ALL SAINTS DEVELOPMENT LP

PHASE TWO
ENVIRONMENTAL SITE ASSESSMENT

315-317 Chapel Street, Ottawa, Ontario

FINAL REPORT

July 28, 2023

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1.0 EXECUTIVE SUMMARY

Terrapex Environmental Ltd. (Terrapex) was retained by All Saints Development LP (All Saints) to complete a Phase Two Environmental Site Assessment (ESA) of the property located at 315 Chapel Street in Ottawa, Ontario, also identified as 317 Chapel Street or 10 Blackburn Avenue, herein referred to as the “Site” or the “Phase Two Property”.

The Site was the former All Saints Church and Bates Memorial Hall, currently occupied by the Working Title restaurant and event space, and Verve Moderns furniture store. All Saints is proposing a redevelopment of the Site to include condominium housing, which is a “residential” property use” per O. Reg. 153/04, requiring the submission of a Record of Site Condition (RSC).

A Phase One ESA was completed by Terrapex in April 2023 in accordance with the requirements of O. Reg. 153/04. The Phase One ESA identified one area of potential environmental concern (APEC) at the Site, resulting from a former fuel oil AST and boiler system, located in the basement of the former Bates Memorial Hall. As a result, a Phase Two ESA was required to investigate soil and groundwater quality at the Site prior to the filing of the mandatory RSC.

The soil quality at the Site was investigated through the advancement of boreholes to (i) characterize environmental conditions within the APEC and (ii) confirm the stratigraphy at the Site. Groundwater was not considered a media of concern for the investigation unless fuel oil or fuel oil concentrations in soil were encountered within the APEC, i.e. any evidence of impact. Contaminants of potential concern (COPCs) associated with fuel oil were BTEX and PHC F1-F4.

The Full Depth Generic Site Condition Standards (SCS) for residential, parkland, or institutional property use in a non-potable groundwater condition with fine- to medium-textured soil, listed in Table 3 of the April 15, 2011 MECP *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act* document were considered appropriate for evaluating laboratory analytical results.

The stratigraphy encountered during drilling was consistent with previous investigations, generally consisting of small amounts of fill overlying silty clay, overlying limestone bedrock at depths greater than 10 m below grade (bg).

Based on analytical results, BTEX and PHC F1-F4 concentrations in the soil samples submitted for analysis from within the APEC were less than the Table 3 SCSs. Further, COPC concentrations were not measured above the laboratory’s reportable detection limit (RDL). Therefore, an assessment of groundwater quality was deemed to not be necessary.

Based on the findings of the Phase Two ESA, the environmental quality of the Site meets the Table 3 SCS.

2.0 INTRODUCTION

Terrapex Environmental Ltd. (Terrapex) was retained by All Saints Development LP (All Saints) to complete a Phase Two Environmental Site Assessment (ESA) of the property located at 315 Chapel Street in Ottawa, Ontario, also identified as 317 Chapel Street or 10 Blackburn Avenue, herein referred to as the “Site” or the “Phase Two Property”.

The objective of the Phase Two ESA was to assess the area of potential environmental concern (APEC) identified in the Phase One ESA to support the filing of an RSC for the Site.

2.1 SITE DESCRIPTION

The Site was the former All Saints Church, currently occupied by the Working Title restaurant and event space, and Verve Moderns furniture store.

Based on the unsealed Plan of Survey, entitled *Lots 9, 10, 11, 12 (South Laurier Avenue), Part of Lots 3 & 4 (West Blackburn Avenue), Registered Plan No. 37220, Geographic Town of Nepean, City of Ottawa*, prepared by Stantec Geomatics Ltd. the property identification number (PIN) and legal property description for the Site are listed below.

PHASE ONE PROPERTY INFORMATION

Address:	315-317 CHAPEL STREET / 10 BLACKBURN AVENUE OTTAWA
Property Identification Number:	04208-0021
Legal Description:	LTS 9, 10, 11 & 12, PL 37220 , S/S LAURIER AV ; PT LTS 3 & 4, PL 37220 , W/S BLACKBURN AV, AS IN CR164102 ; OTTAWA/NEPEAN; OTTAWA/NEPEAN; and Part of Lot 4 W/S Blackburn Avenue PL 37220
UTM Coordinates (centre of site, NAD83):	18T East: 447,016 m North: 5,030,634 m
Site Area:	2,833.22 m^2

The Site was located in a neighbourhood comprised of mixed residential and commercial land uses as shown on Figure 1 (Site Location Plan) and Figure 2 (General Site Layout).

The unsealed plan of survey for the Site is provided in Appendix I.

2.2 PROPERTY OWNERSHIP

Contact information for the registered owner of the Site and the party authorizing this Phase Two ESA is provided in the table below.

Name and Address of Registered Owner:	All Saints Development Inc. 10 Blackburn Ave. Ottawa, Ontario, K1N 8A3
Name and Address of Authorizing Party:	Mr. Ross Farris Windmill Developments 150 Elgin Street, Suite 1000 Ottawa, Ontario, K2P 1L4

2.3 CURRENT AND PROPOSED FUTURE USES

The Site was currently used as a restaurant and event space, and a furniture store, which is a “commercial property” use per O. Reg. 153/04. (Records of Site Condition – Part XV.1 of the Act).

All Saints Development LP is proposing a redevelopment of the Site to include condominium housing, which is a “residential” property use” per O. Reg. 153/04.

2.4 APPLICABLE SITE CONDITION STANDARDS

Generic Ministry of the Environment, Conservation and Parks (MECP) Site Condition Standards for evaluating laboratory analytical results were selected from the April 15, 2011 *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act* (MOE, 2011) document on the basis of the criteria specified in O. Reg. 153/04.

The Site-specific details which influenced the soil and groundwater standards selection are summarized below:

- the Site is not within or adjacent to an area of natural significance as defined within Section 1 (1) of O. Reg. 153/04, does not include any land within 30 m of an area of natural significance, and is not otherwise considered “potentially sensitive”;
- the pH of “surface” and “subsurface” soil samples analysed as part of this Phase Two ESA were within the prescribed values for the application of generic Site Condition Standards;
- more than 2 m of overburden was observed at the Site;
- the Site does not include a waterbody and is not located within 30 m of a waterbody;
- stratified site conditions will not be used when evaluating laboratory analytical results;
- current use of the Site was commercial;
- the most sensitive proposed future use of the Site was residential;

- potable water at the Site, and all other properties located (in whole or in part) within 250 m of the Site, was supplied by a municipal drinking water system (as defined in the *Safe Drinking Water Act, 2002*);
- neither the Site nor any property located (in whole or in part) within 250 m of the Site has a well that was used or intended for use as a source of water for human consumption or for agriculture;
- the Site is not located in an area designated in a municipal Official Plan as a well-head protection area, or another designation by the municipality intended for the protection of groundwater; and,
- soil texture at the Site has been classified as "medium and fine textured" based on the results of grain size analysis.

Based on the above, the Full Depth Generic Site Condition Standards (SCS) for residential, parkland, or institutional property use in a non-potable groundwater condition with fine- to medium-textured soil, listed in Table 3 of the April 15, 2011 MECP *Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act* document (hereafter referenced as the Table 3 SCS), are considered appropriate for evaluating laboratory analytical results.

In accordance with the requirements of Section 35 of O. Reg. 153/04, notification of the intent to use non-potable groundwater standards was provided to the City of Ottawa Clerk on April 28, 2023. The municipality did not immediately provide written notice of its objection to the use of non-potable groundwater standards. However, they have 30 days to do so following this notice.

A copy of the notification correspondence is provided in Appendix II.

3.0 BACKGROUND INFORMATION

3.1 PHYSICAL SETTING

3.1.1 WATER BODIES & AREAS OF NATURAL SIGNIFICANCE

Based on the information provided in the Phase One ESA, the Site does not include, and is not adjacent to, or within 30 m of a water body, as defined in O. Reg. 153/04. There are no major water bodies within the Phase One Study Area. The nearest identified watercourse is the Rideau River located approximately 400 m east of the Site.

3.1.2 TOPOGRAPHY & SURFACE WATER DRAINAGE

The Site was at an elevation of approximately 70 m above mean seal level (amsl) and the Phase One ESA noted that the Site was at a higher elevation than surrounding properties, sloping to the northeast. The surrounding area was noted to be generally flat.

Based on the interpreted topographic contours provided on GeoOttawa, a ridge is located approximately 100 m south of the Site, oriented southwest-northeast and descending approximately 10 m before levelling off. The Rideau River, located approximately 400 m east of the Site, was at an elevation of approximately 56 m amsl.

Storm water from the Site (other than what infiltrates into the ground) was directed towards the municipal storm water sewer system through catch basins located on-Site and on adjacent roadways.

3.2 PAST INVESTIGATIONS

Terrapex has relying on, and has updated where necessary, the information in the 2017 Phase One ESA entitled *Phase One Environmental Site Assessment, 315 Chapel Street, Ottawa, Ontario, Final Report* prepared for All Saints Development Inc. by McIntosh Perry Consulting Engineers Ltd. (McIntosh Perry) and dated August 4, 2017 (the 2017 Phase One ESA).

The 2017 Phase One ESA refers to an earlier environmental report entitled: *Phase I – Environmental Site Assessment, All Saints Anglican Church, 317 Chapel Street, Ottawa, Ontario*, prepared by the Paterson Group (Paterson) and dated in 2014. Terrapex was not provided with a copy of the 2014 Paterson report for review.

It was noted in the 2017 Phase One ESA that the memorial hall building was likely previously heated using an oil-fired boiler, fed by an above ground storage tank (AST) that was located in the basement mechanical room; that It was reportedly removed in 1993; that no evidence of an ASTs was observed during the site reconnaissance in 2014; and, that no visual or olfactory indications of contamination were observed in the basement.

It was also noted in the 2014 Phase I ESA that potential asbestos containing materials (ACMs) were identified throughout the building; it was recommended that an asbestos survey be conducted on the building.

The Phase Ones ESA did not recommend any further investigation.

Terrapex was also provided with a report entitled *Geotechnical Investigation, 315 Chapel Street, Ottawa, Ontario*, prepared by Houle Chevrier Engineering for All Saints Development Inc., dated May 3, 2017.

The report was conducted for geotechnical purposes. However, some pertinent information about the stratigraphy encountered at the Site was provided.

Two boreholes were advanced at the Site, each completed as a monitoring well. Underlying surficial fill, approximately 10 m of silty clay was encountered, overlying approximately 1 m of glacial till, overlying limestone bedrock. One monitoring well was screened in the glacial till and one monitoring well was screened in slightly weathered limestone bedrock.

Three months following installation, the glacial till monitoring well was dry and the water level in the slightly fractured limestone bedrock monitoring well was 13.20 m bg (57.15 m amsl).

Terrapex undertook an update to the 2017 Phase One ESA on behalf of All Saints to ensure that the Phase One information could be relied upon prior to the completion of this Phase Two ESA.

Terrapex's Phase One update report entitled *Update To Phase One Environmental Site Assessment, 315-317 Chapel Street, Ottawa, Ontario* dated April 28, 2023 concluded that potentially contaminating activities (PCAs) were identified within the Phase One Study Area, one of which (the former heating oil AST and boiler system located in the basement of the memorial hall building) led to an area of potential environmental concern (APEC) at the Site.

Therefore, a Phase Two ESA was required in order to file a RSC for the Phase One Property in accordance with the requirements of O. Reg. 153/04.

4.0 SCOPE OF INVESTIGATION

4.1 OVERVIEW OF SITE INVESTIGATION

The Phase One ESA determined that there was an APEC on-Site related to the presence of a former AST and boiler system located in the basement of the Memorial Hall building.

The scope of Terrapex's assessment to investigate within this APEC comprised the following:

- drilling one borehole to a depth of approximately 3.0 m below the basement floor within the APEC;
- drilling one borehole to a depth of approximately 16.9 m below grade (bg) to confirm site stratigraphy to bedrock;
- collecting soil samples and logging visual, olfactory, and tactile soil characteristics;
- submitting selected soil samples for laboratory analyses;
- evaluating laboratory analytical results with respect to the selected SCS; and,
- refining the existing Conceptual Site Model (developed during the Phase One ESA) to reflect the information collected during the Phase Two ESA activities.

The Sampling and Analysis Plan is provided in Appendix III.

4.2 MEDIA INVESTIGATED

The soil underlying the basement floor in the vicinity of the former AST and boiler system, where cracks and a sump were observed, was investigated for the presence of fuel oil.

Groundwater was not considered a media of concern for the investigation unless fuel oil or fuel oil impacts in soil were encountered within the APEC.

4.3 PHASE ONE CONCEPTUAL SITE MODEL

The phase one ESA conceptual site model (CSM) showing the surrounding land use (with water bodies, areas of natural significance, drinking water wells, roads and adjacent property uses), PCAs, and APECs is presented on Figures 2, 3, 4 and 5. A summary of the CSM is provided below.

Site Features: The Site is an irregular-shaped parcel of land located immediately south of Laurier Avenue (between Chapel Street and Blackburn Avenue) in Ottawa, Ontario.

The property is relatively flat. There are two buildings on the Site, a single-storey church with attached tower and basement, and a 2-storey hall building with a paved parking area on the west side of the building. Mature trees are located in the northern portion of the property along Laurier Avenue.

Site History: The Site was first developed as a church circa 1900 and the memorial hall was constructed prior to 1928. The Site has generally remained unchanged since that time.

Uses of Adjacent Properties: The Site was located in a mixed commercial and residential setting.

Existing Buildings and Structures: The Site was first developed as a church circa 1900 and the memorial hall was constructed prior to 1928. The Site has generally remained unchanged since that time.

Water Bodies: The Site does not include, and is not adjacent to, or within 30 m of a water body, as defined in O. Reg. 153/04.

Areas of Natural Significance: The Site does not include, and is not within, adjacent to, or within 30 m of an area of natural significance, as defined in O. Reg. 153/04.

Drinking Water Wells: No drinking water wells are present at the Site, nor was any evidence identified to suggest drinking water wells have previously been present at the Site. No records of drinking water wells were located within the Phase One Study Area.

Geology/Hydrogeology: The overburden at the Site consists of older alluvial deposits, described as clay, silt, sand and gravel that may contain organic remains. Overburden on the subject property was described as: topsoil/fill underlain by silty clay, sand silt with some clay and gravel (till) underlain by bedrock.

The bedrock on Site and in the area was composed of Paleozoic rock of the Verulam Formation, consisting of interbedded limestone and shale. Limestone bedrock at the Site was encountered at approximately 12 and 14 m bg.

It is likely that the shallow silty clay, extending to depths greater than approximately 10 m bg, is acting as an aquitard overlying a confined limestone bedrock aquifer. Perched groundwater may be present in the aquitard. However, not enough information is available to interpret a perched groundwater flow direction at the Site, which may be influenced by subsurface structures, utilities, or other features.

Groundwater flow in the limestone bedrock aquifer is anticipated to be to the northwest toward the Ottawa River.

Potentially Contaminating Activities: Ten (10) PCAs, as listed in Table 2 of Schedule D of O. Reg. 153/04, were identified within the Study Area:

- PCA 28 – Gasoline and Associated Products Storage in Fixed Tanks; and
- PCA 37 – Operation of Dry Cleaning Equipment (where chemicals are used).

One, the former fuel oil AST and boiler system located in the basement of the memorial hall building, contributed to an APEC at the Site.

Areas of Potential Environmental Concern: As a result of that PCA one APEC was identified at the Site:

- APEC 1 – the vicinity of the former fuel oil AST and boiler system in the basement of the memorial hall building.

Contaminants of Potential Concern: The Contaminants of Potential Concern (COPCs) associated with the on-site APEC comprise BTEX and PHCs F1 – F4.

Migration Pathways: It is anticipated that any fuel oil release from the former AST in the basement would migrate through cracks in the floor and subsequently into the underlying silty clay soil.

Uncertainty: Given that the location of the former AST and boiler system was evident during Site reconnaissance, the uncertainty related to the investigation location is low.

Notwithstanding the above, it should be noted that Phase One ESAs have inherent limitations, and therefore findings cannot be considered definitive (i.e., the findings of a Phase One ESA are inherently associated with some uncertainty).

4.4 DEVIATIONS FROM THE SAMPLING AND ANALYSIS PLAN

No deviations from the Sampling and Analysis Plan were encountered during the Phase Two ESA. A copy of the Sampling and Analysis Plan is provided in Appendix III.

4.5 IMPEDIMENTS

Access to the Site was not impeded at any time during the Phase Two ESA work program.

5.0 INVESTIGATION METHOD

5.1 GENERAL

The soil quality at the Site was investigated at the locations shown on Figure 2 through the advancement of boreholes to characterize environmental conditions at the APEC and confirm the stratigraphy at the Site.

Investigation methods followed Standard Operating Procedures (SOPs) prepared by Terrapex for the conduct of environmental investigations.

5.2 DRILLING AND EXCAVATING

Borehole drilling and monitoring well installation services for this work program were provided by Strata Drilling Group (Strata) of Stouffville, Ontario using direct push technology (a Hilti TE 3000-AVR Electric Jackhammer at BH101 and a track mounted MI3 drill rig at BH102). Strata is an MECP-licensed well drilling contractor.

Measures to minimize potential cross-contamination or other potential bias are described in Terrapex's Standard Operating Procedures (Appendix IV). There were no deviations from the Standard Operating Procedures regarding borehole drilling during this investigation.

5.3 SOIL

Borehole locations are shown on Figure 2. Tabular borehole logs illustrating the stratigraphy encountered, chemical analysis samples, and measured SV concentrations are included in Appendix V.

5.3.1 SOIL SAMPLING

Borehole advancement conducted as part of the Phase Two ESA work program was completed under the full-time supervision of Terrapex staff. Soil samples were collected at each borehole location at regular depth intervals using a macro-core sampler.

Each recovered sample was divided into two portions. One portion was placed in a clear sampling bag for field screening/logging. The second portion was collected using laboratory supplied sampling containers for COPC analysis. Samples considered to be “worst-case” based on field screening were submitted for analysis and extracted at the laboratory within the required holding time. Soil descriptions were recorded based on the Unified Soil Classification System (USCS).

Samples for analysis were placed in a cooler with ice and delivered with signed chain of custody to the project laboratory for analysis.

Measures to minimize potential cross-contamination or other potential bias are described in Terrapex's SOPs (Appendix IV).

5.3.2 FIELD SCREENING MEASUREMENTS

Combustible Soil Vapour (CSV) concentrations were measured in each soil sample using an RKI Eagle 2 Hydrocarbon Surveyor (Eagle) calibrated to n-hexane and operated in "methane elimination" mode. The Eagle can measure combustible organic compounds to a nominal detection level of 5 ppm, with an accuracy of ±5%.

The Eagle was calibrated according to the manufacturer's instructions and Terrapex Standard Operating Procedures before the field investigation.

"Worst-case" soil samples from each borehole were identified on the basis of vapour screening, visual and olfactory evidence of contamination, and sample location in relation to potential point sources of impact.

5.4 GROUNDWATER

Groundwater sampling was not completed as groundwater was not a media of concern at the Site.

5.5 SEDIMENT

Sediment sampling was not completed as sediment was not present at the Site.

5.6 ANALYTICAL TESTING

Laboratory analytical services for this work program were provided by Bureau Veritas (BV)'s laboratory in Mississauga, Ontario under contract with Terrapex. BV is accredited by Standards Council of Canada (SCC) to International Standard ISO/IEC 17025:2005, General Requirements for the Competence of Testing and Calibration Laboratories.

Soil samples were analysed as per the sampling and analysis plan (Appendix III).

5.7 RESIDUE MANAGEMENT

No residues were generated during the work program.

5.8 ELEVATION SURVEYING

The ground surface elevation at borehole BH102 was measured by Terrapex with a rod and level tied to the known geodetic elevation at the manhole at the intersection of Laurier Avenue and Blackburn Avenue.

The finished basement floor elevation (borehole BH101) was measured down from the known geodetic elevation at the basement door sill.

5.9 QUALITY ASSURANCE AND QUALITY CONTROL MEASURES

Quality Assurance and Quality Control (QA/QC) measures were implemented during the Phase Two ESA in accordance with Terrapex SOPs (Appendix IV).

During drilling, to mitigate cross-contamination, macro-core sample liners were disposed and split spoons were cleaned after the collection of each sample. Fresh nitrile gloves were worn for the handling of each sample.

QA/QC samples collected as part of the Phase Two investigation program included:

- one blind field duplicate soil sample for analysis of BTEX and PHCs F1 – F4, and
- one methanol blank for BTEX and PHC F1 fraction.

The laboratory was not informed of the nature or number of the field QA/QC samples outlined above.

6.0 REVIEW AND EVALUATION

6.1 GEOLOGY

Based on the information in the 2017 Phase One ESA, the overburden at the Site consists of older alluvial deposits, described as clay, silt, sand and gravel that may contain organic remains; and, based on the 2017 geotechnical investigation, overburden on the subject property was described as: topsoil/fill underlain by silty clay, sand silt with some clay and gravel (till) underlain by bedrock.

The bedrock on Site and in the area was composed of Paleozoic rock of the Verulam Formation, consisting of interbedded limestone and shale. The 2017 geotechnical report noted that limestone bedrock was encountered at approximately 12 and 14 m bg.

Borehole BH101 was advanced from the surface of the finished basement floor. The thickness of the concrete floor slab was approximately 300 mm. The stratigraphy encountered beneath the concrete slab consisted of wet brown clay with trace sand to a depth of 1.2 m, overlying saturated brown silty clay to the depth of investigation.

Borehole BH102 was located on asphaltic concrete pavement; the thickness of the asphaltic concrete measured in the borehole was approximately 75 mm. The stratigraphy encountered beneath the asphaltic concrete consisted of 0.8 m of variable brown sand and gravel, and sand with trace silt fill overlying grey silty clay extending to a depth of approximately 3.8 m bg, overlying moist grey silt and clay extending to bedrock at 10.8 m bg.

The upper zone of the silty clay extending to an approximate depth of 3.8 m bg was weathered and had a very soft to very stiff consistency.

The soil stratigraphy encountered at the Site is shown on the borehole logs in Appendix V and on cross sections Figures 6.

6.2 SOIL TEXTURE

Grain size analysis performed on the silty clay unit (BH102 Sample 7) revealed that it consisted of 52% clay, 47% silt, 1% sand, and 0% gravel.

Therefore, the soil present across the entire site contained 50 per cent or more by mass of particles that were smaller than 75 micrometres in mean diameter and was therefore considered to be “medium and fine textured soil” in accordance with the definitions of O. Reg. 153/04.

6.3 SOIL FIELD SCREENING

Potential impacts associated with fuel oil spills, leaks, or other releases were screened by measuring CSV concentrations in the headspace of one portion of recovered soil samples. The soil samples were placed in sealable sample bags for further site characterization (i.e., the portion not placed directly into sampling containers for possible laboratory analyses).

CSV concentrations measured for each soil sample recovered from with the APEC were less than 10 ppm.

CSV concentrations measured for each soil sample are included on the borehole logs (Appendix V).

6.4 SOIL QUALITY

Laboratory results for the soil samples submitted for analyses of BTEX and PHC F1-F4 are summarized in Table 1 and shown on cross-sectional Figures 6A and 6B.

As shown, BTEX and PHC F1-F4 concentrations in the soil samples submitted for analysis were less than the Table 3 SCSs. Further, COPC concentrations were not measured above the laboratory's reportable detection limit (RDL).

Copies of the Laboratory Certificates of Analyses are provided in Appendix VI.

6.7 GROUNDWATER QUALITY

The environmental quality of groundwater was not investigated as part of this work program as groundwater was not a media of potential environmental concern within the APEC, unless a large volume of fuel oil or high concentrations of fuel oil in soil were encountered, which was not the case.

6.8 SEDIMENT QUALITY

The environmental quality of sediment was not investigated as sediment was not present at the Site.

6.9 QUALITY ASSURANCE AND QUALITY CONTROL RESULTS

The laboratory's QA/QC program consisted of the analysis of laboratory replicates, method and spiked blanks, process percent recoveries, matrix spikes, and surrogate percent recoveries, as appropriate for the particular analytical protocol.

QA/QC Control Limits: A review of the quality assurance reports attached to the laboratory certificates of analyses indicate that the laboratory QA/QC samples were within the quality control limits.
Lab Duplicate Samples: Acceptable correlation was generally observed between the laboratory duplicate and its corresponding sampling pair for each of the tested parameters.

Matrix Spike Recoveries: No issues regarding matrix spike recoveries were outlined in any of the laboratory certificates of analysis.

Detection Limits: Detection limits generally did not require adjustment, with the exception of:

- the detection limits of soil sample BH101-1 were adjusted for analysis of BTEX and F1 due to the sample weight. However, all detection limits were below the applicable SCS.
- the detection limits of soil sample BH102-6 were adjusted for analysis of PHC F2, F3, and F4 due to the moisture content of the sample. However, all detection limits were below the applicable SCS.

General Comments: Laboratory analysis did not deviate from standard protocol.

Field Duplicate Samples: Acceptable correlation for field duplicate sample results was observed between the duplicate sample and its corresponding sampling pair for each of the tested parameters.

Methanol Blank Samples: A methanol blank sample was submitted for analysis of BTEX and PHC F1 as part of the soil sampling program. Analytical results from the methanol blank sample were all less than the laboratory's RDL.

Based on a review of the QA/QC program, no concerns regarding the adequacy or representativeness of the sampling and analytical program were identified and, as a result, did not affect the interpretation of analytical results.

6.10 PHASE TWO CONCEPTUAL SITE MODEL

A preliminary conceptual site model was developed as part of the Phase One ESA. Following the completion of the Phase Two ESA field program, the conceptual site model was updated to present the current Site characteristics and identify actual or potential sources of contamination, pathways, release mechanisms, receptors, and exposure routes.

Additional inputs to the conceptual site model included the stratigraphy observed during the Phase Two ESA work program; and the soil analytical results.

The Phase Two CSM is provided Appendix VIII to be read along with the figures contained in this report.

7.0 CONCLUSIONS

Based on the findings of the Phase Two ESA, the environmental quality of the Site meets the Table 3 SCS.

7.1 SIGNATURES

This report has been completed in accordance with the terms of reference for this project as agreed upon by All Saints Development LP (the Client) and Terrapex Environmental Ltd. (Terrapex) and generally accepted engineering or environmental consulting practices in this area.

The reported information is believed to provide a reasonable representation of the general environmental conditions at the site; however, studies of this nature have inherent limitations. The data were collected at specific locations and conditions may vary at other locations, or with the passage of time. The assessment was also limited to a study of those chemical parameters specifically addressed in this report.

Terrapex has relied in good faith on information and representations obtained from the Client and third parties and, except where specifically identified, has made no attempt to verify such information. Terrapex accepts no responsibility for any deficiency or inaccuracy in this report as a result of any misstatement, omission, misrepresentation, or fraudulent act of those providing information. Terrapex shall not be responsible for conditions or consequences arising from relevant facts that were concealed, withheld, or not fully disclosed at the time of the study.

This report has been prepared for the sole use of All Saints Development LP. Terrapex accepts no liability for claims arising from the use of this report, or from actions taken or decisions made as a result of this report, by parties other than All Saints Development LP.

Respectfully submitted,
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8.0 REFERENCES

Regulations and Guidelines

Ontario Ministry of the Environment. 2011a. *Ontario Regulation 153/04, Records of Site Condition – Part XV.1 of the Act.* July 1.

Ontario Ministry of the Environment, 2011b. *Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act*. April 15.

Terrapex Environmental Ltd. (Terrapex), 2023. Update to *Phase One Environmental Site Assessment, 315 Chapel Street, Ottawa, Ontario (Draft Report)*. April 7, 2023.

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FIGURES

LEGEND

▭ SITE BOUNDARY

DATA SOURCE: ESRI
MAP PROJECTION: NAD 1983 UTM Zone 18N

CLIENT:
ALL SAINTS DEVELOPMENT LP

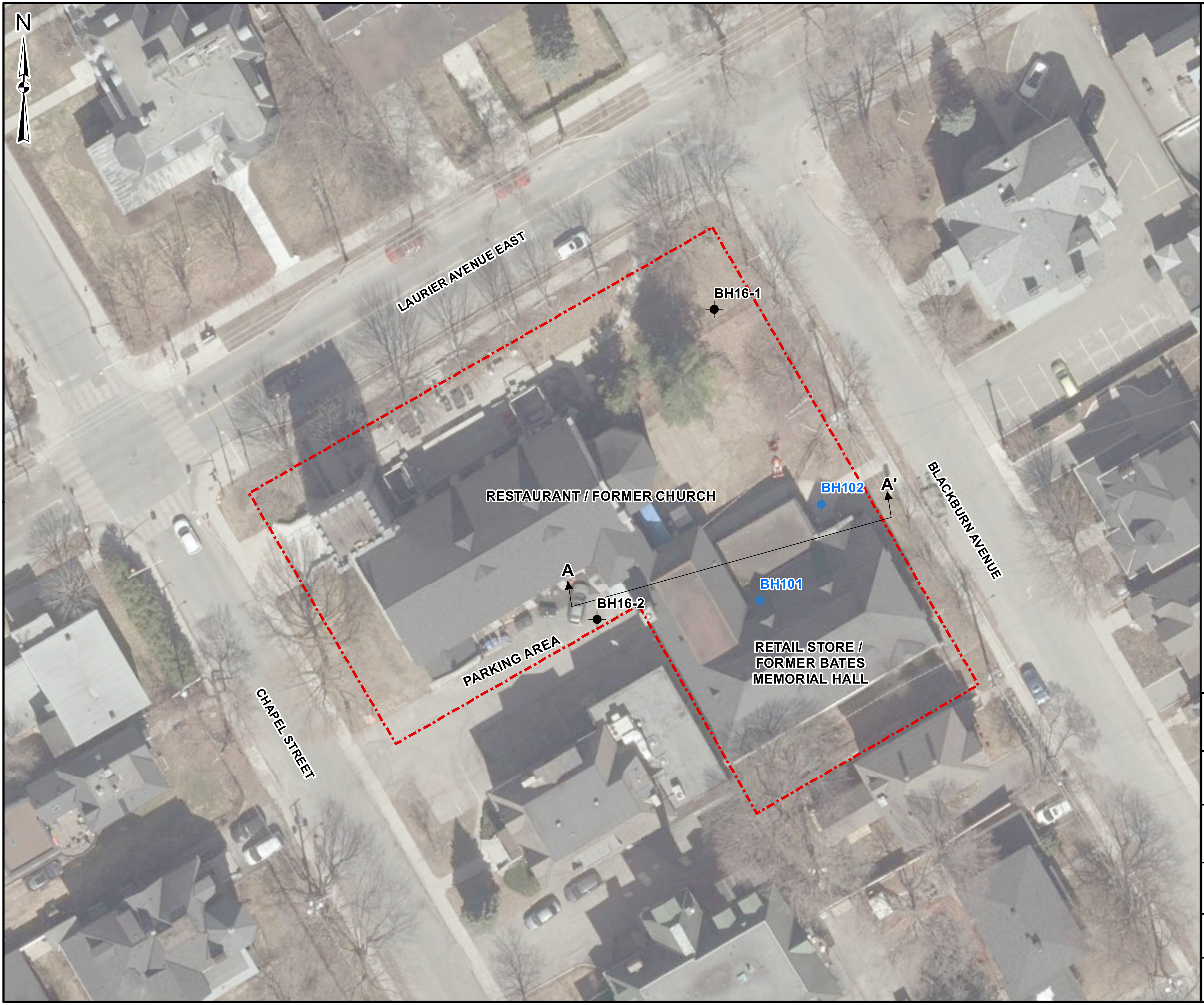
SITE LOCATION:
315-317 CHAPEL STREET
OTTAWA, ONTARIO

TERRAPEX

TITLE:
SITE LOCATION

DRAWN BY: JS	PROJECT NO.: CO923.00	CHECKED BY: JOB
REVISION: 00	DATE: JULY 2023	**FIGURE: 1**

jserroul C:\Users\JSerroul\OneDrive - Terrapex Environmental Ltd\PROJECTS\Ottawa\CO900\CO923.00 315-317 Chapel St, Ottawa\MXD\PHASE TWO ESA\FIG 1 SITE LOCATION.mxd



LEGEND

🟥 SITE BOUNDARY

↔ CROSS SECTION

● BOREHOLE (TERRAPEX)

● BOREHOLE (BY OTHERS)

0 5 10 15
Metres

DATA SOURCE: CITY OF OTTAWA
MAP PROJECTION: NAD 1983 UTM ZONE 18N

CLIENT:
ALL SAINTS DEVELOPMENT LP

SITE LOCATION:
315-317 CHAPEL STREET
OTTAWA, ONTARIO

TERRAPEX

TITLE:
GENERAL SITE LAYOUT

DRAWN BY:	PROJECT NO.:	CHECKED BY:
JS	CO923.00	JOB
REVISION:	DATE:	FIGURE:
00	JULY 2023	**2**

C:\Users\JSerroul\OneDrive - Terrapex Environmental Ltd\PROJECTS\Ottawa\CO900\CO923.00 315-317 Chapel St, Ottawa\MXD\PHASE TWO ESA\FIG 2 GENERAL SITE LAYOUT.mxd

C:\Users\JSerroul\OneDrive - Terrapex Environmental Ltd\PROJECTS\Ottawa\CO900\CO923.00 315-317 Chapel St, Ottawa\MXD\PHASE TWO ESA\FIG 3 STUDY AREA.mxd

LEGEND

- ▭ SITE BOUNDARY
- ▭ STUDY AREA
- ⊕ MECP WATER WELL RECORD
- ● HLUI TANKS

NOTE:
ALL MECP WATER WELL RECORDS ARE NON SUPPLY WELLS.

0 50 100 150
Metres

DATA SOURCE: CITY OF OTTAWA
MAP PROJECTION: NAD 1983 UTM ZONE 18N

CLIENT:
ALL SAINTS DEVELOPMENT LP

SITE LOCATION:
315-317 CHAPEL STREET
OTTAWA, ONTARIO

TERRAPEX

TITLE:
PHASE ONE STUDY AREA AND SURROUNDING LAND USES

DRAWN BY: JS	PROJECT NO.: CO923.00	CHECKED BY: JOB
REVISION: 00	DATE: JULY 2023	FIGURE: 3

C:\Users\JSerroul\OneDrive - Terrapex Environmental Ltd\PROJECTS\Ottawa\CO900\CO923.00 315-317 Chapel St, Ottawa\MXD\PHASE TWO ESA\FIG 4 CSM - PCAs.mxd

LEGEND

- ⬚ SITE BOUNDARY
- ▭ STUDY AREA

POTENITALLY CONTAMINATING ACTIVITY (PCA)

- ● ON-SITE PCA LEADING TO APEC
- ● OFF-SITE PCA NOT LEADING TO APEC

POTENTIALLY CONTAMINATING ACTIVITY TYPES

28. GASOLINE AND ASSOCIATED PRODUCTS STORAGE IN FIXED TANKS
30. IMPORTATION OF FILL MATERIAL OF UNKNOWN QUALITY

NOTE:

- PCA ID (PCA TYPE)

REFER TO TABLE 17 IN THE REPORT FOR ADDITIONAL DETAILS.

0 50 100 150
Metres

DATA SOURCE: CITY OF OTTAWA
MAP PROJECTION: NAD 1983 UTM ZONE 18N

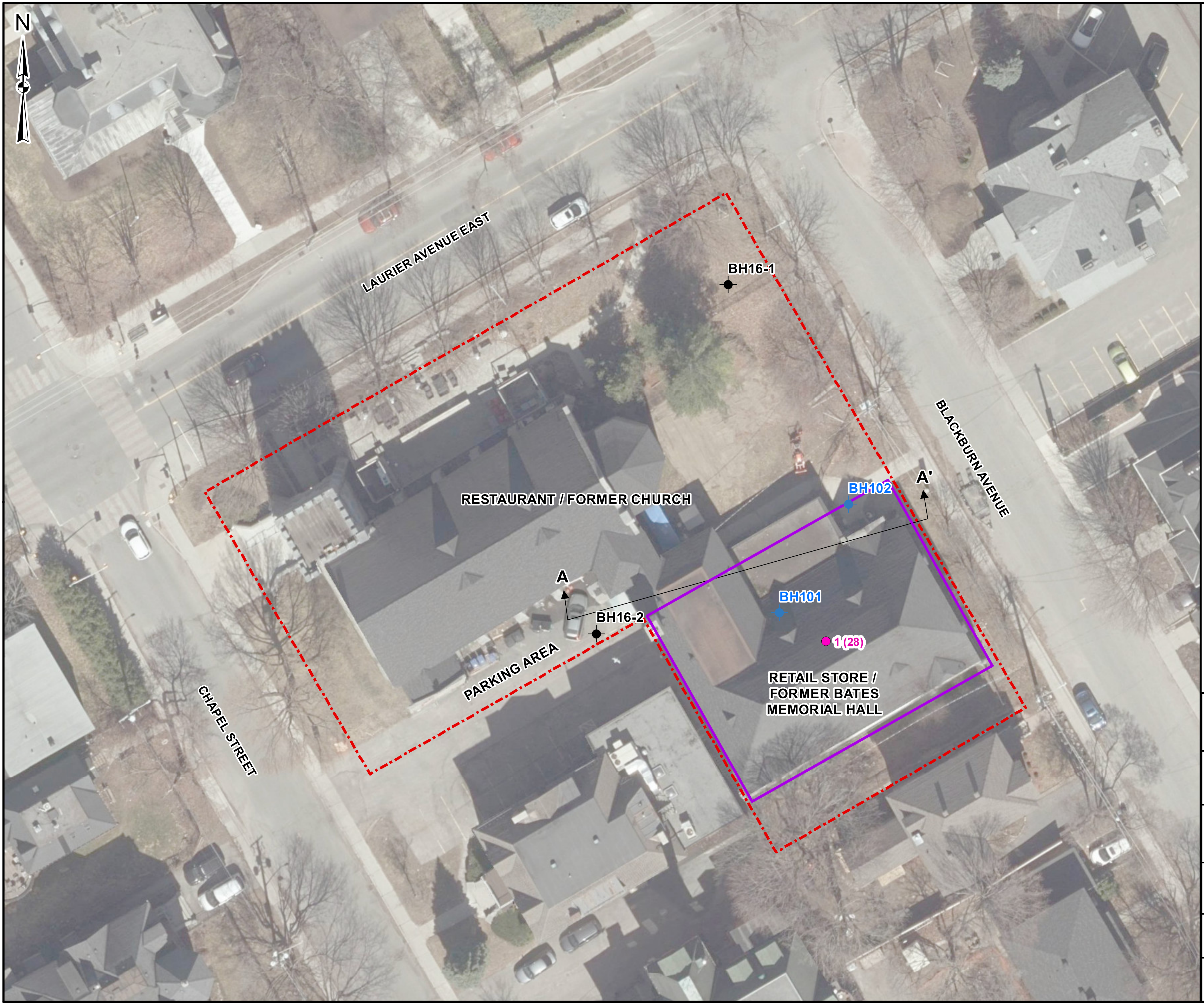
CLIENT:
ALL SAINTS DEVELOPMENT LP

SITE LOCATION:
315-317 CHAPEL STREET
OTTAWA, ONTARIO

TERRAPEX

TITLE:
CONCEPTUAL SITE MODEL AND POTENTIALLY CONTAMINATING ACTIVITIES

DRAWN BY:	PROJECT NO.:	CHECKED BY:
JS/SW	CO923.00	JOB
REVISION:	DATE:	FIGURE:
00	JULY 2023	**4**



LEGEND

- 🟥 SITE BOUNDARY
- ● BOREHOLE (TERRAPEX)
- ● BOREHOLE (BY OTHERS)
- ↔ CROSS SECTION

POTENITALLY CONTAMINATING ACTIVITY (PCA)

- ● ON-SITE PCA LEADING TO

AREAS OF POTENTIAL ENVIRONMENTAL CONCERN (APEC)

- ▭ APEC 1

APEC	PCA TYPE	DESCRIPTION
1	28	GASOLINE AND ASSOCIATED PRODUCTS STORAGE IN FIXED TANKS

0 5 10 15
Metres

DATA SOURCE: CITY OF OTTAWA
MAP PROJECTION: NAD 1983 UTM ZONE 18N

CLIENT:
ALL SAINTS DEVELOPMENT LP

SITE LOCATION:
315-317 CHAPEL STREET
OTTAWA, ONTARIO

TERRAPEX

TITLE:
CONCEPTUAL SITE MODEL - AREAS OF POTENTIAL ENVIRONMENTAL CONCERN

DRAWN BY:	PROJECT NO.:	CHECKED BY:
JS/SW	CO923.00	JOB
REVISION:	DATE:	FIGURE:
00	JULY 2023	5

C:\Users\JSerroul\OneDrive - Terrapex Environmental Ltd\PROJECTS\Ottawa\CO900\CO923.00 315-317 Chapel St, Ottawa\MXD\PHASE TWO ESA\FIG 5 CSM - APECs.mxd

TABLES

TABLE 1 SOIL ANALYTICAL RESULTS - BTEX and PHCs

315 Chapel Street, Ottawa, ON

Sample Name	Units	STANDARDS Table 3 R/P/I fine/medium	BH101-1	BH101-2 (Field duplicate of BH101-1)	BH102-6	METHANOL BLANK
Sample Depth	m bg	-	0.3 - 0.6	0.3 - 0.6	3.8 - 4.4	-
Sampling Date	dd-mmm-yy	-	10-Apr-23	10-Apr-23	11-Apr-23	10-Apr-23
Analysis Date (on or before)	dd-mmm-yy	-	18-Apr-23	18-Apr-23	18-Apr-23	17-Apr-23
Certificate of Analysis No.	-	-	C3A4168	C3A4168	C3A4168	C3A4168
Benzene	ug/g	0.17	<0.04	<0.02	<0.02	<0.02
Toluene	ug/g	6.0	<0.04	<0.02	<0.02	<0.02
Ethylbenzene	ug/g	15	<0.04	<0.02	<0.02	<0.02
Xylene Mixture	ug/g	25	<0.08	<0.04	<0.04	<0.04
Petroleum Hydrocarbons F1[1]	ug/g	65	<20	<10	<10	<10
Petroleum Hydrocarbons F2	ug/g	150	<10	<10	<20	-
Petroleum Hydrocarbons F3	ug/g	1,300	<50	<50	<100	-
Petroleum Hydrocarbons F4	ug/g	5,600	<50	<50	<100	-

Standards from Soil, Ground Water and Sediment Standards for Use Under Part XV.1
of the Environmental Protection Act (April 15, 2011 and as amended)
Table 3: Full Depth Generic SCS in a Non-Potable Ground Water Condition
Residential/Parkland/Institutional Property-Use, Fine- to Medium-Textured Soil

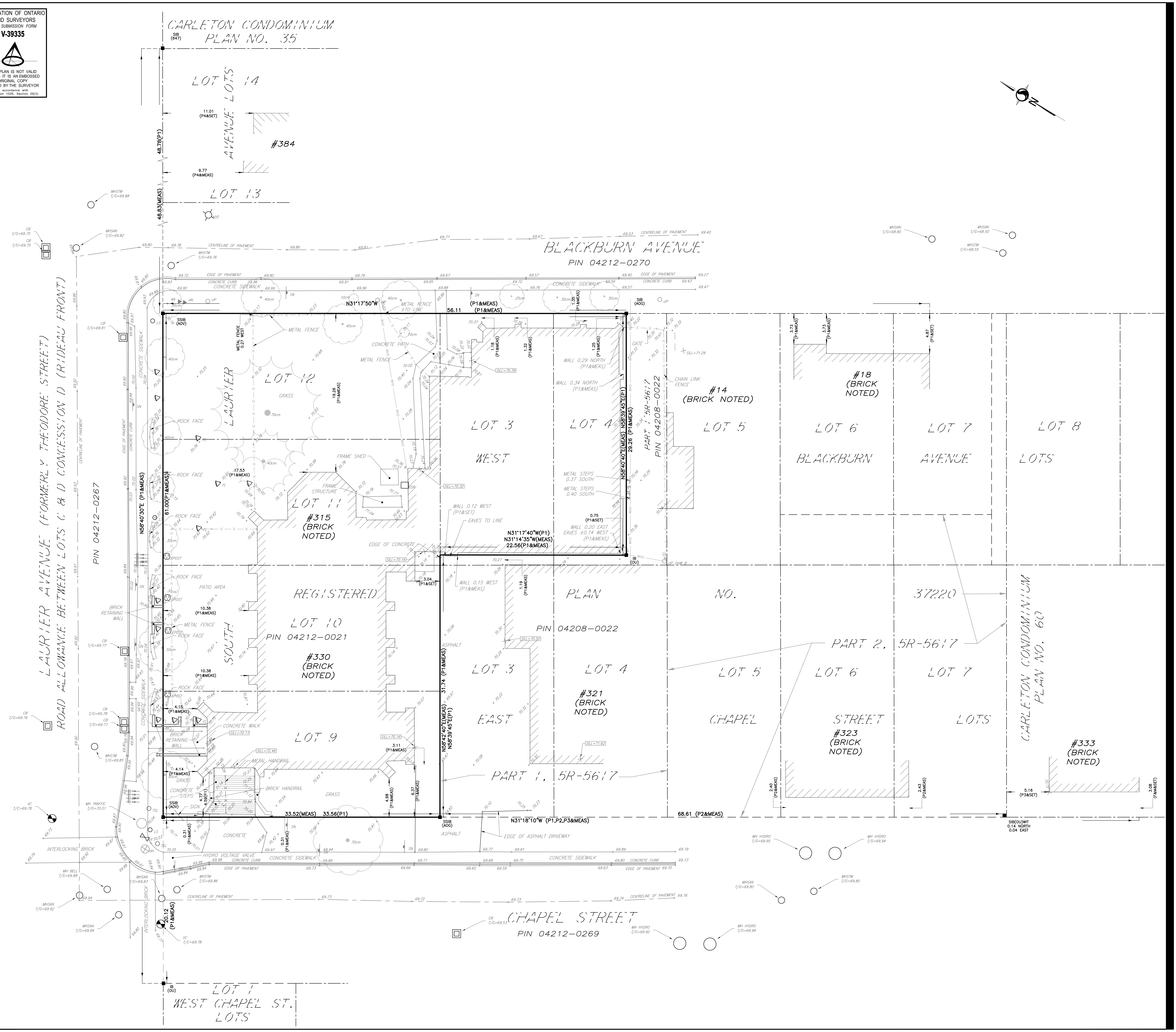
-	Not analyzed
m bg	meters below grade
Value	Exceeds standard
Value	Detection limit exceeds standard
[1]	F1 fraction does not include BTEX.

APPENDIX I
PLAN OF SURVEY

27 March 2023 12:30 PM

ASSOCIATION OF ONTARIO
LAND SURVEYORS
PLAN SUBMISSION FORM
V-39335

THIS PLAN IS NOT VALID
UNLESS IT IS AN EMBOSSED
ORIGINAL COPY
ISSUED BY THE SURVEYOR
In accordance with
Regulation 1026, Section 29(3)



Stantec

Stantec Geomatics Ltd.
300-1331 Clyde Avenue
Ottawa ON
Tel. 613.722.4420
www.stantec.com

TOPOGRAPHIC PLAN OF SURVEY OF

LOTS 9, 10, 11, 12 (SOUTH LAURIER AVENUE) PART OF LOTS 3 & 4 (WEST BLACKBURN AVENUE) REGISTERED PLAN NO. 37220

(GEOGRAPHIC TOWNSHIP OF NEPEAN)

CITY OF OTTAWA

Scale 1:200
5 0 5 10 METRES

Stantec Geomatics Ltd.
ONTARIO LAND SURVEYORS

METRIC CONVERSION
DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

BEARING NOTE
BEARINGS ARE GRID, DERIVED FROM CAN-NET VRS NETWORK GPS OBSERVATIONS ON NCC HORIZONTAL CONTROL MONUMENTS 19773035 AND 19680191, CENTRAL MERIDIAN, 76° 30' WEST LONGITUDE MTM ZONE 9, NAD83 (ORIGINAL).

ELEVATION NOTE
ELEVATIONS SHOWN HEREON ARE GEODETIC (CGVD-1928:1978) AND ARE DERIVED FROM THE CAN-NET VRS NETWORK MONUMENT: OTTAWA ELEVATION=95.230.

ROTATION NOTE
A ROATATION OF 0°02'05" COUNTER-CLOCKWISE WAS APPLIED TO P1

LEGEND

■		DENOTES	FOUND MONUMENTS
□		"	SET MONUMENTS
IB		"	IRON BAR
IBø		"	ROUND IRON BAR
SIB		"	STANDARD IRON BAR
SSIB		"	SHORT STANDARD IRON BAR
CC		"	CUT CROSS
CP		"	CONCRETE PIN
WIT		"	WITNESS
PIN		"	PROPERTY IDENTIFICATION NUMBER
M/MEAS		"	MEASURED
PROP		"	PROPORTIONED
OU		"	ORIGIN UNKNOWN
SG		"	STANTEC GEOMATICS LTD.
P1		"	PLAN BY AOV DATED JUNE 6, 1989
P2		"	PLAN BY H. A. K. SHIPMAN DATED OCTOBER 28, 1985
P3		"	CC-60
P4		"	PLAN BY AOV DATED JUNE 15, 2001
647		"	H. R. FARLEY O.L.S.
F&M		"	FARLEY & MARTIN SURVEYING LTD.
AOV		"	ANNIS, O'SULLIVAN, VOLLEBECK LTD.
◀	*AN*	"	ANCHOR
	BKR	"	BIKE RACK
▣	*CB*	"	CATCH BASIN
	EPOST	"	ELECTRICAL OUTLET
◁	*FL*	"	FLOOD LIGHT
□	*GSR*	"	GAS SERVICE REGULATOR
⋈	*GV*	"	GAS VALVE
	HYD	"	FIRE HYDRANT
○	*LS*	"	LIGHT STANDARD
○	*MHBELL*	"	MAINTENANCE HOLE BELL
○	*MHSAN*	"	MAINTENANCE HOLE SANITARY
○	*MHSTM*	"	MAINTENANCE HOLE STORM
	SN	"	SIGN
○	*UP*	"	UTILITY POLE
	VC	"	VALVE CHAMBER
		"	TREE CONIFEROUS (D.B.H. SHOWN)
		"	TREE DECIDUOUS (D.B.H. SHOWN)

SURVEYOR'S CERTIFICATE

I CERTIFY THAT :

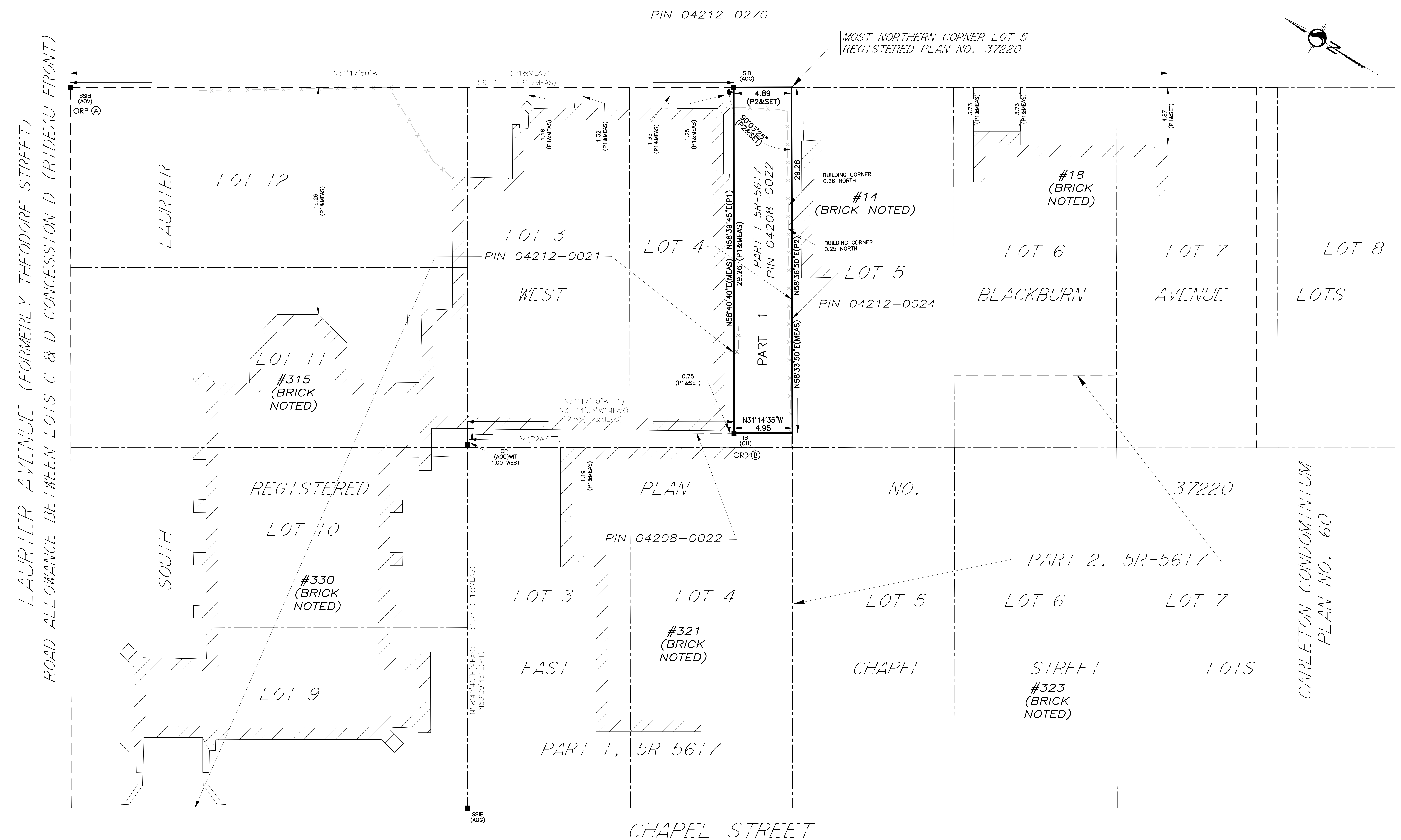
1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON THE 20th DAY OF MARCH, 2023.

DATE

R. G. BENNETT
ONTARIO LAND SURVEYOR

DRAWN: TMT CHECKED: CK PM: CT FIELD: CA PROJECT No.: 161614686-111

SCHEDULE			
PART	LOT	REGISTERED PLAN	PIN
1	PART OF 4	37220	PART OF PIN 04208-0022



PLAN OF SURVEY OF

PART OF LOT 4 (WEST BLACKBURN AVENUE)
REGISTERED PLAN NO. 37220

(GEOGRAPHIC TOWNSHIP OF NEPEAN)

CITY OF OTTAWA

Scale 1:200

5 0 5 10 METRES

Stantec Geomatics Ltd.

THE INTENDED PLOT SIZE OF THIS PLAN IS 762mm IN WIDTH BY 457mm IN HEIGHT WHEN PLOTTED AT A SCALE OF 1:200.

METRIC CONVERSION

DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

BEARING NOTE

BEARINGS ARE GRID, DERIVED FROM CAN-NET VRS NETWORK GPS OBSERVATIONS ON NCC HORIZONTAL CONTROL MONUMENTS 19773035 AND 19680191, CENTRAL MERIDIAN, 76° 30' WEST LONGITUDE MTM ZONE 9, NAD83 (ORIGINAL).

ROTATION NOTE

A ROATATION OF 0°02'05" COUNTER-CLOCKWISE WAS APPLIED TO P1

LEGEND

■	DENOTES	FOUND MONUMENTS
□	"	SET MONUMENTS
IB	"	IRON BAR
IBø	"	ROUND IRON BAR
SIB	"	STANDARD IRON BAR
SSIB	"	SHORT STANDARD IRON BAR
CC	"	CUT CROSS
CP	"	CONCRETE PIN
WIT	"	WITNESS
PIN	"	PROPERTY IDENTIFICATION NUMBER
M/MEAS	"	MEASURED
PROP	"	PROPORTIONED
OU	"	ORIGIN UNKNOWN
SG	"	STANTEC GEOMATICS LTD.
P1	"	PLAN BY AOV DATED JUNE 6, 1989
P2	"	PLAN 5R-5617

SURVEYOR'S CERTIFICATE

I CERTIFY THAT :

1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON THE 4th DAY OF MAY, 2023.

DATE

R. G. BENNETT
ONTARIO LAND SURVEYOR

THIS PLAN OF SURVEY RELATES TO AOLS PLAN SUBMISSION FORM NUMBER ######.

OBSERVED REFERENCE POINTS DERIVED FROM THE CAN-NET VRS NETWORK GPS OBSERVATIONS ON NCC HORIZONTAL CONTROL MONUMENTS 19773035 AND 19680191. CENTRAL MERIDIAN, 76°30' WEST LONGITUDE MTM ZONE 9, NAD83 (ORIGINAL).
COORDINATES TO URBAN ACCURACY PER SEC 14(2) OF O.REG. 216/10

POINT ID	NORTHING	EASTING
Ⓐ	5032293.17	369186.29
Ⓑ	5032230.01	369190.43

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

Stantec
Stantec Geomatics Ltd.
CANADA LANDS SURVEYORS
ONTARIO LAND SURVEYORS
1331 CLYDE AVENUE, SUITE 300
OTTAWA, ONTARIO, K2C 3G4
TEL. 613.722.4420
stantec.com

DRAWN: TMT	CHECKED: CT	PM: CT	FIELD: CA	PROJECT No.: 161614686-314

APPENDIX II
CORRESPONDENCE REGARDING NON-POTABLE STANDARDS

TERRAPEX

April 28, 2023
CO923.00

City of Ottawa
Clerks Office
110 Laurier Avenue West
Ottawa, Ontario
K1P 1J1

Attention: City Clerk

Re: Notification of Environmental Standards
315-317 Chapel Street, Ottawa, Ontario

Dear Sir/Madam:

Terrapex Environmental Ltd. (Terrapex) has been retained by the property owner to conduct a Phase Two Environmental Site Assessment at 315-317 Chapel Street in Ottawa, Ontario (the Site).

After reviewing Ontario Regulation (O. Reg.) 153/04 *Records of Site Condition - Part XV.1 of the Act,* Terrapex has determined that the site meets the requirements outlined in Section 35 of the regulation. As such, applicable full depth generic site condition standards in a non-potable groundwater condition will be applied to the analytical data obtained from the Site.

On behalf of the All Saints Development LP, and in accordance with the requirements of Section 35 of O. Reg. 153/04, Terrapex is hereby providing written notice to the City of Ottawa of the intention to apply non-potable groundwater site condition standards in preparing a Record of Site Condition for the property at the 315-317 Chapel Street, Ottawa, Ontario.

If you have any questions or concerns regarding this matter, please do not hesitate to contact the undersigned.

Sincerely,
TERRAPEX ENVIRONMENTAL LTD.

Rod Rose, PGeo (Limited)
Project Manager

APPENDIX III
SAMPLING AND ANALYSIS PLAN

SAMPLING AND ANALYSIS PLAN
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

Site: 315-317 Chapel Street, Ottawa Ontario
Project No: CO923.00
Date: March 17, 2023

OBJECTIVES

On behalf of All Saints Development LP, Terrapex Environmental Ltd. (Terrapex) has prepared this sampling and analysis plan for a Phase Two Environmental Site Assessment (ESA) at 315-317 Chapel Street, Ottawa, Ontario, the "Phase Two Property". The Phase Two ESA is to be conducted for the purposes of filing a Record of Site Condition per Ontario Regulation (O. Reg.) 153/04, *Records of Site Condition - Part XV.1 of the Act*.

The objective of this Phase Two ESA is to determine the location and concentration of contaminants in the land or water on, in or under the Phase Two Property.

One APEC was identified in the 2023 Terrapex Phase One ESA related to a former fuel oil AST and boiler system located in the basement of the former Memorial Hall building. The APEC is shown on the attached figure.

SAMPLING PROGRAM

Drill one borehole in the location of the former fuel oil AST and boiler system using a direct push drill rig with macrocore sampler to a depth of approximately 3.0 m below the basement floor. Collecting and classifying continuous soil samples. Submitting one worst-case soil sample for the analysis of benzene, toluene, ethylbenzene, xylenes, and petroleum fractions F1 to F4, as well as, one blind field duplicate sample and one methanol field blank.

Modifications may be made to the program during the course of implementation, based on field observations, and will be documented in the Phase Two ESA report.

STANDARD OPERATING PROCEDURES

The following Terrapex Standard Operating Procedures (SOPs) will be used:

SOP E01.00 – Field Meter Calibration
SOP E03.03 – Borehole Advancement Using Direct Push Methodology
SOP E09.00 – Soil Sample Handling
SOP E10.00 – Soil Classification
SOP E11.00 – Measuring and Surveying Using Rod and Level
SOP E12.00 – Field Program Quality Assurance & Quality Control

DATA QUALITY OBJECTIVES

The investigation will be completed following Terrapex SOP *E12.00 - Field Program Quality Assurance & Quality Control*, which specifies requirements for minimizing cross-contamination, record-keeping, sample storage, sample submission, field QA/QC samples and data quality objectives. If the data quality objectives are not met, the Qualified Person for the project will review the results and determine whether the deviation affects decision-making or the overall objectives of the investigation.

LABORATORY PROGRAM

Project Laboratory: Bureau Veritas (BV)

Accreditation: Standards Council of Canada (SCC) in accordance with the International Standard ISO/IEC17025-2005 – *General Requirements for the Competence of Testing and Calibration Laboratories*

Proposed Analytical Program: Submitting one worst-case soil sample for the analysis of benzene, toluene, ethylbenzene, xylenes, and petroleum fractions F1 to F4, as well as, one blind field duplicate sample and one methanol field blank. Submitting two soil samples (one surface sample and one subsurface sample) for pH analysis and one soil sample for grain size analysis.

Analytical Methods: The laboratory will use the methods specified in the *Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act, March 9, 2004, amended as of July 1, 2011 (Analytical Protocol).*

Sample Containers and Preservatives: See Table 1, below.

Table 1 – Sampling Container and Preservation

Media	Analytical Parameter	Field Filtered	Sample Container	Preservation	Holding Time (preserved)
Soil	BTEX, PHC F1	Not applicable	Hermetic sampler (Encore^{TM})	5 ± 3 ºC	Extract within 48 hrs
	PHCs F2-F4	Not applicable	120 mL glass jar, teflon lined lid	5 ± 3 ºC	14 days

BV's Quality Assurance/Quality Control (QA/QC) program will consist of the analysis of method blanks, laboratory control samples, matrix spikes, sample duplicates, and surrogates, as appropriate for the particular analysis protocol and as specified in the *Analytical Protocol.*

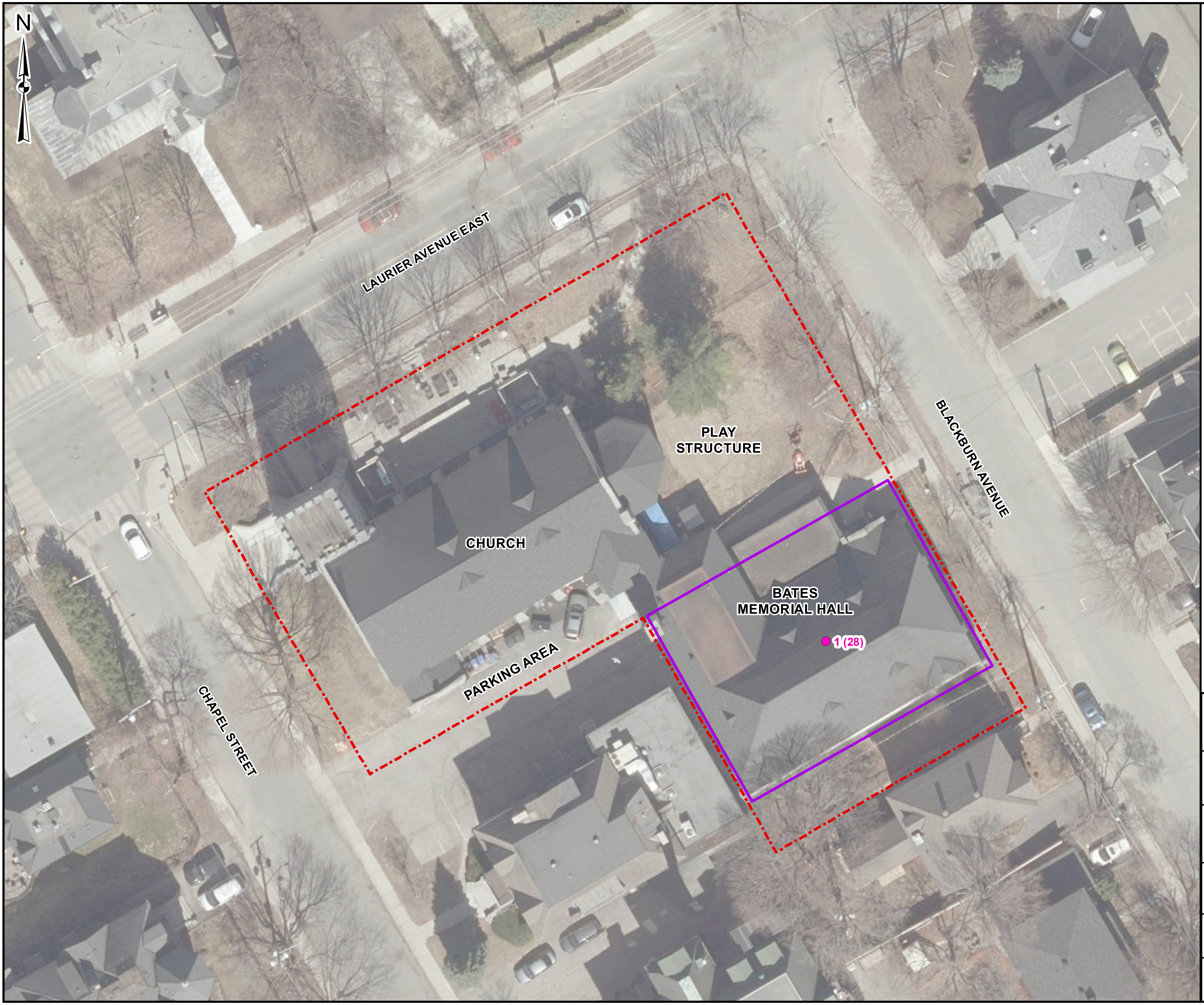
SUB-CONTRACTORS

All sub-contractors used in the Phase Two ESA will be approved suppliers according to Terrapex's ISO 9001:2008 system. The following sub-contractors will be retained for this project:

Private utility locates: USL-1 Underground Services Locators Inc.
Borehole drilling: Strata Drilling Group (Strata)
Laboratory analyses: Bureau Veritas (BV) Mississauga

ATTACHMENTS

Figure 5 – Area of Potential Environmental Concern and Sampling Locations



LEGEND

🟥 SITE BOUNDARY

POTENITALLY CONTAMINATING ACTIVITY (PCA)

● ON-SITE PCA LEADING TO

AREAS OF POTENTIAL ENVIRONMENTAL CONCERN (APEC)

▭ APEC 1

APEC	PCA TYPE	DESCRIPTION
1	28	GASOLINE AND ASSOCIATED PRODUCTS STORAGE IN FIXED TANKS

0 5 10 15
Metres

DATA SOURCE: CITY OF OTTAWA
MAP PROJECTION: NAD 1983 UTM ZONE 18N

CLIENT:
ALL SAINTS DEVELOPMENT LP

SITE LOCATION:
315-317 CHAPEL STREET
OTTAWA, ONTARIO

TERRAPEX

TITLE:
CONCEPTUAL SITE MODEL - AREAS OF POTENTIAL ENVIRONMENTAL CONCERN

DRAWN BY:	PROJECT NO.:	CHECKED BY:
JS/SW	CO923.00	JOB
REVISION:	DATE:	FIGURE:
00	JULY 2023	**5**

C:\Users\JSerroul\OneDrive - Terrapex Environmental Ltd\PROJECTS\Ottawa\CO900\CO923.00 315-317 Chapel St, Ottawa\MXD\FIG 5 CSM - APECs.mxd

APPENDIX IV
STANDARD OPERATING PROCEDURES

TERRAPEX STANDARD OPERATING PROCEDURE
FIELD VAPOUR METER CALIBRATION

GENERAL NOTES

Standard Operating Procedures (SOPs) have been developed by Terrapex Environmental Ltd. to standardize protocols used during environmental assessment work programs. However, certain work programs may warrant deviations from SOPs and some clients may have specific requirements which differ from those outlined in this SOP. Any significant deviations should be discussed with and approved by the project manager. Each deviation, along with the rationale for the deviation, should be documented in the field notes, project scope and/or notes to file.

Where SOPs are appended to reports, all deviations from this SOP, along with the rationale for the deviation, must be documented in the report.

APPLICATION

This SOP describes calibration procedures and requirements for portable meters used to measure combustible vapours, volatile organic compounds, and/or other gases within an atmosphere. The procedures described herein are applicable to calibration both in the office and in the field (using a portable calibration kit).

GENERAL CALIBRATION PROCEDURES

1. Turn on the instrument and allow 5-10 minutes for it to warm up. When calibrating in the field, complete instrument warm up in a sheltered environment, or allow an additional 5-10 minutes for warm up.
2. Attach hoses, water traps, probe ends and other pieces that will be utilized during actual measurement, and set instrument to the intended measurement mode (e.g., on a Gastech Model 1238 ME, turn “methane elimination” on or off, as appropriate).
3. Check instrument flow rate to confirm suitable vapour intake.
4. In a baseline environment (e.g., ambient air), “zero” the instrument. Record any adjustments made on the instrument calibration log, including initial and final (calibrated) readings.
5. Fill an empty Tedlar bag with calibration gas, and connect it to the instrument. If the instrument being calibrated has multiple sensors for different ranges of target vapours (e.g., GasTech model 1238ME), calibrate the coarse range (higher concentrations) first.

6. Allow the instrument to equilibrate with the environment in the Tedlar bag and adjust the instrument span settings as appropriate. Record any adjustments made on the instrument calibration log, including initial and final (calibrated) readings.
7. Remove the Tedlar bag and confirm that the instrument returns to a baseline reading (e.g., zero reading on a combustible vapour meter).
8. Repeat steps 4 through 7, as necessary, for additional sensors and/or target vapours.

CALIBRATION REQUIREMENTS

Portable meters are to be calibrated prior to the start of a site visit, and prior to the start of each successive site visit if the project requires more than a single day onsite.

More frequent calibration may be required on projects where elevated vapour readings are frequently encountered, as such scenarios can results in calibration “drift” (erroneous readings on the instrument). Calibration drift is often characterized by one or more of the following conditions:

- Failure of the instrument to return to a baseline reading in ambient conditions;
- No response or apparently “sluggish” response of the instrument upon exposure to an environment containing target vapours; or,
- Inconsistent instrument readings despite exposure to apparently identical target environments.

Where calibration drift is suspected, the instrument should be recalibrated as soon as practicable. Readings potentially affected by calibration drift should be appropriately annotated on field notes/log sheets.

TERRAPEX STANDARD OPERATING PROCEDURE
BOREHOLE ADVANCEMENT USING DIRECT PUSH METHODOLOGY

GENERAL NOTES

Standard Operating Procedures (SOPs) have been developed by Terrapex Environmental Ltd. to standardize protocols used during environmental assessment work programs. However, certain work programs may warrant deviations from SOPs and some clients may have specific requirements which differ from those outlined in this SOP. Any significant deviations should be discussed with and approved by the project manager. Each deviation, along with the rationale for the deviation, should be documented in the field notes, project scope and/or notes to file.

Where SOPs are appended to reports, all deviations from this SOP, along with the rationale for the deviation, must be documented in the report.

APPLICATION

This SOP is applicable to intrusive environmental investigations involving the advancement of borings using direct push methodology (e.g., Geoprobe) to collect soil samples using a “dual tube” sampling system comprising an inner disposable sampling liner or “sleeve” and a rigid outer casing tube.

The SOP is applicable whether such activity constitutes the whole of a work program, or part of a larger work program.

EQUIPMENT

The following list details the standard equipment necessary for borehole advancement. Specific sites may require additional or specialized equipment.

☐ Portable combustible vapour meter (e.g., Gastech^{TM} 1238ME), calibrated and charged

☐ Combustible vapour meter field calibration kit, if applicable

☐ tape measure with weighted end

☐ sampling equipment (gloves, bags, permanent marker)

☐ bucket for washing non-dedicated down hole equipment

☐ detergent solution in spray bottle

☐ distilled/clean water in spray bottle

☐ laboratory-supplied sampling jars appropriate for contaminants of concern

☐ cooler with ice

☐ laboratory chain of custody forms

☐ field notebook

☐ field borehole logs (F025)

☐ site plan

☐ scope of work/field work instructions

☐ site-specific health and safety plan, including Job Safety Analysis and other POST^{TM} documentation

☐ Personal Protective Equipment (hard hat, vest, safety glasses, respirator, steel toe boots, gloves, hearing protection)

☐ Camera

☐ Measuring wheel or similar device

PREPARATION

- review scope, proposed borehole locations, and utility locates with project manager
- ensure utility locates are complete, contractor is confirmed, and site access is confirmed
- ensure equipment booked is suitable for site (e.g., tracked drill rig vs. truck-mounted rig)
- calibrate and sign-out field equipment

SPECIAL PLANNING AND PREPARATION REQUIREMENTS

Above ground and underground utilities and other services within the assessment area are to be located and identified in the field prior to drilling. Where appropriate, a private locating contractor should also be retained to identify secondary services such as yard lights, internal computer/communication lines, etc., and clear proposed borehole locations. All exclusions or conditions attached to utility service locates (e.g., notification requirements, “hand dig only” areas) are to be strictly adhered to.

NOMENCLATURE

Boreholes should be uniquely numbered on a sequential basis, and prefaced by “BH".

The initial round of borehole advancement should begin with borehole “BH101”, with subsequent boreholes advanced during this round identified as “BH102”, “BH103”, etc.   Additional rounds of borehole advancement would begin by advancing the borehole count to the next 100 (e.g., the first borehole from the second and third investigation program would be “BH201” and “BH301”, respectively).   Borehole numbering is to be maintained irrespective of the manner in which the borehole is advanced (e.g., if the second round of borehole advancement is completed using a method other than direct-push sampling, it would still commence with borehole “BH201”).

If a monitoring well is installed in a borehole (refer to *Monitoring Well Installation*, SOP E04.00), the prefix “MW” is to be substituted for “BH”, however, the borehole numbering sequence is to be maintained (e.g., if the second borehole of the first round of investigation is instrumented as a monitoring well, it would be identified as “MW102”, not “MW101”).

Soil samples collected during borehole advancement should be numbered sequentially using the test pit number followed by a dash as a prefix, (e.g., sample “BH101-4", indicating the fourth sample from borehole BH101). Subdivided samples should be labelled with alphabetical suffixes from the top of the sample (e.g., “BH101-4A” and “BH101-4B”, with the later sample located at the greater depth).

All alphabetical prefixes and suffixes should be written in capital letters.

FIELD PROCEDURES

Sampling

Direct push samples are normally collected on an effectively continuous basis, meaning that samples are collected from ground surface over the full length of the sampling liner, with the next sample collected beginning immediately below the preceding liner.   It should be noted that direct push samplers typically have very poor (in some cases virtually nil) recovery within large granular soils such as granular base beneath asphalt and similar surface treatments.

Sampling sleeves are consumables and should not be re-used. The rigid outer tube casing lengths are to be cleaned prior to use using soapy water and a fresh water rinse.

Recovered soil samples should be handled and screened in the field as specified in *Soil Sample Handling* (SOP E09.00).   Where appropriate, samples should be divided into two or more sub-samples to facilitate logging of observed changes in geological conditions (stratigraphy, etc.) or evidence of possible impact (staining, odours, etc.).   Subdivided samples should be identified as described in the Nomenclature section above; i.e., assigning the suffix “A” to the sub-sample at the top of the spoon (the sample first collected), then “B”, “C”, etc.

Sampling liners are available in lengths of 1 m, 2 feet (approximately 0.6 m), 3 feet (approximately 0.9 m), 4 feet (approximately 1.2 m), and 5 feet (approximately 1.5 m), although 4 feet and 5 feet lengths are most common. Where sampling liners greater than 1 m are employed, recovered samples are to be subdivided (e.g., into “A” and “B” samples) to ensure that each unique sample comprises an interval no more than 1 m in length.

Boreholes are to be advanced to at least the maximum anticipated depth of potential impact (e.g., at least the water table for investigations of possible petroleum hydrocarbon impacts). Whenever possible, the final depth of the borehole should approximately delineate the vertical extent of contamination in the vicinity of the borehole (e.g., one “clean” sample should be obtained from the base of the borehole).

Where a well is to be installed in the completed boring, it may be preferable to enlarge the boring (to increase the diameter of filter pack placement around the well screen and/or to facilitate the installation of a larger diameter well) by over-drilling the hole using continuous flight augers. The over-drilling practice, and the diameter of the enlarged hole, should be noted on the borehole log.

Note Taking

Use the Terrapex field borehole form (Form F025). Always fill in every field of the top portion of the form completely - logs can easily get separated from each other. Where applicable, note the outer diameter of augers.

Avoid using non-established short forms on all descriptions. Do not scribble anything out or erase, just place a line through the word.

The type and thickness of surfacing materials (asphalt, concrete and/or crushed stone) should also be recorded.

Record the sampling interval graphically as the interval over which the dual tube sampler was driven, not the length of the sampling tube (i.e., record the actual sampling interval, accounting for refusal, not the planned sampling interval).

Label each sample collected as 1, 2, 3, etc. as specified in the Nomenclature section. Do not start a new set of numbers if you change collection methods. Do not use depth intervals for the sample name (e.g. 10'-12').

Record percent recovery based on how far you drove the sampler (actual sampling interval, not the intended sampling interval), rounded to the nearest 5%.

% recovery = (Quantity of soil recovered)/(sampling interval) x 100%

For example, if the sampler was driven 1 m, and 78 cm of soil was recovered,

% recovery = (78 cm / 100 cm) x 100% = 78%, rounded to 80%.

When screening soil headspace vapours, record vapour readings AND units. Note the instrument number used to collect vapour readings. If you are using an instrument other than the default GasTech 1238 combustible meter or equivalent, note the type of instrument.

If there is no deflection on the combustible gas meter (or other field headspace screening instrument) record the reading as less than the effective detection limit (<10 ppm for combustible gas meters), not 0 ppm.

For odours, use NONE, SLIGHT, MODERATE and STRONG. The default is assumed to be hydrocarbon odour; other types of odours require a description entered onto the log. Do not leave this blank unless you did not check for odours.

Refer to the *Soil Classification* (SOP E10.00) for standard terminology for recording sample descriptions. In addition:

- always record the relative grain size of sand particles (fine/medium/coarse), not just “sand”;
- note any structural observations (bedding, etc.)
- record presence of rootlets/roots, organic matter, debris, and anything else that might help determine whether the soil is fill or native;
- note fractures and location, width, weathered, staining, open, closed, tight.
- for sand seams, record the depth and thickness as well as a description (coarse, wet, etc.).

Clearly and fully document the stratigraphy encountered during drilling and soil sampling, including the depths of stratigraphic contacts observed **within** recovered samplers (e.g., located within sampling intervals). If there are distinct layers within a sample, the sample should be divided into sub-samples and identified with suffixes A, B, C, etc. as described above.

The depth and reasons for abandoning further borehole advancement (e.g., refusal at bedrock, depth of desired investigation obtained) is to be recorded on the log.

Backfilling

This section applies to boreholes in which monitoring wells are not installed. Refer to Monitoring *Well Installation* (SOP E04.00) for instrumenting boreholes as monitoring wells.

To ensure that the boring does not represent a potential conduit for groundwater flow or contaminant migration, boreholes are to be backfilled using bentonite chips and subsequently hydrated by the addition of a sufficient volume of potable-grade water. Where boreholes have been advanced through a hole cut through asphalt, concrete or similar hard surfacing, a concrete patch is to be applied to mitigate further cracking/degradation of surface treatments.

Prior to Leaving Site

- Check the scope of work to ensure you have completed project objectives
- Measure the final location of all boreholes from permanent site features and show on site plan (refer to *Measuring and Surveying using Rod and Level*, SOP E11.00)
- Ensure boreholes are properly backfilled and the site is sufficiently restored
- Clean up any garbage or debris and leave the site the way you found it (or better)
- Call the project manager to ensure there is nothing else required, to summarize findings and results**,** and select final lab samples
- Pack and submit samples to lab with chain of custody

UPON RETURN TO OFFICE

- Clean and sign in all equipment used
- Log in soil samples in soil bins
- Complete equipment and supply form
- Complete field package (place logs and photocopies of relevant field log book pages in project file folder)
- Submit site drawing depicting borehole locations to drafting.

TERRAPEX STANDARD OPERATING PROCEDURE
SOIL SAMPLE HANDLING

GENERAL NOTE

Standard Operating Procedures (SOPs) have been developed by Terrapex Environmental Ltd. to standardize protocols used during environmental assessment work programs. However, certain work programs may warrant deviations from SOPs and some clients may have specific requirements which differ from those outlined in this SOP. Any significant deviations should be discussed with and approved by the project manager. Each deviation, along with the rationale for the deviation, should be documented in the field notes, project scope and/or notes to file.

Where SOPs are appended to reports, all deviations from this SOP, along with the rationale for the deviation, must be documented in the report.

APPLICATION

These procedures are applicable to intrusive investigations involving the collection of soil samples for the purposes of environmental assessment. The SOP is also applicable to work programs that involve the collection of samples of materials that are not technically soil, but which are soil-like, including sediments, regolith, and engineered granular materials.

It should be noted that this SOP addresses general requirements related to soil sample handling (e.g., once a sample has been recovered). Specific requirements related to sample collection methodology, including sample nomenclature and documentation, are provided in SOPs related to these sampling approaches. Additional information relating to sample description and quality assurance and quality control requirements for soil sampling programs are provided in SOPs E10.00 (*Soil Classification*) and E12.00 (*Field Program Quality Assurance & Quality Control*), respectively.

EQUIPMENT

The following list details standard equipment used in the sampling of soil or soil-like materials. Specific sites may require additional or specialized equipment.

☐ Gastech^{TM} 1238ME, calibrated and charged

☐ Gastech^{TM} field calibration kit, if applicable

☐ tape measure (preferably weighted flexible tape)

☐ trowel or knife for sampling from bucket

☐ sampling equipment (gloves, bags, permanent marker)

☐ laboratory-supplied sampling jars appropriate for contaminants of concern

☐ laboratory chain of custody forms

☐ field notebook

☐ site plan

☐ Sampling Plan (scope of work/field work instructions)

☐ site-specific health and safety plan

☐ Personal Protective Equipment (hard hat, vest, safety glasses, respirator, steel toe boots)

☐ camera

SPECIAL PLANNING AND PREPARATION REQUIREMENTS

Above ground and underground utilities and other services within the assessment area are to be located and identified in the field prior to intrusive sampling. Where appropriate, a private locating contractor should also be retained to identify secondary services such as yard lights, internal computer/communication lines, etc. and clear proposed sampling locations. All exclusions or conditions attached to utility service locates (e.g. notification requirements, "hand dig only" areas) are to be strictly adhered to.

Requirements outlined in the SOP specific to the sampling methodology are to be adopted during sample collection. To mitigate potential cross contamination, new disposable gloves are to be donned for the collection / handling of each sample, and any non-dedicated sampling equipment washed and rinsed prior to use.

Recovered samples should be identified using the nomenclature requirements outlined in the SOP specific to the sampling methodology. Available information relating to previous intrusive sampling programs at the site (including those by parties other than Terrapex) should be reviewed to ensure that sample identifications employed during the work program are unique; in some instances this may require advancing standard Terrapex sampling counts to address sampling identifications used by third parties during earlier investigations (e.g., if another consultant has already advanced boreholes identified as BH1 through BH10, the first round of Terrapex boreholes should begin at BH101, even though this is normally the count for the second round of Terrapex boreholes).

DISCRETE SAMPLES

Recovered samples are to be split into two portions; one portion is to be placed in a clear sealable sampling bag for field logging and screening, while the second portion is to be retained for possible laboratory analyses.

Portions for (Possible) Laboratory Analyses

If contaminants of concern / potential contaminants of concern for the sampling program include volatile constituents (see below for a detailed list of these parameters), the portion of the sample for possible volatile laboratory analyses is to be collected using a hermetically sealed sampling device (e.g., En Core Samplers) or placed directly into laboratory-supplied sampling containers pre-charged with sample preservative.

Samples (or portions of samples) for other analyses should either be placed directly into laboratory-supplied sampling containers appropriate for the intended/potential analyses, or should be placed in a second sealable sampling bag (i.e., a sampling bag other than the bag in which the portion for field screening and logging was placed) without headspace for subsequent transfer to laboratory-supplied sampling containers once samples for laboratory analyses have been selected).

If it is possible to accurately return to the sampling location, it is also acceptable for initial sampling to be completed for field screening and logging purposes only, with the portion of the sample for laboratory analyses recovered at a later time. In such an instance, samples for laboratory analyses are to be collected directly into laboratory-supplied sampling containers. This approach is generally only applicable during the collection of samples from open excavations (remedial excavation work programs, tank removals, etc.).

From a purely technical perspective, the preference for sample collection methodologies (from most preferred to least preferred) is:

1. Collection directly into laboratory-supplied sampling containers concurrently with collection of the portion of the sample for field screening and logging.
2. Initial sampling for field screening and logging only, and returning to the sampling location at a later time to sample for the purposes of laboratory analyses.
3. Collection into sealable sampling bags concurrently with separate bags collected for the portion of the sample for field screening and logging and the portion of the sample for laboratory analyses.

To the extent practicable during the work program, the technical preference outlined above should be adhered to. The sampling methodology employed for each sample should be recorded in the field notes, and included as part of the report documenting the work program.

If the third approach is selected the sampling bags should be managed while in temporary storage as would any other sample (refer to SOP E12.00, *Field Program Quality Assurance & Quality Control*), and should not be manipulated or otherwise disturbed until the bag contents are to be transferred to laboratory-supplied sampling containers for submission to the contract laboratory. When transferring the sample from the sampling bag to the laboratory-supplied sampling containers, efforts should be made to select portions of the sample from the interior of the bag (i.e., not in contact with the sides of the bag) and avoid undue manipulation of the sample.

Sample submissions to the contract laboratory should NOT be prepared using material placed in the sampling bag for field logging and screening (see below), as this activity involves significant manipulation of the recovered sample.

Field Screening and Logging

Logging is the process by which individual samples are recorded (documented). Logging also includes classifying / describing the sample for the purposes of determining overall site stratigraphy.

Samples are to be logged using the appropriate field form (refer to the SOP specific to the sampling methodology), and classified / described as per SOP E10.00, *Soil Classification*.

Detailed examination and logging of samples requires some time, and is often completed at the conclusion of sampling activities. This practice is acceptable, but any information relating to structural or similar details (e.g., bedding, orientation of clasts within soil matrix) likely to be lost during movement of the bag and/or manipulation of the sample during field screening will need to be logged immediately at the time of sample collection.

Field screening is the process by which samples are qualitatively assessed for evidence of chemical impact, often to assist in the selection of samples for quantitative chemical testing by a contract laboratory. As field screening information is often gathered concurrently with field logging of recovered samples and is recorded on field logs, the distinction between field logging and field screening is subtle.

The components of field screening include:

- Measurements of vapours within the headspace of the sealable sampling bag containing the portion of the soil sample for field screening and logging (sometimes referred to combustible soil vapour measurements or CSV measurement);
- Examination of the sample for visual evidence of possible chemical impact (e.g., staining, presence of debris or other inclusions); and,
- Examination of the sample for olfactory evidence of possible chemical impact; and,
- Evaluation of the sampling location (both horizontally and vertically) with respect to the conceptual site model (e.g., proximity to underground storage tanks or other areas of potential environmental concern, relative positioning to the groundwater table or other contaminant fate and transport factors).

Typically, the selection of soil samples for laboratory analyses will be based on the results of the field screening process. On occasion, samples may also be selected to address specific work program objectives (e.g., duplication of previous results, re-evaluation of specific sampling locations), regardless of field screening results, however, field screening of recovered samples is still to be completed in such instances.

Procedures for measuring headspace vapours within the sealable sampling bag are described below.

Observations regarding visual and/or olfactory evidence of possible chemical impact are to be recorded in the sampling log. Where staining is present, describe both the apparent colour and the distribution of the staining (e.g., throughout the soil matrix, or within fractures). Odours are described using NONE, SLIGHT, MODERATE or STRONG, along with a description of the type of odour (e.g., hydrocarbon, organic, etc.).

DUPLICATE SAMPLES

A field duplicate is a second sample concurrently collected from the same location as another sample and submitted for duplicate analyses to provide quality assurance information during sampling programs (refer to SOP E12.00, *Field Program Quality Assurance & Quality Control*).

Field duplicate samples should be recorded in the field notes using their assigned sample nomenclature, along with their corresponding sampling pair. When possible, sample duplicates should be subjected to field screening and logging procedures, although limited sample volume may occasionally preclude such efforts.

COMPOSITE SAMPLES

Composite samples are ‘prepared’ samples; that is they are created by Terrapex out of two or more discrete samples. Composite samples may only be prepared using samples collected from the same depth, and that are located within a single 2 m horizontal radius.

Composite samples should be prepared by placing approximately equal volumes of each contributing discrete sample in a stainless steel bowl and blending the samples together such that the individual samples can no longer be visually distinguished from one another. It should be noted that compositing cohesive soils or very dense cohesionless soils may be impracticable at some sites.

The composite sample should be recorded in the field notes (e.g., on the sampling log), noting each of the contributing discrete samples incorporated within, with the time and date of the composite "sampling" being that when the sample was created. Composite soil samples are NOT to be classified per SOP E10.00, *Soil Classification*, nor are they subject to the field screening procedures applicable to discrete soil samples.

Composite soil samples should not be submitted for laboratory analyses other than metallic (with the exception of mercury and methyl mercury, which are volatile parameters) or general chemistry (inorganic) parameters.

SPECIAL CONSIDERATIONS, SAMPLES FOR ANALYSES OF VOLATILE CONSTITUENTS

To minimize potential losses through off-gassing, soil samples for analyses or potential analyses of volatile constituents are subject to special handling requirements as outlined in Table 1, below.

Table 1 Soil Sampling Requirements, Analyses for Volatile Constituents

Parameter(s)	**Notes**
Mercury, Methyl Mercury	Samples to be packaged in glass, high density polyethylene (HDPE), or polyethylene terephthalate (PET) container without headspace. Note that it is not necessary to prepare additional sampling containers for mercury and/or methyl mercury analyses if analyses of other metallic compounds are also being completed for the sample.
Volatile Organic Compounds (VOCs)	Samples are to be collected using hermetically sealed sampling device (e.g., En Core Samplers) and submitted to the laboratory for receipt within 36 hours of sample collection. The sampling devices may need to be accompanied by a portion of the sample placed in a glass jar to permit moisture content determination; **OR**, Each sample is to be placed into sampling containers pre-charged with methanol preservative (note that a second container may be required by the laboratory to facilitate laboratory QA/QC; verify requirements with the contract laboratory). The methanol-preserved samples must be accompanied by a portion of the sample placed in a glass jar to permit moisture content determination.
Bromomethane (also known as methyl bromide)	Where the collection of soil samples employ methanol preservative and where bromomethane is a contaminant of concern, a separate sample (collected either using a hermetically sealed sampling device, or collected into a container pre-charged with sodium bisulphate solution preservative) may be required to achieve appropriate detection limits.

Parameter(s)	**Notes**
Trihalomethanes (THMs)	THMs are technically VOCs, but since they are primarily related to chlorination of drinking water they may also be considered separately. Requirements for general VOCs apply to THMs. Note that it is not necessary to prepare additional sampling containers for THMs if general VOC analyses are also being completed for the sample.
1,4-Dioxane	1,4-Dioxane is typically an additional analysis to a general VOC analyses, or an additional analysis to an analyses of acid/base/neutral compounds. It is not necessary to collect additional sampling containers when 1,4-Dioxane analyses is to be completed as an addition to either VOC or acid/base/neutral compound analyses. When collected as an addition to acid/base/neutral compound analyses, the sampling requirements of that analysis apply. When completed as an addition to general VOCs analyses, the sampling requirements for general VOCs apply. When a soil sample is collected specifically for analysis or potential analysis of 1,4-Dioxane (e.g., and not also for analyses of VOCs or acid/base/neutral compounds), the requirements for general VOCs apply (see above).
Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX)	BTEX can be determined as part of a general VOC analyses, or as a targeted analyses only for these parameters (typically in combination with the F1 parameter and accompanied by samples for analyses of the F2 to F4 parameters). When soil samples are being collected specifically for analyses or potential analyses of BTEX, the requirements for general VOCs apply (see above).
F1 Petroleum Hydrocarbon (PHC) parameter	Requirements for general VOCs apply to the F1 parameter. Note that it is not necessary to prepare additional sampling containers analysis of F1 if BTEX or general VOC analyses are also being completed for the sample.
F2 to F4 PHC parameters (includes gravimetric determination of F4 parameter)	Samples to be packaged in glass jar without headspace and sealed using polytetrafluoroethylene (PTFE, or “Teflon”) lined cap.

HEADSPACE VAPOUR SCREENING

Headspace vapour screening is completed using portable gas monitoring devices (or meters), with the most common devices being catalytic bead combustible gas meters (e.g., Gastech 1238 ME, RKI Eagle, RKI NP-204) and photo ionization detectors (PIDs).

The selection of the specific gas monitoring device is determined during development of the Sampling Plan. Generally, PIDs are employed at locations where volatile compounds are considered to be contaminants of concern. However, if volatile contaminants of concern are restricted to petroleum hydrocarbons (PHCs), a combustible gas meter calibrated to n-hexane will typically be selected over a PID, due to their relatively greater 'sensitivity' to PHC compounds. Combustible gas meters calibrated to methane may also be used at locations where elevated natural gas levels are a concern or potential concern.

Some combustible gas meters are equipped with a "methane elimination" toggle that, when activated, reduces the response of the instrument to methane gas. However, it should be noted that the switch does not truly eliminate contributions of methane gas to the overall combustible gas reading; where significant methane is present, the gas meter may still report significant overall combustible gas levels, even in the absence of any other gases.

Methodology

1. Field screening is to be completed using portable gas monitoring meters that have been appropriately calibrated (refer to SOP E01.00, *Field Meter Calibration*).
2. The sampling bag containing the portion of the sample for field screening is to be tightly sealed with a nominal headspace, and any clumps within the sampling bag are to be gently broken by manually manipulating the sealed sampling bag.
3. The sampling bag should is not be opened or pierced until headspace vapour screening has been completed.
4. Once the sample has reached a temperature approximately between 5ºC and 15ºC and within two hours of sample collection, the tip of the portable gas monitoring meter is to be inserted into the nominal headspace of the sampling bag to record headspace vapour levels. The tip is to be inserted in a manner that does not permit vapours within the sampling bag to vent to ambient air during measurement.
5. The sample should be gently manipulated, and the peak reading registered by the meter during the first 15 seconds of measurement should be recorded as the sample headspace vapour reading.

TERRAPEX STANDARD OPERATING PROCEDURE
SOIL CLASSIFICATION

GENERAL NOTE

Standard Operating Procedures (SOPs) have been developed by Terrapex Environmental Ltd. to standardize protocols used during environmental assessment work programs. However, certain work programs may warrant deviations from SOPs and some clients may have specific requirements which differ from those outlined in this SOP. Any significant deviations should be discussed with and approved by the project manager. Each deviation, along with the rationale for the deviation, should be documented in the field notes, project scope and/or notes to file.

Where SOPs are appended to reports, all deviations from this SOP, along with the rationale for the deviation, must be documented in the report.

APPLICATION

These procedures are applicable to intrusive investigations involving the completion of localized excavations for the purposes of collecting soil samples and/or documenting subsurface conditions. The procedures are applicable whether such activity constitutes the whole of a work program, or part of a larger work program.

PRESENTATION OF DESCRIPTION

Soils descriptions will be presented in the order specified below:

- Texture Descriptive (applicable for sands and gravels only)
- Major Constituent (principal grain size)
- Minor constituents (major to minor, largest to smallest if same %).
  - ➢ include organics after minor constituents
- Colour
- Moisture Descriptive
- Consistency Descriptive (only where appropriate field tests are conducted)
- Plasticity (if applicable)
- Other Modifiers, e.g. laminated, uniform, fissured, etc. (If applicable)
- Odours, where applicable, i.e., slight, moderate, strong with odour type (e.g., earthy, hydrocarbon, etc.)

CLASSIFICATION BY PARTICLE DIAMETER

Description	**Range**	**Notes**
BOULDERS	> 300 mm	
COBBLES	75 to 300 mm	
GRAVEL		
Coarse	19 to 75 mm	
Fine	4.75 to 19 mm	
SAND		
Coarse	2.0 to 4.75 mm	individual grains are visible to naked eye; refer to examples for texture descriptive
Medium	0.425 to 2.0 mm	
Fine	0.075 to 0.425 mm	
SILT	0.002 to 0.075 mm	individual grains not visible to naked eye; other methods necessary to mores specifically identify distribution/type of fines
CLAY	< 0.002	

DESCRIPTION OF CONSTITUENT PARTS OF A SOIL

Soils will be principally described on the basis of the largest particle size classification by percentage of particles (e.g. sand, silt), with the dominant texture descriptive, where applicable (e.g. coarse sand). Where two or more classifications are present in approximately equal amounts, the sample will be principally described using the constituents presented from largest to smallest and joined by “and” (e.g. “sand and silt”).

Where two or more texture descriptives are present in approximately equal amounts, the sample will be described using the descriptives presented from largest to smallest and joined by “and” (e.g. “coarse and medium sand”).

Minor constituents are described using the terms defined below

Descriptive Term	Range of Proportion
Trace	1-10%
Some	11-20%
Adjective (i.e. sandy, silty)	21-35%
And	36-50%

COLOUR

Generally soil is described using BROWN, GREY, OLIVE.

Use qualifiers such as LIGHT, DARK, or combination terms like REDDISH-BROWN, BROWN/BLACK

Where more specific colour references are required, scientific colour descriptors from the Munsell Colour Chart should be used.

MOISTURE DESCRIPTIVE

- DRY - absence of moisture
- MOIST - damp, but no visible water
- WET - damp, contains visible water
- SATURATED - soil is completely wetted to excess and may be dripping

CONSISTENCY OF COHESIONLESS SOILS

The standard terminology to describe cohesionless soils (i.e., gravel, sand, or silt) includes the compactness as determined by laboratory test or by the Standard Penetration Test ‘N’ value.

Descriptive Term	Density Index	Standard Penetration Test (blows per 300 mm)
Very Loose	0-20%	0 - 4
Loose	20-40%	5 - 10
Compact	40-70%	11 - 30
Dense	70-90%	31 - 50
Very Dense	90-100%	over 50

CONSISTENCY OF COHESIVE SOILS

The standard terminology to describe cohesive soils (i.e., clay, or soil containing significant clay content) includes the consistency, which is based on undrained shear strength as measured by in-situ vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

Descriptive Term	Standard Penetration Test (blows per 300 mm)	
Very Soft	Less than 2	penetrate w/fist
Soft	2-4	indent w/fist
Firm	5-8	penetrate w/thumb
Stiff	9-15	indent w/thumb
Very Stiff	16-30	indent w/thumbnail
Hard	over 30	can't indent

Consistency Limits of Cohesive Soil

Applicable if geotechnical laboratory tests are completed.

Descriptive Term	Plasticity Index
Non-plastic	0 - 3
Low plastic	4 - 9
Medium plastic	10 - 30
Highly plastic	over 30

FIELD TESTS FOR COHESIVE SOIL

For determining relative clay content.

Dilatancy – "none", "slow", or "rapid"

Pat of wet soil is shaken in the palm of the hand and alternately squeezed and released. Predominantly silty materials will show a dull, dry surface when squeezed and a glassy wet surface when released/shaken (dilatent). This characteristic becomes less pronounced with increasing clay content, as clays are not dilatant.

Plasticity from thread test – "none", "low", "medium", or "high"

Attempt to roll a 3 mm thread of soil on a flat surface with the palm of your hand, adding as much water as necessary. Fold the thread and roll until it crumbles. (Note: silts can be plastic as well as clays so this is not a definitive test of particle size.)

- NON-PLASTIC - thread cannot be rolled
- LOW PLASTICITY - thread can barely be rolled
- MEDIUM PLASTICITY - thread can be rolled, but not re-rolled
- HIGH PLASTICITY - can be easily rolled and re-rolled

OTHER MODIFIERS

Sorting

Sorting is a geological term that describes the relative range of particles sizes.

- POORLY SORTED - a wide range of particle sizes is present
- WELL SORTED - a narrow range of particle sizes is present

Sorting is analogous to the geotechnical concept of “grading”, except that opposite descriptors are used (e.g. a poorly sorted soil, geologically, is considered a well graded soil, geotechnically). Geological descriptors are to be used for environmental descriptions of the relative range of particle sizes.

Angularity of Particles

• ANGULAR	Many corners/pointed parts, not smooth
• SUB-ANGULAR	Between angular and rounded
• ROUNDED	Rounded and generally smooth, no corners or pointed parts
• WELL-ROUNDED	Very round and smooth

DESCRIPTIVE SOIL TERMINOLOGY

These terms may be used, where applicable, to further describe soils.

TILL	An unstratified, unsorted glacial deposit of clay, silt, sand, gravel, cobbles and boulders in any combination. Typically dense and heterogeneous.
FILL	Any materials below the surface identified as placed by humans. “FILL (PRESUMED)” may be used when a stratigraphy is suspected as being fill, but the author also wishes to convey uncertainty regarding the accuracy of this determination.
TOPSOIL	Weathered surface materials which are capable of supporting plant life.
INCLUSION	An anomalous substance or fragment incorporated in a soil or rock mass.

STRATIFIED	Containing layers of different soil types (more than 3 mm thick).
LAMINATED	Composed of thin layers (less than 3 mm thick) of varying color and texture.
DESICCATED	Dried by moisture evaporation - desiccated clays are sometimes described as fissured or having nugget structure.
FISSURED	Containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
SENSITIVE	Exhibiting loss of strength on remolding.
FRIABLE	A soil consistency term pertaining to the ease of crumbling of soils. Easily crumbled between the fingers.
CALCAREOUS	Containing appreciable quantities of calcium-carbonate.
LAYER	> 75 mm in thickness
SEAM	2 mm to 75 mm in thickness
PARTING	< 2 mm in thickness
VARVED	Composed of regular alternating layers of silt and clay, often manifesting as alternating light and dark colouring, each usually between 25 and 75 mm in thickness, typically resulting from alternating seasonal deposition in a lacustrine environment.

TERRAPEX STANDARD OPERATING PROCEDURE
MEASURING AND SURVEYING USING ROD AND LEVEL

GENERAL NOTE

Standard Operating Procedures (SOPs) have been developed by Terrapex Environmental Ltd. to standardize protocols used during environmental assessment work programs. However, certain work programs may warrant deviations from SOPs and some clients may have specific requirements which differ from those outlined in this SOP. Any significant deviations should be discussed with and approved by the project manager. Each deviation, along with the rationale for the deviation, should be documented in the field notes, project scope and/or notes to file.

Where SOPs are appended to reports, all deviations from this SOP, along with the rationale for the deviation, must be documented in the report.

APPLICATION

These procedures are applicable to obtaining basic site dimensioning information, including determining reference elevations using a survey rod and level. The procedures are applicable whether such activity constitutes the whole of a work program, or part of a larger work program.

These procedures are not applicable to legal surveying, or the use of a Total Station survey instrument.

EQUIPMENT

The following list details the standard equipment necessary for excavation of test pits. Specific sites may require additional or specialized equipment.

☐ automatic level
☐ tripod
☐ survey rod
☐ survey rod level
☐ field notebook
☐ field form F026 (Survey Form)
☐ 2-way walkie-talkie radios
☐ 30 m tape measure (for small sites)

☐ measuring wheel (for large sites)

☐ safety equipment (hard hat, boots, safety vest, safety glasses)

☐ chalk and/or spray paint

☐ nails and flagging tape (for setting control points)

☐ hammer and chisel (for making control points or benchmarks)

☐ traffic control equipment (pylons, traffic signs), if applicable

☐ site plan

☐ site-specific health and safety plan

☐ Traffic Control Plan and Road Occupation Permit, if applicable

SPECIAL PLANNING AND PREPARATION REQUIREMENTS

Traffic spotters should be employed when surveying or dimensioning activities include locations located in the travelled portion of a roadway or in high traffic areas. A traffic control plan in accordance with Ontario Ministry of Transportation (MTO) guidelines must be implemented for all work in road allowance.

DEFINITIONS

Temporary Benchmark (TBM): semi-permanent structure or point of known (or assumed) elevation such as the flange bolt on a fire hydrant (do not use the top bolt as opening the hydrant will change the elevation of this bolt), the centre of a catch basin, the base of a sign, or a nail on the side of a wooden hydro pole or tree (make note of height of nail above grade).

It is preferable to use an existing (geodetic) benchmark so that elevations can be reported in metres above mean sea level (m amsl). Locations of geodetic benchmarks can be obtained from the municipality or from Control Survey Information Exchange (COSINE).

Where an assumed elevation is used, it is conventional to assign the TBM with an elevation of 100.000 metres above local datum (m ald), and the location and a description of the TBM must be provided in the project report(s).

Turning Point (TP): a point temporarily used to transfer an elevation, where the rod is first held for a foresight reading, then for a back sight reading. It establishes a new bench mark from which a new height of instrument is calculated. Preferably, select a solid surface (concrete sidewalk or block, asphalt, cable box) as your TP.

Back Sight (BS): a rod reading taken on a point of “known” elevation (e.g., an established geodetic benchmark or a TBM with an assumed elevation) in order to establish the elevation of instrument line of sight (TP or TBM).

Height of Instrument (HI): the elevation of the line of sight through the level.

Fore Sight (FS): a rod reading taken on a TP or TBM.

Intermediate Sight (IS): a rod reading taken at any other point where an elevation is required.

FIELD PROCEDURES

Setup

1. Choose a TBM and record information carefully and accurately on form so it can be used again if required. Assign the TBM an elevation of 100.000 m. Avoid using a monitoring well as a TBM, since it may be subject to frost heaving. Also, the well may be decommissioned or destroyed at a later date.
2. Plan your survey path before setting up the instrument. Choose a location where you can see the TBM and minimize the number of turning points.
3. Set up pylons around your surveying location if it is in a traffic pathway on site.
4. Stand tripod, roughly level by adjusting legs.
5. Screw level assembly to base. Set level lens parallel to two of the levelling screws. Turn screws simultaneously in opposite directions until levelling bubble is in line with circle. Turn third screw either clockwise or counter clockwise to centre bubble in circle.
6. Once level, turn 90 degrees to check accuracy. If bubble moves out of circle, repeat above steps.

Hand Signals

Due to the distances involved, and if a 2-way walkie-talkie radio is not available, establish hand signals between the surveyor and rod person, prior to commencing the survey. Common hand signals include:

• “All Right”	Both arms extended horizontally and forearms waved vertically.
• “Wave Rod”	Operator holds arm vertical and moves arm from side to side.
• “Give Foresight”	Operator holds arm vertically above head.
• “Set Turning Point”	Rod person holds rod horizontally over head and brings it down on point.

“Plumb”	Rod arm is held vertically and moved in direction of plumb.
“Move Right/Left”	Arm extended with motion in direction of desired movement.
“Move Up/Down”	Arm extended with motion in direction of desired movement.
“Pick Up Unit”	Arms extended outward and downward, then inward and upward.

Basic Survey

Rod person must hold rod as vertical as possible. Tilt it very slowly back and forth in the direction of the surveyor so the surveyor can read the lowest number (when the rod is vertical).

Alternatively, if the survey rod level is used, ensure that the rod person holds the rod level against the rod and keeps them both completely still and confirms with the surveyor (via walkie talkie) as to when the rod is level to take a reading.

Surveyor must read elevation to nearest millimeter (three decimal places). Surveyor shoots the TBM, enters reading in the BS column. Surveyor calculates and records the HI ($HI = E_{TBM} + BS$).

Surveyor shoots monitoring wells or other points to be surveyed. Both the ground elevation and elevation of the well standpipe measuring point (refer to SOP E06.00, *Groundwater Monitoring*) are to be surveyed. Surveyor enters data for each point in the IS column.

For wells equipped with flush-mounted casings, shoot the top of the protective casing as representing “ground” elevation. For wells equipped with monument (“stick up”) casings, shoot the ground surface adjacent to the casing.

Limit all elevation shots to distances of no more than 30 m (100 ft). If an object is too far away, use a turning point to move the instrument closer. Significant errors may result if longer elevation shots are attempted. To the extent practicable, the level should be placed such that IS shot distances for each placement are approximately equal. To the extent practicable, BS and FS shot distances should also be approximately equal.

When all points have been shot, surveyor re-shoots the TBM to close the survey loop and enters the rod reading in the FS column.

Turning Point (if required)

A TP is required if you cannot see all your survey points from one instrument location, or if the distance between one or more survey points and the instrument exceed 30 m.

Choose a suitable TP where you can see the instrument’s current location and will be able to see the instrument’s new location (the instrument will be located where it can see as many of the points to be surveyed as possible). Try to minimize the number of turning points to minimize the accuracy of rod reading errors.

The rod person moves to the TP and places a mark there (e.g., chalk or spray paint) if it is not a fixed point. Surveyor shoots the TP and records reading in the FS column. Surveyor calculates and records the elevation of the TP (E_{TP} = HI - FS).

Surveyor moves instrument to the new location (note that the instrument location is not assigned a specific name). Surveyor re-levels the instrument. Surveyor re-shoots the TP and enters in BS column. Surveyor calculates and records a new HI (HI = E_{TP} + BS). Note that it is imperative that the rod person must keep the rod on the TP until after the Surveyor has completed setting up the level and has taken a BS reading of the TP from the new instrument location.

Surveyor shoots remaining monitoring wells or other points to be surveyed as above.

When all points have been shot, surveyor traverses back to TBM using new TPs as required. Surveyor records final shot to TBM in the FS column.

Accuracy Check

Method 1: Surveyor adds all the FS readings together, enters result at bottom of form. Repeat for BS readings. The error is the difference between the two totals.

Method 2: Surveyor calculates elevation of the TBM from the final rod reading (E_{TBM} = HI - FS). This requires that calculations be done throughout the survey (for TPs, not for wells). The error is the difference between the assigned elevation of the TBM and the calculated elevation.

Acceptable Error: +/- 3 mm

If the error is greater, the survey must be repeated.

TYING IN EXISTING WELLS

If there are wells already existing at the site, survey them ALL in, even if an older survey exists. Wells can shift over time. Wherever possible, use the benchmark used in the original survey for consistency. If the benchmark has been removed, use another benchmark and re-survey in all the wells.

SITE DIMENSIONING

Use a measuring tape or wheel to measure distances. Pacing to record distances does not yield sufficiently accurate dimensioning information, and is not to be used. Triangulate points to be measured (take two measurements for each location, each from a different mapable point). To avoid large inaccuracies in locating objects, do not measure in objects using offset measurements from linear features (such as sidewalks, building walls, etc) where the measured distances exceed 2 metres.

If a site plan has been provided, double check the accuracy and confirm the drawing is up-to-date by re-measuring dimensions of existing buildings and structures and comparing to the site plan. If measurements do not match site plan, adjust the incorrect dimensions accordingly.

If a site plan does not exist, sketch a site plan with all existing structures and dimensions between them for proper layout and orientation. On-site dimension locations include: buildings, pump islands, fences, property lines/Iron bars, catch basins/manholes, USTs, utility services, etc. Off-site dimension locations include: catch basins/manholes, sidewalks, roads/curbs, hydrants, utility services, hydro poles, etc.

Site plans/sketches must include a North directional arrow. Indicate whether the arrow indicates **magnetic north** (i.e., north from a compass), **true north** (i.e., magnetic north with an appropriate declination correction), or **reference north** (e.g., assumed/approximate north direction).

Where the site/study area is very large and/or a high degree of horizontal accuracy is not required for the project, portable GPS units may be used to determine approximate UTM coordinates for site features, however, the indicated accuracy range on the GPS unit must be identified for each mapped feature in the notes.

TERRAPEX STANDARD OPERATING PROCEDURE
FIELD PROGRAM QUALITY ASSURANCE & QUALITY CONTROL

GENERAL NOTES

Standard Operating Procedures (SOPs) have been developed by Terrapex Environmental Ltd. to standardize protocols used during environmental assessment work programs. However, certain work programs may warrant deviations from SOPs and some clients may have specific requirements which differ from those outlined in this SOP. Any significant deviations should be discussed with and approved by the project manager. Each deviation, along with the rationale for the deviation, should be documented in the field notes, project scope and/or notes to file.

Where SOPs are appended to reports, all deviations from this SOP, along with the rationale for the deviation, must be documented in the report.

APPLICATION

This SOP is applicable to intrusive investigations involving the collection of soil, water, and air samples for possible laboratory chemical analyses, including sediment, groundwater, surface water, indoor air, outdoor air, and soil vapour. The SOP addresses only measures required for quality assurance and quality control purposes. Sample collection, nomenclature, documentation, and other requirements associated with specific sampling approaches (e.g., borehole drilling) are described in other SOPs.

SPECIAL PLANNING AND PREPARATION REQUIREMENTS

Liaison with the contract laboratory in advance of field programs will be required as the laboratory will normally be responsible for providing appropriate sampling containers, prepared trip blank and trip spike quality assurance samples, and appropriate analyte-free water for the preparation of field blanks and equipment blanks by Terrapex.

FIELD PROGRAM QUALITY CONTROL REQUIREMENTS

Sample Collection

Quality control measures during sample collection are primarily intended to mitigate the accidental introduction of a contaminant or the loss of a volatile constituent of the sample.

Specific requirements associated with sampling methods are defined in the SOP(s) applicable to those methods. General requirements for all work programs are described below:

- Sampling containers and field preservative (if applicable) will be obtained from the contract laboratory.
- Available information relating to environmental conditions at the site should be reviewed and, to the extent practicable, sampling should commence in the apparent least-impacted area and progress to areas of apparently greater impact, finishing in the apparent "worst-case" area.
- New disposable gloves are to be donned for the collection / handling of each sample.
- To the extent practicable, dedicated sampling equipment is to be employed during sampling collection; any non-dedicated sampling equipment which comes into contact with the sample must be thoroughly washed and rinsed prior to use.
- For water samples, sampling equipment (regardless of whether it is dedicated or non-dedicated) should be purged prior to sample collection by passing a minimum of three times the volume of the sampling equipment of either sample water or analyte-free water supplied by the contract laboratory through the equipment.

  For groundwater samples, purging of sampling equipment is typically completed concurrently with well purging (e.g., by employing the inertial sampler to be used during sample collection during the initial purging of the well).

  It should be noted that "sampling equipment" in this context does not include laboratory-supplied sampling containers.
- Water samples (including groundwater) are to be collected directly into laboratory-supplied containers appropriate for intended/potential analytical requirements; passing the sample through an in-line field filtration device prior to collection into the sampling container is an acceptable practice for samples that require field filtration.
- When more than one groundwater sampling container is involved and/or when duplicate groundwater samples are being collected, filing should be conducted concurrently, alternating filing so that the containers contain the same "mix" of water (i.e., avoid filling bottles sequentially).
- Soil and sediment samples are often split into two portions – one for field screening/logging, and one for (potential) laboratory analyses; to the extent practical, the sample portion for (potential) laboratory analyses should be immediately placed into laboratory-supplied containers appropriate for the intended/potential analytical requirements. Regardless, samples of soil potentially impacted by volatile or organic contaminants should be containerized immediately to minimize potential volatile loss.
- Samples collected for (potential) analyses of organic contaminants should not be subjected to extended contact with plastics.

Quality control measures are also required to ensure that a record of recovered samples, and the location from which they were obtained, is maintained. Specific requirements associated with sampling methods are defined in the SOP(s) applicable to those methods. General requirements for all work programs are described below:

- All recovered samples during a work program are to be assigned a sample identification that is unique during the work program, and sampling details – INCLUDING the time and date of sample collection – are to be recorded on field forms and/or in the field notes.
- In the case of soil or sediment samples, sample identifications are expected to be unique even over several work programs, including work programs that are completed by other parties. In some instances this may require advancing standard Terrapex sampling counts to address sampling identifications used or potentially used by third parties (e.g., if another consultant has already advanced boreholes identified as BH101 through BH110, the first round of Terrapex boreholes should begin at BH201, even though this is normally the count for the second round of Terrapex boreholes).
- In the case of water or groundwater samples, sample identifications are typically tied to a sampling location (e.g., a monitoring well identification), and it is quite common for several water samples (collected on different dates) to have been assigned a common identification. This is acceptable, provided that the date of sample collection is recorded in the field notes and included in work program documentation so as to create unique sample identification information.

Temporary Sample Storage

Temporary sample storage is required between the time of sample collection and the time of sample submission or when the sample is discarded. Quality control measures during temporary sample storage are primarily intended to mitigate the accidental introduction of a contaminant or the loss of a volatile constituent of the sample. Quality control measures are also required to maintain appropriate Chain of Custody of recovered samples.

- Samples must be labelled prior to being placed in temporary storage. Labelling must include the full sample identification, project number, and date of sample recovery on each container.
- Generally, samples are to be maintained in a cool environment, ideally 3 to 5ºC, and protected from direct exposure to sunlight (e.g., within a cooler with loose ice).
- Samples are not to be left unattended in a public space during storage. A public space includes any work site where access is not restricted by a fence or similar physical barrier to prevent unauthorized entry, even if the site is owned by a private corporation or individual.

Terrapex offices, locked vehicles, or work site trailers are not considered public spaces.

- Unpreserved samples submitted for laboratory analyses of VOCs / F1 PHCs and/or volatile gases should be received by the contract laboratory within 36 hours of sample collection (so as to permit the laboratory sufficient time to prepare sample extractions within regulated hold times). Samples submitted for all other analyses should be received by the contract laboratory within 72 hours of sample collection.

  Note that a sample collected using a hermetic sampling device (e.g., En Core sampler) is NOT considered to be preserved.

Sample Submission

Sample submission is the point at which Terrapex ceases to have custody of samples intended for laboratory analyses. This point may occur when the samples are released directly into the custody of the contract laboratory (i.e., hand delivered by Terrapex), or when the samples are released into the custody of a courier for delivery to the laboratory.

Quality control measures associated with sample submission are required to maintain sample integrity and appropriate Chain of Custody:

- Samples for submission are to be placed in an insulated packing container (e.g., a cooler) along with appropriate packing materials (e.g., bubble wrap) to mitigate breakage during transport to the contract laboratory. Do not overpack the cooler; distribute contents between coolers if needed to keep the mass of any cooler less than 20 kg.
- Seal each container tightly and place in sealed bags to prevent water from intruding into the sample and/or degrading the sample label. Group containers with the same sample ID within the same sealed bag. To the extent possible, place the bags into the cooler so that sampling containers sit upright.
- Loose ice is also to be placed in the cooler to assist in maintaining a cool internal temperature (ideally 3 to 5ºC).
- Sample submissions are to be accompanied by a completed Chain of Custody form. The Chain of Custody form is to be signed immediately before sealing the cooler, and placed inside the cooler within a sealed bag.
- Both the date and time of sample collection is to be recorded for each sample on the Chain of Custody form.
- If coolers are to be released into the custody of a party other than the contract laboratory (e.g., a courier), signed and dated custody seals must be placed on the cooler and secured in a manner that it is not possible to open the cooler without breaking one or more seals.

Sample submissions are also to be subjected to a quality assurance process involving a check of both the Chain of Custody and the cooler contents by a second person to ensure the Chain of

Custody is complete and consistent with the cooler contents. The second person shall record their quality assurance check by initialing the Chain of Custody form, ideally in the "Comments" section accompanied by a note indicating the purpose of the initials (e.g., "submission check by XX").

In instances where sample submission is happening directly from a field location at which a second Terrapex employee is not present, second person review should be completed via transmitted photographs or video conferencing. In such instances, the person who prepares the Chain of Custody should note the name of the remote reviewer, and the fact of the remote review, on the Chain of Custody form.

FIELD PROGRAM QUALITY ASSURANCE SAMPLES

Field Quality Assurance sample requirements for work programs are outlined below. These requirements are related to both the frequency of sample submissions (the number of samples submitted) as well as the duration of the field program.

The following terminology is used in defining sample requirements for this SOP:

- ***Field day*****:** a work program to which this SOP applies that is completed in the space of a single calendar day.
- ***Sampling round:*** a work program to which this SOP applies that is completed over a period of one or more days, and which are associated with a single submission of samples to the contract laboratory. (Note that a single submission may constitute several coolers; "submission" refers to a batch of samples which are delivered to the laboratory at the same time.)
- ***Number of samples:*** for the purposes of this SOP, the number of samples for the work program comprises the sum of uniquely identified samples, excluding field program quality assurance samples, within each of the Analytical Program Groupings (refer to Table 1, below).

  For example, a work program involving the submission of three samples for VOC analyses with two of these three samples also submitted for analyses of metals would comprise a total of five samples, even though only three sample names might be listed on a chain of custody.

  The number of samples can be determined on both a field day and sampling round basis.

Table 1 Analytical Program Groupings, Quality Assurance Sampling and Analyses

Grouping	Analytical Protocol Section [1]	Notes
Acid/Base/Neutral Compounds (ABNs)	1.1.1	-
Chlorophenols	1.1.2	Not considered to be a separate grouping when analyses completed as part of ABN analyses
1,4-Dioxane	1.1.3	Not considered to be a separate grouping when analyses completed as part of ABN or VOC analyses
Dioxins/Furans, PCDDs/PCDFs	1.1.4	-
Organochlorine Pesticides	1.1.5	-
Petroleum Hydrocarbons (PHCs)	1.1.6	-
Polychlorinated Biphenyls (PCBs)	1.1.7	-
Polycyclic Aromatic Hydrocarbons	1.1.8	-
Trihalomethanes	1.1.9	Not considered to be a separate grouping when analyses completed as part of VOC analyses
Volatile Organic Compounds (VOCs)	1.1.10	-
Benzene, Toluene, Ethylbenzene, Xylenes (BTEX)	1.1.11	Not considered to be a separate grouping when analyses completed as part of VOC analyses
Bromomethane	1.1.12	Not considered to be a separate grouping when analyses completed as part of VOC analyses
Calcium and Magnesium	1.2.1	-
Metals	1.2.2	-
Hydride-Forming Metals	1.2.3	Not considered to be a separate grouping when analyses completed as part of Metals analyses
Sodium	1.2.4	-
Other Regulated Parameters (ORPs)	1.3	Single parameter tests; each analysis is considered a separate grouping

1 *Protocol for Analytical Methods Used in the Assessment of Properties and Excess Soil Quality under Part XV.1 of the Environmental Protection Act*, Ministry of the Environment, Conservation and Parks (November 30, 2020)

Field Duplicates

A field duplicate is a second sample concurrently collected from the same location as another sample and submitted for duplicated analyses. Field duplicates provide information relating to:

- The ability of the contract laboratory to provide reproducible (i.e., similar or the same results) analytical results;
- The ability of Terrapex to consistently collect representative samples (as both the duplicate and its sampling pair are purportedly representative of the sampling location, similar results should be obtained); and,
- Homogeneity of the sampled media.

It is generally preferable to obtain field duplicate samples from sampling locations likely to generate quantified concentrations of the target parameters, as comparisons of quantified results is more informative than comparisons of non-detectable concentrations.

To mitigate potential bias in methodology, etc. at the contract laboratory, field duplicate samples should not be identified as field program quality assurance samples at the time of submission.

Field duplicate sampling requirements are provided in Table 2.

Field Blanks

Field blanks, whether they are accompanying soil, sediment, or groundwater samples, comprise a sample of analyte-free water prepared in the field and submitted for laboratory analyses as a measure of:

- The ability of the laboratory to avoid introducing concentrations of target parameters into analysed samples (i.e., potential analytical bias);
- The ability of Terrapex to avoid introducing concentrations of target parameters into recovered samples (e.g., cross contamination);
- Potential cross-contamination between samples during temporary storage and/or transportation to the contract laboratory; and,
- Potential cross-contamination between samples during temporary storage at the contract laboratory.

Analyte-free water for preparing field blanks should be obtained from the contract laboratory in bulk and transferred to appropriate sampling containers in the field. Ideally, a field blank sample should be prepared (or opened) adjacent to the "worst-case" sampling location. If this is impracticable, field blank samples should be prepared at another location in the field. Field blank samples should not be prepared at the office or at the laboratory. The location at which a field blank sample was prepared should be recorded in the field notes.

To mitigate potential bias in methodology, etc., at the contract laboratory, field blank samples should not be identified as field program quality assurance samples at the time of submission. Consequently, because a field blank is by definition a water sample, field blanks are not normally part of soil sampling programs.

The exception to these general rules involves the use of methanol-preserved or sodium bisulphate solution-preserved soil samples for analyses of volatile organic constituents. Unused sampling containers precharged with preservative should be used as field blanks. The container(s) for the blank sample(s) should be opened, exposed to ambient atmosphere for approximately 30 seconds (the approximate time required to collect a soil sample into the sampling container), and re-sealed. It is not necessary, and not advisable, to attempt to transfer the preservative to another sampling container.

The “preparation” of the soil sample field blanks should be completed adjacent to the “worst-case” sampling location or condition; if this is impracticable, the activity should be completed at another location in the field at which bias of sampling results could have resulted. The location at which the soil sample field blank was prepared should be recorded in the field notes.

Field blank sampling requirements are provided in Table 2.

Trip Blanks

A trip blank is a sample prepared by the contract laboratory using analyte-free water and obtained by Terrapex immediately prior to the site visit. Trip blanks may also be prepared by the laboratory using methanol or sodium bisulphate solution for sampling programs involving soil samples for analyses of volatile organic constituents.

The trip blank sample accompanies Terrapex during the execution of the sampling activities and is not opened during this time. While in the possession of Terrapex, trip blanks are to be managed as if they were any other sample (e.g., maintained in a cool, dark environment as described above). At the conclusion of the sampling activities, the sample is submitted to the contract laboratory for analyses as a measure of:

- The ability of the laboratory to avoid introducing concentrations of target parameters into analysed samples;
- Potential cross-contamination between samples during temporary storage and/or transportation to the contract laboratory; and,
- Potential cross-contamination between samples during temporary storage at the contract laboratory.

As it is prepared by the contract laboratory, trip blanks will be received bearing a sampling label and associated sample identification. Reasonable efforts are to be made to limit the amount of time a trip blank sample is in possession of Terrapex (e.g., obtaining the sample is close to practicable to the start of sampling activities whilst ensuring it is in Terrapex's possession at the start). Regardless, the trip blank sample is to be received by the laboratory within seven days of the date/time of preparation listed on the sampling label.

Trip blank sampling requirements are provided in Table 2.

Equipment Blanks

An equipment blank is a sample prepared by exposing analyte-free water (supplied by the contract laboratory) to sampling equipment employed during the sampling activities (e.g., passing water through a bailer). Because the objectives of the equipment blank includes assessment of potential cross-contamination associated with the use of non-dedicated sampling equipment, non-dedicated equipment is to be washed in accordance with normal field procedures prior to preparing equipment blank samples.

Notwithstanding the objective of equipment blank samples, it should be noted that equipment blank laboratory results may also be affected by analytical bias or cross-contamination.

Equipment blanks should be prepared at the conclusion of the field day (as representative of “worst-case” cross-contamination potential when non-dedicated sampling equipment is used), as sampling is to commence in the apparent least impacted area and progress to areas of apparent increasing impact), and ideally in the field itself. The time and location of preparing each equipment blank sample is to be recorded in the field notes.

Equipment blank sampling requirements are provided in Table 2.

Trip Spikes

A trip spike is a sample prepared by the contract laboratory using water containing known concentrations of target parameters. The sample is obtained by Terrapex immediately prior to the site visit and accompanies Terrapex during the execution of the sampling activities, but is not opened. While in the possession of Terrapex, trip spikes are to be managed as if it were any other sample. At the conclusion of the sampling round, the sample is submitted to the contract laboratory for analyses.

Trip Spikes are primarily intended as measures of potential loss (low bias) in samples collected for volatile analysis, although results can also be affected by issues associated with laboratory analytical precision (e.g., laboratory equipment calibration) as well as potential cross-contamination between samples during temporary storage and/or transportation.

As it is prepared by the contract laboratory, trip spikes will be received bearing a sampling label and associated sample identification. Reasonable efforts are to be made to limit the amount of time a trip spike sample is in possession of Terrapex (e.g., obtaining the sample as close to practicable to the start of sampling activities whilst ensuring it is in Terrapex's possession at the start of the work program). Regardless, the trip spike sample is to be received by the laboratory within seven days of the date/time of preparation listed on the sampling label.

Trip spike sampling requirements are provided in Table 2.

Table 2 Field Program Quality Assurance Sampling Requirements

Sample Type	Media	Minimum Frequency	Comments
Field Duplicate [1]	Soil / Sediment	1 per 10 samples	Duplicates not required for TCLP extraction analyses
	Water / Groundwater	1 per 10 samples	
	Air / Soil Vapour	1 per 10 samples	
Field Blank [1]	Soil / Sediment	Generally not required [2]	A field blank is not required if a trip blank is being submitted (e.g., analyses of VOCs / F1 PHCs and/or volatile gases)
	Water / Groundwater	1 per sampling round	
	Air / Soil Vapour	1 per sampling round	
Trip Blank	Soil / Sediment	Generally not required [2]	Applicable only for analyses of VOCs / F1 PHCs and/or volatile gases
	Water / Groundwater	1 per sampling round (see comments)	
	Air / Soil Vapour	1 per sampling round (see comments)	
Equipment Blank [1]	Soil / Sediment	Generally not required [3]	Not required if only dedicated sampling equipment employed
	Water / Groundwater	1 per field day	
	Air / Soil Vapour	Not required	It is generally impracticable to attempt collection of equipment blanks during air or soil vapour sampling

Sample Type	Media	Minimum Frequency	Comments
Trip Spike	Soil / Sediment	Generally not required [4]	Applicable only for analyses of VOCs / F1 PHCs and/or volatile gases
	Water / Groundwater	Not required but 1 per sampling round recommended [5]	
	Air / Soil Vapour	Not required	Commercial laboratories are generally unable to provide reliable trip spike samples for air or soil vapour sampling

Notes:

1. *To the extent practicable, at least one of each type of field program quality assurance sample should be submitted for the various analytical groupings that comprises the sampling program*
2. *A trip blank sample OR a field blank sample is required for each sampling round that includes methanol-preserved or sodium bisulphate solution-preserved soil samples for analyses of volatile constituents*
3. *Equipment blanks are not required if reasonable efforts are made to clean non-dedicated soil or sediment samplers between use (e.g., if split spoon samplers are washed between use, an equipment blank would not be required by this SOP). Otherwise, an equipment blank sample should be prepared by running laboratory-supplied analyte-free water over/through the equipment and collecting these waters for laboratory analyses of the target parameters.*
4. *Trip Spike samples are not required for soil or sediment analyses, as the laboratory-provided spikes are generally not provided in an equivalent media to the recovered samples (e.g., trip spike samples are generally water, and losses in a water sample may not be representative of the presence, absence, or magnitude of losses in hermetic samplers, methanol preserved samples, etc.)*
5. *Trip Spike samples are not required field program Quality Assurance elements per O. Reg. 153/04 and consequently are not mandatory per this SOP. However, as loss of volatile constituents during sample storage / transport to the analytical laboratory can significantly affect the reliability of analytical results, analyses of one trip per sampling round is recommended.*

Nomenclature for Field Quality Assurance Samples

As a general practice, the contract laboratory should not be informed of the number or nature of field program quality assurance samples submitted as part of a sampling program unless the laboratory's assistance is required in investigating a potential data quality issue (e.g., in the event of a result triggering an alert criteria specified in Data Quality Analysis, below).

Notwithstanding this general principal, both trip blank and trip spike samples are typically prepared and provided by the contract laboratory. Accordingly, these samples will be assigned sample identifications by the laboratory, and the date/time of preparation will typically be recorded on the sampling label. Such samples should be recorded on the Chain of Custody form using the sample identification and date/time of preparation provided by the laboratory.

The remaining field program quality assurance samples (field duplicates, field blanks, and equipment blanks) should be submitted on a "blind" basis so that the laboratory ought to be reasonably unaware of the nature of the sample submission. That is, these samples should be assigned a plausible sampling identification that does not correspond to another actual or potential sampling location at the site, and the true nature of the sample identification recorded in the field notes. Selected sample identifications should not, for example, be identified as or include "DUP", "BLANK", or any other nomenclature suggesting that the sample represents a field program quality assurance measure.

This principal extends to field blanks prepared for methanol-preserved or sodium bisulphate solution-preserved soil samples for analyses of volatile constituents. Although field blanks may be readily identified as such at sample reception (through the lack of any soil within the sample container), the nature of such samples would not be readily apparent to other laboratory staff following laboratory extraction procedures. Accordingly, these samples should be assigned a plausible sampling identification that does not correspond to another actual or potential sampling location at the site, and the true nature of the sample identification recorded in the field notes.

LABORATORY QUALITY ASSURANCE

Commercial contract laboratories will have their own internal quality assurance and quality control programs. These programs typically include quality assurance samples in analytical runs, the results of which are provided (in summary form) in the Certificate of Analysis documenting analytical results for a sample submission.

Maintaining overall field program quality assurance and quality control and completing data quality analysis requires a review of the laboratory Certificate of Approval.

For the purposes of this SOP, laboratory quality assurance samples are defined as outlined below. Note that while this nomenclature had been adopted to reflect language typical in the commercial contract laboratory industry, it may not necessarily correlate exactly with that used in the laboratory Certificate of Analysis.

Method Blank: an aliquot prepared using analyte-free water and processed through the entire analytical method, including extracting, digestion, and other preparation procedures.

Blank Spike: an aliquot prepared using water containing known concentrations of target parameters and processed through the entire analytical method, including extracting, digestion, and other preparation procedures.

Matrix Spike: a second aliquot from an analytical sample that is fortified with known concentrations of the target parameters and processed through the entire analytical method, including extracting, digestion, and other preparation procedures. As quality assurance results are assessed on the basis of comparison of the determined concentration versus the known concentrations, high concentrations of the target parameters in the fortified sample can obscure (mask) matrix spike recovery.

Laboratory Duplicate: a second aliquot from an analytical sample that is included in the analytical run for comparison to results from the corresponding sampling pair.

Certificate Reference Material (CRM): an aliquot that has been certified by a recognized agency to contain specific concentrations of target parameters and which is included in the analytical run. A CRM differs from a blank spike in that it is not prepared internally by the contract laboratory.

Surrogate Recovery: Surrogates are parameters not normally found in nature but that behave chemically and physically similar to the analytical run target parameters, and that are introduced into the aliquot of an analytical sample. Surrogate recovery is the evaluation of the determined concentration of the surrogate versus the known concentration introduced into the sample aliquot.

DATA QUALITY OBJECTIVES

Alert criteria for quality assurance and quality control metrics are summarized in Table 3. Any result triggering the specified alert criteria must be identified in the work program report, and specific commentary regarding the implication of this result on the work program findings (if any) offered.

Note that triggering an alert criteria does not mean that the corresponding laboratory results are invalid; it only indicates a situation where specific commentary regarding the validity of the laboratory results is required in the work program report.

Quality assurance samples involving comparisons of actual results to expected results are evaluated on the basis of ***Recovery***, or recovery percentage. Note that Recovery does not necessarily relate to the ability to provide consistent (similar) quantitations between successive analyses.

Recovery is calculated as follows:

$$Recovery = \frac{reported \;\; concentration}{actual \;\; (expected) concentration} \;\; x \;\; 100\%$$

Quality assurance samples involving comparisons of ‘duplicate’ analysis are evaluated on the basis of ***Relative Percent Difference (RPD)***. RPD provides a measure of the ability to provide consistent results on successive analyses, but does not necessarily relate to the ability to provide results that are representative of the actual concentration of the target parameter (e.g., the expected result when comparing against a known standard).

RPD is calculated as follows:

$$RPD \quad = \quad \left| \frac{result_1 - result_2}{\frac{1}{2} \ \ x \ \ (result_1 + \ \ result_2)} \right| \ x \ \ 100\%$$

RPD values should not be calculated where one or both of the results do not yield quantifiable results (i.e., non-detect findings), or where one or both of the results are less than five times the reported detection limits. RPD values should not be calculated for parameters which are based on calculations using raw data (e.g., sodium adsorption ratio, total xylenes); instead, where applicable, RPD values should be calculated for the 'raw' data (e.g., the m&p-xylenes, o-xylenes parameters).

Note that the mere absence of a calculated RPD is not considered a quality assurance failure, but simply a situation where alert criteria cannot be quantifiably evaluated. Similarly, the absence of a RPD value is not necessarily considered to be an acceptable field quality assurance result (e.g., a non-detect result in a duplicate sample but an elevated concentrations reported for the corresponding sampling pair is suggestive of a potentially significant variance is sampling results, and may warrant commentary in the work program report).

Table 3 Field Program Data Quality Objectives

Field QC Metric	**Alert Criteria**
Sample integrity	Deviation from this SOP recorded within field notes Significant variance in field screening results (if applicable) recorded within field notes between duplicate samples Laboratory reports average sample temperature at time of receipt greater than 10ºC Incorrect sampling container employed Broken or leaking sampling container reported by laboratory Excessive particulate within received water sample reported by laboratory
Sample identification integrity	Laboratory reports discrepancy between samples reported on Chain of Custody and those actually received (as per sampling container labels) Laboratory reports unlabelled sample received (no sample identification apparent)
Chain of Custody integrity	Laboratory reports missing/damaged custody seal Laboratory reports missing Chain of Custody form Date/time of sample recovery not recorded on Chain of Custody form

Table 3 Field Program Data Quality Objectives

Sample storage (hold time) integrity	Sample for analysis of VOC / F1 PHCs and/or volatile gases received by laboratory more than 36 hours after recorded sample collection Sample for analysis other than VOC / F1 PHCs and volatile gases received by laboratory more than 72 hours after recorded sample collection

Laboratory QA Metric	**Alert Criteria**		
	Analytical Grouping	**Soil / Sediment**	**Air / Soil Vapour / Water / Groundwater**
Method Blank	ALL	Any concentration in excess of laboratory detection limits	
Blank Spike, Matrix Spike		*results outside:*	*results outside:*
	BNAs, PAHs	50% - 140% Recovery [1]	50% - 140% Recovery [1]
	1,4-Dioxane	50% - 140% Recovery	50% - 140% Recovery
	Dioxins/Furans	50% - 150% Recovery	50% - 150% Recovery
	OC Pesticides	50% - 140% Recovery	50% - 140% Recovery
	PCBs	60% - 140% Recovery	60% - 140% Recovery
	PHCs	60% - 140% Recovery	60% - 140% Recovery
	VOCs	50% - 140% Recovery	50% - 140% Recovery
	Hg, Cr^{6+}, CN^-	70% - 130% Recovery	70% - 130% Recovery
	EC	n/a	n/a
	FOC, Chloride	70% - 130% Recovery	70% - 130% Recovery
	Methyl mercury	60% - 140% Recovery	60% - 140% Recovery
	Metals *(incl. B, HWS B, Ca, Mg, Na)*	70% - 130% Recovery [2]	70% - 130% Recovery [2]
Laboratory Duplicate	BNAs, PAHs	> 40% RPD	> 30% RPD
	1,4-Dioxane	> 50% RPD	> 30% RPD
	Dioxins/Furans	> 40% RPD	> 30% RPD
	OC Pesticides	> 40% RPD	> 30% RPD
	PCBs	> 40% RPD	> 30% RPD
	PHCs	> 30% RPD	> 30% RPD
	VOCs	> 50% RPD	> 30% RPD
	Hg, Cr^{6+}, CN^-	> 35% RPD	> 20% RPD
	EC	> 10% RPD	n/a
	FOC, Chloride	> 35% RPD	> 20% RPD
	Methyl mercury	> 30% RPD	> 20% RPD
	Metals *(incl. B, HWS B, Ca, Mg, Na)*	> 30% RPD [4,5]	> 20% RPD
	pH	[3]	[3]

Table 3 Field Program Data Quality Objectives

Certified Reference Material, Laboratory Control Sample		*results outside:*	*results outside:*
	BNAs, PAHs	50% - 140% Recovery [1]	50% - 140% Recovery [1]
	1,4-Dioxane	50% - 140% Recovery	50% - 140% Recovery
	Dioxins/Furans	50% - 150% Recovery	50% - 150% Recovery
	OC Pesticides	50% - 140% Recovery	50% - 140% Recovery
	PCBs	60% - 140% Recovery	60% - 140% Recovery
	PHCs	80% - 120% Recovery	60% - 140% Recovery
	VOCs	60% - 140% Recovery	60% - 140% Recovery
	Hg, Cr^{6+}, CN^-	80% - 120% Recovery	80% - 120% Recovery
	EC	90% - 110% Recovery	90% - 110% Recovery
	FOC, Chloride	70% - 130% Recovery	70% - 130% Recovery
	Methyl mercury	70% - 130% Recovery	70% - 130% Recovery
	Metals *(incl. B, HWS B, Ca, Mg, Na)*	80% - 120% Recovery [6]	80% - 120% Recovery [6]
Surrogate Recovery		*results outside:*	*results outside:*
	BNAs, PAHs	50% - 140% Recovery	50% - 140% Recovery
	1,4-Dioxane	50% - 140% Recovery	50% - 140% Recovery
	Dioxins/Furans	40% - 140% Recovery	40% - 140% Recovery
	OC Pesticides	50% - 140% Recovery	50% - 140% Recovery
	PCBs	60% - 140% Recovery	60% - 140% Recovery
	PHCs	60% - 140% Recovery	60% - 140% Recovery
	VOCs	50% - 140% Recovery	50% - 140% Recovery

Field Program QA Metric	**Alert Criteria**		
	Analytical Grouping	**Soil / Sediment**	**Air / Soil Vapour / Water / Groundwater**
Field Duplicate	pH	[3]	[3]
	BNAs, PAHs	> 40% RPD [1,4]	>30% RPD [1]
	1,4-Dioxane	> 50% RPD	> 30% RPD
	Dioxins/Furans	> 40% RPD	> 30% RPD
	OC Pesticides	> 40% RPD	> 30% RPD
	PCBs	> 40% RPD	> 30% RPD
	PHCs	> 30% RPD	> 30% RPD
	VOCs	> 50% RPD	> 30% RPD
	Hg, Cr^{6+}, CN^-	> 35% RPD	> 20% RPD
	EC	> 10% RPD	n/a
	FOC, Chloride	> 35% RPD	> 20% RPD
	Methyl mercury	> 30% RPD	> 20% RPD
	Metals *(incl. B, HWS B, Ca, Mg, Na)*	> 30% RPD [4,5]	> 20% RPD
Field Blank	ALL	Any concentration in excess of laboratory detection limits	

Table 3 Field Program Data Quality Objectives

Trip Blank	VOCs / F1 PHCs Volatile Gases	Any concentration in excess of laboratory detection limits
Equipment Blank	ALL	Any concentration in excess of laboratory detection limits
Trip Spike		*results outside:*
	F1 PHC	60% -140% Recovery
	Ketones and Gaseous Compounds at 20°C [7]	60% - 140% Recovery
	Other VOCs	70% - 130% Recovery

Source: adapted from Tables 5-1 through 5-14, Analytical Protocol (November 30, 2020)

Notes:

[1] *Alert Criteria for p-chloroaniline, 3,3-dichlorobenzidene, phenol, 2,4-dimethylphenol, and 2,4-dinitrophenol is 30% - 130%*

[2] *Alert Criteria for Hot Water Soluble Boron is 60% - 140% Recovery*

[3] *RPD values are not calculated for pH analyses; however, results should be within 0.3 pH units*

[4] *Increased RPD values may be encountered whenever duplicate analyses are completed on samples representing heterogeneous fill materials. Specific commentary regarding the validity of analytical results should be offered whenever the specified alert criteria is exceeded; however, significant concerns regarding the validity of analytical results would generally not be suspected if calculated RPD do not exceed the specified alert criteria more than a factor of 2.*

[5] *Alert Criteria for Hot Water Soluble Boron is >40% RPD*

[6] *Alert Criteria for Hot Water Soluble Boron is 70% - 130% Recovery*

[7] *In a standard VOC list, this includes acetone, dichlorodifluoromethane, 1,4-dioxane, methyl ethyl ketone, methyl isobutyl ketone, 1,1,1,2-tetrachloroethane, and vinyl chloride*

APPENDIX V
BOREHOLE LOGS

CLIENT: All Saints Development LP
PROJECT NO.: CO923.00

RECORD OF:
BH101

ADDRESS: 315 Chapel Street
STATION:
CITY/PROVINCE: Ottawa
NORTHING (m):
EASTING (m):
ELEV. (m) 67.25
CONTRACTOR: Strata Drilling Group
METHOD: Direct Push
BOREHOLE DIAMETER (cm):
WELL DIAMETER (cm): -
SCREEN SLOT #: -
SAND TYPE: -
SEALANT TYPE: Bentonite

SAMPLE TYPE ◧ AUGER ◩ DRIVEN ⧗ CORING ⬒ DYNAMIC CONE ▯ SHELBY ⌶ SPLIT SPOON

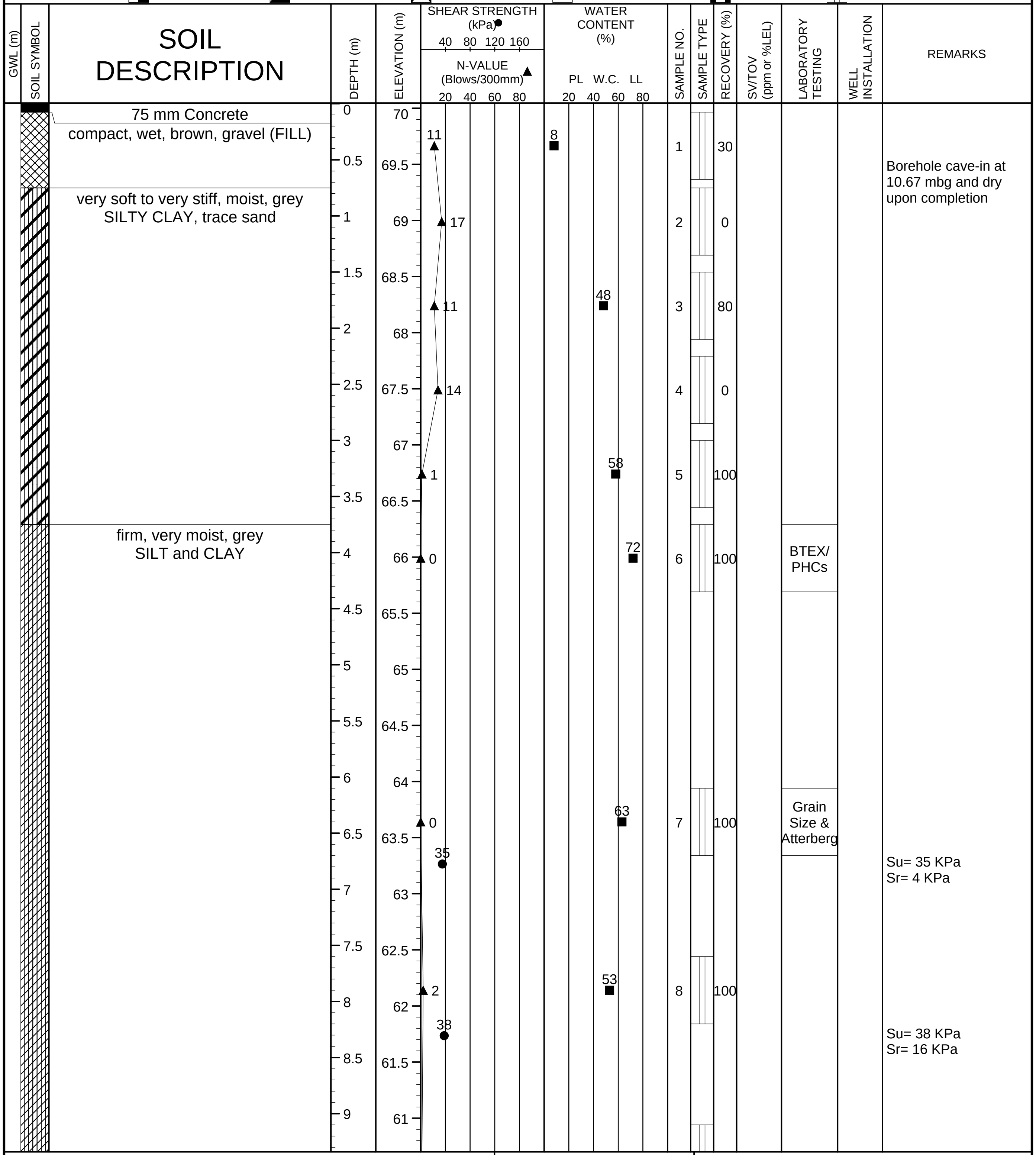
GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) ● 40 80 120 160 N-VALUE (Blows/300mm) ▲ 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
	■	300 mm concrete slab	0	67									
	▨	wet, brown, CLAY, trace sand	0.5				1	◩	100	<10	BTEX/ PHCs		
	▨		1	66.5			2	◩	100	<10			
	▨	saturated, brown SILTY CLAY	1.5	66			3	◩	100	<10			
	▨		2	65.5			4	◩	100	<10			
	▨		2.5	65									
	▨		3	64.5			5	◩	100	<10	pH		
		END OF BOREHOLE											

TERRAPEX

LOGGED BY: EB
INPUT BY: JZ
REVIEWED BY:
DRILLING DATE: 10-APR-2023
MONITORING DATE:

CLIENT: All Saints Development LP	PROJECT NO.: CO923.00	**RECORD OF:**
ADDRESS: 315 Chapel Street	STATION:	**BH102**
CITY/PROVINCE: Ottawa	NORTHING (m):	EASTING (m): ELEV. (m) 70.04
CONTRACTOR: Strata Drilling Group	METHOD: Split Spoon Sampling	
BOREHOLE DIAMETER (cm):	WELL DIAMETER (cm): -	SCREEN SLOT #: - SAND TYPE: - SEALANT TYPE:

SAMPLE TYPE ▮ AUGER ◪ DRIVEN ⧓ CORING ▀ DYNAMIC CONE ▯ SHELBY ⌶ SPLIT SPOON



SOIL DESCRIPTION
75 mm Concrete
compact, wet, brown, gravel (FILL)
very soft to very stiff, moist, grey SILTY CLAY, trace sand
firm, very moist, grey SILT and CLAY

SAMPLE NO.	N-VALUE	W.C. (%)	RECOVERY (%)	LABORATORY TESTING
1	11	8	30	
2	17		0	
3	11	48	80	
4	14		0	
5	1	58	100	
6	0	72	100	BTEX/ PHCs
7	0	63	100	Grain Size & Atterberg
8	2	53	100	

SHEAR STRENGTH (kPa)	REMARKS
	Borehole cave-in at 10.67 mbg and dry upon completion
35	Su= 35 KPa Sr= 4 KPa
38	Su= 38 KPa Sr= 16 KPa

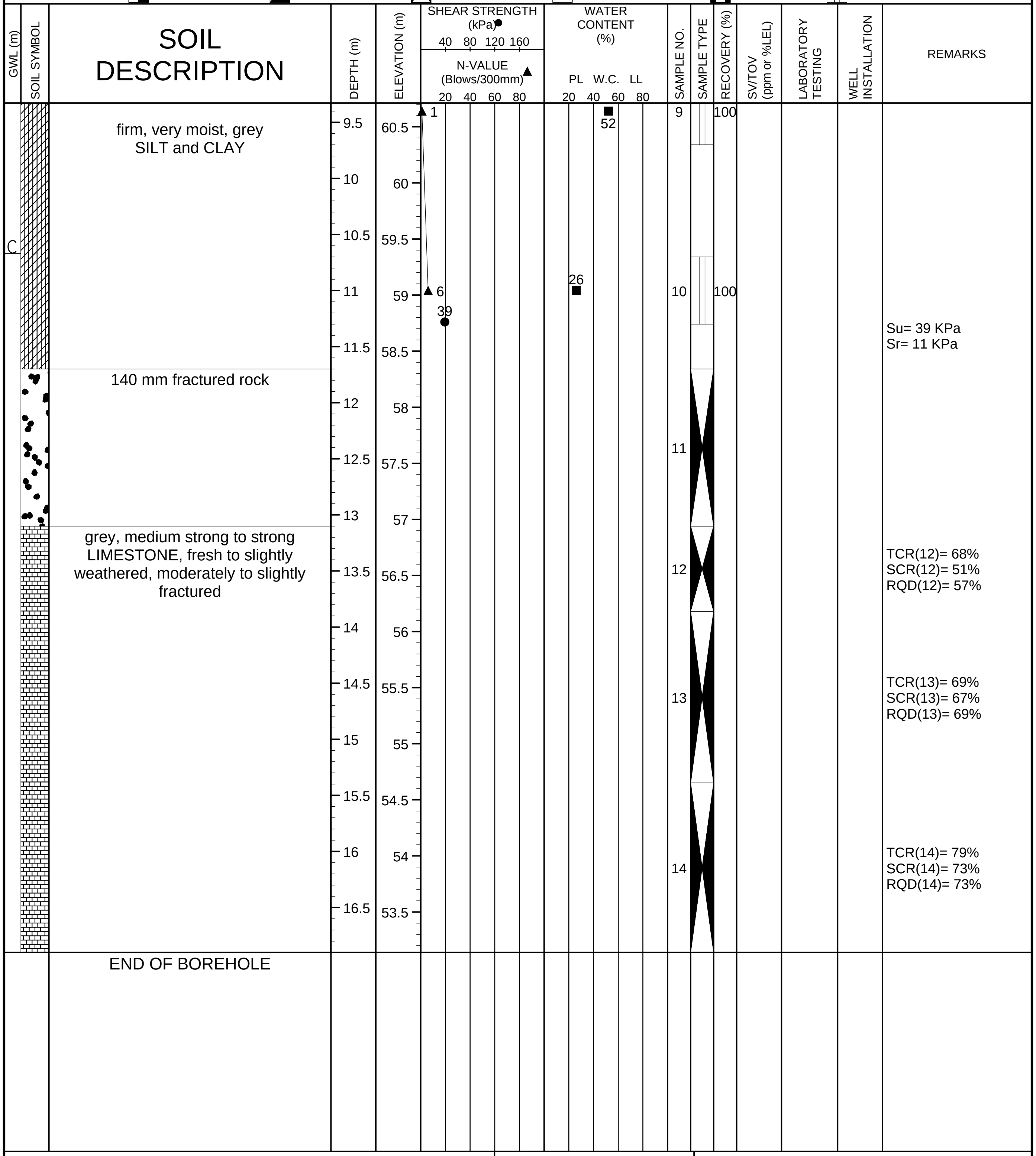
TERRAPEX

LOGGED BY: HM	DRILLING DATE: 11-APR-2023
INPUT BY: JZ	MONITORING DATE:
REVIEWED BY: JZ	PAGE 1 OF 2

CLIENT: All Saints Development LP
PROJECT NO.: CO923.00

RECORD OF:
BH102

ADDRESS: 315 Chapel Street
STATION:
CITY/PROVINCE: Ottawa
NORTHING (m):
EASTING (m):
ELEV. (m) 70.04
CONTRACTOR: Strata Drilling Group
METHOD: Split Spoon Sampling
BOREHOLE DIAMETER (cm):
WELL DIAMETER (cm): -
SCREEN SLOT #: -
SAND TYPE: -
SEALANT TYPE:
SAMPLE TYPE: AUGER, DRIVEN, CORING, DYNAMIC CONE, SHELBY, SPLIT SPOON



firm, very moist, grey
SILT and CLAY

140 mm fractured rock

grey, medium strong to strong
LIMESTONE, fresh to slightly
weathered, moderately to slightly
fractured

END OF BOREHOLE

Su= 39 KPa
Sr= 11 KPa

TCR(12)= 68%
SCR(12)= 51%
RQD(12)= 57%

TCR(13)= 69%
SCR(13)= 67%
RQD(13)= 69%

TCR(14)= 79%
SCR(14)= 73%
RQD(14)= 73%

TERRAPEX

LOGGED BY: HM
DRILLING DATE: 11-APR-2023
INPUT BY: JZ
MONITORING DATE:
REVIEWED BY: JZ
PAGE 2 OF 2

APPENDIX VI
LABORATORY CERTIFICATES OF ANALYSIS

Your Project #: CO923.00
Site Location: 317 CHAPEL STREET
Your C.O.C. #: N/A

Attention: Rod Rose

Terrapex Environmental Ltd
1-20 Gurdwara Rd.
Ottawa, ON
CANADA K2E 8B3

Report Date: 2023/04/20
Report #: R7594822
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3A4168
Received: 2023/04/13, 08:40

Sample Matrix: Soil
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Petroleum Hydro. CCME F1 & BTEX in Soil (1, 2)	4	N/A	2023/04/17	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Soil (1, 3)	3	2023/04/18	2023/04/18	CAM SOP-00316	CCME CWS m
Moisture (1)	3	N/A	2023/04/15	CAM SOP-00445	Carter 2nd ed 51.2 m
pH CaCl2 EXTRACT (1)	2	2023/04/19	2023/04/19	CAM SOP-00413	EPA 9045 D m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) This test was performed by Bureau Veritas Mississauga, 6740 Campobello Rd , Mississauga, ON, L5N 2L8
(2) No lab extraction date is given for F1BTEX & VOC samples that are field preserved with methanol. Extraction date is the date sampled unless otherwise stated.
(3) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following “Alberta Environment’s Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003”. Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

Your Project #: CO923.00
Site Location: 317 CHAPEL STREET
Your C.O.C. #: N/A

Attention: Rod Rose

Terrapex Environmental Ltd
1-20 Gurdwara Rd.
Ottawa, ON
CANADA K2E 8B3

Report Date: 2023/04/20
Report #: R7594822
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3A4168
Received: 2023/04/13, 08:40

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Katherine Szozda, Project Manager
Email: Katherine.Szozda@bureauveritas.com
Phone# (613)274-0573 Ext:7063633
==
This report has been generated and distributed using a secure automated process.
Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

RESULTS OF ANALYSES OF SOIL

Bureau Veritas ID		VNW017	VNW018	VNW019	VNW019			VNW021	VNW022	
Sampling Date		2023/04/10 09:56	2023/04/10 09:56	2023/04/11 17:00	2023/04/11 17:00			2023/04/10 10:20	2023/04/10 16:00	
COC Number		N/A	N/A	N/A	N/A			N/A	N/A	
	UNITS	**BH101-2**	**BH101-1**	**BH102-6**	**BH102-6 Lab-Dup**	**RDL**	**QC Batch**	**BH101-5**	**BH103**	**QC Batch**
Inorganics										
Moisture	%	38	40	36	35	1.0	8610522			
Available (CaCl2) pH	pH							8.46	7.11	8616296

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

PETROLEUM HYDROCARBONS (CCME)

Bureau Veritas ID		VNW017		VNW018			VNW018			VNW019		
Sampling Date		2023/04/10 09:56		2023/04/10 09:56			2023/04/10 09:56			2023/04/11 17:00		
COC Number		N/A		N/A			N/A			N/A		
	UNITS	**BH101-2**	**RDL**	**BH101-1**	**RDL**	**QC Batch**	**BH101-1 Lab-Dup**	**RDL**	**QC Batch**	**BH102-6**	**RDL**	**QC Batch**
BTEX & F1 Hydrocarbons												
Benzene	ug/g	ND	0.020	ND	0.040	8610987				ND	0.020	8610987
Toluene	ug/g	ND	0.020	ND	0.040	8610987				ND	0.020	8610987
Ethylbenzene	ug/g	ND	0.020	ND	0.040	8610987				ND	0.020	8610987
o-Xylene	ug/g	ND	0.020	ND	0.040	8610987				ND	0.020	8610987
p+m-Xylene	ug/g	ND	0.040	ND	0.080	8610987				ND	0.040	8610987
Total Xylenes	ug/g	ND	0.040	ND	0.080	8610987				ND	0.040	8610987
F1 (C6-C10)	ug/g	ND	10	ND	20	8610987				ND	10	8610987
F1 (C6-C10) - BTEX	ug/g	ND	10	ND	20	8610987				ND	10	8610987
F2-F4 Hydrocarbons												
F2 (C10-C16 Hydrocarbons)	ug/g	ND	10	ND	10	8613072	ND	20	8613072	ND	20	8613072
F3 (C16-C34 Hydrocarbons)	ug/g	ND	50	ND	50	8613072	ND	100	8613072	ND	100	8613072
F4 (C34-C50 Hydrocarbons)	ug/g	ND	50	ND	50	8613072	ND	100	8613072	ND	100	8613072
Reached Baseline at C50	ug/g	Yes		Yes		8613072	Yes		8613072	Yes		8613072
Surrogate Recovery (%)												
1,4-Difluorobenzene	%	100		100		8610987				100		8610987
4-Bromofluorobenzene	%	97		98		8610987				99		8610987
D10-o-Xylene	%	102		93		8610987				95		8610987
D4-1,2-Dichloroethane	%	105		102		8610987				103		8610987
o-Terphenyl	%	93		92		8613072	92		8613072	93		8613072

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

PETROLEUM HYDROCARBONS (CCME)

Bureau Veritas ID		VNW020		
Sampling Date		2023/04/10		
COC Number		N/A		
	UNITS	**METHANOL BLANK**	**RDL**	**QC Batch**
BTEX & F1 Hydrocarbons				
Benzene	ug/g	ND	0.020	8610987
Toluene	ug/g	ND	0.020	8610987
Ethylbenzene	ug/g	ND	0.020	8610987
o-Xylene	ug/g	ND	0.020	8610987
p+m-Xylene	ug/g	ND	0.040	8610987
Total Xylenes	ug/g	ND	0.040	8610987
F1 (C6-C10)	ug/g	ND	10	8610987
F1 (C6-C10) - BTEX	ug/g	ND	10	8610987
Surrogate Recovery (%)				
1,4-Difluorobenzene	%	101		8610987
4-Bromofluorobenzene	%	97		8610987
D10-o-Xylene	%	88		8610987
D4-1,2-Dichloroethane	%	103		8610987

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

TEST SUMMARY

Bureau Veritas ID: VNW017
Sample ID: BH101-2
Matrix: Soil

Collected: 2023/04/10
Shipped:
Received: 2023/04/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	8610987	N/A	2023/04/17	Anca Ganea
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	8613072	2023/04/18	2023/04/18	Ksenia Trofimova
Moisture	BAL	8610522	N/A	2023/04/15	Rajkumar Patel

Bureau Veritas ID: VNW018
Sample ID: BH101-1
Matrix: Soil

Collected: 2023/04/10
Shipped:
Received: 2023/04/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	8610987	N/A	2023/04/17	Anca Ganea
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	8613072	2023/04/18	2023/04/18	Ksenia Trofimova
Moisture	BAL	8610522	N/A	2023/04/15	Rajkumar Patel

Bureau Veritas ID: VNW018 Dup
Sample ID: BH101-1
Matrix: Soil

Collected: 2023/04/10
Shipped:
Received: 2023/04/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	8613072	2023/04/18	2023/04/18	Ksenia Trofimova

Bureau Veritas ID: VNW019
Sample ID: BH102-6
Matrix: Soil

Collected: 2023/04/11
Shipped:
Received: 2023/04/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	8610987	N/A	2023/04/17	Anca Ganea
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	8613072	2023/04/18	2023/04/18	Ksenia Trofimova
Moisture	BAL	8610522	N/A	2023/04/15	Rajkumar Patel

Bureau Veritas ID: VNW019 Dup
Sample ID: BH102-6
Matrix: Soil

Collected: 2023/04/11
Shipped:
Received: 2023/04/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	8610522	N/A	2023/04/15	Rajkumar Patel

Bureau Veritas ID: VNW020
Sample ID: METHANOL BLANK
Matrix: Soil

Collected: 2023/04/10
Shipped:
Received: 2023/04/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	8610987	N/A	2023/04/17	Anca Ganea

TEST SUMMARY

Bureau Veritas ID: VNW021
Sample ID: BH101-5
Matrix: Soil

Collected: 2023/04/10
Shipped:
Received: 2023/04/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
pH CaCl2 EXTRACT	AT	8616296	2023/04/19	2023/04/19	Taslima Aktar

Bureau Veritas ID: VNW022
Sample ID: BH103
Matrix: Soil

Collected: 2023/04/10
Shipped:
Received: 2023/04/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
pH CaCl2 EXTRACT	AT	8616296	2023/04/19	2023/04/19	Taslima Aktar

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	5.3°C

Sample VNW018 [BH101-1] : F1 BTEX Analysis: Detection limits were adjusted for sample weight.

F24FID Analysis: Detection limits were adjusted for high moisture content.

Sample VNW019 [BH102-6] : F24FID Analysis: Detection limits were adjusted for high moisture content.

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8610522	MUC	RPD [VNW019-01]	Moisture	2023/04/15	2.3		%	20
8610987	AGA	Matrix Spike	1,4-Difluorobenzene	2023/04/17		100	%	60 - 140
			4-Bromofluorobenzene	2023/04/17		97	%	60 - 140
			D10-o-Xylene	2023/04/17		98	%	60 - 140
			D4-1,2-Dichloroethane	2023/04/17		102	%	60 - 140
			Benzene	2023/04/17		99	%	50 - 140
			Toluene	2023/04/17		93	%	50 - 140
			Ethylbenzene	2023/04/17		105	%	50 - 140
			o-Xylene	2023/04/17		105	%	50 - 140
			p+m-Xylene	2023/04/17		99	%	50 - 140
			F1 (C6-C10)	2023/04/17		102	%	60 - 140
8610987	AGA	Spiked Blank	1,4-Difluorobenzene	2023/04/17		101	%	60 - 140
			4-Bromofluorobenzene	2023/04/17		97	%	60 - 140
			D10-o-Xylene	2023/04/17		93	%	60 - 140
			D4-1,2-Dichloroethane	2023/04/17		104	%	60 - 140
			Benzene	2023/04/17		97	%	50 - 140
			Toluene	2023/04/17		90	%	50 - 140
			Ethylbenzene	2023/04/17		101	%	50 - 140
			o-Xylene	2023/04/17		99	%	50 - 140
			p+m-Xylene	2023/04/17		93	%	50 - 140
			F1 (C6-C10)	2023/04/17		101	%	80 - 120
8610987	AGA	Method Blank	1,4-Difluorobenzene	2023/04/17		101	%	60 - 140
			4-Bromofluorobenzene	2023/04/17		97	%	60 - 140
			D10-o-Xylene	2023/04/17		91	%	60 - 140
			D4-1,2-Dichloroethane	2023/04/17		104	%	60 - 140
			Benzene	2023/04/17	ND, RDL=0.020		ug/g	
			Toluene	2023/04/17	ND, RDL=0.020		ug/g	
			Ethylbenzene	2023/04/17	ND, RDL=0.020		ug/g	
			o-Xylene	2023/04/17	ND, RDL=0.020		ug/g	
			p+m-Xylene	2023/04/17	ND, RDL=0.040		ug/g	
			Total Xylenes	2023/04/17	ND, RDL=0.040		ug/g	
			F1 (C6-C10)	2023/04/17	ND, RDL=10		ug/g	
			F1 (C6-C10) - BTEX	2023/04/17	ND, RDL=10		ug/g	
8610987	AGA	RPD	Benzene	2023/04/17	NC		%	50
			Toluene	2023/04/17	NC		%	50
			Ethylbenzene	2023/04/17	NC		%	50
			o-Xylene	2023/04/17	NC		%	50
			p+m-Xylene	2023/04/17	NC		%	50
			Total Xylenes	2023/04/17	NC		%	50
			F1 (C6-C10)	2023/04/17	NC		%	30
			F1 (C6-C10) - BTEX	2023/04/17	NC		%	30
8613072	KTR	Matrix Spike [VNW018-01]	o-Terphenyl	2023/04/18		93	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2023/04/18		105	%	60 - 130
			F3 (C16-C34 Hydrocarbons)	2023/04/18		106	%	60 - 130

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			F4 (C34-C50 Hydrocarbons)	2023/04/18		108	%	60 - 130
8613072	KTR	Spiked Blank	o-Terphenyl	2023/04/18		93	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2023/04/18		102	%	80 - 120
			F3 (C16-C34 Hydrocarbons)	2023/04/18		105	%	80 - 120
			F4 (C34-C50 Hydrocarbons)	2023/04/18		105	%	80 - 120
8613072	KTR	Method Blank	o-Terphenyl	2023/04/18		96	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2023/04/18	ND, RDL=10		ug/g	
			F3 (C16-C34 Hydrocarbons)	2023/04/18	ND, RDL=50		ug/g	
			F4 (C34-C50 Hydrocarbons)	2023/04/18	ND, RDL=50		ug/g	
8613072	KTR	RPD [VNW018-01]	F2 (C10-C16 Hydrocarbons)	2023/04/18	NC		%	30
			F3 (C16-C34 Hydrocarbons)	2023/04/18	NC		%	30
			F4 (C34-C50 Hydrocarbons)	2023/04/18	NC		%	30
8616296	TAK	Spiked Blank	Available (CaCl2) pH	2023/04/19		100	%	97 - 103
8616296	TAK	RPD	Available (CaCl2) pH	2023/04/19	0.19		%	N/A

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Anastassia Hamanov, Scientific Specialist

APPENDIX VII
QUALIFICATIONS OF ASSESSORS

JASON O’BRIGHT, P.Eng.

Position: Project Engineer, Smithers, BC

Qualifications:
B.Eng. Environmental Engineering
Professional Engineers of Ontario
Engineers and Geoscientists British Columbia

Experience:

Terrapex Environmental Ltd.	2009 to present
DST Consulting Engineers Inc.	2009

Mr. O’Bright has experience in both performing and interpreting data from all stages of environmental assessment and remediation. Mr. O’Bright has conducted Phase I ESAs in accordance with the CSA standards and O.Reg 153/04, including historical research, site inspection and report preparation. Mr. O’Bright has experience in site assessment; small- and large-scale site remediation (both in-situ and ex-situ); environmental monitoring programs for sites impacted with PHCs, VOCs, PAHs and/or heavy metals; soil, groundwater, soil vapour and air sampling; designated substance surveys; and, peer reviews. More recently, Mr. O’Bright is responsible for coordination, monitoring and analytical data interpretation, drafting, and all aspects of report preparation.

Representative projects include the following:

Phase One ESA: Mr. O’Bright was responsible for historical research and review, interviews, site inspection, and report preparation in accordance with the requirements of Ontario Regulation (O. Reg.) 153/04 (with amendments) under the Environmental Protection Act, *Records of Site Condition - Part XV.1 of the Act*, in order to: determine potential sources of environmental impact; identify contaminants and media in areas of potential environmental concern; and, develop a conceptual site model (CSM) for the site.

Phase Two ESA: Based on a Phase One CSM developed for the site, the initial investigation consisted of drilling boreholes and installing monitoring wells, soil sampling, soil vapour surveying, elevation surveying, and groundwater monitoring and sampling (including from the existing monitoring well network). Based on the monitoring data and analytical results from the initial investigation, additional boreholes were drilled (some completed as monitoring wells or soil vapour probes) to fully delineate identified soil and groundwater impacts at the site. Soil vapour and indoor air samples were also collected. Mr. O’Bright completed the work program and reported the findings of the Phase Two in accordance with O.Reg 153/04. The Phase Two CSM was used as the basis for a Risk Assessment at the site, in support of the submission of a Record of Site Condition.

Designated Substance Survey: Mr. O’Bright completed an inspection, sampling various building materials suspected of containing asbestos, lead, mercury and/or other designated substances as listed in the Ontario Occupational Health and Safety Act (R.S.O. 1990,c.E.19). Mr. O’Bright prepared specifications for contractors in terms of the abatement required to address the identified asbestos- and lead-containing materials during the building demolition.

Assessment and Remediation of Hydrocarbon Impacted Soil: Mr. O’Bright conducted an extensive test pit program to delineate the extent of previously identified hydrocarbon impacted soil at the site, which involved soil sampling, soil vapour surveying, and soil classification. Based on a review of analytical results, Mr. O’Bright determined that there were three distinct zones of impact and estimated total volumes of impacted soil beneath the former building and pump islands and within the former tank nest. Mr. O’Bright supervised the excavation of impacted soil and collected confirmatory soil samples at the extent of the excavations. Completed excavations were backfilled with soil deemed suitable for re-use (based on analytical results) and imported fill. Impacted soil was sent off-site to a MOECC-licensed facility.

Assessment and Ongoing Groundwater Remediation: As part of an on-going contaminant management plan where the groundwater plume was delineated but was not decreasing in concentration and impacted soil identified could not be removed due to geotechnical limitations. Mr. O’Bright supervised the injection of a chemical oxidant into identified soil impacts in both the saturated and unsaturated zones. Mr. O’Bright conducted several pre- and post-injection groundwater monitoring and sampling events and interpreted several years of monitoring and analytical data. Mr. O’Bright presented a historical trend analysis showing that the oxidant injections have been effective in reducing the groundwater plume concentration in a report.

Peer Review: Mr. O’Bright reviewed affidavits documenting a heating oil loss and the subsequent remedial effort conducted by others. Mr. O’Bright summarized the environmental reports and tabulated the associated costs and presented the summaries in figures, tables, and charts in support of expert witness testimony.

ROD ROSE, P.Geo. (Limited)

Current Position:	Branch Manager / Senior Project Manager	
Qualifications:	B.A. Biology Dipl. (Hons.) Environmental Technology QP_{ESA} in accordance with O.Reg. 153/04	
Experience:	Terrapex Environmental Ltd.	2000 to Present
	Greenbank Environmental / Environmental Management Solutions Inc.	1998 to 2005
	Jacques Whitford Limited	1997 to 1998

Mr. Rose has 21 years of experience in the consulting industry, and is registered as a Limited member of the Association of Professional Geoscientists of Ontario (APGO) entitled to practice as a Professional Geoscientist (Limited) in the disciplines of Phase I and Phase II Environmental Site Assessments (ESAs) and Soil and Groundwater Remediation. As a Senior Project Manager, Mr. Rose manages Phase I, II, and III ESAs environmental monitoring programs, site remediation projects and Designated Substance Surveys (DSSs). Mr. Rose brings to Terrapex expertise in the environmental industry, having managed and conducted numerous environmental site assessments and remediations. He additionally, has conducted Occupational Exposure Air Monitoring, Ambient Air Monitoring and Real Time Air Monitoring for environmental remediation projects. Mr. Rose has experience in multiple client sectors including petroleum companies, fuel outlet dealers, national retail chains, commercial landowners and developers and all levels of government (municipal, provincial and federal).

Representative Projects:

National Capital Commission: Managed a historical reviews of site activities, interviews, and site visits in accordance with the Canadian Standards Association (CSA) Standard Z768-01 for Phase I Environmental Site Assessments of a number of properties in the National Capital Region. Assessments were enhanced to include Designated Substances Assessment / Hazardous Materials Reviews and storage tank compliance audits.

Municipality: Supervised and/or Conducted Phase I ESAs including historical reviews of site activities, interviews, and site visits in accordance with the Canadian Standards Association (CSA) Standard Z768-01 for 25 properties.

Various Clients: Completion/management of approximately 100 Phase I ESAs at various sites in Ontario, including industrial sites, commercial and residential properties and vacant lots.

Municipality: Phase II ESAs were conducted to investigate potential impacts from historic property use, neighboring properties and a historically reported VOC groundwater plume. Shallow overburden monitoring wells and deeper multi-level nested monitoring wells were installed to investigate the impacts.

Retail Petroleum Company: Completion of Phase I ESA and Phase II ESAs at a number of commercial retail petroleum stations across Ontario and implementing of contaminant management plans in accordance with Technical Standards and Safety Authority (TSSA) regulatory requirements.

Retail Client: Conducted Hazardous Materials Audits of major retail store buildings on two properties in preparation for demolition of the buildings and remediation of contaminated soil. Designated substances and hazardous materials present in the buildings were identified and quantified and the resulting information was used in the development of a specification document for contractors bidding on the related demolition/abatement and remediation contracts. Included the development and communication of site-specific safe work practices for abatement workers, supervision of remediation activities to meet generic MOECC site condition standards and/or site-specific criteria. Final site re-instatement included preparation for future construction and the implementation of risk management measures such as site soil barriers.

APPENDIX VIII
PHASE TWO CONCEPTUAL SITE MODEL

PHASE TWO CONCEPTUAL SITE MODEL

315-317 Chapel Street, Ottawa, Ontario

A preliminary Conceptual Site Model was developed as part of the Phase One ESA, which is discussed in Section 4.3. Following the completion of the Phase Two ESA field program, the CSM has been updated to present the current Site characteristics and identify actual or potential sources of contamination, pathways, release mechanisms, receptors, and exposure routes.

Based on the results of the Phase Two ESA, no soil or groundwater contaminants of concern were found exceeding MECP Table 3 SCS. Accordingly, no additional works are required to support the filing of a Record of Site Condition.

Additional inputs to the CSM include:

- stratigraphy observed during this Phase Two ESA work program; and,
- results of chemical testing for the current soil condition.

A narrative summary of the Phase Two CSM is provided below and, Figures 1 through 6 illustrating the Phase Two CSM are attached, and referenced in the appropriate sections below.

OVERVIEW

Site Description: The Site was the former All Saints Church and Bates Memorial Hall, currently occupied by the Working Title restaurant and event space, and Verve Moderns furniture store. All Saints is proposing a redevelopment of the Site to include condominium housing, which is a "residential" property use" per O. Reg. 153/04, requiring the submission of a Record of Site Condition (RSC).

The Site location and nearby waterbodies are shown on Figure 1. The general Site layout is shown on Figure 2. The Phase One Study Area, illustrating the Site and surrounding land use is shown on Figure 3.

Assessment Criteria: The generic full-depth Ministry of the Environment, Conservation and Parks (MECP) Site Condition Standards (SCS) determined to be applicable to the intended use of the Site are those for residential/parkland/institutional property use, coarse-textured soils, in a non-potable groundwater condition (the "Table 3 SCS"). The Site is not environmentally sensitive per the definition of Ontario Regulation (O. Reg.) 153/04.

PCAs AND APECs

Potential Contaminating Activity: Based on the review, evaluation, and interpretation of the information obtained from the records review, interviews, and site reconnaissance, PCAs were identified within the Phase One Study Area. Details regarding the PCAs are provided below. PCA locations are shown in Figure 4.

POTENTIALLY CONTAMINATING ACTIVITIES

PCA[1]	Address (Location[2])	Potentially Contaminating Activity[3]	Description	Source	Likelihood to Contribute to an APEC	Uncertainty
PCA1	Site	28 – Gasoline and Associated Products Storage in Fixed Tanks	Fuel Oil Spill	2017 Phase One MECP FOI	Possible	Low
PCA2A	345 Laurier Ave (30m N)	28 – Gasoline and Associated Products Storage in Fixed Tanks	9,080L Fuel Oil UST (1967)	HLUI	Unlikely	Low
PCA2B	404 Laurier Ave. (100m E)	28 – Gasoline and Associated Products Storage in Fixed Tanks	13,620L Fuel Oil AST (1959)	HLUI	Unlikely	Low
PCA2C	27 Gouldburn Ave. (100m E)	28 – Gasoline and Associated Products Storage in Fixed Tanks	4,540L Fuel Oil (1947) 181.6L gasoline (1922)	HLUI	Unlikely	Low
PCA2D	21 Blackburn Ave. (60m SE)	28 – Gasoline and Associated Products Storage in Fixed Tanks	544.8L gasoline (1924)	HLUI	Unlikely	Low
PCA2E	353 Friel St. (100m WNW)	28 – Gasoline and Associated Products Storage in Fixed Tanks	9,080L Fuel Oil UST (1954)	HLUI	Unlikely	Low
PCA2F	55 Sweetland Ave. (175m SW)	28 – Gasoline and Associated Products Storage in Fixed Tanks	9,080L Fuel Oil UST (1965)	HLUI	Unlikely	Low
PCA2G	240 Stewart St (175m NW)	28 – Gasoline and Associated Products Storage in Fixed Tanks	4,540L Oil AST (1957)	HLUI	Unlikely	Low
PCA2H	245 Augusta St. (160m N)	28 – Gasoline and Associated Products Storage in Fixed Tanks	227L gasoline (1927)	HLUI	Unlikely	Low
PCA3	332 Friel St. (220m NW)	30 - Operation of Dry Cleaning Equipment (where chemicals are used)	Parker Clean (1960 - 1980)	HLUI	Unlikely	Low

[1] As shown on Figure 4.

[2] Direction and approximate distance between nearest property limits

[3] As set out in Table 2 in Schedule D of O. Reg. 153/04

Areas of Potential Environmental Concern: One Area of Potential Environmental Concern (APECs) associated with the PCAs was identified on the Phase Two Property as per below:

AREA OF POTENTIAL ENVIRONMENTAL CONCERN

Area of Potential Environmental Concern[1]	Location Of Area of Potential Environmental Concern On Phase One Property	Potentially Contaminating Activity[2]	Location of PCA (On-Site Or Off-Site)	Contaminants Of Potential Concern[3]	Media Potentially Impacted (Ground water, Soil, and/or Sediment)
APEC 1	Vicinity of basement Oil-fired boiler system	28 – Gasoline and Associated Products Storage in Fixed Tanks	On-Site	- BTEX and PHCs	- Soil

[1] Areas of potential environmental concern means the area on, in or under a Phase One property where one or more contaminants are potentially present, as determined through the Phase One environmental site assessment, including through,
(a) identification of past or present uses on, in or under the Phase One property, and
(b) identification of potentially contaminating activity.

[2] Potentially contaminating activity means a use or activity set out in Column A of Table 2 of Schedule D that is occurring or has occurred in a Phase One study area.

[3] Contaminants of potential concern according to the Method Groups as identified in the "Protocol for in the Assessment of Properties under Part XV.1 of the Environmental Protection Act", March 9, 2004, amended as of July 1, 2011:
BTEX: benzene, toluene, ethylbenzene, xylenes
PHCs: petroleum hydrocarbons (F1-F4)

Subsurface Structures and Utilities That May Affect Contaminant Distribution and Transport: Underground utilities at the Phase Two Property include water and sanitary sewer lines, telephone, and natural gas. These utilities are typically at depths ranging from 0.3 to 3 m below ground surface, it is not anticipated that shallow utilities at the Site will act as potential migration pathways.

As the on-Site APEC was located in the basement of the on-Site building and related to a former fuel oil boiler and AST, it was anticipated that any fuel oil release from the former AST in the basement would migrate through cracks in the floor and subsequently into the underlying silty clay soil.

PHYSICAL SETTING OF THE PHASE TWO ESA PROPERTY

Stratigraphy: The stratigraphy encountered at the Site consisted generally of less than 1 m of variable brown sand and gravel, and sand with trace silt fill overlying grey silty clay extending to a depth of approximately 3.8 m bg, overlying moist grey silt and clay extending to bedrock at 10.8 m bg.

The upper zone of the silty clay extending to an approximate depth of 3.8 m bg was weathered and had a very soft to very stiff consistency.

Refer to Figures 2 for the borehole locations and Figure 6A or 6B for cross sections profile showing the soil stratigraphy at the APEC, and Borehole Logs for soil stratigraphy encountered in the boreholes.

Hydrogeological Characteristics: It is likely that the shallow silty clay, extending to depths of approximately 10 m bg, is acting as an aquitard overlying a confined limestone bedrock aquifer. Perched groundwater may be present in the aquitard. However, not enough information is available to interpret a perched groundwater flow direction at the Site.

Groundwater flow in the limestone bedrock aquifer is anticipated to be to the northwest toward the Ottawa River.

Depth to Bedrock: Limestone bedrock was encountered in Borehole BH102 at 10.8 m bg. Boreholes drilled previously at the Site encountered limestone bedrock at approximately 12 and 14 m bg.

Depth to Water Table: The depth to groundwater in the limestone bedrock was measured during the previous assessment at approximately 13 m bg.

Applicability of Section 35, 41 or 43.1 of O. Reg. 153/04: The Site and all other properties located, in whole or in part, within 250 metres of the boundaries of the property, are supplied by a municipal drinking water system. The Site is to be developed for residential property use and non-potable Standards were deemed applicable for the Site.

Notification of the intent to use non potable groundwater standards was provided to the City of Ottawa Clerk on April 28, 2023. The municipality did not immediately provide written notice of its objection to the use of non-potable groundwater standards. However, they have 30 days to do so following this notice. In anticipation, Section 35 of O. Reg. 153/04 was considered to apply to this Site.

Per Section 35(2) of O. Reg. 153/04 (as amended on July 1, 2020), non-potable SCS are determined to be appropriate for use at the Site as the following conditions apply:

- The use of the Site will not constitute “agricultural or other use” per the definitions of O. Reg. 153.04;
- the Site and all properties located, in whole or in part, within 250 m of the Site boundaries are supplied by a municipal drinking water system;
- the Site is not located in an area designated in the official plan as a well-head protection area, or any other area identified by the municipality for the protection of groundwater; and,
- neither the Site nor any property within the Phase One Study Area was identified as having a well used or intended for use as a source of water for human consumption or agriculture.

Section 35 of O. Reg. 153/04 describes conditions, which when present, can require the use of certain Site Condition Standards. Specifically, if the groundwater condition of a property may be considered non-potable or potable.

Based on the information available for the Site and requests made to the City of Ottawa, the Site meets all of the circumstances described in subsection 35.(3), and as a result, non-potable groundwater Site Condition Standards may be applied.

Section 41 of O. Reg. 153/04 describes conditions, which when present, can constitute an "environmentally sensitive site". They include the presence of areas of natural significance (such as wetlands, provincial parks, nature reserves and valuable animal habitats) within 30 m of the Site, and sites where soil pH lies outside prescribed ranges.

The Site does not contain any areas of natural significance, nor are there any within 30 m of Site. The Site does not display any conditions, which would classify the Site as environmentally sensitive. Soil pH values are within the prescribed ranges.

Section 43.1 of O. Reg. 153/04 describes conditions, which when present, can require the use of certain Site Condition Standards. Section 43.1 specifies Site Condition Standards for properties that have more than one-third of the area with less than 2 m of soil. However, overburden depths at the Site were greater than 2 m for the entire Site. Section 43.1 also specifies Site Condition Standards for properties where there is a water body within 30 m of the site. However, there is no water body within 30 m of the Site.

As a result of the above, Sections 41 and 43.1 of O. Reg. 153/04 are not considered to apply to this Site and the applicable full-depth generic Site Condition Standards may be used in the submission of a Record of Site Condition for the Site.

Areas on, in or under the Phase Two Property where excess soil is finally placed: No soil was excavated for reuse on the Phase Two Property and no excess soils were brought from another property during or following completion of the Phase Two ESA.

Locations of Proposed Buildings and Structures: At the time of the investigation, there were two commercial buildings on the Phase Two Property. Based on the proposed development plan for the property, the Site will be developed with a residential building in the general location of the Memorial Hall building. The former church (with heritage designation) is to remain.

CONTAMINATION

Investigation of Potential Areas of Contamination: The Phase Two ESA investigative scope was designed to investigate the identified APEC using boreholes. Phase Two ESA sampling locations are shown on Figure 2 and Figure 5.

Drill one borehole in the location of the former fuel oil AST and boiler system using a direct push drill rig with macrocore sampler to a depth of approximately 3.0 m below the basement floor. Collecting and classifying continuous soil samples. Submitting one worst-case soil sample for the analysis of benzene, toluene, ethylbenzene, xylenes, and petroleum fractions F1 to F4.

Identification of Contaminants of Concern*:* All of the soil analytical results were less than the applicable MECP Table 3 SCS.

The sampling locations investigated for potential contaminants of concern in soil have been illustrated in Figures 6A and 6B.

Environmental Media of Concern: Based on the findings of the Phase One ESA, the Phase Two ESA work program included an investigation of the environmental quality of soil at the Site. It is anticipated that any fuel oil release from the oil-fired boiler and AST system in the basement would migrate through cracks in the floor and subsequently into the underlying silty clay soil.

Based on this investigation, no environmental impacts were found in soil at the Site. Therefore, the need to investigate the groundwater condition in the aquitard underlying the floor was deemed unnecessary. The environmental quality of sediment was not investigated due to the absence of sediment at the Site.

Details of Contaminated Areas: Contaminated areas were not identified at the Site.

Origin, Extent, Distribution and Delineation of Contaminants: Contaminated areas were not identified at the Site

Migration of Contaminants: Contaminated areas were not identified at the Site.

Climatic or Meteorological Impacts on Contaminant Migration: Contaminated areas were not identified at the Site.

Soil Vapour Intrusion of Contaminants into Buildings: Contaminated areas were not identified at the Site.

CROSS-SECTIONS

Lateral and Vertical Distribution of Contaminants: Contaminated areas were not identified at the Site.

Depth to Water in Contaminated Areas: Contaminated areas were not identified at the Site.

Stratigraphy in Contaminated Areas: Impacted soil and/or groundwater was not identified on the Site.

Subsurface Structures and Utilities in Contaminated Areas: Contaminated areas were not identified at the Site.

RISK ANALYSIS

Risk assessment, in the context of properties potentially impacted by contaminants, is the process of estimating the likelihood of undesirable effects on human and ecological health resulting from exposure to chemical contaminants. Three components must be present for risks to human or ecological health to exist at sites impacted by contaminants:

- the contaminant must be present at concentrations sufficient to cause a possible adverse effect;
- a receptor (human or ecological) must be present; and,
- there must be a complete exposure pathway by which the receptor can come into contact with the contaminant.

Since no contaminants were identified, there are no potential human or ecological receptors and exposure routes.