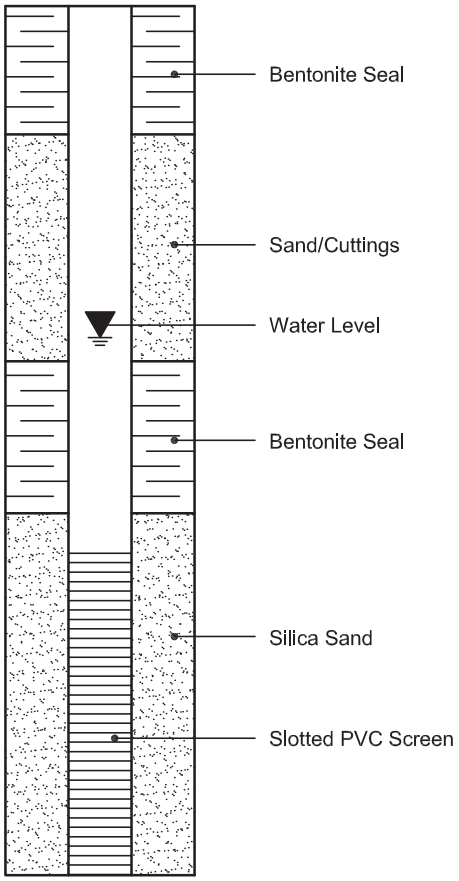
SYMBOLS AND TERMS (continued)

STRATA PLOT

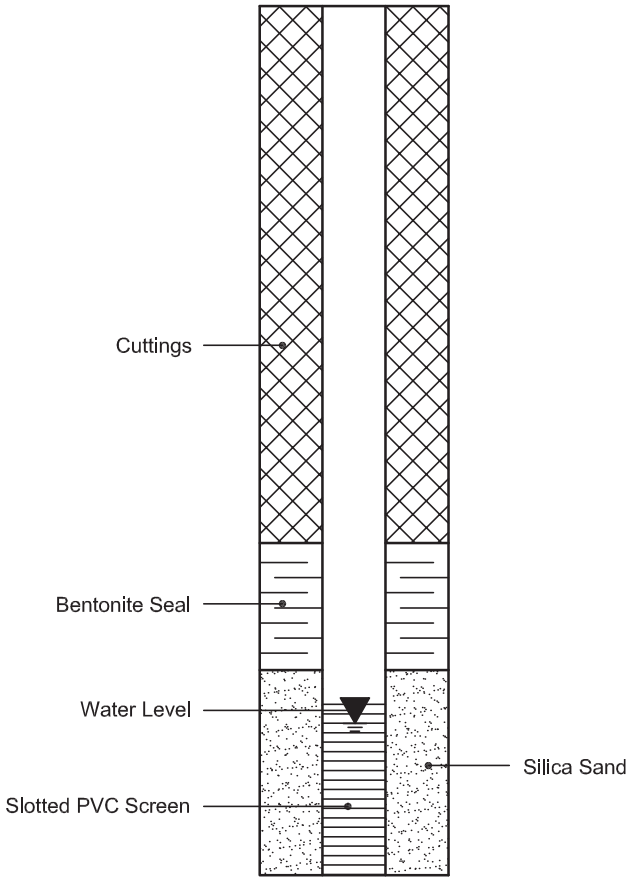


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 23105
Project: PE4140
Custody: 114208

Report Date: 20-Nov-2017
Order Date: 14-Nov-2017

Order #: 1746241

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

Paracel ID	Client ID
1746241-01	BH1-SS8
1746241-02	BH3-SS5
1746241-03	BH3-SS1

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23105

Report Date: 20-Nov-2017
Order Date: 14-Nov-2017
Project Description: PE4140

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
REG 153: Metals by ICP/OES, soil	based on MOE E3470, ICP-OES	17-Nov-17	17-Nov-17
REG 153: VOCs by P&T GC/MS	EPA 8260 - P&T GC-MS	17-Nov-17	18-Nov-17
Solids, %	Gravimetric, calculation	15-Nov-17	16-Nov-17

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 23105

Report Date: 20-Nov-2017

Order Date: 14-Nov-2017

Project Description: PE4140

	Client ID:	BH1-SS8	BH3-SS5	BH3-SS1	-
	Sample Date:	10-Nov-17	10-Nov-17	10-Nov-17	-
	Sample ID:	1746241-01	1746241-02	1746241-03	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	60.4	61.8	89.4	-
Metals					
Antimony	1.0 ug/g dry	-	-	<1.0	-
Arsenic	1.0 ug/g dry	-	-	8.1	-
Barium	1.0 ug/g dry	-	-	214	-
Beryllium	1.0 ug/g dry	-	-	<1.0	-
Boron	1.0 ug/g dry	-	-	8.1	-
Cadmium	0.5 ug/g dry	-	-	<0.5	-
Chromium	1.0 ug/g dry	-	-	24.3	-
Cobalt	1.0 ug/g dry	-	-	6.4	-
Copper	1.0 ug/g dry	-	-	51.4	-
Lead	1.0 ug/g dry	-	-	373	-
Molybdenum	1.0 ug/g dry	-	-	1.0	-
Nickel	1.0 ug/g dry	-	-	17.1	-
Selenium	1.0 ug/g dry	-	-	<1.0	-
Silver	0.5 ug/g dry	-	-	<0.5	-
Thallium	1.0 ug/g dry	-	-	<1.0	-
Uranium	1.0 ug/g dry	-	-	<1.0	-
Vanadium	1.0 ug/g dry	-	-	27.6	-
Zinc	1.0 ug/g dry	-	-	246	-
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

Client: Paterson Group Consulting Engineers

Client PO: 23105

Report Date: 20-Nov-2017

Order Date: 14-Nov-2017

Project Description: PE4140

	Client ID:	BH1-SS8	BH3-SS5	BH3-SS1	-
	Sample Date:	10-Nov-17	10-Nov-17	10-Nov-17	-
	Sample ID:	1746241-01	1746241-02	1746241-03	-
	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 (dibromoethan	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	95.3%	95.5%	-	-
Dibromofluoromethane	Surrogate	107%	118%	-	-
Toluene-d8	Surrogate	101%	95.1%	-	-

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23105

Report Date: 20-Nov-2017
Order Date: 14-Nov-2017
Project Description: PE4140

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	1.0	ug/g						
Boron	ND	1.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium	ND	1.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	1.0	ug/g						
Lead	ND	1.0	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	1.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.5	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	1.0	ug/g						
Zinc	ND	1.0	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	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						

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23105

Report Date: 20-Nov-2017
Order Date: 14-Nov-2017
Project Description: PE4140

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	*3.13*		*ug/g*		*97.7*	*50-140*			
Surrogate: Dibromofluoromethane	*3.78*		*ug/g*		*118*	*50-140*			
Surrogate: Toluene-d8	*3.48*		*ug/g*		*109*	*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				30	
Arsenic	4.56	1.0	ug/g dry	5.58			20.2	30	
Barium	95.8	1.0	ug/g dry	102			6.3	30	
Beryllium	ND	1.0	ug/g dry	ND			0.0	30	
Boron	10.6	1.0	ug/g dry	11.4			7.9	30	
Cadmium	ND	0.5	ug/g dry	ND			0.0	30	
Chromium	21.4	1.0	ug/g dry	22.7			6.0	30	
Cobalt	10.4	1.0	ug/g dry	11.0			5.4	30	
Copper	20.9	1.0	ug/g dry	22.3			6.3	30	
Lead	13.1	1.0	ug/g dry	14.5			10.0	30	
Molybdenum	ND	1.0	ug/g dry	ND			0.0	30	
Nickel	21.5	1.0	ug/g dry	23.0			6.4	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	ND	0.5	ug/g dry	ND			0.0	30	
Thallium	ND	1.0	ug/g dry	ND			0.0	30	
Uranium	ND	1.0	ug/g dry	ND				30	
Vanadium	32.2	1.0	ug/g dry	34.2			6.2	30	
Zinc	52.9	1.0	ug/g dry	52.7			0.5	30	
Physical Characteristics									
% Solids	86.3	0.1	% by Wt.	86.8			0.6	25	
Volatiles									
Acetone	ND	0.50	ug/g dry	ND				50	
Benzene	ND	0.02	ug/g dry	ND				50	
Bromodichloromethane	ND	0.05	ug/g dry	ND				50	
Bromoform	ND	0.05	ug/g dry	ND				50	
Bromomethane	ND	0.05	ug/g dry	ND				50	
Carbon Tetrachloride	ND	0.05	ug/g dry	ND				50	
Chlorobenzene	ND	0.05	ug/g dry	ND				50	
Chloroform	ND	0.05	ug/g dry	ND				50	
Dibromochloromethane	ND	0.05	ug/g dry	ND				50	
Dichlorodifluoromethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,3-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,4-Dichlorobenzene	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,2-Dichloroethane	ND	0.05	ug/g dry	ND				50	
1,1-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
cis-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
trans-1,2-Dichloroethylene	ND	0.05	ug/g dry	ND				50	
1,2-Dichloropropane	ND	0.05	ug/g dry	ND				50	
cis-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
trans-1,3-Dichloropropylene	ND	0.05	ug/g dry	ND				50	
Ethylbenzene	ND	0.05	ug/g dry	ND			0.0	50	
Ethylene dibromide (dibromoethane	ND	0.05	ug/g dry	ND				50	
Hexane	ND	0.05	ug/g dry	ND				50	
Methyl Ethyl Ketone (2-Butanone)	ND	0.50	ug/g dry	ND				50	
Methyl Isobutyl Ketone	ND	0.50	ug/g dry	ND				50	
Methyl tert-butyl ether	ND	0.05	ug/g dry	ND				50	
Methylene Chloride	ND	0.05	ug/g dry	ND				50	
Styrene	ND	0.05	ug/g dry	ND				50	
1,1,1,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2,2-Tetrachloroethane	ND	0.05	ug/g dry	ND				50	
Tetrachloroethylene	ND	0.05	ug/g dry	ND				50	
Toluene	ND	0.05	ug/g dry	ND			0.0	50	
1,1,1-Trichloroethane	ND	0.05	ug/g dry	ND				50	
1,1,2-Trichloroethane	ND	0.05	ug/g dry	ND				50	
Trichloroethylene	ND	0.05	ug/g dry	ND				50	

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				50	
Vinyl chloride	ND	0.02	ug/g dry	ND				50	
m,p-Xylenes	ND	0.05	ug/g dry	0.061			0.0	50	
o-Xylene	ND	0.05	ug/g dry	ND			0.0	50	
Surrogate: 4-Bromofluorobenzene	*3.73*		*ug/g dry*		*95.2*	*50-140*			
Surrogate: Dibromofluoromethane	*4.53*		*ug/g dry*		*116*	*50-140*			
Surrogate: Toluene-d8	*3.96*		*ug/g dry*		*101*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	301		ug/L	ND	120	70-130			
Arsenic	355		ug/L	112	97.4	70-130			
Barium	2230		ug/L	2040	74.6	70-130			
Beryllium	248		ug/L	5.75	96.7	70-130			
Boron	470		ug/L	229	96.5	70-130			
Cadmium	236		ug/L	ND	94.3	70-130			
Chromium	662		ug/L	454	83.0	70-130			
Cobalt	437		ug/L	221	86.7	70-130			
Copper	682		ug/L	446	94.4	70-130			
Lead	489		ug/L	290	79.8	70-130			
Molybdenum	230		ug/L	9.27	88.2	70-130			
Nickel	658		ug/L	459	79.5	70-130			
Selenium	213		ug/L	19.0	77.6	70-130			
Silver	233		ug/L	ND	93.0	70-130			
Thallium	206		ug/L	ND	82.3	70-130			
Uranium	323		ug/L	ND	129	70-130			
Vanadium	902		ug/L	684	87.1	70-130			
Zinc	219		ug/L		87.7	70-130			
Volatiles									
Acetone	6.75	0.50	ug/g		67.5	50-140			
Benzene	3.26	0.02	ug/g		81.4	60-130			
Bromodichloromethane	4.57	0.05	ug/g		114	60-130			
Bromoform	4.95	0.05	ug/g		124	60-130			
Bromomethane	4.93	0.05	ug/g		123	50-140			
Carbon Tetrachloride	4.26	0.05	ug/g		106	60-130			
Chlorobenzene	3.14	0.05	ug/g		78.5	60-130			
Chloroform	4.36	0.05	ug/g		109	60-130			
Dibromochloromethane	4.19	0.05	ug/g		105	60-130			
Dichlorodifluoromethane	3.87	0.05	ug/g		96.8	50-140			
1,2-Dichlorobenzene	3.19	0.05	ug/g		79.8	60-130			
1,3-Dichlorobenzene	3.39	0.05	ug/g		84.8	60-130			
1,4-Dichlorobenzene	3.14	0.05	ug/g		78.4	60-130			
1,1-Dichloroethane	3.73	0.05	ug/g		93.2	60-130			
1,2-Dichloroethane	3.65	0.05	ug/g		91.3	60-130			
1,1-Dichloroethylene	4.18	0.05	ug/g		105	60-130			
cis-1,2-Dichloroethylene	2.95	0.05	ug/g		73.7	60-130			
trans-1,2-Dichloroethylene	3.50	0.05	ug/g		87.5	60-130			
1,2-Dichloropropane	3.02	0.05	ug/g		75.5	60-130			
cis-1,3-Dichloropropylene	3.68	0.05	ug/g		92.1	60-130			
trans-1,3-Dichloropropylene	5.03	0.05	ug/g		126	60-130			
Ethylbenzene	2.98	0.05	ug/g		74.4	60-130			
Ethylene dibromide (dibromoethane	3.15	0.05	ug/g		78.8	60-130			
Hexane	3.83	0.05	ug/g		95.8	60-130			
Methyl Ethyl Ketone (2-Butanone)	12.3	0.50	ug/g		123	50-140			
Methyl Isobutyl Ketone	7.11	0.50	ug/g		71.1	50-140			
Methyl tert-butyl ether	10.1	0.05	ug/g		101	50-140			
Methylene Chloride	3.54	0.05	ug/g		88.5	60-130			
Styrene	2.88	0.05	ug/g		71.9	60-130			
1,1,1,2-Tetrachloroethane	3.75	0.05	ug/g		93.8	60-130			
1,1,2,2-Tetrachloroethane	2.91	0.05	ug/g		72.7	60-130			
Tetrachloroethylene	3.10	0.05	ug/g		77.6	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Toluene	2.98	0.05	ug/g		74.4	60-130			
1,1,1-Trichloroethane	4.72	0.05	ug/g		118	60-130			
1,1,2-Trichloroethane	3.79	0.05	ug/g		94.6	60-130			
Trichloroethylene	2.78	0.05	ug/g		69.6	60-130			
Trichlorofluoromethane	4.51	0.05	ug/g		113	50-140			
Vinyl chloride	3.73	0.02	ug/g		93.3	50-140			
m,p-Xylenes	6.59	0.05	ug/g		82.4	60-130			
o-Xylene	3.32	0.05	ug/g		83.0	60-130			
Surrogate: 4-Bromofluorobenzene	*2.24*		*ug/g*		*69.9*	*50-140*			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

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Paracel ID: 1746241

Chain of Custody
(Lab Use Only)
№ 114208

Page of

Client Name: Paterson Group Inc.	Project Reference: PE4140	Turnaround Time:
Contact Name: Karyn Munch	Quote #	
Address: 154 Colonnade Rd S.	PO # 23105	☐ 1 Day ☐ 3 Day
Telephone: 613-226-7381	Email Address: kmunch@patersongroup.ca	☐ 2 Day ☒ Regular
		Date Required:

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

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

Required Analyses

Paracel Order Number: 1746241

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	PHC + BTEX + MTBE	VOCs	PAHs	Metals by ICP	Hg	CrVI	DOC		
1	BH1-SS8	S		2	Nov.10/17	9:00		✓						130 mL + 1 vial	
2	BH2-SS8 *	S		2	Nov.10/17	12:00								↓	
3	BH3-SS5	S		2	Nov.10/17	2:00		✓							
4	BH3-SS1 **	S		1	Nov.10/17	1:00				✓					
5															
6															
7															
8															
9															
10															

Analyses All on hold?

Comments:
*please hold. ** will send today (Nov. 14, 2017) w/ a copy of this CoC.

Method of Delivery: Paracel

Relinquished By (Sign): K Munch	Received by Driver/Depot: A Seguin	Received at Lab: SUNLEPORN 20K 2007	Verified By: MC
Relinquished By (Print): Karyn Munch	Date/Time: 13/11/17 3 10 PM	Date/Time: Nov 13, 2017 04:45	Date/Time: Nov 14/17 8:03
Date/Time: Nov. 13, 2017 1:30	Temperature: °C	Temperature: 18.9 °C	pH Verified ☐ By: N/A

SAMPLE #4 A Seguin 14/11/17 3:00 PM

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Paracel ID: 1746241

Chain of Custody (Lab Use Only)
Nº 114208

Page ___ of ___

Client Name: Paterson Group Inc.	Project Reference: PE4140	**Turnaround Time:**
Contact Name: Karyn Munch	Quote #	☐ 1 Day ☐ 3 Day
Address: 154 Colonnade Rd S.	PO # 23105	☐ 2 Day ☒ Regular
Telephone: 613-226-7381	Email Address: kmunch@patersongroup.ca	Date Required:

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

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

Required Analyses

Paracel Order Number: 1746241

	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-SS8	S		2	Nov.10/17	9:00											330mL+1vial			
2	BH2-SS8	S		2	Nov.10/17	12:00											↓			
3	BH3-SS5 *	S		2	Nov.10/17	2:00											↓			
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments: * please hold.

Method of Delivery: Paracel

Relinquished By (Sign): K Munch	Received by Driver/Depot: A Scott	Received at Lab: SUNEPORN	Verified By: MC
Relinquished By (Print): Karyn Munch	Date/Time: 13/11/17 3 10 PM	Date/Time: NOV13,2017 04.43	Date/Time: Nov 14/17 5:03
Date/Time: Nov.13,2017 1:30	Temperature: °C	Temperature: 18.5 °C	pH Verified [ ] By: N/A

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 23107
Project: P4140
Custody: 114211

Report Date: 28-Nov-2017
Order Date: 22-Nov-2017

Order #: 1747333

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

Paracel ID	Client ID
1747333-01	BH1-SS1
1747333-02	BH2-SS1
1747333-03	BH3-SS2

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 23107

Report Date: 28-Nov-2017
Order Date: 22-Nov-2017
Project Description: P4140

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
REG 153: Metals by ICP/OES, soil	based on MOE E3470, ICP-OES	28-Nov-17	28-Nov-17
Solids, %	Gravimetric, calculation	27-Nov-17	27-Nov-17

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 23107

Report Date: 28-Nov-2017

Order Date: 22-Nov-2017

Project Description: P4140

	Client ID:	BH1-SS1	BH2-SS1	BH3-SS2	-
	Sample Date:	10-Nov-17	10-Nov-17	10-Nov-17	-
	Sample ID:	1747333-01	1747333-02	1747333-03	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	87.3	87.3	93.3	-
Metals					
Antimony	1.0 ug/g dry	<1.0	<1.0	<1.0	-
Arsenic	1.0 ug/g dry	12.4	11.0	<1.0	-
Barium	1.0 ug/g dry	244	302	22.3	-
Beryllium	1.0 ug/g dry	<1.0	<1.0	<1.0	-
Boron	1.0 ug/g dry	7.9	8.3	1.7	-
Cadmium	0.5 ug/g dry	0.6	0.8	<0.5	-
Chromium	1.0 ug/g dry	20.5	30.6	13.1	-
Cobalt	1.0 ug/g dry	5.7	4.9	3.2	-
Copper	1.0 ug/g dry	55.9	56.9	5.3	-
Lead	1.0 ug/g dry	369	523	9.3	-
Molybdenum	1.0 ug/g dry	1.0	<1.0	<1.0	-
Nickel	1.0 ug/g dry	15.2	13.9	8.4	-
Selenium	1.0 ug/g dry	<1.0	<1.0	<1.0	-
Silver	0.5 ug/g dry	<0.5	<0.5	<0.5	-
Thallium	1.0 ug/g dry	<1.0	<1.0	<1.0	-
Uranium	1.0 ug/g dry	<1.0	<1.0	<1.0	-
Vanadium	1.0 ug/g dry	29.0	26.6	15.8	-
Zinc	1.0 ug/g dry	577	342	18.8	-

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	1.0	ug/g						
Boron	ND	1.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium	ND	1.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	1.0	ug/g						
Lead	ND	1.0	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	1.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.5	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	1.0	ug/g						
Zinc	ND	1.0	ug/g						

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				30	
Arsenic	13.0	1.0	ug/g dry	12.4			5.3	30	
Barium	268	1.0	ug/g dry	244			9.6	30	
Beryllium	ND	1.0	ug/g dry	ND			0.0	30	
Boron	8.55	1.0	ug/g dry	7.86			8.5	30	
Cadmium	0.74	0.5	ug/g dry	0.60			20.8	30	
Chromium	20.1	1.0	ug/g dry	20.5			1.9	30	
Cobalt	5.63	1.0	ug/g dry	5.65			0.5	30	
Copper	59.2	1.0	ug/g dry	55.9			5.7	30	
Lead	407	1.0	ug/g dry	369			10.0	30	
Molybdenum	1.25	1.0	ug/g dry	1.02			20.6	30	
Nickel	14.5	1.0	ug/g dry	15.2			4.9	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	ND	0.5	ug/g dry	ND			0.0	30	
Thallium	ND	1.0	ug/g dry	ND			0.0	30	
Uranium	ND	1.0	ug/g dry	ND				30	
Vanadium	29.3	1.0	ug/g dry	29.0			1.1	30	
Zinc	593	1.0	ug/g dry	577			2.8	30	
Physical Characteristics									
% Solids	89.2	0.1	% by Wt.	88.7			0.6	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Metals									
Antimony	301		ug/L	ND	120	70-130			
Arsenic	518		ug/L	247	108	70-130			
Barium	5070		ug/L	4880	78.3	70-130			
Beryllium	252		ug/L	4.65	98.8	70-130			
Boron	402		ug/L	157	97.9	70-130			
Cadmium	244		ug/L	11.9	93.0	70-130			
Chromium	623		ug/L	410	85.4	70-130			
Cobalt	334		ug/L	113	88.6	70-130			
Copper	1360		ug/L	1120	95.7	70-130			
Lead	228		ug/L		91.2	70-130			
Molybdenum	248		ug/L	20.3	91.0	70-130			
Nickel	514		ug/L	304	83.7	70-130			
Selenium	241		ug/L	ND	96.6	70-130			
Silver	199		ug/L	5.30	77.5	70-130			
Thallium	208		ug/L	7.42	80.4	70-130			
Uranium	323		ug/L	ND	129	70-130			
Vanadium	824		ug/L	579	97.9	70-130			
Zinc	214		ug/L		85.5	70-130			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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 ID: 1747333

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Page ___ of ___

Client Name: Paterson Group	Project Reference: PE4140
Contact Name: Kaya Munch	Quote #
Address: 154 Colonnade Rd. S.	PO # 23107
Telephone: 613-226-7381	Email Address: kmunch@patersongroup.ca

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

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

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

Required Analyses

Paracel Order Number: 1747333

	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-SS1	S		1	Nov. 10/17					✓							72 hr TAT			✓
2	BH2-SS1	S		1	↓					✓							↓			✓
3	BH3-SS2	S		1	↓					✓										
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): KMunch	Received by Driver/Depot: T Louise	Received at Lab: Summerside DOKMAI
Relinquished By (Print): KMunch	Date/Time: 22/11/17 4:00 PM	Date/Time: NOV 23, 2017 05:00
Date/Time: Nov. 22/17 2:45	Temperature:	Temperature: 3.2°

Verified By: Date/Time: Nov 23/17 5:00p

pH Verified [ ] By:

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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 22729
Project: PE4140
Custody: 114343

Report Date: 27-Nov-2017
Order Date: 20-Nov-2017

Order #: 1747084

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

Paracel ID	Client ID
1747084-01	BH1-GW1
1747084-02	BH2-GW1
1747084-03	BH3-GW1

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 22729

Report Date: 27-Nov-2017
Order Date: 20-Nov-2017
Project Description: PE4140

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	23-Nov-17	26-Nov-17

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 22729

Report Date: 27-Nov-2017

Order Date: 20-Nov-2017

Project Description: PE4140

	Client ID:	BH1-GW1	BH2-GW1	BH3-GW1	-
	Sample Date:	17-Nov-17	17-Nov-17	17-Nov-17	-
	Sample ID:	1747084-01	1747084-02	1747084-03	-
	MDL/Units	Water	Water	Water	-
Volatiles					
Acetone	5.0 ug/L	<5.0	68.8	<5.0	-
Benzene	0.5 ug/L	<0.5	<0.5	<0.5	-
Bromodichloromethane	0.5 ug/L	<0.5	<0.5	<0.5	-
Bromoform	0.5 ug/L	<0.5	<0.5	<0.5	-
Bromomethane	0.5 ug/L	<0.5	<0.5	<0.5	-
Carbon Tetrachloride	0.2 ug/L	<0.2	<0.2	<0.2	-
Chlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
Chloroform	0.5 ug/L	<0.5	<0.5	<0.5	-
Dibromochloromethane	0.5 ug/L	<0.5	<0.5	<0.5	-
Dichlorodifluoromethane	1.0 ug/L	<1.0	<1.0	<1.0	-
1,2-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,3-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,4-Dichlorobenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,1-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-
1,2-Dichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-
1,1-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	-
cis-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	-
trans-1,2-Dichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,2-Dichloropropane	0.5 ug/L	<0.5	<0.5	<0.5	-
cis-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5	-
trans-1,3-Dichloropropylene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,3-Dichloropropene, total	0.5 ug/L	<0.5	<0.5	<0.5	-
Ethylbenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
Ethylene dibromide (dibromoethan	0.2 ug/L	<0.2	<0.2	<0.2	-
Hexane	1.0 ug/L	<1.0	<1.0	<1.0	-
Methyl Ethyl Ketone (2-Butanone)	5.0 ug/L	<5.0	24.8	<5.0	-
Methyl Isobutyl Ketone	5.0 ug/L	<5.0	<5.0	<5.0	-
Methyl tert-butyl ether	2.0 ug/L	<2.0	<2.0	<2.0	-
Methylene Chloride	5.0 ug/L	<5.0	<5.0	<5.0	-
Styrene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,1,1,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-
1,1,2,2-Tetrachloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-
Tetrachloroethylene	0.5 ug/L	2.3	<0.5	<0.5	-
Toluene	0.5 ug/L	<0.5	<0.5	<0.5	-
1,1,1-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 22729

Report Date: 27-Nov-2017

Order Date: 20-Nov-2017

Project Description: PE4140

	Client ID:	BH1-GW1	BH2-GW1	BH3-GW1	-
	Sample Date:	17-Nov-17	17-Nov-17	17-Nov-17	-
	Sample ID:	1747084-01	1747084-02	1747084-03	-
	MDL/Units	Water	Water	Water	-
1,1,2-Trichloroethane	0.5 ug/L	<0.5	<0.5	<0.5	-
Trichloroethylene	0.5 ug/L	<0.5	<0.5	<0.5	-
Trichlorofluoromethane	1.0 ug/L	<1.0	<1.0	<1.0	-
Vinyl chloride	0.5 ug/L	<0.5	<0.5	<0.5	-
m,p-Xylenes	0.5 ug/L	<0.5	<0.5	<0.5	-
o-Xylene	0.5 ug/L	<0.5	<0.5	<0.5	-
Xylenes, total	0.5 ug/L	<0.5	<0.5	<0.5	-
4-Bromofluorobenzene	Surrogate	117%	114%	120%	-
Dibromofluoromethane	Surrogate	92.8%	93.8%	92.5%	-
Toluene-d8	Surrogate	87.8%	86.7%	87.7%	-

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	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	*97.3*		*ug/L*		*122*	*50-140*			
Surrogate: Dibromofluoromethane	*75.9*		*ug/L*		*94.9*	*50-140*			
Surrogate: Toluene-d8	*70.9*		*ug/L*		*88.6*	*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				30	
Benzene	ND	0.5	ug/L	ND				30	
Bromodichloromethane	ND	0.5	ug/L	ND				30	
Bromoform	ND	0.5	ug/L	ND				30	
Bromomethane	ND	0.5	ug/L	ND				30	
Carbon Tetrachloride	ND	0.2	ug/L	ND				30	
Chlorobenzene	ND	0.5	ug/L	ND				30	
Chloroform	ND	0.5	ug/L	ND				30	
Dibromochloromethane	ND	0.5	ug/L	ND				30	
Dichlorodifluoromethane	ND	1.0	ug/L	ND				30	
1,2-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,3-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,4-Dichlorobenzene	ND	0.5	ug/L	ND				30	
1,1-Dichloroethane	ND	0.5	ug/L	ND				30	
1,2-Dichloroethane	ND	0.5	ug/L	ND				30	
1,1-Dichloroethylene	ND	0.5	ug/L	ND				30	
cis-1,2-Dichloroethylene	ND	0.5	ug/L	ND				30	
trans-1,2-Dichloroethylene	ND	0.5	ug/L	ND				30	
1,2-Dichloropropane	ND	0.5	ug/L	ND				30	
cis-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
trans-1,3-Dichloropropylene	ND	0.5	ug/L	ND				30	
Ethylbenzene	ND	0.5	ug/L	ND				30	
Ethylene dibromide (dibromoethane	ND	0.2	ug/L	ND				30	
Hexane	ND	1.0	ug/L	ND				30	
Methyl Ethyl Ketone (2-Butanone)	ND	5.0	ug/L	ND				30	
Methyl Isobutyl Ketone	ND	5.0	ug/L	ND				30	
Methyl tert-butyl ether	ND	2.0	ug/L	ND				30	
Methylene Chloride	ND	5.0	ug/L	ND				30	
Styrene	ND	0.5	ug/L	ND				30	
1,1,1,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
1,1,2,2-Tetrachloroethane	ND	0.5	ug/L	ND				30	
Tetrachloroethylene	ND	0.5	ug/L	ND				30	
Toluene	ND	0.5	ug/L	ND				30	
1,1,1-Trichloroethane	ND	0.5	ug/L	ND				30	
1,1,2-Trichloroethane	ND	0.5	ug/L	ND				30	
Trichloroethylene	3.58	0.5	ug/L	4.12			14.0	30	
Trichlorofluoromethane	ND	1.0	ug/L	ND				30	
Vinyl chloride	ND	0.5	ug/L	ND				30	
m,p-Xylenes	ND	0.5	ug/L	ND				30	
o-Xylene	ND	0.5	ug/L	ND				30	
Surrogate: 4-Bromofluorobenzene	*97.0*		*ug/L*		*121*	*50-140*			
Surrogate: Dibromofluoromethane	*76.2*		*ug/L*		*95.2*	*50-140*			
Surrogate: Toluene-d8	*69.6*		*ug/L*		*87.0*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Volatiles									
Acetone	60.0	5.0	ug/L		60.0	50-140			
Benzene	43.6	0.5	ug/L		109	60-130			
Bromodichloromethane	49.6	0.5	ug/L		124	60-130			
Bromoform	48.0	0.5	ug/L		120	60-130			
Bromomethane	26.2	0.5	ug/L		65.4	50-140			
Carbon Tetrachloride	51.3	0.2	ug/L		128	60-130			
Chlorobenzene	45.4	0.5	ug/L		113	60-130			
Chloroform	48.2	0.5	ug/L		121	60-130			
Dibromochloromethane	45.9	0.5	ug/L		115	60-130			
Dichlorodifluoromethane	42.7	1.0	ug/L		107	50-140			
1,2-Dichlorobenzene	48.2	0.5	ug/L		120	60-130			
1,3-Dichlorobenzene	45.7	0.5	ug/L		114	60-130			
1,4-Dichlorobenzene	50.4	0.5	ug/L		126	60-130			
1,1-Dichloroethane	45.7	0.5	ug/L		114	60-130			
1,2-Dichloroethane	42.8	0.5	ug/L		107	60-130			
1,1-Dichloroethylene	48.7	0.5	ug/L		122	60-130			
cis-1,2-Dichloroethylene	47.9	0.5	ug/L		120	60-130			
trans-1,2-Dichloroethylene	46.9	0.5	ug/L		117	60-130			
1,2-Dichloropropane	47.4	0.5	ug/L		119	60-130			
cis-1,3-Dichloropropylene	45.8	0.5	ug/L		114	60-130			
trans-1,3-Dichloropropylene	42.6	0.5	ug/L		106	60-130			
Ethylbenzene	46.7	0.5	ug/L		117	60-130			
Ethylene dibromide (dibromoethane	43.4	0.2	ug/L		108	60-130			
Hexane	47.6	1.0	ug/L		119	60-130			
Methyl Ethyl Ketone (2-Butanone)	93.7	5.0	ug/L		93.7	50-140			
Methyl Isobutyl Ketone	81.6	5.0	ug/L		81.6	50-140			
Methyl tert-butyl ether	106	2.0	ug/L		106	50-140			
Methylene Chloride	48.5	5.0	ug/L		121	60-130			
Styrene	42.6	0.5	ug/L		106	60-130			
1,1,1,2-Tetrachloroethane	44.5	0.5	ug/L		111	60-130			
1,1,2,2-Tetrachloroethane	36.6	0.5	ug/L		91.5	60-130			
Tetrachloroethylene	45.1	0.5	ug/L		113	60-130			
Toluene	43.5	0.5	ug/L		109	60-130			
1,1,1-Trichloroethane	49.0	0.5	ug/L		122	60-130			
1,1,2-Trichloroethane	43.4	0.5	ug/L		108	60-130			
Trichloroethylene	47.9	0.5	ug/L		120	60-130			
Trichlorofluoromethane	42.4	1.0	ug/L		106	60-130			
Vinyl chloride	28.5	0.5	ug/L		71.3	50-140			
m,p-Xylenes	89.0	0.5	ug/L		111	60-130			
o-Xylene	42.8	0.5	ug/L		107	60-130			
Surrogate: 4-Bromofluorobenzene	*80.9*		*ug/L*		*101*	*50-140*			

Qualifier Notes:

None

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

PARACEL LABORATORIES LTD.

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Paracel ID: 1747084

Chain of Custody
(Lab Use Only)
№ 114343

Page 1 of 1

Client Name: Paterson Group	Project Reference: PE4140	**Turnaround Time:**
Contact Name: Karyn Munch	Quote #	☐ 1 Day ☐ 3 Day
Address: 154 Colonnade Rd S.	PO # 22729	☐ 2 Day ☒ Regular
Telephone:	Email Address: Kmunch@patersongroup.ca	Date Required:

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

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

Required Analyses

Paracel Order Number: 1747084

	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-GW1	GW		2	Nov 17, 2017	—		✓												
2	BH2-GW1	↓		↓	↓	—		✓												
3	BH3-GW1	↓		↓	↓	—		✓												
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received by Driver/Depot: A Touse	Received at Lab: SUPPORT DOCUMENT	Verified By:
Relinquished By (Print): ERIK ARDLEY	Date/Time: 20/11/17 12:40	Date/Time: Nov 20, 2017 @ 9:20	Date/Time: 11/20/17 2:15pm
Date/Time: Nov 17, 2017	Temperature: °C	Temperature: 8.5 °C	pH Verified [ ] By: