Hydrogeology, Terrain Analysis and Impact Assessment Report 3400 Old Montreal Road, Ottawa

Client:
Humanics Universal Inc.
601 Brookridge Crescent
Ottawa, Ontario K4A1Z6

Type of Document:
Final

Project Number:
OTT-00229886-A0

Prepared By:

Shawn Doherty, P.Eng.
Delwar Ahmed, P.Geo.
Chris Kimmerly, P.Geo.

EXP Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 7H6

Date Submitted:
Original submission January 25, 2017
Revision 1 July 20, 2017,
Revision 2 November 28, 2022
Revision 3 October 6, 2023

Hydrogeology, Terrain Analysis and Impact Assessment
3400 Old Montreal Road, Ottawa

Type of Document:
Final

Client:
Humanics Universal Inc.
601 Brookridge Crescent,
Ottawa, Ontario K4A 1Z6

Project Number:
OTT-00229886-A0

Prepared By:
exp
100-2650 Queensview Drive
Ottawa, ON K2B 8H6
Canada
T: 613 688-1899
F: 613 225-7337
www.exp.com

PROFESSIONAL GEOSCIENTIST
DA, Oct. 6, 2023
DELWAR AHMED
PRACTISING MEMBER
1406
ONTARIO

Delwar Ahmed, P. Geo.
Senior Hydrogeologist

Chris Kimmerly, P. Geo.
Senior Geoscientist

Preface

This report was originally submitted January 25, 2017 and then revised July 20, 2017 due to modifications to the original proposed development vision. Recent design changes and the establishment of City of Ottawa guidelines in March 2021 required an update to the report which was completed in November 2022. This current version, September 2023, incorporates responses to City of Ottawa review comments dated March 21, 2023 and June 14, 2023. As such, this version of the report has been updated with the following information addressing the recent comments.

November 2022 Update:

This version of the report was updated as per City of Ottawa Hydrogeological and Terrain Analysis Guidelines (March 2021) with the following information:

- Revision of site layout and inclusion of the Phase 1A and 1B construction phases and assessment of any potential impacts on already assessed vulnerabilities (Section 2.0 Construction Phasing Plan);
- Update to water quantity demands (Section 4.2);
- Water quality testing results from a November 9, 2022 groundwater sampling event to monitor groundwater quality and assess any changes over time (Section 4.3);
- Assessment of the impact of revised sewage treatment system design based on updated maximum sewage flow rate considering revised occupancy and land use type (Section 5.0 Sewage Disposal);
- Evaluation of potential impacts of Phase 1A and 1B construction (Section 6.0);
- Update to Executive Summary and Conclusion (Section 7).

September 2023 Update:

This current version of the report incorporates responses to City of Ottawa review comments dated March 21, 2023 and June 14, 2023 with the following information:

- Water quality testing results from a July 20, 2023 groundwater sampling event for turbidity, trace metals and volatile organic compounds (VOC) (Section 4.3);
- Discussion regarding peak demand window and assessment of a higher peak demand rate based on longer peak demand window (6 hours) compared to the previous peak demand time window of 3 hours (Section 4.2).
- Update to Executive Summary and Conclusion (Section 7)

Executive Summary

EXP Services Inc. (EXP) was retained by Humanics Universal Inc. to conduct a hydrogeological investigation, terrain analysis and impact assessment for a proposed institutional development on the south side of old Montreal Road and is identified 3400 old Montreal Road and is legally described as: Part 4, 4R-22542, Part of Lot 7, Concession 1 (old survey), Geographic Township of Cumberland, City of Ottawa. Refer to Figures 1 in Appendix A for the site location and surrounding area.

It is proposed that the portion of the 18.5 acres (7.4 hectares) to the south of the ravine be developed into institutional land. Phase 1A has been constructed and includes the gravel roadway+ access, washrooms and septic system The Phase 1B Site Plan includes a Pavilion building and a workshop building and a public park.

This hydrogeological assessment was submitted to the City of Ottawa (CO) and Rideau Valley Conservation Authority (RVCA) as part of the site plan approval application. In the meantime, the Phase 1 construction was revised and modified during submission. Based on the modified Phase 1 construction plan, the initial submission was reviewed by the CO and the RVCA and they had comments and required and updated assessment. An updated construction plan designated as Phase 1A and 1B was developed as a response to the comments and a letter of response to address those comments were prepared and submitted on September 23, 2022, to the city and RVCA for their review. Later on based the CO requested to submit an updated hydrogeological and terrain analysis report in light of the revised and modified construction plan.

This updated report has been prepared to fulfill the requirement as per the City of Ottawa Hydrogeological and Terrain Analysis Guidelines (March 2021). This revised and updated report includes responses to the City of Ottawa and RVCA comments, assessment of impacts of the modified construction plan (Phase 1A and 1B) and its implications on the completed investigation including septic system design.

This investigation was completed and updated as per City of Ottawa Hydrogeological and Terrain Analysis Guidelines (March 2021) and consisted of the following tasks:

- On-site hydrogeological conditions were originally investigated through the construction and testing of two water wells. The wells were drilled on the subject property in February, 2016 by Air-Rock Drilling Company in accordance with Ontario Regulation 903. The wells were drilled in the specific locations proposed within the existing site plan design;
- Soil stratigraphy on the site was assessed through the completion of 12 test pits and two boreholes (as part of a geotechnical investigation). Select test pits were then outfitted with piezometers. This information was then used to assess the hydrogeological sensitivity of the site and the sizing for the required septic systems
- Water quantity was assessed on the basis of six-hour constant-rate pumping tests conducted on the wells and subsequent recovery tests (completed on February 23, 2016)
- Water quality was originally evaluated through chemical and bacteriological analysis of samples collected at the beginning and end of each pumping test (in February 23, 2016);
- Water quality was reassessed by collecting and submitting raw groundwater samples for the subdivision package (November 9, 2022) and for trace metals, volatile organic compounds, and turbidity (July 20, 2023).
- Re-evaluation of the water demand based on the updated development plans design parameters.

Based on the results of this updated investigation, the following conclusions and recommendations are presented:

- Two water supply wells were completed in the limestone bedrock at depths of 34.7 and 38 m respectively, while extending through over 30 m of over overburden material predominantly consisting of clay. Six-hour constant rate pumping tests followed by recovery tests conducted on each of these wells indicate well yields at or in excess of the tested rates. The sustainable well yield for Well #1 was rated to be 27 L/min. The sustainable well yield for Well #2 was rated to be 45 L/min;
- The pumping tests indicated very minor well interference within the aquifer during the pumping test. The impacts within monitoring wells approximately 70 to 80 m away from each other throughout the pump tests were less than 10 cm on the respective wells after the continuous pumping of the wells for 6 hours. As such, cumulative well impacts on the wells is not anticipated to be significant.
- The updated water demand was determined to be 4,600 L/day. Based on a potential peak demand of 3-hrs (time associated with service), the peak water demand would be in the order of 25.8 L/min. This analysis was updated with an conservative scenario of considering a longer peak water demand period of 6-hrs. This resulted in a peak demand of 44.1 L/min.
- This demand will be met by water supply from Well #2 which has a well yield of 45 L/min and thus can effectively provide necessary amount of water for daily usage considering 3-hr peak demand window;
- Based on pumping tests and analysis of test data the Well #2 may be considered as the main water supply well for the site considering the intended use of the site;
- The construction of test pits and wells revealed that overburden materials is comprised of sand layer ranging between 1 to 1.4 m deep followed by silty clay to depths of approximately 30 m. Therefore, the surficial soils are suitable and can accommodate a septic system field bed. Conversely, the silty clay soils below the sand provide the suitable protective buffer between the septic effluent at surface and the bedrock groundwater aquifer below.
- The existence of more than 30 m thick clay layer over the deeper bedrock aquifer where the drinking water wells are set will provide adequate protection for the deeper bedrock aquifer from surficial contamination specially from the septic pad on site.
- The hydrogeological conductivity of the soils combined with the thickness of bedrock at the site, suggest that the site is not hydrogeologically sensitive.
- Based on the original February 2016 testing followed by updated sampling and analyses in November 2022 and July 2023, it appears that the water quality over the long term is consistent with hard and slightly mineralized water. Due to high sodium concentration, there is health related concerns associated with the water supply for those on sodium reduced diets however the remainder of exceedances are related to aesthetic parameters.

The following table summarizes the exceedances.

Parameter	ODWQS – (mg/L)	Treatability Limit MECP D-5-5 (mg/L)	Feb. 23, 2016 Sample Concentration (mg/L)	Nov. 9, 2022 Sample Concentration (mg/L)	Jul. 20, 2023 Sample Concentration (mg/L)
Iron	0.3 (AO)	5	Well 1 – **1.78** to 0.095 Well 2 – 0.278 to **0.325**	Tap2 - 1A – **3.530** Tap2 - 1B – **3.640**	**0.606**
Sodium	200 (AO), 20 (MAC)	200	Well 1 – **35.8** to **30.9** Well 2 – **20.5** to 19.3	Tap2 - 1A – **30.7** Tap2 - 1B – **31.2**	**35.1**
Hardness (as $CaCO_3$)	100 (OG)	500	Well 1 – **230** to **265** Well 2 – **264** to **286**	Tap2 - 1A – **275** Tap2 - 1B – **284**	Not tested
Manganese	0.05 (AO)	1	Well 1 – **0.054** to 0.026 Well 2 – 0.028 to 0.034	Tap2 - 1A – **0.064** Tap2 - 1B – **0.068**	**0.410**
Organic Nitrogen	0.15 (AO)	No Value	Well 1 – 0.14 to **0.16** Well 2 – 0.08 to 0.06	Tap2 - 1A – 0.10 Tap2 – 1B – 0.20	Not tested
Turbidity (NTU)	5 NTU (AO,OG)	5 NTU	Well 1 – **38** to 2.5 NTU Well 2 – **7** to 4.4 NTU	Tap2 - 1A – **36** NTU Tap2 - 1B – **41.1** NTU	2.5

Exceedances of applicable standards are shown in bold texts.
AO- Aesthetic Objective – AOs are established for parameters that may impair the taste, odour or colour of water or which may interfere with good water quality control practices.
OG – Operational Guideline – OGs are established for parameters that, if not controlled, may negatively affect the efficiency of treatment, disinfection and distribution of the water.
MAC – Maximum Acceptable Concentration – The MAC is established for parameters which when present above a certain concentration, have known or suspected adverse health effects.
Treatability Limit MECP D-5-5 - Maximum Concentration Considered Reasonably Treatable (MCCRT)

Based on the above, apart from sodium there are no concerns regarding the quality and quantity of water for the purpose of developing Phase 1B,. If the well and / or septic locations are to be altered from the existing layout, they must be adjusted in accordance with the Ontario Building Codes.

Based on the currently proposed site development plan approved as Phase 1B (assembly hall and public park), it is our opinion that the facility should be characterized as a small non-municipal non-residential water system. As such, the facility would be governed under Ontario Regulation 318/08 – Small Drinking Water Systems. Understanding that the local Public Health Unit would likely require a site-specific risk assessment once the buildings are constructed and the water distribution systems are installed, it is still understood that regular water sampling programs for bacteriological parameters, nitrates/nitrites, etc. would likely be required.

Construction dewatering is not anticipated based on depth of floor foundations and groundwater conditions at the site.

Table of Contents

List of Figures in Appendix A

List of Appendices

1.0 Introduction

1.1. General

EXP Services Inc. (EXP) was retained by Humanics Universal Inc. to conduct a hydrogeological investigation, terrain analysis and impact assessment for a proposed institutional development on the south side of Old Montreal Road, approximately 400 m west of the intersection between Beckett's Creek Road and Old Montreal Road. The site is identified as 3400 Old Montreal Road. Refer to Figure 1 in Appendix A for the site location and surrounding area.

It is proposed that the portion of the 18.5 acres (7.4 hectares) to the south of the ravine be developed into institutional land. The development construction for the site is divided into two phases - Phase 1A has been constructed and includes the gravel roadway/access, washrooms and septic system. Phase 1B includes construction of a Pavilion building, a workshop building and a public park.

1.2. Methodology

Background information relating to local geology and hydrogeology was obtained from published maps and reports, and provincial Water Well Records.

On-site hydrogeological conditions were investigated through the construction and testing of two domestic water wells. Given that property is not intended to be subdivided into individual lots and the number of institutional buildings is less than five, it is our opinion that Procedure D-5-5, does not directly apply to this study. It was used as a guide for assessing water quality and water quantity.

Two test wells were drilled on the site a distance away from the ravine and/or septic fields. One of the wells was drilled near the sanctuary / education centre and another was drilled to the west (in the event of expansion in the future or additional water demand). The wells were drilled on the subject property on February 10/11 by Air-Rock Drilling Company in accordance with Ontario Regulation 903. The Water Well Records for the four water wells are included in Appendix B.

Water quantity of the site was assessed on the basis of six-hour constant-rate pumping tests conducted on the two wells. The recovery of the wells subsequent to pump shut down was monitored for 2 hours and/or until 95 % recovery was noted. The non-pumping wells were monitored during the tests to identify potential well interference.

Water quality was evaluated through chemical and bacteriological analysis of samples collected at the beginning and end of each pumping test. Both samples were collected for a suite of parameters identified as a detailed "private well" package consisting of major anions, inorganics, organics and bacteriological parameters. Turbidity was periodically monitored in the field during the tests. Two water samples were also collected from residences nearby for analyses of water quality parameters to establish the background water quality. To monitor groundwater quality two groundwater samples (first sample at 0.5-hr into the test and second sample was collected at 6-hr into the test) were collected during the long-term well yield test. The samples were analyzed by a CALA certified laboratory and the results were compared to the Ontario Drinking Water Quality Standards (ODWQS). As a follow and update of the water quality, raw groundwater samples were collected on November 9, 2022 and July 23, 2023 from a tap onsite and analyzed for comparison with the ODWQS drinking water parameters.

All field and desktop work as part of this hydrogeological investigation was done in general accordance with City of Ottawa Hydrogeological and Terrain Analysis Guidelines (March 2021).

Overburden soil conditions at the subject site (to the south of the ravine) were investigated through the completion of 12 test pits and 2 boreholes in November, 2015. The soil was investigated to assess the suitability of the soils for the purpose of installing septic systems and to conduct a groundwater impact study (i.e. potential for septic effluent from entering the groundwater system). Each test pit was logged for depth, soil characteristics and groundwater conditions. Select test pits were subsequently outfitted with slotted standpipes to determine the overburden static water elevation and to allow for monitoring of the overburden during the pumping program.

1.3. Site Location and Physiography

The site is located on the south side of Old Montreal Road, approximately 400 m west of the intersection between Beckett's Creek Road and Old Montreal Road, Ottawa as shown on Figure 1 (Appendix B). The City of Ottawa PIN is 145340140. The site is zoned Rural Residential 1. A survey plan is presented in Appendix B. The municipal address of the site is 3400 Old Montreal Road and is legally described as: Part 4, 4R-22542, Part of Lot 7, Concession 1 (old survey), Geographic Township of Cumberland, City of Ottawa.

The subject site consists of a vacant parcel of land with no existing buildings and/or structures. The site is described as having agricultural lands on the north and southern limits of the property and forested land along a ravine that is located within the central portions and northeastern corner of the property. A hydro corridor is located on the southern portion of the property and metal hydro towers are located within the property. A watercourse / ditch is located within the bottom of the ravine and outlets to the Ottawa River. The ravine is described as being forested (trees along the slope of the ravine). The ravine has been slightly manipulated to create a sanctuary complete with stone sculptures, stone dust pathways and small ponds/bird paths made with stones.

The topography of the site is relatively flat along the agricultural / low vegetative areas of the site with a gentle grade towards the main ravine that traverses through the center of the property but to the north of the proposed development. It is also noted that a slight southern influence followed by a steep slope is noted within the southeastern corner where a smaller ravine and water tributary is noted.

The site is accessed via a small driveway off of Old Montreal Road that provides access to the south of the ravine.

1.3.1. Environmental Impacts

The neighbouring properties are described as follows:

- North: It is noted that buildings, water wells and/or septic systems are currently not proposed for any portion of the property to the north of the ravine. As such, the ravine is located to the north of the proposed development followed by agricultural land (still within the Humanics property) followed by Old Montreal Road and sparsely populated residential dwellings before encountering the Ottawa River.
- East: A mixed farming / residential building with several out-buildings.
- South: Vacant land owned by Humanics and currently proposed to be a residential development.
- West: Vacant / agricultural lands as wells as residential developments to the southwest.

Based on a review of the neighbouring properties, no potential sources of contamination to the groundwater supply are present such as gas stations / landfills / industrial properties or other properties of that nature within a 500 m radius of the subject property.

EXP is not aware of any additional large scale water users in the area that would draw significant amounts of water. There are no listed permits for high water use in the area.

1.4. Topography / Drainage

The topography in the area is noted to be complex, with some areas described as being predominantly flat with other areas described as having steep slopes and water bodies.

The specific area, which is proposed for development, is predominantly flat with a potential gentle grade towards the large ravine that traverse the central / northeastern portions of the property. This ravine essentially serves as the northern limits of the proposed development. It is anticipated that the majority of the overburden groundwater flows are directed towards this large ravine. The ravine is noted to be between 10 to 12 m in depth, compared to the flatter ground on site. A watercourse is located within the base of the ravine and eventually directs water to the Ottawa River.

In addition to the ravine with a permanent water course, a smaller scale ravine is located within the southeastern corner of the property and extends more than 6 m in depth. Seasonal water flows stem from this ravine and appear to flow towards Beckett's Creek. As such, it is anticipated that some of the overburden groundwater flow within the southeastern corner of the property may flow towards the smaller ravine.

The northwestern portions of the property currently described as low vegetative land and not proposed for development is predominantly flat with no significant grade. It is anticipated that localised overburden groundwater flow from the area is towards the larger ravine.

2.0 Construction Phasing Plan

Initially, the proposed Phase 1 works (EXP Phasing Letter, dated April 26, 2022) primarily consisted of work within the eastern half of the property with access road from Old Montreal Road. The proposed works included:

- Constructing the heavy-duty granular based access road between the north and south property limits;
- The bio-retention stormwater pond between the onsite parking and the adjacent southern creek;
- The proposed workshop building (with temporary vehicle access), pavilion building and washroom facility;
- The pavilion and washroom facility will be serviced by a septic system designed by Green Valley Environmental (ref: DWG SP-6853-20, Date: 02/07/20) also to be constructed during this phase; and,
- Other works include installing underground hydro electrical utilities including a pad mount transformer and completing the necessary toe erosion protection in the northern watercourse as described in the supplementary Geotechnical recommendation letter.

Later on, the initial Phase 1 work program was divided in to two work programs and the design was revised, modified and updated, subsequently after discussions with the City of Ottawa, Rideau Valley Conservation Authority (RVCA).

The following is the work plan for the Phase 1A construction:

- Two interim washrooms and interim septic system (to be designed for pavilion as well);
- Five gazebos – only those outside the current limit of development;
- Electrical installation from Old Montreal Road including the transformer that is to be relocated outside of the current limit of development; and
- Entrance from Old Montreal Road into the site including erosion works at the entrance.

The Phase 1B construction plan includes the following works:

- The pavilion in the south and one gazebo;
- The workshop in the southwest;
- The remaining roadworks in the southern part of the site;
- The sewage servicing lines between the pavilion and the washrooms (sewage pump chamber and force main to Phase 1A septic system);
- Parking lot in the southern portion of the site;
- Bioretention pond and associated drainage ditch work; and
- Some associated landscaping works.

The above modifications and revisions from the original construction plans and modified and revised drawings have been reviewed to update this hydrogeological report.

The following approved (by the City of Ottawa on October 20, 2022) updated construction drawings have been reviewed to update this hydrogeological report:

- Approved Site Servicing and Grading Plan, Phase 1A (SGP-1A and 1B)
- Approved Erosion and Sediment Control Plan Phase 1A (ESC-1A and 1B)
- Approved Details and Notes Phase 1A (DET-1A and 1B) and
- Approved Proposed Site and Landscape Plan, Phase 1A (SP-1A and 1B)

This updated report will evaluate the modified and approved construction plan under Phase 1B (as Phase 1A has already been constructed) with reference to the completed hydrogeological and groundwater impact assessment study.

3.0 Geology

3.1. Surficial Geology

The surficial geology of the site, as mapped by S.H. Richard (1991) indicates that the site is underlain by various types of soil. According to the mapping, the soils within the site are described as Champlain Sea Deposits consists of clay and silt. The material generally consists of a uniform blue-grey clay/silty material with channels and bars of sand and silt. Site soil stratigraphy is shown in Figure 2 in Appendix A.

Based on the information collected from the test-pit and borehole drilling program on the site, the soils are confirmed to consist of a thin 1 to 1.5 m layer of sand over silty clay extending to depths beyond 19 m from ground surface. It is noted that the soils assessment was limited to the portion of the property to the south of the ravine and not to the north.

Accurate overburden groundwater flows were not measured/conducted at the time of the investigations due to winter conditions and overburden water levels could only be measured within three piezometers. The piezometers were installed within test pits to obtain a general estimate on water levels for the purpose of septic field bed installation. Nevertheless, overburden groundwater levels during the test pitting program were measured to be anywhere between 2 to 3 m from surface with static water levels between 1.48 and 1.74 m from surface.

3.2. Bedrock Geology

The bedrock geology, as mapped by Harrison (1976) at the subject site is described as being dolomite and limestone of the Oxford Formation. This Ordovician-aged formation can have a thickness of 60 m and is underlain by sandstone of the March and Nepean formations.

It is also noted that a fault line is located just to the south of the subject site. To the south of the fault line, the bedrock is described as shale and grey limestone of the Ottawa formation, which generally is known for poorer water quantity and quality.

3.3. Desktop Hydrogeology

A review of provincial Water Well Records for 14 wells drilled within the general area (i.e. within a 2 km radius) from Lots 6, 7 and 8 of Concession 1 within the Township of Cumberland of the site was completed as part of the previously completed 2009 *Hydrogeological, Terrain Analysis and Impact Study, 3400 Old Montreal Road*. In addition, the previous wells drilled to the south of the property (i.e. as part of the proposed residential development) were also included in the assessment.

Based on the well record and neighbouring well review, the depth to the bedrock surface is quite variable across the general area and was noted to range from 3 m to 80 m from surface (i.e. west of Kinsella Road) with the average depth to bedrock in the area in the order of 40 m. The depth of the wells in the area were found to range from 17 to 89 m. The estimated well yield was generally within 13.6 L/min to over 91 L/min with an average of 70 L/min.

A review of the six wells drilled to the south of the property as part of the 2009 study, variability in the well depths and well yields were also present (likely due to the presence of the nearby fault and escarpments in the area). Within the development to the south, the well depths ranged from 48 m to 104 m with well yields ranging from 17 L/min to 91 L/min.

3.4. Preliminary Conceptual Hydrogeological Model Summary

The site consists of a vacant lot with low vegetation divided through the centre/northeastern portions of the property by a deep ravine with a creek in its base. A second, yet smaller and shallower ravine, is located within the southeastern corner of the property. The ravines are considered to control / direct the shallow overburden groundwater flow as well as the surface water flows in the area. The regional groundwater flows are anticipated to flow towards the north and eventually towards the Ottawa River.

The general topography of the area displays notable sloping from south to north and eventually to the Ottawa River. It is anticipated that the majority of the overburden and surface water flows would follow a similar direction.

It is understood that the soils on site and within the general area are considered to be quite thick and consists of a thin layer of sand followed by a thick clay layer. The soil thickness diminishes further to the south where bedrock is observed near surface, however, this is beyond 500 m from the subject site.

The presence of the hydrogeological fault does provide some potential for variability in the groundwater characteristics on the site with generally deeper and lower yielding wells immediately to the south of the fault and suspected shallower and higher yielding wells to the north of the fault. This is based on the information gathered during the hydrogeological assessment and pumping test programs completed for the subdivision proposals to the south of the subject property (i.e. 2009 report referred to above).

4.0 Hydrogeology

4.1. Well Construction

In February 2016, two 152-mm diameter test wells were constructed on the property by Air-Rock Drilling, to the south of the ravine (i.e., where the development is proposed). The wells were drilled in locations where they are intended to be used for consumption when the property is developed as shown on Figure 3. The wells are completed within 4.3 to 6.4 m of limestone bedrock in accordance with O. Reg. 903. However, during the drilling program, consistent bedrock was encountered followed by large fractures intercepted at 4.3 and 6.4 m. Some levels of gravel/coarse sand were initially observed within the water (stemming from these fractures) and hampered drilling. Nevertheless, the wells were deemed deep enough, and the well driller estimated well yields suggested that water bearing fractures were intercepted. As such, it was determined that sufficient drilling had occurred, and a 6-hr pump test could be completed to confirm the well yield. The wells both extend 60 cm above ground surface and are capped. Well records are included in Appendix B.

Table 4.1: Well Construction Summary

Well No.	Completion Depth (m)	Depth to Rock (m)	Water Found (m)	Casing Depth (m)	Grout Pumped in Annular Space (ft^3)
Well #1	34.7	30.4	34.7	34	29.4 (bentonite) 12.5 (cement)
Well #2	38.4	32	38.4	38.5	29.4 (bentonite) 12.5 (cement)

The 152 mm diameter casing was installed into the well annulus. Once the casing was loosely installed, the grouting process commenced, which consisted of the pumping of cement at the bottom of the well casing followed by the pumping of quick gel through the centre of the drill rods. Once the grout was observed at the surface and allowed to settle for a short period of time, the well casing was hammered into the rock with the hydraulic hammer. The well casing extended to depths of 3 to 6 m from surface of the suspected bedrock with the goal of extending the casing through competent bedrock. EXP was present to review the installation of the casing and observe the grout rise to the surface via the side of the well.

Once the grout had stabilized, Air-Rock continued with the drilling of the well below the casing to intercept water. Water-bearing fractures were intercepted within 0.3 to 0.6 m below the well casing, respectively, in which gravel and sand seems appeared to be encountered within rock. According to the driller, the rock appeared consistent and not representative of boulders/cobbles prior to encountering this fracture (i.e. drill rods were not bouncing or irregular in drilling progress).

Following completion of the well drilling program, each well was developed with air pressure to clean out the well. All the sand/gravel could not be removed from the well, but the well was closely monitored to ensure that sand/gravel did not continuously pour into the bottom of the well. Subsequently, the well drillers flushed and allowed water to flow from the well for reportedly 60 minutes to remove the residual drilling mud and rock fragments to ensure the water column was clearing. Lastly, the well driller completed a one-hour pump and recovery test as per the O. Reg. 903 requirements for well technician contractors to determine the optimum flow rates for the subsequent 6-hour pumping test.

Both wells intercepted a thick clay formation extending from 29.8 to 31.4 m below ground surface before encountering a 0.6 m thick gravel seam. Limestone was then encountered at depths of 30.4 and 32 m respectively followed by large and/or vertical fractures suspected to have been intercepted within 4.5 to 6.5 m below the top of bedrock.

4.2. Water Quantity

4.2.1. Anticipated Water Demand

At this time, with the updated construction plan included in Phases 1A (already constructed) and 1B there are water demands proposed for the site which include a sanctuary and private park. The water demand for the sanctuary and private parklands has been calculated based on Section 8.2.1.3 of the Ontario Building Code. Initially a 3-hr peak water demand window was evaluated. However, to assess a worst-case water demand scenario a 6-hr time window was assessed. The summary of the evaluation is provided below.

Table 4.2: Anticipated Water Demand

Construction Phase		Building	Occupancy	Sewage Rate	Seats	Sewage Flow	Peak water demand
Phase 1A (already constructed)		Structures built in this Phase 1A includes washrooms, roadworks and septic system.					
		Peak Water Demand Period – 3-hr time window					
Phase 1B (proposed construction)		Assembly Hall/Workshop	Day use	36 L/person/day	100	3,600 L/day	20.2 L/min (3 hr peak)
		Park	Public Park (with toilet)	20 L/person/day	50	1,000 L/day	5.6 L/min (3-hr peak)
		Total peak use (3-hr) =					25.8 L/min
		Peak Water Demand Period – 6-hr time window (conservative case)					
Phase 1B (proposed construction)		Assembly Hall/Workshop	Day use	36 L/person/day	100	3,600 L/day	34.5 L/min (6 hr peak)
		Park	Public Park (with toilet)	20 L/person/day	50	1,000 L/day	9.58 L/min (6 hr peak)
		Total peak use (6-hr) =					44.1 L/min

4.2.2. Well Yields

Information on groundwater quality at the site was determined by completing six-hour pumping tests followed by recovery tests on the two newly installed test wells. Interpretation of the well yield characteristics of the test wells was conducted by calculating the transmissivity of the well and assessing the well yield. The transmissivity of an aquifer is the rate at which water is transmitted through a unit width of the aquifer under a unit hydraulic gradient. The calculation of the transmissivity for the pumping test was conducted using the Cooper-Jacob method which is based on the following assumptions: 1) the aquifer is confined; 2) water was discharged at a constant rate; 3) the well fully penetrates the bedrock aquifer; 4) discharge from the well is derived exclusively from storage in the aquifer. These assumptions and methods were used in determining the transmissivity values in this section. The pumping and recovery test data was also inputted into the Theis method to cross-reference the data. Tabular and graphical representations of the data collected from these pump tests are presented in Appendix C.

Although standpipes were installed on the property, testing to address impacts on overburden water was not feasible as the pumping test programs were completed in the winter (water was frozen).

Well #1

Well #1 was pumped for six hours at a constant rate of 27 L/min on February 23, 2016. Drawdown at the end of the test was 4.59 m, which represents approximately 18 % of the available drawdown based on a static water level of 10.59 m. It is noted that over 88% of the drawdown occurred within the first hour of the test. Within an hour into the test, the pumping rate decreased slightly to 25 L/min but drawdown did continue until approximately 3 hours into the test. Subsequently, the water level did appear to increase slightly suggesting either a positive boundary and/or a well yield in excess of 25 to 27 L/min. Following the pump test, the well recovered 77 % of the observed drawdown within 120 minutes of the end test. Although 95% recovery was not obtained, it is our opinion that sufficient data was collected to demonstrate that water levels would recover to and/or close to 95% recovery within 24 hours.

It should be noted that the apparent static water level of Well #1 is actually 11.35 m from top of casing and not 10.59 m as measured at the start of the pumping test. Prior to EXP arriving on site, Air-Rock had already installed the pump in the well thus lifting the level of the water column (i.e. inserting a slug in the well).

An aquifer transmissivity of 6.055 m^2/day was calculated using the Cooper-Jacob method and 12.67 m^2/day using the Theis method, respectively. The above-noted transmissivity values are both within the same order of magnitude and are considered representative of the water producing capabilities of the local aquifer. The storage coefficient was shown to range between $3x10^{-2}$ to $7x10^{-6}$.

It is also noted that Air-Rock also completed a one-hour pumping test on Test Well #1 a few days prior. The well was pumped at a rate of 38 L/min for a period of 1-hour (2,280 L), which resulted in a drawdown of 15 m. However, the well experienced approximately 95% recovery within 20 minutes according to the well records.

Well #2

Well #2 was pumped for six hours at a constant rate of 45 L/min on February 22, 2016. The maximum drawdown attained during the test was 0.6 m, which represents approximately 2 % of the available drawdown based on a static water level of 10.95 m. It is noted that over 50% of the drawdown occurred within the first minute of the test. Following the pump test, the well recovered 70 % of the observed drawdown within 60 minutes of the end of the test and eventually to 92 % within 18 hours after pump shut-off. Although 95% recovery was not obtained, it is our opinion that there is sufficient water given that the drawdown was only 0.6 m and the lack of 95% recovery could result from slight variations in the static water

level. It is understood that over 50% of the drawdown occurred within the first minute into the 6-hr pump test. The drawdown then slowed down/stabilized but continued gradually through the remainder of the test.

An aquifer transmissivity of 116 m^2/day was calculated using the Cooper-Jacob method and 108 m^2/day using the Theis method, respectively. The above-noted transmissivity values are both within the same order of magnitude and are considered representative of the water producing capabilities of the local aquifer. The storage coefficient was shown to range between 0.095 to 0.0005.

Considering the pumping duration and rate it was pumped, Well #2 has the capacity to be the primary water supply well for the proposed development site for its intended use.

4.2.3. Well Interference

During each pumping test program, each non-pumping test well was used as a monitoring well to determine potential well interference at the site and the overall impact on the aquifer with increased groundwater usage. Therefore, as an example, while Well #1 was being pumped, the monitoring well consisted of Well #2. The water levels were measured periodically at the monitoring wells during the pumping test. All data is shown in Appendix C. The actual total drawdown from the monitoring wells and the distances from the pumping well are identified in the following table.

Table 4.3: Well Interference Measurements

	Monitoring Wells			
Production Well	Test Well #1		Test Well #2	
	Drawdown (m)	Distance (m)	Drawdown (m)	Distance (m)
Well #1	-	-	0.07	80
Well #2	0.10	80	-	-

Note: Distance indicates the total horizontal distance between the pumping well and the monitoring well.

Based on the above, it is anticipated that the wells are slightly hydraulically connected. Some well interference was noted on Test Well #2 during the pumping of Test Well #1 and vice versa in the order of 0.07 to 0.1 m. As such, it is understood that there is hydraulic connection between the wells since both the wells are completed in the same bedrock aquifer. However, the impact on the monitoring wells accounted for less than 0.1% of the available drawdown within the respective wells.

When assessing these well interference calculations and reviewing the monitoring well drawdown, it must be understood that higher volumes of water (than would be used by normal daily residential usage) was pumped from the well. Based on the pumping rates, a total of 9,700 L of water was pumped from Well #1 and 16,100 L of water was pumped from Well #2. As such, it is understood that significantly more water was withdrawn from these wells over two six-hour intervals than what would be expected during water usage at the proposed facilities over the course of a day. As such, it is our opinion that the impacts of well interference should be minimal during the proposed water withdrawal.

4.2.4. Summary

Based on the above-noted information and considering a 3-hr peak water demand window of 25.8 L/min, Well #2 has adequate capacity and will provide the required well yield for the anticipated well usage. The sustainable well yield for Well #2 was rated to be 45 L/min and thus can effectively provide necessary amount of water for daily usage considering 3-hr peak demand window of 25.8 L/min.

Furthermore, a 6-hr peak window was considered to evaluate a more conservative condition of peak water demand. The results of the 6-hour peak demand of 44.1 L/min indicates that Well #2 has the capacity to be the primary water supply well.

Water levels measured within the monitoring wells accounted for less than 0.1% of the available drawdowns of the respective wells. The water levels within the monitoring wells were also shown to recover sufficiently within 24 hrs.

Cumulative well impact assessments conducted for the site were shown to produce drawdowns of 0.03 to 0.04 m/well based on the expected usage of 2000 L of water. This impact is considered to be minimal. Therefore, there are no concerns regarding well yields on the subject site.

4.3. Water Quality

4.3.1. General

The water quality in the bedrock aquifer was assessed through chemical, physical, and bacteriological analyses of samples collected at the beginning and end of the pumping tests. Two samples were collected during each pump test, the first sample being collected within the first 60 minutes of the test and the second sample being collected after 360 minutes of pumping. Each sample was submitted to Caduceon Environmental Laboratories in Ottawa, Ontario. The samples were analysed for a “private well” water quality package, which includes bacteriological parameters, general inorganic parameters, metals and organics. For the purpose of this report, samples collected at the beginning of the test are identified by “A” and samples collected near the end of the test are identified by “B”.

Water samples were not submitted for agricultural related parameters as the were previously collected and analysed for these samples as part of the 2009 study and no pesticides/herbicides were observed.

Prior to collecting samples for bacteria, free and total chlorine were measured in the field to be 0 mg/L, thus indicating that no residual chlorine remained in the well. No colour change was observed in the vials during field measurements. Turbidity was also measured periodically in the field during each pumping test. Turbidity levels generally decreased as the pump tests progressed. The field readings are included within the pump test data (Appendix C) as field readings are generally considered to be more reliable if elevated iron and/or other materials that precipitate are found within the water.

The results of the tests, presented in Appendix D, indicate that the groundwater available from the bedrock aquifer is of good quality, and meets all health-related criteria of the ODWS and Procedure D-5-5 treatability limits for those parameters tested following the required shocking and re-sampling/pumping.

The water quality from each well tested as part of this program is discussed in the ensuing sections:

4.3.2. Well #1

The analytical results from the groundwater sample collected on February 23, 2016 are shown to be hard and slightly mineralized but did not exceed health-related criteria outlined in the Ontario Drinking Water

Standards (ODWS). Total coliform and E.Coli. were determined to be 0 cts/100 ml at the start and the end of the pumping test whereas background bacteria was measured at 5 cts/ml and 3 cts/ml, respectively. This is well below the previously used criteria of 200 cts/ml.

It is noted that sodium levels were shown to be slightly elevated during the pumping test with levels of 35.8 mg/L at the start of pumping and 30.9 mg/L at the end of pumping. These levels are slightly above the health criteria of 20 mg/L for persons on low salt diets. Therefore, the local medical officer should be notified regarding elevated sodium levels.

All other health related parameters tested such as fluoride, nitrate, nitrite were either non-detect or well below the applicable criteria.

Turbidity levels were shown to decrease from 38 NTU at 30 min of pumping to 2.5 NTU at 360 minutes of pumping. Field turbidity readings were conducted to assess the turbidity levels using a Hach 2100P turbidity meter. The readings were shown to decrease from 32.4 NTU at 40 min to 2.75 NTU at 240 min. It is our opinion that turbidity levels are within acceptable levels.

A limited number of aesthetic parameters exceeded the applicable criteria during the pumping test including hardness, iron, manganese and organic nitrogen. Although iron and manganese were above their applicable aesthetic criteria with concentrations of 1.78 mg/L and 0.054 mg/L, respectively at the start of the test, their concentrations both decreased to well within the applicable criteria from the water samples collected at the end of the pumping test.

Organic nitrogen levels were shown to increase from 0.14 to 0.16 mg/L. As such, the concentrations were determined to be slightly above the criteria of 0.15 mg/L. Organic nitrogen is a function of the difference between total Kjeldahl nitrogen (TKN) and ammonia. Although the organic nitrogen concentration was shown to increase, it is noted that TKN and ammonia levels both decreased during the pumping. This suggests that overall nutrient loading content is decreasing in the water. In addition, dissolved organic carbons, nitrate/nitrite as well as tannin and lignin were determined to be quite low. As such, surficial related impacts are not considered to be a significant concern from this well. As such, there is no anticipated connection between the aquifer intercepted in Test Well #1 and the nearby creek / Ottawa River and/or overburden materials.

Hardness levels were shown to be between 230 to 265 mg/L. These levels are indicative of hard water as any level above 200 mg/L is considered hard. Given that the levels are well below 500 mg/L, they are considered potable and within the D-5-5 treatability limits.

Following the pumping test of Well #1, the water was then determined to be acceptable for consumption and no further development of the well is necessary.

4.3.3. Well #2

The analytical results from groundwater samples collected on February 22, 2016 did not exceed any health-related criteria outlined in the ODWS. It is noted that E.Coli. and Total Coliform were not detected, and background bacteria levels were not slightly elevated with levels of 32 and 24 ctu/ml, respectively. This is well below the accepted concentrations of 200 ctu/ml. As such, there are no concerns regarding bacteriological impacts in the water supply.

Sodium levels were detected to be slightly above the criteria of 20 mg/L with a concentration of 20.5 mg/L at the start of the test but then decrease to 19.3 at the end of the test. Although levels were shown to be below 20 mg/L, the local medical officer shall still be advised of the elevated sodium.

All other health related parameters tested such as fluoride, nitrate, nitrite were either non-detectable and/or well below the applicable criteria.

Turbidity levels were initially observed to have a concentration of 7 NTU at the start of the pumping test but then decreased to levels of 4.4 NTU at the end of the pumping test. It is anticipated that the turbidity levels would continue to decrease over time and would be lower when pumped at lower rates.

Other aesthetic parameter exceedances from this well included iron and hardness. Hardness levels were determined to be 264 (start of test) and 286 mg/L (end of test), respectively. As such, the levels were observed to increase slightly. This does suggest that the water is considered to be quite hard.

Similarly, iron levels were also shown to increase during the pumping test with levels increasing from 0.278 mg/L to 0.325 mg/L, thus increasing above the criteria of 0.3mg/L. It is understood that over 16,100 L of water was pumped from the well over a 6-hour period.

Other parameters that increased slightly over the test, but remained within the acceptable criteria include manganese and TDS. Nevertheless, these slight increases are not considered a concern and these parameters are still well within applicable aesthetic criteria.

Surficial and/or organic related parameters such as DOC, ammonia, tannin and lignin, organic nitrogen and TKN were all other below their aesthetic criteria and/or quite low. Therefore, there are no anticipated concerns regarding any surficial related impacts.

4.3.4. Water Quality Update (Sampling November 09, 2022)

To update and monitor water quality two (2) groundwater samples were collected on November 9, 2022 from the taps connected to Well #2 and analyzed for general drinking water parameters. Prior to collecting raw water samples, the tap was allowed to run approximately for 10 minutes to flush the system of any stagnant water. The collected samples were sent to Caduceon Laboratories, a CALA accredited laboratory for analysis. The results indicate exceedances of some of the parameters however the overall water quality is consistent to what was observed during previous investigation of 2016. The results are included in Appendix D.

Sodium concentrations identified in the samples are above ODWS of 20 mg/L and may have undesirable and unwanted effects on persons on low salt diet. Hardness levels (275 to 284 mg/L) were above the ODWS as previously noted. Turbidity levels (36.3 to 41.1 NTU) are detected above aesthetic objective of 5 NTU. Iron concentrations were elevated (3.53 to 3.64 mg/L) from 2016 levels. Stagnated condition of groundwater has the potential to induce oxidation of dissolved iron and may allow precipitation of iron which may cause elevated concentrations. It may also cause staining of the fixtures. All other tested parameters are below the ODWS (O. Reg. 169/03) limits.

The results of the November 2022 groundwater sampling and analyses indicates that the water quality is consistent as compared to the original testing slight changes in some parameters (Table 1, Appendix D).

4.3.5. Water Quality Update (Sampling July 20, 2023)

To update the water quality for turbidity, trace metals and VOC, one raw groundwater sample was collected on July 20, 2023 from a tap in one of the washrooms that is connected to Well #2. The tap was run for approximately 60 minutes to flush the plumbing system. The collected sample was sent to Caduceon Laboratories, a CALA accredited laboratory for analysis. The results of July 20, 2023 groundwater sampling and analysis are presented in Table 2A and 2 B (Appendix D). A copy of the Certificate of Analysis is attached in Appendix D.

The analytical results indicate that concentrations of iron and sodium was detected elevated above AO-Aesthetic Objective (non-health related concentration) and MAC – Maximum Acceptable Concentrations (health related concentration levels) respectively. Exceedance of iron has the potential to cause staining of

laundry and fixtures and impart a change in the taste of water. Well water may need simple treatment (water softener can remove low concentrations of iron) to reduce the concentration of iron. Sodium concentration is higher than health related objective standard and may not be suitable for persons with medical issues (controlled-sodium diet, hypertension) and may require treatment and/or signage advising of the sodium concentrations. People on low-sodium diet should not consume the water from this well unless the water is treated to lower the sodium concentration. Simple treatment of well water using a reverse osmosis system may be a suitable option.

4.3.6. Summary

Based on a review of the analytical results, it appears that the water quality over the long term is consistent with hard and slightly mineralized water. Due to high sodium concentration, there is health related concerns associated with the water supply however the remainder of exceedances are related to aesthetic parameters. Low level organic nitrogen exceedances were initially observed within Well #1 but the overall nutrient content of the water decreased with increased pumping/dewatering of the well. Given that Well #2 did not show elevated organic levels, surficial impacts within the well are not anticipated.

Results of the water quality sampling (February 23, 2016, November 9, 2022 and July 20, 2023) indicates that the water quality is consistent and has remained relatively unchanged. The following table summarizes the ODWS AO and/or MAC exceedances.

Table 4.4: Summary of Parameters of Concern (2016, 2022, 2023)

Parameter	ODWQS – (mg/L)	Treatability Limit MECP D-5-5 (mg/L)	Feb. 23, 2016 Sample Concentration (mg/L)	Nov. 9, 2022 Sample Concentration (mg/L)	Jul. 20, 2023 Sample Concentration (mg/L)
Iron	0.3 (AO)	5	Well 1 – **1.78** to 0.095 Well 2 – 0.278 to **0.325**	Tap2 - 1A – **3.530** Tap2 - 1B – **3.640**	**0.606**
Sodium	200 (AO), 20 (MAC)	200	Well 1 – **35.8** to **30.9** Well 2 – **20.5** to 19.3	Tap2 - 1A – **30.7** Tap2 - 1B – **31.2**	**35.1**
Hardness (as $CaCO_3$)	100 (OG)	500	Well 1 – **230** to **265** Well 2 – **264** to **286**	Tap2 - 1A – **275** Tap2 - 1B – **284**	Not tested
Manganese	0.05 (AO)	1	Well 1 – **0.054** to 0.026 Well 2 – 0.028 to 0.034	Tap2 - 1A – **0.064** Tap2 - 1B – **0.068**	**0.410**
Organic Nitrogen	0.15 (AO)	No Value	Well 1 – 0.14 to **0.16** Well 2 – 0.08 to 0.06	Tap2 - 1A – 0.10 Tap2 – 1B – 0.20	Not tested
Turbidity (NTU)	5 NTU (AO,OG)	5 NTU	Well 1 – **38** to 2.5 NTU Well 2 – **7** to 4.4 NTU	Tap2 - 1A – **36** NTU Tap2 - 1B – **41.1** NTU	2.5

Exceedances of applicable standards are shown in bold texts.
AO- Aesthetic Objective – AOs are established for parameters that may impair the taste, odour or colour of water or which may interfere with good water quality control practices.
OG – Operational Guideline – OGs are established for parameters that, if not controlled, may negatively affect the efficiency of treatment, disinfection and distribution of the water.
MAC – Maximum Acceptable Concentration – The MAC is established for parameters which when present above a certain concentration, have known or suspected adverse health effects.
Treatability Limit MECP D-5-5 - Maximum Concentration Considered Reasonably Treatable (MCCRT)

The above summary table indicates that there are parameters of concerns that exceeds the applicable drinking water guideline standards but are below MCCRT limits or the limits for reasonable treatment which

means the exceedances are treatable and can be lowered with reasonable treatment options if required. Iron, high hardness and manganese are in the groundwater and appear as background elements in the groundwater in the region, because of the aquifer composition. Hardness is above the operational guideline limits (normal and historical trend) but below MCCRT limits. If left untreated the water may affect the treatment and filtration system. High hardness may cause scaling. Sodium and organic nitrogen are most likely originating from winter salt application and agricultural (fertilizer application) land use.

The following provides additional discussion regarding water quality:

- Sodium: Low level sodium identified within the drinking water is above the ODWS health related concentration of 20 mg/L that can cause issues for persons on low salt diets. The concentrations of sodium detected during previous analysis (February 23, 2016 and November 9, 2022) and recent analysis (July 20, 2023) are consistent and above the health related standards. The results of July 20, 2023 groundwater sampling and analysis indicates sodium concentration to be 35.1 mg/L which is above the health related criteria and is consistent with previous sampling results.
- Hardness: Hardness levels are above the ODWS and noted to be consistent over time. Given that the levels range from 230 to 286 mg/L, the hardness does not hamper the potability of the water. In general water of hardness up 60 mg/L is considered soft, 61 to 120 mg/L moderately hard, 121 to 180 mg/L hard and more than 180 mg/L is very hard. Elevated hardness can cause scaling deposits and can form scum when mixed with soaps.
- Turbidity: Turbidity levels are above 1 NTU, which is an operational guideline for the operation of ultraviolet treatment systems designed to remove bacteria. During pumping tests of Wells 1 and 2 in 2016, the turbidity value detected was higher then the AO value initially but over time the turbidity was reduced to below AO level of 5 NTU. During November 9, 2022 sampling of groundwater, turbidity was detected between 36.0 to 41.1 NTU. The reason may be attributed to inadequate flushing of the water in the system and stagnant condition of water over an extended period of time. During July 20, 2023 sampling event the plumbing system was flushed for about an hour and the turbidity was 2.5 NTU. This suggests that the high turbidity detected during November 22, 2022 sampling event was the result of inadequate flushing of the water supply plumbing system.
- Iron: Iron levels were detected to be above the ODWS criteria at both wells at various stages in pumping. In Well #1, the iron levels decreased from 1.78 to 0.095 mg/L whereas the levels increased from 0.278 to 0.325 mg/L within Well #2 during pumping test. Iron was detected at 3.5 to 3.6 mg/L range during November 9, 2022 sampling (Tap2-1A and Tap2-1B). The iron concentration in July 20, 2023 raw groundwater sample was detected at 0.606 mg/L. The variable iron concentrations may be a function of system flushing. Elevated iron can cause staining of fixtures but can be treated, as discussed in Section 4.3.7.
- Manganese: Manganese was detected slightly above the aesthetic objective limit (0.05 mg/L) of ODWS but was below MCCRT limit (1 mg/L) . The exceedances were noted in 2016, 2022 and 2023 sampling rounds. The oxidized form of manganese in groundwater causes dark brown or black stains. Elevated manganese can be treated as discussed in Section 4.3.7.

4.3.7. Treatment Systems

Based on the above-noted water quality data, sporadic aesthetic related exceedances were identified in the groundwater samples collected from the on-site test wells. Even though the aesthetic exceedances will not cause any health-related concerns, they can still hamper the colour and taste of the water. It is also noted that turbidity was noted below 5 NTU but above 1 NTU, which can be considered a health related criteria for water going through UV treatment.

- Cartridge Filter:
  - Would be used to lower the turbidity to acceptable levels below 1 NTU, if required for treatment. Treatment systems may be required if the sites (depending on their final usage) are defined as designated facilities and/or small drinking water facility.
  - Used as pre-treatment for the use of UV units to ensure that turbidity levels are below 1 NTU, if UV systems are to be installed in the event that bacteria are present in the future and/or it is required as part of the required / recommended treatment system.
- Softener:
  - Lowers water hardness to acceptable levels, which minimizes scaling of the water in the water. It can also be used to treat low level iron and other metals, however, that is not its intended use. Reduction of water hardness to a particular level may also be necessary as a pre-treatment criteria for certain UV units.
- Chemical-free Iron Filter:
  - Lowers elevated iron concentrations to aesthetic levels if the elevated iron and manganese levels persist.
- Point of use reverse osmosis
  - Can be placed under a tap (to be used for drinking purposes) to lower sodium levels below 20 mg/L for persons on low salt diets.
- Carbon Filters
  - Can be used to reduce the organic nitrogen level of the water, if the organic levels do not decrease as expected.
- Reverse osmosis
  - Can be used to treat for elevated concentrations of manganese and iron also.

Based on the above, it is our understanding that the facility can be characterized as a small non-municipal non-residential building which is regulated under Ontario Regulation 318/08, which is now governed by the local public health unit. Therefore, it is understood that the public health unit will likely require a risk assessment of the facility once the water distribution system is installed to review the water treatment systems and water sampling schedules during the operation of the facility. The treatment system will be designated to lower the aforementioned aesthetic parameters.

5.0 Sewage Disposal

5.1. Site Sensitivity

5.1.1. Background

The current City of Ottawa Guidance Se (Procedure D-5-4) indicates that development may not be permitted on exposed bedrock, highly conductive soils (cobbles, gravel, coarse sand) and in areas with thin soil cover. It is considered that such a site would be characterized as being hydrogeologically sensitive. However, a specific soil thickness and/or maximum hydraulic conductivity is not specified and it is up to the proponent to establish the appropriate soil cover characteristics to accommodate a private residential development.

To establish the thickness of sufficient soil on a site in deeming it is not sensitive, EXP refers back to prior discussions with local health units and our professional experience. Based on prior discussions with the health unit on other similar developments, it was determined that a soil thickness of 30 cm of native soil is required to accommodate a septic system to 1) provide a proper buffer below the underlying septic field bed and 2) provide sufficient soil for downgradient nitrate dilution prior to entering the bedrock and/or migrating off property. The local conservation authorities have also been referring to a required soil thickness of 2 m based on O.Reg. 511/09 and O.Reg. 153/04.

The soil thickness at the site extends beyond 30 m from ground surface, therefore, there is no concern regarding site sensitivity associated with short circuiting of septic effluent or surficial water to the aquifer. This is confirmed via the drilling of the test wells for drinking water purposes as well as the installation of boreholes along the ravine.

Once one has established that sufficient soil thickness is present, a review of the soils is required to ensure that the overburden is not highly permeable and prone to short-circuiting of septic effluent to the bedrock aquifer.

5.1.2. Work Program

The work plan consisted of assessing the nature and distribution of overburden materials on the site through the construction of 12 test pits on the site. The test pits were excavated across the subject site to determine the general soil conditions at the site as part of the geotechnical assessments and septic suitability assessment. Samples were collected from the different soil horizons for further laboratory grain size analysis. All soils were logged for soil type, colour, moisture, and sample number. The locations of the boreholes and test pits are shown on Figure 2 (Appendix A) and descriptions of the materials encountered are presented in Appendix E.

5.1.3. Bedrock Groundwater Impact Assessment

To proceed with the development, the soils at or near the ground surface have to be assessed to determine if they are suitable for the construction of septic field beds. This assessment included:

- Assessing the soil stratigraphy from 12 test pits on the site;
- Collecting and submitting two soil samples from the surficial soil layers on the site (i.e. surficial 1 m) to assess hydraulic conductivity and T-times;
- Installing piezometers in select wells for the purpose of measuring the water levels to determine general overburden water levels for determining in-ground versus raised beds;

- Determining a hydraulic conductivity of the various soil type layers (samples of silty sand with traces as well as the silty clay layer).

The majority of the site is described as having 0.2 m to 0.3 m of topsoil over 1 to 1.5 of silty sand throughout the entire portion of the site to the south of the ravine but north of the hydro corridor. This layer of soil was then underlain by thick layer of silty clay which was documented through the test pit, borehole and well drilling program to extend to depths in the order of 30 m from surface. The silty clay was observed within each test pit and considered to be consistent within this portion of the property. It is understood that the thickness of the silty clay is lesser within the ravine portion compared to the other portions of the site.

Grain size analysis was conducted on the soils to determine the isolating properties of the soil to determine the potential for short circuiting of septic effluent into the bedrock formation while also assessing the suitability of the soils for septic systems. The sand cover on the site was assessed through the soil samples collected from TP1-SS1 and TP9-SS1 was determined to have a hydraulic conductivity of $8.1x10^{-3}$ to 10^{-2} cm/s. This sand material is consistent through the proposed development portion of the site. This is representative of soils within the surficial 1 m of soil.

Conversely, a sample of soil collected from TP2-SS2 is considered to be representative of the soils below the sand layer where the materials begin to shift to more of a defining clay layer. The soils were submitted for a grain size and it was noted that the 98.6% of the soils pass the 0.075 mm pore size. As such, the majority of the material would be characterized as a silt and/or clay. Based on the visual observations and field test in the soil, the soils are characterized as silty clay and likely have hydraulic conductivity in the order of $<10^{-7}$ cm/s. These soils are consistent for over 20 to 30 m in depth, thus providing sufficient buffer between the proposed septic systems and the underlying bedrock aquifer.

Based on the soil thickness (30m) as well as the type of soil (silty clay), there are no concerns regarding the short circuiting over surficial water and/or septic effluent to the bedrock groundwater supply.

Understanding that the soils and site conditions do not provide a concern for infiltration / short circuiting of septic effluent, one can proceed to assess the septic sizing. Understanding the variability in the hydraulic conductivity of the soils throughout the site based on clay to the east or gravelly sand with some silt, **exp** provided three differing soil classifications that describe the site.

Overburden groundwater levels can also impact the installation of a septic field bed (i.e. raised vs in-ground). As such, static water levels were measured from three locations on the site. The water levels were measured to be between 1.48 to 1.72 m from ground surface. Given that field bed and the associated tiles required dry soils to depth of 0.9 m from ground surface, the existing water levels are not considered a concern at this time.

Septic System Sizing – Class IV

Based on the information collected from the test pits excavated at the site, the dominant soils on the site are described as a sand material beneath the surficial topsoil, generally extending to depth of 1.2 to 1.4 m from surface. These sandy soils displayed hydraulic conductivities ranging from $8.1x10^{-3}$ to 10^{-2} cm/s. This would result in a T-time ranging from 1 to 20 min/cm. Below this layer, the soils shifted to a silty clay with hydraulic conductivities of $<10^{-7}$ cm/s, and thus having a loading rate likely exceeding 50 min/cm.

At initial stage, the sizing of the septic system that was considered to be preliminary in nature and intended to provide an estimate on the size/area required for the septic system required for the sanctuary / educational centre. The size of the sewage system envelope for these lots is based on Section 8.7.5.2 of Part 8 (sewage systems) of the Ontario Building Code.

The septic system will be designed to accommodate a total cumulative sewage flow of 4,600 L/day. For a daily design flow in excess of 3000 L/day, the surface area of the filter bed shall not exceed 50 L/m2/day.

The loading area is the area required to move the treated effluent out the filer media and into the underlying native soils, and is based on the loading rates noted in the OBC, which are based on the ability of the soil to absorb the applied effluent, and specifically the underlying soil's percolation rate. The required contact area (stone area) is:

$A_1 = 4600 / 50 = 92\ m^2$

- The minimum number of filter beds is 92/50 = 1.8 (Rounded up to 2)

Therefore 2 filter beds each a minimum of 46 m^2 is required. The distribution piping for each bed will consist of 10 runs of 5m long piping @ 1.2m o/c separated by 5m between beds. The two beds will sit on an extension of the filter medium, based on the required area:

$A_2 = QT/850$:

$A_2 = Q * 20 / 850$
$A_2 = 4{,}600 * 20 / 850 = 108.2\ m^2$

where: .....

Q = daily sewage flow in litres
T = soil percolation time (min/cm)

The loading area is the area required to move the treated effluent out of the filter media and into the underlying native soils and is based on the loading rates noted in the OBC, which are based on the ability of the soil to absorb the applied effluent, and specifically the underlying soil's percolation rate. The required loading area for a native soil with a percolation rate of between 1<T<20 min/cm and a loading rate of 10 L/m^2/day is:

- Loading Area (f x e): $A_3 = Q / 10$

  $A_3 = 4{,}600 / 10 = 460\ m^2$

where:

A_3= area of contact of the stone layer in m^2
Q = daily sewage flow in litres

The distribution piping, as noted above, will be spaced at a 1.2m offset, with 0.8m outside buffer. For a raised filter bed, the distribution piping will be evenly distributed over the surface areas of the filter medium (Area A_1) with 10 runs at 5m each (1.2m spacing), and 5m between beds. This yields two filter areas each 10m x 5m = 50 m^2 each or 100 m^2 for two (2) beds.

The total combined contact area (which includes the mantle is 15 m x 28 m = 420 m^2. The following summarizes the filter bed dimensions proposed:

Surface area of filter media, A_1 =	2 @ 10m x 5m = 100 m^2	(92 m^2 required)
Extension of base filter area, A_2 =	2 @ 6.6 x 10 = 132 m^2	(108.2 m^2 required)
Loading area, A_3 =	15m x 34m = 510 m^2	(460 m^2 required)

The material specifications for the filter sand shall be clean sand meeting OBC 8.7.5.3(3), specifically the sand particles ranging in size between the limits of:

a) An effective size of 0.25mm with a uniformity coefficient of not less that 3.5,

b) An effective size of 2.5mm with a uniformity coefficient not greater than 1.5 and,

c) Uniformity coefficient not greater than 4.5.

The provider of the sand must ensure that the sand meets this requirement through grain size analysis performed within the last six months of installation of the filter bed system

Partially to Fully Raised Beds

Based on the test pit program conducted on site, fully raised beds are not anticipated at the current time Sand was consistently identified to depths beyond 1 m from surface and static water levels were observed to be below 1.48 m from surface.

However, there is the potential, depending on the specific septic system location (where less sand and/or slightly higher water table is present) and/or proposed technology to be used that the two field beds may have to be raised slightly (0.1 to 0.2 m) above ground surface. This will be determined once the site is appropriately graded the final sand thickness is determined.

Septic System Locations

The preliminary location of the septic system for the sanctuary building and educational centre is in the area represented by TP1 through TP4 where surficial sand extends to depths of 1 to 1.4 m and groundwater is in the order of 1.6 m from surface.

The location can be adjusted during the planning process, however must maintain the required separation distances of 15 m from a well, 5 m from any proposed building structure and 3 m from the property line. It is noted that the field bed should also be located a minimum of 15 m from the ravine.

New Technology

It is understood that the field beds for a Class IV sewage system required to handle the volume of sewage from boarding and/or institutional complex can occupy large portions of the property. As such, consideration can be given to investigate the potential installation of a Class VII / tertiary system which would minimize the level of effluent while minimize the are to be occupied by the field bed.

5.1.4. Updated Design Considerations

The initial septic system was designed to accommodate the Sanctuary and Education buildings with a total cumulative sewage flow for these two buildings at 4,100 L/day. The design has been updated, based on the comments from the City of Ottawa and RVCA, as revised and contemplated as Phase 1A and 1B plan.

Previously, the septic system as designed by GVE was based on 120-person (at 20 L/person/day for Public Park with toilets only, Section 8.2.1.3 of the Ontario Building Code (OBC)) per day occupancy. However, based on revised workplan and further comments from the RVCA (via email dated September 15, 2022) the sewage flow rate was re-evaluated considering 50 people at the park onsite any day (public parks with toilet only, Section 8.2.1.3.16a of the OBC) at 20 L/person/day (total 1,000 L /d) and 100 people at the pavilion (Assembly Hall with food service, Section 8.2.1.3.2b) at 36L/person/day (total of 3,600L/d) the reassessed flow rate is 4,600 L/day. The proposed sewage flows for Phase 1A and 1B are similar to the initial septic system proposed for the development and the proposed flow is under 5,000 L/day for a Class IV sewage system, as defined by the OBC.

Because of the considerable thick clay layer (more than 30 m of clay at the locations of the wells) present over the deeper bedrock aquifer where the drinking water wells for this site is completed there, is insignificant risk of contamination from the septic system proposed at this site. The thick clay layer encountered at this site will act as a protective barrier to migration of contaminants from the septic beds.

6.0 Evaluation of Proposed Modifications

The approved Site Servicing and Stormwater Management Report for the Humanics Sanctuary was prepared by EXP, (dated July 2017 (Revision 3, updated November 25, 2022). The approved Hydrogeology and Terrain Analysis Report for the Humanics Sanctuary, prepared by EXP, is dated January 25, 2017, was revised July 20, 2017 has been updated to a November 25, 2022 report and this current version of October 6, 2023.

The initial septic system was designed to accommodate the Sanctuary and Education buildings with a total cumulative sewage flow of 4,100 L/day for these two buildings. Previously designed septic system by GVE was based on 120-person (at 20 L/person/day for Public Park with toilets only, Section 8.2.1.3 of the Ontario Building Code (OBC)) per day occupancy. The design was revised based on the SPA review comments from the City of Ottawa and the RVCA (via email dated September 15, 2022). The sewage flow rate was re-evaluated considering 50 people at the park onsite any day (public parks with toilet only, Section 8.2.1.3.16a of the OBC) at 20 L/person/day (total 1,000 L /d) and 100 people at the pavilion (Assembly Hall with food service, Section 8.2.1.3.2b) at 36L/person/day (total of 3,600L/d) the reassessed flow rate is 4,600 L/day. The proposed sewage flows for Phase 1A and 1B are similar to the initial septic system proposed for the development and the proposed flow is under 5,000 L/day for a Class IV sewage system, as defined by the OBC.

The completed water supply assessment (MECP D-5-5 procedures) indicates the yield rates as tested at the two test wells varied between 27 litres/minute (LPM) in Well #1 to 45 LPM in Well #2. The required minimum rate for a water supply well as per MECP D-5-5 procedures is 13.7 LPM and based on analysis of a 3-hr peak water demand window the supply from Well #2 is adequate and may be considered as the primary water supply well.

The construction under Phase 1A (Servicing and Grading Plan Phase 1A, Figure 5) has already been completed. The areas built in this phase will not put any demand on water supply unless 1B structures are built. The proposed Phase 1B (Site Landscaping Plan and Servicing and Grading Plan Phase 1B, Figures 4 and 6) includes construction of assembly hall and a public park and a workshop area and the construction components are similar or less in scope than the previously approved reports and drawings.

In terms of construction dewatering requirements and assessments, it is anticipated considering the type of proposed structures (workshop, pavilion, gazebos) the foundations are very shallow and will not be very elaborate structures that may require deep and significant excavations for foundations. So dewatering is not anticipated during construction and even if it is required it would be fairly easy to keep the pumping volume at or under 50,000 litres/day registration threshold limit. Pumping under 50,000 LPD does not require a registration or a permit.

7.0 Conclusions and Recommendations

This investigation was completed and updated as per City of Ottawa Hydrogeological and Terrain Analysis Guidelines (March 2021) and consisted of the following tasks:

- On-site hydrogeological conditions were originally investigated through the construction and testing of two water wells. The wells were drilled on the subject property in February, 2016 by Air-Rock Drilling Company in accordance with Ontario Regulation 903. The wells were drilled in the specific locations proposed within the existing site plan design;
- Soil stratigraphy on the site was assessed through the completion of 12 test pits and two boreholes (as part of a geotechnical investigation). Select test pits were then outfitted with piezometers. This information was then used to assess the hydrogeological sensitivity of the site and the sizing for the required septic systems
- Water quantity was assessed on the basis of six-hour constant-rate pumping tests conducted on the wells and subsequent recovery tests (completed on February 23, 2016)
- Water quality was originally evaluated through chemical and bacteriological analysis of samples collected at the beginning and end of each pumping test (in February 23, 2016);
- Water quality was reassessed by collecting and submitting raw groundwater samples for the subdivision package (November 9, 2022) and for trace metals, volatile organic compounds, and turbidity (July 20, 2023).
- Re-evaluation of the water demand based on the updated development plans design parameters.

Based on the results of this updated investigation, the following conclusions and recommendations are presented:

- Two water supply wells were completed in the limestone bedrock at depths of 34.7 and 38 m respectively, while extending through over 30 m of over overburden material predominantly consisting of clay. Six-hour constant rate pumping tests followed by recovery tests conducted on each of these wells indicate well yields at or in excess of the tested rates. The sustainable well yield for Well #1 was rated to be 27 L/min. The sustainable well yield for Well #2 was rated to be 45 L/min;
- The pumping tests indicated very minor well interference within the aquifer during the pumping test. The impacts within monitoring wells approximately 70 to 80 m away from each other throughout the pump tests were less than 10 cm on the respective wells after the continuous pumping of the wells for 6 hours. As such, cumulative well impacts on the wells is not anticipated to be significant.
- The updated water demand was determined to be 4,600 L/day. Based on a potential peak demand of 3-hrs (time associated with service), the peak water demand would be in the order of 25.8 L/min. This analysis was updated with an conservative scenario of considering a longer peak water demand period of 6-hrs. This resulted in a peak demand of 44.1 L/min.
- This demand will be met by water supply from Well #2 which has a well yield of 45 L/min and thus can effectively provide necessary amount of water for daily usage considering 3-hr peak demand window;
- Based on pumping tests and analysis of test data the Well #2 may be considered as the main water supply well for the site considering the intended use of the site;

- The construction of test pits and wells revealed that overburden materials is comprised of sand layer ranging between 1 to 1.4 m deep followed by silty clay to depths of approximately 30 m. Therefore, the surficial soils are suitable and can accommodate a septic system field bed. Conversely, the silty clay soils below the sand provide the suitable protective buffer between the septic effluent at surface and the bedrock groundwater aquifer below.
- The existence of more than 30 m thick clay layer over the deeper bedrock aquifer where the drinking water wells are set will provide adequate protection for the deeper bedrock aquifer from surficial contamination specially from the septic pad on site.
- The hydrogeological conductivity of the soils combined with the thickness of bedrock at the site, suggest that the site is not hydrogeologically sensitive.
- Based on the original February 2016 testing followed by updated sampling and analyses in November 2022 and July 2023, it appears that the water quality over the long term is consistent with hard and slightly mineralized water. Due to high sodium concentration, there is health related concerns associated with the water supply for those on sodium reduced diets however the remainder of exceedances are related to aesthetic parameters.

The following table summarizes the exceedances.

Parameter	ODWQS – (mg/L)	Treatability Limit MECP D-5-5 (mg/L)	Feb. 23, 2016 Sample Concentration (mg/L)	Nov. 9, 2022 Sample Concentration (mg/L)	Jul. 20, 2023 Sample Concentration (mg/L)
Iron	0.3 (AO)	5	Well 1 – **1.78** to 0.095 Well 2 – 0.278 to **0.325**	Tap2 - 1A – **3.530** Tap2 - 1B – **3.640**	**0.606**
Sodium	200 (AO), 20 (MAC)	200	Well 1 – **35.8** to **30.9** Well 2 – **20.5** to 19.3	Tap2 - 1A – **30.7** Tap2 - 1B – **31.2**	**35.1**
Hardness (as $CaCO_3$)	100 (OG)	500	Well 1 – **230** to **265** Well 2 – **264** to **286**	Tap2 - 1A – **275** Tap2 - 1B – **284**	Not tested
Manganese	0.05 (AO)	1	Well 1 – **0.054** to 0.026 Well 2 – 0.028 to 0.034	Tap2 - 1A – **0.064** Tap2 - 1B – **0.068**	**0.410**
Organic Nitrogen	0.15 (AO)	No Value	Well 1 – 0.14 to **0.16** Well 2 – 0.08 to 0.06	Tap2 - 1A – 0.10 Tap2 – 1B – 0.20	Not tested
Turbidity (NTU)	5 NTU (AO,OG)	5 NTU	Well 1 – **38** to 2.5 NTU Well 2 – **7** to 4.4 NTU	Tap2 - 1A – **36** NTU Tap2 - 1B – **41.1** NTU	2.5

Exceedances of applicable standards are shown in bold texts.
AO- Aesthetic Objective – AOs are established for parameters that may impair the taste, odour or colour of water or which may interfere with good water quality control practices.
OG – Operational Guideline – OGs are established for parameters that, if not controlled, may negatively affect the efficiency of treatment, disinfection and distribution of the water.
MAC – Maximum Acceptable Concentration – The MAC is established for parameters which when present above a certain concentration, have known or suspected adverse health effects.
Treatability Limit MECP D-5-5 - Maximum Concentration Considered Reasonably Treatable (MCCRT)

Based on the above, apart from sodium there are no concerns regarding the quality and quantity of water for the purpose of developing Phase 1B,. If the well and / or septic locations are to be altered from the existing layout, they must be adjusted in accordance with the Ontario Building Codes.

Based on the currently proposed site development plan approved as Phase 1B (assembly hall and public park), it is our opinion that the facility should be characterized as a small non-municipal non-residential water system. As such, the facility would be governed under Ontario Regulation 318/08 – Small Drinking Water Systems. Understanding that the local Public Health Unit would likely require a site-specific risk assessment once the buildings are constructed and the water distribution systems are installed, it is still understood that regular water sampling programs for bacteriological parameters, nitrates/nitrites, etc. would likely be required.

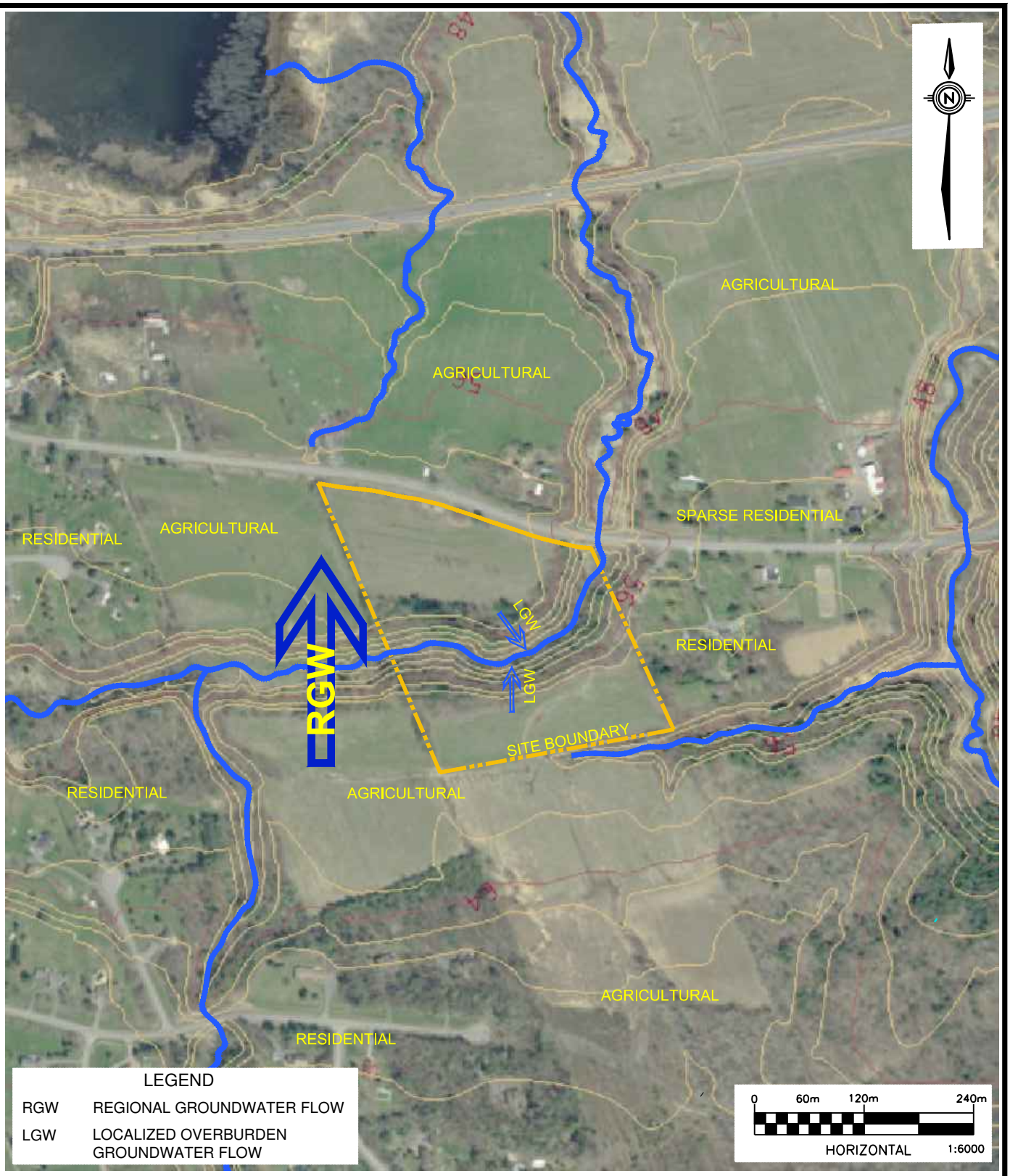
Construction dewatering is not anticipated based on depth of floor foundations and groundwater conditions at the site.

8.0 References

1. EXP, November 25, 2022, Site Servicing Report Humanics Sanctuary – Phase 1B
2. Cooper, H.H. and Jacob, C.E., 1946; *A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Well-Field History, Trans, Amer. Geophys. Union, Vol. 27*, No IV, pp 526-534.
3. Freeze, R.A. and Cherry, J.A., 1979; *Groundwater: Prentice Hall.*
4. Hantush, M.S. and Jacob, C.E. (1955); *Non-steady radial flow in an infinite leaky aquifer, Am. Geophys. Union Trans., v. 36*, p. 95-100.
5. Harrison, 1976: Ottawa-Hull: 1: 125,000: Map 1508A, *Generalized Bedrock Geology, Geological Survey of Canada*.
6. Johnson Division, 1986: *Groundwater and Wells, 2nd Edition*; F.G. Driscoll, Principal Author.
7. Ministry of the Environment: *Water Well Records*.
8. Ministry of the Environment 1995: *MOEE Hydrogeological Technical Information Requirements for Land Development Applications*.
9. Ministry of the Environment, 1982: Excerpt from *MOE Policy, Procedures, and Guidelines for Private Sewage Disposal Systems*.
10. Ministry of the Environment, *D-5-5 Technical Guideline for Private Wells: Water Supply Assessment*, August 1996 (revision).
11. Ministry of the Environment, Ontario Drinking Water Standards, 2004
12. Ontario Building Code, 1997: *Regulation 403/97, Code & Guide for Sewage Systems 1997*. Ministry of Municipal Affairs and Housing.
13. Richard S.H. et al., 1974: *Surficial Materials and Terrain Features (Ottawa-Hull), Map 1425A, Scale 1: 125,000 Geological Survey of Canada*.
14. Theis, C.V., 1935: The relation between the lowering of the piezometric surface and the rate, and the duration of discharge of a well using groundwater storage. *Trans, Amer, Geophys. Union, 2*, pp. 519-524.

Appendix A: Figures

Figure 1 Site Location Plan
Figure 2 Soil Stratigraphy Plan
Figure 3 Water Supply Well and Septic Location Plan
Figure 4 Proposed Site and Landscape Plan Phase 1B
Figure 5 Site Servicing and Grading Plan Phase 1A
Figure 6 Site Servicing and Landscape Plan Phase 1B

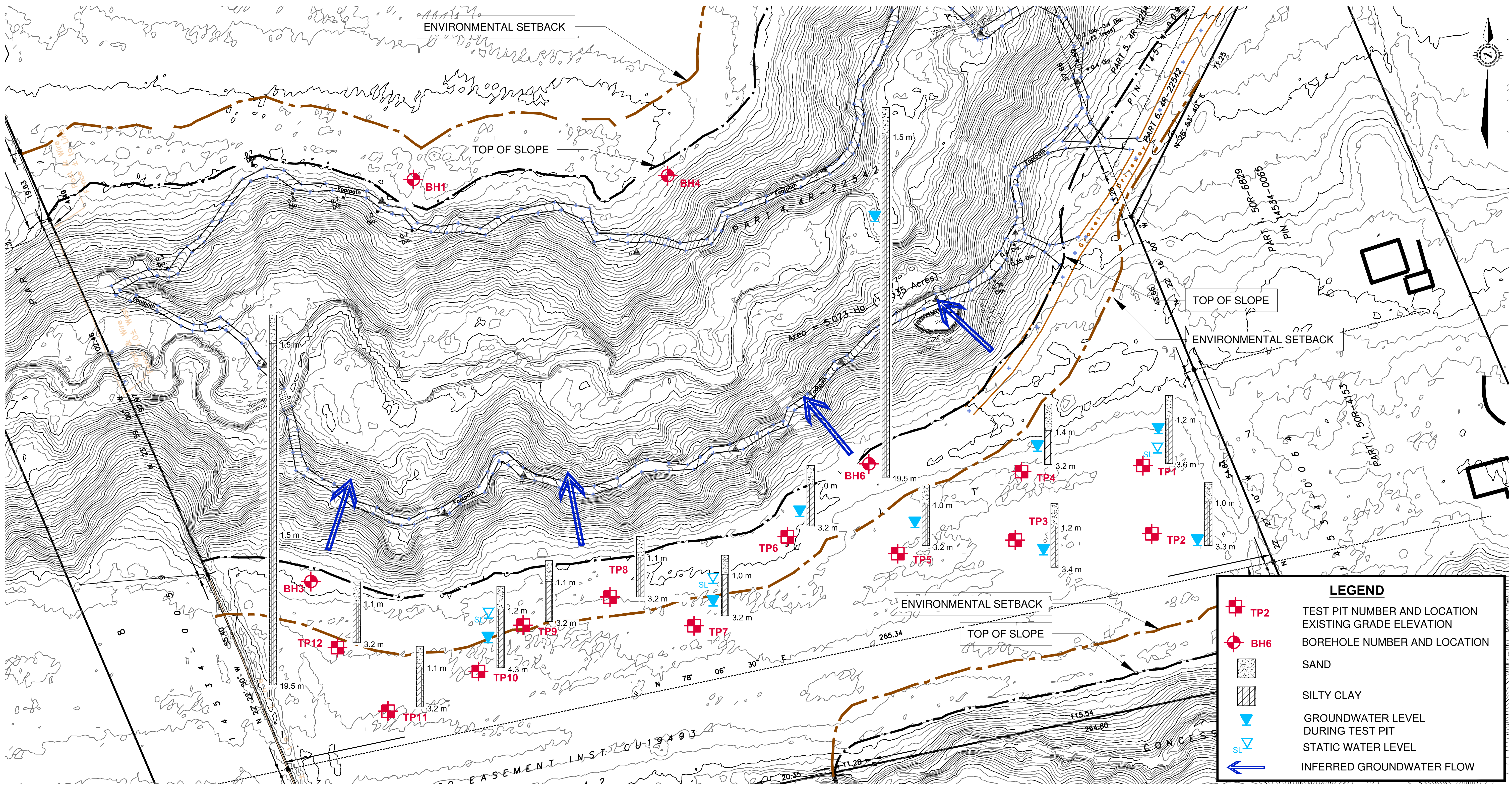


exp Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com

• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

scale NTS	CLIENT: HUMANICS UNIVERSAL INC.	project no. OTT-00229886-A0
date MAR. 2016	TITLE: SITE LOCATION PLAN 3400 OLD MONTREAL ROAD, OTTAWA, ON	FIG -1
drawn by J.R.		

Filename: r:\220000\229000\229886-a0 3400 old montreal\environmental\hydrology report\229886 site loc plan.dwg
Last Saved: 3/21/2016 10:32:01 AM
Last Plotted:3/23/2016 12:15:20 PM Plotted by: revellj Pen Table:: trow standard, july 01, 2004.ctb



NOTES :
1. THE BOUNDARIES AND SOIL TYPES HAVE BEEN ESTABLISHED ONLY AT BOREHOLE LOCATIONS. BETWEEN BOREHOLES THEY ARE ASSUMED AND MAY BE SUBJECT TO CONSIDERABLE ERROR.
2. SOIL SAMPLES AND ROCK WILL BE RETAINED IN STORAGE FOR THREE MONTHS AND THEN DESTROYED UNLESS THE CLIENT ADVISES THAT AN EXTENDED TIME PERIOD IS REQUIRED.
3. TOPSOIL QUANTITIES SHOULD NOT BE ESTABLISHED FROM THE INFORMATION PROVIDED AT THE BOREHOLE LOCATIONS.
4. BOREHOLE ELEVATIONS SHOULD NOT BE USED TO DESIGN BUILDING(S) OR FLOOR SLABS OR PARKING LOT(S) GRADES.
5. THIS DRAWING FORMS PART OF THE REPORT PROJECT NUMBER AS REFERENCED AND SHOULD BE USED ONLY IN CONJUNCTION WITH THIS REPORT.
6. BASE PLAN OBTAINED FROM exp SERVICES INC,

0 10m 20m 40m
HORIZONTAL 1:1000

exp Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

scale	1:1000
date	31/03/2016
drawn by	J.REVELL
CLIENT:	HUMANICS UNIVERSAL INC. HUMANICS SANCTUARY AND SCULPTURAL PARK
TITLE:	SOIL STRATIGRAPHY PLAN 3400 OLD MONTREAL ROAD, OTTAWA, ON
project no.	OTT-00229886-A0

FIG -2

Filename: r:\220000\229000\229886-a0 3400 old montreal\environmental\hydrology report\229886-a0 soil stratigraphy.dwg
Last Saved: 4/1/2016 8:53:35 AM
Last Plotted: 4/7/2016 2:40:11 PM
Plotted by: revellj
Pen Table:: trow standard, july 01, 2004.ctb

SKETCH SHOWING

PART OF LOT 7
CONCESSION 1 (OLD SURVEY)
GEOGRAPHIC TOWNSHIP OF CUMBERLAND
Now CITY OF OTTAWA

3400 Old Montreal Rd. - RR1 Zoning		
SITE INFORMATION		
SITE AREA	12.535 acres (50,727 m²)	
GROSS BUILDING AREA	234.78 m²	
% OF BUILDING AREA	0.83%	
BUILDING HEIGHT (WORKSHOP)	5.58m	
BUILDING HEIGHT (PAVILLION)	6.30m	
GROSS FLOOR AREA (GFA)		
WORK SHOP	128.25m²	
PAVILLION	141.36m²	
TOTAL	269.61m²	
PARKING	REQ'D	PROP.
SCULPTURE PARK	0	0
PAVILLION (10 per 100m² GFA)	15	43

SCALE: 1:750

5 15 30 50 100 meters

LEGEND:

- EXISTING STATUE
- PROPOSED STATUE
- MEDITATION AREA
- LIMIT OF DEVELOPMENT
- TOP OF CREST
- ENVIRONMENTAL SETBACK
- EROSION ALLOWANCE
- LIMIT OF HAZARDOUS LANDS

LANDSCAPE LEGEND:

(LANDSCAPE INFORMATION PROVIDED BY HUMANICS UNIVERSAL INC.)

QTY.		PROPOSED TREES
55	✳	BLUE SPRUCE
35	✹	CEDAR
1	⊙	WHITE PINE
14	◌	ORCHARD (APPLE, PEAR, PLUM, MULBERRY)
	☁	PERENNIAL GARDENS

Holzman Consultants Inc. prepared the proposed site plan from revision 1 through 14.

NO.	REVISION DESCRIPTION	DATE	BY	APPD
7	STATUE LOCATIONS	5/15/2016	SB	BH
6	EMERGENCY VEHICLE ACCESS	5/10/2016	SB	BH
5	REVISED MAIN DRIVEWAY ENTRANCE	4/26/2016	SB	BH
4	REVISED REAR VEHICLE ACCESS ROAD	4/25/2016	SB	BH
3	REVISED 3.5m LAYBY AT TEMPLE	4/10/2016	SB	BH
2	REVISED FOOTPATHS & DEV. LINES	2/3/2016	SB	BH
1	REVISED WITH TOP OF CREST	1/22/2016	SB	BH

NO.	REVISION DESCRIPTION	DATE	BY	APPD
14	BUTTERNUT TREE LOCATIONS	5/25/2017	SB	BH
13	REVISED BUILDING NAME & BUILDING LOCATION	1/21/2017	SB	BH
12	REVISED LIMIT OF HAZARDOUS LANDS	12/20/2016	SB	BH
11	REVISED LIMIT OF DEVELOPMENT, TOP OF CREST & DRIVEWAY ROUTING	12/7/2016	SB	BH
10	REVISED SITE STATISTICS	6/5/2016	SB	BH
9	ADDED MEDITATION AREA	5/30/2016	SB	BH
8	REMOVAL OF CURBS	5/25/2016	SB	BH

NO.	REVISION DESCRIPTION	DATE	BY	APPD
21	REVISED PER CITY COMMENTS	29/09/23	AAS	BMT
20	ISSUED FOR PHASE 1B SUBMISSION	12/05/23	AAS	BMT
19	ISSUED FOR PHASE 1B SUBMISSION	02/09/22	SAB	BMT
18	ISSUED FOR PHASE 1A SUBMISSION	17/08/22	SAB	BMT
17	REVISED PER CITY COMMENTS	26/4/2022	JH	BMT
16	ISSUED FOR SITE PLAN AMENDMENT	12/3/2021	AJ	BMT
15	WORKSHOP UPDATED (by EXP.)	3/16/2021	SAB	BMT

SCALE: 1:750

0 5m 10m 30m

HORIZONTAL 1:750

DESIGNED BY

REVIEWED BY

CLIENT: Humanics Universal Inc.

exp Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

(Revision 15)

BASEPLAN: A.O.
DESIGN: -
CHECKED: B.H.
CAD: S.R.B.
PROJ. MAN: -
APPROVED: -

PROJECT: Humanics Sanctuary

TITLE: Water Supply Well and Septic Location Plan Proposed Site and Landscape Plan Phase 1B

PROJ. NO.: N/A
SURVEY: N/A
DATE: MAR. 15/21

DRAWING NO.: SP-1B FIG -3

D07-12-23-003

SKETCH SHOWING

PART OF LOT 7
CONCESSION 1 (OLD SURVEY)
GEOGRAPHIC TOWNSHIP OF CUMBERLAND
Now CITY OF OTTAWA

3400 Old Montreal Rd. - RR1 Zoning		
SITE INFORMATION		
SITE AREA	12.535 acres (50,727 m²)	
GROSS BUILDING AREA	234.78 m²	
% OF BUILDING AREA	0.83%	
BUILDING HEIGHT (WORKSHOP)	5.58m	
BUILDING HEIGHT (PAVILLION)	6.30m	
GROSS FLOOR AREA (GFA)		
WORK SHOP	128.25m²	
PAVILLION	141.36m²	
TOTAL	269.61m²	
PARKING	REQ'D	PROP.
SCULPTURE PARK	0	0
PAVILLION (10 per 100m² GFA)	15	43

SCALE: 1:750

5 15 30 50 100 meters

LEGEND:

- EXISTING STATUE
- PROPOSED STATUE
- MEDITATION AREA
- LIMIT OF DEVELOPMENT
- TOP OF CREST
- ENVIRONMENTAL SETBACK
- EROSION ALLOWANCE
- LIMIT OF HAZARDOUS LANDS

LANDSCAPE LEGEND:

(LANDSCAPE INFORMATION PROVIDED BY HUMANICS UNIVERSAL INC.)

QTY.		PROPOSED TREES
55	✳	BLUE SPRUCE
35	✹	CEDAR
1	⊙	WHITE PINE
14	◌	ORCHARD (APPLE, PEAR, PLUM, MULBERRY)
	☁	PERENNIAL GARDENS

Holzman Consultants Inc. prepared the proposed site plan from revision 1 through 14.

NO.	REVISION DESCRIPTION	DATE	BY	APPD
7	STATUE LOCATIONS	5/15/2016	SB	BH
6	EMERGENCY VEHICLE ACCESS	5/10/2016	SB	BH
5	REVISED MAIN DRIVEWAY ENTRANCE	4/26/2016	SB	BH
4	REVISED REAR VEHICLE ACCESS ROAD	4/25/2016	SB	BH
3	REVISED 3.5m LAYBY AT TEMPLE	4/10/2016	SB	BH
2	REVISED FOOTPATHS & DEV. LINES	2/3/2016	SB	BH
1	REVISED WITH TOP OF CREST	1/22/2016	SB	BH

NO.	REVISION DESCRIPTION	DATE	BY	APPD
14	BUTTERNUT TREE LOCATIONS	5/25/2017	SB	BH
13	REVISED BUILDING NAME & BUILDING LOCATION	1/21/2017	SB	BH
12	REVISED LIMIT OF HAZARDOUS LANDS	12/20/2016	SB	BH
11	REVISED LIMIT OF DEVELOPMENT, TOP OF CREST & DRIVEWAY ROUTING	12/7/2016	SB	BH
10	REVISED SITE STATISTICS	6/5/2016	SB	BH
9	ADDED MEDITATION AREA	5/30/2016	SB	BH
8	REMOVAL OF CURBS	5/25/2016	SB	BH

NO.	REVISION DESCRIPTION	DATE	BY	APPD
21	REVISED PER CITY COMMENTS	29/09/23	AAS	BMT
20	ISSUED FOR PHASE 1B SUBMISSION	12/05/23	AAS	BMT
19	ISSUED FOR PHASE 1B SUBMISSION	02/09/22	SAB	BMT
18	ISSUED FOR PHASE 1A SUBMISSION	17/08/22	SAB	BMT
17	REVISED PER CITY COMMENTS	26/4/2022	JH	BMT
16	ISSUED FOR SITE PLAN AMENDMENT	12/3/2021	AJ	BMT
15	WORKSHOP UPDATED (by EXP.)	3/16/2021	SAB	BMT

SCALE: 1:750

0 5m 10m 30m

HORIZONTAL 1:750

DESIGNED BY

REVIEWED BY

CLIENT: Humanics Universal Inc.

exp Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

(Revision 15)

BASEPLAN: A.O.
DESIGN: -
CHECKED: B.H.
CAD: S.R.B.
PROJ. MAN: -
APPROVED: -

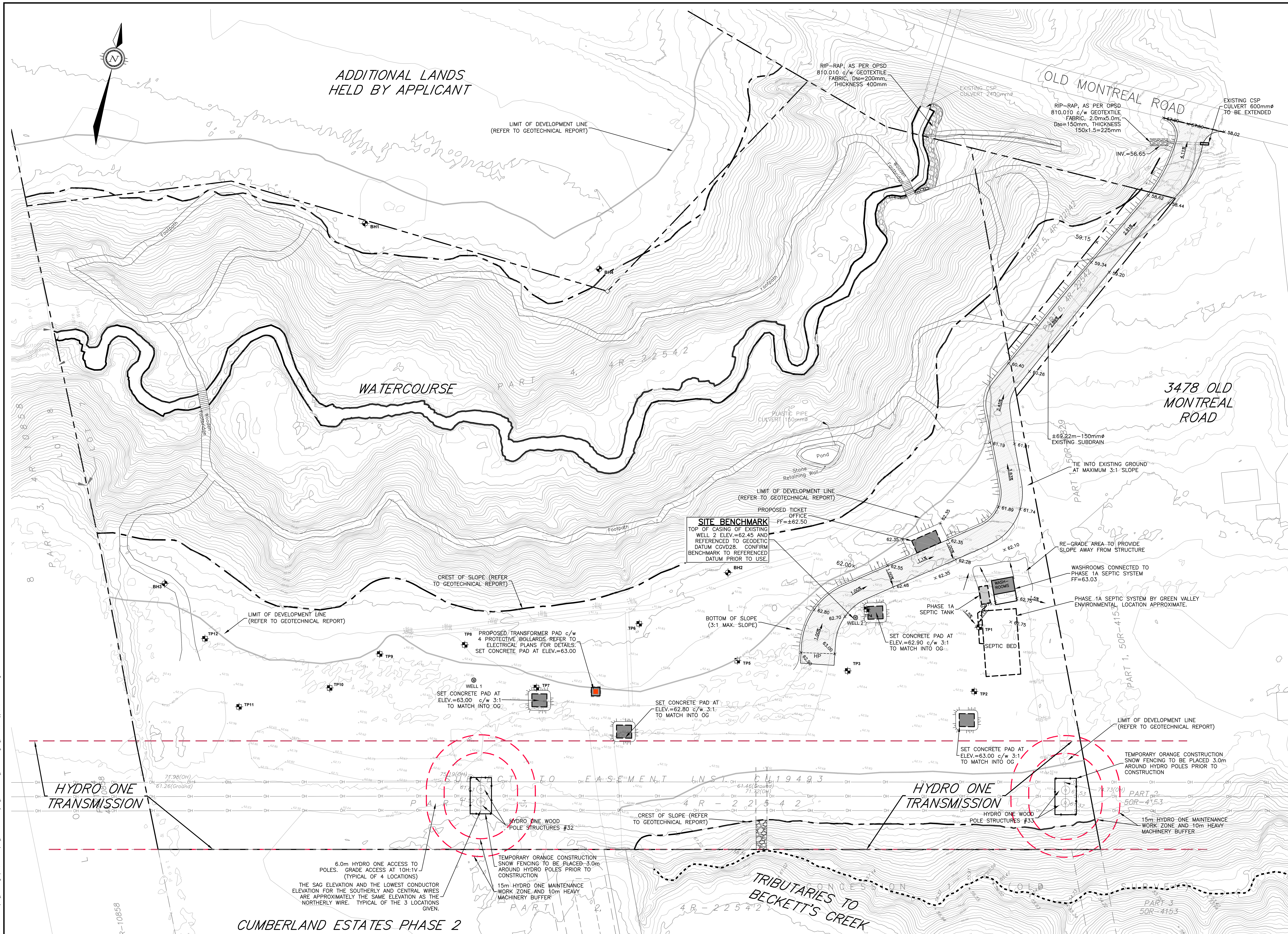
PROJECT: Humanics Sanctuary

PROJ. NO.: N/A
SURVEY: N/A
DATE: MAR. 15/21

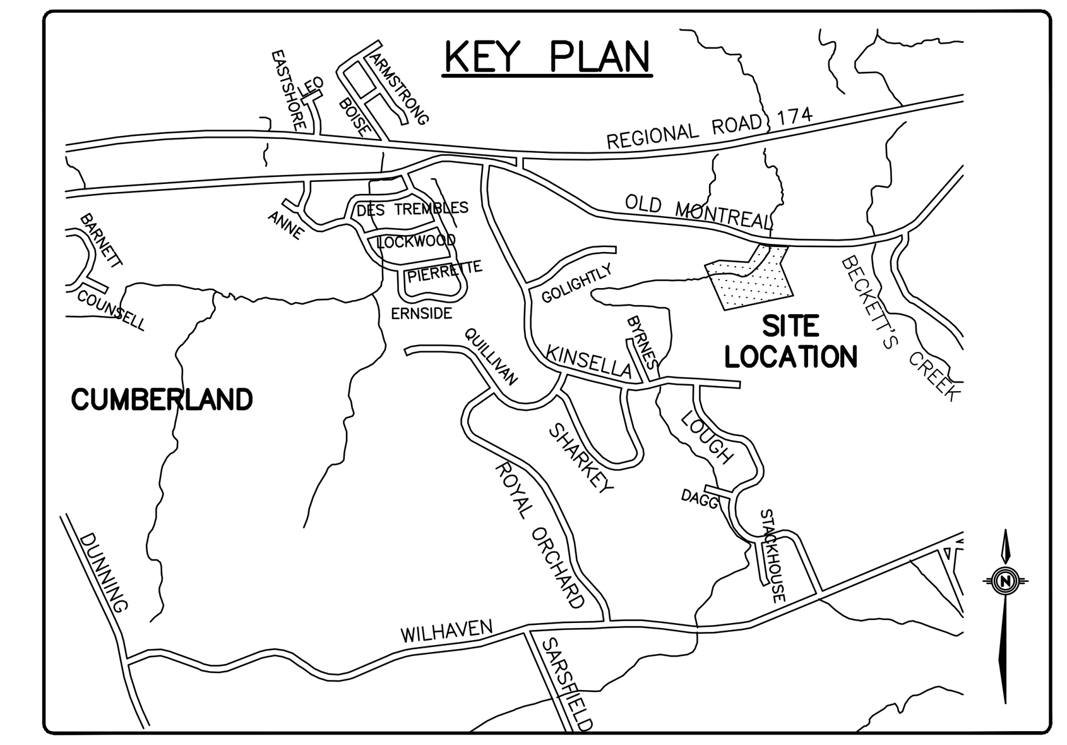
TITLE: Proposed Site and Landscape Plan Phase 1B

DRAWING NO.: SP-1B FIG -4

D07-12-23-003



ADDITIONAL LANDS HELD BY APPLICANT
LIMIT OF DEVELOPMENT LINE (REFER TO GEOTECHNICAL REPORT)
RIP–RAP, AS PER OPSD 810.010 c/w GEOTEXTILE FABRIC, D50=200mm, THICKNESS 400mm
OLD MONTREAL ROAD
EXISTING CSP CULVERT 600mmø TO BE EXTENDED
RIP–RAP, AS PER OPSD 810.010 c/w GEOTEXTILE FABRIC, 2.0mx5.0m, D50=150mm, THICKNESS 150x1.5=225mm
INV.=56.65
WATERCOURSE
3478 OLD MONTREAL ROAD
±69.22m–150mmø EXISTING SUBDRAIN
TIE INTO EXISTING GROUND AT MAXIMUM 3:1 SLOPE
LIMIT OF DEVELOPMENT LINE (REFER TO GEOTECHNICAL REPORT)
PROPOSED TICKET OFFICE FF=±62.50
SITE BENCHMARK
TOP OF CASING OF EXISTING WELL 2 ELEV.=62.45 AND REFERENCED TO GEODETIC DATUM CGVD28. CONFIRM BENCHMARK TO REFERENCED DATUM PRIOR TO USE.
RE–GRADE AREA TO PROVIDE SLOPE AWAY FROM STRUCTURE
WASHROOMS CONNECTED TO PHASE 1A SEPTIC SYSTEM FF=63.03
PHASE 1A SEPTIC SYSTEM BY GREEN VALLEY ENVIRONMENTAL. LOCATION APPROXIMATE.
PHASE 1A SEPTIC TANK
SEPTIC BED
CREST OF SLOPE (REFER TO GEOTECHNICAL REPORT)
BOTTOM OF SLOPE (3:1 MAX. SLOPE)
SET CONCRETE PAD AT ELEV.=62.90 c/w 3:1 TO MATCH INTO OG
PROPOSED TRANSFORMER PAD c/w 4 PROTECTIVE BOLLARDS. REFER TO ELECTRICAL PLANS FOR DETAILS. SET CONCRETE PAD AT ELEV.=63.00
SET CONCRETE PAD AT ELEV.=63.00 c/w 3:1 TO MATCH INTO OG
SET CONCRETE PAD AT ELEV.=62.80 c/w 3:1 TO MATCH INTO OG
SET CONCRETE PAD AT ELEV.=63.00 c/w 3:1 TO MATCH INTO OG
LIMIT OF DEVELOPMENT LINE (REFER TO GEOTECHNICAL REPORT)
TEMPORARY ORANGE CONSTRUCTION SNOW FENCING TO BE PLACED 3.0m AROUND HYDRO POLES PRIOR TO CONSTRUCTION
HYDRO ONE TRANSMISSION
HYDRO ONE WOOD POLE STRUCTURES #32
HYDRO ONE WOOD POLE STRUCTURES #33
15m HYDRO ONE MAINTENANCE WORK ZONE AND 10m HEAVY MACHINERY BUFFER
CREST OF SLOPE (REFER TO GEOTECHNICAL REPORT)
6.0m HYDRO ONE ACCESS TO POLES. GRADE ACCESS AT 10H:1V (TYPICAL OF 4 LOCATIONS)
THE SAG ELEVATION AND THE LOWEST CONDUCTOR ELEVATION FOR THE SOUTHERLY AND CENTRAL WIRES ARE APPROXIMATELY THE SAME ELEVATION AS THE NORTHERLY WIRE. TYPICAL OF THE 3 LOCATIONS GIVEN.
TRIBUTARIES TO BECKETT'S CREEK
CUMBERLAND ESTATES PHASE 2



LEGEND

	PROPERTY LINE
	EXISTING OVERHEAD HYDRO & POLE
	EXISTING HYDRO EASEMENT
	EXISTING CHAINLINK FENCE
	PROPOSED TERRACING (SLOPE 3:1 MAX.)
	PROPOSED SWALE
	PROPOSED CULVERT
WELL 2	WELL LOCATION
TP4	TESTPIT LOCATION
BH2	BOREHOLE OCATION
FF= / USF=	FINISHED FLOOR ELEVATION / UNDERSIDE OF FOOTING ELEVATION
69.50	EXISTING CONTOUR
×71.98(OH)	EXISTING HYDRO CONDUCTOR SAG ELEVATION
×61.80 / 61.80	PROPOSED ELEVATION / EXISTING ELEVATION
1.31%	PROPOSED SLOPE AND DIRECTION OF FLOW
	PROPOSED LIMIT OF DEVELOPMENT
	CREST OF SLOPE
	PROPOSED ACCESS ROAD STRUCTURE 100mm GRANULAR 'A' 300mm GRANULAR 'B' TYPE II

NO.	REVISION DESCRIPTION	DATE	BY	APPD
11	REVISED PER CITY COMMENTS	14/09/22	SAB	BMT
10	ISSUED FOR PHASE 1A SUBMISSION	17/02/22	SAB	BMT
9	REVISED PER CITY COMMENTS	26/04/22	JH	BMT
8	ISSUED FOR SITE PLAN AMENDMENT	03/12/21	AJ	BMT
7	ISSUED FOR CLIENT REVIEW	29/11/21	AJ	BMT
6	HYDRO ONE COMMENTS	15/03/18	SAB	BMT
5	CITY STAMP ADDED	13/12/17	SAB	BMT
4	REVISED SEPTIC BED	25/07/17	SAB	BMT
3	REVISED AS PER CITY COMMENTS	25/01/17	SAB	BMT
2	ISSUED FOR SITE PLAN APPROVAL	06/06/16	SAB	BMT
1	ISSUED FOR CLIENT REVIEW	03/06/16	SAB	BMT

SCALE
HORIZ 1:500

DESIGNED BY
REVIEWED BY

CLIENT
HUMANICS UNIVERSAL INC.
601 BROOKRIDGE CRES
ORLEANS, ON K4A 1Z6, 613–824–1525

exp.
exp Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7330
2650 Queensview Drive, Unit 100
Ottawa, ON K2B 8H6
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

BASEPLAN exp.
DESIGN J. FITZPATRICK
CHECKED B. THOMAS
CAD S.BUTLER
PROJ. MAN B. THOMAS
APPROVED J. FITZPATRICK

PROJECT
HUMANICS SANCTUARY
3400/3468 OLD MONTREAL ROAD
ORLEANS, ONTARIO.

TITLE
SITE SERVICING
AND GRADING PLAN
PHASE 1A

PROJ. NO. OTT–00229886–A0
SURVEY exp.
DATE FEB 09, 2016
DRAWING NO. SGP–1A
FIG -5

Filename: \\ottfsg002\data\projects\civil engineering services\229000\ott-00229886-a0 - humanics sanctuary\60-project execution\2-drawings\229886 sgp-ph1a.dwg
Last Saved: 9/14/2022 6:15:59 PM
Last Plotted: 9/14/2022 6:17:58 PM Plotted by: butlers
Pen Table: exp-64.pf.ctb
References: Xref-CityBase-2008.dwg; Xref-Legal-(Cumberland Estates Ph2).dwg; Xref-Legal-(sk192h-statues).dwg; Xref-EXP Survey.dwg; Xref-Arch.dwg; Xref-Phasing.dwg; Xref-2017-App-GEO-lines-PH1B.dwg

Filename: \\potfsg002\data\projects\civil engineering services\229000\ott-00229886-a0 - humanics sanctuary\60-project execution\2-drawings\229886 sgp-ph1b.dwg
Last Saved: 9/29/2023 3:49:35 PM
Last Plotted: 9/29/2023 3:53:28 PM Plotted by: SalemA
Pen Table: exp-64.ctb
References: Xref-CityBase-2008.dwg; Xref-Legal-(Cumberland Estates Ph2).dwg; Xref-Legal-(sk192h-statues).dwg; Xref-EXP Survey.dwg; Xref-Arch-1B.dwg; Xref-Phasing.dwg; Xref-2017-App-GEO-lines.dwg

ADDITIONAL LANDS HELD BY APPLICANT
LIMIT OF DEVELOPMENT LINE (REFER TO GEOTECHNICAL REPORT)
WATERCOURSE
3478 OLD MONTREAL ROAD
OLD MONTREAL ROAD
EXISTING CSP CULVERT 2400mmø
EXISTING GRAVEL ACCESS ROAD TO BE WALKWAY
SET CONCRETE PAD AT ELEV.=59.75 AND MATCH INTO OG
SET CONCRETE PAD AT ELEV.=59.81 AND MATCH INTO OG
10.0m ENVIRONMENTAL SETBACK AS PER BERNIE MUNCASTER'S LETTER DATED APRIL 14, 2022.
PLASTIC PIPE CULVERT 150mmø
Pond
Stone Retaining Wall
Footpath
LANDSCAPED PARKING AREA (TYP.)
SET CONCRETE PAD AT ELEV.=62.40 AND MATCH INTO OG
PROPOSED WORKSHOP FF=62.90
PROPOSED PAVILION FF=62.80
WELL 1
WELL 2
SEWAGE PUMP CHAMBER & FORCEMAIN TO PHASE 1A SEPTIC SYSTEM. LOCATION & ALIGNMENT SHOWN ARE APPROX.
PROPOSED 38mmø FORCEMAIN BY OTHERS
PROPOSED TEMPORARY DITCH TO BE BUILT IN PHASE 1B
PROPOSED SEPTIC TANK DESIGN BY OTHERS. REFER TO GVE DWG NO. SP-6853-20
LIMIT OF DEVELOPMENT LINE (REFER TO GEOTECHNICAL REPORT)
TEMPORARY ORANGE CONSTRUCTION SNOW FENCING TO BE PLACED 3.0m AROUND HYDRO POLES PRIOR TO CONSTRUCTION
15m HYDRO ONE MAINTENANCE WORK ZONE AND 10m HEAVY MACHINERY BUFFER
HYDRO ONE TRANSMISSION
HYDRO ONE WOOD POLE STRUCTURES #32
HYDRO ONE WOOD POLE STRUCTURES #33
15.55m-500mmø CSP CULVERT @0.3% 2.8mm THICKNESS INV.E=62.19 INV.SW=62.23
16.45m-500mmø CSP CULVERT @0.3% 2.8mm THICKNESS INV.E=61.98 INV.W=62.03
POND SPILL POINT
SPILL CHANNEL
HWL=62.15
BIO RETENTION POND STORAGE VOLUME=±196m³ BOTTOM OF POND=61.55 WATER SPILL ELEVATION=62.55 1:100 YEAR ELEVATION=62.25 SIDE SLOPES=3.3:1 MAX
RIP-RAP, AS PER OPSD 810.010 c/w GEOTEXTILE FABRIC, 3.0mx8.0m, D50=150mm, THICKNESS 150x1.5=225mm
20.0m-200mmø PVC SDR 35 OUTLET PIPE @3.7% c/w 102mmø ORIFICE PLUG, AS PER MH REPORT INV.N=61.77 INV.S=61.03
6.0m HYDRO ONE ACCESS TO POLES. GRADE ACCESS AT 10H:1V (TYPICAL OF 4 LOCATIONS)
THE SAG ELEVATION AND THE LOWEST CONDUCTOR ELEVATION FOR THE SOUTHERLY AND CENTRAL WIRES ARE APPROXIMATELY THE SAME ELEVATION AS THE NORTHERLY WIRE. TYPICAL OF THE 3 LOCATIONS GIVEN.
TRIBUTARIES TO BECKETT'S CREEK
CUMBERLAND ESTATES PHASE 2
KEY PLAN
REGIONAL ROAD 174
OLD MONTREAL
CUMBERLAND
SITE LOCATION
BECKETT'S CREEK
WILHAVEN
LEGEND
PROPERTY LINE
EXISTING OVERHEAD HYDRO & POLE
EXISTING HYDRO EASEMENT
EXISTING CHAINLINK FENCE
PROPOSED TERRACING (SLOPE 3:1 MAX.)
PROPOSED SWALE
PROPOSED CULVERT
WELL LOCATION
TESTPIT LOCATION
BOREHOLE OCATION
FF= FINISHED FLOOR ELEVATION
USF= UNDERSIDE OF FOOTING ELEVATION
EXISTING CONTOUR
EXISTING HYDRO CONDUCTOR SAG ELEVATION
PROPOSED ELEVATION
EXISTING ELEVATION
PROPOSED SLOPE AND DIRECTION OF FLOW
PROPOSED LIMIT OF DEVELOPMENT
CREST OF SLOPE
PROPOSED ACCESS ROAD STRUCTURE 100mm GRANULAR 'A' 300mm GRANULAR 'B' TYPE II
SITE BENCHMARK
COSINE STATION: 0011985U504
GEODETIC DATUM CGVD28:78
ELEVATION 81.197
CONFIRM BENCHMARK TO REFERENCED DATUM PRIOR TO USE

NO.	REVISION DESCRIPTION	DATE	BY	APPD	NO.	REVISION DESCRIPTION	DATE	BY	APPD
13	REVISED PER CITY COMMENTS	29/09/23	AAS	BMT	7	ISSUED FOR CLIENT REVIEW	29/11/21	AJ	BMT
12	REVISED PER CITY COMMENTS	12/05/23	AAS	BMT	6	HYDRO ONE COMMENTS	15/03/18	SAB	BMT
11	REVISED PER CITY COMMENTS	25/04/23	SAB	BMT	5	CITY STAMP ADDED	13/12/17	SAB	BMT
10	ISSUED FOR PHASE 1B SUBMISSION	02/09/22	SAB	BMT	4	REVISED SEPTIC BED	25/07/17	SAB	BMT
9	REVISED PER CITY COMMENTS	26/04/22	JH	BMT	3	REVISED AS PER CITY COMMENTS	25/01/17	SAB	BMT
8	ISSUED FOR SITE PLAN AMENDMENT	03/12/21	AJ	BMT	2	ISSUED FOR SITE PLAN APPROVAL	06/06/16	SAB	BMT
					1	ISSUED FOR CLIENT REVIEW	03/06/16	SAB	BMT

SCALE
HORIZ 1:500

DESIGNED BY

REVIEWED BY

CLIENT
HUMANICS UNIVERSAL INC.
601 BROOKRIDGE CRES
ORLEANS, ON K4A 1Z6, 613-824-1525

exp.
exp Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7330
2650 Queensview Drive, Unit 100
Ottawa, ON K2B 8H6
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

BASEPLAN: exp.
DESIGN: J. FITZPATRICK
CHECKED: B. THOMAS
CAD: S.BUTLER
PROJ. MAN: B. THOMAS
APPROVED: J. FITZPATRICK

PROJECT
HUMANICS SANCTUARY
3400/3468 OLD MONTREAL ROAD
ORLEANS, ONTARIO.

TITLE
SITE SERVICING AND GRADING PLAN
PHASE 1B

PROJ. NO. OTT-00229886-A0
SURVEY exp.
DATE FEB 09, 2016
DRAWING NO. SGP-1B
FIG -6

D07-12-23-0003

Appendix B:
MOE Well Records

Ottawa

CERTIFICATE OF WELL COMPLIANCE

I, Ken Desaulniers DO HEREBY CERTIFY that I am licensed to drill wells in the Province of Ontario, and that I have supervised the drilling of a well on the property of HUMANICS UNIVERSAL located at # 3400 OLD MONTREAL ROAD, CUMBERLAND Lot/Plan No.) in the City of Ottawa (Geographical Township of [redacted] Cumberland South 1/4 LOT 7 CONC 1 PLAN# 50R-535 S/L# Lot 1 to 6

CERTIFY FURTHER that, I am aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to this site and City Standards.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

Signed this 10TH day of FEBRUARY 2015

Kenny [redacted] Air Rock Drilling Co. Ltd.
Well Driller/Company

The Engineer on behalf of the landowner set out above Certifies that he/she has inspected the well and it was constructed in accordance with the specifications in O.Reg.903, this report and the Hydrogeological Report with regards to casing length and grouting requirements.

SIGNED this _____ day of _____, _____.

_____
Engineer

TW# 2 (CTW#8)
TAGA 199907

2001
International Year of Volunteers
Année internationale des volontaires

Shaping our future together
Ensemble, formons notre avenir

City of Ottawa
Client Service Centre
8243 Victoria Street
Ottawa, ON K0A 2P0

Ville d'Ottawa
Centre de service
8243, rue Victoria
Ottawa, ON K0A 2P0

Ontario — Ministry of the Environment

Measurements recorded in: ☐ Metric ☒ Imperial

Tag#: A199907 (Yellow)

A199907

Well Record

Regulation 903 Ontario Water Resources Act

Page _____ of _____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	Humanics Universal		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
601 Brookbridge Crescent	Orleans	ON	K4A 1Z6	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
3400 Old Montreal Road	Cumberland	s 1/4 7	1

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa Carleton	Cumberland	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	18	471514	5040192	50R 535	Lot 1 to 6

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
Grey	Clay			0'	98'
	Gravel			98'	100'
Grey	Limestone			100'	114'

*DO NOT SET PUMP BELOW 80 FEET

*TW # 2 * (TW#8)

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
112'	102'	Neat cement	12.5
102'	0'	Bentonite slurry	29.4

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify _____

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify _____

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6 1/4"	Steel	.188"	+2'	112'
6"	Open hole		112'	114'

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Water Details

Water found at Depth (m/ft)	Gas	Kind of Water	Hole Diameter Depth From	Depth To	Diameter (cm/in)
114 (m/ft)	☐ Gas	☐ Fresh ☒ Untested			
	☐ Other, specify		0'	112'	9 3/4"
Water found at Depth (m/ft)	☐ Gas	Kind of Water: ☐ Fresh ☐ Untested	112'	114'	6"
	☐ Other, specify				

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify **Not tested**

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 80

Pumping rate (l/min / GPM): 10

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 85.1'

If flowing give rate (l/min / GPM): X

Recommended pump depth (m/ft): 80'

Recommended pump rate (l/min / GPM): 10

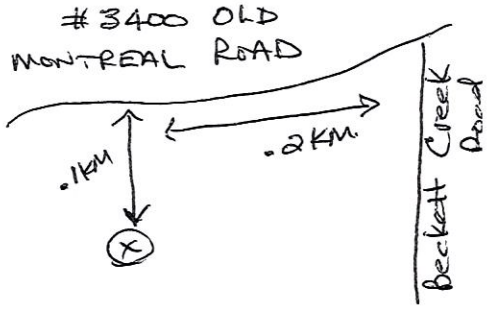
Well production (l/min / GPM): 10

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	35.7"		85.1"
1	44.4	1	70
2	50.1	2	64.6
3	53.6	3	60.7
4	56.8	4	57.2
5	58.7	5	53.6
10	65.4	10	44
15	68.1	15	39.7
20	71	20	38
25	75	25	37.5
30	76.6	30	37.4
40	79.3	40	37.3
50	83.8	50	37.2
60	85.1	60	37.1"

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

**DO NOT SET PUMP PAST 80 FEET **

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd	1119

Business Address (Street Number/Name)	Municipality
6659 Franktown Road, RR#1	Richmond

Province	Postal Code	Business E-mail Address
ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6138382170	Hanna, Jeremy

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
T3632		2016 02 29

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☒ Yes ☐ No	2016 02 15	2016 02 10

Ministry Use Only

Audit No. Z 202745

Received

0506E (2007/12) © Queen's Printer for Ontario, 2007

Ministry's Copy

Ottawa

CERTIFICATE OF WELL COMPLIANCE

I, Ken Desaulniers DO HEREBY CERTIFY that I am licensed to drill wells in the Province of Ontario, and that I have supervised the drilling of a well on the property of HUMANICS UNIVERSAL located at # 3400 OLD MONTREAL ROAD, CUMBERLAND Lot/Plan No.) in the City of Ottawa (Geographical Township of [redacted] Cumberland SOUTH 1/4 LOT 7 CONC 1 PLAN# 50R-535 S/L# Lot 1 to 6

CERTIFY FURTHER that, I am aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to this site and City Standards.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

Signed this 11TH day of FEBRUARY 2015

Kenny Air Rock Drilling Co. Ltd.
Well Driller/Company

The Engineer on behalf of the landowner set out above Certifies that he/she has inspected the well and it was constructed in accordance with the specifications in O.Reg.903, this report and the Hydrogeological Report with regards to casing length and grouting requirements.

SIGNED this _____ day of _____, _____.

_____
Engineer

TW#1 (TW#7)
TAG A199906

2001
International Year of Volunteers
Année internationale

Shaping our future together
Ensemble, formons notre avenir

City of Ottawa
Client Service Centre
8243 Victoria Street
Ottawa, ON K0A 2P0

Ville d'Ottawa
Centre de service
8243, rue Victoria
Ottawa, ON K0A 2P0

Ontario Ministry of the Environment

Measurements recorded in: ☐ Metric ☒ Imperial

Tag#: A199906 (t Below)

A199906

Well Record

Regulation 903 Ontario Water Resources Act

Page _____ of _____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	Humanics Universal		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
601 Brookbridge Crescent	Orleans	ON	K4A 1Z6	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
3400 Old Montreal Road	Cumberland	S 1/4 7	1

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa-Carleton	Cumberland	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	18	471408	5040155	50R-535	Lot 1 to 6

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
Grey	Clay			0	103
	Gravel			103	105
Grey	Limestone			105	126

* DO NOT SET PUMP BELOW 80 FEET

* TW# 1 (TW#7)

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
125'	115'	Neat cement	12.5
115'	0'	Bentonite slurry	29.4

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify _____

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify _____

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6 1/4"	Steel	.188"	+2'	125'
6"	Open Hole		125'	126'

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify **Not tested**

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 80

Pumping rate (l/min / GPM): 20

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 37.8'

If flowing give rate (l/min / GPM): X

Recommended pump depth (m/ft): 80'

Recommended pump rate (l/min / GPM): 20

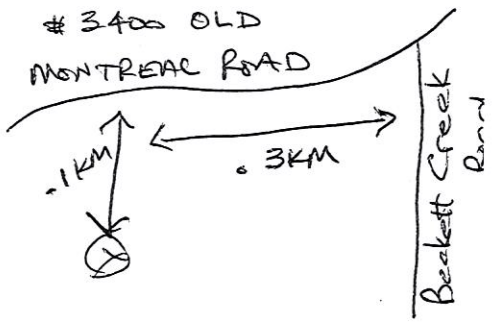
Well production (l/min / GPM): 20

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	36'3"		37.8'
1	37.6	1	36.9
2	37.6	2	36.7
3	37.6	3	36.7
4	37.6	4	36.6
5	37.6	5	36.6
10	37.6	10	36.5
15	37.7	15	36.5
20	37.7	20	36.4
25	37.7	25	36.4
30	37.8	30	36.3
40	37.8	40	36.3
50	37.8	50	36.3
60	37.8'	60	36.3'

Map of Well Location

Please provide a map below following instructions on the back.



Water Details

Water found at Depth	Kind of Water	Hole Diameter Depth From	Depth To	Diameter (cm/in)
126 (m/ft) ☐ Gas	☐ Fresh ☒ Untested ☐ Other, specify			
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify	0'	125'	9 3/4"
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify	125'	126'	6"

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd.	1119

Business Address (Street Number/Name)	Municipality
6659 Franktown Road, RR#1	Richmond

Province	Postal Code	Business E-mail Address
ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6138382170	Hanna, Jeremy

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
T3632		2016 02 29

Comments:

** DO NOT SET PUMP PAST 80 FEET **

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☒ Yes ☐ No	2016 02 15	2016 02 11

Ministry Use Only

Audit No. Z 202746

Received

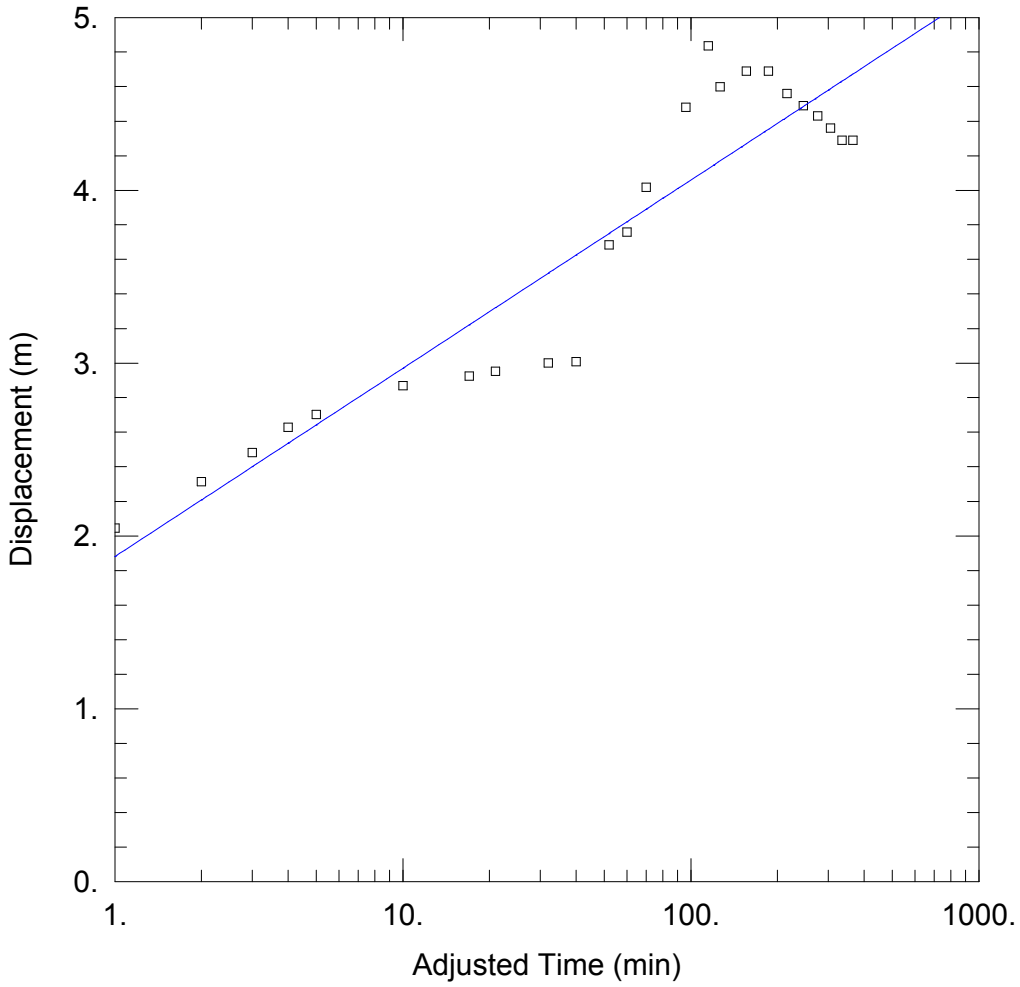
Ministry's Copy

Table #1 (OTEN00018446C)
Proposed Subdivision Development
Local Well Record Summary
December, 2008

MOE Well Number			Concession	Lot	Water found	Well Dia.	Estimated	Pumping Rate	Duration	Static Level	Pump Level	Well Depth	Type	Available	Specific Capacity	Transmissivity	Potential 20 Yr
					(m)	(m)	Storativity	(m^3/day)	(days)	(m)	(m)	(m)		Drawdown (m)	(m2/day)	(m^2/day)	Yield (m3/day)
12910	471500	5040600	1	6	25.91	0.05	0.00001	54.500	0.125	10.671	18.293	25.915	Bedrock (L)	15.24	7.15	11.40	71.87
12907	471640	5040550	1	6	16.77	0.12	0.00001	54.500	0.042	6.707	7.317	17.073	Bedrock (L)	10.37	89.38	139.83	566.89
12908	471800	5040150	1	6	34.15	0.05	0.00001	54.500	0.083	10.976	15.244	34.146	Bedrock (L)	23.17	12.77	20.54	167.40
14516	472062	5039741	1	6	21.34	0.15	0.00001	43.600	0.083	12.195	12.195	21.341	Bedrock (L)	9.15	n/a	n/a	n/a
12912	471260	5040200	1	7	22.26	0.05	0.00001	59.950	0.083	7.927	15.244	22.256	Bedrock (L)	14.33	8.19	12.88	69.44
19193	471599	5039099	1	7	38.11	0.15	0.00001	49.050	0.042	15.244	85.366	88.415	Bedrock (L)	73.17	0.70	0.78	19.98
12911	471610	5040010	1	7	31.10	0.05	0.00001	43.600	0.083	7.927	15.244	31.098	Bedrock (L)	23.17	5.96	9.21	70.12
18162	470699	5040299	1	8	36.59	0.15	0.00001	163.500	0.042	13.110	30.488	36.585	Bedrock (SL)	23.48	9.41	12.61	120.34
12443	470750	5040570	1	8	85.37	0.05	0.00001	43.600	0.083	4.573	10.671	85.366	Bedrock (L)	80.79	7.15	11.16	231.81
12914	470750	5040250	1	8	45.43	0.07	0.00001	27.250	0.083	14.024	16.768	45.427	Bedrock (L)	31.40	9.93	15.21	170.15
12917	470750	5040300	1	8	32.01	0.05	0.00001	43.600	0.083	9.758	15.244	32.012	Bedrock (L)	22.26	7.94	12.47	96.80
12918	470800	5040380	1	8	36.59	0.05	0.00001	43.600	0.083	9.146	15.244	36.585	Bedrock (L)	27.44	7.15	11.16	99.35
12920	470850	5040200	1	8	40.85	0.05	0.00001	54.500	0.083	12.195	18.293	40.854	Bedrock (L)	28.66	8.94	14.11	139.27
12919	470750	5040200	1	8	36.89	0.05	0.00001	-	-	8.537	13.720	36.890	Bedrock (L)	28.35	-	6.59	60.22

Geometric Mean	33.33		51.56	0.07	9.76	16.92	35.45		24.23	8.22	11.78	107.43
Arithmetic Mean	35.95		56.60	0.08	10.21	20.67	39.57		29.36	14.56	21.38	144.90
Maximum Value	85.37		163.50	0.13	15.24	85.37	88.41		80.79	89.38	139.83	566.89
Minimum Value	16.77		27.25	0.04	4.57	7.32	17.07		9.15	0.70	0.78	19.98

Appendix C:
Pump Test Data



TW1 DRAWDOWN

Data Set: P:\...\Aqtw2_SD.aqt
Date: 03/24/16 Time: 08:44:16

PROJECT INFORMATION

Company: exp Services Inc.
Client: Humanics Universal Inc
Project: OTT-00229886-A0
Location: 3400 Old Montreal Road
Test Well: TW1
Test Date: February 23, 2016

AQUIFER DATA

Saturated Thickness: 25. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
TW1	0	0

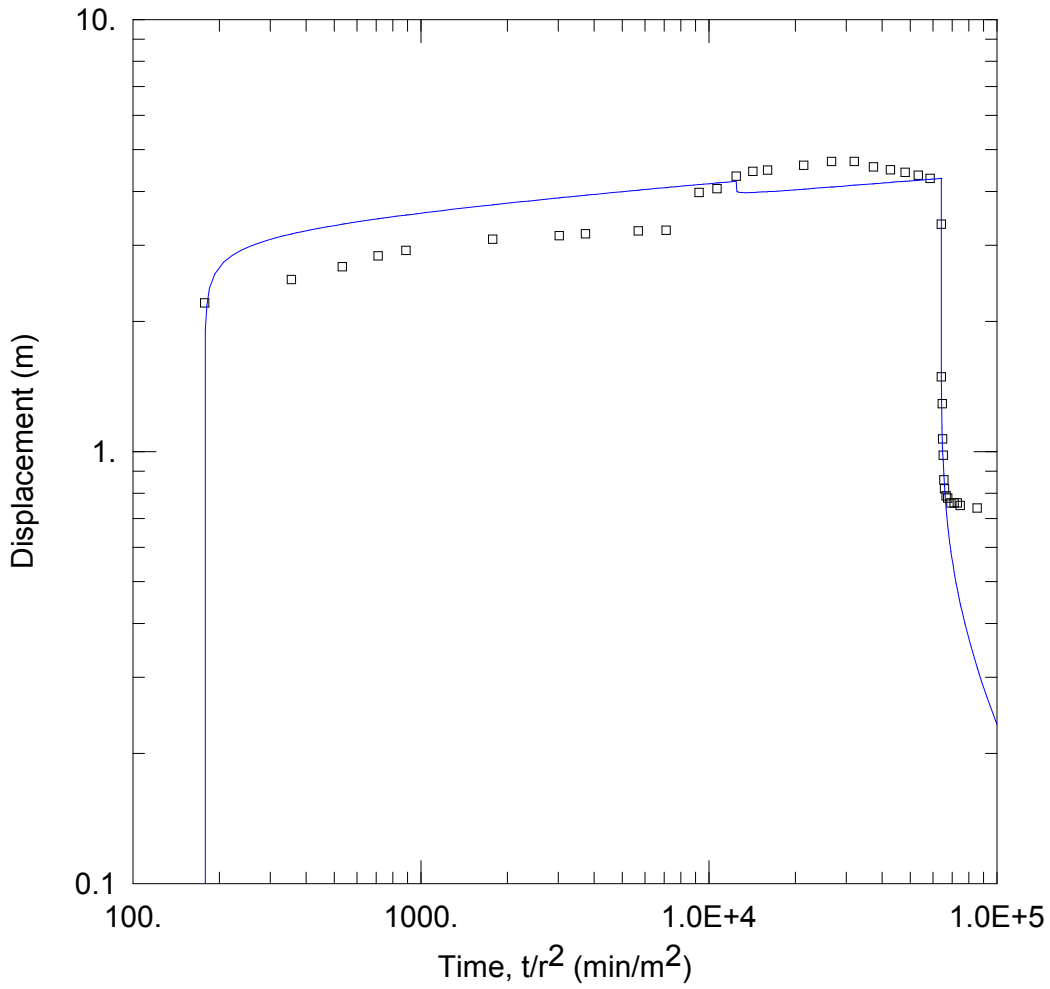
Observation Wells

Well Name	X (m)	Y (m)
TW1	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Cooper-Jacob

T = 6.055 m^2/day S = 0.03154



TW1 PUMP AND RECOVERY TEST

Data Set: P:\...\tw2 - recovery.aqt
Date: 03/29/16 Time: 08:27:36

PROJECT INFORMATION

Company: exp Services Inc.
Client: Humanics Universal Inc
Project: OTT-00229886-A0
Location: 3400 Old Montreal Road
Test Well: TW1
Test Date: February 23, 2016

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
TW1	0	0

Observation Wells

Well Name	X (m)	Y (m)
▫ TW1	0	0

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 12.67 m^2/day
S = 7.499E-6
Kz/Kr = 1.
b = 25. m

OTT-00229886-A0
Pump Test on Well 1
Pump Test Conducted on February 23, 2016

Pump Depth 27 m

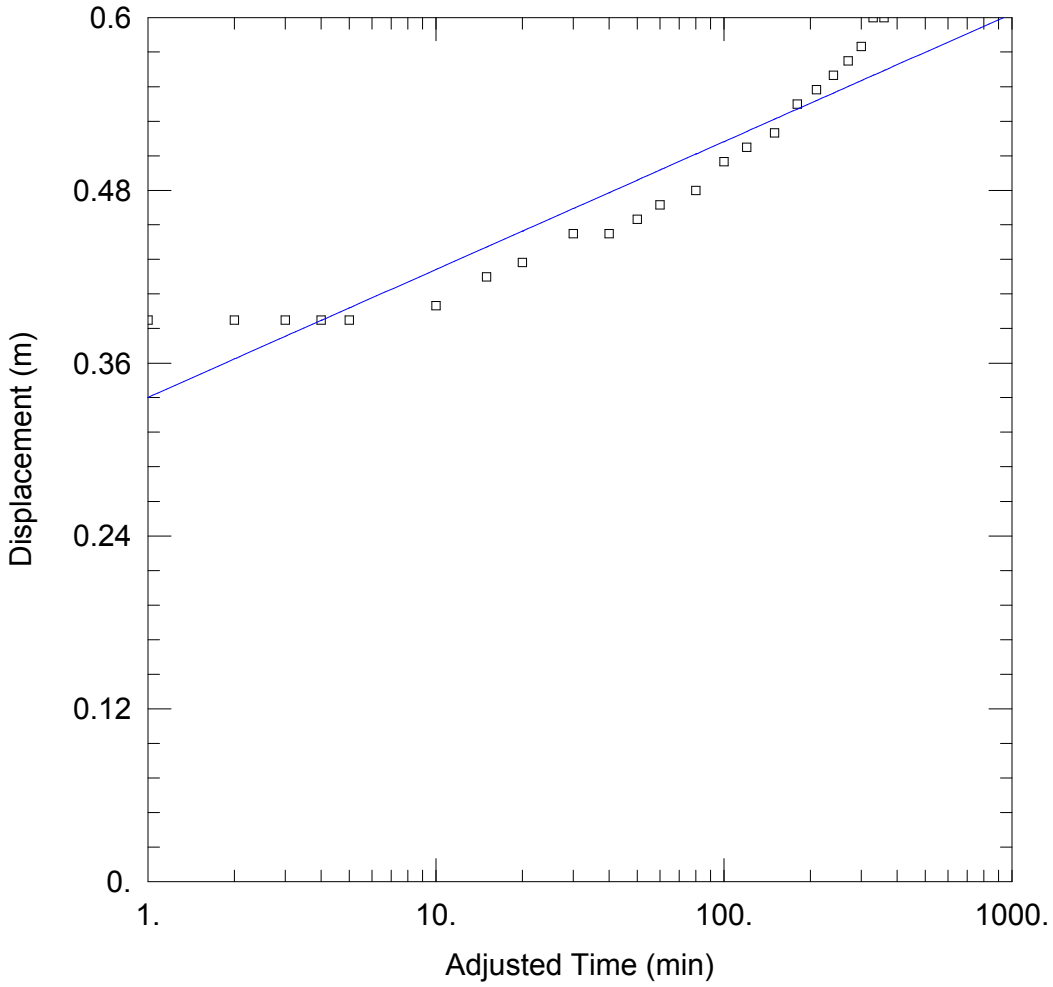
Pumping Test		
Running Time (min)	Water Levels (m)	Drawdown (m)
Pumping Rate 27 L/min		
0	10.59	0
1	12.80	2.21
2	13.09	2.5
3	13.27	2.68
4	13.43	2.84
5	13.51	2.92
10	13.69	3.1
17	13.75	3.16
21	13.78	3.19
32	13.83	3.24
40	13.84	3.25
52	14.57	3.98
60	14.65	4.06
Pumping Rate 25 L/min		
70	14.93	4.34
80	15.04	4.45
90	15.07	4.48
120	15.19	4.6
150	15.28	4.69
180	15.28	4.69
210	15.24	4.56
240	15.15	4.49
270	15.08	4.43
300	15.02	4.36
330	14.95	4.29
360	14.88	4.29

Recovery Test			
Recovery Time (min)	Running Time (min)	Water Levels (m)	Residual Drawdown (m)
0	360	14.88	4.29
0.5	360.5	13.95	3.36
1	361	12.08	1.49
4	364	11.88	1.29
5	365	11.66	1.07
6	366	11.57	0.98
8	368	11.45	0.86
10	370	11.41	0.82
15	375	11.38	0.79
20	380	11.37	0.78
30	390	11.35	0.76
40	400	11.35	0.76
50	410	11.35	0.76
60	420	11.34	0.75
120	480	11.33	0.74

Time (min)	Parameters		
	Free Chloirne	Total Chloirne	Turbidity (NTU)
40	0	0	32.4
120			32.6
180			11
240			2.75
300			8.91
360	0	0	6.52

Monitoring Well Data

Time (min)	Well 2
Pumping Test	
0	11.01
60	11.03
120	11.05
180	11.06
240	11.07
300	11.08
360	11.08



TW2 DRAWDOWN

Data Set: P:\...\test well 2 pump.aqt
Date: 03/24/16 Time: 08:41:48

PROJECT INFORMATION

Company: Exp Services Inc.
Client: Humanics Universal Inc.
Project: OTT-00229886-A0
Location: 3400 Old Montreal Road
Test Well: TW2
Test Date: February 22, 2016

AQUIFER DATA

Saturated Thickness: 24. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

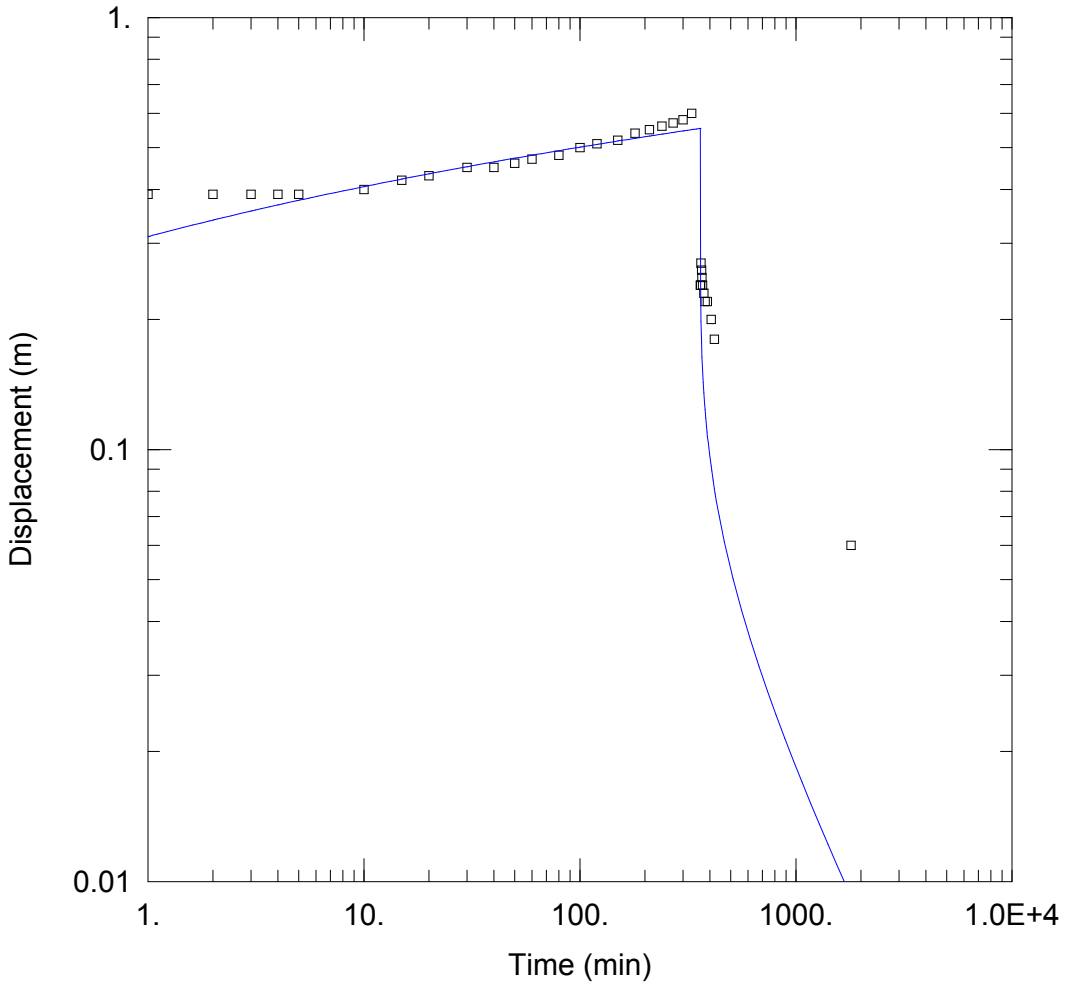
Well Name	X (m)	Y (m)
TW2	0	0

Observation Wells

Well Name	X (m)	Y (m)
TW2	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Cooper-Jacob
T = 115.9 m^2/day S = 0.005247



TW2 PUMP AND RECOVERY TEST

Data Set: P:\...\test well 2 recovery.aqt
Date: 03/29/16 Time: 08:28:23

PROJECT INFORMATION

Company: Exp Services Inc.
Client: Humanics Universal Inc.
Project: OTT-00229886-A0
Location: 3400 Old Montreal Road
Test Well: TW2
Test Date: February 22, 2016

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
TW2	0	0

Observation Wells

Well Name	X (m)	Y (m)
▫ TW2	0	0

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 108.3 m^2/day
S = 0.01596
Kz/Kr = 1.
b = 24. m

OTT-00229886-A0
Pump Test on Well 2
Pump Test Conducted on February 22, 2016

Pump Depth 27 m

Pumping Test		
Running Time (min)	Water Levels (m)	Drawdown (m)
Pumping Rate 39-40 L/min		
0	10.95	0
1	11.34	0.39
2	11.34	0.39
3	11.34	0.39
4	11.34	0.39
5	11.34	0.39
10	11.35	0.4
15	11.37	0.42
20	11.38	0.43
30	11.40	0.45
40	11.40	0.45
50	11.41	0.46
60	11.42	0.47
80	11.43	0.48
100	11.45	0.5
120	11.46	0.51
150	11.47	0.52
180	11.49	0.54
210	11.50	0.55
240	11.51	0.56
270	11.52	0.57
300	11.53	0.58
330	11.55	0.60
360	11.55	0.60

Monitoring Well Data

Time (min)	Well 1
Pumping Test	
0	11.35
60	11.34
120	11.35
210	11.4
270	11.41
330	11.45

Recovery Test			
Recovery Time (min)	Running Time (min)	Water Levels (m)	Residual Drawdown (m)
0	360	11.55	0.60
1	361	11.19	0.24
2	362	11.19	0.24
4	364	11.22	0.27
6	366	11.21	0.26
8	368	11.20	0.25
10	370	11.19	0.24
15	375	11.18	0.23
20	380	11.17	0.22
30	390	11.17	0.22
45	405	11.15	0.20
60	420	11.13	0.18
1440	1800	11.01	0.06

Time (min)	Parameters		
	Free Chloirne	Total Chloirne	Turbidity (NTU)
25	0	0	5
100			14
150			11.3
180			11.7
210			4.2
240			2.48
270			1.58
300			1.34
330			1

Appendix D:
Groundwater Chemistry

Table #1 (OTT-00229886-A0)
Groundwater Analytical Results
General Water Chemistry

					2016				2022		2023
					Well 1		Well 2		Well 2		Well 2
PARAMETER	**UNITS**	**Type of Criteria**	**ODWS Criteria**	**D-5-5 Treatability**	**0.5 hr**	**6 hr**	**0.5 hr**	**6 hr**	**Tap2-1A**	**Tap2-1B**	**3600**
Sampling Notes					0.5 hr into the test	6 hr into the test	0.5 hr into the test	6 hr into the test	10 min flushing		1-hr flushing
Date					**23-Feb-16**	**23-Feb-16**	**23-Feb-16**	**23-Feb-16**	**09-Nov-22**	**09-Nov-22**	**20-Jul-23**
Alkalinity as $CaCO_3$	mg/L	OG	30 to 500	-	282	329	259	280	312	311	
Background	ct/1ml	n/v	n/v	-	5	3	32	24			
Calcium	mg/L	n/v	n/v	-	63.5	74.3	74.0	80.7	75.9	79.0	
Chloride	mg/L	OG	250	250	8.0	6.8	16.9	16.1	13.7	13.2	
Colour	TCU	AO	5	7	5	4	4	4	4	4	
Conductivity	umho/cm	n/v	n/v	-	8	8	586	617	635	642	
Dissolved Organic Carbon	mg/L	AO	5.0	10	2.3	2.1	1.5	1.5	1.9	1.8	
E. Coli	ct/100ml	MAC	1	-	0	0	0	0	0	0	
Fluoride[8]	mg/L	MAC	1.5	-	0.2	0.2	0.3	0.2	<0.1	<0.1	
Hardness as $CaCO_3$	mg/L	OG	100	500[9]	**230**	**265**	**264**	**286**	**275**	**284**	
Hydrogen Sulphide	mg/L	AO	0.05	-	0.01	0.01	<0.01	<0.01			
Iron	mg/L	AO	0.30	5	**1.78**	0.095	0.278	**0.325**	**3.530**	**3.640**	**0.606**
Magnesium	mg/L	n/v	n/v	-	17.2	19.2	19.3	20.5	20.8	21.1	
Manganese	mg/L	AO	0.05	1	**0.054**	0.026	0.028	0.034	**0.064**	**0.068**	
N-NH_3 (Ammonia)	mg/L	n/v	n/v	-	0.26	0.19	0.15	0.14	0.21	0.20	
N-NO_2 (Nitrite)	mg/L	MAC	1.0	-	<0.1	<0.1	<0.1	<0.1	< 0.1	< 0.1	
N-NO_3 (Nitrate)	mg/L	MAC	10.0	-	<0.1	0.1	<0.1	<0.1	< 0.1	< 0.1	
Organic Nitrogen	mg/L	AO	0.15		0.14	**0.16**	0.08	0.06	0.10	0.20	
pH	$-\log_{10}[H+]$	AO	6.5-8.5	-	8.23	8.17	8.36	8.41	8.08	8.12	
Phenols	mg/L	n/v	n/v	-	<0.001	<0.001	<0.001	<0.001	< 0.001	< 0.001	
Potassium	mg/L	n/v	n/v	-	10.5	4.5	3.6	2.9	3.2	3.3	
Sodium	mg/L	AO	20[6] ; 200	200	**35.8**	**30.9**	**20.5**	**19.3**	**30.7**	**31.2**	**35.1**
Sulphate	mg/L	AO	500	500	28	26	37	35	25	24	
Tannin & Lignin	mg/L	n/v	n/v	-	0.2	0.2	<0.1	<0.1	< 0.5	< 0.5	
Total Coliform	ct/100ml	MAC	1 ; 5[7]	-	0	0	0	0	0	0	
Total Dissolved Solids	mg/L	AO	500	-	335	360	327	343	360	362	
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	-	0.4	0.35	0.23	0.20	0.30	0.40	
Turbidity	NTU	AO/OG	5	5	**38**	2.5	**7**	4.4	**36**	**41.1**	2.5

Notes : AO= aesthetic objective, OG = operational guideline, MAC = maximum allowable concentration

1. Ontario Drinking Water Standards - 2004 is used as the health related criteria
2. **Bold** - concentration exceeds appropriate ODWS criteria
   shade - exceeds D-5-5 criteria
3. OG (operational guideline) criteria are for treated drinking water systems .
4. n/a - not analysed
5. N/v - no value
6. Sodium value is a health related criteria for people with low salt diets.
7. D-5-5 criteria for raw water
8. Where supplies contain naturally occurring fluoride at levels higher than 1.5 mg/L but less than 2.4 mg/L, the Ministry of Health and Long-Term Care recommends an approach through local boards of health to raise public and professional awareness to control excessive exposure to fluoride from other sources.
9. Under D-5-5, hardness is accepted at values below 500 mg/L and considered non-potable. It is not noted as an official treatability limit.

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: DW 116650 **REPORT No. B22-34049**

Report To:

EXP Services Inc
2650 Queensview Drive, Suite 100
Ottawa ON K2B 8H6 Canada
Attention: Chris Kimmerly

Caduceon Environmental Laboratories
2378 Holly Lane
Ottawa Ontario K1V 7P1
Tel: 613-526-0123
Fax: 613-526-1244

DATE RECEIVED: 09-Nov-22
DATE REPORTED: 22-Nov-22
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER:
WATERWORKS NO.

			Client I.D.		Tap2-1A	Tap2-1B		
			Sample I.D.		B22-34049-1	B22-34049-2		
			Date Collected		09-Nov-22	09-Nov-22		
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
Dissolved Organic Carbon	mg/L	0.2	EPA 415.2	14-Nov-22/O	1.9	1.8		
Dissolved Inorganic Carbon	mg/L	0.2	EPA 415.2	14-Nov-22/O	74.9	74.6		
Hardness (as CaCO3)	mg/L	1	SM 3120	14-Nov-22/O	275	284		
Calcium	mg/L	0.02	SM 3120	14-Nov-22/O	75.9	79.0		
Magnesium	mg/L	0.02	SM 3120	14-Nov-22/O	20.8	21.1		
Sodium	mg/L	0.2	SM 3120	14-Nov-22/O	30.7	31.2		
Potassium	mg/L	0.1	SM 3120	14-Nov-22/O	3.2	3.3		
Iron	mg/L	0.005	SM 3120	14-Nov-22/O	3.53	3.64		
Manganese	mg/L	0.001	SM 3120	14-Nov-22/O	0.064	0.068		
Ammonia + Ammonium (N)	mg/L	0.01	SM4500-NH3-H	11-Nov-22/K	0.21	0.20		
Total Kjeldahl Nitrogen	mg/L	0.1	E3516.2	15-Nov-22/K	0.3	0.4		
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	10-Nov-22/O	312	311		
Conductivity @25°C	µmho/cm	1	SM 2510B	10-Nov-22/O	633	632		
Colour	TCU	2	SM 2120C	10-Nov-22/O	4	4		
Fluoride	mg/L	0.1	SM4110C	16-Nov-22/O	< 0.1	< 0.1		
Chloride	mg/L	0.5	SM4110C	16-Nov-22/O	13.7	13.2		
Nitrite (N)	mg/L	0.1	SM4110C	16-Nov-22/O	< 0.1	< 0.1		
Nitrate (N)	mg/L	0.1	SM4110C	16-Nov-22/O	< 0.1	< 0.1		
Sulphate	mg/L	1	SM4110C	16-Nov-22/O	25	24		
Total Coliform	cfu/100mL	1	MOE E3407	09-Nov-22/O	0	0		
E coli	cfu/100mL	1	MOE E3407	09-Nov-22/O	0	0		
Background	cfu/100mL	1	MOE E3407	09-Nov-22/O	> 200	> 200		
Phenolics	mg/L	0.001	MOEE 3179	22-Nov-22/K	< 0.001	< 0.001		
Tannins and Lignins	mg/L	0.5	SM5500B	15-Nov-22/K	< 0.5	< 0.5		
pH @25°C	pH Units		SM 4500H	10-Nov-22/O	8.08	8.12		
Organic Nitrogen (Calculation)	mg/L	0.1	E3516.2	21-Nov-22/K	0.1	0.2		

Tahir Yapici Ph.D
Lab Manager - Ottawa District

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: DW 116650 **REPORT No. B22-34049**

Report To:

EXP Services Inc
2650 Queensview Drive, Suite 100
Ottawa ON K2B 8H6 Canada
Attention: Chris Kimmerly

Caduceon Environmental Laboratories
2378 Holly Lane
Ottawa Ontario K1V 7P1
Tel: 613-526-0123
Fax: 613-526-1244

DATE RECEIVED: 09-Nov-22
DATE REPORTED: 22-Nov-22
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER:
WATERWORKS NO.

			Client I.D.		Tap2-1A	Tap2-1B		
			Sample I.D.		B22-34049-1	B22-34049-2		
			Date Collected		09-Nov-22	09-Nov-22		
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
Anion Sum	meq/L		Calc.	10-Nov-22/O	7.13	7.09		
Cation Sum	meq/L		Calc.	10-Nov-22/O	7.12	7.33		
% Difference	%		Calc.	10-Nov-22/O	0.0711	1.66		
Ion Ratio	AS/CS		Calc.	10-Nov-22/O	1.00	0.967		
Sodium Adsorption Ratio	-		Calc.	10-Nov-22/O	0.805	0.805		
TDS(ion sum calc.)	mg/L	1	Calc.	10-Nov-22/O	360	362		
TDS(calc.)/EC(actual)	-		Calc.	10-Nov-22/O	0.569	0.573		
Conductivity (calc.)	µmho/cm		Calc.	10-Nov-22/O	635	642		
EC(calc.)/EC(actual)	-		Calc.	10-Nov-22/O	1.00	1.02		
Langelier Index(25°C)	S.I.		Calc.	10-Nov-22/O	1.00	1.06		
Turbidity	NTU	0.1	SM 2130	21-Nov-22/O	36.3	41.1		
o-Phosphate (P)	mg/L	0.002	PE4500-S	21-Nov-22/K	< 0.002	< 0.002		
Sulphide	mg/L	0.01	SM4500-S2	10-Nov-22/K	0.03	0.03		

Tahir Yapici Ph.D
Lab Manager - Ottawa District

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

DRINKING WATER SUBMISSION FORM

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured. Proudly Canadian.

SAMPLES SUBMITTED TO:

Kingston	
Ottawa	X
Richmond Hill	
Barrie	
London	
Windsor	

DRINKING WATER FACILITY CLASSIFICATION

Municipal	Non-Municipal	Reg. 170/03
Large	Small	Reg. 319/08
Residential	Non-Residential	Reg. 243/07
X Seasonal	Year-Round	Private Drinking Water
Other:		Not in Service

REPORT NUMBER (Lab Use)
NOV. 9. 22
B22-35404 9

Organization: EXP Services Inc
Contact: Chris Kimmerly
Tel: 613-688-1899 Fax:
After Hours Tel: Public Health Unit:
Email: Chris.Kimmerly@exp.com

Waterworks Address:
Waterworks #:
Quote #:

Invoicing Address (if different): SAME
Project Name or #: OTT-00229886-A0
P.O. #: EXP Standing Offer

ANALYSES REQUESTED

Microbiological: Total Coliform / E.coli; Background; Heterotrophic Plate Count
Chemical: Sodium; Lead; Fluoride; Trihalomethanes; HAA's; Nitrite, Nitrate as N; Sch. 23 Inorganics; Sch. 24 Organics
Other: SUB DIVISION Package

TURNAROUND SERVICE REQUESTED (see back page)

* Must be arranged in advance

	Platinum*	200% Surcharge
	Gold*	100% Surcharge
	Silver	50% Surcharge
	Bronze	25% Surcharge
X	Standard	5-7 days
	Specific Date:	

Sample Matrix Legend: TW = Treated Water, DW = Distribution Water, GW = Raw Groundwater, SW = Raw Surface Water, UGW = Untreated Groundwater (Drinking Water/Distribution)
GUDI = Groundwater under the influence of surface water, PR = Plumbing Residential, PNR = Plumbing Non-Residential

Lab No.	Sample Source and/or Sample Identification	S.P.L.	Sample Matrix *	Human Consumption (Y/N)	Date Collected (yy-mm-dd)	Time Collected	Adverse Resample	Indicate Test For Each Sample By Using A Check Mark In The Box Provided													Chlorine Free	Chlorine Total	# Bottles/ Sample
								Total Coliform / E.coli	Background	Heterotrophic Plate Count	Sodium	Lead	Fluoride	Trihalomethanes	HAA's	Nitrite, Nitrate as N	Sch. 23 Inorganics	Sch. 24 Organics	SUB DIVISION	Package			
	TAP 2-1A		GW	Y	2022-11-09	9h45													X	X			8
	Tap 2-1B.		GW	Y	"	"													X	X			8

Has Lab Service Notification (LSN) Form been completed & submitted to the MECP/PHU? ☐ Yes ☐ No ☒ Not applicable
Laboratory Analysis will not commence until all Notification information is received and the Submission form is appropriately completed

SAMPLE SUBMISSION INFORMATION

	Sampled by:	Submitted by:
Print:	Philip Oliveira	Philip Oliveira
Sign:	Philip Oliveira	Philip Oliveira
	2022-11-05	2022-11-09 10h30
	Date (yy-mm-dd)/Time:	Date (yy-mm-dd)/Time:

SHIPPING INFORMATION

Courier (Client account)	
Courier (Caduceon account)	
Drop Off	X
Caduceon (Pick-up)	

Invoice
# of Pieces: 1

REPORTING / INVOICING

Report by Fax	
Report by Email	X
Invoice by Email	X
Invoice by Mail	

SAMPLE RECEIVING INFORMATION (LABORATORY USE ONLY)

Received By (print): Jessica C Signature: JC
Date Received (yy-mm-dd): 22-11-09 Time Received: 10:58
Laboratory Prepared Bottles: ✓ Yes ☐ No
Sample Temperature °C: 11.2 Labeled by:

Comments: 2PET+2baby+2NP+2M+2H2S+2bact+2Phen+2DOC

Page 1 of 1

DW 116650

CofC DW, Jun 2020 Revision No: 15

GENERAL TERMS, CONDITIONS AND SAMPLING INFORMATION GUIDE

Sample Acceptance

Caduceon Enterprises is a commercial testing laboratory specializing in environmental analyses of samples including, but not limited to the following:
Drinking Water, Groundwater, Surface Water, Wastewater and/or Industrial Process Water/Effluents, Liquid and Solid Sludge, Soil and Sediment, Oil (limited types).

Caduceon does not accept samples including but not limited to the following matrices unless otherwise prearranged with an authorized Caduceon representative:
Human or Animal Tissue, Unprocessed Human or Animal Waste, Food or Beverage (other than Drinking Water), Unknown solids and liquids, Vegetation, Hazardous Waste, Highly contaminated samples (which cause process and instrument complications).

Samples submitted to Caduceon without proper designation are subject to supplementary charges, but not limited to the following:
Sample Disposal Fees, Process and Handling Fees, Instrument Maintenance and Refurbishment Fees (parts and labour).

Chain of Custody Forms must be completed with all required information. Analyses of samples will not commence until all required information is received. Receipt of samples will only occur at this time.

Samples must be submitted in Caduceon sampling containers and/or acceptable alternatives with appropriate preservatives (if required).
Samples must be received at the laboratory within required sample holding times. If samples require RUSH analyses based on sample holding times, surcharges may apply. See Turnaround Time Terms and Conditions.

Turnaround Time

Platinum Service – 200% Surcharge (minimum)** Fastest possible Turnaround Time available and/or achievable, same day service or does not meet one of the other listed categories. Subject to additional fees for weekend and/or after hours service. Arrangments must be made in advance with your local laboratory prior to submission of samples.

Gold Service – 100% Surcharge Samples received prior to 2 p.m. will be reported by 5 p.m. on the next business day from the day of receipt. Samples received after 2 p.m. will be reported by 12 p.m. on the second business day from the day of receipt. Arrangments must be made in advance with your local laboratory prior to submission of samples.

Silver Service - 50% Surcharge Samples received prior to 2 p.m. will be reported by 5 p.m. on the second business day from the day of receipt. Samples received after 2 p.m. will be reported by 12 p.m. on the third business day from the day of receipt.

Bronze Service - 25% Surcharge Samples received prior to 2 p.m. will be reported by 5 p.m. on the third business day from the day of receipt. Samples received after 2 p.m. will be reported by 12 p.m. on the fourth business day from the day of receipt.

Standard Service – No Surcharge 5- 7 business days from the time of receipt. Note: Samples received after 2 p.m. are considered received the next business day.

Note: If the specific level of Turnaround Time requested is not met the next level of service achieved will be surcharged accordingly. This is at the sole discretion of the laboratory.

Payment

By submission of samples and signing of the chain of custody you agree to Caduceon's Payment Terns and Conditions. (See Caduceon website for details www.caduceonlabs.com)

CADUCEON™

ENVIRONMENTAL LABORATORIES

Client committed. Quality assured. Proudly Canadian.

www.caduceonlabs.com

Laboratory & Depot Locations/Shipping Addresses

Kingston Lab - 285 Dalton Ave., Kingston, ON K7K 6Z1, Tel: (613) 544-2001 Fax: (613) 544-2770 Email: supplieskingston@caduceonlabs.com
Ottawa Lab - 2378 Holly Lane, Ottawa, ON K1V 7P1, Tel: (613) 526-0123 Fax: (613) 526-1244 Email: suppliesottawa@caduceonlabs.com
Richmond Hill Lab - #14-110 West Beaver Creek Rd., ON L4B 1J9, Tel: (289) 475-5442 Fax: (866) 562-1963 Email: suppliesgta@caduceonlabs.com
Windsor Lab - #5-3201 Marentette Ave., Windsor, ON N8X 4G3, Tel: (519) 966-9541 Fax: (519) 966-9567 Email: supplieswindsor@caduceonlabs.com
Barrie Lab - 112 Commerce Park Drive, Unit L, Barrie, ON L4N 8W8, Tel: (705) 252-5743 Fax: (705) 252-5746 Email: suppliesgta@caduceonlabs.com
London Depot - #1-600 Newbold St., London, ON N6E 2T7, Tel: (519) 601-1833 Fax: (519) 601-1833 Email: supplieslondon@caduceonlabs.com

~~DRINKING~~ WATER SUBMISSION FORM

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured. Privately Canadian

SAMPLES SUBMITTED TO: Kingston [ ] Ottawa [✓] Richmond Hill [ ] Barrie [ ] Windsor [ ]

DRINKING WATER FACILITY CLASSIFICATION: Municipal [ ] Non-Municipal [ ] Reg. 170/03 [ ] Large [ ] Small [ ] Reg. 319/08 [ ] Residential [ ] Non-Residential [ ] Reg. 243/07 [ ] Seasonal [ ] Year-Round [ ] Private Drinking Water [ ] Other: _____ [ ] Not in Service

REPORT NUMBER (Lab Use): 23107120 / 23-018367

Organization: EXP SERVICES	Waterworks Address:	Invoicing Address (if different): SAME	
Contact: CHRIS Kimmerly			
Tel: 613-688-1899	Fax:		
After Hours Tel:	Public Health Unit:	Waterworks #:	Project Name or #: OTT-00229886-A0
Email: Chris.Kimmerly@exp.com; DeNAR.AHMED@exp.com		Quote #: Q3417	P.O. #:

ANALYSES REQUESTED

Microbiological: Total Coliform / E.coli; Background; Heterotrophic Plate Count

Chemical: Sodium; Lead; Fluoride; Trihalomethanes; HAA's; Nitrite, Nitrate as N; Sch. 23 Inorganics; Sch. 24 Organics

Other: TRACE METALS; VOC's; TURBIDITY

TURNAROUND SERVICE REQUESTED (see back page) * Must be arranged in advance

- [ ] Platinum* 200% Surcharge
- [ ] Gold* 100% Surcharge
- [ ] Silver 50% Surcharge
- [ ] Bronze 25% Surcharge
- [X] Standard 5-7 days
- [ ] Specific Date: _____

Sample Matrix Legend: TW = Treated Water, DW = Distribution Water, GW = Raw Groundwater, SW = Raw Surface Water, UGW = Untreated Groundwater (Drinking Water/Distribution) GUDI = Groundwater under the influence of surface water, PR = Plumbing Residential, PNR = Plumbing Non-Residential

Lab No.	Sample Source and/or Sample Identification	WaterTrax S.P.L.	Sample Matrix*	Human Consumption (Y/N)	Date Collected (yy-mm-dd)	Time Collected	Adverse Resample	Indicate Test For Each Sample By Using A Check Mark In The Box Provided	Chlorine Free	Chlorine Total	# Bottles/ Sample
1	3600		GW		2023-07-20	11h15		TRACE METALS: X; VOC's: X; TURBIDITY: X			4
	Na = 35.1 mg/L. client informed.						2				

Has Lab Service Notification (LSN) Form been completed & submitted to the MECP/PHU? [ ] Yes [ ] No [X] Not applicable
Laboratory Analysis will not commence until all Notification information is received and the Submission form is appropriately completed

SAMPLE SUBMISSION INFORMATION

	Sampled by:	Submitted by:
Print:	Philip Oliveira	Philip Oliveira
Sign:	Phil Oliveira	Phil Oliveira
Date (yy-mm-dd)/Time:	2023-07-20	2023-07-20 12h30

SHIPPING INFORMATION

- Courier (Client account) [ ]
- Courier (Caduceon account) [ ]
- Drop Off [X]
- Caduceon (Pick-up) [ ]

Invoice: # of Pieces: 1

REPORTING / INVOICING

- Report by Fax [ ]
- Report by Email [X]
- Invoice by Email [X]
- Invoice by Mail [ ]

SAMPLE RECEIVING INFORMATION (LABORATORY USE ONLY)

Received By (print): Sabrina Signature: S
Date Received (yy-mm-dd): July 2023 Time Received: 12:03
Laboratory Prepared Bottles: [X] Yes [ ] No
Sample Temperature °C: 7.9 Labeled by:

Comments: * Not FIELD Filtered *

Page 1 of 1

121828

CADUCEON™
ENVIRONMENTAL LABORATORIES
Client committed. Quality assured. Canadian owned.

Date	Quote #
23/Jul/21	Q3417

Expire Date	PO Number
24/Jul/18	

Quoted to:

EXP Services Inc - Ottawa

2650 Queensview Drive
Suite 100
Ottawa ON K2B 8H6
CA

Attention:

HST Number	Currency	Terms
898699194	CAD	Net 30

#	Item Code	Description	Quantity	Unit Cost, $	Amount, $
1	R153_VOC	R153 - VOC's (Liquid)	1	$91.51	$91.51
2	DW_PKG1	Package 1 (Private Well) with additional ICP Metals (Al, Ba, B, Cu, Fe, Li, Si, SiO2, W, Y, Zn)	1	$205.20	$205.20
3	TURBIDITY_RGW	Turbidity (Liquid)	1	$12.60	$12.60
4	METALS_ICPOES_RPW_GRP3	ICP Metals (Liquid) 6+ Metals - Hardness, Al, Ba, Be, B, Ca, Cu, Fe, Mg, Mn, Na, K, Ni, Sr, Zn	1	$18.38	$18.38
5	METALS_ICPMS_RPT_GRP3	ICPMS Total Metals (Liquid) Sb, As, Cd, Cr, Co, Pb, Mo, Se, Ag, Tl, U, V	1	$23.63	$23.63
6	ENVIRONMENTAL_FEE	Environmental Fee (Per sample)	1	$2.00	$2.00
		Sample Supply Surcharge		5.0 %	$17.57
				Subtotal	$370.89
				HST	$48.22
				Total Cost	$419.11

All submissions must have a completed C-o-C form indicating report recipient name and address, invoicing information (if different from recipient), P.O. Number &/or Project Number, **Caduceon Quotation Number**, and analysis requested. If not referencing a P.O./S.O. Number a quote number is mandatory or **General pricing will be applied.** If a P.O./S.O or Quote Number is mandatory to process payment, the P.O./S.O. or Quote Number must be supplied prior to invoicing or an administrative charge of $50.00 will be applied to revise invoices. Caduceon is a member of the Canadian Association for Laboratory Accreditation (CALA) and participates in the proficiency testing program for a list of parameters registered with the association. The laboratory is accredited for specific tests by CALA and was found to comply with the requirements of ISO/IEC Guide 17025. See Scope of Accreditation for list of tests. This quote is intended for the addressee(s) show on this form only, and may contain information which is confidential and privileged, any disclosure, copying, distribution or use of the contents of this quote without the consent of **Caduceon Environmental Laboratories** is prohibited.

Prepared By: _____

Damien Gilbert
CEO

elwar Ahmed
uesday, July 18, 2023 3:29 PM
lichelle Dubien <mdubien@caduceonlabs.com>
Philip Oliveira <Philip.Oliveira@exp.com>
ubject: Sampling bottles for trace metals and VOCs for City of Ottawa Sewer Use Criteria

Hi Michelle,

We will need bottles (delivered to our 2650 Queensview Drive office ASAP) for GW sampling for trace metals and VOCs as per City of Ottawa Sewer Use By-Law standard parameters.

Trace Metals: Samples for metal testing must be filtered. Unless otherwise indicated, for the purpose of these guidelines the suite of trace metal parameters shall include the following, as a minimum: Aluminum (Al), Antimony (Sb), Arsenic (As), Barium (Ba), Beryllium (Be), Boron (B), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Lead (Pb), Molybdenum (Mo), Nickel (Ni), Selenium (Se), Silver (Ag), Strontium (Sr), Thallium (Tl), Uranium (U), Vanadium (V), Zinc (Zn). Other metals, such as Calcium, Iron, Magnesium, Manganese, Potassium, and Sodium are already included in the Subdivision Package suite of parameters.

Let me know if you need anything else.

exp.

Delwar Ahmed, P.Geo., CISEC
EXP | Project Manager, Senior Hydrogeologist
t : +1.613.688.1899, 63886 | m : +1.289.404.3187 | e : delwar.ahmed@exp.com
2650 Queensview Drive
Suite 100
Ottawa, ON K2B 8H6
CANADA
exp.com / *legal disclaimer*

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured. Canadian owned.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: G 121828

REPORT No: 23-018367 - Rev. 1

Report To:
EXP Services Inc - Ottawa
2650 Queensview Drive
Suite 100
Ottawa, ON K2B 8H6

Attention: Chris Kimmerly

CADUCEON Environmental Laboratories
2378 Holly Lane
Ottawa, ON K1V 7P1

DATE RECEIVED: 2023-Jul-20
DATE REPORTED: 2023-Aug-02
SAMPLE MATRIX: Ground Water

CUSTOMER PROJECT: OTT-00229886-AO
P.O. NUMBER:

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
ICP/MS (Liquid)	1	OTTAWA	TPRICE	2023-Aug-01	D-ICPMS-01	EPA 200.8
ICP/OES (Liquid)	1	OTTAWA	NHOGAN	2023-Aug-01	D-ICP-01	SM 3120B
Turbidity (Liquid)	1	OTTAWA	MDON	2023-Jul-21	A-TURB-01	SM 2130B
VOC-Volatiles Full (Water)	1	RICHMOND_HILL	FLENA	2023-Jul-26	C-VOC-02	EPA 8260

R.L. = Reporting Limit
NC = Not Calculated
Test methods may be modified from specified reference method unless indicated by an *

Michelle Dubien
Laboratory Manager

Parameter	Units	R.L.	Limits	DWG	Client I.D.: 3600 Sample I.D.: 23-018367-1 Date Collected: 2023-Jul-20 -
Turbidity	NTU	0.1	5	AO	2.5
Aluminum	mg/L	0.01			0.06
Barium	mg/L	0.001	1.0	MAC	0.205
Boron	mg/L	0.005	5.0	MAC	0.145
Calcium	mg/L	0.02			82.0
Iron	mg/L	0.005	0.3	AO	**0.606**
Magnesium	mg/L	0.02			19.8
Manganese	mg/L	0.001	0.05	AO	0.041
Potassium	mg/L	0.1			3.0
Sodium	mg/L	0.2	200, 20	AO, MAC	**35.1**
Strontium	mg/L	0.001			3.75
Zinc	mg/L	0.005	5	AO	<0.005
Antimony	mg/L	0.0001	0.006	MAC	<0.0001
Arsenic	mg/L	0.0001	0.01	MAC	0.0001
Beryllium	mg/L	0.0001			<0.0001
Cadmium	mg/L	0.000015	0.005	MAC	<0.000015
Chromium	mg/L	0.001	0.05	MAC	<0.001
Cobalt	mg/L	0.0001			0.0002
Copper	mg/L	0.0001	1.0	AO	0.0003
Lead	mg/L	0.00002	0.010	MAC	0.00005
Molybdenum	mg/L	0.0001			0.0003

Michelle Dubien
Laboratory Manager

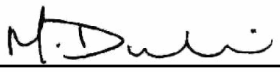
				Client I.D.	3600
				Sample I.D.	23-018367-1
				Date Collected	2023-Jul-20
Parameter	Units	R.L.	Limits	DWG	-
Nickel	mg/L	0.0002			0.0009
Selenium	mg/L	0.001	0.05	MAC	<0.001
Silver	mg/L	0.0001			<0.0001
Thallium	mg/L	0.00005			<0.00005
Uranium	mg/L	0.00005	0.02	MAC	0.00011
Vanadium	mg/L	0.0001			0.0003

Michelle Dubien
Laboratory Manager

Parameter	Units	R.L.	Limits	DWG	Client I.D.: 3600 Sample I.D.: 23-018367-1 Date Collected: 2023-Jul-20 -
Acetone	µg/L	30			<30
Benzene	µg/L	0.5	1.0	MAC	<0.5
Bromodichloromethane	µg/L	2			<2
Bromoform	µg/L	5			<5
Bromomethane	µg/L	0.5			<0.5
Carbon Tetrachloride	µg/L	0.2	2.0	MAC	<0.2
Chlorobenzene	µg/L	0.5	80.0, 30.0	MAC, AO	<0.5
Chloroform	µg/L	1			<1
Dibromochloromethane	µg/L	2			<2
Ethylene Dibromide	µg/L	0.2			<0.2
Dichlorobenzene,1,2-	µg/L	0.5	200.0, 3.0	MAC, AO	<0.5
Dichlorobenzene,1,3-	µg/L	0.5			<0.5
Dichlorobenzene,1,4-	µg/L	0.5	5.0, 1.0	MAC, AO	<0.5
Dichlorodifluoromethane (Freon 12)	µg/L	2			<2
Dichloroethane,1,1-	µg/L	0.5			<0.5
Dichloroethane,1,2-	µg/L	0.5	5.0	MAC	<0.5
Dichloroethylene,1,1-	µg/L	0.5	14.0	MAC	<0.5
Dichloroethylene,1,2-cis-	µg/L	0.5			<0.5
Dichloroethylene,1,2-trans-	µg/L	0.5			<0.5
Dichloropropane,1,2-	µg/L	0.5			<0.5
Dichloropropene,1,3-cis-	µg/L	0.5			<0.5

Michelle Dubien
Laboratory Manager

				Client I.D.	3600
				Sample I.D.	23-018367-1
				Date Collected	2023-Jul-20
Parameter	Units	R.L.	Limits	DWG	-
Dichloropropene,1,3-cis+trans-(Calculated)	µg/L	0.5			<0.5
Dichloropropene,1,3-trans-	µg/L	0.5			<0.5
Ethylbenzene	µg/L	0.5	140.0, 1.6	MAC, AO	<0.5
Hexane	µg/L	5			<5
Dichloromethane (Methylene Chloride)	µg/L	5	50	MAC	<5
Methyl Ethyl Ketone	µg/L	20			<20
Methyl Isobutyl Ketone	µg/L	20			<20
Methyl tert-Butyl Ether (MTBE)	µg/L	2			<2
Styrene	µg/L	0.5			<0.5
Tetrachloroethane,1,1,1,2-	µg/L	0.5			<0.5
Tetrachloroethane,1,1,2,2-	µg/L	0.5			<0.5
Tetrachloroethylene	µg/L	0.5	10.0	MAC	<0.5
Toluene	µg/L	0.5	60.0	MAC	<0.5
Trichloroethane,1,1,1-	µg/L	0.5			<0.5
Trichloroethane,1,1,2-	µg/L	0.5			<0.5
Trichloroethylene	µg/L	0.5	5.0	MAC	<0.5
Trichlorofluoromethane (Freon 11)	µg/L	5			<5
Vinyl Chloride	µg/L	0.2	1.0	MAC	<0.2
Xylene, m,p-	µg/L	1			<1
Xylene, m,p,o-	µg/L	1.1	90.0, 20.0	MAC, AO	<1.1
Xylene, o-	µg/L	0.5			<0.5



Michelle Dubien
Laboratory Manager

DWG - Drinking Water Guidelines
ODWS - Ontario Drinking Water Standards
AO - Aesthetic Objectives
IMAC - Interim Maximum Acceptable Concentration
MAC - Maximum Acceptable Concentration
ODWO - D-5-5 Objective
OG - Operational Guidelines
WL - Warning Level - Sodium Restricted Diets

Summary of Exceedances

Aesthetic Objectives

3600	Found Value	Limit
Iron	0.606	0.3

Maximum Acceptable Concentration

3600	Found Value	Limit
Sodium	35.1	20

Michelle Dubien
Laboratory Manager

Appendix E:
Test Pit Logs, Grain Size Analyses

Test Pit Logs
3400 Old Montreal Road, Cumberland, ON
OTT-00229886-A0

Test Pit Name	Depth (m)	Soil Analysis	Soil Description
TP1	0-0.15		Topsoil, some organics
	0.15-1.2	SS1	Fine grained brown sand
	1.2-3.6		Grey silty clay.
Static water level at approximately 1.67m, water entering at 3m Stand pipe installed			

Test Pit Name	Depth (m)	Soil Analysis	Soil Description
TP2	0-0.2		Topsoil, some organics
	0.2-1		Fine grained brown sand
	1-3.3	SS2	Grey silty clay
Water entering at approximately 3 m			

Test Pit Name	Depth (m)	Soil Analysis	Soil Description
TP3	0-0.2		Topsoil, some organics
	0.2-1.2		Fine grained orange/brown sand
	1.2-3.3		Grey silty clay
Water entering at approximately 3 m			

Test Pit Name	Depth (m)	Soil Analysis	Soil Description
TP4	0-0.3		Topsoil
	0.3-1.5		Fine grained brown sand
	1.5-3.35		Grey silty clay
Water entering at approximately 3 m			

Test Pit Name	Depth (m)	Soil Analysis	Soil Description
TP5	0-0.3		Topsoil
	0.3-0.9		Fine grained brown sand
	0.9-3.35		Grey silty clay
water entering at approximately 3 m			

Test Pit Name	Depth (m)	Soil Analysis	Soil Description
TP6	0-0.3		Topsoil
	0.3-0.9		Fine graind brown sand
	0.9-3.3		Grey silty clay
Water entering at approximately 3 m			

Test Pit Logs
3400 Old Montreal Road, Cumberland, ON
OTT-00229886-A0

Test Pit Name	Depth (m)	Soil Analysis	Soil Description
TP7	0-0.3		Topsoil, dry
	0.3-0.9		Fine grained brown sand
	0.9-3.3		Grey silty clay
Static water level is 1.74 m, water entering at approximately 3 m			

Test Pit Name	Depth (m)	Soil Analysis	Soil Description
TP8	0-0.2		Topsoil, dry
	0.2-1.2		Fine grained brown sand
	0.9-3.3		Grey silty clay
Water enteering at approximately 3 m			

Test Pit Name	Depth (m)	Soil Analysis	Soil Description
TP9	0-0.2		Topsoil, dry
	0.2-1.2	SS1	Fine grained brown sand
	0.9-3.3		Grey silty clay
Water entering at approximately 3 m			

Test Pit Name	Depth (m)	Soil Analysis	Soil Description
TP10	0-0.35		Topsoil
	0.35 - 1.2		Fine grained brown sand
	1.2-3.3		Grey silty clay
Static water level of 1.48, water entering at 3 m			

Test Pit Name	Depth (m)	Soil Analysis	Soil Description
TP11	0-0.2		Topsoil
	0.2-1.2		Fine grained brown sand
	1.2-3.3		Grey silty clay
Water entering at approximately 3 m			

Test Pit Name	Depth (m)	Soil Analysis	Soil Description
TP12	0-0.2		Topsoil
	0.2-1.2		Fine grained brown sand
	1.2-3.3		Grey silty clay
Water entering at approximately 3 m			

Log of Borehole BH1

Project No: OTT-00229886-A0

Project: Geotechnical Investigation, Humanics Sanctuary

Location: 3400 Old Montreal Road, Ottawa, Ontario

Figure No. 3

Page. 1 of 3

Date Drilled: 11/30/15

Drill Type: CME55 Track

Datum: Geodetic

Logged by: MD Checked by: ZG

Split Spoon Sample ⊠ | Auger Sample ◧ | SPT (N) Value ○ | Dynamic Cone Test —— | Shelby Tube ■ | Shear Strength by Vane Test + S

Combustible Vapour Reading □ | Natural Moisture Content × | Atterberg Limits |—○—| | Undrained Triaxial at % Strain at Failure ⊕ | Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		SAND AND GRAVEL FILL crushed limestone, grey, loose, moist	60.6	0
		brown silt and clay in tip, moist	60.0	
		CLAY some silt, brown to grey, moist to wet, soft to firm		1
				2
				3
				4
				5
		becoming wet	55.3	6
				7
				8
				9
				10

Standard Penetration Test N Value: 20 40 60 80

Shear Strength kPa: 50 100 150 200

Combustible Vapour Reading (ppm): 250 500 750

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Natural Unit Wt. kN/m³

7 | 12 | 5 | 180 s=4.9 | 2 | 101 s=5.6 | HW | 91 s=5.4 | HW | 67 s=6.7 | HW | 43 s=3.3 | HW | 91 s=7 | HW | 46 s=3.5 | HW | 57 s=1.7

17.3

Continued Next Page

LOG OF BOREHOLE LOGS OF BOREHOLES CUMBERLAND.GPJ TROW OTTAWA.GDT 2/25/16

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19 mm standpipe was installed in the borehole following completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00229886-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	16.3	
Dec 14, 2015	5.3	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH1

Project No: OTT-00229886-A0

Project: Geotechnical Investigation, Humanics Sanctuary

Figure No. 3

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa (20 40 60 80 / 50 100 150 200)	Combustible Vapour Reading (ppm) 250 500 750 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m³
		CLAY some silt, brown to grey, moist to wet, soft to firm *(continued)*	50.6	10				
				11				
				12				
				13				
				14				
				15				
				16	58			
				17				
				18				
				19				
				20				
				21				
				22				
		DYNAMIC CONE	41.7					

HW

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19 mm standpipe was installed in the borehole following completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00229886-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	16.3	
Dec 14, 2015	5.3	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES CUMBERLAND.GPJ TROW OTTAWA.GDT 2/25/16

Log of Borehole BH1

Project No: OTT-00229886-A0

Project: Geotechnical Investigation, Humanics Sanctuary

Figure No. 3

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		DYNAMIC CONE *(continued)*	38.6	22
				23
				24
				25
				26
				27
				28
				29
			30.4	30
		Cone Refusal at 30.2 m Depth		

Standard Penetration Test N Value: 20 40 60 80

Shear Strength kPa: 50 100 150 200

Combustible Vapour Reading (ppm): 250 500 750

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Natural Unit Wt. kN/m^3

LOG OF BOREHOLE LOGS OF BOREHOLES CUMBERLAND.GPJ TROW OTTAWA.GDT 2/25/16

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19 mm standpipe was installed in the borehole following completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00229886-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
Completion	16.3	
Dec 14, 2015	5.3	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH3

Project No: OTT-00229886-A0

Project: Geotechnical Investigation, Humanics Sanctuary

Location: 3400 Old Montreal Road, Ottawa, Ontario

Figure No. 4

Page. 1 of 3

Date Drilled: 12/3/15

Drill Type: CME55 Track

Datum: Geodetic

Logged by: BV Checked by: ZG

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)

Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength (kPa)	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		SILTY SAND brown, moist, loose	62.5	0	4			
				1	2			
		CLAY brown to grey, moist to wet, soft to firm	61.0	2	5			17.5
				3	3; 60 s=3.0			
					HW; 19 s=5.3			
		becoming wet		6	HW			16.1
				7	49 s=8.0			
				9	HW			

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled upon completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00229886-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES CUMBERLAND.GPJ TROW OTTAWA.GDT 2/25/16

Log of Borehole BH3

Project No: OTT-00229886-A0

Project: Geotechnical Investigation, Humanics Sanctuary

Figure No. 4

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		CLAY brown to grey, moist to wet, soft to firm *(continued)*	52.5	10	49			
				11				
				12				
				12	HW			
				13	93 s=3.2			
				14				
				15				
				15	HW			
				16				
				16	83			
				17				
				18				
				18	HW			
				19				
				19	97 s=5.0			
			42.7	20				
		DYNAMIC CONE		21				
				22				

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled upon completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00229886-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES CUMBERLAND.GPJ TROW OTTAWA.GDT 2/25/16

Log of Borehole BH3

Project No: OTT-00229886-A0

Project: Geotechnical Investigation, Humanics Sanctuary

Figure No. 4

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		DYNAMIC CONE *(continued)*	40.5	22	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
				23				
				24				
				25				
				26				
				27				
				28				
				29				
				30				
				31				
				32				
				33				
			29.0					
		Cone Refusal at 33.5 m						

LOG OF BOREHOLE LOGS OF BOREHOLES CUMBERLAND.GPJ TROW OTTAWA.GDT 2/25/16

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled upon completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00229886-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH4

Project No: OTT-00229886-A0

Project: Geotechnical Investigation, Humanics Sanctuary

Location: 3400 Old Montreal Road, Ottawa, Ontario

Figure No. 5

Page. 1 of 3

Date Drilled: November 31, 2015

Drill Type: CME55 Track

Datum: Geodetic

Logged by: MD Checked by: ZG

Split Spoon Sample ⊠
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○⊣
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		TOPSOIL sand, some organics, some roots, brown, moist, loose to compact	59.6 / 59.3	0	10	×		
		SANDY SILT AND CLAY brown, moist, loose to compact	58.7	1	10	×		
		CLAY some silt, brown to grey, moist to wet, soft to firm		2	2	×		17.8
				2	105 s=8.8			
				3	HW	×		
				3	82 s=10.2			
				3	HW	×		16.2
				4	50 s=8.3			
				4	HW	×		
				5	58 s=29			
			54.6	5	HW	×		
		becoming wet		6	70 s=6.4			
				6	HW	×		
				7	67 s=6.1			
				8	HW	×		
				8	34 s=6.8			
				9	HW	96 ×		
				10				

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19 mm standpipe was installed in the borehole following completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00229886-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
1 Day	4.9	
Dec 14, 2015	5.0	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES CUMBERLAND.GPJ TROW OTTAWA.GDT 2/25/16

Log of Borehole BH4

Project No: OTT-00229886-A0

Project: Geotechnical Investigation, Humanics Sanctuary

Figure No. 5

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		CLAY some silt, brown to grey, moist to wet, soft to firm *(continued)*	49.6	10	65			
				11				
				12				
				13	HW			
				14	79 s=4.2			
				15				
				16				
				17	72			
				18				
				19	82			
				20				
				21				
				22				
		DYNAMIC CONE	40.7					

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19 mm standpipe was installed in the borehole following completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00229886-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
1 Day	4.9	
Dec 14, 2015	5.0	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES CUMBERLAND.GPJ TROW OTTAWA.GDT 2/25/16

Log of Borehole BH4

Project No: OTT-00229886-A0

Project: Geotechnical Investigation, Humanics Sanctuary

Figure No. 5

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		DYNAMIC CONE *(continued)*	37.6	22	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
				23				
				24				
				25				
				26				
				27				
				28				
				29				
				30				
			28.7					
		Cone Refusal at 30.9 m						

LOG OF BOREHOLE LOGS OF BOREHOLES CUMBERLAND.GPJ TROW OTTAWA.GDT 2/25/16

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A 19 mm standpipe was installed in the borehole following completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00229886-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
1 Day	4.9	
Dec 14, 2015	5.0	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH6

Project No: OTT-00229886-A0

Project: Geotechnical Investigation, Humanics Sanctuary

Location: 3400 Old Montreal Road, Ottawa, Ontario

Figure No. 6

Page. 1 of 4

Date Drilled: December 3-4, 2015

Drill Type: CME55 Track

Datum: Geodetic

Logged by: BV Checked by: ZG

Split Spoon Sample ⊠
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test —
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		CLAYEY SAND brown, moist, soft	62.3	0	9	×		
				1	4	×		
		CLAY slightly sandy, grey, moist to wet, soft to firm	60.8	2	6	×		17.4
				2	3	×		17.3
				3	81 s=6.4			
				HW		×		
				5	61 s=7.1			
		becoming wet		6				
				HW		|—○ ×		
				7	49 s=8.0			
				8				
				9				
				HW		×		
				10				

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled upon completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00229886-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES CUMBERLAND.GPJ TROW OTTAWA.GDT 2/25/16

Log of Borehole BH6

Project No: OTT-00229886-A0

Project: Geotechnical Investigation, Humanics Sanctuary

Figure No. 6

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		CLAY slightly sandy, grey, moist to wet, soft to firm *(continued)*	52.3	10	78			
				11				
				12				
				12	HW			
				13				
				14				
				15				
				15	HW			
				16				
				16	83			
				17				
				18				
				18	HW			
				19				
				19	93			
			42.5	20	s=3.8			
		DYNAMIC CONE		20				
				21				
				22				

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled upon completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00229886-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES CUMBERLAND.GPJ TROW OTTAWA.GDT 2/25/16

Log of Borehole BH6

Project No: OTT-00229886-A0

Project: Geotechnical Investigation, Humanics Sanctuary

Figure No. 6

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		DYNAMIC CONE *(continued)*	40.3	22	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
				23				
				24				
				25				
				26				
				27				
				28				
				29				
				30				
				31				
				32				
				33				
				34				

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled upon completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00229886-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES CUMBERLAND.GPJ TROW OTTAWA.GDT 2/25/16

Log of Borehole BH6

Project No: OTT-00229886-A0

Project: Geotechnical Investigation, Humanics Sanctuary

Figure No. 6

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		DYNAMIC CONE *(continued)*	28.3	34	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
			27.5					
		Cone Refusal at 34.8 m						

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole backfilled upon completion
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00229886-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES CUMBERLAND.GPJ TROW OTTAWA.GDT 2/25/16