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Phase II Environmental Site Assessment

243 & 245 Hinchey Avenue
Ottawa, Ontario

Prepared For

Orange Design Build

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Report: PE4876-2

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EXECUTIVE SUMMARY

Assessment

A Phase II ESA was conducted for the property at 243 and 245 Hinchey Avenue in Ottawa, Ontario. The purpose of the Phase II ESA was to assess 3 potential areas of environmental concern (APECs) on the Phase II property, resulting from (1) the removal/demolition of the former residence at 243 Hinchey Avenue and subsequent infilling; (2) Hydro One electrical substation operation on the adjacent property to the north; and (3) a historic furnace oil leak on the adjacent residential property to the east. The Phase II ESA consisted of drilling 3 boreholes on the Phase II property, all of which were constructed with groundwater monitoring well installations.

Soil samples were obtained from the test holes and screened using visual observations and/or combustible vapour measurements. Based on these, 3 soil samples and one duplicate sample were submitted for laboratory analysis. Two samples were analysed for benzene, toluene, ethylbenzene, xylenes (BTEX), and petroleum hydrocarbons (PHCs); 2 samples and a duplicate were analysed for metals.

No BTEX, PHC F1 or PHC F2 parameters were identified in the soil samples submitted for testing. Petroleum hydrocarbons in the F3 and F4 ranges were identified, as well as various metal parameters. All identified parameter concentrations were in compliance with the MECP Table 7 residential standards with the exception of lead. Lead concentrations in soil samples analysed from BH1 and BH2 in the vicinity of the former residence at 243 Hinchey Avenue exceeded the standards.

Groundwater samples recovered from the monitoring wells installed in BH1, BH2, and BH3 were submitted for analysis of BTEX, PHCs, and/or PCBs. No PCBs, BTEX or PHC parameter concentrations were identified in any of the groundwater samples analysed.

Conclusion

Based the findings of the Phase II ESA, it is our opinion that the fill used in the area of the former residence at 243 Hinchey Avenue is contaminated. This lead-impacted fill should be remediated by means of removal from the site and disposal at an approved waste disposal facility in conjunction with future site redevelopment. This work should be monitored by Paterson. In addition, PHC F4 impacts exceeding background concentrations were identified in soil in BH3. A further assessment of soil at BH3 will be required to determine where this soil can be taken, assuming that it has to be removed for future construction purposes.

Based on the findings of the Phase II ESA, the groundwater beneath the Phase II property is in compliance with the MECP Table 7 standards.

It is recommended that the monitoring wells will be abandoned in accordance with Ontario Regulation 903 prior to site redevelopment. In the meantime, these wells should be maintained.

1.0 INTRODUCTION

At the request of Orange Design Build, Paterson Group (Paterson) conducted a Phase II Environmental Site Assessment (ESA) for the properties located at 243 and 245 Hinchey Avenue in Ottawa, Ontario. The purpose of this Phase II ESA was to address areas of potential environmental concern (APECs) associated with electrical substation operations on the adjacent property to the north, a historical fuel oil release on the adjacent property to the east, and infilling in the location of the former residence on the 243 Hinchey Avenue portion of the Phase II property.

1.1 Site Description

Address:	243 & 245 Hinchey Avenue, Ottawa, Ontario
Legal Description:	Lots 181 & 180 on Plan 88291; Hinchey E, in the City of Ottawa
Property Identification Numbers (PINs):	04094-0131 & 04094-0130
Location:	The Phase I property is located on the east side of Hinchey Avenue, between Scott Street and Bullman Street in Ottawa, Ontario. Refer to Figure 1 – Key Plan for the site location.
Latitude and Longitude:	45° 24' 19" N, 75° 43' 45" W
Configuration:	Rectangular
Site Area:	590 m^2 (approximate)

1.2 Property Ownership

The Phase II property is currently owned by 2693245 ONTARIO LTD. Paterson was retained to complete this Phase II ESA by Mr. Ryan MacIntosh of Orange Design Build (Tel: 613-255-8999) on behalf of 2693245 ONTARIO LTD.

1.3 Current and Proposed Future Uses

The Phase II property is currently occupied by a residential building and private garage on the portion addressed as 245 Hinchey Avenue. The portion addressed as 243 Hinchey Avenue is occupied by a gravel parking lot. It is our understanding that the current on-site residential building and garage will be demolished and a new residential building will be erected.

1.4 Applicable Site Condition Standard

The site condition standards for the property were obtained from Table 7 of the document entitled “Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act”, prepared by the Ontario Ministry of the Environment, Conservation and Parks (MECP), April 2011. The selected MECP Table 7 Standards are based on the following considerations:

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

The property is serviced with municipal water and sewer; as such, non-potable groundwater conditions were selected.

A comparison of the soil test data to the MECP Table 1 standards was also conducted, since some of the fill may be removed from this property for redevelopment. The Table 1 standards are considered to be indicative of typical Ontario background concentrations.

Section 41 of O.Reg. 153/04 does not apply to the Phase II property, as the property is not within 30 m of an area of natural significance or a body of water and the pH is between 5 and 9.

2.0 BACKGROUND INFORMATION

2.1 Physical Setting

The Phase II property is situated in a mature neighbourhood in a residential and commercial area of Ottawa. The portion of the Phase II property identified as 245 Hinchey Avenue is occupied by a two-storey residential dwelling. There is a paved (asphalt) driveway along the south side of the residence, which leads to a

private single-car garage. The backyard is grassed and fenced. The portion of the Phase II property identified as 243 Hinchey Avenue is currently used as a gravel parking lot.

The site is generally flat, although the local topography slopes gently north toward Scott Street. The regional topography slopes north toward the Ottawa River and groundwater flow is expected to be in this direction. Water drainage on the Phase I property occurs primarily via infiltration in the gravel and landscaped areas, as well as sheet flow over the driveway toward Hinchey Avenue.

2.2 Past Investigation

Phase I Environmental Site Assessment, 2020

In February 2020, Paterson conducted a Phase I ESA of the site. Based on the findings of the Phase I ESA, fill material of unknown quality was identified as an on-site potentially contaminating activity (PCA) resulting in an area of potential environmental concern (APEC) on the Phase I property, as shown in Table 1 below. Off-site PCAs that were considered to have resulted in APECs on the Phase I property include the Hydro One substation operating on the adjacent property to the north and a historical furnace oil release on the adjacent property to the east. A Phase II ESA was recommended to investigate these APECs.

Table 1: Areas of Potential Environmental Concern

Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern with respect to Phase I Property	Potentially Contaminating Activity	Location of PCA (on-site or off-site)	Contaminants of Potential Concern	Media Potentially Impacted (Groundwater, Soil, and/or Sediment)
APEC 1	The area of the former residence at 243 Hinchey Avenue	Item 30 – Importation of fill material of unknown quality	On-site	Metals	Soil
APEC 2	Northern portion of the Phase I property	Item 18 – Electricity generation, transformation and power stations	Off-site	PHC F_1-F_4 PCBs	Groundwater
APEC 3	Eastern portion of Phase I property	Item 28 – Gasoline and associated products storage in fixed tanks	Off-site	PHC F_1-F_4 BTEX	Soil and groundwater

3.0 SCOPE OF INVESTIGATION

3.1 Overview of Site Investigation

The subsurface investigation was conducted between February 28 and March 2, 2020. The field program consisted of drilling 3 boreholes to depths ranging from approximately 4.4 to 6.1 m below ground surface. All boreholes were completed with monitoring well installations. Bedrock was encountered between 0.4 and 1.0 m below ground surface.

3.2 Media Investigated

During the subsurface investigation, soil samples and groundwater samples were obtained and submitted for laboratory analysis. The rationale for sampling and analyzing these media is based on the Contaminants of Potential Concern (CPCs) identified in the Phase I ESA. As noted in Section 2.2, Table 1, CPCs for soil and groundwater include benzene, toluene, ethylbenzene, xylenes (BTEX), petroleum hydrocarbons (PHCs, fractions F_1-F_4), and polychlorinated biphenyls (PCBs). The CPCs were selected based on the importation of fill material of unknown quality following the removal of the residence at 243 Hinchey Avenue, the electrical substation operations, and the historical furnace oil release.

3.3 Phase I Conceptual Site Model

Geological and Hydrogeological Setting

Based on information from the Geological Survey of Canada, the Phase I property is located in an area of limestone bedrock, with limited overburden, generally ranging from 0 m to 1 m in thickness. Groundwater is anticipated to be encountered in the shallow bedrock and flow in a northerly direction toward the Ottawa River.

Existing Buildings and Structures

The Phase I property is occupied by a residential dwelling and a private, one-car garage.

Areas of Natural Significance

No areas of natural significance were identified on-site or within the Phase I study area.

Water Bodies

No water bodies are present on the Phase I property or within the Phase I study area. The nearest water body is the Ottawa River, located approximately 630 m north of the site at its closest point.

Water Wells

The Phase I property is located within a municipally serviced area. No MECP potable water well records were identified within the Phase I study area.

The search identified 16 well records within the Phase I study area. These were geotechnical or environmental monitoring/remediation wells installed in between 2007 and 2014. The records for wells installed in 2007 are related to the dewatering zone associated with the contaminant plume originating from 3 Hamilton Avenue. According to the well records, the overburden stratigraphy in the general area of the Phase I property consists of brown or grey gravel and sand. Limestone bedrock was typically encountered at depths ranging from approximately 0.5 to 1.2 m below ground surface, which is consistent with the geologic mapping for the area.

Neighbouring Land Use

Neighbouring land use within the Phase I study area consists of mixed commercial and residential use. The current residential use of the immediately adjacent properties is not considered to pose an environmental concern to the Phase I property. The Hydro One substation, located immediately north of the site, does present an environmental concern and is considered to have resulted in an APEC on the Phase I property. Several other PCAs were observed on properties along Scott Street; however, these PCAs are not considered to have resulted in APECs on-site.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

Per Table 1 in Section 2.2, the following potentially contaminating activities were identified on the Phase I property:

- Item 30: Importation of fill material of unknown quality – this PCA was identified based on the former presence of a residential building at 243 Hinchey Avenue and was considered to result in APEC 1 on the Phase I Property.

The following off-site PCAs were identified within the Phase I study area:

- Item 18 – Electricity generation, transformation and power stations – this PCA was identified based on the presence of an active electrical substation immediately north of the site and was considered to result in APEC 2 on the Phase I property.
- Item 28 – Gasoline and associated products storage in fixed tanks stations – this PCA was identified based on the reported furnace oil release that occurred at 188 Carruthers Avenue in 1990, immediately east of the site and was considered to result in APEC 3 on the Phase I property.

Contaminants of Potential Concern (CPCs)

The CPCs identified with respect to the Phase I property are considered to be petroleum hydrocarbons (PHCs F_1-F_4), as well as benzene, toluene, ethylbenzene, xylenes (BTEX), metals, and polychlorinated biphenyls (PCBs) in soil and/or groundwater.

Assessment of Uncertainty and/or Absence of Information

The information available for review as part of the preparation of this Phase I ESA is considered to be sufficient to conclude that 3 PCAs identified in the Phase I ESA report represent APECs, whereas the remaining PCAs identified off-site, though in the Phase I Study area, do not represent APECs with respect to the Phase I property.

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

3.4 Deviations from Sampling and Analysis Plan

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

Duplicate groundwater samples were not recovered during the Phase II field work. Given that no detectible concentrations of any of the groundwater parameters were identified, the lack of duplicate testing is not considered to have any bearing on the quality of the test results. Otherwise, there were no deviations from the Sampling and Analysis Plan.

3.5 Impediments

Overhead lines and trees presented physical impediments during the field portion of the Phase II ESA. The boreholes were situated where feasible, given these impediments to drilling.

4.0 INVESTIGATION METHOD

4.1 Subsurface Investigation

The subsurface investigation was conducted between February 28 and March 2, 2020. The field program consisted of drilling 3 boreholes to depths ranging from approximately 4.4 to 6.1 m below ground surface. All boreholes were completed with monitoring well installations.

All boreholes were drilled with a track-mounted, CME-55LC low clearance drill rig, provided by George Downing Estate Drilling of Hawkesbury, Ontario, under the full-time supervision of Paterson personnel. All test hole locations are shown on Drawing PE4876-3 – Test Hole Location Plan, appended to this report.

4.2 Soil Sampling

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

Generally, the subsurface profile encountered at the test hole locations consists of a fill layer overlying grey limestone. Bedrock was encountered between 0.4 m and 1.0 m below ground surface.

4.3 Field Screening Measurements

All soil samples collected were subjected to a preliminary screening procedure, which included visual screening for colour/staining and evidence of fill material/ metal impacts. Soil vapour screening with an RKI Eagle gas detector with methane elimination and calibrated to hexane, was conducted on samples recovered from the borehole locations.

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

The parts per million (ppm) scale is used to measure concentrations of hydrocarbon vapours that are too low to register on the Lower Explosive Limit (LEL) scale. The explosive point, 100% LEL, represents the leanest mixture which will burn (or explode) if ignited.

The combustible vapour readings generally ranged from 0 to 10 ppm and were not considered to be indicative of petroleum hydrocarbon compounds. Vapour readings are noted on the Soil Profile and Test Data Sheets in Appendix 1.

No visual or olfactory indications of potential hydrocarbons were noted in any of the samples during the field programs. Fill material was noted in BH1 and BH2. The fill material generally consisted of a mixture of reddish brown to brown silty sand, some gravel, crushed stone, and occasional brick and will be discussed further in the Phase II CSM (Section 5.8). Topsoil was observed in BH3, along with trace gravel that is suspected to have originated from the driveway. Aside from the brick, no deleterious materials or obvious signs of contamination were identified. Soil samples were selected based on the results of the vapour screening, in combination with visual observations and sample depth.

4.4 Groundwater Monitoring Well Installation

Three groundwater monitoring wells were installed on the Phase II property, at boreholes BH1, BH2, and BH3. The monitoring wells consisted of 32 mm diameter Schedule 40 threaded PVC risers and screens. Monitoring well construction details are listed below in Table 2 and are also presented on the Soil Profile and Test Data Sheets provided in Appendix 1.

Table 2: Monitoring Well Construction Details

Well ID	Total Depth (m BGS)	Screened Interval (m BGS)	Sand Pack (m BGS)	Bentonite Seal (m BGS)	Casing Type
BH1	6.07	3.07-6.07	2.64-6.07	0.25-2.64	Flushmount
BH2	4.52	1.52-4.52	1.09-4.52	0.25-1.09	Flushmount
BH3	4.42	1.42-4.42	0.96-4.42	0.20-0.96	Flushmount

4.5 Groundwater Sampling

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

4.6 Analytical Testing

Based on the guidelines outlined in the Sampling and Analysis Plan appended to this report, the soil and groundwater samples submitted for analytical testing are outlined in Tables 3 and 4.

Table 3: Soil Samples Submitted for Analytical Testing

Sample ID	Sample Depth/ Stratigraphic Unit	Parameters Analyzed			Rationale
		BTEX	PHCs (F_1-F_4)	Metals	
BH1-AU1	0-0.61 m; Fill material			X	Sample selected based on borehole location and visual screening of fill material.
BH2-AU1	0-0.61 m; Fill material	X	X	X	Sample selected based on borehole location and visual screening of fill material.
DUP (BH2-AU1)	0-0.61 m; Fill material			X	Sample selected based on borehole location and visual screening of fill material.
BH3-AU1	0-0.41 m; Topsoil, some gravel	X	X		Sample selected based on visual and vapour screening of material.

Table 4: Groundwater Samples Submitted for Analytical Testing					
Sample ID	Sample Depth/ Stratigraphic Unit	Parameters Analyzed			Rationale
		BTEX	PHCs (F_1-F_4)	PCBs	
BH1-GW1	3.07-6.07 m; limestone bedrock	X	X	X	Parameter selected based on borehole location.
BH2-GW1	1.52-4.52 m; limestone bedrock	X	X	X	
BH3-GW1	1.42-4.42 m; limestone bedrock	X	X		

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.

4.7 Residue Management

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

4.8 Elevation Surveying

The borehole locations were surveyed by Paterson and are presented on Drawing PE4876-3 - Test Hole Location Plan, appended to this report. The ground surface elevations at the test hole locations are referenced to a temporary benchmark (TBM), which was the top spindle of the fire hydrant located across from the Phase II property, on the west side of Hinchey Avenue. Its geodetic elevation is 63.34 m.

4.9 Quality Assurance and Quality Control Measures

A summary of quality assurance and quality control (QA/QC) measures, including sampling containers, preservation, labelling, handling, 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

Based on the information obtained during the subsurface investigation, site soils generally consist of topsoil with occasional gravel and fill material consisting of a mixture of reddish brown to brown silty sand, some gravel, crushed stone, and occasional brick over shallow limestone bedrock.

Groundwater was encountered in the shallow bedrock at depths ranging from approximately 0.69 to 0.97 m below ground surface.

5.2 Groundwater Elevations, Flow Direction, and Hydraulic Gradient

Groundwater levels were measured during the groundwater sampling event on March 9, 2020, using an electronic water level meter. Groundwater levels are summarized below in Table 5 below.

Table 5: Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Water Level Depth (m below ground surface)	Water Level Elevation (m ASL)	Date of Measurement
BH1	62.80	0.97	61.83	March 9, 2020
BH2	62.92	0.69	62.23	March 9, 2020
BH3	63.01	0.83	62.18	March 9, 2020

Based on the groundwater elevations measured at the aforementioned borehole locations, contour mapping was completed. Groundwater contours, as shown on Drawing PE4876-4 – Groundwater Contour Plan, indicate that the groundwater beneath the Phase II property flows to the west with a calculated hydraulic gradient of 0.04 m/m.

Based on the regional topography and proximity to the Ottawa River, in combination with work previously conducted in the immediate vicinity of the Phase II property, the regional groundwater flow is in a northerly direction.

5.3 Fine-Coarse Soil Texture

Based on field soil observations, fine-grained soil standards are not applicable to the Phase II property.

5.4 Soil: Field Screening

Field screening of the soil samples collected during drilling resulted in combustible vapour readings ranging from 0 to 10 ppm. Field screening results for individual soil samples are provided on the Soil Profile and Test Data Sheets appended to this report.

5.5 Soil Quality

Three soil samples were submitted for analysis of BTEX, PHCs (F_1-F_4) and/or metals. The results of the analytical testing are presented below in Tables 6 through 8. The laboratory certificate of analysis is provided in Appendix 1.

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

Parameter	MDL (µg/g)	Soil Samples (µg/g)		MECP Table 7 Residential Standards (µg/g)
		February 28, 2020		
		BH2-AU1 (0-0.61 m)	BH3-AU1 (0-0.41 m)	
Benzene	0.02	nd	nd	0.21
Ethylbenzene	0.05	nd	nd	2
Toluene	0.05	nd	nd	2.3
Xylenes	0.05	nd	nd	3.1
PHC F1	7	nd	nd	55
PHC F2	4	nd	nd	98
PHC F3	8	38	137	300
PHC F4	6	10	367	2,800
PHC F4G	50	na	1290	2,800

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- na – not analysed for this parameter

All BTEX and PHC concentrations comply with the MECP Table 7 standards. The F_4/F_{4G} concentrations in BH3-AU1 exceed the MECP Table 1 Standards. All other concentrations comply with the MECP Table 1 Standards.

Table 7: Analytical Test Results – Soil
Metals

Parameter	MDL (µg/g)	Soil Samples (µg/g) Borehole Samples February 28, 2020			MECP Table 7 Residential Standards (µg/g)
		BH1-AU1 (0-0.61 m)	BH2-AU1 (0-0.61 m)	Dup (BH2-AU1)	
Antimony	1.0	1.3	1.6	1.9	7.5
Arsenic	1.0	3.4	4.3	3.9	18
Barium	1.0	273	163	140	390
Beryllium	0.5	nd	nd	nd	4
Boron	5.0	5.4	5.3	5.5	120
Cadmium	0.5	nd	0.6	0.6	1.2
Chromium	5.0	22.1	16.0	11.6	160
Cobalt	1.0	3.6	2.6	2.5	22
Copper	5.0	21.8	53.5	50.7	140
Lead	1.0	**254**	**305**	**257**	120
Molybdenum	1.0	nd	nd	nd	6.9
Nickel	5.0	9.3	8.0	7.4	100
Selenium	1.0	nd	nd	nd	2.4
Silver	0.3	nd	0.5	nd	20
Thallium	1.0	nd	nd	nd	1
Uranium	1.0	nd	nd	nd	23
Vanadium	10.0	13.6	nd	nd	86
Zinc	20.0	102	242	251	340

Notes:
- MDL – Method Detection Limit
- nd – not detected above the MDL
- na – not analysed for this parameter
- **Bold** – concentration exceeds MECP Table 7 standard

Lead concentrations in the soil samples analysed exceed the MECP Table 7 standards. The remaining metals concentrations comply with the selected MECP Table 7 standards. When compared to the MECP Table 1 standards, concentrations of antimony in the sample analysed from BH2 and lead in samples from BH1 and BH2 exceeded the Table 1 standards.

Table 8: Maximum Soil Concentrations			
Parameter	**Maximum Concentration (µg/g)**	**Borehole**	**Depth Interval (m BGS)**
Petroleum Hydrocarbons			
PHC F_3	137	BH3-AU1	0-0.41
PHC F_4	1290	BH3-AU1	0-0.41
Metals			
Antimony	1.9	BH2-AU1	0-0.61
Arsenic	4.3	BH2-AU1	0-0.61
Barium	273	BH1-AU1	0-0.61
Boron	5.5	BH2-AU1	0-0.61
Cadmium	0.6	BH2-AU1	0-0.61
Chromium	22.1	BH1-AU1	0-0.61
Cobalt	3.6	BH1-AU1	0-0.61
Copper	53.5	BH2-AU1	0-0.61
Lead	**305**	BH2-AU1	0-0.61
Nickel	9.3	BH1-AU1	0-0.61
Silver	0.5	BH2-AU1	0-0.61
Vanadium	13.6	BH1-AU1	0-0.61
Zinc	251	BH2-AU1	0-0.61

Notes:
- **Bold** - value exceeds MECP Table 7 standards

All other parameter results were non-detect.

5.6 Groundwater Quality

Groundwater samples from monitoring wells installed in BH1, BH2, and BH3 were submitted for a combination of BTEX, PHC (F_1-F_4), and PCBs analyses. The groundwater samples were obtained from the screened intervals noted on Table 2. No visual or olfactory evidence of petroleum hydrocarbons was noted on the groundwater at any of the borehole locations.

The results of the analytical testing are presented in Table 9 and in the following text. The laboratory certificate of analysis is provided in Appendix 1.

Table 9: Analytical Test Results - Groundwater
BTEX and PHCs (F_1-F_4)

Parameter	MDL (µg/L)	Groundwater Samples (µg/L) March 9. 2020			MECP Table 7 Standards (µg/L)
		BH1-GW1	BH2-GW1	BH3-GW1	
Benzene	0.5	nd	nd	nd	0.5
Ethylbenzene	0.5	nd	nd	nd	54
Toluene	0.5	nd	nd	nd	320
Xylenes	0.5	nd	nd	nd	72
PHC F1	25	nd	nd	nd	420
PHC F2	100	nd	nd	nd	150
PHC F3	100	nd	nd	nd	500
PHC F4	100	nd	nd	nd	500

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

No BTEX or PHC parameters were detected above the laboratory method detection limits in any of the groundwater samples submitted for analytical testing. The results are in compliance with the MECP Table 7 standards.

It is our interpretation that the analyzed parameter concentrations do not indicate the potential presence of light non-aqueous phase liquids (LNAPLs). As previously noted, no free phase hydrocarbons were noted in the wells at the time of groundwater sampling event.

Groundwater samples from BH1 and BH2 (BH1-GW1 and BH2-GW2) were submitted for analysis of PCBs. PCB concentrations were not detected in either sample and are therefore in compliance with MECP Table 7 standards.

5.7 Quality Assurance and Quality Control Results

All soil and groundwater samples were handled in accordance with the Analytical Protocol with respect to holding time, preservation method, storage requirement, and container type.

As per Subsection 47(3) of O.Reg. 153/04 as amended 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 data was assessed by comparing the soil field duplicate (Dup) to the original sample (BH2-AU1). The relative percent difference (RPD) was calculated for the parameters whose concentrations were above laboratory

detection limits. The calculated RPDs were generally below 20% for each parameter, which indicates an acceptable level of uncertainty between the field duplicate and the original sample. The RPD calculated for chromium in soil was 32%. However this RPD may be attributed to the heterogeneity of soil, and is below 40%, which is considered acceptable for soil, given that the duplicate concentration was less than 5 times the detection limit. Overall, the quality of the field data collected during this Phase II ESA is considered to be sufficient to meet the overall objectives of this assessment.

5.8 Phase II Conceptual Site Model

The following section has been prepared in accordance with the requirements of the MECP Record of Site Condition Regulation, O.Reg. 153/04, as amended, made under the Environmental Protection Act. Conclusions and recommendations are discussed in a subsequent section.

Site Description

The Phase II property is located on the east side of Hinchey Avenue, approximately 50 m south of Scott Street, in the City of Ottawa, Ontario.

The Phase II property has an approximate area of 590 m^2 and is occupied by a residential building with a private, single-car garage on the southern half of the property. The remainder of the southern half of the property (245 Hinchey Avenue) is grassed with an asphalt driveway. The northern half of the Phase II property is a gravel parking lot.

Potentially Contaminating Activities and Areas of Potential Environmental Concern

As per Table 1 in Section 2.2, the following Potentially Contaminating Activities were identified on the subject property:

- Item 30, Table 2, O.Reg.153/04, as amended: Importation of fill material of unknown quality – this PCA was identified based on the removal of the former residence and presumed subsequent infilling at 243 Hinchey Avenue and was considered to result in APEC 1 on the Phase I Property.

As shown on Drawing PE4876-2, appended to the Phase I ESA, the following off-site PCAs were identified within the Phase I study area and were considered to represent APECs on the Phase I property:

- Item 18, Table 2, O.Reg.153/04, as amended: Electricity Generation, Transformation and Power Stations – this PCA refers to the Hydro One substation located immediately north of the site.
- Item 28, Table 2, O.Reg.153/04, as amended: Gasoline and Associated Products Storage in Fixed Tanks – this PCA refers to the historical furnace oil release that occurred at 188 Carruthers Avenue.

Based on their nature, separation distance, and/or elevation relative to the site, the remainder of the PCAs identified in the Phase I ESA were not considered to have resulted in APECs on-site.

Contaminants of Potential Concern and Impacted Media

The following contaminants of potential concern (CPC) were identified with respect to the soil and/or groundwater beneath the Phase II property:

- Benzene, toluene, ethylbenzene, and xylenes (BTEX);
- Petroleum hydrocarbon fractions 1 through 4 (PHCs F_1-F_4);
- Metals;
- Polychlorinated biphenyls (PCBs).

Subsurface Structures and Utilities

Underground utilities on the Phase II property include natural gas and municipal water and sewer and are shown on Drawing PE4876-3, attached.

Physical Setting

Site Stratigraphy

The site stratigraphy, as presented on Drawings PE4876-5B and 6B – Cross-Sections A-A' generally consists of the following:

- Fill material consisting of a combination of silty sand/sandy silt and crushed stone with some gravel in BH1 and BH2. Fragments of brick were identified in the fill material in BH1. The fill material extended from ground surface to depths ranging from approximately 0.4 to 1.0m below ground surface. The

overburden in BH3 consisted of topsoil with an occasional piece of crushed stone gravel.

- Grey limestone bedrock was encountered between 0.4 to 1.0 m below ground surface. Groundwater was encountered within this stratigraphic unit.

Hydrogeological Characteristics

Contour mapping was completed based on the groundwater elevations measured at the monitoring wells during the March 2020 groundwater sampling event. Groundwater contours as shown on Drawing PE4876-4 – Groundwater Contour Plan, indicate that the groundwater beneath the Phase II property flows to the west toward Hinchey Avenue. A hydraulic gradient of 0.04 m/m was calculated.

Based on the regional topography and proximity of the Ottawa River, in combination with work previously conducted in the immediate vicinity of the Phase II property, the regional groundwater flow is in a northerly direction.

Approximate Depth to Bedrock

Bedrock was encountered between 0.4 to 1.0 m below ground surface. According to the Geological Survey of Canada website on the Urban Geology of the National Capital Area, consulted as part of this assessment, bedrock in the area of the site consists of limestone of the Bobcageon Formation.

Approximate Depth to Water Table

Depth to the water table at the site varies between approximately 0.7 m and 1.0 m below ground surface.

Sections 41 and 43.1 of the Regulation

Section 41 of O.Reg. 153/04 does not apply to the Phase II property, as the property is not within 30 m of an area of natural significance or a body of water and the pH is between 5 and 9.

Section 43.1 of O.Reg. 153/04 applies since there is very little natural overburden and bedrock is less than 2 m below ground surface. Therefore, shallow soil and groundwater standards have been applied.

Soil Brought to the Phase II Property

Fill material was encountered in BH1 and BH2 at 243 Hinchey Avenue, generally extending to bedrock. The fill material generally consisted of silty sand/sandy silt and crushed stone with some gravel, with trace brick observed in BH1 on the northern portion of the site.

Proposed Buildings and Other Structures

It is our understanding that the current on-site residential building will be demolished as part of the redevelopment of the site, which will consist of the construction of a multiunit residential building.

Existing Buildings and Structures

The Phase II property is occupied by a residential dwelling and a private, single-car garage.

Water Bodies

No water bodies are present on the Phase II property or within the study area. The nearest water body is the Ottawa River, located approximately 630 m north of the site at its closest point.

Areas of Natural Significance

No areas of natural significance were identified on-site or within the Phase II study area.

Environmental Condition

Areas Where Contaminants are Present

Based on the findings of the Phase II ESA, concentrations of lead exceeding the MECP Table 7 standards were identified in the fill material on the northern portion of the site.

Types of Contaminants

As noted above, lead concentrations exceeding the MECP Table 7 standards were identified in the fill material on the northern portion of the Phase II property.

Contaminated Media

Concentrations of lead exceeding the MECP Table 7 standards were identified in the fill material on the northern portion of the Phase II property.

The groundwater across the Phase II property is in compliance with the MECP Table 7 standards.

What Is Known About Areas Where Contaminants Are Present

Lead concentrations exceeding the MECP Table 7 standard were identified in the fill material on the northern portion of the Phase II property, in the vicinity of the former residential dwelling. The contamination is expected to be confined to the fill material associated with the demolition of the former building.

Distribution of Contaminants

Based on the low solubility of metal parameters, in combination with field observations and its location above the water table, the lead impacts are considered to be confined to the fill layer.

Discharge of Contaminants

The concentrations of lead identified in the soil samples collected from BH1 and BH2 are considered to be associated with the demolition of the former residence (demolition debris, lead paint, lead piping, etc.).

Migration of Contaminants

Considering the low solubility of metals, as well as the location of the contaminated fill above the water table, migration of lead is considered to be negligible. Lead concentrations are expected to be confined to the fill layer and localized to the vicinity of the former residence at 243 Hinchey Avenue.

Climatic and Meteorological Conditions

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

Given the low solubility of metals, the specific concentrations of lead identified in soil on-site, and the location of the lead impacts above the water table, climatic

and meteorological conditions are not expected to have affected contaminant distribution.

6.0 CONCLUSIONS

Assessment

A Phase II ESA was conducted for the property at 243 and 245 Hinchey Avenue in Ottawa, Ontario. The purpose of the Phase II ESA was to assess 3 potential areas of environmental concern (APECs) on the Phase II property, resulting from (1) the removal/demolition of the former residence at 243 Hinchey Avenue and subsequent infilling; (2) Hydro One electrical substation operation on the adjacent property to the north; and (3) a historic furnace oil leak on the adjacent residential property to the east. The Phase II ESA consisted of drilling 3 boreholes on the Phase II property, all of which were constructed with groundwater monitoring well installations.

Soil samples were obtained from the test holes and screened using visual observations and/or combustible vapour measurements. Based on these, 3 soil samples and one duplicate sample were submitted for laboratory analysis. Two samples were analysed for benzene, toluene, ethylbenzene, xylenes (BTEX), and petroleum hydrocarbons (PHCs); 2 samples and a duplicate were analysed for metals.

No BTEX, PHC F_1 or PHC F_2 parameters were identified in the soil samples submitted for testing. Petroleum hydrocarbons in the F_3 and F_4 ranges were identified, as well as various metal parameters. All identified parameter concentrations were in compliance with the MECP Table 7 residential standards with the exception of lead. Lead concentrations in soil samples analysed from BH1 and BH2 in the vicinity of the former residence at 243 Hinchey Avenue exceeded the standards.

Groundwater samples recovered from the monitoring wells installed in BH1, BH2, and BH3 were submitted for analysis of BTEX, PHCs, and/or PCBs. No PCBs, BTEX or PHC parameter concentrations were identified in any of the groundwater samples analysed.

Conclusion

Based the findings of the Phase II ESA, it is our opinion that the fill used in the area of the former residence at 243 Hinchey Avenue is contaminated. This lead-impacted fill should be remediated by means of removal from the site and disposal at an approved waste disposal facility in conjunction with future site redevelopment. This work should be monitored by Paterson. In addition, PHC F_4 impacts exceeding background concentrations were identified in soil in BH3. A further assessment of soil at BH3 will be required to determine where this soil can be taken, assuming that it has to be removed for future construction purposes.

Based on the findings of the Phase II ESA, the groundwater beneath the Phase II property is in compliance with the MECP Table 7 standards.

It is recommended that the monitoring wells will be abandoned in accordance with Ontario Regulation 903 prior to site redevelopment. In the meantime, these wells should be maintained.

7.0 STATEMENT OF LIMITATIONS

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

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

Should any conditions be encountered at the 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 2693245 ONTARIO LTD. Notification from 2693245 ONTARIO LTD and Paterson Group will be required to release this report to any other party.

Paterson Group Inc.

Kelly Martinell, P.Eng.

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

Report Distribution:

- ❒ 2693245 ONTARIO LTD
- ❒ Paterson Group Inc.

FIGURES

FIGURE 1 – KEY PLAN

DRAWING PE4876-3 – TEST HOLE LOCATION PLAN

DRAWING PE4876-4 – GROUNDWATER CONTOUR PLAN

DRAWING PE4876-5A – ANALYTICAL TESTING PLAN – SOIL (BTEX, PHCs, METALS)

DRAWING PE4876-5B – CROSS-SECTION A-A' – SOIL (BTEX, PHCs, METALS)

DRAWING PE4876-6A – ANALYTICAL TESTING PLAN – GROUNDWATER (BTEX, PHCs, PCBs)

DRAWING PE4876-6B – CROSS-SECTION A-A' – GROUNDWATER (BTEX, PHCs, PCBs)

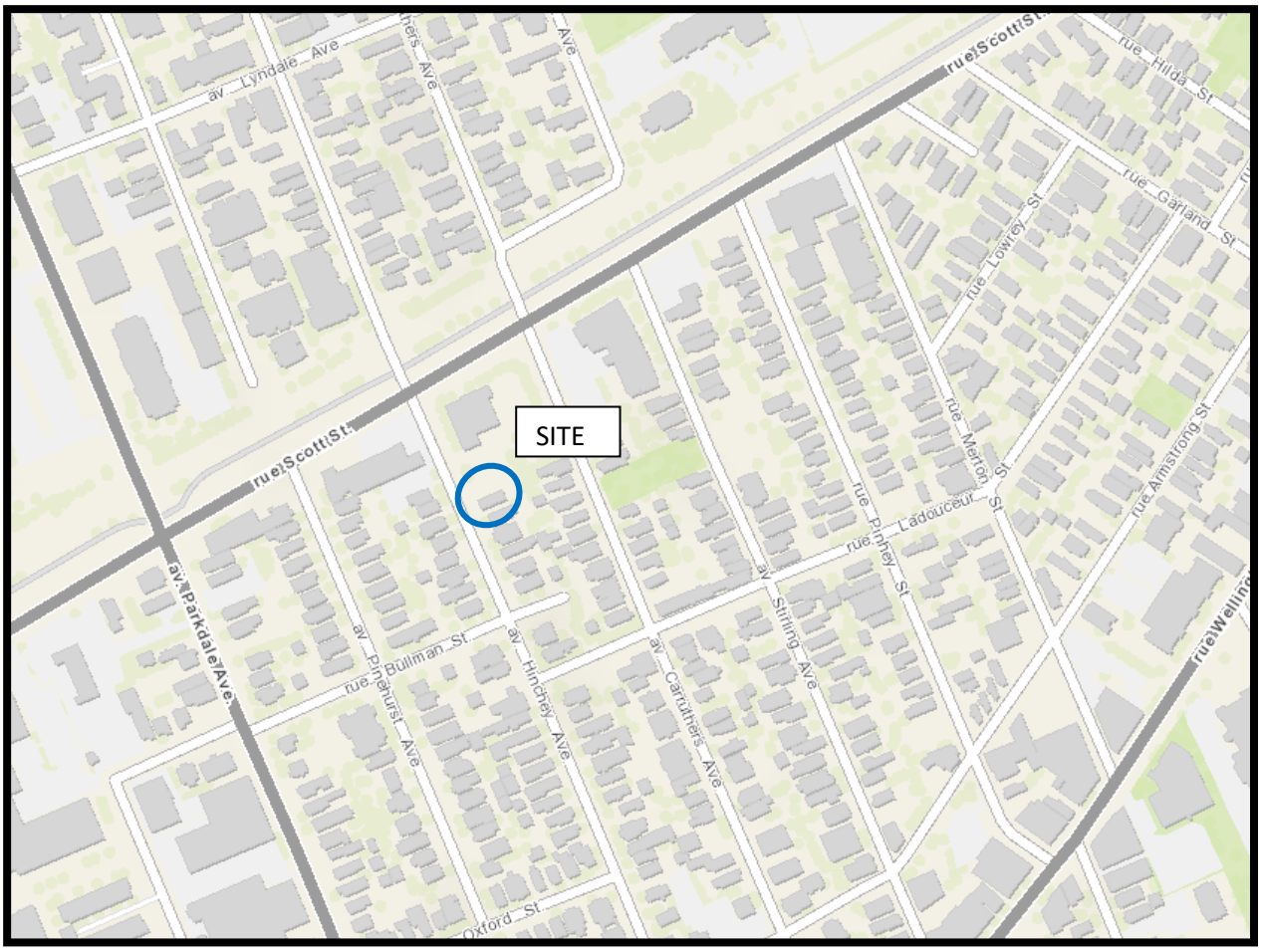

FIGURE 1

KEY PLAN

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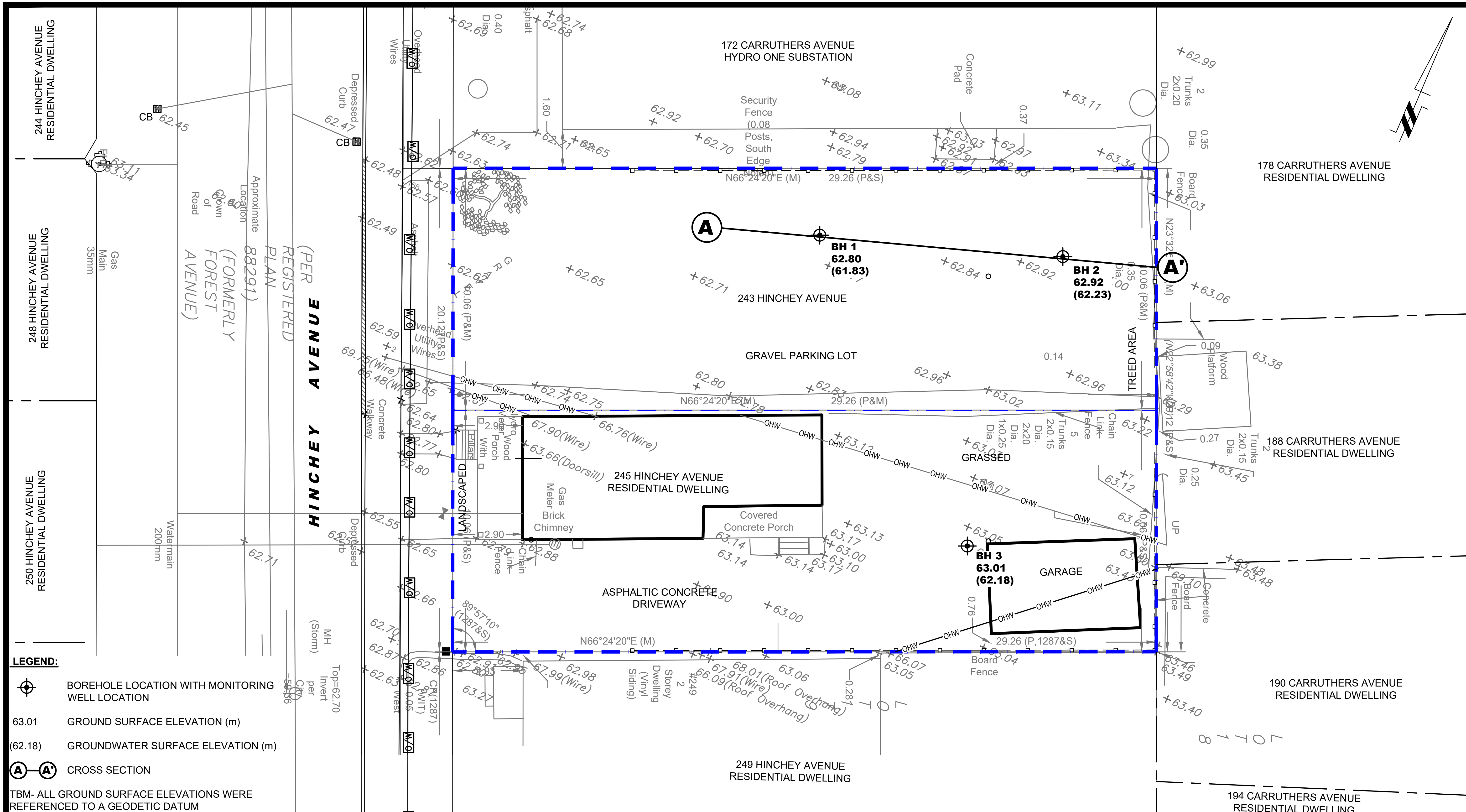

LEGEND:

- BOREHOLE LOCATION WITH MONITORING WELL LOCATION
- 63.01 GROUND SURFACE ELEVATION (m)
- (62.18) GROUNDWATER SURFACE ELEVATION (m)
- A—A' CROSS SECTION

TBM- ALL GROUND SURFACE ELEVATIONS WERE REFERENCED TO A GEODETIC DATUM

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NO.	REVISIONS	DATE	INITIAL

ORANGE DESIGN BUILD

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
243 AND 245 HINCHEY AVENUE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:150	Date: 04/2020
Drawn by: YA	Report No.: PE4876-2
Checked by: KAM	Dwg. No.: **PE4876-3**
Approved by: MSD	Revision No.:

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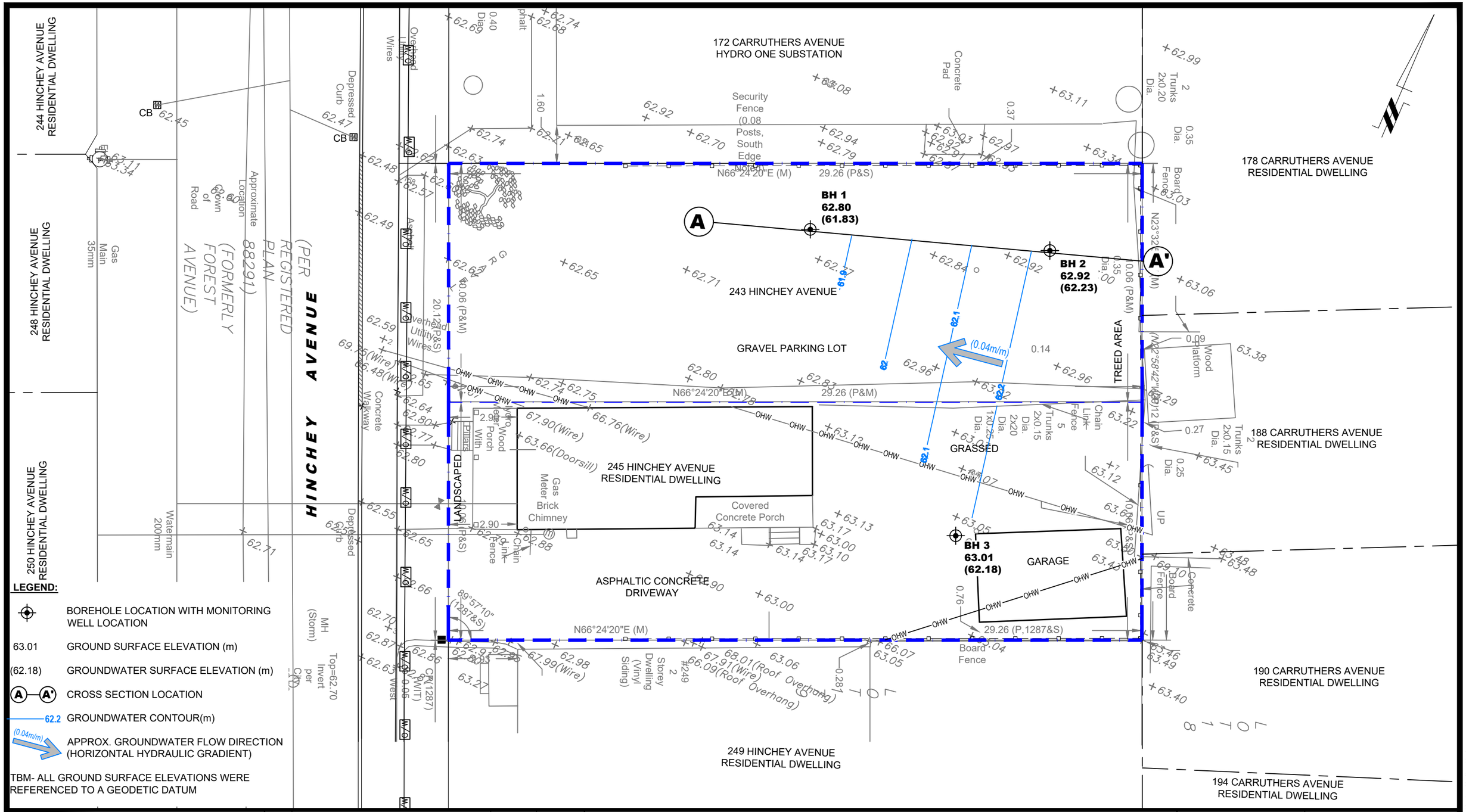

LEGEND:

- BOREHOLE LOCATION WITH MONITORING WELL LOCATION
- 63.01 GROUND SURFACE ELEVATION (m)
- (62.18) GROUNDWATER SURFACE ELEVATION (m)
- A—A' CROSS SECTION LOCATION
- 62.2 GROUNDWATER CONTOUR(m)
- (0.04m/m) APPROX. GROUNDWATER FLOW DIRECTION (HORIZONTAL HYDRAULIC GRADIENT)

TBM- ALL GROUND SURFACE ELEVATIONS WERE REFERENCED TO A GEODETIC DATUM

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ORANGE DESIGN BUILD

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
243 AND 245 HINCHEY AVENUE

OTTAWA, ONTARIO

Title:

GROUNDWATER CONTOUR PLAN

Scale: 1:150	Date: 04/2020
Drawn by: YA	Report No.: PE4876-2
Checked by: KAM	Dwg. No.: PE4876-4
Approved by: MSD	Revision No.:

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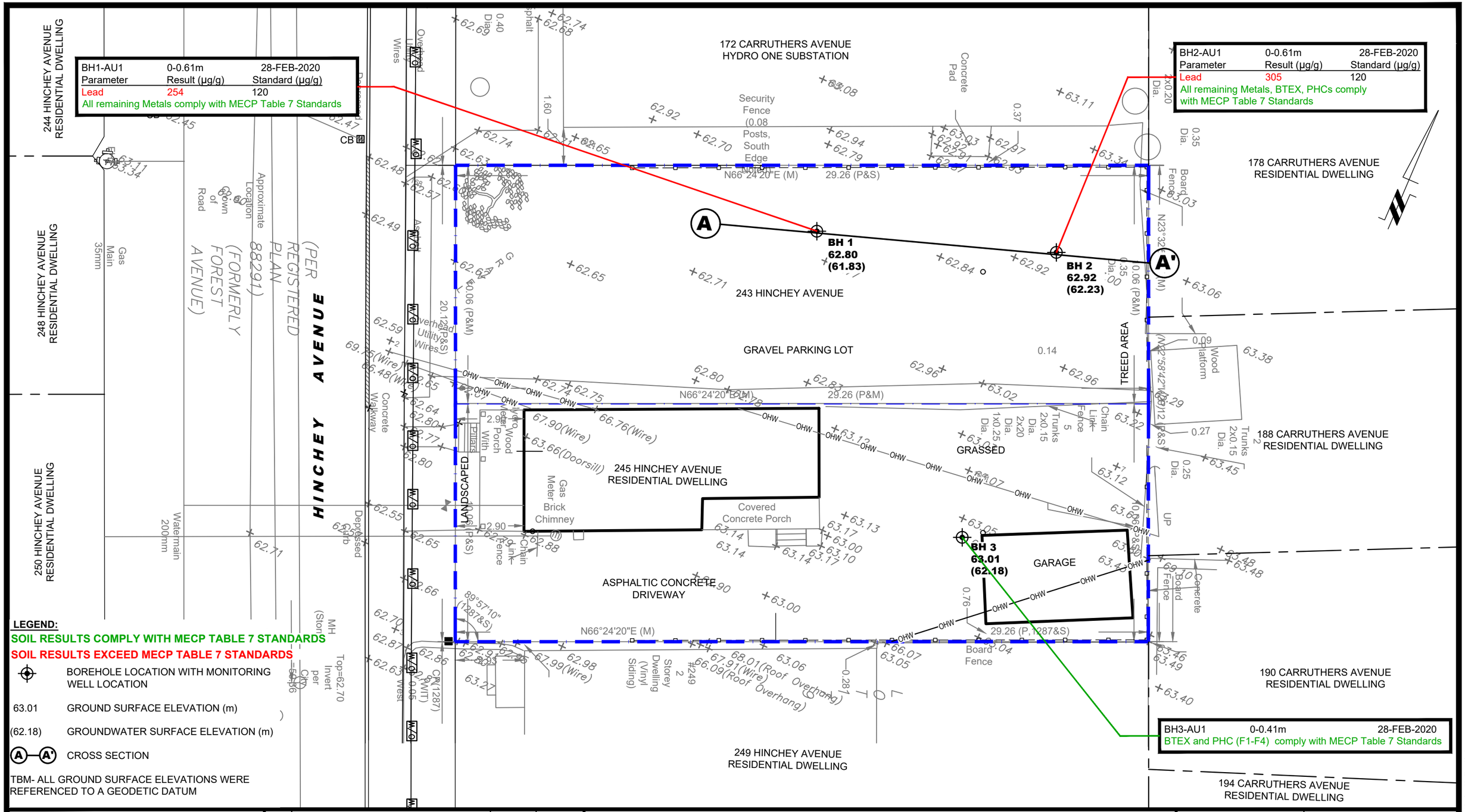

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ORANGE DESIGN BUILD

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
243 AND 245 HINCHEY AVENUE

OTTAWA, ONTARIO

Title:

ANALYTICAL TESTING PLAN-SOIL

Scale: 1:150	**Date:** 04/2020
Drawn by: YA	**Report No.:** PE4876-2
Checked by: KAM	**Dwg. No.:** PE4876-5A
Approved by: MSD	**Revision No.:**

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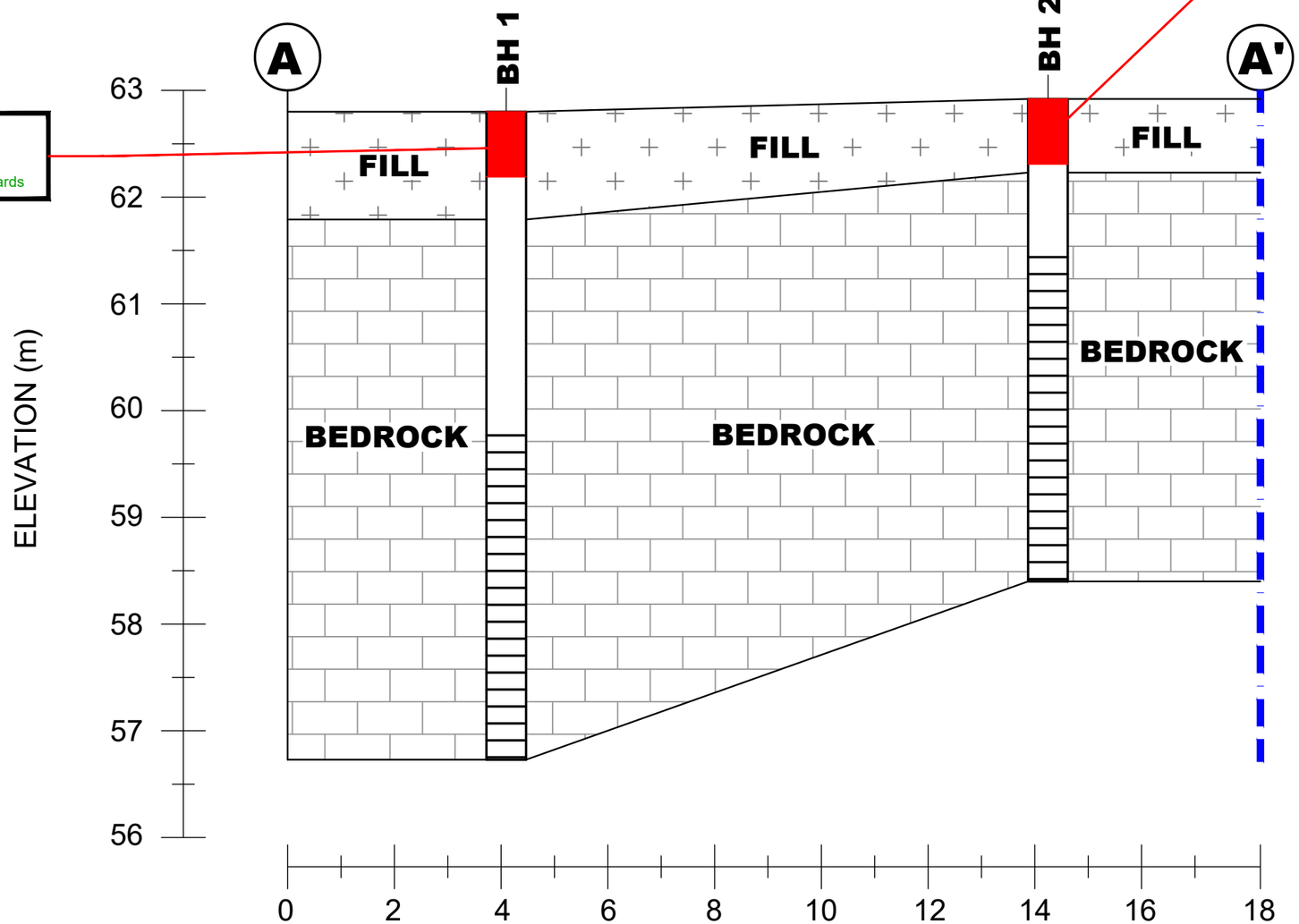
BH1-AU1	0-0.61m	28-FEB-2020
Parameter	Result (µg/g)	Standard (µg/g)
Lead	254	120
All remaining Metals comply with MECP Table 7 Standards		

BH2-AU1	0-0.61m	28-FEB-2020
Parameter	Result (µg/g)	Standard (µg/g)
Lead	305	120
All remaining Metals comply with MECP Table 7 Standards		



SOIL RESULTS COMPLY WITH MECP TABLE 7 STANDARDS

SOIL RESULTS EXCEED MECP TABLE 7 STANDARDS

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
243 AND 245 HINCHEY AVENUE

OTTAWA, ONTARIO

Title:

CROSS SECTION A-A'- SOIL

Scale: AS SHOWN	Date: 04/2020
Drawn by: YA	Report No.: PE4876-2
Checked by: KAM	Dwg. No.: PE4876-5B
Approved by: MSD	Revision No.:

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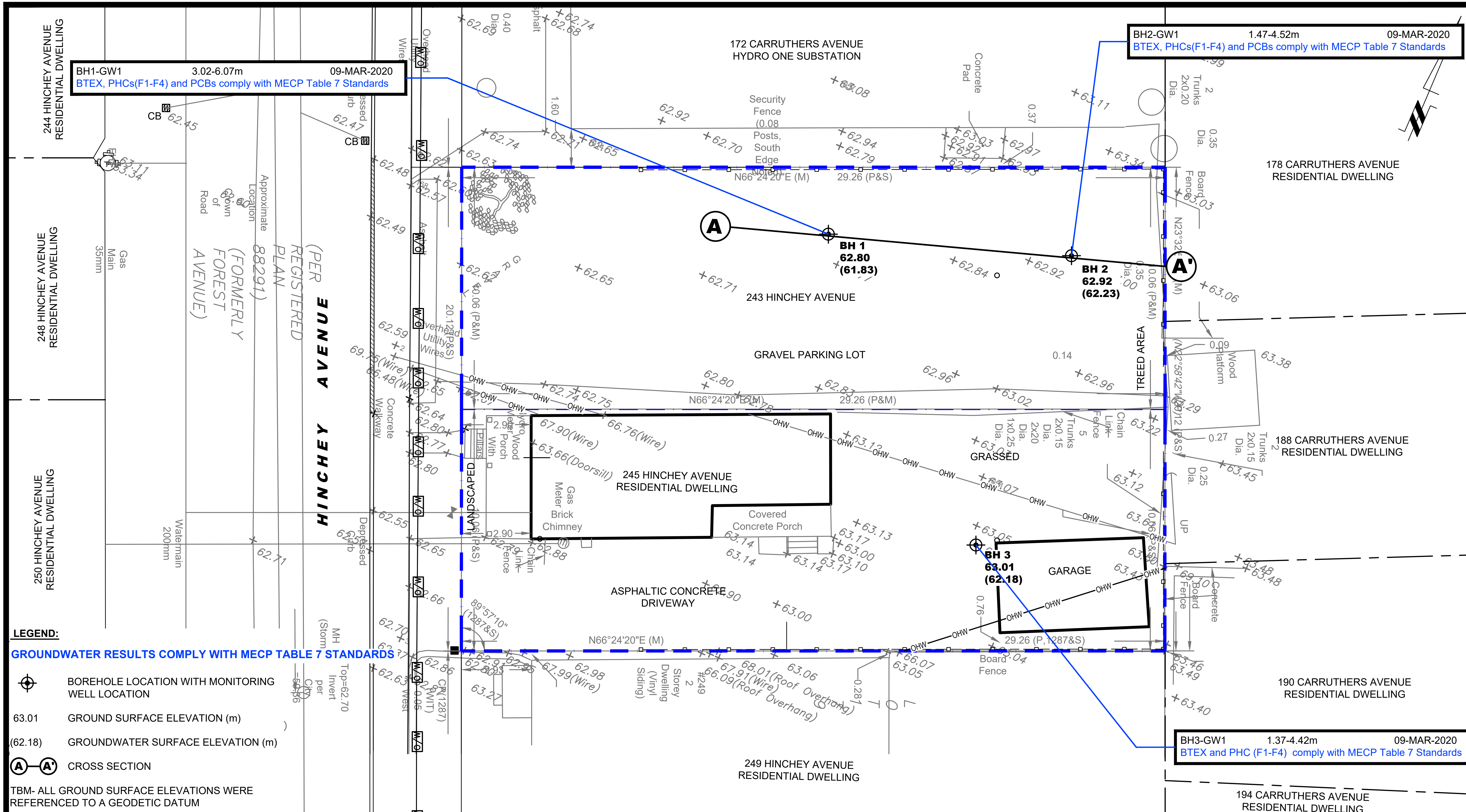

LEGEND:

GROUNDWATER RESULTS COMPLY WITH MECP TABLE 7 STANDARDS

⌖	BOREHOLE LOCATION WITH MONITORING WELL LOCATION
63.01	GROUND SURFACE ELEVATION (m)
(62.18)	GROUNDWATER SURFACE ELEVATION (m)
Ⓐ—Ⓐ'	CROSS SECTION

TBM- ALL GROUND SURFACE ELEVATIONS WERE REFERENCED TO A GEODETIC DATUM

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NO.	REVISIONS	DATE	INITIAL

ORANGE DESIGN BUILD

PHASE II - ENVIRONMENTAL SITE ASSESSMENT
243 AND 245 HINCHEY AVENUE

OTTAWA, ONTARIO

Title: **ANALYTICAL TESTING PLAN-GROUNDWATER**

Scale: 1:150	Date: 04/2020
Drawn by: YA	Report No.: PE4876-2
Checked by: KAM	Dwg. No.: PE4876-6A
Approved by: MSD	Revision No.:

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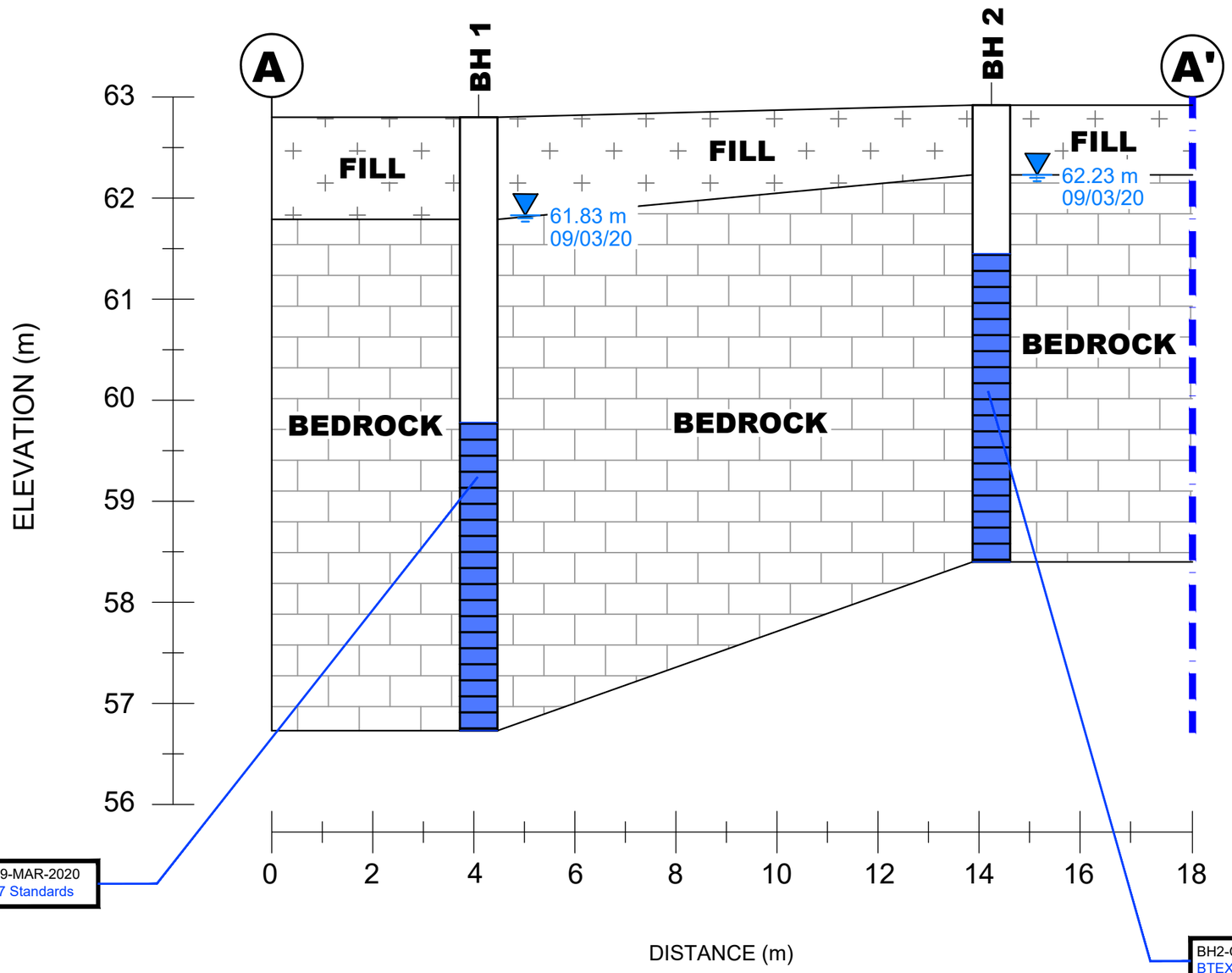

GROUNDWATER RESULTS COMPLY WITH MECP TABLE 7 STANDARDS

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PHASE II - ENVIRONMENTAL SITE ASSESSMENT
243 AND 245 HINCHEY AVENUE

OTTAWA, ONTARIO

Title:

CROSS SECTION A-A'- GROUNDWATER

Scale: AS SHOWN	Date: 04/2020
Drawn by: YA	Report No.: PE4876-2
Checked by: KAM	Dwg. No.: PE4876-6B
Approved by: MSD	Revision No.:

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APPENDIX 1

SAMPLING AND ANALYSIS PLAN

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

LABORATORY CERTIFICATES OF ANALYSIS

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

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Sampling & Analysis Plan

Phase II Environmental Site Assessment
243 & 245 Hinchey Avenue
Ottawa, Ontario

Prepared For

Orange Design Build

February 2020

Report: PE4876-SAP

TABLE OF CONTENTS

1.0 SAMPLING PROGRAM

Paterson Group Inc. (Paterson) was commissioned by Orange Design Build to conduct a Phase II Environmental Site Assessment (ESA) of 243 and 245 Hinchey Avenue, Ottawa, Ontario. Based on the Phase I ESA completed for the property, a subsurface investigation program, consisting of borehole drilling and monitoring well installation, was developed.

Borehole	Location & Rationale	Proposed Depth & Rationale
BH1	Place borehole toward the northern boundary of the site to assess any potential impacts from APEC 1 (fill of unknown quality) and APEC 2 (potential impacts originating from the Hydro One substation).	Borehole to be advanced to approximately 2 m below the expected long-term groundwater table and install a monitoring well.
BH2	Place borehole toward the eastern boundary of the 243 Hinchey Avenue portion of the site to assess any potential impacts from APEC 1 (fill of unknown quality); APEC 2 (Hydro One substation); and APEC 3 (furnace oil leak).	Borehole to be advanced to approximately 2 m below the expected long-term groundwater table and install a monitoring well.
BH3	Place borehole toward the eastern boundary of the 245 Hinchey Avenue portion of the site to assess any potential impacts from APEC 3 (furnace oil leak).	Borehole to be advanced to approximately 2 m below the expected long-term groundwater table and install a monitoring well.

At each borehole, split-spoon samples of overburden soils will be obtained at 0.6 m (2') intervals until practical refusal to augering. All soil samples will be retained, and samples will be selected for submission following a preliminary screening analysis.

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

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

2.0 ANALYTICAL TESTING PROGRAM

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

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

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

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

3.0 STANDARD OPERATING PROCEDURES

3.1 Environmental Drilling Procedure

Purpose

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

Equipment

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

- ❒ glass soil sample jars
- ❒ two buckets
- ❒ cleaning brush (toilet brush works well)
- ❒ dish detergent
- ❒ methyl hydrate
- ❒ water
- ❒ latex or nitrile gloves (depending on suspected contaminant)
- ❒ RKI Eagle organic vapour meter or MiniRae photoionization detector (depending on contamination suspected)

Determining Borehole Locations

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

After drilling is completed, a plan with the borehole locations must be provided. Distances and orientations of boreholes with respect to site features (buildings, roadways, etc.) must be provided. Distances should be measured using a measuring tape or wheel rather than paced off. Ground surface elevations at each borehole should be surveyed relative to a catch basin of known geodetic elevation.

Drilling Procedure

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

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

Spoon Washing Procedure

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

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

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

Screening Procedure

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

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

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

3.2 Monitoring Well Installation Procedure

Equipment

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

Procedure

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

- ❒ Install flushmount casing. Seal space between flushmount and borehole annulus with concrete, cold patch, or holeplug to match the surrounding ground surface.

3.3 Monitoring Well Sampling Procedure

Equipment

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

Sampling Procedure

- ❒ Locate well and use a socket wrench or Allan key to open metal flush mount protector cap. Remove plastic well cap.
- ❒ Measure water level, with respect to the existing ground surface, using water level meter or interface probe. If using an interface probe on suspected NAPL site, measure the thickness of the free product.
- ❒ Measure the total depth of well.
- ❒ Clean water level tape or interface probe using methanol and water. Change gloves between wells.
- ❒ Calculate the volume of standing water within well and record.
- ❒ Insert polyethylene tubing into well and attach to the peristaltic pump. Turn on the peristaltic pump and purge into the graduated bucket. Purge at least three well volumes of water from the well. Measure and record field chemistry. Continue to purge, measuring field chemistry after every well volume purged, until appearance or field chemistry stabilizes.
- ❒ Note the appearance of purge water, including colour, opacity (clear, cloudy, silty), sheen, presence of LNAPL, and odour. Note any other unusual features (particulate matter, effervescence (bubbling) of dissolved gas, etc.).

- ❒ Fill the required sample bottles. If sampling for metals, attach 75-micron filter to discharge tube and filter metals sample. If sampling for VOCs, use low flow rate to ensure a continuous stream of non-turbulent flow into sample bottles. Ensure no headspace is present in VOC vials.
- ❒ Replace well cap and flushmount casing cap.

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

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

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

5.0 DATA QUALITY OBJECTIVES

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

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

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

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

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

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

These considerations are discussed in the body of the report.

6.0 PHYSICAL IMPEDIMENTS TO SAMPLING & ANALYSIS PLAN

Physical impediments to the Sampling and Analysis plan may include:

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

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
243 - 245 Hinchey Avenue
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the west side of Hinchey Avenue, across from subject subject site. Geodetic elevation = 63.342m.

FILE NO. PE4876

REMARKS

HOLE NO. BH 1

BORINGS BY CME-55 Low Clearance Drill **DATE** February 28, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	62.80
FILL: Reddish brown silty sand, some gravel, crushed stone, trace brick		AU	1				
		SS	2	50	50+		
1.01						1	61.80
		RC	1	100	78		
						2	60.80
		RC	2	100	91		
BEDROCK: Good to excellent quality, grey limestone						3	59.80
		RC	3	100	100	4	58.80
						5	57.80
		RC	4	100	97		
6.07						6	56.80
End of Borehole							
(GWL @ 0.97m - March 9, 2020)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
243 - 245 Hinchey Avenue
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the west side of Hinchey Avenue, across from subject subject site. Geodetic elevation = 63.342m.

FILE NO. PE4876

REMARKS

HOLE NO. BH 2

BORINGS BY CME-55 Low Clearance Drill **DATE** February 28, 2020

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						0	62.92		
FILL: Brown silty sand with crushed stone, some gravel		AU	1						
0.69									
		RC	1	100	36	1	61.92		
BEDROCK: Poor to excellent quality, grey limestone		RC	2	100	84	2	60.92		
- vertical seam from 0.7 to 1.0m depth						3	59.92		
		RC	3	100	90	4	58.92		
4.52									
End of Borehole									
(GWL @ 0.69m - March 9, 2020)									

Photo Ionization Detector: ○ Lower Explosive Limit % (20, 40, 60, 80)

RKI Eagle Rdg. (ppm) (100, 200, 300, 400, 500)

▲ Full Gas Resp. △ Methane Elim.

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
243 - 245 Hinchey Avenue
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the west side of Hinchey Avenue, across from subject subject site. Geodetic elevation = 63.342m.

FILE NO. PE4876

REMARKS

HOLE NO. BH 3

BORINGS BY CME-55 Low Clearance Drill **DATE** February 28, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
FILL: Topsoil with sandy silt and crushed stone		AU	1			0	63.01
0.43							
		RC	1	98	27	1	62.01
BEDROCK: Poor to excellent quality, grey limestone		RC	2	100	80	2	61.01
		RC	3	100	90	3	60.01
						4	59.01
4.42							
End of Borehole							
(GWL @ 0.83m - March 9, 2020)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

Monitoring Well Construction

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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 x D60)
Cu	-	Uniformity coefficient = D60 / D10

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

CONSOLIDATION TEST

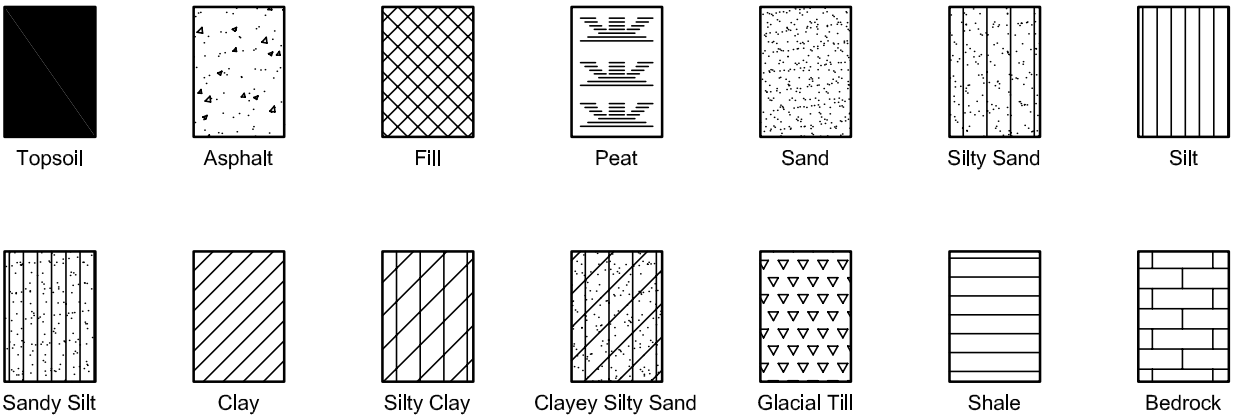
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

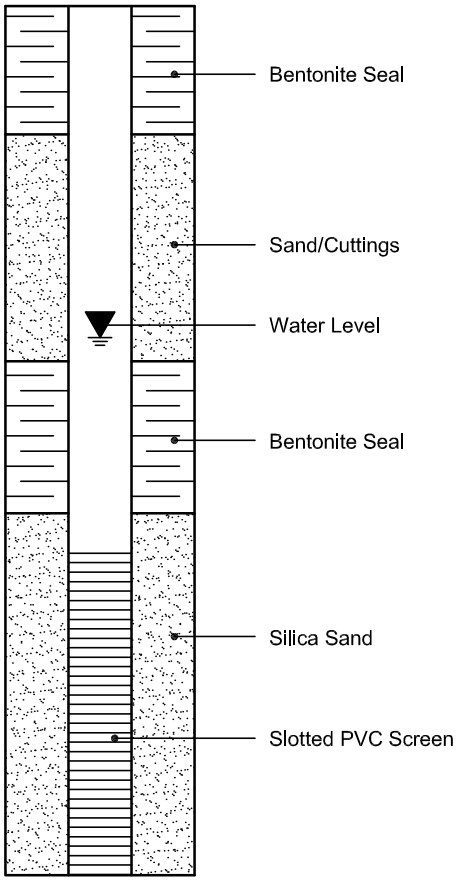
SYMBOLS AND TERMS (continued)

STRATA PLOT

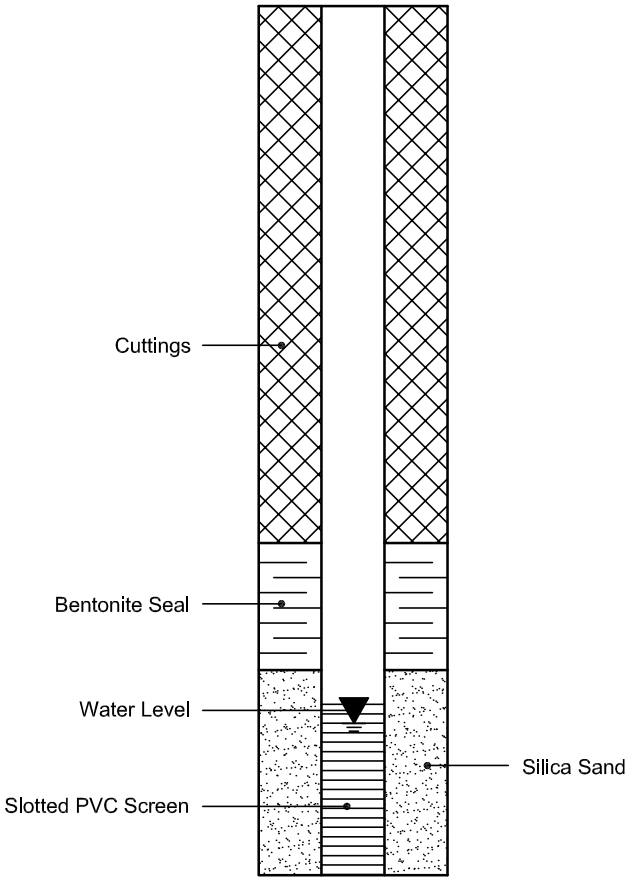


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



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Certificate of Analysis

Paterson Group Consulting Engineers

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

Client PO: 29117
Project: PE4876
Custody: 52379

Report Date: 9-Mar-2020
Order Date: 3-Mar-2020

Order #: 2010208

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

Paracel ID	Client ID
2010208-01	BH1-AU1
2010208-02	BH2-AU1
2010208-03	BH3-AU1
2010208-04	Dup

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 09-Mar-2020

Client: Paterson Group Consulting Engineers

Order Date: 3-Mar-2020

Client PO: 29117

Project Description: PE4876

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	3-Mar-20	5-Mar-20
PHC F1	CWS Tier 1 - P&T GC-FID	3-Mar-20	5-Mar-20
PHC F4G (gravimetric)	CWS Tier 1 - Extraction Gravimetric	9-Mar-20	9-Mar-20
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	4-Mar-20	6-Mar-20
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	5-Mar-20	9-Mar-20
Solids, %	Gravimetric, calculation	5-Mar-20	5-Mar-20

Certificate of Analysis

Report Date: 09-Mar-2020

Client: **Paterson Group Consulting Engineers**

Order Date: 3-Mar-2020

Client PO: **29117**

Project Description: PE4876

	Client ID:	BH1-AU1	BH2-AU1	BH3-AU1	Dup
	Sample Date:	28-Feb-20 09:00	28-Feb-20 11:00	28-Feb-20 13:00	28-Feb-20 09:00
	Sample ID:	2010208-01	2010208-02	2010208-03	2010208-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	89.3	92.8	87.6	92.1
Metals					
Antimony	1.0 ug/g dry	1.3	1.6	-	1.9
Arsenic	1.0 ug/g dry	3.4	4.3	-	3.9
Barium	1.0 ug/g dry	273	163	-	140
Beryllium	0.5 ug/g dry	<0.5	<0.5	-	<0.5
Boron	5.0 ug/g dry	5.4	5.3	-	5.5
Cadmium	0.5 ug/g dry	<0.5	0.6	-	0.6
Chromium	5.0 ug/g dry	22.1	16.0	-	11.6
Cobalt	1.0 ug/g dry	3.6	2.6	-	2.5
Copper	5.0 ug/g dry	21.8	53.5	-	50.7
Lead	1.0 ug/g dry	254	305	-	257
Molybdenum	1.0 ug/g dry	<1.0	<1.0	-	<1.0
Nickel	5.0 ug/g dry	9.3	8.0	-	7.4
Selenium	1.0 ug/g dry	<1.0	<1.0	-	<1.0
Silver	0.3 ug/g dry	<0.3	0.5	-	<0.3
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	10.0 ug/g dry	13.6	<10.0	-	<10.0
Zinc	20.0 ug/g dry	102	242	-	251
Volatiles					
Benzene	0.02 ug/g dry	-	<0.02	<0.02	-
Ethylbenzene	0.05 ug/g dry	-	<0.05	<0.05	-
Toluene	0.05 ug/g dry	-	<0.05	<0.05	-
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	-
Toluene-d8	Surrogate	-	107%	114%	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	-	<7	<7	-
F2 PHCs (C10-C16)	4 ug/g dry	-	<4	<4	-
F3 PHCs (C16-C34)	8 ug/g dry	-	38	137	-
F4 PHCs (C34-C50)	6 ug/g dry	-	10	367 [3]	-
F4G PHCs (gravimetric)	50 ug/g dry	-	-	1290	-

Certificate of Analysis

Report Date: 09-Mar-2020

Client: Paterson Group Consulting Engineers

Order Date: 3-Mar-2020

Client PO: 29117

Project Description: PE4876

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
F4G PHCs (gravimetric)	ND	50	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium	ND	5.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	5.0	ug/g						
Lead	ND	1.0	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	5.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	10.0	ug/g						
Zinc	ND	20.0	ug/g						
Volatiles									
Benzene	ND	0.02	ug/g						
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	*3.44*		*ug/g*		*108*	*50-140*			

Certificate of Analysis

Report Date: 09-Mar-2020

Client: Paterson Group Consulting Engineers

Order Date: 3-Mar-2020

Client PO: 29117

Project Description: PE4876

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND			NC	40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND			NC	30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND			NC	30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND			NC	30	
Metals									
Antimony	ND	1.0	ug/g dry	ND			NC	30	
Arsenic	3.4	1.0	ug/g dry	3.8			10.0	30	
Barium	13.6	1.0	ug/g dry	12.9			5.5	30	
Beryllium	ND	0.5	ug/g dry	ND			NC	30	
Boron	9.9	5.0	ug/g dry	9.7			1.3	30	
Cadmium	ND	0.5	ug/g dry	ND			NC	30	
Chromium	9.5	5.0	ug/g dry	9.0			5.5	30	
Cobalt	3.2	1.0	ug/g dry	3.1			3.7	30	
Copper	15.3	5.0	ug/g dry	14.8			3.0	30	
Lead	6.5	1.0	ug/g dry	6.0			7.3	30	
Molybdenum	ND	1.0	ug/g dry	ND			NC	30	
Nickel	6.6	5.0	ug/g dry	6.5			1.8	30	
Selenium	ND	1.0	ug/g dry	ND			NC	30	
Silver	ND	0.3	ug/g dry	ND			NC	30	
Thallium	ND	1.0	ug/g dry	ND			NC	30	
Uranium	ND	1.0	ug/g dry	ND			NC	30	
Vanadium	23.2	10.0	ug/g dry	23.1			0.6	30	
Zinc	42.5	20.0	ug/g dry	ND			NC	30	
Physical Characteristics									
% Solids	82.1	0.1	% by Wt.	81.5			0.7	25	
Volatiles									
Benzene	ND	0.02	ug/g dry	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g dry	ND			NC	50	
Toluene	ND	0.05	ug/g dry	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g dry	ND			NC	50	
o-Xylene	ND	0.05	ug/g dry	ND			NC	50	
Surrogate: Toluene-d8	*5.52*		*ug/g dry*		*114*	*50-140*			

Certificate of Analysis

Report Date: 09-Mar-2020

Client: Paterson Group Consulting Engineers

Order Date: 3-Mar-2020

Client PO: 29117

Project Description: PE4876

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	197	7	ug/g	ND	98.3	80-120			
F2 PHCs (C10-C16)	100	4	ug/g	ND	102	60-140			
F3 PHCs (C16-C34)	258	8	ug/g	ND	107	60-140			
F4 PHCs (C34-C50)	170	6	ug/g	ND	111	60-140			
F4G PHCs (gravimetric)	980	50	ug/g	ND	98.0	80-120			
Metals									
Antimony	48.0	1.0	ug/g	ND	95.5	70-130			
Arsenic	53.8	1.0	ug/g	1.5	105	70-130			
Barium	55.2	1.0	ug/g	5.1	100	70-130			
Beryllium	49.3	0.5	ug/g	ND	98.3	70-130			
Boron	47.4	5.0	ug/g	ND	87.1	70-130			
Cadmium	48.2	0.5	ug/g	ND	96.3	70-130			
Chromium	59.7	5.0	ug/g	ND	112	70-130			
Cobalt	51.8	1.0	ug/g	1.2	101	70-130			
Copper	55.5	5.0	ug/g	5.9	99.1	70-130			
Lead	50.1	1.0	ug/g	2.4	95.3	70-130			
Molybdenum	50.6	1.0	ug/g	ND	101	70-130			
Nickel	52.7	5.0	ug/g	ND	100	70-130			
Selenium	48.7	1.0	ug/g	ND	97.0	70-130			
Silver	48.9	0.3	ug/g	ND	97.6	70-130			
Thallium	47.8	1.0	ug/g	ND	95.3	70-130			
Uranium	50.8	1.0	ug/g	ND	101	70-130			
Vanadium	63.9	10.0	ug/g	ND	109	70-130			
Zinc	63.7	20.0	ug/g	ND	113	70-130			
Volatiles									
Benzene	2.85	0.02	ug/g	ND	71.2	60-130			
Ethylbenzene	3.41	0.05	ug/g	ND	85.1	60-130			
Toluene	3.32	0.05	ug/g	ND	83.0	60-130			
m,p-Xylenes	6.68	0.05	ug/g	ND	83.5	60-130			
o-Xylene	3.52	0.05	ug/g	ND	87.9	60-130			
Surrogate: Toluene-d8	*2.96*		*ug/g*		*92.6*	*50-140*			

Qualifier Notes:

Login Qualifiers :

Container(s) - Labeled improperly/insufficient information - Time reads 1:00 PM on bottles
Applies to samples: BH1-AU1, BH2-AU1

Container(s) - Labeled improperly/insufficient information - Time reads 1:15 PM on bottles
Applies to samples: BH3-AU1

Sample Qualifiers :

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

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

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

CCME PHC additional information:

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

PARA LABORATORI

Paracel ID: 2010208

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Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
20202K	Nº 52379

Page 1 of 1

Client Name: Paterson Group
Contact Name: Mark D'Arcy
Address: 154 Colonade Rd S
Telephone: 613-226-7381

Project Ref: PE4876
Quote #:
PO #: 29117
E-mail:

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

Regulation 153/04: ☐ Table 1 ☐ Res/Park ☐ Med/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☑ Table 7
For RSC: ☐ Yes ☒ No

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

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

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	Required Analysis: HCPMetals	Required Analysis: BTEX/PHCs
1	BH1 - AU1	S		2	Feb 28 2020	9 am	✓	
2	BH2 - AU1	S		2	Feb 28 2020	11:00	✓	✓
3	BH3 - AU1	S		2	Feb 28 2020	1 pm		✓
4	Dup	S		1	Feb 28 2020		✓	
5								
6								
7								
8								
9								
10								

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received By Driver/Depot: T. Krouse	Received at Lab:	Verified By:
Relinquished By (Print): Mark St Pierre	Date/Time: 03/03/20 3:20	Date/Time: 03-03-20 15:05	Date/Time: 03-03-20 16:15
Date/Time: Mar 3 2020	Temperature: °C	Temperature: 11.3 °C	pH Verified: ☐ By:

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Certificate of Analysis

Paterson Group Consulting Engineers

154 Colonnade Road South
Nepean, ON K2E 7J5
Attn: Kelly Martinell

Client PO: 29556
Project: PE4876
Custody: 126382

Report Date: 12-Mar-2020
Order Date: 10-Mar-2020

Order #: 2011204

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

Paracel ID	Client ID
2011204-01	BH1-GW1
2011204-02	BH2-GW1
2011204-03	BH3-GW1

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 12-Mar-2020

Client: Paterson Group Consulting Engineers

Order Date: 10-Mar-2020

Client PO: 29556

Project Description: PE4876

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 624 - P&T GC-MS	11-Mar-20	11-Mar-20
PCBs, total	EPA 608 - GC-ECD	12-Mar-20	12-Mar-20
PHC F1	CWS Tier 1 - P&T GC-FID	10-Mar-20	11-Mar-20
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	11-Mar-20	11-Mar-20

Certificate of Analysis

Report Date: 12-Mar-2020

Client: Paterson Group Consulting Engineers

Order Date: 10-Mar-2020

Client PO: 29556

Project Description: PE4876

	Client ID:	BH1-GW1	BH2-GW1	BH3-GW1	-
	Sample Date:	09-Mar-20 12:00	09-Mar-20 12:00	09-Mar-20 12:00	-
	Sample ID:	2011204-01	2011204-02	2011204-03	-
	MDL/Units	Water	Water	Water	-
Volatiles					
Benzene	0.5 ug/L	<0.5	<0.5	<0.5	-
Ethylbenzene	0.5 ug/L	<0.5	<0.5	<0.5	-
Toluene	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	-
Toluene-d8	Surrogate	111%	101%	103%	-
Hydrocarbons					
F1 PHCs (C6-C10)	25 ug/L	<25	<25	<25	-
F2 PHCs (C10-C16)	100 ug/L	<100	<100	<100	-
F3 PHCs (C16-C34)	100 ug/L	<100	<100	<100	-
F4 PHCs (C34-C50)	100 ug/L	<100	<100	<100	-
PCBs					
PCBs, total	0.05 ug/L	<0.05	<0.05	-	-
Decachlorobiphenyl	Surrogate	94.8%	87.0%	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L						
F2 PHCs (C10-C16)	ND	100	ug/L						
F3 PHCs (C16-C34)	ND	100	ug/L						
F4 PHCs (C34-C50)	ND	100	ug/L						
PCBs									
PCBs, total	ND	0.05	ug/L						
Surrogate: Decachlorobiphenyl	*0.475*		*ug/L*		*95.0*	*60-140*			
Volatiles									
Benzene	ND	0.5	ug/L						
Ethylbenzene	ND	0.5	ug/L						
Toluene	ND	0.5	ug/L						
m,p-Xylenes	ND	0.5	ug/L						
o-Xylene	ND	0.5	ug/L						
Xylenes, total	ND	0.5	ug/L						
Surrogate: Toluene-d8	*87.3*		*ug/L*		*109*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	25	ug/L	ND			NC	30	
Volatiles									
Benzene	ND	0.5	ug/L	ND			NC	30	
Ethylbenzene	ND	0.5	ug/L	ND			NC	30	
Toluene	ND	0.5	ug/L	ND			NC	30	
m,p-Xylenes	ND	0.5	ug/L	ND			NC	30	
o-Xylene	ND	0.5	ug/L	ND			NC	30	
Surrogate: Toluene-d8	*84.8*		*ug/L*		*106*	*50-140*			

Certificate of Analysis

Report Date: 12-Mar-2020

Client: Paterson Group Consulting Engineers

Order Date: 10-Mar-2020

Client PO: 29556

Project Description: PE4876

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1450	25	ug/L	ND	72.4	68-117			
F2 PHCs (C10-C16)	1490	100	ug/L	ND	93.0	60-140			
F3 PHCs (C16-C34)	3760	100	ug/L	ND	95.9	60-140			
F4 PHCs (C34-C50)	2140	100	ug/L	ND	86.5	60-140			
PCBs									
PCBs, total	1.21	0.05	ug/L	ND	121	60-140			
Surrogate: Decachlorobiphenyl	*0.473*		*ug/L*		*94.7*	*60-140*			
Volatiles									
Benzene	26.6	0.5	ug/L	ND	66.4	60-130			
Ethylbenzene	30.2	0.5	ug/L	ND	75.6	60-130			
Toluene	27.8	0.5	ug/L	ND	69.6	60-130			
m,p-Xylenes	63.5	0.5	ug/L	ND	79.4	60-130			
o-Xylene	31.3	0.5	ug/L	ND	78.4	60-130			
Surrogate: Toluene-d8	*88.3*		*ug/L*		*110*	*50-140*			

Qualifier Notes:

Login Qualifiers :

Container(s) - Bottle and COC sample ID don't match - Vials read BH1-GW2

Applies to samples: BH1-GW1

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

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

CCME PHC additional information:

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

PARAC LABORATORIES

Paracel ID: 2011204

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Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2011204	Nº 126382

Client Name: Paterson Group	Project Ref: PE4876	Page 1 of 1
Contact Name: Kelly Martinell	Quote #:	Turnaround Time
Address: 154 Colonnade Rd. S.	PO #: 29556	☐ 1 day ☐ 3 day
	E-mail: Kmartinell@patersongroup.ca	☐ 2 day ☒ Regular
Telephone: 613-226-7381		Date Required:

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

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

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	PCBs
1	BH1-GW1	GW		4	Mar 9/20	PM	X							X
2	BH2-GW1	〃		4	〃	〃	X							X
3	BH3-GW1	〃		3	〃	〃	X							
4														
5														
6														
7														
8														
9														
10														

Comments:

Method of Delivery: Paracel

Relinquished By (Sign):	Received By Driver/Depot: M. Fleuve	Received at Lab:	Verified By:
Relinquished By (Print): Nicholas Doucette	Date/Time: 10/03/20 1:00 PM	Date/Time: 03-10-20 1805	Date/Time: 03-10-20 1817
Date/Time: Mar 10/20 1:06 pm	Temperature: °C	Temperature: 9.3 °C	pH Verified: ☐ By: