

**HYDROGEOLOGICAL INVESTIGATION
PROPOSED DEVELOPMENT**

613 Helena Street, Fort Erie, Ontario

Prepared for:

SS WELLAND INC.

4080 Confederation Parkway, Unit 701
Mississauga, ON L5B 0G1

Prepared by:



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Project No. 2100394AG

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Reference No.: 2100394AG

SS Welland Inc.
4080 Confederation Parkway, Unit 701
Mississauga, ON L5B 0G1
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Attention: Mr. Hunain Siddiqui
Email: hunain@emrahomes.ca

**RE: Hydrogeological Consulting Services for Proposed Development
613 Helena Street, Fort Erie, Ontario**

Dear Mr. Siddiqui,

HLV2K Engineering Limited (HLV2K) is pleased to provide the Hydrogeological Investigation Report for the above-mentioned project. The report presents HLV2K's understanding of the hydrogeological setting of the study area based on exploratory drilling, data collection, analyses, and review.

We trust that this information meets your present requirements. If we can be of additional assistance in this regard, please contact this office.

For and on behalf of HLV2K Engineering Limited,

k. Mohammadi

Kourosh Mohammadi, Ph.D., P.Eng.

President and Principal Hydrogeological Engineer

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LIST OF ACRONYMS AND DEFINITIONS

BH	Borehole
EASR	Environmental Activity and Sector Registry
GPM	Gallon per Minute
K	Hydraulic Conductivity
mbgs	Metres Below Ground Surface
MECP	Ontario Ministry of the Environment, Conservation and Parks
O.Reg.903	Ontario's Wells Regulation
PAHs	Polycyclic Aromatic Hydrocarbons
PHCs	Petroleum Hydrocarbons
PTTW	Permit To Take Water
PWQOs	Provincial Water Quality Objectives
VOCs	Volatile Organic Compounds
WWIS	Water Well Information System
WWR	Water Well Record

1 INTRODUCTION

1.1 General

HLV2K Engineering Limited (HLV2K) was retained by SS Welland Inc. (the Client) to complete a hydrogeological investigation to evaluate the site conditions at proposed development area located at 613 Helena Street in Fort Erie, Ontario (the Site). The Site location is shown on **Figure 1**.

The Site is a rectangular shaped property, approximately 8.15 (ha), lies in a typical rural setting in an area of mixed residential, agricultural and vacant land use. Approximately 60% of the subject property is used for agricultural purposes.

The Site is currently occupied by a two-storey residential dwelling and associated garage, a two-storey barn and two storage buildings (The site buildings covered approximately 15% of the total Site area). The western portion of the Site is occupied by a forested area. Prior to the development of these structures, the Site was in agricultural use.

It is our understanding that the project involves the development of a residential subdivision on the property

1.2 Purpose

The purpose of the hydrogeological investigation was to characterize the existing hydrogeological conditions at and in the vicinity of the Site, assess the need for, and options for, groundwater control in association with the proposed construction, evaluate potential impacts to the local groundwater regime resulting from the proposed construction, and identify appropriate mitigative measures, as warranted.

This hydrogeological study may be utilized in support for an application for a Permit to Take Water (PTTW) for dewatering purposes during construction or registering in Environmental Activity and Sector Registry (EASR), if necessary. The purpose of completing the PTTW / EASR application is to conduct the work in compliance with Ontario Regulation 387/04 (as amended) and the Ontario Water Resources Act (OWRA). The water taking EASR is for construction projects that require more than 50,000 liters per day (L/day) of water and less than 400,000 L/day under normal conditions. A PTTW is required for any surface water or groundwater taking during construction in excess of 400 cubic metres per day (m³/day).

2 METHOD OF INVESTIGATION

2.1 General

This hydrogeological investigation was based on review of previously completed geotechnical and environmental reports and published information for the study area, including previously published regional physiographic and geologic mapping and watershed planning reports. Many of these documents are referred to throughout various sections of this report and the relevant details can be found in the References section following the text of the report.

In particular, the work completed in association with this hydrogeological study consisted of the following tasks:

- Reviewing and interpreting available reports and published data;
- Developing Health & Safety and Sampling and Analysis Plans for work at the Site;
- Assessing the current Site conditions, areas of interest and to confirm the previous borehole locations;
- Developing the groundwater monitoring wells installed by geotechnical group on the Site by removing at least three well volumes of groundwater or two times to dry;
- Reviewing water well records available from the Ministry of the Environment, Conservation, and Parks (MECP);
- Reviewing measured groundwater levels in each of the monitoring wells located at the Site;
- Evaluating proposed construction dewatering requirements;
- Estimation of the underfloor and perimeter drainage flow for permanent dewatering; and,
- Prepare a final report on the findings of this investigation.

2.2 Boreholes and Monitoring Wells

As part of geotechnical investigation for this Site (HLV2K, 2021), eleven boreholes (BH1 to BH11), were drilled to depths varying from 4.6m to 6.9m on September 08 and 09, 2021. The boreholes were advanced by utilizing continuous flight hollow stem augers. Upon completion of drilling, each borehole was backfilled in accordance with current regulations.

Four boreholes (BH5, BH6, BH7 and BH11) were converted to groundwater monitoring well and were used to obtain hydrologic and groundwater quality information. Monitoring wells were constructed in accordance with Ontario Regulation 903. The sand pack was extended above the screened interval to allow for settling of the sand/expansion of overlaying bentonite seal. A 50mm diameter Schedule 40 polyvinyl chloride (PVC) pipe including a screen section of 3 m length with a factory machined slot width of 0.25 mm, completed with a PVC riser pipe was used.

All the pipe and screen sections were wrapped in plastic that was removed just prior to installation to minimize the potential for contamination. The base of the monitoring wells was covered with a PVC cap to prevent the influx of sediment. Clean silica sand supplied in bags, was placed in the annular space between the pipe and the sides of the borehole to obtain relatively sediment free groundwater. A bentonite seal was added to the annular space above the sand pack to reduce the infiltration of surface water into the borehole annulus.

The wells were extended to grade with solid PVC riser pipe. The sand pack was extended above the screened interval to allow for settling of the sand/expansion of overlaying bentonite seal. The wells were completed with slip on cap. Wells construction details and borehole logs from this investigation and previously drilled by others are presented in **Appendix A**.

The locations of the boreholes were established in the field by HLV2K based on the plan provided by the client. The borehole elevations and locations were surveyed and established by the HLV2K staff. The approximate borehole locations are shown in **Figure 2**.

It should be noted that the ground surface elevations noted on the appended borehole logs are approximate and were used for the purpose of relating borehole soil stratigraphy and should not be used or relied on for other purposes. Two existing and one newly installed

Table 1: Information on Groundwater Monitoring Wells

MW ID	Estimated Ground Surface Elevation (m)	Borehole Bottom		Well Screen Interval Depth (mbgs)		Well Screen Interval Elevation (m)	
		Depth (mbgs)	Elevation (m)	from	to	from	To
BH5	181.4	5.2	176.2	2.0	5.0	179.4	176.4
BH6	181.3	5.2	176.1	2.0	5.0	179.3	176.3
BH7	181.7	4.6	177.1	1.4	4.4	180.3	177.3
BH11	181.9	6.1	175.8	2.9	5.9	179.0	176.0

2.3 Groundwater Monitoring and Sampling

One (1) groundwater sample was collected from monitoring well (BH6) on September 28, 2021. This groundwater sample was collected and analyzed for general chemical parameters and compared with Provincial Water Quality Objectives (PWQOs).

Prior to sampling, all wells were developed. The development of the monitoring wells was conducted by purging and surging the well water to stress the formation around the well screen so that mobile particulates were removed. The purpose of the well development is to improve the hydraulic connection between the well and the geologic materials in the vicinity of the well, and to subsequently obtain a groundwater sample representative of the in-situ conditions. The groundwater level was measured in the monitoring wells and wells were developed by purging to dry, twice.

The collected sample was submitted to ALS Environmental Laboratories in Mississauga, a member of the Canadian Association for Laboratory Accreditation (CALA), for chemical analysis. Copies of the laboratory certificates of analysis are provided in **Appendix B**.

2.4 In-Situ Hydraulic Conductivity Testing

Rising head hydraulic conductivity tests (slug tests) were conducted on four (4) monitoring wells, BH5, BH6, BH7 and BH11 on October 21, 2021 to assess the subsurface hydraulic conductivity conditions.

A summary of the hydraulic conductivity test methodology is as follows:

- The static groundwater level in each monitoring well was initially measured and recorded;
- For the rising head test, a known volume of water was removed from each tested well using an inertial pump and low density tubing; and,
- The water level in each well was then measured and recorded at regular time intervals

The water level data from the monitoring wells were analysed using AQTESOLV Professional V4.5 and the Bouwer-Rice equation to estimate the hydraulic conductivity (K) of the soil adjacent to the screened portion of the well.

3 SITE CONDITIONS

3.1 Physical Setting

The Site is located on north side of Concession Road 5 and west side of Osborne Street. The surrounding areas are mostly vacant with natural cover and few residential and commercial properties. According to the Oak Ridges Moraine (ORM) Atlas which is available online at (<http://www.mah.gov.on.ca/page334.aspx>) and the Niagara Escarpment Plan (NEP) Maps available online at (<http://www.escarpment.org/landplanning>), the Site is not located within an area where either the Oak Ridges Moraine Conservation Plan or the Niagara Escarpment Plan would be applicable.

3.2 Climatic Conditions

Average monthly climate data from an Environment Canada climate station located at the Fort Erie (Station ID 6132470), approximately 2.2 km southwest of the Site, for the period between 1981 and 2010 is provided in **Table 2**, below (Environment Canada, 2021). The data indicates that the climate in the study area is typical continental with cold winters and warm summers and precipitation records showing local seasonal variation. As shown in **Table 2**, below, the mean annual precipitation is 1051.3 mm/year, with annual mean rainfall of 876.3 mm/year (83% of total precipitation). Average monthly precipitation ranged from 66.6 mm in February to 105.4 mm in September. The mean annual daily temperature is 8.6 degrees Celsius (°C), ranging from -4.1 °C in January to 21.2 °C in July.

Table 2: Climate Data Summary (1981 – 2010) – Fort Erie Station (ID 6132470)

MONTH	Daily Average Temperature (°C)	Average Rainfall (mm)	Average Snow (cm)	Average Precipitation (mm)
January	-4.1	34.2	44.7	78.9
February	-3.3	32.8	33.8	66.6
March	0.4	44.7	26.3	71.0
April	6.6	74.4	4.4	78.8
May	12.7	92.3	0.9	93.2
June	18.1	81.7	0.0	81.7
July	21.2	84.7	0.0	84.7
August	20.6	88.5	0.0	88.5
September	16.7	105.4	0.0	105.4
October	10.4	95.3	1.4	96.7
November	4.9	89.9	12.9	102.8
December	-0.8	52.5	50.7	103.2
Year	8.6	876.4	175.1	1051.5

NOTE: Data was obtained from Environment Canada website (Environment Canada 2021).

3.3 Physiography and Drainage

A review of the topographic map provided online by Natural Resources Canada (Toporama) depicts the Site as located within an area that is generally low relief at an approximate elevation of 122 m. The Site is located within Lake Erie drainage area part of Niagara Peninsula watershed. The Site located approximately 1.1 km north of Lake Erie.

Lake Erie drainage area contains several small creek watersheds and tile drained areas which flow generally south and discharge into Lake Erie. The Site is located within Krafts Drain area. The Kraft Drain is approximately 900 m west of the Site.

According to the physiographic regions of Ontario identified by Chapman and Putnam (2007), the Site is located in Haldimand Clay Plain physiographic region. The Haldimand Clay Plain consists of fine-grained silts and clays deposited at the bottom of a deep glacial lake basin. It is characterized by heavy clay soils which are relatively impermeable, resulting in a high level of runoff and little groundwater recharge.

3.4 Geological Mapping

Most of the Niagara Peninsula is covered by unconsolidated sediment. The unconsolidated sediments mainly resulted from glacial advances and retreats that occurred during the last glaciation period in southern Ontario (NPSA, 2013). A regional description of the Quaternary geology for the area of the Site can be found on the Ontario Geological Survey Digital Map - Surficial geology of southern Ontario (OGS, 2010) and Freenstra (1984). A section of this map showing the surficial geology in the vicinity of the Site is presented on **Figure 3**.

As shown on **Figure 3**, the surficial deposits in the immediate vicinity of the Site are mapped as deeper water glaciolacustrine unit consists of clay and silt overlying the Wentworth Till.

The sedimentary bedrock consists mainly of interbedded limestone and dolostone carbonate materials, and shale. Bedrock units of the Devonian Period (newest) to the Ordovician Period (oldest) are present. Dolomite bedrock was encountered in boreholes BH1, BH4, BH7, and BH11 at approximate depth of 4.5 m to 6.8 m.

3.5 Subsurface Soil Conditions

The subsurface soil conditions encountered during boreholes advanced at the Site are shown on the borehole logs in **Appendix A**. A summary of the soil conditions is provided below. Reference should be made to the geotechnical report (HLV2K, 2021) for a detailed description of the soil conditions at the Site.

In general, below the fill/disturbed native materials (silty clay, trace sand, trace gravel), the site is underlain by native soils (silty clay till to clayey silt till, trace gravel). The native materials encountered at all the borehole locations were quite consistent and were generally firm to very stiff silty clay till over silty clay to maximum explored depth ranging from 0.6 to 6.8 mbgs. In all borehole soft clayey materials found ranging 3.1 to 4.9 mbgs.

4 GROUNDWATER CONDITIONS

4.1 Regional Groundwater Recharge

Recharge is the process by which groundwater is replenished and involves the vertical infiltration of water through the subsoil deposits and geologic materials to the saturated zone. The major sources of recharge in the study area are a result of precipitation and freshet. The amount of groundwater recharge in a particular area depends on surficial geology, topography, and the extent of land development in that area. Generally, regional groundwater recharge is irregularly distributed temporally and spatially as interpreted from specific climatic conditions, local geology, and land development status.

The Site is mostly vacant and is currently occupied by a two-storey residential dwelling and associated garage, a two-storey barn and two storage buildings (The site buildings covered approximately 15% of the total Site area). The western portion of the Site is occupied by a forested area. Therefore, the groundwater recharge occurs under natural condition. The native soil in the area is dense with low hydraulic conductivity and the infiltration is expected to be low. However, a water balance analysis will be completed for the site to estimate the change in water recharge pre and post development. The results will be presented in a separate report.

4.2 Groundwater Level Fluctuations

The groundwater level data collected from the monitoring wells are provided in **Table 3**, below. The screen elevations of these monitoring wells are shown in **Table 1** above.

The groundwater level monitoring rounds were completed in September and October 2021 as part of this investigation. As shown in **Table 3** below, the groundwater levels in monitoring wells were measured at approximate depth of 0.41 to 2.59 m below the existing ground surface (mbgs). The corresponding elevations for groundwater were from 179.31 m to 180.84 m.

It should be noted that groundwater conditions vary depending on factors such as temperature, season, precipitation, construction activity and other situations, which may be different from those encountered at the time of the monitoring. The possibility of groundwater level fluctuations at the Site should be considered when designing and developing the construction plans for the project.

Regional groundwater flow in the area typically reflects the local topography and generally occurs from topographic highs to topographic lows. The dominant groundwater flow direction at the Site is north to south towards Lake Erie.

Table 3: Summary of Groundwater Level Observations in Monitoring Wells

MW ID	Ground Surface Elevation (m)	Groundwater Level Observations			
		28-SEP-21		21-OCT-21	
		Depth (mbgs)	Elevation (m)	Depth (mbgs)	Elevation (m)
BH5	181.4	0.82	180.58	0.76	180.64
BH6	181.3	0.90	180.35	0.41	180.84
BH7	181.7	1.43	180.31	1.36	180.38
BH11	181.9	2.59	179.31	1.09	180.81

4.3 Inferred Hydrostratigraphy

The subsurface investigations revealed that beneath the surficial materials, the subsurface conditions encountered in the boreholes consisted of fill materials overlaying native soil, and dolomite bedrock. The bedrock was relatively shallow at approximate depth of 4.5 to 6.8 mbgs. Groundwater was encountered in the silty clay layer. Conditions encountered in the monitoring wells in the silty clay layer indicated that the groundwater in this layer can be considered confined.

4.4 Results of In-Situ Hydraulic Conductivity Tests

Table 4 below summarizes the results of the hydraulic conductivity testing in the monitoring wells and the hydrostratigraphic units in which these monitoring wells were screened. The hydraulic conductivity and analysis data sheets are presented in **Appendix C**.

Table 4: Summary of In-Situ Hydraulic Conductivity Test Results

MW ID	Hydraulic Conductivity (cm/s)	Hydraulic Conductivity (m/day)	Stratigraphic Unit
BH5	1.2×10^{-6}	1.0×10^{-3}	Silty clay
BH6	7.3×10^{-7}	6.3×10^{-4}	Silty clay
BH7	2.2×10^{-6}	1.9×10^{-3}	Silty clay
BH11	2.5×10^{-7}	2.1×10^{-4}	Silty clay

4.5 Groundwater Use in the Study Area

As part of this hydrogeological study, HLV2K did a search of the MECP Water Well Information System (WWIS) database to identify active wells near the Site. The database search was for the area located within 500 m from the Site. The database search identified records for 8 wells.

Figure 4 presents the locations of the identified wells as well as the associated water use categories within 500 m around the Site. A detailed table showing water well record (WRR) information for these wells is provided in **Appendix D**. The classification of these wells is as follows:

- 3 wells stated as observation wells
- 5 wells stated as water supply.

The search revealed the presence of 5 domestic water wells or other water supply wells potentially in use in the area of the Site. These wells were completed between 1946 and 2000.

4.6 Groundwater Quality for Temporary Dewatering

During construction, the groundwater pumped in conjunction with excavation dewatering (where required) may be discharged into the water bodies within the Site. In this case, the discharge water quality will have to conform to the discharge limits identified in the Ontario Water Quality Objective Limits (PWQOs).

The analytical results for the groundwater samples from BH6 were compared to the PWQO limits. BH6 is screened in silty clay and silty clay till at approximate depth of 5.1 mbgs.

The laboratory certificates of analysis are provided in **Appendix B**. These results showed that all parameter concentrations were below the PWQO limits with the exception of copper. In addition, the detection limit of phosphorus concentration was higher than the PWQO limit.

5 GROUNDWATER DEWATERING ESTIMATES

5.1 Introduction

It is our understanding that the project is considered for approximately 8.15 ha of residential development. According to the drawings provided by the Client (**Appendix E**), all houses will have one level of basement. The finish floor of underground basement is expected to be at an approximate depth of 3 mbgs or the geodetic elevation of 179 m.

It is anticipated that the base of the footings will be about 1 m below the finished basement floor at approximate elevation 178 m±.

The highest stabilized groundwater level measured in the monitoring wells installed at the Site in was at about 180.4 m measured in BH6. Therefore, dewatering is anticipated to be necessary during construction.

Assuming that the groundwater level should be reduced as necessary to 1 m below the base of the excavations, the approximate groundwater elevation during the construction should be 177 m or less. For the purpose of calculations to estimate the potential dewatering rate, the excavation was considered as an open excavation.

Hydraulic conductivity is varied from 2.5×10^{-7} to 2.2×10^{-6} cm/s. the highest hydraulic conductivity of 2.2×10^{-6} cm/s was used in dewatering estimation.

Uniform aquifer thicknesses were assumed for the layer. According to the drawing provided to HLV2K by the Client (**Appendix E**) the area of the buildings is approximately 13,000 m² assuming approximately 50% of the lot size to be building area and basement is extended to the edge of the building.

For the purpose of the dewatering estimation, it was assumed that the excavation is carried out in stages and at each stage the excavation is a rectangular with 200 m length and 50 m wide for the largest plot.

5.2 Estimating Short-Term Dewatering Rate during Construction

The anticipated daily dewatering rates were estimated using the equations provided in the reference book "Construction Dewatering and Groundwater Control: New Methods and Applications - Third Edition. New York, New York: John Wiley & Sons (Powers et. al., 2007)", for a rectangular system of closely spaced wells to dewater an excavation. Steady flow to the excavation was assumed for the purpose of the analysis.

The estimated groundwater inflow rate (Q_R) to an excavation was calculated as follows:

$$Q_R = \frac{2 \pi K (H^2 - h^2)}{\ln \left(\frac{R}{r_e} \right)}$$

Where,

K – Hydraulic conductivity = 1.9×10^{-3} [m/d];

H – Distance from static water level to bottom of aquifer = 5.4 [m];

h – Distance from lowered water level to bottom of the aquifer = 2.0 [m];

R - Radius of the cone of depression (zone of influence) [m], estimated approximately using the following empirical relationship developed by Sichart

$$R = r_e + 3000(H - h)K^{0.5}, \text{ (K in m/s); and}$$

$$r_e = ((w \times l) / \pi)^{0.5}$$

w – excavation width and **l** – excavation length

To lower the water table 1 m below the bottom of the excavation, it is estimated that the total dewatering rate to be approximately 2.5 m³/day. The total flow at any time will depend on the length of excavation that needs dewatering and the expected rate of progress. The zone of influence (R) is estimated to be maximum 1.5 m from the edge of the excavation.

Allowing for changes in soil properties, specifically hydraulic conductivity and transmissivity, it is expected that there will be variations and changes in the amount of groundwater that can be pumped from any part of the site. Allowing a 100% contingency for the variability in hydraulic conductivity that could be experienced, the expected pumping rate needed for the site is about 5 m³/day. This rate is below the MECP threshold of 50 m³/day for registration under the Environmental Activity and Sector Registry (EASR). Considering the possibility of heavy rain during the excavation, the maximum dewatering rate is proposed to be **49 m³/day**.

It should also be noted that the construction works will most likely be carried out in stages and dewatering of the entire site for the full term of the contract will not be necessary to achieve the required drawdown.

5.3 Estimating Long-Term Drainage Requirement

The perimeter and underfloor drainage systems were proposed by geotechnical investigation to cut-off the groundwater seepage into the excavations and lower the groundwater below the subgrade level. The rate for the long-term drainage system for each house is expected to be 1.5 m³/day considering the largest plot and assuming 50% of the plot size area to be the basement area. The seeped water from surface should also be considered in the long-term drainage system. According to the Ontario Ministry of Transportation IDF Curve (available online: http://www.mto.gov.on.ca/IDF_Curves), the storm event with 2-year return period of Site is 58.8 mm/day. Assuming 50% infiltration rate for this storm event and 50% of the lot to be permeable surface, the expected infiltrated water is 12.5 m³/day.

Allowing for variations in grain size in the aquifer, specifically hydraulic conductivity and transmissivity, seepage through shoring wall or from surface, and presence of sand seems, it is expected that there will be variations in the amount of groundwater that can be drained by foundation and/or underfloor drainage systems. Therefore, it is prudent to consider a contingency factor in designing the drainage capacity. It is recommended that the drainage capacity including sumps, pumps and related utilities for foundation and underfloor drains be designed for minimum 18.9 L/min (approximately 5 GPM) for each house.

The analytical results for samples collected at the monitoring location indicated that groundwater from properly filtered drains and/or with filtration/settlement of the discharge as appropriate, would meet the Region's storm and/or sanitary discharge limits. The pumped water can also discharge into the backyard or landscape area of the house.

6 PREDICTED EFFECTS

Based on the hydrogeological information and data analysis in this report, the potential impacts to surface water and groundwater resources in the vicinity of the Site due to excavation dewatering for construction of the proposed tower at the Site are described below.

6.1 Groundwater Use

As indicated in Section 4.5, the search of the MECP water well records indicated the presence of 5 water supply wells within approximately 500 m of the Site. These wells were completed between 1946 and 2000. A water well survey is recommended before commencing the excavation to ensure the existence of these wells.

6.2 Surface Water Resources

No surface watercourse was identified in the vicinity and within the zone of influence of the dewatering. Kraft Drain is approximately 900 m west of the Site and no impact is anticipated on that.

It should be noted that the flow and water level in any surface water body is naturally fluctuated with the season and precipitation regime. Therefore, these natural fluctuations should be separated from the impact of dewatering, if any.

6.3 Discharge to Municipal Sewer System

It is our understanding that discharge to sewer municipality has not been considered during the construction and pumped water can be managed on Site. Based on the results provided in the certificate of analysis, all parameters were below the PWQos limits with the exception of dissolved copper. Since no surface body is in the vicinity of the Site, as long as the pumped water is managed within the Site, no adverse impact is expected.

7 DEWATERING MONITORING AND MITIGATION PLAN

7.1 Groundwater Monitoring

The dewatering requirements may be variable depending on the size of the excavation (length, width and depth), aquifer properties and construction methods. Suitable dewatering method(s) and volume of discharge need to be identified by the contractor using technical evaluation reports and proposed dewatering plan(s). Prior to construction, and where required, discharge permits should be in place for discharging water into local sanitary and/or storm sewers. If discharge to surface water is expected, the water quality should meet the limits of PWQOs. Due to the low hydraulic conductivity and anticipated low water quantity, the impact of groundwater on the outside of the Site is expected to be minimum.

The location(s) of the point of discharge with respect to the dewatering systems need to be confirmed by the contractor and where required, Erosion and Sedimentation Control (ESC) measures such as filter bags, straw bales, and silt fences should be implemented.

Discharge locations should be monitored on a daily basis. Discharge volume should be measured using a digital totalizing flow meter (in-line flow meter).

If any impacts attributable to the dewatering are noted, then mitigation measures should be initiated. In the event of excessive sediment, these measures could potentially include use of additional filtration measures such as settlement tanks or filter bags.

Records of daily water quantity pumped, treatment method used, water quality parameters tested, and the method of discharge should be maintained and updated regularly by the construction contractor.

7.2 Water Well Survey

Based on the results provided in water well record search, 5 water supply have been identified within 500 m radius around the Site. A water well survey is recommended before the commencement of the construction to ensure the existence of these wells. Selected wells should be monitored during the construction and water level and quality of the water should be recorded and tested. If the impact of dewatering on these wells is observed, the mitigation measures should be initiated. These measures could potentially include the reduction of the dewatering rate or supplying water to the well owner.

8 SUMMARY AND CONCLUSION

Based on the results of the subsurface investigation, hydrogeological assessment, and analysis of hydraulic conductivity testing and groundwater level monitoring data, the following summary of conclusions and recommendations is provided:

- The estimated daily groundwater pumping rate for temporary dewatering is below than the 50 m³/day PTTW or EASR threshold. The registration on MECP EASR is not required.
- It is recommended that the dewatering system be designed and evaluated by a qualified engineer and performed by a licensed dewatering contractor. The dewatering engineer/contractor should be reminded that during the dewatering activities, care must be taken to prevent the removal of fine soil particles with the pumped water or to use proper filtration prior to discharge to the Region and/or Town sewer system.
- Discharge from temporary dewatering during the construction of the proposed underground basement is expected to be managed on Site. If off-site discharge is required, the water quality should meet receiver municipality or PWQOs limits. Dissolved copper concentration was above the PWQOs limit.
- Long-term foundation and underfloor drainage system are recommended for the houses to reduce the hydrostatic pressure and remove seeped water. The anticipated flow rate including the infiltrated water from the surface is approximately 14 m³/day or less for each house. It is prudent to consider a contingency factor in designing the drainage capacity. It is recommended that the drainage capacity including sumps, pumps and related utilities is designed for minimum 18.9 L/min (5 GPM).
- HLV2K recommends the decommissioning of existing groundwater monitoring wells after completion of the construction of the project. In conformance with Ontario's Wells Regulation (O.Reg.903) of the Ontario Water Resources Act, the installation and eventual decommissioning of groundwater wells must be carried out by a licensed well contractor. If a well will be damaged/destroyed during the construction activities, then the well should be properly decommissioned in advance of that work.

9 STATEMENT OF LIMITATIONS

The contents of this report are subject to the attached '**Statement of Limitation**' sheet. The reader's attention is specifically drawn to these conditions as it is considered essential that they be followed for proper use and interpretation of this report. The Statement of Limitations is not intended to reduce the level of responsibility accepted by HLV2K, but rather to ensure that all parties who have been given reliance for this report are aware of the responsibilities each assumes in so doing.

This report was prepared by HLV2K exclusively for the account of SS WELLAND INC. (the CLIENT). Other than by the CLIENT, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of HLV2K. Any use, reliance on or decision made by any person other than CLIENT based on this report is the sole responsibility of such other person. The CLIENT and HLV2K make no representation or warranty to any other person with regard to this report and the work referred to in this report and the CLIENT and HLV2K accept no duty of care to any other person or any liability or responsibility whatsoever for any losses, expenses, damages, fines, penalties or other harm that may be suffered or incurred by any other person as a result of the use of, reliance on, any decision made or any action taken based on this report or the work referred to in this report.

10 CLOSURE

We trust that this information is satisfactory for your present requirements. Should you have any questions or require additional information, please do not hesitate to contact this office.

For and Behalf of HLV2K Engineering Limited

K. Mohammadi

Kourosh Mohammadi, PhD., P.Eng.

Principal Hydrogeological Engineer and Groundwater Modeller



REFERENCES

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- HLV2K Engineering Limited (2021). Geotechnical Investigation Report for Proposed New Subdivision at 613 Helena Street, Fort Erie, ON, Project No. 2100394AG dated November 2021.
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HLV2K Engineering Limited

STATEMENT OF LIMITATIONS

Your report has been developed based on your unique project specific requirements as understood by HLV2K Engineering Limited (HLV2K) and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking HLV2K to assess how factors that changed subsequent to the date of the report affect the report's recommendations. HLV2K cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions, which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult HLV2K to be advised how time may have impacted on the project.

The findings derived from this investigation were based on information collected and/or provided by the Client. It may become apparent that soil and groundwater conditions differ between and beyond the testing locations examined during future investigations or other work that could not be detected or anticipated at the time of this study. As such, HLV2K cannot be held liable for environmental conditions that were not apparent from the available information. The conclusions presented represent the best judgment of the assessors based on limited investigations.

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature, external data source review, sampling, and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions, which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of HLV2K through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only HLV2K, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and HLV2K cannot be held responsible for such misinterpretation.

To avoid misuse of the information contained in your report it is recommended that you confer with HLV2K before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

HLV2K Engineering Limited

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain HLV2K to work with other project design professionals who are affected by the report. Have HLV2K explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way.

Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment.

Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact HLV2K for information relating to geoenvironmental issues.

HLV2K is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with HLV2K to develop alternative approaches to problems that may be of genuine benefit both in time and in cost.

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from HLV2K to other parties but are included to identify where HLV2K's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from HLV2K closely and do not hesitate to ask any questions you may have.

Third party information reviewed and used to formulate this report is assumed to be complete and correct. HLV2K used this information in good faith and will not accept any responsibility for deficiencies, misinterpretation or incompleteness of the information contained in documents prepared by third parties.


Nothing in this report is intended to constitute or provide a legal opinion.


Should additional information become available, HLV2K requests that this information be brought to our attention so that we may re-assess the conclusions presented herein.

FIGURES



Legend

 Approx. Site Boundary

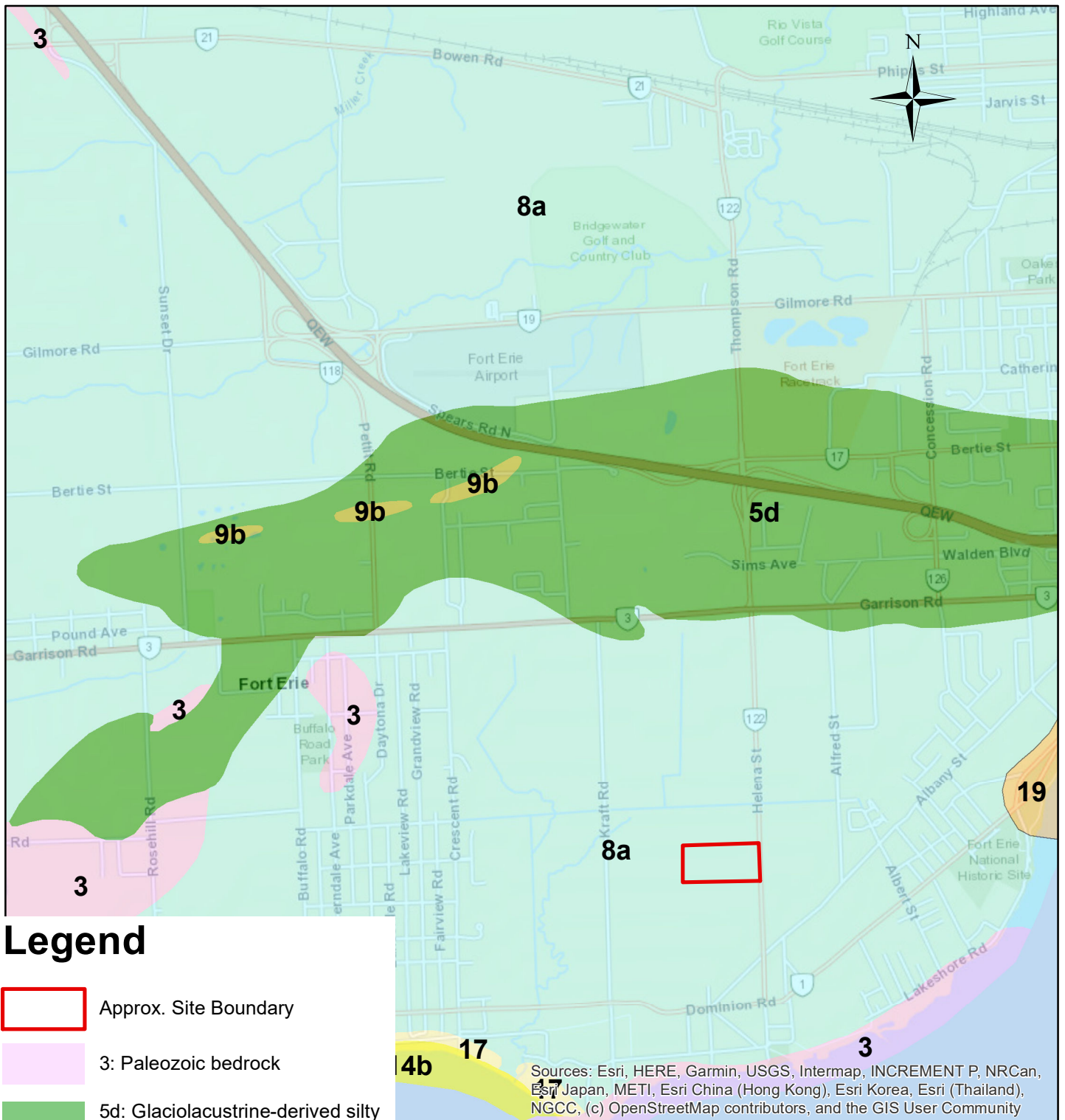
Drawn: MM	Title SITE LOCATION PLAN	
Approved: KM	Project	
Date: NOV. 2021	HYDROGEOLOGICAL INVESTIGATION	
Project No.: 2100394AG	Proposed Residential Development	
	613 Helena Street, Fort Erie, Ontario	
	Client SS WELLAND INC.	
	0 125 250 500 Meters	FIGURE 1



Legend

- Approx. Site Boundary
- Borehole
- ⊕ Monitoring Well



Drawn: MM	Title BOREHOLE LOCATION PLAN	
Approved: KM	Project	
Date: NOV. 2021	HYDROGEOLOGICAL INVESTIGATION Proposed Residential Development 613 Helena Street, Fort Erie, Ontario	
Project No.: 2100394AG	Client SS WELLAND INC.	
	0 20 40 80 Meters	FIGURE 2

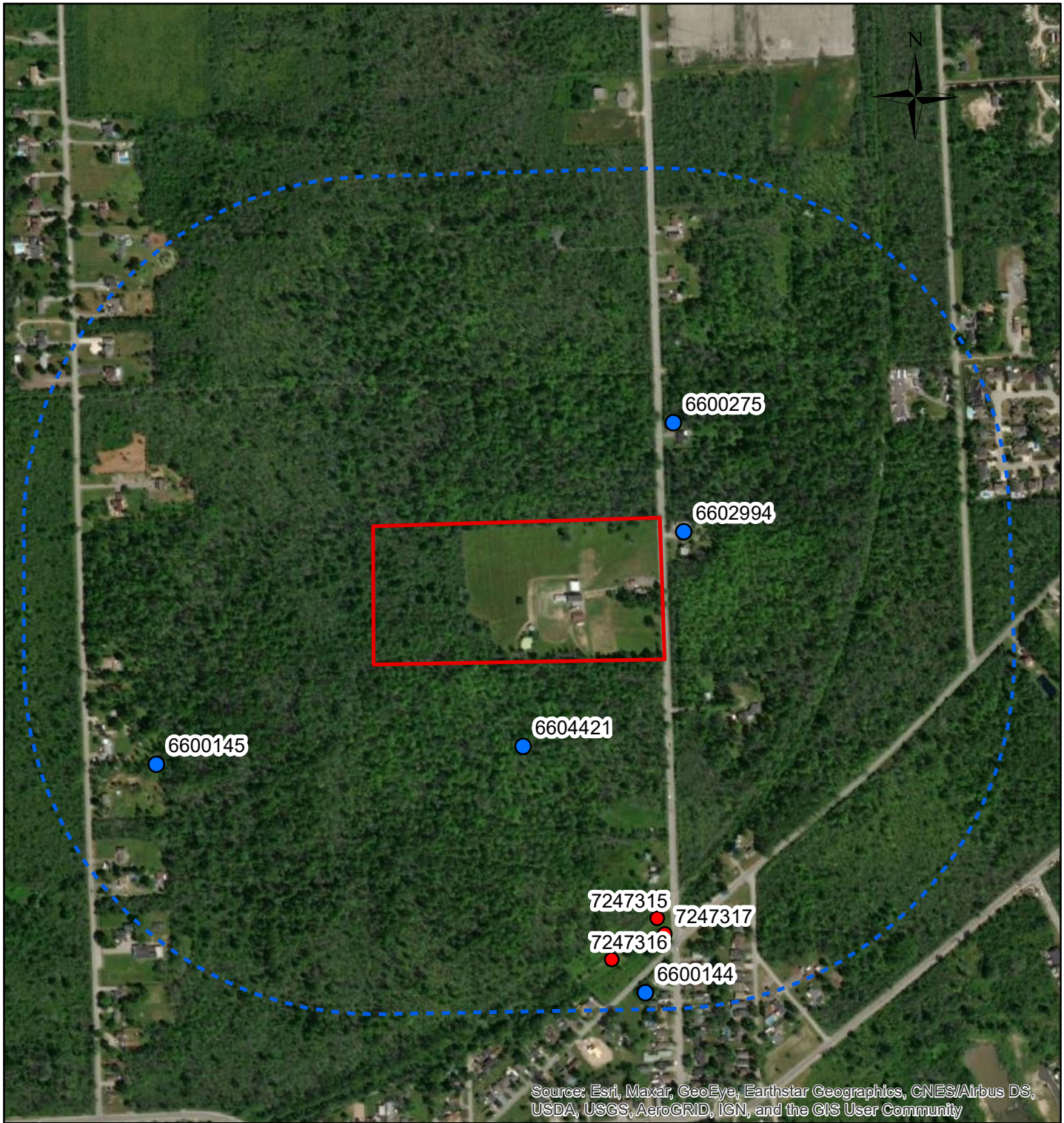


Legend


- Approx. Site Boundary
- 3: Paleozoic bedrock
- 5d: Glaciolacustrine-derived silty to clayey till
- 8a: Glaciolacustrine deep water deposits
- 9b: Littoral-foreshore deposits
- 14b: Littoral-foreshore deposits
- 17: Eolian deposits
- 19: Modern alluvial deposits

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Drawn: MM	Title	SURFICIAL GEOLOGY MAP	
Approved: KM	Project	HYDROGEOLOGICAL INVESTIGATION Proposed Residential Development 613 Helena Street, Fort Erie, Ontario	
Date: NOV. 2021	Client	SS WELLAND INC.	
Project No.: 2100394AG			
		0 255 510 1,020  Meters	FIGURE 3



Legend


 Approx. Site Boundary

 500m Buffer

Final Status

 Observation Wells

 Water Supply

Drawn: MM	Title WATER WELL RECORDS	
Approved: KM	Project	
Date: NOV. 2021	HYDROGEOLOGICAL INVESTIGATION	
Project No.: 2100394AG	Proposed Residential Development	
	613 Helena Street, Fort Erie, Ontario	
	Client SS WELLAND INC.	
	0 65 130 260 Meters	FIGURE 4

APPENDIX A

Borehole Logs

PROJECT: Sabrina Homes
 CLIENT: Sabrina Homes
 PROJECT LOCATION: 613 Helena Street, Fort Erie, ON
 DATUM: Geodetic
 BH LOCATION: See Borehole Location Plan N 4751014.752 E 668156.609

DRILLING DATA
 Method: Hollow Stem Augur
 Diameter: 150mm
 Date: Sep/08/2021
 REF. NO.: 2100394AG
 DRAWING NO.: 2

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)	
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40	60	80				100
182.2	Asphalt: 150mm	[Solid Black]													
182.0	Fill: sand and gravel, trace silt and clay, brown, moist, compact	[Cross-hatch]	1	SS	57										
181.4	Silty Clay Till: trace gravel and sand, brown, very moist, firm to very stiff	[Diagonal Hatch]	2	SS	7										
181.0			3	SS	16										1 7 45 47
180.0			4	SS	27										
179.0			5	SS	17										
178.0															
177.6	Silty Clay: trace sand, brown, moist, firm to very stiff	[Diagonal Hatch]	6	SS	6										
177.0															

Continued Next Page

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ = 3% Strain at Failure

PROJECT: Sabrina Homes
 CLIENT: Sabrina Homes
 PROJECT LOCATION: 613 Helena Street, Fort Erie, ON
 DATUM: Geodetic
 BH LOCATION: See Borehole Location Plan N 4751014.752 E 668156.609

DRILLING DATA
 Method: Hollow Stem Augur
 Diameter: 150mm
 Date: Sep/08/2021
 REF. NO.: 2100394AG
 DRAWING NO.: 2

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT					POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40	60	80	100			
175.3	Silty Clay: trace sand, brown, moist, firm to very stiff(Continued)		7	SS	8										
176.0			8	SS	50/50mm										
6.9	Bedrock: weathered, black dolomite End of Borehole: borehole terminated at 6.9m Upon completion: 1) Cave-in: open 2) Water: dry														

GROUNDWATER ELEVATIONS
 Measurement

GRAPH NOTES + 3, x 3: Numbers refer to Sensitivity ○ ●=3% Strain at Failure

PROJECT: Sabrina Homes
 CLIENT: Sabrina Homes
 PROJECT LOCATION: 613 Helena Street, Fort Erie, ON
 DATUM: Geodetic
 BH LOCATION: See Borehole Location Plan N 4750966.835 E 668089.3891

DRILLING DATA
 Method: Soild Stem Augur
 Diameter: 150mm
 Date: Sep/08/2021
 REF. NO.: 2100394AG
 DRAWING NO.: 3

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)		
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40	60	80				100	PLASTIC LIMIT W _p
181.6	0.0	Topsoil:300mm														
181.3	0.3	Disturbed Native/Fill: silty clay, trace sand and gravel, trace rootlets, brown to black, very moist, loose Silty Clay Till: trace sand, trace gravel, brown to black, very moist, stiff to very stiff	1	SS	4											
181.0	0.6		2	SS	16											
			3	SS	20											
			4	SS	15											
			5	SS	8											
			6	SS	3										1 7 52 40	
177.0	4.6	Silty Clay: trace sand, brown, very moist, soft														
176.4	5.2	End of Borehole:borehole terminated at 5.2m Upon completion: 1) Cave-in: open 2) Water: dry														

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, x 3: Numbers refer to Sensitivity ○ ●=3% Strain at Failure

PROJECT: Sabrina Homes
 CLIENT: Sabrina Homes
 PROJECT LOCATION: 613 Helena Street, Fort Erie, ON
 DATUM: Geodetic
 BH LOCATION: See Borehole Location Plan N 4750999.13 E 668085.3975

DRILLING DATA
 Method: Soild Stem Augur
 Diameter: 150mm
 Date: Sep/09/2021
 REF. NO.: 2100394AG
 DRAWING NO.: 4

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)				
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40	60	80				100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L
181.7																		
180.6	Gravel: 100mm																	
0.1	Fill: sandy silt with some gravel, organic inclusions, brown, very moist, loose		1	SS	6													
181.3	Silty Clay Till: trace sand and gravel, trace rootlets, brown, very moist, firm to stiff																	
0.4																		
1			2	SS	13													
2			3	SS	18													
3			4	SS	15													
4			5	SS	10													
177.2																		
4.6	Silty Clay: trace sand, brown, very moist, soft		6	SS	4													
176.6																		
5.2	End of Borehole: borehole terminated at 5.2m Upon completion: 1) Cave-in: open 2) Water: dry																	

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, x 3: Numbers refer to Sensitivity ○ ●=3% Strain at Failure

PROJECT: Sabrina Homes
 CLIENT: Sabrina Homes
 PROJECT LOCATION: 613 Helena Street, Fort Erie, ON
 DATUM: Geodetic
 BH LOCATION: See Borehole Location Plan N 4750990.884 E 668007.3711

DRILLING DATA
 Method: Soild Stem Augur
 Diameter: 150mm
 Date: Sep/09/2021
 REF. NO.: 2100394AG
 DRAWING NO.: 5

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)	
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)							WATER CONTENT (%)
						20 40 60 80 100 ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE				W _p	w	W _L	GR SA SI CL		
181.4	Topsoil: 150mm														
0.0 181.3	Disturbed Native/Fill: silty clay, trace gravel, trace rootlets, brown, very moist, loose		1	SS	5										
0.2															
181.0	Silty Clay Till: trace gravel, brown, very moist, firm to very stiff		2	SS	18										
0.5															
1															
2															
3															
4															
176.6	Bedrock: weathered dolomite		4	SS	14										
176.4															
5.0	End of Borehole: borehole terminated at 5.0m Upon completion: 1) Cave-in: open 2) Water: dry		6	SS50/130mm	10										

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ● = 3% Strain at Failure

PROJECT: Sabrina Homes
 CLIENT: Sabrina Homes
 PROJECT LOCATION: 613 Helena Street, Fort Erie, ON
 DATUM: Geodetic
 BH LOCATION: See Borehole Location Plan N 4750949.591 E 668062.0856

DRILLING DATA
 Method: Soild Stem Augur
 Diameter: 150mm
 Date: Sep/08/2021
 REF. NO.: 2100394AG
 DRAWING NO.: 6

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)	
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40	60	80				100
181.4	Topsoil: 150mm														
0.0 181.3 0.2	Disturbed Native/Fill: silty clay, trace gravel, trace rootlets, brown, very moist, loose		1	SS	5										
180.9 0.5	Silty Clay Till: trace gravel, brown, very moist, firm to very stiff														
1			2	SS	14										
2			3	SS	21										
			4	SS	16										
3			5	SS	10										
4															
176.8 4.6	Silty Clay: trace sand and gravel, brown, very moist, firm		6	SS	6										
176.2 5.2	End of Borehole: borehole terminated at 5.2m Upon completion: 1) Cave-in: open 2) Water: dry 3) Monitoring well installed upon completion														

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, x 3: Numbers refer to Sensitivity ○ = 3% Strain at Failure

PROJECT: Sabrina Homes
 CLIENT: Sabrina Homes
 PROJECT LOCATION: 613 Helena Street, Fort Erie, ON
 DATUM: Geodetic
 BH LOCATION: See Borehole Location Plan N 4750942.554 E 668149.6001

DRILLING DATA
 Method: Soild Stern Augur
 Diameter: 150mm
 Date: Sep/08/2021
 REF. NO.: 2100394AG
 DRAWING NO.: 7

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			"N" BLOWS 0.3 m	SHEAR STRENGTH (kPa)								
181.2																
0.0 181.1	Topsoil: 150mm															
0.2 180.9	Disturbed Native/Fill: silty clay, trace gravel, trace rootlets, brown, moist, loose		1	SS	5											
0.3	Silty Clay Till: trace sand and gravel, greyish brown, very moist, firm to very stiff															
1			2	SS	22											
			3	SS	26											
2			4	SS	14											
3			5	SS	8											
4			6	SS	4											
176.7																
4.6	Silty Clay: trace sand and gravel, brown, very moist, soft															
5																
176.1																
5.2	End of Borehole: borehole terminated at 5.2m Upon completion: 1) Cave-in: open 2) Water: dry 3) Monitoring well installed upon completion															

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES +3, x3: Numbers refer to Sensitivity ○ = 3% Strain at Failure

PROJECT: Sabrina Homes
 CLIENT: Sabrina Homes
 PROJECT LOCATION: 613 Helena Street, Fort Erie, ON
 DATUM: Geodetic
 BH LOCATION: See Borehole Location Plan N 4751054.703 E 668018.9953

DRILLING DATA
 Method: Soild Stem Augur
 Diameter: 150mm
 Date: Sep/08/2021
 REF. NO.: 2100394AG
 DRAWING NO.: 8

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS 0.3 m			20 40 60 80 100	20 40 60 80 100	W _p	w	W _L			
181.7	Topsoil: 150mm													
0.0 181.6 0.2 181.4 0.3	Disturbed Native/Fill: silty clay, trace gravel, trace rootlets, brown, very moist, loose Silty Clay Till: trace gravel, brown, very moist, firm to very stiff	1	SS	7										
1		2	SS	12										
2		3	SS	22										
3		4	SS	16										
3.1 178.7	Silty Clay: trace sand and gravel, brown, very moist, firm	5	SS	6										
4														
177.2 4.5 177.4	Bedrock: weathered dolomite													
4.6	End of Borehole: borehole terminated at 4.6m Upon completion: 1) Cave-in: open 2) Water: dry 3) Monitoring well installed upon completion	6	SS	50/50mm										

W. L. 179.5 m
Oct 21, 2021

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ●=3% Strain at Failure

PROJECT: Sabrina Homes
 CLIENT: Sabrina Homes
 PROJECT LOCATION: 613 Helena Street, Fort Erie, ON
 DATUM: Geodetic
 BH LOCATION: See Borehole Location Plan N 4751060.32 E 668093.7114

DRILLING DATA
 Method: Soild Stern Augur
 Diameter: 150mm
 Date: Sep/08/2021
 REF. NO.: 2100394AG
 DRAWING NO.: 9

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)		
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40	60	80				100	PLASTIC LIMIT W _p
181.8	0.0	Topsoil: 230mm														
181.5	0.2	Disturbed Native/Fill: silty clay, trace gravel, trace rootlets, brown, very moist, loose Silty Clay Till: trace sand and gravel, brown, very moist, firm to very stiff	1	SS	5											
181.3	0.5															
	1			2	SS	15										
	2			3	SS	21										
	3			4	SS	18										
178.7	3.1	Silty Clay: trace sand and gravel, brown, very moist, firm turning soft	5	SS	6											
	4															
	5			6	SS	3										
176.6	5.2	End of Borehole: borehole terminated at 5.2m Upon completion: 1) Cave-in: open 2) Water: dry														

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, x 3: Numbers refer to Sensitivity ○ = 3% Strain at Failure

PROJECT: Sabrina Homes
 CLIENT: Sabrina Homes
 PROJECT LOCATION: 613 Helena Street, Fort Erie, ON
 DATUM: Geodetic
 BH LOCATION: See Borehole Location Plan N 4751026.281 E 668127.6148

DRILLING DATA
 Method: Soild Stern Augur
 Diameter: 150mm
 Date: Sep/09/2021
 REF. NO.: 2100394AG
 DRAWING NO.: 10

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40	60	80							100
181.8 0.0	Topsoil: 230mm																	
181.6 0.2	Disturbed Native/Fill: silty clay, trace gravel, trace rootlets, brown, very moist, loose	[Hatched Pattern]	1	SS	6													
181.3 0.5																		
	Silty Clay Till: trace sand and gravel, brown, very moist, firm to very stiff	[Hatched Pattern]	2	SS	16													
			3	SS	20													
			4	SS	16													
			5	SS	3													
178.7 3.1	Silty Clay: trace sand, brown, very moist, firm turning soft	[Hatched Pattern]	5	SS	8													
		[Hatched Pattern]	6	SS	3													
176.6 5.2			End of Borehole: borehole terminated at 5.2m Upon completion: 1) Cave-in: open 2) Water: dry															

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, x 3: Numbers refer to Sensitivity ○ ●=3% Strain at Failure

PROJECT: Sabrina Homes
 CLIENT: Sabrina Homes
 PROJECT LOCATION: 613 Helena Street, Fort Erie, ON
 DATUM: Geodetic
 BH LOCATION: See Borehole Location Plan N 4750966.835 E 668089.3891

DRILLING DATA
 Method: Soild Stern Augur
 Diameter: 150mm
 Date: Sep/09/2021
 REF. NO.: 2100394AG
 DRAWING NO.: 11

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)			
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40	60	80				100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W
181.6	Topsoil: 150mm																
181.4	Disturbed Native/Fill: silty clay, trace gravel, trace rootlets, brown, very moist, loose Silty Clay Till: trace sand and gravel, brown, very moist, firm to very stiff		1	SS	5												
181.1			2	SS	13												
181.05			3	SS	20												
181.0			4	SS	23												
180.5			5	SS	8												
178.5			Silty Clay: trace sand, brown, very moist, firm		6	SS	4										
176.4	End of Borehole: borehole terminated at 5.2m Upon completion: 1) Cave-in: open 2) Water: dry																

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, x 3: Numbers refer to Sensitivity ○ ●=3% Strain at Failure

PROJECT: Sabrina Homes
 CLIENT: Sabrina Homes
 PROJECT LOCATION: 613 Helena Street, Fort Erie, ON
 DATUM: Geodetic
 BH LOCATION: See Borehole Location Plan N 4751054.793 E 668166.184

DRILLING DATA
 Method: Soild Stern Augur
 Diameter: 150mm
 Date: Sep/08/2021
 REF. NO.: 2100394AG
 DRAWING NO.: 12

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m ³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40						
0.0	Topsoil: 150mm													
181.8	Disturbed Native/Fill: silty clay, trace gravel, trace rootlets, brown, moist, loose	1	SS	5										
0.2														
181.4	Silty Clay Till: trace sand and gravel, brown, very moist, firm to very stiff	2	SS	14										
0.5														
1		3	SS	18										
2		4	SS	20										
3		5	SS	14										
4		6	SS	4										
177.3	Silty Clay: trace sand, brown, very moist, firm	7	SS	60mm										
4.6														
6														
175.9	Bedrock: weathered, dolomite													
176.8	End of Borehole: borehole terminated at 6.1m													
6.1	Upon completion: 1) Cave-in: open 2) Water: dry 3) Monitoring well installed upon completion													

GROUNDWATER ELEVATIONS
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, x 3: Numbers refer to Sensitivity ○ = 3% Strain at Failure

APPENDIX B

Water Quality Certificates of Analysis



HLV2K Engineering Limited (Brampton)
ATTN: Kourosh Mohammadi
2179 Dunwin Drive
Unit 4
Mississauga ON L5L 1X2

Date Received: 28-SEP-21
Report Date: 07-OCT-21 11:14 (MT)
Version: FINAL

Client Phone: 437-370-0317

Certificate of Analysis

Lab Work Order #: L2644748
Project P.O. #: NOT SUBMITTED
Job Reference: 2100394AG
C of C Numbers:
Legal Site Desc:

Comments: ADDITIONAL 29-SEP-21 07:56

Amanda Overholster
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 5730 Coopers Avenue, Unit #26, Mississauga, ON L4Z 2E9 Canada | Phone: +1 905 507 6910 | Fax: +1 905 507 6927
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

Summary of Guideline Exceedances

Guideline		Grouping	Analyte	Result	Guideline Limit	Unit
ALS ID	Client ID					
Ontario Provincial Water Quality Objectives (JULY, 1994) - Surface Water PWQO						
L2644748-1	BH6	Dissolved Metals	Copper (Cu)-Dissolved	0.00133	0.001	mg/L
			Phosphorus (P)-Dissolved	<0.050	0.01	mg/L

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Physical Tests - WATER

Lab ID L2644748-1
Sample Date 28-SEP-21
Sample ID BH6

Analyte	Unit	Guide Limits		
		#1	#2	
Colour, Apparent	CU	-	-	<2.0 ^{PEHT}
Conductivity	umhos/cm	-	-	968
pH	pH units	6.5-8.5	-	8.05
Total Dissolved Solids	mg/L	-	-	541 ^{DLDS}
Turbidity	NTU	-	-	<0.10

Guide Limit #1: Surface Water PWQO

- Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
- Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Anions and Nutrients - WATER

Lab ID L2644748-1
Sample Date 28-SEP-21
Sample ID BH6

Analyte	Unit	Guide Limits		
		#1	#2	
Alkalinity, Bicarbonate (as CaCO3)	mg/L	-	-	486
Alkalinity, Carbonate (as CaCO3)	mg/L	-	-	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	-	-	<1.0
Alkalinity, Total (as CaCO3)	mg/L	-	-	486
Ammonia, Total (as N)	mg/L	-	-	0.041
Bromide (Br)	mg/L	-	-	<0.10
Chloride (Cl)	mg/L	-	-	4.17
Computed Conductivity	uS/cm	-	-	911
Conductivity % Difference	%	-	-	-6
Fluoride (F)	mg/L	-	-	0.699
Hardness (as CaCO3)	mg/L	-	-	514
Ion Balance	%	-	-	112
Langelier Index		-	-	1
Nitrate and Nitrite as N	mg/L	-	-	0.129
Nitrate (as N)	mg/L	-	-	0.129
Nitrite (as N)	mg/L	-	-	<0.010
Saturation pH	pH	-	-	7.09
Orthophosphate-Dissolved (as P)	mg/L	-	-	0.0099
TDS (Calculated)	mg/L	-	-	579
Sulfate (SO4)	mg/L	-	-	103
Anion Sum	me/L	-	-	10.4
Cation Sum	me/L	-	-	11.6
Cation - Anion Balance	%	-	-	6

Guide Limit #1: Surface Water PWQO

- Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
- Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Organic / Inorganic Carbon - WATER

Lab ID L2644748-1
Sample Date 28-SEP-21
Sample ID BH6

Analyte	Unit	Guide Limits		
		#1	#2	
Dissolved Carbon Filtration Location		-	-	LAB
Dissolved Organic Carbon	mg/L	-	-	4.25

Guide Limit #1: Surface Water PWQO

- Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
- Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Inorganic Parameters - WATER

Lab ID L2644748-1
Sample Date 28-SEP-21
Sample ID BH6

Guide Limits
Unit #1 #2

Analyte	Unit	#1	#2	
Silica	mg/L	-	-	12.8

Guide Limit #1: Surface Water PWQO

- Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
- Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Bacteriological Tests - WATER

Lab ID L2644748-1
Sample Date 28-SEP-21
Sample ID BH6

Guide Limits
Unit #1 #2

Analyte	Unit	#1	#2	
E. Coli	CFU/100m L	100	-	0
Total Coliforms	CFU/100m L	-	-	0

Guide Limit #1: Surface Water PWQO

- Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
- Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Dissolved Metals - WATER

Analyte	Unit	Guide Limits		
		#1	#2	
		Lab ID	L2644748-1	
		Sample Date	28-SEP-21	
		Sample ID	BH6	
Dissolved Metals Filtration Location		-	-	LAB
Aluminum (Al)-Dissolved	mg/L	0.015	-	<0.0050
Antimony (Sb)-Dissolved	mg/L	0.02	-	0.00040
Arsenic (As)-Dissolved	mg/L	0.005	-	0.00102
Barium (Ba)-Dissolved	mg/L	-	-	0.0871
Beryllium (Be)-Dissolved	mg/L	0.011	-	<0.00010
Bismuth (Bi)-Dissolved	mg/L	-	-	<0.000050
Boron (B)-Dissolved	mg/L	0.2	-	0.133
Cadmium (Cd)-Dissolved	mg/L	0.0001	-	<0.000010
Calcium (Ca)-Dissolved	mg/L	-	-	54.1
Chromium (Cr)-Dissolved	mg/L	-	-	<0.00050
Cobalt (Co)-Dissolved	mg/L	0.0009	-	0.00027
Copper (Cu)-Dissolved	mg/L	0.001	-	0.00133
Iron (Fe)-Dissolved	mg/L	0.3	-	<0.010
Lead (Pb)-Dissolved	mg/L	0.001	-	<0.000050
Magnesium (Mg)-Dissolved	mg/L	-	-	92.0
Manganese (Mn)-Dissolved	mg/L	-	-	0.0298
Molybdenum (Mo)-Dissolved	mg/L	0.04	-	0.0105
Nickel (Ni)-Dissolved	mg/L	0.025	-	0.00148
Phosphorus (P)-Dissolved	mg/L	0.01	-	<0.050
Potassium (K)-Dissolved	mg/L	-	-	5.05
Selenium (Se)-Dissolved	mg/L	0.1	-	0.0110
Silicon (Si)-Dissolved	mg/L	-	-	6.00
Silver (Ag)-Dissolved	mg/L	0.0001	-	<0.000050
Sodium (Na)-Dissolved	mg/L	-	-	28.1
Strontium (Sr)-Dissolved	mg/L	-	-	6.75
Sulfur (S)-Dissolved	mg/L	-	-	35.0
Thallium (Tl)-Dissolved	mg/L	0.0003	-	0.000026
Tin (Sn)-Dissolved	mg/L	-	-	0.00097
Titanium (Ti)-Dissolved	mg/L	-	-	<0.00030

Guide Limit #1: Surface Water PWQO

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Dissolved Metals - WATER

Lab ID L2644748-1
Sample Date 28-SEP-21
Sample ID BH6

Analyte	Unit	Guide Limits		
		#1	#2	
Tungsten (W)-Dissolved	mg/L	0.03	-	<0.00010
Uranium (U)-Dissolved	mg/L	0.005	-	0.00428
Vanadium (V)-Dissolved	mg/L	0.006	-	0.00183
Zinc (Zn)-Dissolved	mg/L	0.02	-	<0.0010
Zirconium (Zr)-Dissolved	mg/L	0.004	-	<0.00030

Guide Limit #1: Surface Water PWQO

- Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
- Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
PEHT	Parameter Exceeded Recommended Holding Time Prior to Analysis

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
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ALK-SPEC-PCT-WT	Water	Automated Speciated Alkalinity	APHA 2320B
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This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

BR-IC-N-WT	Water	Bromide in Water by IC	EPA 300.1 (mod)
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Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CL-IC-N-WT	Water	Chloride by IC	EPA 300.1 (mod)
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Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

COLOUR-APPARENT-WT	Water	Colour	APHA 2120
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Apparent Colour is measured spectrophotometrically by comparison to platinum-cobalt standards using the single wavelength method after sample decanting. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.

DOC-WT	Water	Dissolved Organic Carbon	APHA 5310B
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Sample is filtered through a 0.45um filter, then injected into a heated reaction chamber which is packed with an oxidative catalyst. The water is vaporized and the organic carbon is oxidized to carbon dioxide. The carbon dioxide is transported in a carrier gas and is measured by a non-dispersive infrared detector.

EC-MF-WT	Water	E. coli	SM 9222D
-----------------	-------	---------	----------

A 100 mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at 44.5 – 0.2 °C for 24 – 2 h. Method ID: WT-TM-1200

EC-SCREEN-WT	Water	Conductivity Screen (Internal Use Only)	APHA 2510
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Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

EC-WT	Water	Conductivity	APHA 2510 B
--------------	-------	--------------	-------------

Water samples can be measured directly by immersing the conductivity cell into the sample.

ETL-N2N3-WT	Water	Calculate from NO2 + NO3	APHA 4110 B
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ETL-SILICA-CALC-WT	Water	Calculate from SI-TOT-WT	EPA 200.8
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F-IC-N-WT	Water	Fluoride in Water by IC	EPA 300.1 (mod)
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Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

IONBALANCE-OP03-WT	Water	Detailed Ion Balance Calculation	APHA 1030E, 2330B, 2510A
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MET-D-CCMS-WT	Water	Dissolved Metals in Water by CRC	APHA 3030B/6020A (mod)
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Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
ICPMS			
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).			
NH3-F-WT	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-IC-WT	Water	Nitrite in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-IC-WT	Water	Nitrate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
PH-WT	Water	pH	APHA 4500 H-Electrode
Water samples are analyzed directly by a calibrated pH meter.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days			
PO4-DO-COL-WT	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.			
SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
SOLIDS-TDS-WT	Water	Total Dissolved Solids	APHA 2540C
This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.			
TC-MF-WT	Water	Total Coliforms	SM 9222B
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200			
TURBIDITY-WT	Water	Turbidity	APHA 2130 B
Sample result is based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. Sample readings are obtained from a Nephelometer.			

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Reference Information

L2644748 CONT'D....
Job Reference: 2100394AG
PAGE 12 of 12
07-OCT-21 11:14 (MT)

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.



Quality Control Report

Workorder: L2644748

Report Date: 07-OCT-21

Page 1 of 11

Client: HLV2K Engineering Limited (Brampton)
 2179 Dunwin Drive Unit 4
 Mississauga ON L5L 1X2

Contact: Kourosh Mohammadi

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-SPEC-PCT-WT								
	Water							
Batch	R5605452							
WG3628224-4	DUP	WG3628224-3						
Alkalinity, Total (as CaCO3)		97.6	94.8		mg/L	2.9	20	30-SEP-21
Alkalinity, Bicarbonate (as CaCO3)		97.6	94.8		mg/L	2.9	20	30-SEP-21
Alkalinity, Carbonate (as CaCO3)		<1.0	<1.0	RPD-NA	mg/L	N/A	20	30-SEP-21
Alkalinity, Hydroxide (as CaCO3)		<1.0	<1.0	RPD-NA	mg/L	N/A	20	30-SEP-21
WG3628224-2	LCS							
Alkalinity, Total (as CaCO3)			104.3		%		85-115	30-SEP-21
WG3628224-1	MB							
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	30-SEP-21
Alkalinity, Bicarbonate (as CaCO3)			<2.0		mg/L		2	30-SEP-21
Alkalinity, Carbonate (as CaCO3)			<2.0		mg/L		2	30-SEP-21
Alkalinity, Hydroxide (as CaCO3)			<2.0		mg/L		2	30-SEP-21
BR-IC-N-WT								
	Water							
Batch	R5607207							
WG3629471-4	DUP	WG3629471-3						
Bromide (Br)		<0.10	<0.10	RPD-NA	mg/L	N/A	20	01-OCT-21
WG3629471-2	LCS							
Bromide (Br)			101.5		%		85-115	01-OCT-21
WG3629471-1	MB							
Bromide (Br)			<0.10		mg/L		0.1	01-OCT-21
WG3629471-5	MS	WG3629471-3						
Bromide (Br)			101.4		%		75-125	01-OCT-21
CL-IC-N-WT								
	Water							
Batch	R5607207							
WG3629471-4	DUP	WG3629471-3						
Chloride (Cl)		7.62	7.62		mg/L	0.0	20	01-OCT-21
WG3629471-2	LCS							
Chloride (Cl)			100.6		%		90-110	01-OCT-21
WG3629471-1	MB							
Chloride (Cl)			<0.50		mg/L		0.5	01-OCT-21
WG3629471-5	MS	WG3629471-3						
Chloride (Cl)			97.6		%		75-125	01-OCT-21
COLOUR-APPARENT-WT								
	Water							
Batch	R5605759							
WG3629030-3	DUP	L2645896-6						
Colour, Apparent		5.1	5.1		CU	1.0	20	30-SEP-21
WG3629030-2	LCS							



Quality Control Report

Workorder: L2644748

Report Date: 07-OCT-21

Page 2 of 11

Client: HLV2K Engineering Limited (Brampton)
 2179 Dunwin Drive Unit 4
 Mississauga ON L5L 1X2

Contact: Kourosh Mohammadi

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
COLOUR-APPARENT-WT Water								
Batch	R5605759							
WG3629030-2	LCS							
Colour, Apparent			100.0		%		85-115	30-SEP-21
WG3629030-1	MB							
Colour, Apparent			<2.0		CU		2	30-SEP-21
DOC-WT Water								
Batch	R5613019							
WG3630165-3	DUP	L2645135-2						
Dissolved Organic Carbon		12.6	14.2		mg/L	12	20	06-OCT-21
WG3630165-2	LCS							
Dissolved Organic Carbon			93.2		%		80-120	06-OCT-21
WG3630165-1	MB							
Dissolved Organic Carbon			<0.50		mg/L		0.5	06-OCT-21
WG3630165-4	MS	L2645135-2						
Dissolved Organic Carbon			N/A	MS-B	%		-	06-OCT-21
EC-MF-WT Water								
Batch	R5605334							
WG3627624-3	DUP	L2644972-2						
E. Coli		3	3		CFU/100mL	0.0	65	29-SEP-21
WG3627624-1	MB							
E. Coli			0		CFU/100mL		1	29-SEP-21
EC-WT Water								
Batch	R5605452							
WG3628224-4	DUP	WG3628224-3						
Conductivity		319	318		umhos/cm	0.3	10	30-SEP-21
WG3628224-2	LCS							
Conductivity			96.0		%		90-110	30-SEP-21
WG3628224-1	MB							
Conductivity			<1.0		umhos/cm		1	30-SEP-21
F-IC-N-WT Water								
Batch	R5607207							
WG3629471-4	DUP	WG3629471-3						
Fluoride (F)		0.056	0.056		mg/L	0.2	20	01-OCT-21
WG3629471-2	LCS							
Fluoride (F)			102.0		%		90-110	01-OCT-21
WG3629471-1	MB							
Fluoride (F)			<0.020		mg/L		0.02	01-OCT-21
WG3629471-5	MS	WG3629471-3						



Quality Control Report

Workorder: L2644748

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Client: HLV2K Engineering Limited (Brampton)
2179 Dunwin Drive Unit 4
Mississauga ON L5L 1X2

Contact: Kourosh Mohammadi

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F-IC-N-WT		Water						
Batch	R5607207							
WG3629471-5	MS	WG3629471-3						
Fluoride (F)			98.6		%		75-125	01-OCT-21
MET-D-CCMS-WT		Water						
Batch	R5607058							
WG3629897-4	DUP	WG3629897-3						
Aluminum (Al)-Dissolved		<0.050	<0.050	RPD-NA	mg/L	N/A	20	01-OCT-21
Antimony (Sb)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	01-OCT-21
Arsenic (As)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	01-OCT-21
Barium (Ba)-Dissolved		0.115	0.120		mg/L	4.2	20	01-OCT-21
Beryllium (Be)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	01-OCT-21
Bismuth (Bi)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	01-OCT-21
Boron (B)-Dissolved		<0.10	<0.10	RPD-NA	mg/L	N/A	20	01-OCT-21
Cadmium (Cd)-Dissolved		0.000480	0.000474		mg/L	1.3	20	01-OCT-21
Calcium (Ca)-Dissolved		135	128		mg/L	5.6	20	01-OCT-21
Chromium (Cr)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	01-OCT-21
Cobalt (Co)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	01-OCT-21
Copper (Cu)-Dissolved		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	01-OCT-21
Iron (Fe)-Dissolved		<0.10	<0.10	RPD-NA	mg/L	N/A	20	01-OCT-21
Lead (Pb)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	01-OCT-21
Magnesium (Mg)-Dissolved		27.1	29.4		mg/L	8.0	20	01-OCT-21
Manganese (Mn)-Dissolved		0.0097	0.0104		mg/L	7.5	20	01-OCT-21
Molybdenum (Mo)-Dissolved		0.00135	0.00149		mg/L	9.8	20	01-OCT-21
Nickel (Ni)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	01-OCT-21
Phosphorus (P)-Dissolved		<0.50	<0.50	RPD-NA	mg/L	N/A	20	01-OCT-21
Potassium (K)-Dissolved		3.84	3.95		mg/L	2.7	20	01-OCT-21
Selenium (Se)-Dissolved		0.00164	0.00175		mg/L	6.5	20	01-OCT-21
Silicon (Si)-Dissolved		4.48	4.61		mg/L	2.9	20	01-OCT-21
Silver (Ag)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	01-OCT-21
Sodium (Na)-Dissolved		378	398		mg/L	5.2	20	01-OCT-21
Strontium (Sr)-Dissolved		0.646	0.622		mg/L	3.8	20	01-OCT-21
Sulfur (S)-Dissolved		15.5	16.2		mg/L	4.2	20	01-OCT-21
Thallium (Tl)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	01-OCT-21
Tin (Sn)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	01-OCT-21



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Client: HLV2K Engineering Limited (Brampton)
2179 Dunwin Drive Unit 4
Mississauga ON L5L 1X2

Contact: Kourosh Mohammadi

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT		Water						
Batch	R5607058							
WG3629897-4	DUP	WG3629897-3						
Titanium (Ti)-Dissolved		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	01-OCT-21
Tungsten (W)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	01-OCT-21
Uranium (U)-Dissolved		0.00114	0.00112		mg/L	1.5	20	01-OCT-21
Vanadium (V)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	01-OCT-21
Zinc (Zn)-Dissolved		0.078	0.083		mg/L	6.4	20	01-OCT-21
Zirconium (Zr)-Dissolved		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	01-OCT-21
WG3629897-2	LCS							
Aluminum (Al)-Dissolved			94.7		%		80-120	01-OCT-21
Antimony (Sb)-Dissolved			91.5		%		80-120	01-OCT-21
Arsenic (As)-Dissolved			95.0		%		80-120	01-OCT-21
Barium (Ba)-Dissolved			98.4		%		80-120	01-OCT-21
Beryllium (Be)-Dissolved			95.6		%		80-120	01-OCT-21
Bismuth (Bi)-Dissolved			95.7		%		80-120	01-OCT-21
Boron (B)-Dissolved			91.3		%		80-120	01-OCT-21
Cadmium (Cd)-Dissolved			95.1		%		80-120	01-OCT-21
Calcium (Ca)-Dissolved			94.9		%		80-120	01-OCT-21
Chromium (Cr)-Dissolved			92.6		%		80-120	01-OCT-21
Cobalt (Co)-Dissolved			93.0		%		80-120	01-OCT-21
Copper (Cu)-Dissolved			92.3		%		80-120	01-OCT-21
Iron (Fe)-Dissolved			92.2		%		80-120	01-OCT-21
Lead (Pb)-Dissolved			93.8		%		80-120	01-OCT-21
Magnesium (Mg)-Dissolved			100.9		%		80-120	01-OCT-21
Manganese (Mn)-Dissolved			92.3		%		80-120	01-OCT-21
Molybdenum (Mo)-Dissolved			94.2		%		80-120	01-OCT-21
Nickel (Ni)-Dissolved			92.9		%		80-120	01-OCT-21
Phosphorus (P)-Dissolved			95.8		%		80-120	01-OCT-21
Potassium (K)-Dissolved			90.0		%		80-120	01-OCT-21
Selenium (Se)-Dissolved			95.4		%		80-120	01-OCT-21
Silicon (Si)-Dissolved			89.3		%		60-140	01-OCT-21
Silver (Ag)-Dissolved			90.5		%		80-120	01-OCT-21
Sodium (Na)-Dissolved			99.2		%		80-120	01-OCT-21
Strontium (Sr)-Dissolved			96.2		%		80-120	01-OCT-21
Sulfur (S)-Dissolved			95.2		%		80-120	01-OCT-21



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Client: HLV2K Engineering Limited (Brampton)
2179 Dunwin Drive Unit 4
Mississauga ON L5L 1X2

Contact: Kourosh Mohammadi

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT		Water						
Batch	R5607058							
WG3629897-2	LCS							
Thallium (Tl)-Dissolved			95.1		%		80-120	01-OCT-21
Tin (Sn)-Dissolved			90.7		%		80-120	01-OCT-21
Titanium (Ti)-Dissolved			90.4		%		80-120	01-OCT-21
Tungsten (W)-Dissolved			91.7		%		80-120	01-OCT-21
Uranium (U)-Dissolved			90.2		%		80-120	01-OCT-21
Vanadium (V)-Dissolved			94.6		%		80-120	01-OCT-21
Zinc (Zn)-Dissolved			94.7		%		80-120	01-OCT-21
Zirconium (Zr)-Dissolved			91.4		%		80-120	01-OCT-21
WG3629897-1	MB							
Aluminum (Al)-Dissolved			<0.0050		mg/L		0.005	01-OCT-21
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	01-OCT-21
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	01-OCT-21
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	01-OCT-21
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	01-OCT-21
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	01-OCT-21
Boron (B)-Dissolved			<0.010		mg/L		0.01	01-OCT-21
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	01-OCT-21
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	01-OCT-21
Chromium (Cr)-Dissolved			<0.00050		mg/L		0.0005	01-OCT-21
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	01-OCT-21
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	01-OCT-21
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	01-OCT-21
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	01-OCT-21
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	01-OCT-21
Manganese (Mn)-Dissolved			<0.00050		mg/L		0.0005	01-OCT-21
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	01-OCT-21
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	01-OCT-21
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	01-OCT-21
Potassium (K)-Dissolved			<0.050		mg/L		0.05	01-OCT-21
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	01-OCT-21
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	01-OCT-21
Silver (Ag)-Dissolved			<0.000050		mg/L		0.00005	01-OCT-21
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	01-OCT-21
Strontium (Sr)-Dissolved			<0.0010		mg/L		0.001	01-OCT-21



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Client: HLV2K Engineering Limited (Brampton)
 2179 Dunwin Drive Unit 4
 Mississauga ON L5L 1X2

Contact: Kourosh Mohammadi

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT								
	Water							
Batch	R5607058							
WG3629897-1	MB							
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	01-OCT-21
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	01-OCT-21
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	01-OCT-21
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	01-OCT-21
Tungsten (W)-Dissolved			<0.00010		mg/L		0.0001	01-OCT-21
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	01-OCT-21
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	01-OCT-21
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	01-OCT-21
Zirconium (Zr)-Dissolved			<0.00020		mg/L		0.0002	01-OCT-21
WG3629897-5	MS	WG3629897-6						
Aluminum (Al)-Dissolved			88.8		%		70-130	01-OCT-21
Antimony (Sb)-Dissolved			89.8		%		70-130	01-OCT-21
Arsenic (As)-Dissolved			96.4		%		70-130	01-OCT-21
Barium (Ba)-Dissolved			N/A	MS-B	%		-	01-OCT-21
Beryllium (Be)-Dissolved			97.0		%		70-130	01-OCT-21
Bismuth (Bi)-Dissolved			90.7		%		70-130	01-OCT-21
Boron (B)-Dissolved			N/A	MS-B	%		-	01-OCT-21
Cadmium (Cd)-Dissolved			92.6		%		70-130	01-OCT-21
Calcium (Ca)-Dissolved			N/A	MS-B	%		-	01-OCT-21
Chromium (Cr)-Dissolved			90.2		%		70-130	01-OCT-21
Cobalt (Co)-Dissolved			92.9		%		70-130	01-OCT-21
Copper (Cu)-Dissolved			76.0		%		70-130	01-OCT-21
Iron (Fe)-Dissolved			85.8		%		70-130	01-OCT-21
Lead (Pb)-Dissolved			89.0		%		70-130	01-OCT-21
Magnesium (Mg)-Dissolved			N/A	MS-B	%		-	01-OCT-21
Manganese (Mn)-Dissolved			78.7		%		70-130	01-OCT-21
Molybdenum (Mo)-Dissolved			85.2		%		70-130	01-OCT-21
Nickel (Ni)-Dissolved			90.1		%		70-130	01-OCT-21
Phosphorus (P)-Dissolved			101.9		%		70-130	01-OCT-21
Potassium (K)-Dissolved			N/A	MS-B	%		-	01-OCT-21
Selenium (Se)-Dissolved			93.2		%		70-130	01-OCT-21
Silicon (Si)-Dissolved			N/A	MS-B	%		-	01-OCT-21
Silver (Ag)-Dissolved			88.7		%		70-130	01-OCT-21
Sodium (Na)-Dissolved			N/A	MS-B	%		-	01-OCT-21



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Client: HLV2K Engineering Limited (Brampton)
 2179 Dunwin Drive Unit 4
 Mississauga ON L5L 1X2

Contact: Kourosh Mohammadi

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-WT								
	Water							
Batch	R5607207							
WG3629471-1	MB							
Nitrate (as N)			<0.020		mg/L		0.02	01-OCT-21
WG3629471-5	MS	WG3629471-3						
Nitrate (as N)			97.4		%		75-125	01-OCT-21
PH-WT								
	Water							
Batch	R5605452							
WG3628224-4	DUP	WG3628224-3						
pH		7.75	7.67	J	pH units	0.08	0.2	30-SEP-21
WG3628224-2	LCS							
pH			7.01		pH units		6.9-7.1	30-SEP-21
PO4-DO-COL-WT								
	Water							
Batch	R5605172							
WG3628180-3	DUP	WG3628180-5						
Orthophosphate-Dissolved (as P)		0.0073	0.0069		mg/L	6.0	20	30-SEP-21
WG3628180-2	LCS							
Orthophosphate-Dissolved (as P)			98.5		%		80-120	30-SEP-21
WG3628180-1	MB							
Orthophosphate-Dissolved (as P)			<0.0030		mg/L		0.003	30-SEP-21
WG3628180-4	MS	WG3628180-5						
Orthophosphate-Dissolved (as P)			98.5		%		70-130	30-SEP-21
SO4-IC-N-WT								
	Water							
Batch	R5607207							
WG3629471-4	DUP	WG3629471-3						
Sulfate (SO4)		13.0	13.0		mg/L	0.2	20	01-OCT-21
WG3629471-2	LCS							
Sulfate (SO4)			102.0		%		90-110	01-OCT-21
WG3629471-1	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	01-OCT-21
WG3629471-5	MS	WG3629471-3						
Sulfate (SO4)			98.9		%		75-125	01-OCT-21
SOLIDS-TDS-WT								
	Water							
Batch	R5606921							
WG3629395-3	DUP	L2645224-6						
Total Dissolved Solids		2290	2250		mg/L	1.8	20	01-OCT-21
WG3629395-2	LCS							
Total Dissolved Solids			99.9		%		85-115	01-OCT-21
WG3629395-1	MB							



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Client: HLV2K Engineering Limited (Brampton)
2179 Dunwin Drive Unit 4
Mississauga ON L5L 1X2

Contact: Kourosh Mohammadi

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SOLIDS-TDS-WT	Water							
Batch	R5606921							
WG3629395-1	MB							
Total Dissolved Solids			<10		mg/L		10	01-OCT-21
TC-MF-WT	Water							
Batch	R5605352							
WG3627621-3	DUP	L2644876-5						
Total Coliforms		0	0		CFU/100mL	0.0	65	29-SEP-21
WG3627621-1	MB							
Total Coliforms			0		CFU/100mL		1	29-SEP-21
TURBIDITY-WT	Water							
Batch	R5605915							
WG3628480-2	LCS							
Turbidity			102.0		%		85-115	30-SEP-21
WG3628480-1	MB							
Turbidity			<0.10		NTU		0.1	30-SEP-21

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Client: HLV2K Engineering Limited (Brampton)
2179 Dunwin Drive Unit 4
Mississauga ON L5L 1X2

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Contact: Kourosch Mohammadi

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

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Client: HLV2K Engineering Limited (Brampton)
2179 Dunwin Drive Unit 4
Mississauga ON L5L 1X2

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Contact: Kourosch Mohammadi

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Organic / Inorganic Carbon							
Dissolved Organic Carbon	1	28-SEP-21 11:00	02-OCT-21 00:00	3	4	days	EHT

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2644748 were received on 28-SEP-21 14:28.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



L2644748-COFC

Chain of Custody (COC) / Analytical Request Form

COC Number: 20 - 898430

Canada Toll Free: 1 800 668 9878

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Report To Contact and company name below will appear on the report		Reports / Recipients			Turnaround Time (TAT) Requested			AFFIX ALS BARCODE LABEL HERE (ALS use only)						
Company:	HLV2K Engineering Ltd	Select Report Format:	<input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)	<input checked="" type="checkbox"/> Routine [R] if received by 3pm M-F - no surcharges apply										
Contact:	Kouresh Mohammadi	Merge QC/QCI Reports with COA:	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A	<input type="checkbox"/> 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum										
Phone:	905-569-2765	<input checked="" type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked		<input type="checkbox"/> 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum										
Company address below will appear on the final report		Select Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	<input type="checkbox"/> 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum										
Street:	279 Dunwin Dr unit 4	Email 1 or Fax:	Kouresh.mohammadi@HLV2K.com	<input type="checkbox"/> 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum										
City/Province:	Mississauga	Email 2:		<input type="checkbox"/> Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush requests on weekends, statutory holidays and non-routine tests										
Postal Code:	L5L 1X9	Email 3:		Date and Time Required for all E&P TATs:				dd-mm-yy hh:mm am/pm						
Invoice To	Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Invoice Recipients			For all tests with rush TATs requested, please contact your AM to confirm availability.									
	Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Select Invoice Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	Analysis Request										
Company:		Email 1 or Fax:		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below										
Contact:		Email 2:		NUMBER OF CONTAINERS						SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)		
Project Information			Oil and Gas Required Fields (client use)											
ALS Account # / Quote #:		AFE/Cost Center:	PO#:											
Job #:	2100394AC	Major/Minor Code:	Routing Code:											
PO / AFE:		Requisitioner:												
LSD:		Location:												
ALS Lab Work Order # (ALS use only):	L2644748	ALS Contact:	AO											
ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type										
	BH6	28-9-21	11:00	C.W										
Drinking Water (DW) Samples¹ (client use)		Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)			SAMPLE RECEIPT DETAILS (ALS use only)									
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		PWCOS (Provincial water quality objectives)			Cooling Method: <input type="checkbox"/> NONE <input checked="" type="checkbox"/> ICE <input checked="" type="checkbox"/> ICE PACKS <input type="checkbox"/> FROZEN <input type="checkbox"/> COOLING INITIATED									
Are samples for human consumption/ use? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO					Submission Comments identified on Sample Receipt Notification: <input type="checkbox"/> YES <input type="checkbox"/> NO									
					Cooler Custody Seals Intact: <input type="checkbox"/> YES <input type="checkbox"/> N/A Sample Custody Seals Intact: <input type="checkbox"/> YES <input type="checkbox"/> N/A									
					INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C							
					7.5		7.5							
SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (ALS use only)			FINAL SHIPMENT RECEPTION (ALS use only)								
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:			
			Karan	9/28/2021	14:28	W	09/28/21				17:0			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

APPENDIX C

In-Situ Hydraulic Conductivity Testing Results

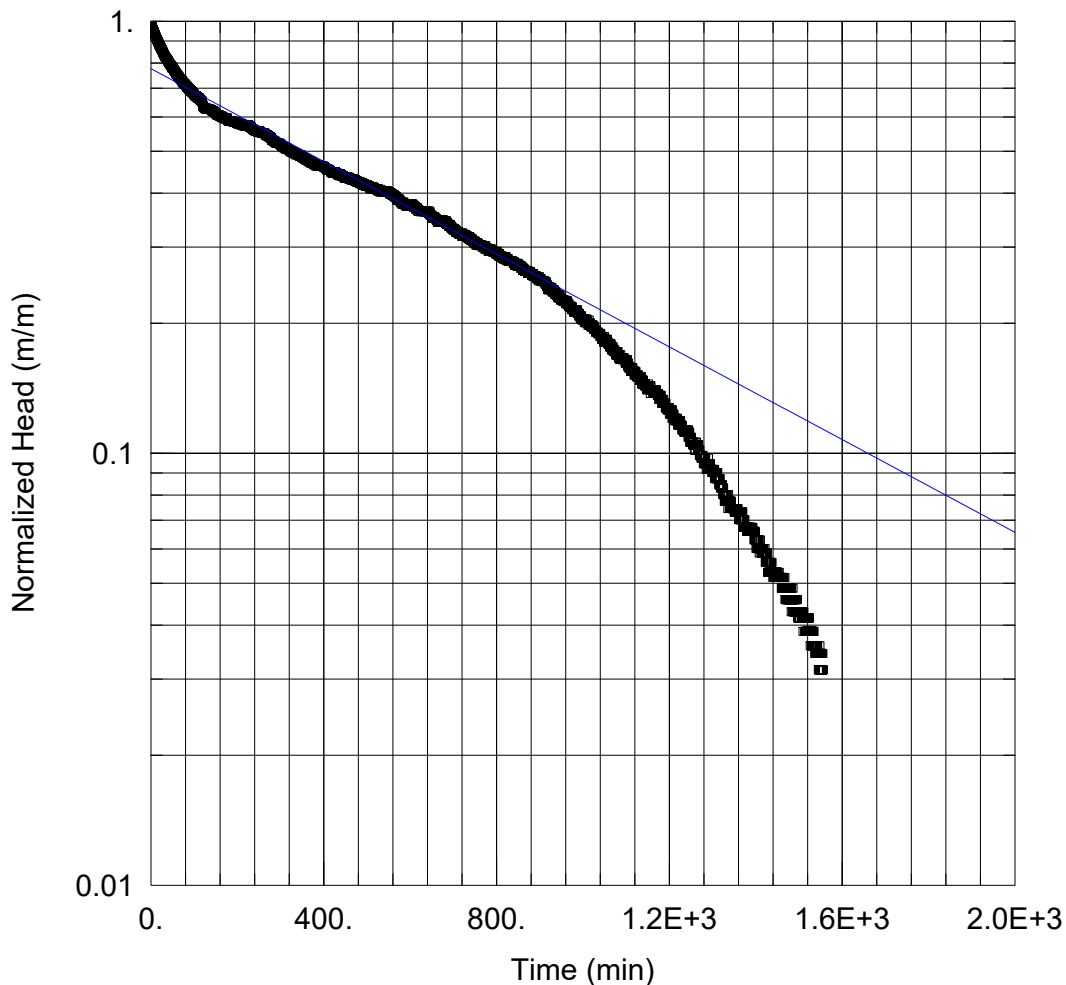
In-Situ Hydraulic Conductivity Test (BH5)

Prepared By:
HLV2K Engineering

Prepared For:
SS Welland Inc.

Project:
2100394AG

Location:
Fort Erie, Ontario



SOLUTION

Aquifer Model: Confined
 Solution Method: Bouwer-Rice
 $K = 1.183E-6$ cm/sec $y_0 = 0.5419$ m

AQUIFER DATA

Saturated Thickness: 1.4 m Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH5)

Initial Displacement: 0.698 m
 Static Water Column Height: 4.24 m
 Total Well Penetration Depth: 0.4 m
 Screen Length: 0.4 m
 Casing Radius: 0.025 m
 Well Radius: 0.1 m

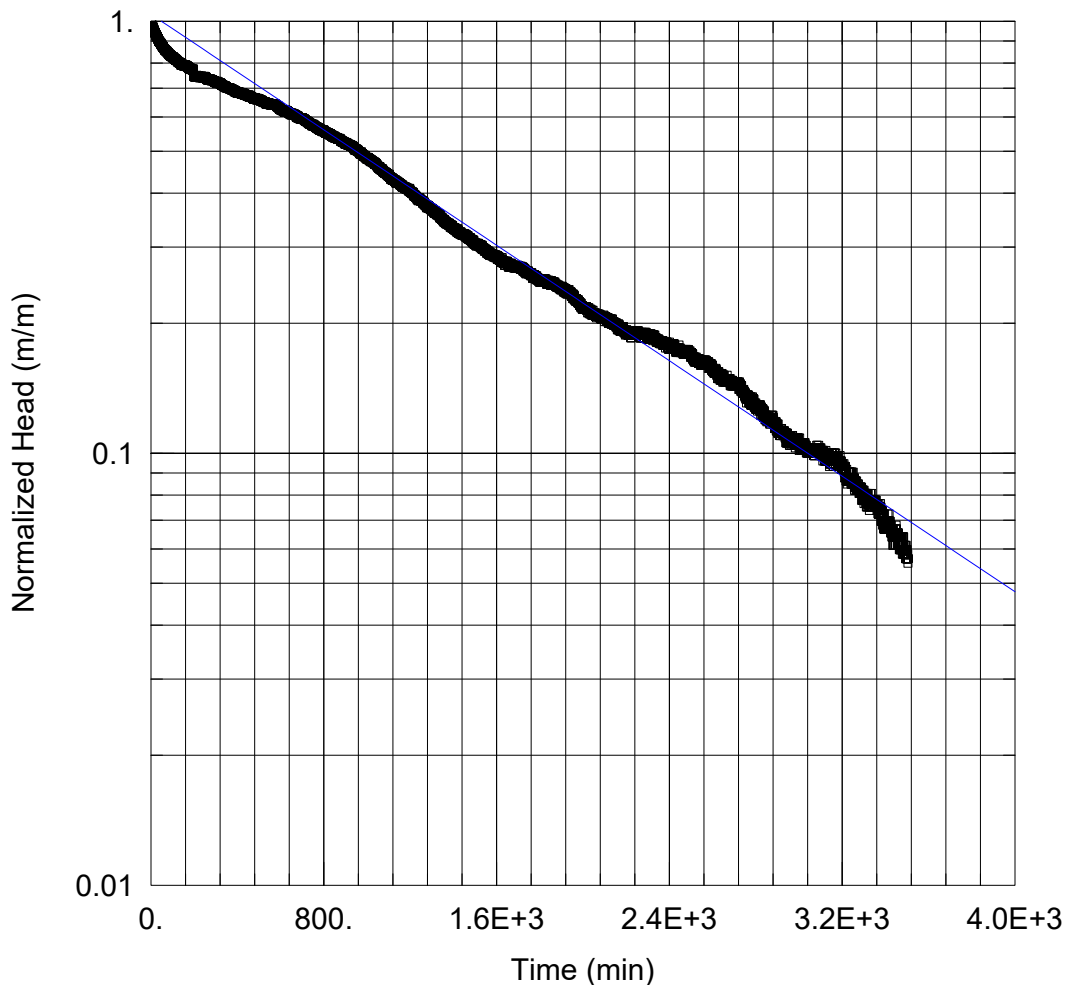
In-Situ Hydraulic Conductivity Test (BH6)

Prepared By:
HLV2K Engineering

Prepared For:
SS Welland Inc.

Project:
2100394AG

Location:
Fort Erie, Ontario



SOLUTION

Aquifer Model: Confined
 Solution Method: Bouwer-Rice
 $K = 7.339E-7$ cm/sec $y_0 = 0.7463$ m

AQUIFER DATA

Saturated Thickness: 1.5 m Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH6)

Initial Displacement: 0.719 m
 Static Water Column Height: 4.54 m
 Total Well Penetration Depth: 0.4 m
 Screen Length: 0.4 m
 Casing Radius: 0.025 m
 Well Radius: 0.1 m

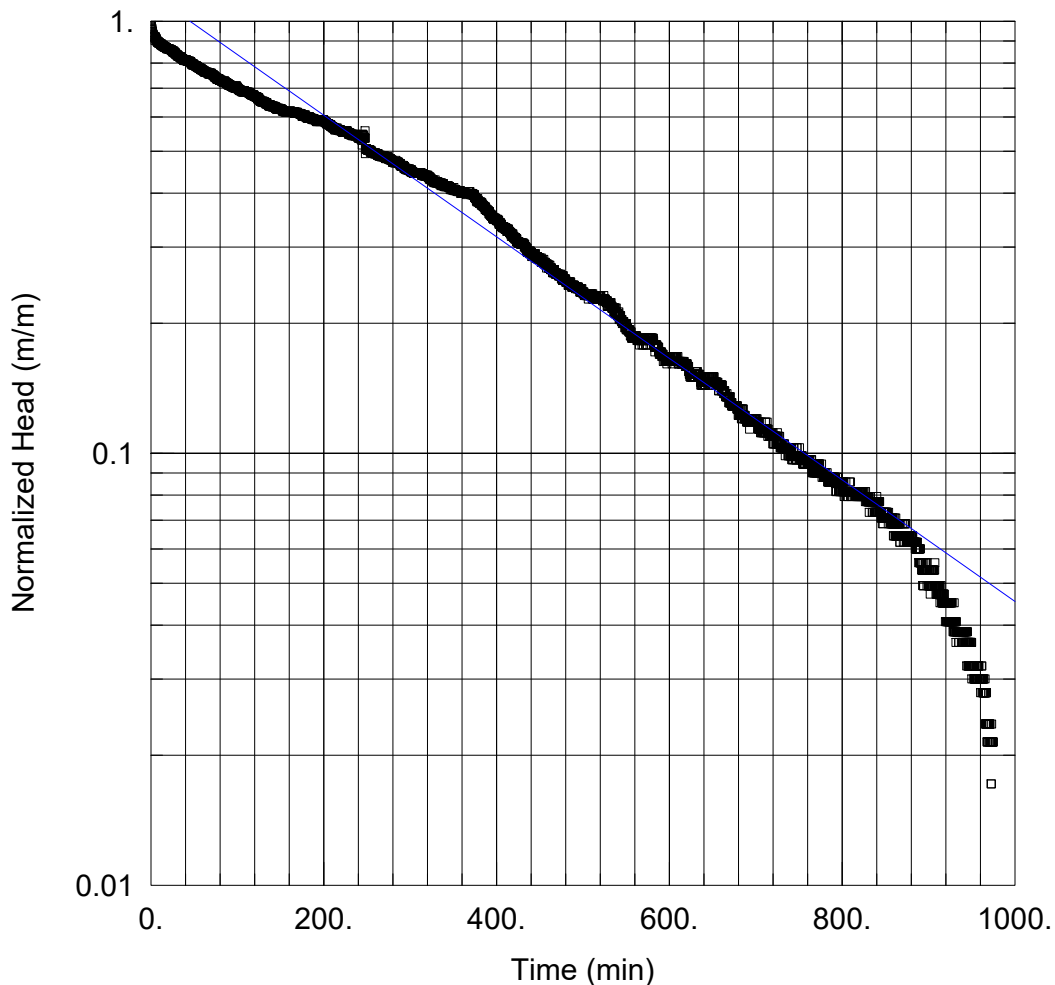
In-Situ Hydraulic Conductivity Test (BH7)

Prepared By:
HLV2K Engineering

Prepared For:
SS Welland Inc.

Project:
2100394AG

Location:
Fort Erie, Ontario



SOLUTION

Aquifer Model: Confined
 Solution Method: Bouwer-Rice
 $K = 2.185E-6$ cm/sec $y_0 = 0.5395$ m

AQUIFER DATA

Saturated Thickness: 1.46 m Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH7)

Initial Displacement: 0.466 m
 Static Water Column Height: 3.04 m
 Total Well Penetration Depth: 1.36 m
 Screen Length: 1.36 m
 Casing Radius: 0.025 m
 Well Radius: 0.1 m

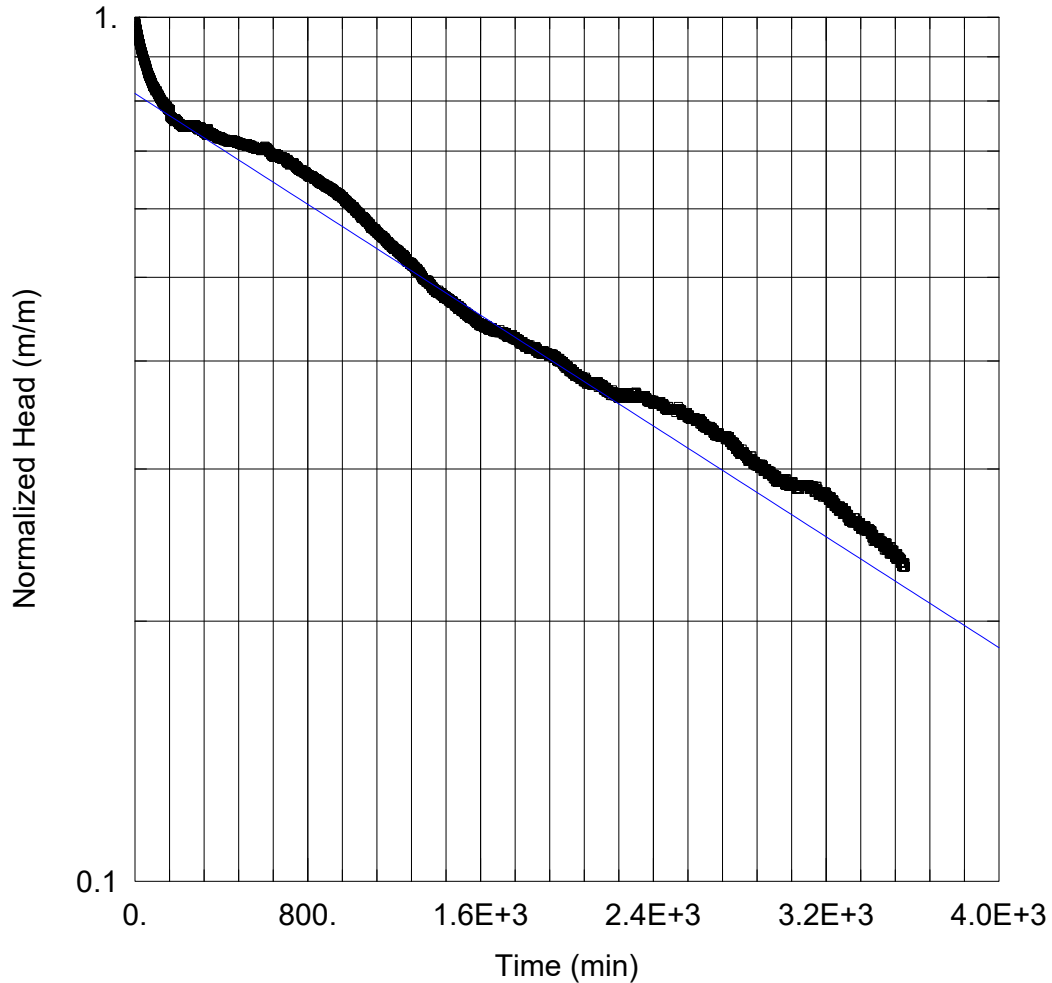
In-Situ Hydraulic Conductivity Test (BH11)

Prepared By:
HLV2K Engineering

Prepared For:
SS Welland Inc.

Project:
2100394AG

Location:
Fort Erie, Ontario



SOLUTION

Aquifer Model: Confined
 Solution Method: Bouwer-Rice
 K = 2.455E-7 cm/sec $y_0 =$ 0.7092 m

AQUIFER DATA

Saturated Thickness: 1.5 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH11)

Initial Displacement: 0.869 m
 Static Water Column Height: 4.91 m
 Total Well Penetration Depth: 1.4 m
 Screen Length: 1.4 m
 Casing Radius: 0.025 m
 Well Radius: 0.1 m

APPENDIX D

Information on Water Well Records

Water Well Record

WELL_ID	BOREHOLE ID	Easting	Northing	Well Depth (m)	Static Depth (m)	Bedrock Depth (m)	Date Completed	Final Status
6600144	10459878	668165	4750428	8.2	1.5	5.2	1967-06-28	Water Supply
6600145	10459879	667580	4750771	9.1		7.9	1946-07-10	Water Supply
6600275	10460009	668205	4751243	6.1	2.1	4.6	1961-07-10	Water Supply
6602994	10462616	668220	4751087	13.7	4.6	5.8	1974-08-17	Water Supply
6604421	10464018	667990	4750780	12.8	4.9	0.3	2000-03-20	Water Supply
7247315	1005653589	668182	4750534	4.6			2015-07-07	Observation Wells
7247316	1005653600	668117	4750475	4.3			2015-07-07	Observation Wells
7247317	1005653639	668193	4750512	4.3			2015-07-07	Observation Wells

Water Well Records

November 9, 2021

7:24:06 PM

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
FORT ERIE TOWN (BERT	17 668193 4750512 W	2015-07 7320	2 4	UT 0013		MT	0004 10	7247317 (Z214185) A187875	BRWN CLAY 0014 GREY ROCK
FORT ERIE TOWN (BERT	17 668117 4750475 W	2015-07 7320	2 4	UT 0013		MT	0004 10	7247316 (Z214186) A187874	BRWN CLAY 0014 GREY ROCK
FORT ERIE TOWN (BERT	17 668182 4750534 W	2015-07 7320	2 4	UT 0004		MT	0005 10	7247315 (Z214187) A187873	BRWN CLAY 0015 GREY ROCK
FORT ERIE TOWN (BERT CR	17 668220 4751087 W	1974-08 3661	6	FR 0044	15/30/5/2:0	DO		6602994 ()	BRWN CLAY 0019 GREY LMSN 0045
FORT ERIE TOWN (BERT CR	17 668661 4751703 W	1974-06 3640	6 6	UK 0024	5/15/5/1:0	DO		6602964 ()	BRWN LOAM 0001 BRWN CLAY 0010 GREY CLAY 0013 GREY LMSN 0025
FORT ERIE TOWN (BERT CR	17 668205 4751243 W	1961-07 5425	6 6	FR 0018	7/17/4/0:30	DO		6600275 ()	BRWN CLAY 0015 LMSN 0020
FORT ERIE TOWN (BERT CR	17 668165 4750428 W	1967-06 4720	6 6	FR 0027	5/15/20/1:0	DO		6600144 ()	BLUE CLAY 0017 LMSN 0027
FORT ERIE TOWN (BERT CR	17 668694 4751377 W	1957-07 5425	6 6	FR 0023	10/48/2/:	DO		6600032 ()	LOAM 0001 BRWN CLAY 0014 LMSN 0048
FORT ERIE TOWN (BERT LEF 02 001	17 667990 4750780 L	2000-03 4795	5 5	FR 0040	16/16/21/1:30	DO		6604421 (211395)	BLCK LOAM PCKD 0001 GREY SHLE LYRD 0016 GREY LMSN LYRD 0042
FORT ERIE TOWN (BERT LEF 02 002	17 667580 4750771 L	1946-07 4629	6	SU 0018	///:	DO		6600146 ()	LOAM 0024 LMSN 0030
FORT ERIE TOWN (BERT LEF 02 002	17 667580 4750771 L	1946-07 4629	6 6	FR 0010	///:	DO		6600145 ()	LOAM 0026 LMSN 0030
FORT ERIE TOWN (BERT LEF 03 001	17 668139 4751669 W	2015-06 7295	1.29			MO	0015 5	7244895 (Z204805) A179624	GREY GRVL GREY CLAY

TOWNSHIP CON LOT UTM DATE CNTR CASING DIA WATER PUMP TEST WELL USE SCREEN WELL FORMATION

Notes:

UTM: UTM in Zone, Easting, Northing and Datum is NAD83; L: UTM estimated from Centroid of Lot; W: UTM not from Lot Centroid
 DATE CNTR: Date Work Completed and Well Contractor Licence Number
 CASING DIA: .Casing diameter in inches
 WATER: Unit of Depth in Fee. See Table 4 for Meaning of Code

PUMP TEST: Static Water Level in Feet / Water Level After Pumping in Feet / Pump Test Rate in GPM / Pump Test Duration in Hour : Minutes
 WELL USE: See Table 3 for Meaning of Code
 SCREEN: Screen Depth and Length in feet
 WELL: WEL (AUDIT #) Well Tag . A: Abandonment; P: Partial Data Entry Only
 FORMATION: See Table 1 and 2 for Meaning of Code

1. Core Material and Descriptive terms

Code	Description	Code	Description	Code	Description	Code	Description	Code	Description
BLDR	BOULDERS	FCRD	FRACTURED	IRFM	IRON FORMATION	PORS	POROUS	SOFT	SOFT
BSLT	BASALT	FGRD	FINE-GRAINED	LIMY	LIMY	PRDG	PREVIOUSLY DUG	SPST	SOAPSTONE
CGRD	COARSE-GRAINED	FGVL	FINE GRAVEL	LMSN	LIMESTONE	PRDR	PREV. DRILLED	STKY	STICKY
CGVL	COARSE GRAVEL	FILL	FILL	LOAM	TOPSOIL	QRTZ	QUARTZITE	STNS	STONES
CHRT	CHERT	FLDS	FELDSPAR	LOOS	LOOSE	QSND	QUICKSAND	STNY	STONEY
CLAY	CLAY	FLNT	FLINT	LTCL	LIGHT-COLOURED	QTZ	QUARTZ	THIK	THICK
CLN	CLEAN	FOSS	FOSILIFEROUS	LYRD	LAYERED	ROCK	ROCK	THIN	THIN
CLYY	CLAYEY	FSND	FINE SAND	MARL	MARL	SAND	SAND	TILL	TILL
CMTD	CEMENTED	GNIS	GNEISS	MGRD	MEDIUM-GRAINED	SHLE	SHALE	UNKN	UNKNOWN TYPE
CONG	CONGLOMERATE	GRNT	GRANITE	MGVL	MEDIUM GRAVEL	SHLY	SHALY	VERY	VERY
CRYS	CRYSTALLINE	GRSN	GREENSTONE	MRBL	MARBLE	SHRP	SHARP	WBRG	WATER-BEARING
CSND	COARSE SAND	GRVL	GRAVEL	MSND	MEDIUM SAND	SHST	SCHIST	WDFR	WOOD FRAGMENTS
DKCL	DARK-COLOURED	GRWK	GREYWACKE	MUCK	MUCK	SILT	SILT	WTHD	WEATHERED
DLMT	DOLOMITE	GVLV	GRAVELLY	OBND	OVERBURDEN	SLTE	SLATE		
DNSE	DENSE	GYPG	GYPSUM	PCKD	PACKED	SLTY	SILTY		
DRTY	DIRTY	HARD	HARD	PEAT	PEAT	SNDS	SANDSTONE		
DRY	DRY	HPAN	HARDPAN	PGVL	PEA GRAVEL	SNDY	SANDY SOAPSTONE		

2. Core Color

Code	Description
WHIT	WHITE
GREY	GREY
BLUE	BLUE
GRN	GREEN
YLLW	YELLOW
BRWN	BROWN
RED	RED
BLCK	BLACK
BLGY	BLUE-GREY

3. Well Use

Code	Description	Code	Description
DO	Domestic	OT	Other
ST	Livestock	TH	Test Hole
IR	Irrigation	DE	Dewatering
IN	Industrial	MO	Monitoring
CO	Commercial	MT	Monitoring TestHole
MN	Municipal		
PS	Public		
AC	Cooling And A/C		
NU	Not Used		

4. Water Detail

Code	Description	Code	Description
FR	Fresh	GS	Gas
SA	Salty	IR	Iron
SU	Sulphur		
MN	Mineral		
UK	Unknown		

APPENDIX E

Drawing Provided by the Client

LAND USE SCHEDULE		
BLOCKS	DESCRIPTION	AREA (ha)
BLOCKS 1-17	RESIDENTIAL	2.70
BLOCK 18	STORMWATER MANAGEMENT	0.53
BLOCK 19	ENVIRONMENTAL LANDS	3.82
BLOCK 20	ROAD WIDENING	0.07
R.O.W.	STREET 'A'	1.02
TOTAL AREA		5.14

DRAFT PLAN OF SUBDIVISION

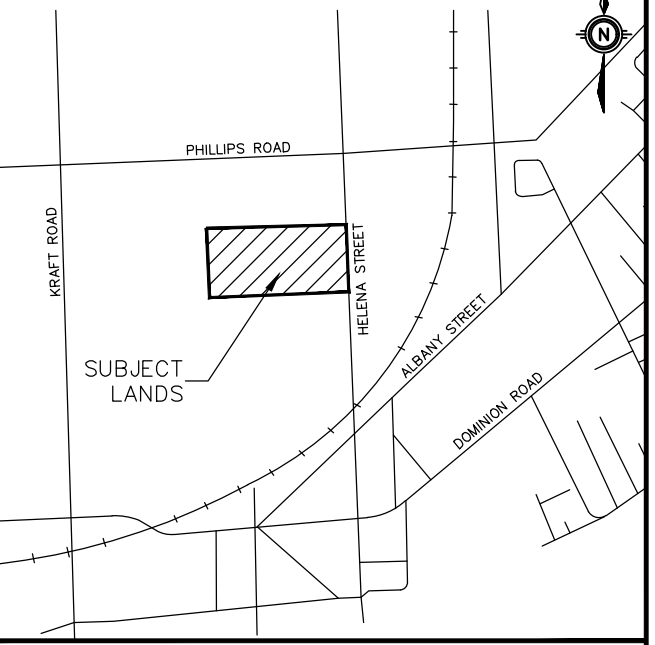
613 HELENA STREET

PART OF LOT 1, CONCESSION 2,
LAKE ERIE TOWNSHIP OF BERTIE
IN THE TOWN OF FORT ERIE
REGIONAL MUNICIPALITY OF NIAGARA

COPYRIGHT
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IBI Group Professional Services (Canada) Inc.
is a member of the IBI Group of companies

KEY MAP - N.T.S.



INFORMATION REQUIRED

- UNDER SECTION 51 (17) OF THE PLANNING ACT, R.S.O. 1990, c.P.13 AS AMENDED
- (a) - AS SHOWN
 - (b) - AS SHOWN
 - (c) - AS SHOWN
 - (d) - RESIDENTIAL
 - (e) - AS SHOWN
 - (f) - AS SHOWN
 - (g) - AS SHOWN
 - (h) - MUNICIPAL (PUBLIC)
 - (i) - SILTY CLAY
 - (j) - AS SHOWN
 - (k) - ALL SERVICES TO BE MADE AVAILABLE
 - (l) - AS SHOWN

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED ON THIS PLAN AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

SIGNED
PHILIP S. SUDA, O.L.S.
SUDA & MALESZYK SURVEYING INC.

DATE

OWNER'S CERTIFICATE

I HEREBY CONSENT TO THE FILING OF THIS PLAN BY IBI GROUP, IN DRAFT FORM.

SIGNED
MARIO BEVACQUA
1891187 ONTARIO INC.

DATE

#	DATE	BY	DESCRIPTION
1			

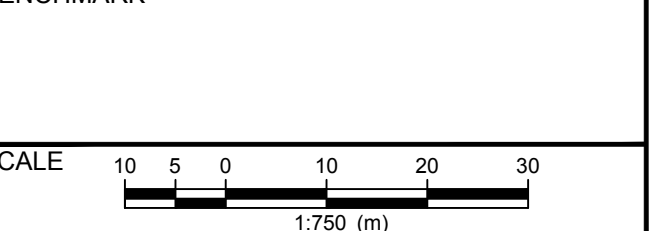
DRAWING ISSUE RECORD

#	DATE	BY	DESCRIPTION
1			

APPROVALS

IBI GROUP
Suite 200 - 360 James Street North
Hamilton ON L8L 1H5 Canada
tel 905 546 1010 fax 905 546 1011
ibigroup.com

BENCHMARK



PROJECT NO:
131951

DRAWN BY:
T. NGUYEN

CHECKED BY:
T. TUCKER

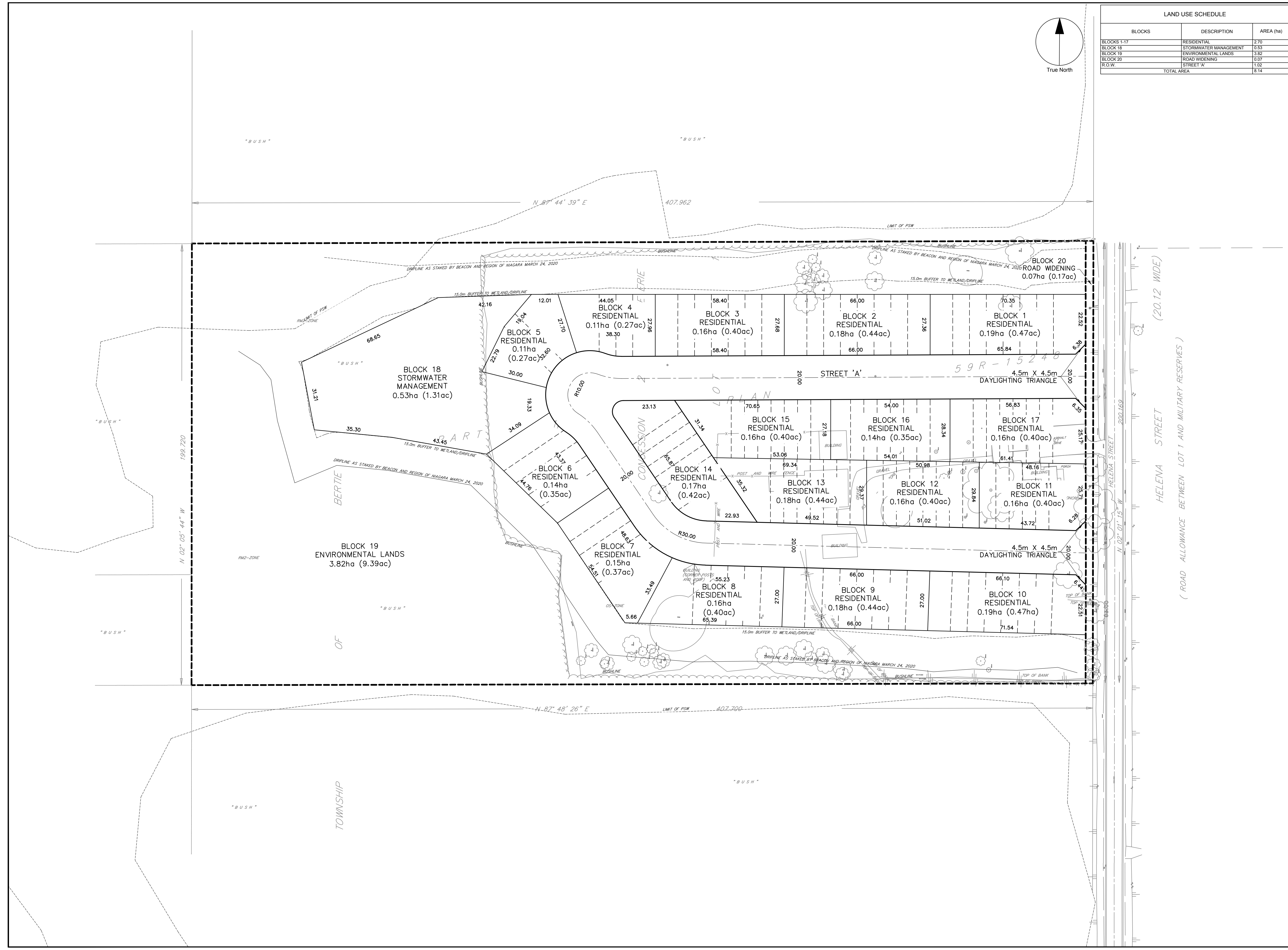
PROJECT MGR:
T. TUCKER

APPROVED BY:

SHEET TITLE
DRAFT PLAN OF SUBDIVISION

SHEET NUMBER
DP 1.0

ISSUE
1



HELENA STREET (20.12 WIDE)
(ROAD ALLOWANCE BETWEEN LOT 1 AND MILITARY RESERVES)

File Location: J:\131951_613_Helena\0_Production\01_Sent-Received\SentClient\2021-04-08 - Draft Plan\131951-DP-2021-04-08.dwg Last Saved: April 8, 2021 10:39:00 AM by Tracy Tucker