Terraprobe
an **Englobe** Company
Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

HYDROGEOLOGICAL INVESTIGATION
AND SEPTIC IMPACT ASSESSMENT
RESIDENTIAL TOWNHOUSE SUBDIVISION
AGNES STREET
ALTON ONTARIO

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1.0 INTRODUCTION

Terraprobe was retained by The Alton Development Inc. to complete a hydrogeological investigation in support of private sewage servicing for a proposed residential development (the Site) in the Village of Alton (Caledon), Ontario. It is proposed to construct a residential subdivision consisting of 14 townhouse blocks consisting of a total of 67 residential units. The Village of Alton is currently serviced with municipal water servicing with properties utilizing private sewage servicing.

The subject property is situated south of Queen Street West between Agnes Street and Emeline Street in the Village of Alton as indicated on the attached **Figure 1**. The Site consists of an irregular shaped undeveloped parcel of land covering an area of approximately 4.0 hectares (10 acres).

A hydrogeological investigation has been completed for the Site to summarize the findings of the field study and related ground water monitoring and quality sampling program; to provide a description of the physical soil and ground water characteristics of the Site; and, to establish the baseline ground water quality for nutrient parameters (including nitrogen containing species and phosphorus) to allow for any required future assessment of the nutrient loading and attenuation capacity of the site to accommodate planned sewage system servicing for the development of the Site. A review of applicable planning policies, including the Town of Caledon Official Plan and Source Water mapping and wellhead protection zones was completed to assess potential site restrictions with regards to applicable planning policies for the subject property.

2.0 SCOPE OF WORK

In addressing the above components, the following scope of work was undertaken:

- *Review of Geological and Hydrogeological Setting of the Site:* A review of available background geological and Hydrogeological information for the Site was completed using Ontario Geological Survey (OGS) maps, Ministry of Environment Conservation and Parks (MECP) water well records database and Oak Ridges Moraine Group (ORMGP) database for the Site. A detailed visual inspection of the Site and surrounding areas to determine local topography and drainage. The presence of significant hydrogeological features such as closed depressions (areas of groundwater recharge), seeps and springs was assessed.

- *Private Well Survey:* A private well survey was completed to assess potential downgradient receptors for proposed on-site subsurface sewage disposal. Property owners were contacted concerning the presence of, and details about water supply wells on private properties within a 500 m radius of the site. Where private water supply wells were present, if property owners did not respond to inquiries, staff were sent to physically inspect the wells. The Peel Works Department was also contacted and confirmed that all properties are connected to the municipal water system.

- *Completion of Subsurface Investigations:* Multiple subsurface investigations were conducted to investigate shallow soil and groundwater conditions at the Site. A borehole program was completed by Terraprobe in February 2019 to investigate shallow soil and groundwater conditions, which established a series of monitoring wells across the site to monitor stabilized groundwater elevations, including seasonal high groundwater conditions, and to complete in-situ hydraulic conductivity testing and groundwater sampling. In addition to the completed borehole program a series of 18 test pits were completed by Gunnell Engineering in August 2022 to evaluate shallow soil and groundwater conditions in the vicinity of proposed subsurface sewage disposal beds.

- *Laboratory Soil Analysis:* Laboratory analysis of grain size distribution was carried out for soil samples obtained from the completed subsurface investigation. Grain size analysis was carried out to establish percolation rates to assess tile bed sizing for the various proposed development concepts.

- *Groundwater Monitoring and Sampling:* Groundwater monitoring and water quality sampling was carried out to establish seasonal groundwater fluctuations including seasonal high groundwater conditions and to conduct water quality analysis to establish background water quality with respect to nitrates.

3.0 SITE DESCRIPTION

3.1 Location and Site Description

The Site is located south of Queen Street West between Agnes Street and Emeline Street in the Village of Alton, where the intersection of Queen Street West and Main Street is located approximately 250 m to the northwest of the Site. The location of the Site is shown on the attached **Figure 1**. The Site consists of an irregular parcel of land covering an area of approximately 4.0 hectares (10 acres) consisting of a vacant lot. The Site is situated within the Village of Alton surrounded by detached residential dwellings to the north, east, south and west limits of the Site. Properties within the Village of Alton are provided with municipal water servicing. Alton municipal supply wells 3 and 4 servicing the Village of Alton are situated along Queen Street East approximately 650 m northeast of the Site (approximately 400 m northwest of the intersection of Queen Street West and Main Street. Municipal sewage servicing is not currently available within the Village of Alton.

It is proposed to develop the Site for use as a residential subdivision consisting of 14 condominium townhouse blocks comprising a total of 67 residential units with a combined common amenity/SWM area.

Proposed plans of development are provided in the attached **Appendix A**. The proposed residential development is to be serviced using municipal water servicing and private subsurface sewage disposal systems.

3.2 Regional Geology and Hydrogeology

The current understanding of the surface geological setting of the Site is based on scientific work conducted by the OGS (OGS, 2003). Much of the Site is mapped as till consisting of a stone poor sandy silt to silty sand-textured till. However, northwest, and west portions of the Site are mapped as glaciofluvial deposits, comprising river deposits and delta topset facies and sandy deposits (OGS, 2003). Overburden deposits in the vicinity of the Site are expected in the range of 6 to 10 m in thickness based on well records on file with the MECP.

Bedrock underlying the Site consists mainly of Amabel Formation consisting of white to blue-grey, thick to massive bedded, dolostone (OGS, 2007). However, the northwest portion of the Site is mapped with Clinton Cataract Group, consisting of shale, sandstone and dolostone. Limestone bedrock forms a

productive regionally extensive confined to semi-confined aquifer. The municipal supply wells for the Village of Alton are completed within the limestone bedrock at depth.

The local hydrogeology was assessed through a review of well records on file with the Ministry of the Environment Conservation and Parks (MECP). Well records located downgradient from the site were reviewed within the study area extending to Emeline Street to the west, Agnes Street to the east, the subject site to the south and Shaws Creek to the north. **Table 3-1** provides a summary of well records situated within the defined study area.

Table 3-1: Summary of Down-Gradient Well Records

Well ID	Easting	Northing	Year Installed	Water Level (m)	Well Use	Stratigraphy (depth in metres)
4908785	574517	4856373	2001	n/a	n/a	Abandonment
4904962	574566	4856373	1976	2.7	Test Hole	No Info
4900960	574564	4856421	1957	5.2	Domestic	Clay (5.5) Limestone (17.7)
4900964	574563	4856444	1959	0.9	Domestic	Clay (4.9) Limestone (12.2)
4904746	574675	4856531	1975	3.0	Domestic	Clay/Stones (4.3) Limestone (27.4)
7211283	574700	4856551	2013	n/a	n/a	Abandonment
4900968	574724	4856547	1962	2.4	Domestic	Clay/Stones (6.4) Limestone (12.8)
4900967	574730	4856552	1960	4.3	Domestic	Sand/Stones/Clay (8.4) Limestone (23.8)
7330876	574612	4856350	2019	1.5	Test Hole	Sand/Gravel (6.1)
7330874	574736	4856520	2019	4.0	Test Hole	Sand/Gravel (4.6) Limestone (4.7)

In total 10 well records were situated within the study area with two decommissioning records, three test holes/monitoring wells and five domestic wells reported to have been completed between 1957 and 1976. Alton is presently serviced with municipal water. A well survey was complete to confirm locations of the above noted well records further discussed in Section 3.8 below.

3.3 Regional Physiography

The Site is located within a regional physiography of Southern Ontario known as Guelph Drumlin Field. It is underlain by dolostones of the Amabel and Guelph Formations which dip gently toward the southwest. The till in drumlins is loamy and calcareous and was derived mostly from dolostone of the Amabel Formation. In addition, it contains fragments of the underlying red shale which is exposed below

the escarpment. The till throughout is rather stony, with large surface boulders being more numerous in some localities than others (Chapman and Putnam, 1984).

3.4 Topography and Drainage

The topography at the Site consists of gently rolling topography sloping to the north toward Queen Street West. The topographic high to the southern extent of the Site sits at an elevation of approximately 421.9 m, falling to the north and eastern extents of the Site at an elevation of approximately 411.2 m, a total grade change of approximately 10.7 m.

Topography slopes toward Shaws Creek situated approximately 80 m north of the Site. Shaws Creek forms a sub-watershed of the Credit River watershed. Shaws Creek flows eastward to form the West Credit River approximately 750 m east of the Site. Shallow groundwater flow in the vicinity of the Site is expected to follow topography and be directed to the west and northwest toward Shaws Creek.

3.5 Natural Heritage Features

Records for wetland features are scattered around the Site, with the details summarized below:

- Provincial Wetland Features: Two provincial wetland complexes are in proximity to the Site. Credit River at Alton Wetland Complex: This feature is located approximately 750 m to the northeast, and Alton-Hillsburg Wetland Complex is located approximately 1.4 km to the west of the Site.

- Evaluated as Other: Coulterville Wetland Complex, located approximately 550 m to the southwest of the Site, is evaluated as other natural heritage features.

- Not Evaluated Wetland Features: A wetland feature located approximately 70 m to the northwest of the Site (adjacent to the Queen Street West) is not evaluated as per Ontario Wetland Evaluation System (OWES).

Records for Area of Natural and Scientific Interest (ANSI) are mapped approximately 2.7 km and 2.6 km to the northwest and west of the Site, respectively. Additionally, wooded areas are scattered around the Site. Record review indicates that there are no records of any above-mentioned natural heritage features within or abutting the Site.

3.6 Source Water Protection Areas

Source Water Information Atlas provided by MECP was reviewed on October 22, 2019, and March 01, 2023. The Site is mapped within the jurisdiction of Credit Valley Source Protection Area. Record review indicates that the Site is located within the area designated as 'Groundwater Under the Direct Influence of Surface Water' (GUDI) or Wellhead Protection Area (WHPA)-E for Alton municipal wells 3 and 4 servicing the community of Alton. The Vulnerability Score assigned to the site falls within a score of 8 and is identified as a medium threat area for pathogens. Wellhead protection mapping for the Site and surrounding areas of Alton are provided in the attached **Appendix B**.

Under the Credit Valley, Toronto and Region and Central Lake Ontario (CTC) Source Water Protection Plan the identified ground water threat resulting from site development is anticipated to be septic systems governed under the Building Code Act (SWG-1). Specific actions would require a prioritized maintenance inspection program for the oldest identified systems or for systems in the highest areas of vulnerability. Areas within a WHPA-E are identified as high vulnerability with a Vulnerability Score of 10. The site is not identified within an area of highest vulnerability. For the remaining areas the primary concern would be potential increases for nitrates and pathogens to underlying ground water. CTC mapping indicated the subject site falls outside significant ground water quality threat areas.

Given the GUDI designation for Alton Municipal Wells 3 and 4, and the proximity of the site to Shaws Creek surface water has been considered the primary groundwater receptor for effluent from proposed on-site sewage disposal.

3.7 Results of Site Inspection

A site inspection was completed on April 4, 2019, to assess site conditions. The Site consisted of a vacant grass field with a gradual fall in topography from the east to west across the Site. Drainage features at the Site were not evident, and runoff is expected to form a sheet flow and be largely infiltrated across the Site. Local areas of depression, ponding water and phreatophytic vegetation were not observed. Areas of enhanced groundwater infiltration are not expected at the Site.

3.8 Private Well Survey

In addition to the MECP well records search, private well surveys were conducted by Terraprobe on March 17, 2022, and by Gunnell Engineering in June 2022. Field confirmations of the MECP well records summarized in Table 3-1 was not able to be completed because well tags were not evident on the

surveyed wells. Private well survey letters distributed by both Terraprobe and Gunnell Engineering and no local property owners responded to indicate that they had a drinking water well. Visual surveys were completed to confirm the details of private well. Properties located along Agnes Street (northeast), Davis Drive (southeast) and Emeline Street (southwest) represent relatively new residential dwellings which were confirmed through the well survey to be serviced using municipal water supplies. The older properties along Queen Street West that existed prior to the installation of the municipal water system in the 1980s were confirmed by the Region of Peel to be municipally serviced, but a number were identified as still having existing private wells. Private wells were identified at the following municipal addresses:

- Existing Dug Wells: 1341 (lot 15), 1349 (lot 14), 1365 (lot 13), and 1409 (lot 6) Queen St. W.
- Drilled Wells: 1375 (lot 11) and 1387 (lot 9) Queen St. W.
- No Located Well: 1367 (lot 12) and 1379 (lot 10) Queen St. W
- Decommissioned Well: 1401 (lot 7) and 1417 (lot 5) Queen St. W.

Confirmed well locations determined by the completed well surveys are indicated on the attached site plan provided in **Appendix A** (Drawing SP-1 by Gunnell Engineering, dated July 21, 2022).

The private wells located along Queen Street West immediately northwest of the site were not sampled as permission to access wells was not provided by property owners and because they were not reported as being used for potable water supplies and therefore not considered as a groundwater receptor of concern for on-site septic systems. Given the proposed on-site sewage systems are under 10,000 L/day, Reasonable Use assessment to the down-gradient property boundary for the on-site septic systems is not required and approvals for septic systems would be under the Ontario Building Code. For the detailed septic designs the required OBC setback distances to the drilled and dug wells are to be provided based on the surveyed well type (i.e., 30 m setback from dug wells and 15 m setback from drilled wells).

3.9 Results of Subsurface Investigation

A subsurface investigation was carried out on February 7th and 8th, 2019 consisting of 8 borehole locations to various depths between 2.5 and 6.7 m below existing grades (elevations between 415.5 and 408.9 m). Drilling was carried out by a specialized drilling sub-contractor using a track mounted drilling rig equipped with hollow stem augers. Split spoon soil sampling was completed at regular intervals along with Standard Penetration Testing. Soil and groundwater conditions encountered within completed boreholes were logged by a Terraprobe technician present over the duration of drilling activities.

Soil conditions encountered as part of the subsurface investigation generally consisted of topsoil overlying localized areas of fill and silty fine sand followed by silty sand and gravel with occasional cobbles and boulders to the depth of completion. Borehole locations are indicated on the attached **Figure 2**, borehole logs summarizing the results of the subsurface investigation and results of soil laboratory testing are provided in the attached **Appendix C**. A detailed description of the soil stratigraphy encountered at the Site is provided below.

A series of 18 test pits were excavated at the site in August 2022 by Gunnell Engineering in the vicinity of proposed tile beds. Test pits were completed to varying depths between 1.8 to 2.1 m below existing grades. Test pit locations are indicated on Gunnell Engineering drawing SP-1 dated July 21, 2022, provided in **Appendix A**. Test pits indicated shallow soils consisted of topsoil overlying fine to coarse sands with varying amounts of gravel. Groundwater was not encountered within any of the completed test pits.

3.9.1 Topsoil

A layer of topsoil was encountered at the surface of each completed borehole between 150 to 600 mm in thickness. Topsoil thickness was confirmed at the location of boreholes and should not be used to estimate quantities of topsoil present at the Site.

3.9.2 Fill

Fill deposits were encountered underlying topsoil within boreholes BH2 and BH5 to BH8. Fill deposits consisted of silty fine sand to sand and gravel. The thickness of fill deposits where encountered was observed to be variable with thicknesses between 0.5 to 1.5 m. Fill deposits were encountered to depths between 0.8 to 2.1 m below existing grades (elevations between 420.4 and 412.6 m). The relative density of fill deposits was generally observed to be loose to dense based on the completed Standard Penetration Testing.

3.9.3 Silty Fine Sand

A layer of silty fine sand was encountered underlying topsoil within BH1 and underlying fill deposits within BH5 and BH6. The thickness of silty fine sand was observed to range from 1.6 to 2.5 m. Silty fine sand deposits were encountered to depths between 2.1 to 4.0 m below existing grades (elevations between 417.9 and 410.9 m). The relative density of silty fine sand deposits was generally observed to be loose to compact based on the completed Standard Penetration Testing.

3.9.4 Silty Sand and Gravel

A layer of silty sand and gravel was encountered within all boreholes at depths between 0.5 to 4.0 m below existing grades extending to the depth of completion. It was encountered underlying topsoil deposits within BH3 and BH4, underlying fill deposits within BH2, BH7 and BH8 and underlying silty fine sand in BH1, BH5 and BH6. The relative density of silty sand and gravel ranged from compact to very dense based on the completed Standard Penetration Testing.

Laboratory soil grain size analysis was carried out on selected soil samples and is summarized in the following **Table 3-2**:

Table 3-2: Summary of Borehole Soil Grain Size Analysis

Sample ID	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Soil Description
BH1 Sa2	1.0	2	86	4	8	Fine sand, trace gravel silt and clay
BH8 Sa3	1.8	27	41	23	9	Silty sand, trace clay and gravel

Shallow soils up to depths ranging from 2.0 to 4.0 m were generally observed as compact in nature becoming dense at depths greater than 4.0 m. Based on the above grain size analysis the investigated soils were assigned a classification of SM under the universal soil classification with expected percolation rates of 12 min/cm.

Table 3-3 provides a summary of grain size analysis completed by Gunnell Engineering for completed test pits:

Table 3-3: Summary of Test Pit Soil Grain Size Analysis

Sample ID	Sample Depth (m)	Gravel (%)	Sand (%)	Silt and Clay (%)	Soil Description
TP22-1	2.1	0	95	5	Sand, little or no fines
TP22-4	2.0	0	95	5	Sand, little or no fines
TP22-7	2.1	0	95	5	Sand, little or no fines
TP22-13	1.8	0	95	5	Sand, little or no fines

Based on the completed grain size analysis for shallow test pits soils were assigned a classification of SP under the universal soil classification with expected percolation rates between 6 to 10 min/cm.

It should be noted that the subsurface conditions are confirmed at the borehole location only and may vary at other locations. The boundaries between the various strata represent an inferred transition rather

than a precise plane of geological change. This provided summary is intended to correlate the data to assist in the interpretation of the subsurface conditions at the Site. For more specific subsurface details including results of standard penetration testing, soil grain size analysis, moisture content, detailed soil descriptions and a water level summary, refer to borehole logs provided in the attached **Appendix C**.

3.9.5 Groundwater Conditions

Groundwater levels were measured within four (4) monitoring wells installed within selected boreholes BH2, BH5 and BH8. Monitoring well identification followed the numbering of the boreholes completed as part of this investigation. Geodetic elevations of monitoring well locations were obtained from the topographic survey competed for the Site and monitoring well locations were mapped with a handheld GPS device. **Table 3-4** provides a summary of monitoring well locations established at the Site:

Table 3-4: Monitoring Wells Details

MW ID	Coordinates		Ground Surface Elevation (masl)*	Well Depth	
	Easting (m)	Northing (m)		mbgs**	masl
MW2-S	574614	4856342	415.8	3.0	412.8
MW2-D				6.1	409.7
MW5	574776	4856396	421.9	6.2	415.7
MW8	574738	4856521	413.9	4.6	409.3

Note:
*masl: meters above sea level
**mbgs: meters below ground surface

Monitoring wells were screened with a 1.5 m length well screen completed within silty sand and gravel deposits. One (1) pair of nested monitoring well was installed at BH2 location to assess vertical groundwater flow gradients. Monitoring wells were identified using the same numbering as borehole locations (i.e., MW5 was completed within BH5). The shallow and deep monitoring wells are identified as MW2-S and MW2-D, respectively. Water levels were monitored at the installed monitoring wells as summarized in the following table (**Table 3-5**):

Table 3-5: Summary of Groundwater Monitoring

Location	Water Levels							
	04-Mar-19		04-Apr-19		25-Apr-19		09-Aug-19	
	mbgl *	masl **	mbgl	Masl	mbgl	masl	mbgl	masl
MW2-S	2.3	413.5	1.6	414.2	1.3	414.5	2.4	413.4
MW2-D	2.4	413.4	1.8	414.0	1.6	414.2	2.6	413.2

MW5	6.3	415.6	6.2	415.7	>6.4	<415.5	6.1	415.8
MW8	2.2	411.7	1.6	412.3	1.1	412.8	2.4	411.5

Note:
*mbgs: meters below ground surface
**masl: meters above sea level

From the above measured groundwater levels the seasonal high groundwater level was observed at the Site on April 25, 2019. Seasonal variation in groundwater levels at the Site ranged from 1.1 mbgs at MW8 to lower than 6.4 mbgs at MW5. The groundwater flow direction is expected to the north of the Site toward Shaws Creek situated approximately 120 m north of the Site. The inferred groundwater flow direction is provided on the attached **Figure 3**. Monitoring wells achieved adequate site coverage to provide horizontal groundwater flow gradients as illustrated in Figure 3. At the time of investigation, the locations of stormwater features were not finalized.

Groundwater levels are expected to vary across the site due to the horizontal groundwater flows to the northeast to Shaw's Creek and grading across the site also sloping to the north of the site. Seasonal high groundwater conditions for the infiltration/stormwater chambers were assessed based on interpolated groundwater conditions determined from measured groundwater levels within instrumentation spread across the site. Based on this review groundwater elevations of 414.2 m, measured at MW 2-D, were considered as a conservative value for seasonal high groundwater conditions for these features. Groundwater elevations of 415.8 m noted at MW5 are representative of groundwater levels to the topographically higher portions of the property along the south property limit and would not be reflective of groundwater elevations in the areas of proposed infiltration/stormwater chambers. Groundwater levels within MW8 to the northeast were observed at 412.8 m.

Vertical hydraulic gradients were assessed based on the observed water level within MW2-S/MW2-D. A review of groundwater level at the nested monitoring wells indicates a slight downward hydraulic gradient within the Site. The vertical hydraulic gradient considering groundwater level elevations measured on August 9, 2019, is estimated at 0.06.

3.10 In-Situ Hydraulic Conductivity Testing

Single well response tests were carried out at each monitoring well location to evaluate the rate of flow of groundwater through native soils present at the Site. Single well response tests were carried out as rising head tests at MW2-S, MW2-D and MW8. Rising head hydraulic conductivity testing involved removing a quantity of groundwater from within the well and monitoring the rate of groundwater recovery to static conditions with time. Due to insufficient groundwater within MW5 hydraulic conductivity testing was

not completed at this Location. **Table 3-6** provides a summary of the results of in-situ hydraulic conductivity testing carried out at the Site:

Table 3-6: Summary of In-Situ Hydraulic Conductivity Testing

Monitoring Well ID	Screened Formation	Hydraulic Conductivity (m/s)
MW2-S	Silty Sand and Gravel	4.7×10^{-7}
MW2-D	Silty Sand and Gravel	4.1×10^{-6}
MW8	Silty Sand and Gravel	8.6×10^{-7}

The average hydraulic conductivity for silty sand and gravel deposits at the Site are expected at 1.8×10^{-6} m/s. It is anticipated that the average value would be representative of compact soils. Dense deposits of silty sand and gravel are generally expected at depths greater than 2.0 m below existing grades and would be representative of conditions encountered at MW2-S. The results of in-situ hydraulic testing are provided in the attached **Appendix D**. These values are considered consistent with the expected percolation rates of 12 min/cm based on the completed grain size analysis testing as summarized in Section 3.5.4 above.

3.11 Groundwater Quality

Groundwater quality sampling was completed from within MW2-S, MW2-D and MW8 on March 4, 2019. Groundwater quality sampling was not completed from MW5 due to insufficient groundwater within the monitoring well. Groundwater was sampled for nitrogen containing parameters and total phosphorus. The results of water quality analysis are summarized in the **Table 3-7**:

Table 3-7: Summary of Groundwater Quality Results

Parameter	Unit	MW2-S	MW2-D	MW8
Total Ammonia	mg/L	<0.05	0.11	<0.05
Total Kjeldahl Nitrogen	mg/L	0.42	0.39	0.66
Total Phosphorus	mg/L	0.63	2.8	2.1
Nitrite	mg/L	<0.01	<0.01	<0.01
Nitrate	mg/L	2.87	0.32	0.96
Nitrite + Nitrate	mg/L	2.87	0.32	0.96

Laboratory certificates of analysis for completed groundwater sampling are provided in the attached **Appendix E**. The above water quality is considered background groundwater quality with respect to nitrate and phosphorus. The shallow monitoring well MW2-S showed the highest concentrations of nitrate at 2.87 mg/L. Deeper monitoring wells MW2-D and MW8 showed concentration of nitrate at 0.32

and 0.96 mg/L respectively. It is expected that nitrates observed within shallow groundwater are due to private subsurface sewage systems surrounding the Site.

3.12 Proposed Development

The residential development is proposed to consist of 67 residential units within a total of 14 condominium townhouse blocks with 4 to 5 units. Each townhouse block will each be serviced with an on-site sewage system, with daily design sewage flows ranging between 1,750 to 2,000 L/day based on the proposed individual unit sizes, with each of the 14 individual sewage systems to be based on total daily design sewage flows between 8,000 to 9,900 L/day. Proposed sewage systems will be subject to Ontario Building Code (OBC) approvals through the Town and would not be applicable to approvals with the Ministry of the Environment Conservation and Parks as sewage flows are not proposed to exceed 10,000 L/day. Sewage system design is discussed further in Section 4.0 below and is based on the proposed dispersal bed layout prepared by Gunnell Engineering.

Dewatering will be addressed at detailed site plan design stage when foundation elevations are established. SWM and water servicing is expected above shallow groundwater and therefore dewatering is not expected for site servicing.

4.0 DISCUSSION AND ANALYSIS

4.1 Summary of Site Conditions

The results of the investigation indicate the following general hydrogeological function for the Site:

- A subsurface investigation was carried out at the Site which involved drilling at eight locations with monitoring wells established at three selected locations and a series of 18 test pits completed to depths ranging from 1.8 to 2.1 m in depth in areas proposed for septic tile beds. Soil conditions generally consisted of topsoil overlying localized areas of fill and silty fine sand to sand, followed by silty fine sand and sand and gravel to the completed depth of investigation. Groundwater was not encountered, and test pits remained open and dry upon completion.

- Seasonal high groundwater levels were observed at the Site during the Site investigation completed on April 25, 2019, at depths of approximately from 1.1 mbgs at MW8 to lower than 6.4 mbgs at MW5. Seasonal variation in groundwater levels was observed between 1.0 to 1.3 m below grades at the Site from within MW2 and MW8 (MW5 was observed to be dry during

monitoring). It is expected that groundwater flows to the north of the Site towards Shaws Creek situated approximately 120 m north of the Site.

- Seasonal high groundwater conditions for the infiltration/stormwater chambers were assessed based on interpolated groundwater conditions determined from measured groundwater levels within instrumentation spread across the site. Based on this review groundwater elevations of 414.2 m, measured at MW 2-D, were considered as a conservative value for seasonal high groundwater conditions for these features.

- A review of the Ministry of the Environment Conservation and Parks well record database was completed for properties located downgradient of the site. The search area was defined by the subject property to the south, Emeline Street to the west, Agnes Street to the east and Shaws Creek to the north. In total 10 well records were situated within the study area with two decommissioning records, three test holes/monitoring wells and five domestic wells reported to have been completed between 1957 and 1976. Alton is presently serviced with municipal water.

- A private well survey was completed for properties within a 500 m radius of the site. Properties along Agnes Street (northeast), Davis Drive (southeast) and Emeline Street (southwest) represent relatively new residential dwellings which were confirmed to be serviced using municipal water supplies. Properties along Queen Street West were noted to also be municipally serviced, but several were identified with existing private wells. Of the 12 lots immediately northwest of the site four lots were confirmed with dug wells, two were confirmed with drilled wells, two lots were confirmed to have decommissioned wells and two lots received no response to the survey.

- It was verified through the Region of Peel, that all homes surrounding the site are connected to the municipal water system.

- Soil grain size analysis was carried out for native silty sand and gravel. Based on the observed grain size distribution it is expected that soil percolation rates of approximately 6 to 10 min/cm are applicable for the Site.

- In-situ hydraulic conductivity testing was completed at MW2-S, MW2-D and MW8. The average hydraulic conductivity for silty sand and gravel deposits at the Site is expected at 1.8×10^{-6} m/s.

- Groundwater quality analysis was completed for monitoring wells MW2-S, MW2-D and MW8. The background groundwater quality with respect to nitrate in shallow groundwater ranged from

0.32 to 2.87 mg/L. The observed background nitrate concentrations are anticipated to be due to surrounding private subsurface sewage disposal systems located up-gradient from the Site.

- It is proposed to develop the Site as a residential subdivision consisting of 67 residential units with 14 condominium townhouse blocks. Sewage servicing will be provided by private subsurface sewage disposal systems. Sewage systems beds are proposed for each townhouse block and will be designed based on daily design sewage flows ranging from 7,000 to 9,900 L/day.

4.2 Sewage System Design for Proposed Development

Design parameters have been provided by Gunnell Engineering for the construction of Waterloo Biofilter tertiary treatment sewage systems with Type 'A' Dispersal Beds to service proposed townhouse blocks. Design parameters were summarized in the Sewage System Brief prepared by Gunnell Engineering dated March 14, 2023, and summarized on Drawing SP-1, Overall Site Plan: Septic System Layout Criteria included within **Appendix A**. Dispersal Bed requirements by block are summarized in **Table 4-1** below:

Table 4-1: Type 'A' Dispersal Bed Sizing Requirements

Block	Daily Design Flow (Q) L/day	Area Required (Q/50) m^2	Bed Dimensions* m
1	9,900	198.0	5.0 x 40.0
2	9,900	198.0	7.2 x 32.0
3	9,900	198.0	7.2 x 32.0
4	9,900	198.0	7.2 x 32.0
5	8,000	160.0	7.2 x 28.0
6	9,900	198.0	7.2 x 32.0
7	8,000	160.0	7.2 x 32.0
8	9,900	198.0	7.2 x 32.0
9a and 9b	9,900	198.0	7.2 x 32.0
10	9,900	198.0	7.2 x 32.0
11	9,900	198.0	7.2 x 32.0
12	7,000	160.0	7.2 x 23.5
13	9,900	198.0	7.2 x 32.0
14	9,900	198.0	7.2 x 32.0

*Bed dimensions to be confirmed by Gunnell Engineering

Sewage servicing at the Site for individual sewage systems will not exceed 10,000 L/day.

4.2.1 Sewage Setback Requirements

Given the prevalent sandy soil conditions, and that shallow groundwater was not encountered within test pits completed in the vicinity of the proposed leaching beds, it is expected that the tile bed will be constructed as an in-ground bed, and that setbacks from the proposed OBC Type 'A' Dispersal Beds and sewage treatment facilities will be required as follows (**Table 4-2**):

Table 4-2: Summary of Setback Clearances

	Distribution Pipe Clearances (m)
Structure	5
Well with a watertight casing to a depth of 6 m	15
Any other well	30
Surface water	15
Spring not used as a source of potable water	15
Property line	3

Proposed Dispersal Beds were located to meet the required setback distances from private wells identified to the northwest of the site for properties fronting to Queen Street West, in addition to structures, townhouse units, and property lines as indicated on drawing SP-1 provided in **Appendix A**. Vertical separation from the base of tile beds and the seasonal high groundwater level is expected to exceed 900 mm, as such raised dispersal beds will not be required. This was confirmed within proposed leaching bed areas through the completion of shallow test pits completed to depths between 1.8 to 2.1 m below existing grades.

5.0 SEWAGE IMPACT ANALYSIS

5.1 Impacts to Private Wells

Properties located to the northwest of the site along Queen Street West were identified to have private wells through completed well surveys. It was confirmed by the Region of Peel that residential properties surrounding the site have installed water meters and are serviced with municipal water supplies. Private wells do not represent a sensitive down-gradient receptor for sewage effluent. The sewage impact assessment does not consider private wells since private wells are not reported to be used for potable supply.

5.2 Impacts to Surface Water

For the purposes of Sewage Impact Assessment, the closest downgradient receptor was considered as Shaws Creek. As indicated by the CVC in their pre-application review comments shallow groundwater entering environmentally sensitive areas are to be less than 3.0 mg/L to meet the Canadian Water Quality Guidelines (CWQG) for nitrate in shallow groundwater (i.e., 2.93 mg/L) would be applicable. Nitrate concentrations expected at the downgradient receptor of Shaws Creek was further assessed based on a review of the *'Nitrate-Nitrogen Impact Assessment Guideline for Dvelopment Applications in the Credit Valley Watershed'* prepared by Credit Valley Conservation, dated March 2022, and following the approach outlined within MECP Procedure D-5-4, given individual sewage systems will have flows below 10,000 L/day, as follows:

$$\textbf{Predicted Nitrate Increase} = \frac{N \times F \times C}{(N \times F) + (A_S \times I) + (A_D \times I)}$$

Where: N is the number of proposed residential units (67);

F is the expected sewage flows per year (365 m^3/yr);

C is the effluent nitrate concentration (mg/L);

I is the infiltration rate for native soils (0.3 m/yr); and,

A is the Site area (A_S for the Site area and A_D for downgradient dilution area).

The total site area for the development consists of approximately 40,000 m^2 (A_S). The downgradient area from the northern property limit to Shaws Creek is expected to provide additional dilution for groundwater prior to baseflow contributions to Shaws Creek. The expected downgradient dilution area is expected to cover an area of approximately 23,400 m^2 (A_D) for a dilution volume of approximately 7,020 m^3 (based on infiltration rates of 0.300 m/a for sand and gravel). Attenuation areas for the Site and downgradient areas to Shaws Creek are indicated on the attached **Figure 4**. The expected nitrate effluent concentrations required to meet the CWQO guideline for nitrate of 2.93 mg/L is calculated at 5.2 mg/L. It is expected that through pre-treatment of sewage effluent impacts to Shaws Creek will be negligible. The above predictive nitrate impact assessment does not account for the dilution of effluent from dispersal beds for the proposed development with groundwater underflow. It is anticipated that additional dilution of effluent will be provided due to mixing with underlying groundwater. The background concentrations of nitrate at the Site were observed between 0.32 to 2.87 mg/L.

5.3 Impacts to Municipal Wells

Potential impacts to municipal wells servicing the Village of Alton were considered. As discussed in Section 3.6 above, the Site is located within the area designated as 'Groundwater Under the Direct Influence of Surface Water' (GUDI) or Wellhead Protection Area (WHPA)-E for Alton Municipal Wells 3 and 4 servicing the community of Alton. The Vulnerability Score assigned to the site falls within a score of 8 and is identified as a medium threat area for pathogens. With regards to surface water, the Canadian Water Quality Objectives (CWQO) for nitrate in shallow groundwater (i.e., 2.93 mg/L) would be applicable and met using effluent pre-treatment to achieve nitrate concentrations of 5.2 mg/L within sewage effluent.

Potential impacts to Alton Municipal Wells 3 and 4 were further assessed based on a review of surface water flow rates through the Alton Millpond assessed my CIMA+ in conjunction with the Alton Millpond LRIA dam reconstruction application. Average monthly flows of the Millpond Dam were assessed through a review of flow data over an 8-year period from 1983 to 1991. Monthly average flows are expected to range from 0.45 m^3/sec to upwards of 1.63 m^3/sec. Sewage flows from the proposed on-site septic system are predicted at 1.5 x 10^{-3} m^3/sec based on the daily design sewage flows. Based on average flow rates reported for the Alton Millpond over 1983 to 1991 it is expected that design sewage flows represent approximately 0.3 % of the seasonal low flow conditions and approximately 0.1 % of the seasonal high flow conditions. Given the reported average monthly flow rates for the Alton Millpond it is expected that nitrate concentrations within surface water will have negligible increases due to the private sewage systems proposed for the subject property.

Further to the predicted negligible impacts to the Alton Millpond, Alton Municipal Wells 3 and 4 are situated approximately 750 m downstream of the Alton Millpond dam. Nitrate increases within surface water near Alton Municipal Wells 3 and 4 will be negligible, given that effluent pre-treatment will achieve effluent quality with respected to nitrates at <5.2 mg/L to meet the CWQG guideline for nitrates of 2.93 mg/L downgradient of the site, sewage flows from the site represent between 0.3% to 0.1% of average flows at the Alon Millpond, and the Alton Millpond is located approximately 750 m upstream of Alton Municipal Wells 3 and 4. The Alton Millpond Hydraulic Characteristics report is provided in **Appendix F**.

6.0 SUMMARY AND CONCLUSIONS

The following provides a summary of the results of detailed investigations completed under the scope of the hydrogeological investigation:

1. A subsurface investigation was carried out at the Site which involved drilling at eight locations with monitoring wells established at three selected locations and a series of 18 test pits completed to depths ranging from 1.8 to 2.1 m in depth in areas proposed for septic dispersal beds. Soil conditions generally consisted of topsoil overlying localized areas of fill and silty fine sand to sand, followed by silty fine sand and sand and gravel to the completed depth of investigation.

2. Seasonal high groundwater levels were observed at the Site during the Site investigation completed on April 25, 2019, at depths of approximately from 1.1 mbgs at MW8 to lower than 6.4 mbgs at MW5. Seasonal variation in groundwater levels was observed between 1.0 to 1.3 m below grades at the Site from within MW2 and MW8 (MW5 was observed to be dry during monitoring). It is expected that groundwater flows to the north of the Site towards Shaws Creek situated approximately 120 m north of the Site.

3. Seasonal high groundwater conditions for the infiltration/stormwater chambers were assessed based on interpolated groundwater conditions determined from measured groundwater levels within instrumentation spread across the site. Based on this review groundwater elevations of 414.2 m, measured at MW 2-D, were considered as a conservative value for seasonal high groundwater conditions for these features.

4. A review of the Ministry of the Environment Conservation and Parks well record database was completed for properties located downgradient of the site. The search area was defined by the subject property to the south, Emeline Street to the west, Agnes Street to the east and Shaws Creek to the north. In total 10 well records were situated within the study area with two decommissioning records, three test holes/monitoring wells and five domestic wells reported to have been completed between 1957 and 1976. Alton is presently serviced with municipal water.

5. A private well survey was completed for properties within a 500 m radius of the site. Properties along Agnes Street (northeast), Davis Drive (southeast) and Emeline Street (southwest) represent relatively new residential dwellings which were confirmed to be serviced using municipal water supplies. Properties along Queen Street West were noted to also be municipally serviced, but many were identified with existing private wells. Of the 12 lots immediately northwest of the site four lots were confirmed with dug wells, two were confirmed with drilled wells, two lots were confirmed to have decommissioned wells and two lots received no response to the survey.

6. It is reported by the Region of Peel that properties surrounding the site all have municipal water servicing. As any remnant wells are not utilized for potable water supply, they are not considered a

down-gradient groundwater receptor of concern for effluent from proposed subsurface sewage systems.

7. Soil grain size analysis was carried out for native silty sand and gravel. Based on the observed grain size distribution it is expected that soil percolation rates of approximately 6 to 10 min/cm are applicable for the Site.

8. In-situ hydraulic conductivity testing was completed at MW2-S, MW2-D and MW8. The average hydraulic conductivity for silty sand and gravel deposits at the Site is expected at 1.8×10^{-6} m/s.

9. Groundwater quality analysis was completed for monitoring wells MW2-S, MW2-D and MW8. The background groundwater quality with respect to nitrate in shallow groundwater ranged from 0.32 to 2.87 mg/L. The observed background nitrate concentrations are anticipated to be due to surrounding private subsurface sewage disposal systems located up-gradient from the Site.

10. It is proposed to develop the Site as a residential subdivision consisting of 67 residential units within 14 condominium townhouse blocks, each under separate land ownership. Sewage servicing will be provided by proposed tertiary/advanced package sewage treatment plants and subsurface type 'A' dispersal beds. The 14 individual sewage systems will be OBC compliant, each based on daily design sewage flows ranging from 8,000 to 9,900 L/day.

11. Dewatering will be addressed at detailed site plan design stage when foundation elevations are established. SWM and water servicing is expected above shallow groundwater and therefore dewatering is not expected for site servicing.

The following summarizes the conclusions with regards to the on-site sewage system requirements and impacts assessment for downgradient receptors including private wells, surface water and Alton municipal wells 3 and 4 classified as GUDI:

1. Design parameters provided by Gunnell Engineering for the construction of type 'A' dispersal beds with advanced treatment units to service proposed townhouse blocks. Dispersal beds are expected to range in area between 140 to 198 m^2 based on the calculated daily design sewage flows for individual units.

2. Dispersal beds can be constructed as in-ground beds, sufficient OBC clearance will be maintained from seasonal high groundwater levels. Proposed dispersal beds have been located to meet the

required setback distances from private wells identified to the northwest of the site for properties fronting to Queen Street West, in addition to structures, townhouses, and property lines.

3. Some properties located to the northwest of the site along Queen Street West were identified through have private wells through completed well surveys. It was confirmed by the Region of Peel that residential properties surrounding the site have installed water meters and are serviced with municipal water supplies. Private wells do not represent a sensitive down-gradient receptor for sewage effluent. The private wells therefore do not represent a down-gradient receptor of concern for sewage effluent as part of this sewage impact assessment.

4. For the purposes of Sewage Impact Assessment, the closest downgradient receptor was considered as Shaws Creek. With regards to surface water, the Canadian Water Quality Guidelines (CWQG) for nitrate in shallow groundwater would be applicable and nitrates within shallow groundwater would be required beow 3.0 mg/L as indicated n comments received by the CVC. The expected nitrate effluent concentrations required to meet the CWQG for nitrate of 2.93 mg/L is calculated at 5.2 mg/L.

5. Potential impacts to municipal wells servicing the Village of Alton were considered. The Site is located within the area designated as 'Groundwater Under the Direct Influence of Surface Water' (GUDI) or Wellhead Protection Area (WHPA)-E for Alton Municipal Wells 3 and 4 servicing the community of Alton. The Vulnerability Score assigned to the site falls within a score of 8 and is identified as a medium threat area for pathogens.

6. Nitrate increases within surface water near Alton Municipal Wells 3 and 4 will be negligible, given that effluent pre-treatment will achieve effluent quality with respected to nitrates at 5.2 mg/L to meet the CWQG for nitrates of 2.93 mg/L downgradient of the site, sewage flows from the site represent between 0.3% to 0.1% of monthly average flows at the Alon Millpond, and the Alton Millpond is located approximately 750 m upstream of Alton Municipal Wells 3 and 4. Impacts to municipal wells are not expected.

We trust that this information is sufficient for your present purposes. Should you have any questions regarding the information presented, please do not hesitate to contact our office.

Yours truly,

Terraprobe Inc.

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Stoney Creek Office

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4. Chapman, L.J. and D.F. Putnam, 1984. The Physiography of Southern Ontario. Ontario.

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8.0 LIMITATIONS OF LIABILITY

This report was prepared at the request of, and for the exclusive use of Normaple Development Ltd. and its affiliates ("the Intended User") is intended to provide an assessment of the hydrogeological conditions of the Property located at Agnes Street, Alton, Ontario (the Site). No one other than the Intended User has the right to use and rely on the work without first obtaining the written authorization of Terraprobe Inc. and Normaple Development Ltd..

Terraprobe Inc. expressly excludes liability to any party except the Intended User for any use of, and/or reliance upon, the work. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Terraprobe Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report, including consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

The assessment should not be considered a comprehensive audit that eliminates all risks of encountering hydrogeological problems. The information presented in this report is based on information collected during the completion of the hydrogeological study by Terraprobe Inc. It was based on the conditions on the Site at the time of the hydrogeological study by a review of historical information and field investigation to assess the hydrogeological conditions of the Site, as reported herein.

There is no warranty expressed or implied by this report regarding the hydrogeological conditions for the Site. Professional judgement was exercised in gathering and analyzing information collected by reviewing previous reports, data provided by government and are open to public and field work investigation. The conclusions presented are the product of professional care and competence, and cannot be construed as an absolute guarantee.

In the event that during future work new information regarding the hydrogeological conditions of the Site is encountered, or in the event that the outstanding responses from the regulatory agencies indicate outstanding issues on file with respect to the Site, Terraprobe Inc. should be notified in order that we may re-evaluate the findings of this assessment and provide amendments, as required.

Terraprobe
an **Englobe** Company
Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

HYDROGEOLOGICAL INVESTIGATION
AND SEPTIC IMPACT ASSESSMENT
RESIDENTIAL TOWNHOUSE SUBDIVISION
AGNES STREET
ALTON ONTARIO

Prepared For: **The Alton Development Inc.**
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File No. T1220087.000
December 14, 2023

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1.0 INTRODUCTION

Terraprobe was retained by The Alton Development Inc. to complete a hydrogeological investigation in support of private sewage servicing for a proposed residential development (the Site) in the Village of Alton (Caledon), Ontario. It is proposed to construct a residential subdivision consisting of 14 townhouse blocks consisting of a total of 67 residential units. The Village of Alton is currently serviced with municipal water servicing with properties utilizing private sewage servicing.

The subject property is situated south of Queen Street West between Agnes Street and Emeline Street in the Village of Alton as indicated on the attached **Figure 1**. The Site consists of an irregular shaped undeveloped parcel of land covering an area of approximately 4.0 hectares (10 acres).

A hydrogeological investigation has been completed for the Site to summarize the findings of the field study and related ground water monitoring and quality sampling program; to provide a description of the physical soil and ground water characteristics of the Site; and, to establish the baseline ground water quality for nutrient parameters (including nitrogen containing species and phosphorus) to allow for any required future assessment of the nutrient loading and attenuation capacity of the site to accommodate planned sewage system servicing for the development of the Site. A review of applicable planning policies, including the Town of Caledon Official Plan and Source Water mapping and wellhead protection zones was completed to assess potential site restrictions with regards to applicable planning policies for the subject property.

2.0 SCOPE OF WORK

In addressing the above components, the following scope of work was undertaken:

- *Review of Geological and Hydrogeological Setting of the Site:* A review of available background geological and Hydrogeological information for the Site was completed using Ontario Geological Survey (OGS) maps, Ministry of Environment Conservation and Parks (MECP) water well records database and Oak Ridges Moraine Group (ORMGP) database for the Site. A detailed visual inspection of the Site and surrounding areas to determine local topography and drainage. The presence of significant hydrogeological features such as closed depressions (areas of groundwater recharge), seeps and springs was assessed.

- *Private Well Survey:* A private well survey was completed to assess potential downgradient receptors for proposed on-site subsurface sewage disposal. Property owners were contacted concerning the presence of, and details about water supply wells on private properties within a 500 m radius of the site. Where private water supply wells were present, if property owners did not respond to inquiries, staff were sent to physically inspect the wells. The Peel Works Department was also contacted and confirmed that all properties are connected to the municipal water system.

- *Completion of Subsurface Investigations:* Multiple subsurface investigations were conducted to investigate shallow soil and groundwater conditions at the Site. A borehole program was completed by Terraprobe in February 2019 to investigate shallow soil and groundwater conditions, which established a series of monitoring wells across the site to monitor stabilized groundwater elevations, including seasonal high groundwater conditions, and to complete in-situ hydraulic conductivity testing and groundwater sampling. In addition to the completed borehole program a series of 18 test pits were completed by Gunnell Engineering in August 2022 to evaluate shallow soil and groundwater conditions in the vicinity of proposed subsurface sewage disposal beds.

- *Laboratory Soil Analysis:* Laboratory analysis of grain size distribution was carried out for soil samples obtained from the completed subsurface investigation. Grain size analysis was carried out to establish percolation rates to assess tile bed sizing for the various proposed development concepts.

- *Groundwater Monitoring and Sampling:* Groundwater monitoring and water quality sampling was carried out to establish seasonal groundwater fluctuations including seasonal high groundwater conditions and to conduct water quality analysis to establish background water quality with respect to nitrates.

3.0 SITE DESCRIPTION

3.1 Location and Site Description

The Site is located south of Queen Street West between Agnes Street and Emeline Street in the Village of Alton, where the intersection of Queen Street West and Main Street is located approximately 250 m to the northwest of the Site. The location of the Site is shown on the attached **Figure 1**. The Site consists of an irregular parcel of land covering an area of approximately 4.0 hectares (10 acres) consisting of a vacant lot. The Site is situated within the Village of Alton surrounded by detached residential dwellings to the north, east, south and west limits of the Site. Properties within the Village of Alton are provided with municipal water servicing. Alton municipal supply wells 3 and 4 servicing the Village of Alton are situated along Queen Street East approximately 650 m northeast of the Site (approximately 400 m northwest of the intersection of Queen Street West and Main Street. Municipal sewage servicing is not currently available within the Village of Alton.

It is proposed to develop the Site for use as a residential subdivision consisting of 14 condominium townhouse blocks comprising a total of 67 residential units with a combined common amenity/SWM area.

Proposed plans of development are provided in the attached **Appendix A**. The proposed residential development is to be serviced using municipal water servicing and private subsurface sewage disposal systems.

3.2 Regional Geology and Hydrogeology

The current understanding of the surface geological setting of the Site is based on scientific work conducted by the OGS (OGS, 2003). Much of the Site is mapped as till consisting of a stone poor sandy silt to silty sand-textured till. However, northwest, and west portions of the Site are mapped as glaciofluvial deposits, comprising river deposits and delta topset facies and sandy deposits (OGS, 2003). Overburden deposits in the vicinity of the Site are expected in the range of 6 to 10 m in thickness based on well records on file with the MECP.

Bedrock underlying the Site consists mainly of Amabel Formation consisting of white to blue-grey, thick to massive bedded, dolostone (OGS, 2007). However, the northwest portion of the Site is mapped with Clinton Cataract Group, consisting of shale, sandstone and dolostone. Limestone bedrock forms a

productive regionally extensive confined to semi-confined aquifer. The municipal supply wells for the Village of Alton are completed within the limestone bedrock at depth.

The local hydrogeology was assessed through a review of well records on file with the Ministry of the Environment Conservation and Parks (MECP). Well records located downgradient from the site were reviewed within the study area extending to Emeline Street to the west, Agnes Street to the east, the subject site to the south and Shaws Creek to the north. **Table 3-1** provides a summary of well records situated within the defined study area.

Table 3-1: Summary of Down-Gradient Well Records

Well ID	Easting	Northing	Year Installed	Water Level (m)	Well Use	Stratigraphy (depth in metres)
4908785	574517	4856373	2001	n/a	n/a	Abandonment
4904962	574566	4856373	1976	2.7	Test Hole	No Info
4900960	574564	4856421	1957	5.2	Domestic	Clay (5.5) Limestone (17.7)
4900964	574563	4856444	1959	0.9	Domestic	Clay (4.9) Limestone (12.2)
4904746	574675	4856531	1975	3.0	Domestic	Clay/Stones (4.3) Limestone (27.4)
7211283	574700	4856551	2013	n/a	n/a	Abandonment
4900968	574724	4856547	1962	2.4	Domestic	Clay/Stones (6.4) Limestone (12.8)
4900967	574730	4856552	1960	4.3	Domestic	Sand/Stones/Clay (8.4) Limestone (23.8)
7330876	574612	4856350	2019	1.5	Test Hole	Sand/Gravel (6.1)
7330874	574736	4856520	2019	4.0	Test Hole	Sand/Gravel (4.6) Limestone (4.7)

In total 10 well records were situated within the study area with two decommissioning records, three test holes/monitoring wells and five domestic wells reported to have been completed between 1957 and 1976. Alton is presently serviced with municipal water. A well survey was complete to confirm locations of the above noted well records further discussed in Section 3.8 below.

3.3 Regional Physiography

The Site is located within a regional physiography of Southern Ontario known as Guelph Drumlin Field. It is underlain by dolostones of the Amabel and Guelph Formations which dip gently toward the southwest. The till in drumlins is loamy and calcareous and was derived mostly from dolostone of the Amabel Formation. In addition, it contains fragments of the underlying red shale which is exposed below

the escarpment. The till throughout is rather stony, with large surface boulders being more numerous in some localities than others (Chapman and Putnam, 1984).

3.4 Topography and Drainage

The topography at the Site consists of gently rolling topography sloping to the north toward Queen Street West. The topographic high to the southern extent of the Site sits at an elevation of approximately 421.9 m, falling to the north and eastern extents of the Site at an elevation of approximately 411.2 m, a total grade change of approximately 10.7 m.

Topography slopes toward Shaws Creek situated approximately 80 m north of the Site. Shaws Creek forms a sub-watershed of the Credit River watershed. Shaws Creek flows eastward to form the West Credit River approximately 750 m east of the Site. Shallow groundwater flow in the vicinity of the Site is expected to follow topography and be directed to the west and northwest toward Shaws Creek.

3.5 Natural Heritage Features

Records for wetland features are scattered around the Site, with the details summarized below:

- Provincial Wetland Features: Two provincial wetland complexes are in proximity to the Site. Credit River at Alton Wetland Complex: This feature is located approximately 750 m to the northeast, and Alton-Hillsburg Wetland Complex is located approximately 1.4 km to the west of the Site.

- Evaluated as Other: Coulterville Wetland Complex, located approximately 550 m to the southwest of the Site, is evaluated as other natural heritage features.

- Not Evaluated Wetland Features: A wetland feature located approximately 70 m to the northwest of the Site (adjacent to the Queen Street West) is not evaluated as per Ontario Wetland Evaluation System (OWES).

Records for Area of Natural and Scientific Interest (ANSI) are mapped approximately 2.7 km and 2.6 km to the northwest and west of the Site, respectively. Additionally, wooded areas are scattered around the Site. Record review indicates that there are no records of any above-mentioned natural heritage features within or abutting the Site.

3.6 Source Water Protection Areas

Source Water Information Atlas provided by MECP was reviewed on October 22, 2019, and March 01, 2023. The Site is mapped within the jurisdiction of Credit Valley Source Protection Area. Record review indicates that the Site is located within the area designated as 'Groundwater Under the Direct Influence of Surface Water' (GUDI) or Wellhead Protection Area (WHPA)-E for Alton municipal wells 3 and 4 servicing the community of Alton. The Vulnerability Score assigned to the site falls within a score of 8 and is identified as a medium threat area for pathogens. Wellhead protection mapping for the Site and surrounding areas of Alton are provided in the attached **Appendix B**.

Under the Credit Valley, Toronto and Region and Central Lake Ontario (CTC) Source Water Protection Plan the identified ground water threat resulting from site development is anticipated to be septic systems governed under the Building Code Act (SWG-1). Specific actions would require a prioritized maintenance inspection program for the oldest identified systems or for systems in the highest areas of vulnerability. Areas within a WHPA-E are identified as high vulnerability with a Vulnerability Score of 10. The site is not identified within an area of highest vulnerability. For the remaining areas the primary concern would be potential increases for nitrates and pathogens to underlying ground water. CTC mapping indicated the subject site falls outside significant ground water quality threat areas.

Given the GUDI designation for Alton Municipal Wells 3 and 4, and the proximity of the site to Shaws Creek surface water has been considered the primary groundwater receptor for effluent from proposed on-site sewage disposal.

3.7 Results of Site Inspection

A site inspection was completed on April 4, 2019, to assess site conditions. The Site consisted of a vacant grass field with a gradual fall in topography from the east to west across the Site. Drainage features at the Site were not evident, and runoff is expected to form a sheet flow and be largely infiltrated across the Site. Local areas of depression, ponding water and phreatophytic vegetation were not observed. Areas of enhanced groundwater infiltration are not expected at the Site.

3.8 Private Well Survey

In addition to the MECP well records search, private well surveys were conducted by Terraprobe on March 17, 2022, and by Gunnell Engineering in June 2022. Field confirmations of the MECP well records summarized in Table 3-1 was not able to be completed because well tags were not evident on the

surveyed wells. Private well survey letters distributed by both Terraprobe and Gunnell Engineering and no local property owners responded to indicate that they had a drinking water well. Visual surveys were completed to confirm the details of private well. Properties located along Agnes Street (northeast), Davis Drive (southeast) and Emeline Street (southwest) represent relatively new residential dwellings which were confirmed through the well survey to be serviced using municipal water supplies. The older properties along Queen Street West that existed prior to the installation of the municipal water system in the 1980s were confirmed by the Region of Peel to be municipally serviced, but a number were identified as still having existing private wells. Private wells were identified at the following municipal addresses:

- Existing Dug Wells: 1341 (lot 15), 1349 (lot 14), 1365 (lot 13), and 1409 (lot 6) Queen St. W.
- Drilled Wells: 1375 (lot 11) and 1387 (lot 9) Queen St. W.
- No Located Well: 1367 (lot 12) and 1379 (lot 10) Queen St. W
- Decommissioned Well: 1401 (lot 7) and 1417 (lot 5) Queen St. W.

Confirmed well locations determined by the completed well surveys are indicated on the attached site plan provided in **Appendix A** (Drawing SP-1 by Gunnell Engineering, dated July 21, 2022).

The private wells located along Queen Street West immediately northwest of the site were not sampled as permission to access wells was not provided by property owners and because they were not reported as being used for potable water supplies and therefore not considered as a groundwater receptor of concern for on-site septic systems. Given the proposed on-site sewage systems are under 10,000 L/day, Reasonable Use assessment to the down-gradient property boundary for the on-site septic systems is not required and approvals for septic systems would be under the Ontario Building Code. For the detailed septic designs the required OBC setback distances to the drilled and dug wells are to be provided based on the surveyed well type (i.e., 30 m setback from dug wells and 15 m setback from drilled wells).

3.9 Results of Subsurface Investigation

A subsurface investigation was carried out on February 7th and 8th, 2019 consisting of 8 borehole locations to various depths between 2.5 and 6.7 m below existing grades (elevations between 415.5 and 408.9 m). Drilling was carried out by a specialized drilling sub-contractor using a track mounted drilling rig equipped with hollow stem augers. Split spoon soil sampling was completed at regular intervals along with Standard Penetration Testing. Soil and groundwater conditions encountered within completed boreholes were logged by a Terraprobe technician present over the duration of drilling activities.

Soil conditions encountered as part of the subsurface investigation generally consisted of topsoil overlying localized areas of fill and silty fine sand followed by silty sand and gravel with occasional cobbles and boulders to the depth of completion. Borehole locations are indicated on the attached **Figure 2**, borehole logs summarizing the results of the subsurface investigation and results of soil laboratory testing are provided in the attached **Appendix C**. A detailed description of the soil stratigraphy encountered at the Site is provided below.

A series of 18 test pits were excavated at the site in August 2022 by Gunnell Engineering in the vicinity of proposed tile beds. Test pits were completed to varying depths between 1.8 to 2.1 m below existing grades. Test pit locations are indicated on Gunnell Engineering drawing SP-1 dated July 21, 2022, provided in **Appendix A**. Test pits indicated shallow soils consisted of topsoil overlying fine to coarse sands with varying amounts of gravel. Groundwater was not encountered within any of the completed test pits.

3.9.1 Topsoil

A layer of topsoil was encountered at the surface of each completed borehole between 150 to 600 mm in thickness. Topsoil thickness was confirmed at the location of boreholes and should not be used to estimate quantities of topsoil present at the Site.

3.9.2 Fill

Fill deposits were encountered underlying topsoil within boreholes BH2 and BH5 to BH8. Fill deposits consisted of silty fine sand to sand and gravel. The thickness of fill deposits where encountered was observed to be variable with thicknesses between 0.5 to 1.5 m. Fill deposits were encountered to depths between 0.8 to 2.1 m below existing grades (elevations between 420.4 and 412.6 m). The relative density of fill deposits was generally observed to be loose to dense based on the completed Standard Penetration Testing.

3.9.3 Silty Fine Sand

A layer of silty fine sand was encountered underlying topsoil within BH1 and underlying fill deposits within BH5 and BH6. The thickness of silty fine sand was observed to range from 1.6 to 2.5 m. Silty fine sand deposits were encountered to depths between 2.1 to 4.0 m below existing grades (elevations between 417.9 and 410.9 m). The relative density of silty fine sand deposits was generally observed to be loose to compact based on the completed Standard Penetration Testing.

3.9.4 Silty Sand and Gravel

A layer of silty sand and gravel was encountered within all boreholes at depths between 0.5 to 4.0 m below existing grades extending to the depth of completion. It was encountered underlying topsoil deposits within BH3 and BH4, underlying fill deposits within BH2, BH7 and BH8 and underlying silty fine sand in BH1, BH5 and BH6. The relative density of silty sand and gravel ranged from compact to very dense based on the completed Standard Penetration Testing.

Laboratory soil grain size analysis was carried out on selected soil samples and is summarized in the following **Table 3-2**:

Table 3-2: Summary of Borehole Soil Grain Size Analysis

Sample ID	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Soil Description
BH1 Sa2	1.0	2	86	4	8	Fine sand, trace gravel silt and clay
BH8 Sa3	1.8	27	41	23	9	Silty sand, trace clay and gravel

Shallow soils up to depths ranging from 2.0 to 4.0 m were generally observed as compact in nature becoming dense at depths greater than 4.0 m. Based on the above grain size analysis the investigated soils were assigned a classification of SM under the universal soil classification with expected percolation rates of 12 min/cm.

Table 3-3 provides a summary of grain size analysis completed by Gunnell Engineering for completed test pits:

Table 3-3: Summary of Test Pit Soil Grain Size Analysis

Sample ID	Sample Depth (m)	Gravel (%)	Sand (%)	Silt and Clay (%)	Soil Description
TP22-1	2.1	0	95	5	Sand, little or no fines
TP22-4	2.0	0	95	5	Sand, little or no fines
TP22-7	2.1	0	95	5	Sand, little or no fines
TP22-13	1.8	0	95	5	Sand, little or no fines

Based on the completed grain size analysis for shallow test pits soils were assigned a classification of SP under the universal soil classification with expected percolation rates between 6 to 10 min/cm.

It should be noted that the subsurface conditions are confirmed at the borehole location only and may vary at other locations. The boundaries between the various strata represent an inferred transition rather

than a precise plane of geological change. This provided summary is intended to correlate the data to assist in the interpretation of the subsurface conditions at the Site. For more specific subsurface details including results of standard penetration testing, soil grain size analysis, moisture content, detailed soil descriptions and a water level summary, refer to borehole logs provided in the attached **Appendix C**.

3.9.5 Groundwater Conditions

Groundwater levels were measured within four (4) monitoring wells installed within selected boreholes BH2, BH5 and BH8. Monitoring well identification followed the numbering of the boreholes completed as part of this investigation. Geodetic elevations of monitoring well locations were obtained from the topographic survey competed for the Site and monitoring well locations were mapped with a handheld GPS device. **Table 3-4** provides a summary of monitoring well locations established at the Site:

Table 3-4: Monitoring Wells Details

MW ID	Coordinates		Ground Surface Elevation (masl)*	Well Depth	
	Easting (m)	Northing (m)		mbgs**	masl
MW2-S	574614	4856342	415.8	3.0	412.8
MW2-D				6.1	409.7
MW5	574776	4856396	421.9	6.2	415.7
MW8	574738	4856521	413.9	4.6	409.3

Note:
*masl: meters above sea level
**mbgs: meters below ground surface

Monitoring wells were screened with a 1.5 m length well screen completed within silty sand and gravel deposits. One (1) pair of nested monitoring well was installed at BH2 location to assess vertical groundwater flow gradients. Monitoring wells were identified using the same numbering as borehole locations (i.e., MW5 was completed within BH5). The shallow and deep monitoring wells are identified as MW2-S and MW2-D, respectively. Water levels were monitored at the installed monitoring wells as summarized in the following table (**Table 3-5**):

Table 3-5: Summary of Groundwater Monitoring

Location	Water Levels							
	04-Mar-19		04-Apr-19		25-Apr-19		09-Aug-19	
	mbgl *	masl **	mbgl	Masl	mbgl	masl	mbgl	masl
MW2-S	2.3	413.5	1.6	414.2	1.3	414.5	2.4	413.4
MW2-D	2.4	413.4	1.8	414.0	1.6	414.2	2.6	413.2

MW5	6.3	415.6	6.2	415.7	>6.4	<415.5	6.1	415.8
MW8	2.2	411.7	1.6	412.3	1.1	412.8	2.4	411.5

Note:
*mbgs: meters below ground surface
**masl: meters above sea level

From the above measured groundwater levels the seasonal high groundwater level was observed at the Site on April 25, 2019. Seasonal variation in groundwater levels at the Site ranged from 1.1 mbgs at MW8 to lower than 6.4 mbgs at MW5. The groundwater flow direction is expected to the north of the Site toward Shaws Creek situated approximately 120 m north of the Site. The inferred groundwater flow direction is provided on the attached **Figure 3**.

Vertical hydraulic gradients were assessed based on the observed water level within MW2-S/MW2-D. A review of groundwater level at the nested monitoring wells indicates a slight downward hydraulic gradient within the Site. The vertical hydraulic gradient considering groundwater level elevations measured on August 9, 2019, is estimated at 0.06.

3.10 In-Situ Hydraulic Conductivity Testing

Single well response tests were carried out at each monitoring well location to evaluate the rate of flow of groundwater through native soils present at the Site. Single well response tests were carried out as rising head tests at MW2-S, MW2-D and MW8. Rising head hydraulic conductivity testing involved removing a quantity of groundwater from within the well and monitoring the rate of groundwater recovery to static conditions with time. Due to insufficient groundwater within MW5 hydraulic conductivity testing was not completed at this Location. **Table 3-6** provides a summary of the results of in-situ hydraulic conductivity testing carried out at the Site:

Table 3-6: Summary of In-Situ Hydraulic Conductivity Testing

Monitoring Well ID	Screened Formation	Hydraulic Conductivity (m/s)
MW2-S	Silty Sand and Gravel	4.7×10^{-7}
MW2-D	Silty Sand and Gravel	4.1×10^{-6}
MW8	Silty Sand and Gravel	8.6×10^{-7}

The average hydraulic conductivity for silty sand and gravel deposits at the Site are expected at 1.8×10^{-6} m/s. It is anticipated that the average value would be representative of compact soils. Dense deposits of silty sand and gravel are generally expected at depths greater than 2.0 m below existing grades and would be representative of conditions encountered at MW2-S. The results of in-situ hydraulic testing are provided in the attached **Appendix D**. These values are considered consistent with the expected

percolation rates of 12 min/cm based on the completed grain size analysis testing as summarized in Section 3.5.4 above.

3.11 Groundwater Quality

Groundwater quality sampling was completed from within MW2-S, MW2-D and MW8 on March 4, 2019. Groundwater quality sampling was not completed from MW5 due to insufficient groundwater within the monitoring well. Groundwater was sampled for nitrogen containing parameters and total phosphorus. The results of water quality analysis are summarized in the **Table 3-7**:

Table 3-7: Summary of Groundwater Quality Results

Parameter	Unit	MW2-S	MW2-D	MW8
Total Ammonia	mg/L	<0.05	0.11	<0.05
Total Kjeldahl Nitrogen	mg/L	0.42	0.39	0.66
Total Phosphorus	mg/L	0.63	2.8	2.1
Nitrite	mg/L	<0.01	<0.01	<0.01
Nitrate	mg/L	2.87	0.32	0.96
Nitrite + Nitrate	mg/L	2.87	0.32	0.96

Laboratory certificates of analysis for completed groundwater sampling are provided in the attached **Appendix E**. The above water quality is considered background groundwater quality with respect to nitrate and phosphorus. The shallow monitoring well MW2-S showed the highest concentrations of nitrate at 2.87 mg/L. Deeper monitoring wells MW2-D and MW8 showed concentration of nitrate at 0.32 and 0.96 mg/L respectively. It is expected that nitrates observed within shallow groundwater are due to private subsurface sewage systems surrounding the Site.

3.12 Proposed Development

The residential development is proposed to consist of 67 residential units within a total of 14 condominium townhouse blocks with 4 to 5 units. Each townhouse block will each be serviced with an on-site sewage system, with daily design sewage flows ranging between 1,750 to 2,000 L/day based on the proposed individual unit sizes, with each of the 14 individual sewage systems to be based on total daily design sewage flows between 8,000 to 9,900 L/day. Proposed sewage systems will be subject to Ontario Building Code (OBC) approvals through the Town and would not be applicable to approvals with the Ministry of the Environment Conservation and Parks as sewage flows are not proposed to exceed

10,000 L/day. Sewage system design is discussed further in Section 4.0 below and is based on the proposed dispersal bed layout prepared by Gunnell Engineering.

4.0 DISCUSSION AND ANALYSIS

4.1 Summary of Site Conditions

The results of the investigation indicate the following general hydrogeological function for the Site:

- A subsurface investigation was carried out at the Site which involved drilling at eight locations with monitoring wells established at three selected locations and a series of 18 test pits completed to depths ranging from 1.8 to 2.1 m in depth in areas proposed for septic tile beds. Soil conditions generally consisted of topsoil overlying localized areas of fill and silty fine sand to sand, followed by silty fine sand and sand and gravel to the completed depth of investigation. Groundwater was not encountered, and test pits remained open and dry upon completion.

- Seasonal high groundwater levels were observed at the Site during the Site investigation completed on April 25, 2019, at depths of approximately from 1.1 mbgs at MW8 to lower than 6.4 mbgs at MW5. Seasonal variation in groundwater levels was observed between 1.0 to 1.3 m below grades at the Site from within MW2 and MW8 (MW5 was observed to be dry during monitoring). It is expected that groundwater flows to the north of the Site towards Shaws Creek situated approximately 120 m north of the Site.

- A review of the Ministry of the Environment Conservation and Parks well record database was completed for properties located downgradient of the site. The search area was defined by the subject property to the south, Emeline Street to the west, Agnes Street to the east and Shaws Creek to the north. In total 10 well records were situated within the study area with two decommissioning records, three test holes/monitoring wells and five domestic wells reported to have been completed between 1957 and 1976. Alton is presently serviced with municipal water.

- A private well survey was completed for properties within a 500 m radius of the site. Properties along Agnes Street (northeast), Davis Drive (southeast) and Emeline Street (southwest) represent relatively new residential dwellings which were confirmed to be serviced using municipal water supplies. Properties along Queen Street West were noted to also be municipally serviced, but several were identified with existing private wells. Of the 12 lots immediately northwest of the site four lots were confirmed with dug wells, two were confirmed with drilled wells, two lots were confirmed to have decommissioned wells and two lots received no response to the survey.

- It was verified through the Region of Peel, that all homes surrounding the site are connected to the municipal water system.

- Soil grain size analysis was carried out for native silty sand and gravel. Based on the observed grain size distribution it is expected that soil percolation rates of approximately 6 to 10 min/cm are applicable for the Site.

- In-situ hydraulic conductivity testing was completed at MW2-S, MW2-D and MW8. The average hydraulic conductivity for silty sand and gravel deposits at the Site is expected at 1.8×10^{-6} m/s.

- Groundwater quality analysis was completed for monitoring wells MW2-S, MW2-D and MW8. The background groundwater quality with respect to nitrate in shallow groundwater ranged from 0.32 to 2.87 mg/L. The observed background nitrate concentrations are anticipated to be due to surrounding private subsurface sewage disposal systems located up-gradient from the Site.

- It is proposed to develop the Site as a residential subdivision consisting of 67 residential units with 14 condominium townhouse blocks. Sewage servicing will be provided by private subsurface sewage disposal systems. Sewage systems beds are proposed for each townhouse block and will be designed based on daily design sewage flows ranging from 7,000 to 9,900 L/day.

4.2 Sewage System Design for Proposed Development

Design parameters have been provided by Gunnell Engineering for the construction of Waterloo Biofilter tertiary treatment sewage systems with Type 'A' Dispersal Beds to service proposed townhouse blocks. Design parameters were summarized in the Sewage System Brief prepared by Gunnell Engineering dated March 14, 2023, and summarized on Drawing SP-1, Overall Site Plan: Septic System Layout Criteria included within **Appendix A**. Dispersal Bed requirements by block are summarized in **Table 4-1** below:

Table 4-1: Type 'A' Dispersal Bed Sizing Requirements

Block	Daily Design Flow (Q) L/day	Area Required (Q/50) m^2	Bed Dimensions* m
1	9,900	198.0	5.0 x 40.0
2	9,900	198.0	7.2 x 32.0
3	9,900	198.0	7.2 x 32.0
4	9,900	198.0	7.2 x 32.0

Block	Daily Design Flow (Q) L/day	Area Required (Q/50) m^2	Bed Dimensions* m
5	8,000	160.0	7.2 x 28.0
6	9,900	198.0	7.2 x 32.0
7	8,000	160.0	7.2 x 32.0
8	9,900	198.0	7.2 x 32.0
9a and 9b	9,900	198.0	7.2 x 32.0
10	9,900	198.0	7.2 x 32.0
11	9,900	198.0	7.2 x 32.0
12	7,000	160.0	7.2 x 23.5
13	9,900	198.0	7.2 x 32.0
14	9,900	198.0	7.2 x 32.0

*Bed dimensions to be confirmed by Gunnell Engineering

Sewage servicing at the Site for individual sewage systems will not exceed 10,000 L/day.

4.2.1 Sewage Setback Requirements

Given the prevalent sandy soil conditions, and that shallow groundwater was not encountered within test pits completed in the vicinity of the proposed leaching beds, it is expected that the tile bed will be constructed as an in-ground bed, and that setbacks from the proposed OBC Type 'A' Dispersal Beds and sewage treatment facilities will be required as follows (**Table 4-2**):

Table 4-2: Summary of Setback Clearances

	Distribution Pipe Clearances (m)
Structure	5
Well with a watertight casing to a depth of 6 m	15
Any other well	30
Surface water	15
Spring not used as a source of potable water	15
Property line	3

Proposed Dispersal Beds were located to meet the required setback distances from private wells identified to the northwest of the site for properties fronting to Queen Street West, in addition to structures, townhouse units, and property lines as indicated on drawing SP-1 provided in **Appendix A**. Vertical separation from the base of tile beds and the seasonal high groundwater level is expected to exceed 900 mm, as such raised dispersal beds will not be required. This was confirmed within proposed leaching bed

areas through the completion of shallow test pits completed to depths between 1.8 to 2.1 m below existing grades.

5.0 SEWAGE IMPACT ANALYSIS

5.1 Impacts to Private Wells

Properties located to the northwest of the site along Queen Street West were identified to have private wells through completed well surveys. It was confirmed by the Region of Peel that residential properties surrounding the site have installed water meters and are serviced with municipal water supplies. Private wells do not represent a sensitive down-gradient receptor for sewage effluent. The sewage impact assessment does not consider private wells since private wells are not reported to be used for potable supply.

5.2 Impacts to Surface Water

For the purposes of Sewage Impact Assessment, the closest downgradient receptor was considered as Shaws Creek. As indicated by the CVC in their pre-application review comments shallow groundwater entering environmentally sensitive areas are to be less than 3.0 mg/L to meet the Canadian Water Quality Guidelines (CWQG) for nitrate in shallow groundwater (i.e., 2.93 mg/L) would be applicable. Nitrate concentrations expected at the downgradient receptor of Shaws Creek was further assessed based on a review of the *'Nitrate-Nitrogen Impact Assessment Guideline for Dvelopment Applications in the Credit Valley Watershed'* prepared by Credit Valley Conservation, dated March 2022, and following the approach outlined within MECP Procedure D-5-4, given individual sewage systems will have flows below 10,000 L/day, as follows:

$$\textbf{Predicted Nitrate Increase} = \frac{N \times F \times C}{(N \times F) + (A_S \times I) + (A_D \times I)}$$

Where: N is the number of proposed residential units (67);

F is the expected sewage flows per year (365 m^3/yr);

C is the effluent nitrate concentration (mg/L);

I is the infiltration rate for native soils (0.3 m/yr); and,

A is the Site area (A_S for the Site area and A_D for downgradient dilution area).

The total site area for the development consists of approximately 40,000 m^2 (A_S). The downgradient area from the northern property limit to Shaws Creek is expected to provide additional dilution for

groundwater prior to baseflow contributions to Shaws Creek. The expected downgradient dilution area is expected to cover an area of approximately 23,400 m^2 (A_D) for a dilution volume of approximately 7,020 m^3 (based on infiltration rates of 0.300 m/a for sand and gravel). Attenuation areas for the Site and downgradient areas to Shaws Creek are indicated on the attached **Figure 4**. The expected nitrate effluent concentrations required to meet the CWQO guideline for nitrate of 2.93 mg/L is calculated at 5.2 mg/L. It is expected that through pre-treatment of sewage effluent impacts to Shaws Creek will be negligible. The above predictive nitrate impact assessment does not account for the dilution of effluent from dispersal beds for the proposed development with groundwater underflow. It is anticipated that additional dilution of effluent will be provided due to mixing with underlying groundwater. The background concentrations of nitrate at the Site were observed between 0.32 to 2.87 mg/L.

5.3 Impacts to Municipal Wells

Potential impacts to municipal wells servicing the Village of Alton were considered. As discussed in Section 3.6 above, the Site is located within the area designated as 'Groundwater Under the Direct Influence of Surface Water' (GUDI) or Wellhead Protection Area (WHPA)-E for Alton Municipal Wells 3 and 4 servicing the community of Alton. The Vulnerability Score assigned to the site falls within a score of 8 and is identified as a medium threat area for pathogens. With regards to surface water, the Canadian Water Quality Objectives (CWQO) for nitrate in shallow groundwater (i.e., 2.93 mg/L) would be applicable and met using effluent pre-treatment to achieve nitrate concentrations of 5.2 mg/L within sewage effluent.

Potential impacts to Alton Municipal Wells 3 and 4 were further assessed based on a review of surface water flow rates through the Alton Millpond assessed my CIMA+ in conjunction with the Alton Millpond LRIA dam reconstruction application. Average monthly flows of the Millpond Dam were assessed through a review of flow data over an 8-year period from 1983 to 1991. Monthly average flows are expected to range from 0.45 m^3/sec to upwards of 1.63 m^3/sec. Sewage flows from the proposed on-site septic system are predicted at 1.5 x 10^{-3} m^3/sec based on the daily design sewage flows. Based on average flow rates reported for the Alton Millpond over 1983 to 1991 it is expected that design sewage flows represent approximately 0.3 % of the seasonal low flow conditions and approximately 0.1 % of the seasonal high flow conditions. Given the reported average monthly flow rates for the Alton Millpond it is expected that nitrate concentrations within surface water will have negligible increases due to the private sewage systems proposed for the subject property.

Further to the predicted negligible impacts to the Alton Millpond, Alton Municipal Wells 3 and 4 are situated approximately 750 m downstream of the Alton Millpond dam. Nitrate increases within surface water near Alton Municipal Wells 3 and 4 will be negligible, given that effluent pre-treatment will achieve effluent quality with respected to nitrates at <5.2 mg/L to meet the CWQG guideline for nitrates of 2.93 mg/L downgradient of the site, sewage flows from the site represent between 0.3% to 0.1% of average flows at the Alon Millpond, and the Alton Millpond is located approximately 750 m upstream of Alton Municipal Wells 3 and 4. The Alton Millpond Hydraulic Characteristics report is provided in **Appendix F**.

6.0 SUMMARY AND CONCLUSIONS

The following provides a summary of the results of detailed investigations completed under the scope of the hydrogeological investigation:

1. A subsurface investigation was carried out at the Site which involved drilling at eight locations with monitoring wells established at three selected locations and a series of 18 test pits completed to depths ranging from 1.8 to 2.1 m in depth in areas proposed for septic dispersal beds. Soil conditions generally consisted of topsoil overlying localized areas of fill and silty fine sand to sand, followed by silty fine sand and sand and gravel to the completed depth of investigation.

2. Seasonal high groundwater levels were observed at the Site during the Site investigation completed on April 25, 2019, at depths of approximately from 1.1 mbgs at MW8 to lower than 6.4 mbgs at MW5. Seasonal variation in groundwater levels was observed between 1.0 to 1.3 m below grades at the Site from within MW2 and MW8 (MW5 was observed to be dry during monitoring). It is expected that groundwater flows to the north of the Site towards Shaws Creek situated approximately 120 m north of the Site.

3. A review of the Ministry of the Environment Conservation and Parks well record database was completed for properties located downgradient of the site. The search area was defined by the subject property to the south, Emeline Street to the west, Agnes Street to the east and Shaws Creek to the north. In total 10 well records were situated within the study area with two decommissioning records, three test holes/monitoring wells and five domestic wells reported to have been completed between 1957 and 1976. Alton is presently serviced with municipal water.

4. A private well survey was completed for properties within a 500 m radius of the site. Properties along Agnes Street (northeast), Davis Drive (southeast) and Emeline Street (southwest) represent

relatively new residential dwellings which were confirmed to be serviced using municipal water supplies. Properties along Queen Street West were noted to also be municipally serviced, but many were identified with existing private wells. Of the 12 lots immediately northwest of the site four lots were confirmed with dug wells, two were confirmed with drilled wells, two lots were confirmed to have decommissioned wells and two lots received no response to the survey.

5. It is reported by the Region of Peel that properties surrounding the site all have n=municipal water servicing. As any remnant wells are not utilized for potable water supply, they are not considered a down-gradient groundwater receptor of concern for effluent from proposed subsurface sewage systems.

6. Soil grain size analysis was carried out for native silty sand and gravel. Based on the observed grain size distribution it is expected that soil percolation rates of approximately 6 to 10 min/cm are applicable for the Site.

7. In-situ hydraulic conductivity testing was completed at MW2-S, MW2-D and MW8. The average hydraulic conductivity for silty sand and gravel deposits at the Site is expected at 1.8×10^{-6} m/s.

8. Groundwater quality analysis was completed for monitoring wells MW2-S, MW2-D and MW8. The background groundwater quality with respect to nitrate in shallow groundwater ranged from 0.32 to 2.87 mg/L. The observed background nitrate concentrations are anticipated to be due to surrounding private subsurface sewage disposal systems located up-gradient from the Site.

9. It is proposed to develop the Site as a residential subdivision consisting of 67 residential units within 14 condominium townhouse blocks, each under separate land ownership. Sewage servicing will be provided by proposed tertiary/advanced package sewage treatment plants and subsurface type ‘A’ dispersal beds. The 14 individual sewage systems will be OBC compliant, each based on daily design sewage flows ranging from 8,000 to 9,900 L/day.

The following summarizes the conclusions with regards to the on-site sewage system requirements and impacts assessment for downgradient receptors including private wells, surface water and Alton municipal wells 3 and 4 classified as GUDI:

1. Design parameters provided by Gunnell Engineering for the construction of type ‘A’ dispersal beds with advanced treatment units to service proposed townhouse blocks. Dispersal beds are expected to range in area between 140 to 198 m^2 based on the calculated daily design sewage flows for individual units.

2. Dispersal beds can be constructed as in-ground beds, sufficient OBC clearance will be maintained from seasonal high groundwater levels. Proposed dispersal beds have been located to meet the required setback distances from private wells identified to the northwest of the site for properties fronting to Queen Street West, in addition to structures, townhouses, and property lines.

3. Some properties located to the northwest of the site along Queen Street West were identified through have private wells through completed well surveys. It was confirmed by the Region of Peel that residential properties surrounding the site have installed water meters and are serviced with municipal water supplies. Private wells do not represent a sensitive down-gradient receptor for sewage effluent. The private wells therefore do not represent a down-gradient receptor of concern for sewage effluent as part of this sewage impact assessment.

4. For the purposes of Sewage Impact Assessment, the closest downgradient receptor was considered as Shaws Creek. With regards to surface water, the Canadian Water Quality Guidelines (CWQG) for nitrate in shallow groundwater would be applicable and nitrates within shallow groundwater would be required beow 3.0 mg/L as indicated n comments received by the CVC. The expected nitrate effluent concentrations required to meet the CWQG for nitrate of 2.93 mg/L is calculated at 5.2 mg/L.

5. Potential impacts to municipal wells servicing the Village of Alton were considered. The Site is located within the area designated as ‘Groundwater Under the Direct Influence of Surface Water’ (GUDI) or Wellhead Protection Area (WHPA)-E for Alton Municipal Wells 3 and 4 servicing the community of Alton. The Vulnerability Score assigned to the site falls within a score of 8 and is identified as a medium threat area for pathogens.

6. Nitrate increases within surface water near Alton Municipal Wells 3 and 4 will be negligible, given that effluent pre-treatment will achieve effluent quality with respected to nitrates at 5.2 mg/L to meet the CWQG for nitrates of 2.93 mg/L downgradient of the site, sewage flows from the site represent between 0.3% to 0.1% of monthly average flows at the Alon Millpond, and the Alton Millpond is located approximately 750 m upstream of Alton Municipal Wells 3 and 4. Impacts to municipal wells are not expected.

We trust that this information is sufficient for your present purposes. Should you have any questions regarding the information presented, please do not hesitate to contact our office.

Yours truly,

Terraprobe Inc.

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Project Hydrogeologist

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Stoney Creek Office

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2. Geological Survey. Ontario Geological Survey (OGS), 2003. Surficial Geology of Southern Ontario. Miscellaneous Release – Data 128 – revised.

3. Geological Survey. Ontario Geological Survey (OGS), 2007. Bedrock Geology of Ontario. Miscellaneous Release – MRD 219.

4. Chapman, L.J. and D.F. Putnam, 1984. The Physiography of Southern Ontario. Ontario.

5. Approved Source Protection Plan, CTC Source Protection Region, Effective date December 31, 2015.

8.0 LIMITATIONS OF LIABILITY

This report was prepared at the request of, and for the exclusive use of Normaple Development Ltd. and its affiliates ("the Intended User") is intended to provide an assessment of the hydrogeological conditions of the Property located at Agnes Street, Alton, Ontario (the Site). No one other than the Intended User has the right to use and rely on the work without first obtaining the written authorization of Terraprobe Inc. and Normaple Development Ltd..

Terraprobe Inc. expressly excludes liability to any party except the Intended User for any use of, and/or reliance upon, the work. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Terraprobe Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report, including consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

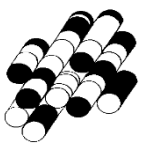
The assessment should not be considered a comprehensive audit that eliminates all risks of encountering hydrogeological problems. The information presented in this report is based on information collected during the completion of the hydrogeological study by Terraprobe Inc. It was based on the conditions on the Site at the time of the hydrogeological study by a review of historical information and field investigation to assess the hydrogeological conditions of the Site, as reported herein.

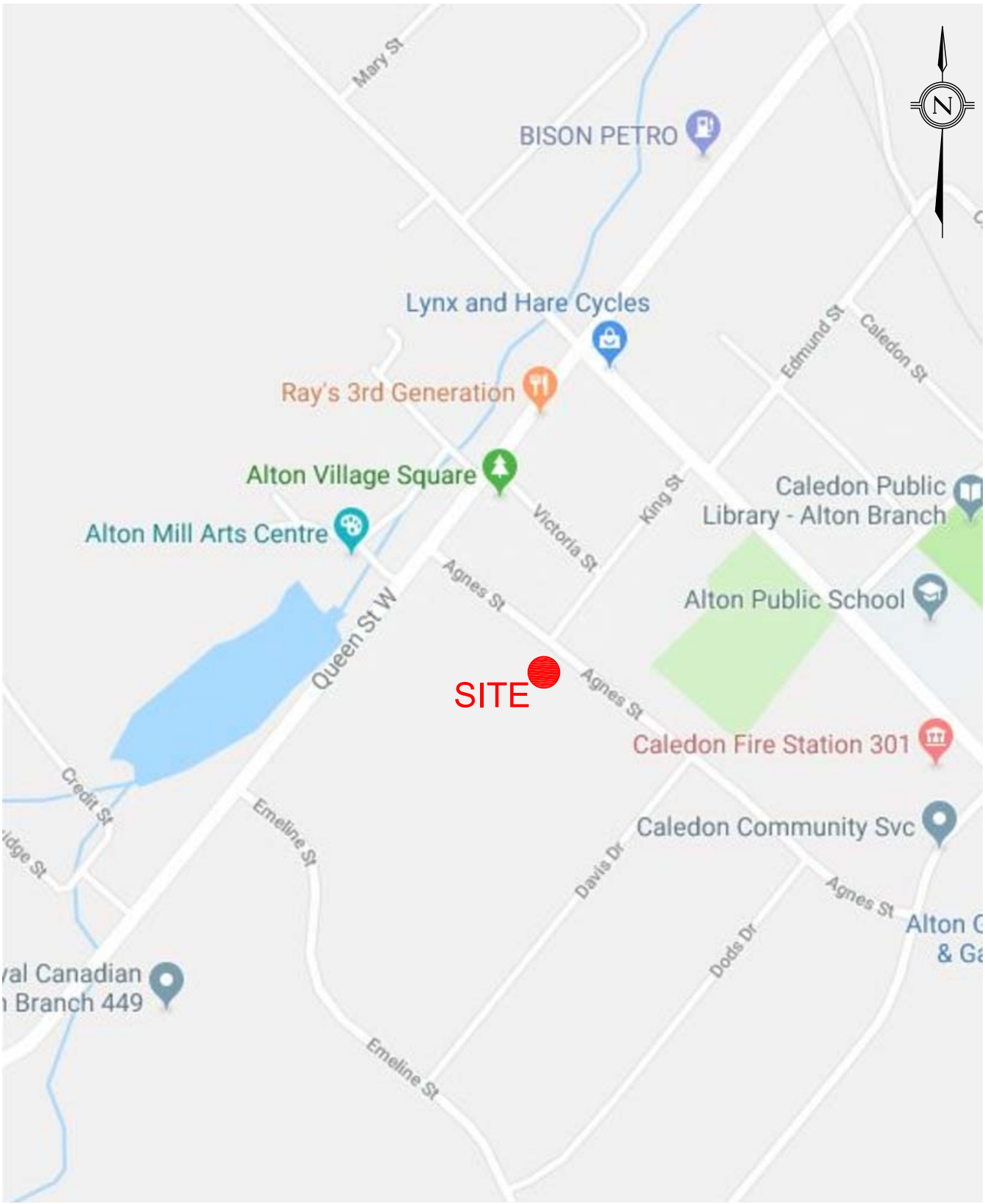
There is no warranty expressed or implied by this report regarding the hydrogeological conditions for the Site. Professional judgement was exercised in gathering and analyzing information collected by reviewing previous reports, data provided by government and are open to public and field work investigation. The conclusions presented are the product of professional care and competence, and cannot be construed as an absolute guarantee.

In the event that during future work new information regarding the hydrogeological conditions of the Site is encountered, or in the event that the outstanding responses from the regulatory agencies indicate outstanding issues on file with respect to the Site, Terraprobe Inc. should be notified in order that we may re-evaluate the findings of this assessment and provide amendments, as required.

FIGURES

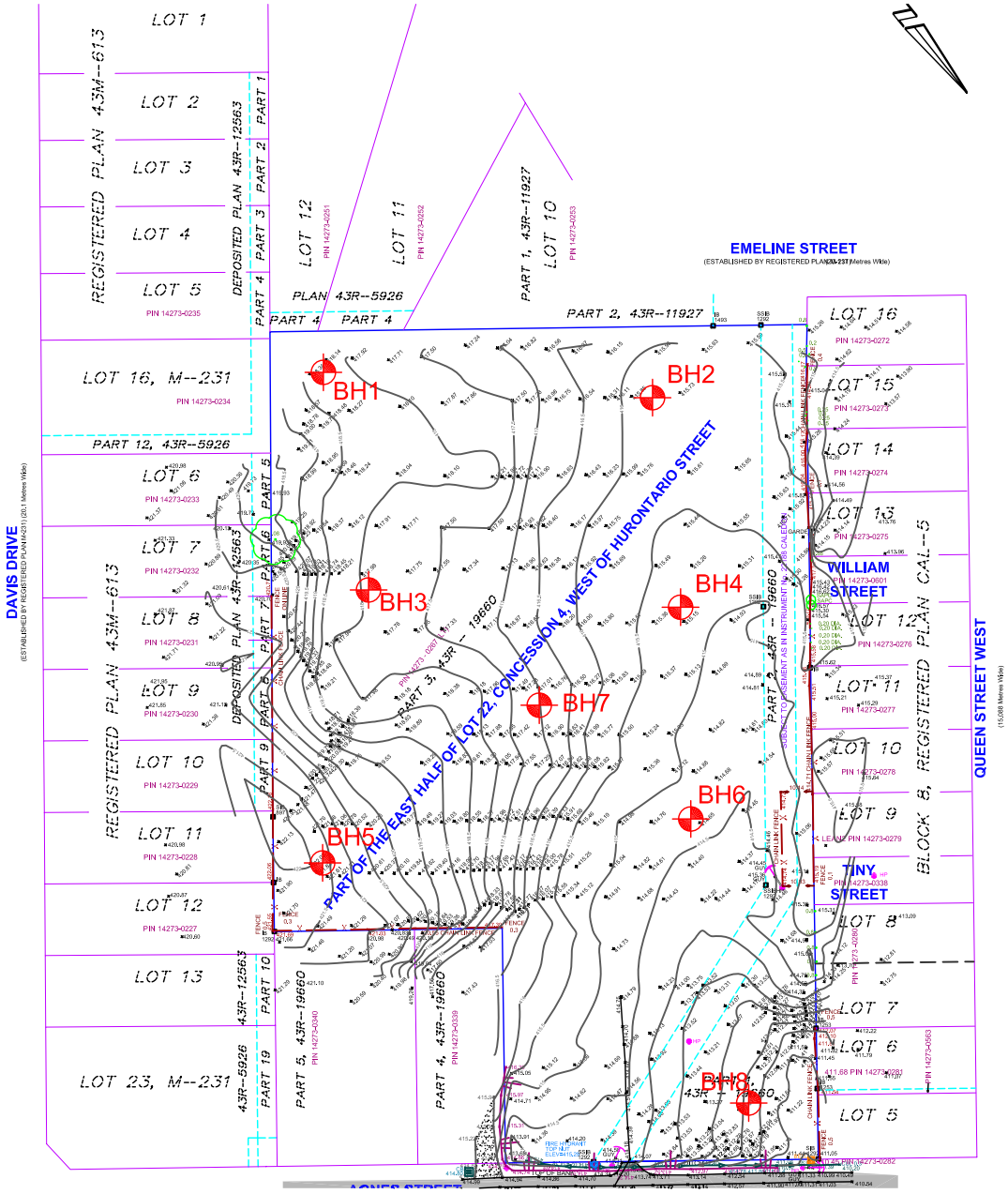
Terraprobe Inc.





Terraprobe
903 Barton Street - Unit 22, Stoney Creek, Ontario, L8E 5R7
Tel: (905) 643-7560, Fax: (905) 643-7559

Title:	FIGURE :
SITE LOCATION PLAN	1
File No. 7-18-0158-01	



Source:

REVISION SCHEDULE			
No.	DATE	BY	COMMENTS
1	7/25/18	S.J.	INITIAL SUBMISSION

Van Harten SURVEYING INC.
LAND SURVEYORS and ENGINEERS

Kitchener Ph: 519-742-8371 | Guelph Ph: 519-821-2763 | Orangeville Ph: 519-940-4110
www.vanharten.com info@vanharten.com

DRAWN BY: S.J. | CHECKED BY:ML | PROJECT No. 25228-17

Jul 25,2018-9:41pm
G:\CALEDON\CON4\WHS\AGNES ST DEVELPOMENT\ACAD\TOPO-ROBB UTM 2010 NR.dwg

LEGEND

BH1 Borehole Location

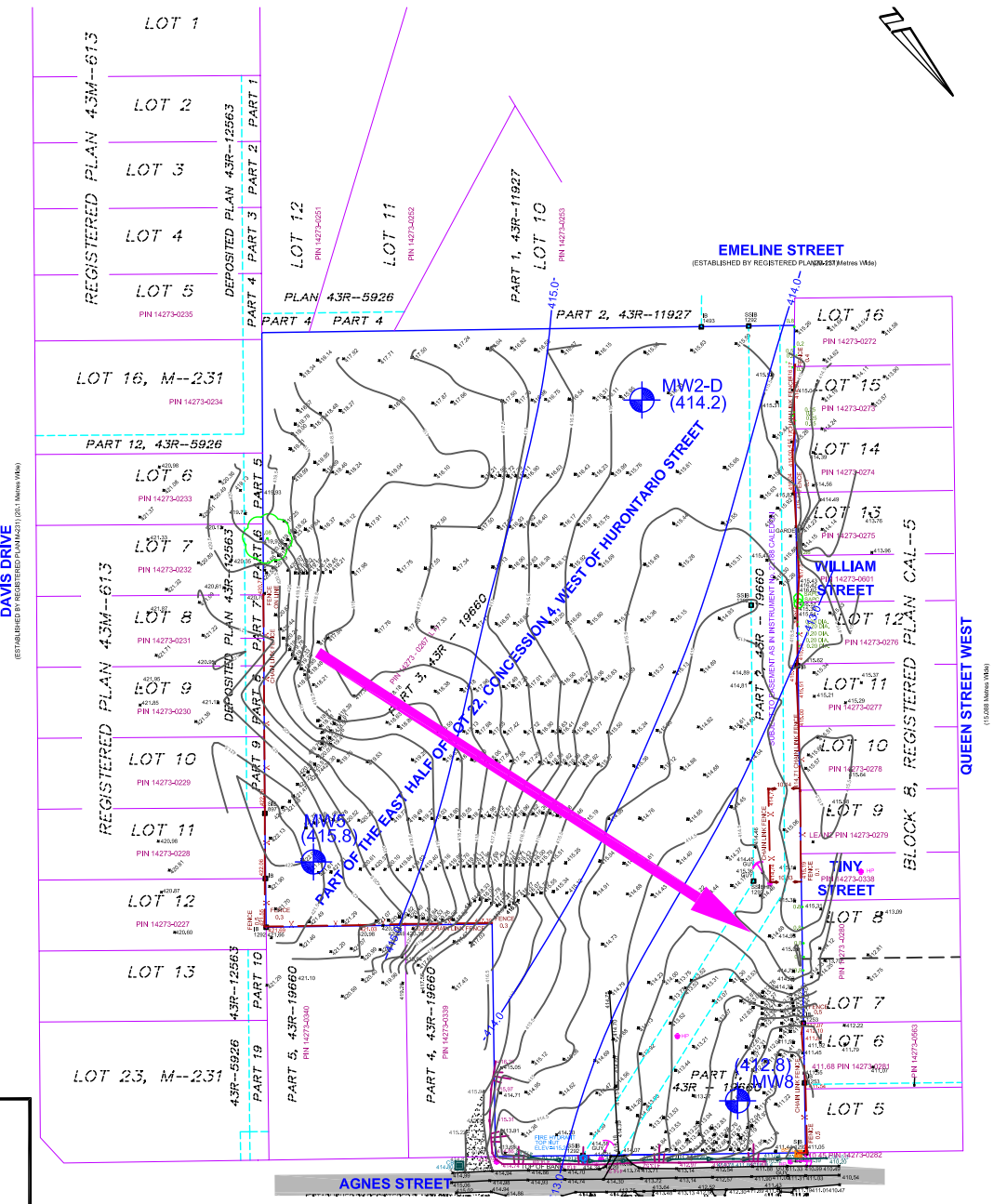
Terraprobe

903 Barton Street - Unit 22, Stoney Creek, Ontario, L8E 5R7
Tel: (905) 643-7560, Fax: (905) 643-7559

Title: BOREHOLE LOCATION PLAN

File No. 7-18-0158-01

FIGURE : 2



LEGEND

- Monitoring Well Location
- Inferred Groundwater Flow Direction
- (412.8) Groundwater Elevation (Apr.25,2019)
- Groundwater Contour (1.0m Interval)

Source:

REVISION SCHEDULE			
No.	DATE	BY	COMMENTS
1	7/25/18	S.J.	INITIAL SUBMISSION

Van Harten SURVEYING INC.
LAND SURVEYORS and ENGINEERS
Kitchener Ph: 519-742-8371 | Guelph Ph: 519-821-2763 | Orangeville Ph: 519-940-4110
www.vanharten.com info@vanharten.com
DRAWN BY: S.J. | CHECKED BY:ML | PROJECT No. 25228-17
Jul 25,2018-9:41pm G:\CAD\DWGS\DWGS\WHS\AGNES ST DEVELOPMENT\ACAD\TOPO-ROBB UTM 2010 NR.dwg

Terraprobe
903 Barton Street - Unit 22, Stoney Creek, Ontario, L8E 5R7
Tel: (905) 643-7560, Fax: (905) 643-7559

Title: GROUNDWATER FLOW DIRECTION PLAN

File No. 7-18-0158-01

FIGURE : 3

Terraprobe
903 Barton Street - Unit 22, Stoney Creek, Ontario, L8E 5R7
Tel: (905) 643-7560, Fax: (905) 643-7559

Title:	FIGURE :
SEWAGE ATTENUATION AREAS	4
File No. 7-18-0158-01	

Site Plans and Septic Design

APPENDIX A

Terraprobe Inc.

QUEEN STREET W.

EMELINE STREET

AGNES STREET

KING ST.

15m WIDE WALKWAY EXTENDED TO QUEEN ST.

WALKWAY / EMERGENCY ACCESS ROUTE

LOT 16 | LOT 15 | LOT 14 | LOT 13 | LOT 12 | LOT 11 | LOT 10 | LOT 9 | LOT 8 | LOT 7 | LOT 6 | LOT 5

BLOCK 1 | BLOCK 2 | BLOCK 3 | BLOCK 4 | BLOCK 5 | BLOCK 6 | BLOCK 7 | BLOCK 8 | BLOCK 9a | BLOCK 9b | BLOCK 10 | BLOCK 11 | BLOCK 12 | BLOCK 13 | BLOCK 14

COMBINED COMMUNAL AMENITY / SWM AREA (1,031 sq.m.)

SNOW STORAGE | PRIVACY SCREEN | LOW WALL | 1.5m SIDEWALK | FIRE ROUTE | ONE WAY | TWO WAY | DECORATIVE HARDSCAPE PAVING STONES | EXISTING HYDRO EASEMENT | TYPE 'A' | TYPE 'B' | CMB

LOT COVERAGE

BLOCK	COVERAGE
1	35.4%
2	39.6%
3	39.4%
4	32.0%
5	31.5%
6	29.7%
7	23.7%
8	29.7%
9	22.7%
10	35.7%
11	39.9%
12	31.7%
13	37.8%
14	37.2%

LEGEND

- PROPERTY LINE
- 6.0m WIDE FIRE ROUTE
- STOP SIGN
- EXISTING TOPOGRAPHY (XXX.XX)
- PAINTED STOP BAR
- EXISTING TREE TO REMAIN
- DISPERSAL BED
- PEDESTRIAN CROSSING
- PROPOSED DRY STACK STONE WALL
- PROPOSED 1mX3m WASTE COLLECTION POINT

NOTES:

1. THIS IS A CONCEPT PLAN FOR THE PURPOSE OF GUIDING THE DESIGN OF THE DRAFT PLAN OF SUBDIVISION AND ZONING BY-LAW AMENDMENT. DETAILED SITE PLANS WILL BE PREPARED FOR THE INDIVIDUAL BLOCKS FOR INCLUSION IN BUILDING PERMIT APPLICATIONS.
2. A MODIFIED RT (RESIDENTIAL TOWNHOUSE) ZONE IS PROPOSED BASED ON THE CONCEPT PLAN CONTAINING SITE-SPECIFIC STANDARDS WHERE NECESSARY. SEE THE PROPOSED ZONING MATRIX DETAILED TABLE OUTLINING ALL PROPOSED ZONING STANDARDS.
3. TOPOGRAPHICAL INFORMATION INCLUDING TREE LOCATIONS TAKEN FROM VANHARTEN SURVEY PLAN DATED SEPTEMBER 16, 2022
4. TREE INVENTORY INFORMATION FROM WILLIAMS & ASSOCIATES ARBORISTS REPORT FEB. 16, 2023 AND UPDATED OCT. 16, 2023. 29 TREES ARE IDENTIFIED FOR RETENTION. GRADING PLAN WILL PROVIDE DETAILS ABOUT TREE PROTECTION MEASURES AT SITE PLAN STAGE.
5. 3-WAY STOP, STOP BARS, PEDESTRIAN CROSSING PAVEMENT MARKINGS AND CHICANE FEATURE AS RECOMMENDED IN TRAFFIC IMPACT STUDY BY PARADIGM ENGINEERING. TO BE DETAILED DURING DETAILED SUBDIVISION DESIGN PROCESS IN ACCORDANCE WITH ONTARIO TRAFFIC MANUAL BOOK 11.
6. WALLS AND PRIVACY SCREEN LOCATIONS ARE APPROXIMATE ONLY AND WILL BE FINALIZED DURING THE DETAILED SUBDIVISION/CONDOMINIUM PROCESS(ES). THESE ELEMENTS WILL BE MAINTAINED BY THE CONDOMINIUM CORPORATION(S).
7. ACCESSIBLE SPACES INCLUDE ONE TYPE 'A' SPACE AND ONE TYPE 'B' SPACE.

SITE DATA

REGULATION	PROPOSED
LOT FRONTAGE (ON AGNES STREET)	99.90 m
SITE AREA (ha)	40,445.80 sq.m. (4.04ha)
# UNITS WITH DOUBLE GARAGES	41
# UNITS WITH SINGLE GARAGEGS	26
TOTAL UNITS	67
DENSITY	16.58 Upha
# OF RESIDENTIAL BLOCKS	14
# OF UNITS PER BLOCK (MAX.)	5
BUILDING HEIGHT	10.5 m
MINIMUM SETBACK TO AGNES STREET	6.0 m
MIM. SETBACK FROM REAR OF DWELLINGS TO ABUTTING RESIDENTIAL PROPERTIES	13.07 m
AREA TABLE	
RESIDENTIAL BLOCKS	3.319 ha
COMMON ROAD AND PARKING	0.435 ha
COMMON AMENITY AND WALKWAY	0.291 ha
TOTAL	4.045 ha
OPEN SPACE and COVERAGE YARDS, ABSORPTION BEDS, COMMON AMENITY AREAS	2.001 ha (49.4%)
HARD SURFACE AREAS (BUILDINGS, PATIOS, ROADS, WALKWAYS, SIDEWALKS, DRIVWAYS)	2.044 ha (50.6%)
TOTAL	4.045 ha
PARKING PROVIDED	**TOTAL**
PRIVATE PARKING WITHIN GARAGES	108
PRIVATE PARKING IN DRIVEWAYS	108
COMMON VISITOR PARKING	14
TOTAL	230

ORCHARD DESIGN STUDIO INC.
marketingmeetsarchitecture

User Defined

Project Information

SEATON GROUP
AGNES STREET TOWNHOMES
Village of Alton, Caledon, ON.

Set Issuance

No.	Date	Description
1	2023.02.08	FIRST SUBMISSION
2	2023.11.21	SECOND SUBMISSION

Sheet Information

CONCEPT PLAN

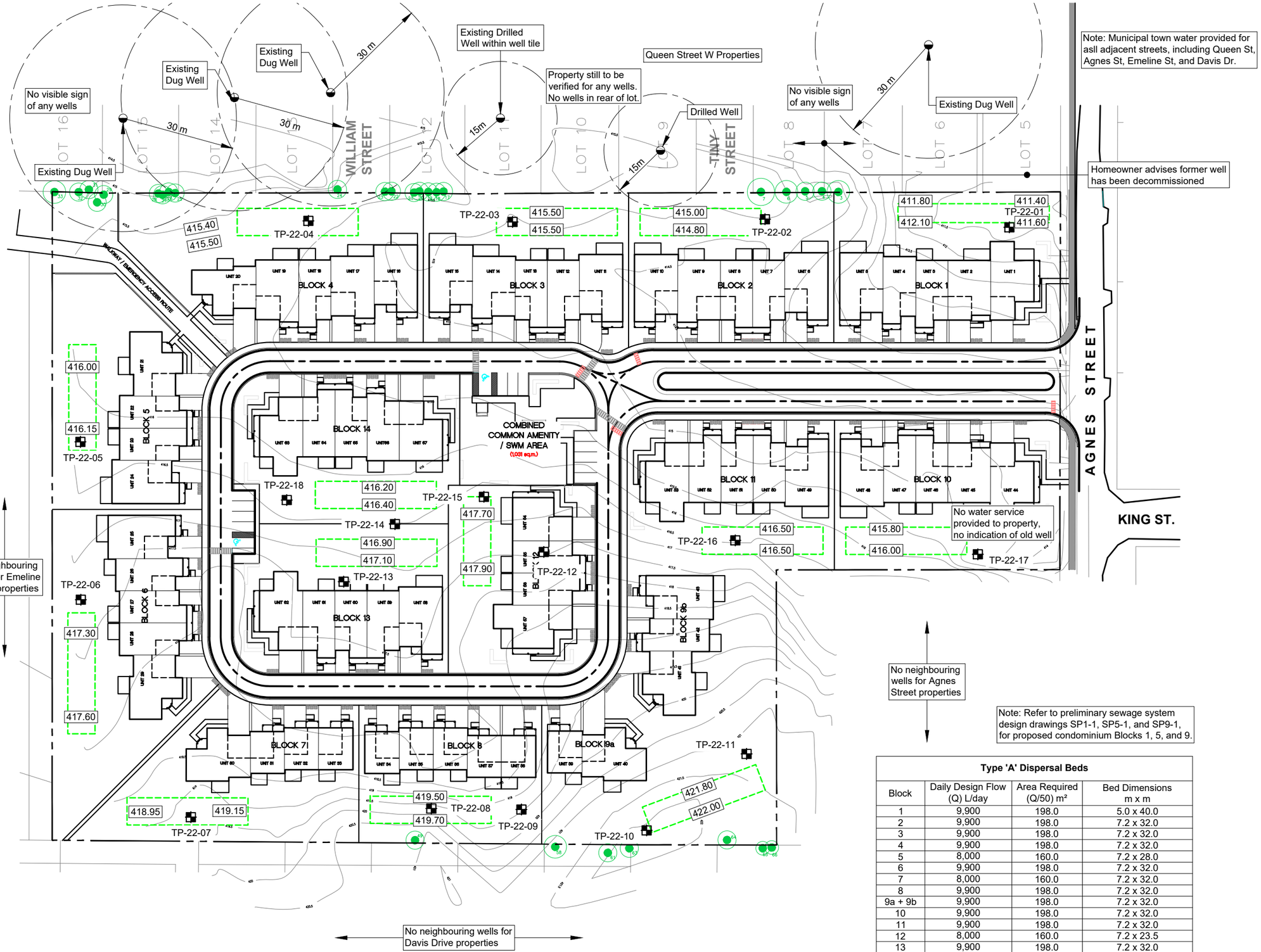
Project No. 14948
Project Start Date: 2023.11.01
File: Agnes Street - Site Plan.dwg
Drawn by: KBR
Scale: 1:400

PRELIMINARY

A1.01

Plot Date | Time - 11/21/2023 4:49:53 PM

P:\1-Projects\Seaton Group\14948_Agnes st\02-Drawings\



Note: Refer to preliminary sewage system design drawings SP1-1, SP5-1, and SP9-1, for proposed condominium Blocks 1, 5, and 9.

Type 'A' Dispersal Beds

Block	Daily Design Flow (Q) L/day	Area Required (Q/50) m²	Bed Dimensions m x m
1	9,900	198.0	5.0 x 40.0
2	9,900	198.0	7.2 x 32.0
3	9,900	198.0	7.2 x 32.0
4	9,900	198.0	7.2 x 32.0
5	8,000	160.0	7.2 x 28.0
6	9,900	198.0	7.2 x 32.0
7	8,000	160.0	7.2 x 32.0
8	9,900	198.0	7.2 x 32.0
9a + 9b	9,900	198.0	7.2 x 32.0
10	9,900	198.0	7.2 x 32.0
11	9,900	198.0	7.2 x 32.0
12	8,000	160.0	7.2 x 23.5
13	9,900	198.0	7.2 x 32.0
14	9,900	198.0	7.2 x 32.0

Gunnell Engineering Ltd.
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www.septicdesign.ca

LEGEND

- Existing Known Wells
- Test Pit Locations
- Type 'A' Dispersal Beds (14)

Preliminary

Rev. No.	Date	Description	CAD
Rev. 1	25-Jul-2022	Updated Well Locations	KD
Rev. 2	7-Mar-2023	Updated Site Plan	JK
Rev. 3	28-NOV-2023	Town Comments	JK

Agnes Street Townhouse Residential Development Town of Caledon

Overall Site Plan: Neighbouring Well Locations Test Pit Locations Septic Field Locations

Scale: 1:1,000	Designed By: EG
Date: 21-JUL-2022	Drawn By: JK
Project No.: D3082	Checked By: EG
	Drawing No.: SP-1

File: \\Gunnell\NAP\Shared\Gunnell Engineering AutoCAD\D3000 - PROJECTS\D3082 - Alton Residential Infill\CAD\-BC- Updated Site Plan\D3082BC-SP1.dwg
Plotted On: Thu, 30 Nov 2023 - 4:26pm

Gunnell Engineering Ltd.
1110 Stellar Drive, Unit 106
Newmarket, ON L3Y 7B7
bus: 905-868-9400
fax: 905-853-5734
www.septicdesign.ca

Test Pit
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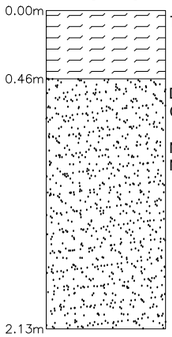

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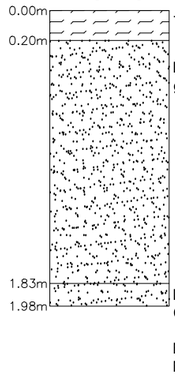

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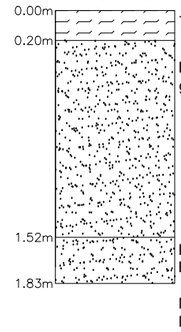

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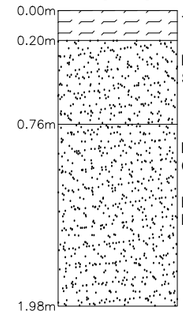

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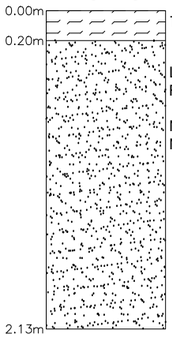

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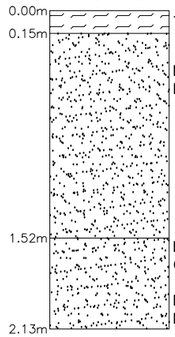

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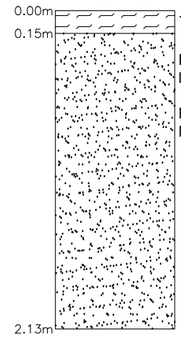

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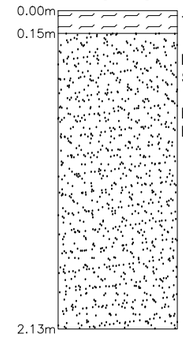

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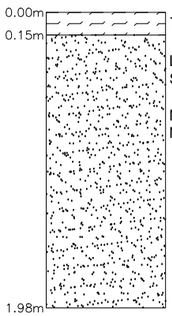

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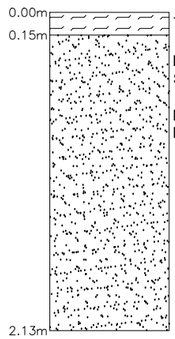

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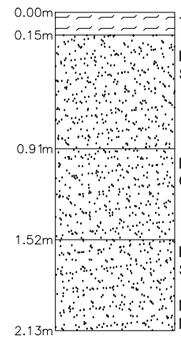

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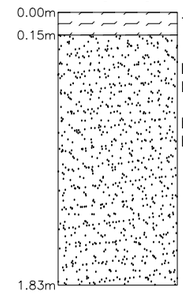

Alton Residential Infill
Agnes Street
Town of Caledon

Test Pit Soil Profiles

Scale: N.T.S.	Designed By: KD
Date: 19-AUG-2022	Drawn By: KD
Project No.: D3082	Checked By: EG
	Drawing No.: DT-1

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Test Pit
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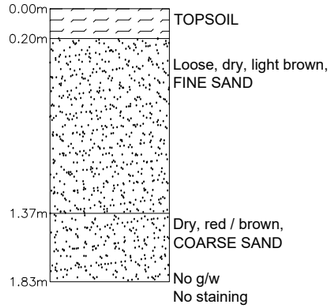

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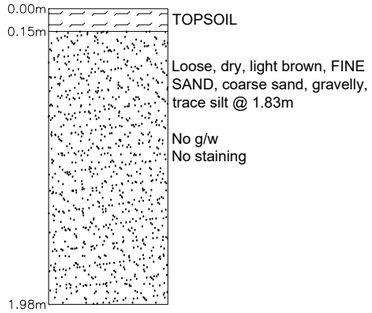

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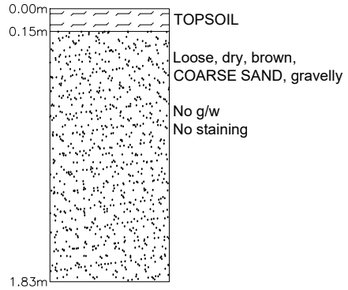

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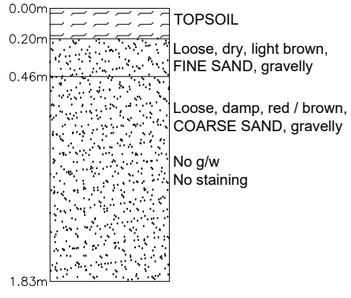

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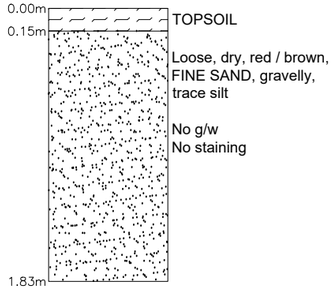

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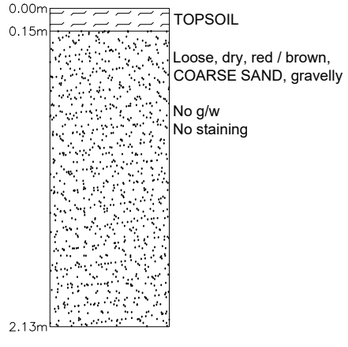
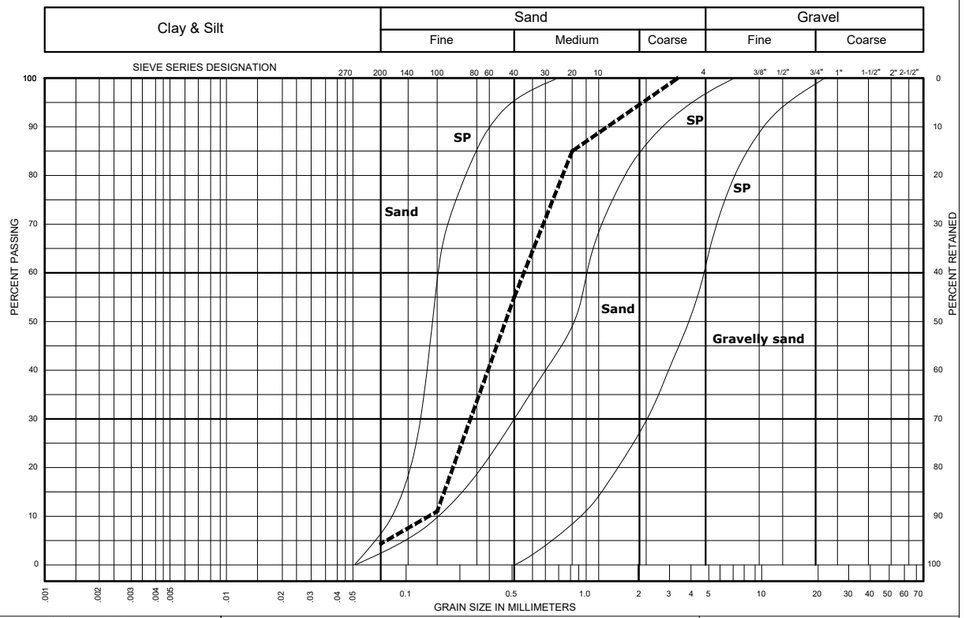


Alton Residential Infill
Agnes Street
Town of Caledon

Test Pit Soil Profiles

Scale: N.T.S.	Designed By: KD
Date: 19-AUG-2022	Drawn By: KD
Project No.: D3082	Checked By: EG
	Drawing No.: DT-2

UNIFIED SOIL CLASSIFICATION SYSTEM



Prepared for Gunnell Engineering Ltd.

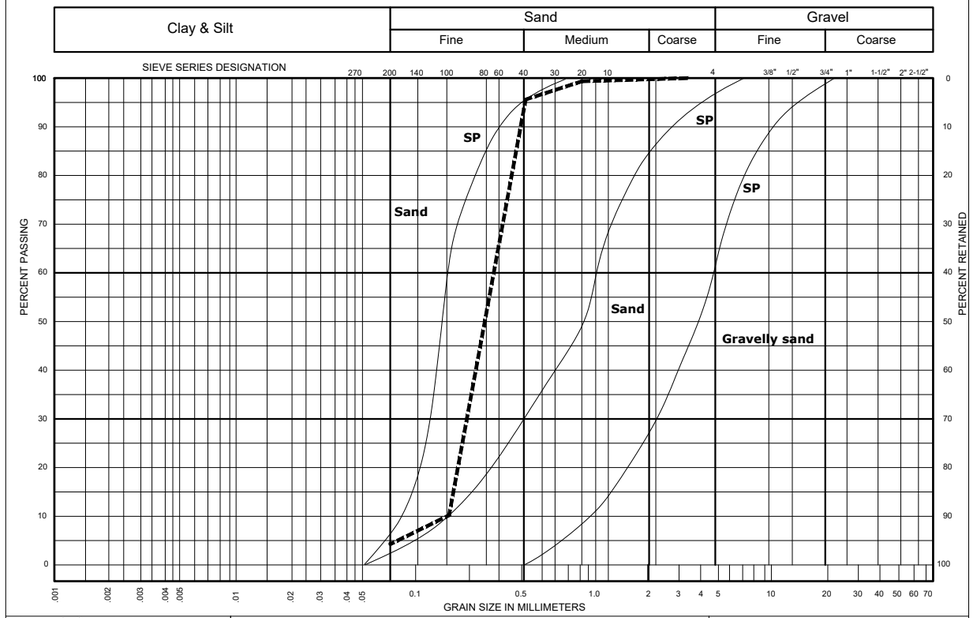
Project: D3082
Sample: TP22-1
Depth: 2.13m
Date Sampled: Aug 11, 2022

USCS
Coarse Grained Soils
Poorly-graded sands (SP)

Poorly-graded sands & gravelly-sands
Little or no fines (< 5% passing
No. 200 sieve (0.074mm)

Percolation Time
: T = 6 mins/cm

UNIFIED SOIL CLASSIFICATION SYSTEM



Prepared for Gunnell Engineering Ltd.

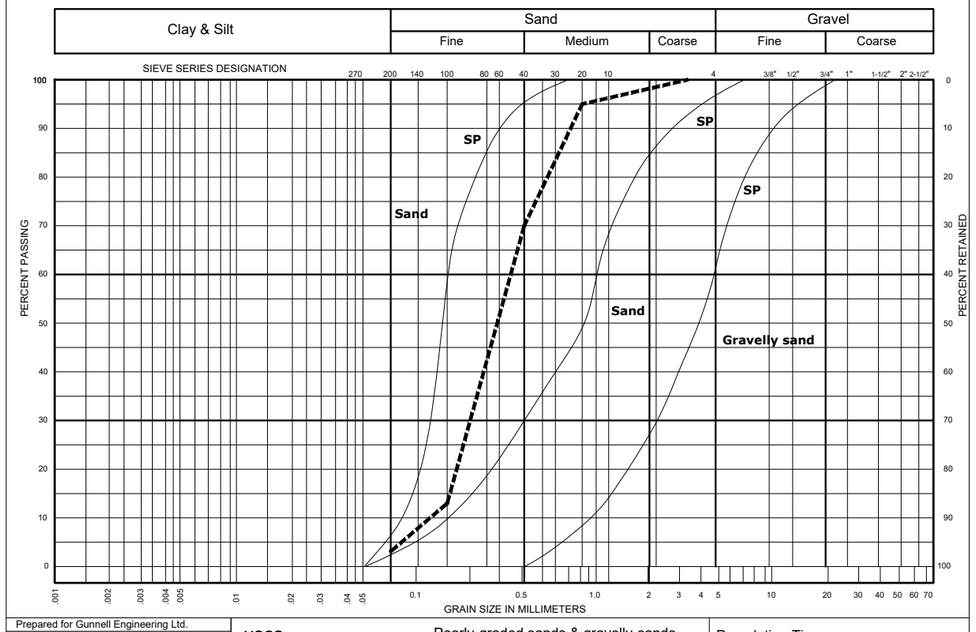
Project: D3082
Sample: TP22-7
Depth: 2.13m
Date Sampled: Aug 11, 2022

USCS
Coarse Grained Soils
Poorly-graded sands (SP)

Poorly-graded sands & gravelly-sands
Little or no fines (< 5% passing
No. 200 sieve (0.074mm)

Percolation Time
: T = 8 mins/cm

UNIFIED SOIL CLASSIFICATION SYSTEM



Prepared for Gunnell Engineering Ltd.

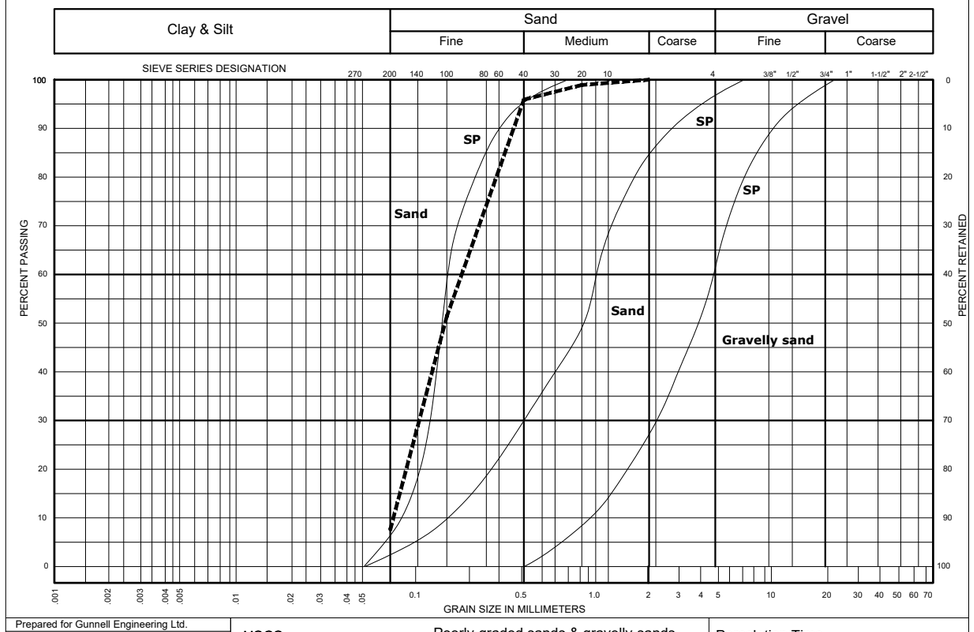
Project: D3082
Sample: TP22-13
Depth: 1.83m
Date Sampled: Aug 11, 2022

USCS
Coarse Grained Soils
Poorly-graded sands (SP)

Poorly-graded sands & gravelly-sands
Little or no fines (< 5% passing
No. 200 sieve (0.074mm)

Percolation Time
: T = 6 mins/cm

UNIFIED SOIL CLASSIFICATION SYSTEM



Prepared for Gunnell Engineering Ltd.

Project: D3082
Sample: TP22-4
Depth: 1.98m
Date Sampled: Aug 11, 2022

USCS
Coarse Grained Soils
Poorly-graded sands (SP)

Poorly-graded sands & gravelly-sands
Little or no fines (< 5% passing
No. 200 sieve (0.074mm)

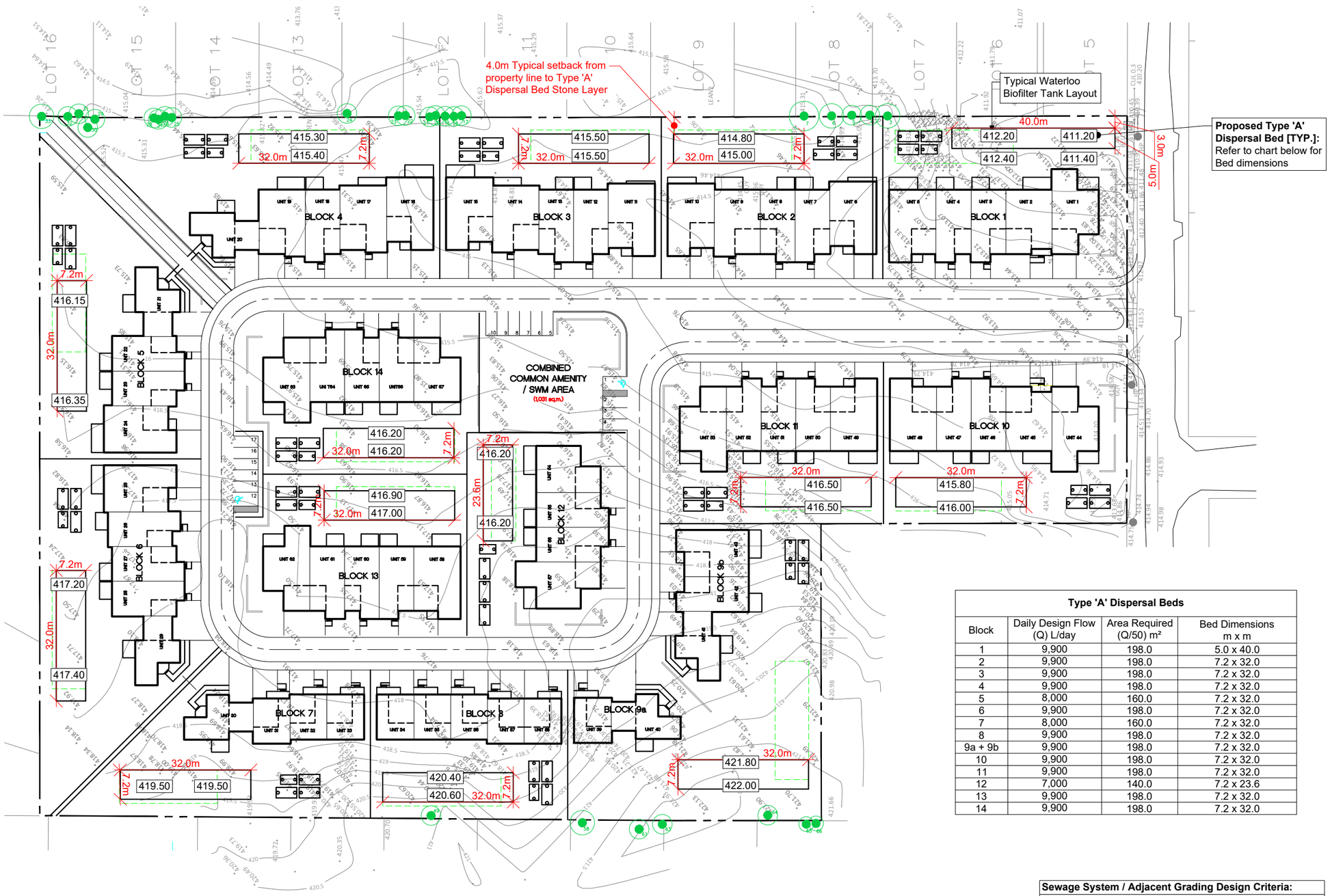
Percolation Time
: T = 10 mins/cm

Gunnell Engineering Ltd.
1110 Stellar Drive, Unit 106
Newmarket, ON L3Y 7B7
bus: 905-868-9400
www.septicdesign.ca

Alton Residential Infill
Agnes Street
Town of Caledon

Soil Laboratory Analysis

Scale: N.T.S.	Designed By: --
Date: 7-MAR-2023	Drawn By: JK
Project No.: D3082	Checked By: --
	Drawing No.: DT-3



Type 'A' Dispersal Beds			
Block	Daily Design Flow (Q) L/day	Area Required (Q/50) m²	Bed Dimensions m x m
1	9,900	198.0	5.0 x 40.0
2	9,900	198.0	7.2 x 32.0
3	9,900	198.0	7.2 x 32.0
4	9,900	198.0	7.2 x 32.0
5	8,000	160.0	7.2 x 32.0
6	9,900	198.0	7.2 x 32.0
7	8,000	160.0	7.2 x 32.0
8	9,900	198.0	7.2 x 32.0
9a + 9b	9,900	198.0	7.2 x 32.0
10	9,900	198.0	7.2 x 32.0
11	9,900	198.0	7.2 x 32.0
12	7,000	140.0	7.2 x 23.6
13	9,900	198.0	7.2 x 32.0
14	9,900	198.0	7.2 x 32.0

Sewage System / Adjacent Grading Design Criteria:

1. 4:1 max. down slopes away from septic field.
2. No slopes directly down to septic fields (direct surface water around field with swales).
3. Swales are to be min. 0.15m deep with max. 4:1 side slopes adjacent to septic fields.
4. Septic fields are to be min. 3.0m from property lines and 5.0m from residences and installed at existing grades.
5. Septic tanks are to be min. 3.0m from property lines and 1.5m from residences.
6. No retaining walls constructed adjacent to septic fields.

Gunnell Engineering Ltd.
1110 Stellar Drive, Unit 106
Newmarket, ON L3Y 7B7
bus: 905-868-9400
fax: 905-853-5734
www.septicdesign.ca

LEGEND

100.00 Proposed Septic Elevation

100.00 Proposed Septic Elevation (Grading Issue)

Draft

Rev. No.	Date	Description	CAD
Rev. 1	2-DEC-2022	Revised Townhouses	JK

Agnes Street Residential Development Town of Caledon

Overall Site Plan: Septic System Layout Criteria

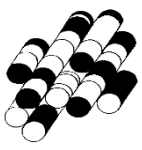
Scale: 1:1,000	Designed By: EG
Date: 15-Jul-2022	Drawn By: JK
Project No.: D3082	Checked By: EG
	Drawing No.: SP-1

File: \\GunnellQNAP\Shared\Gunnell Engineering AutoCAD\D3000 - PROJECTS\D3082 - Alton Residential Infill\CAD\-AB-\D3082B-SP1.dwg
Plotted On: Fri, 16 Dec 2022 - 7:55am

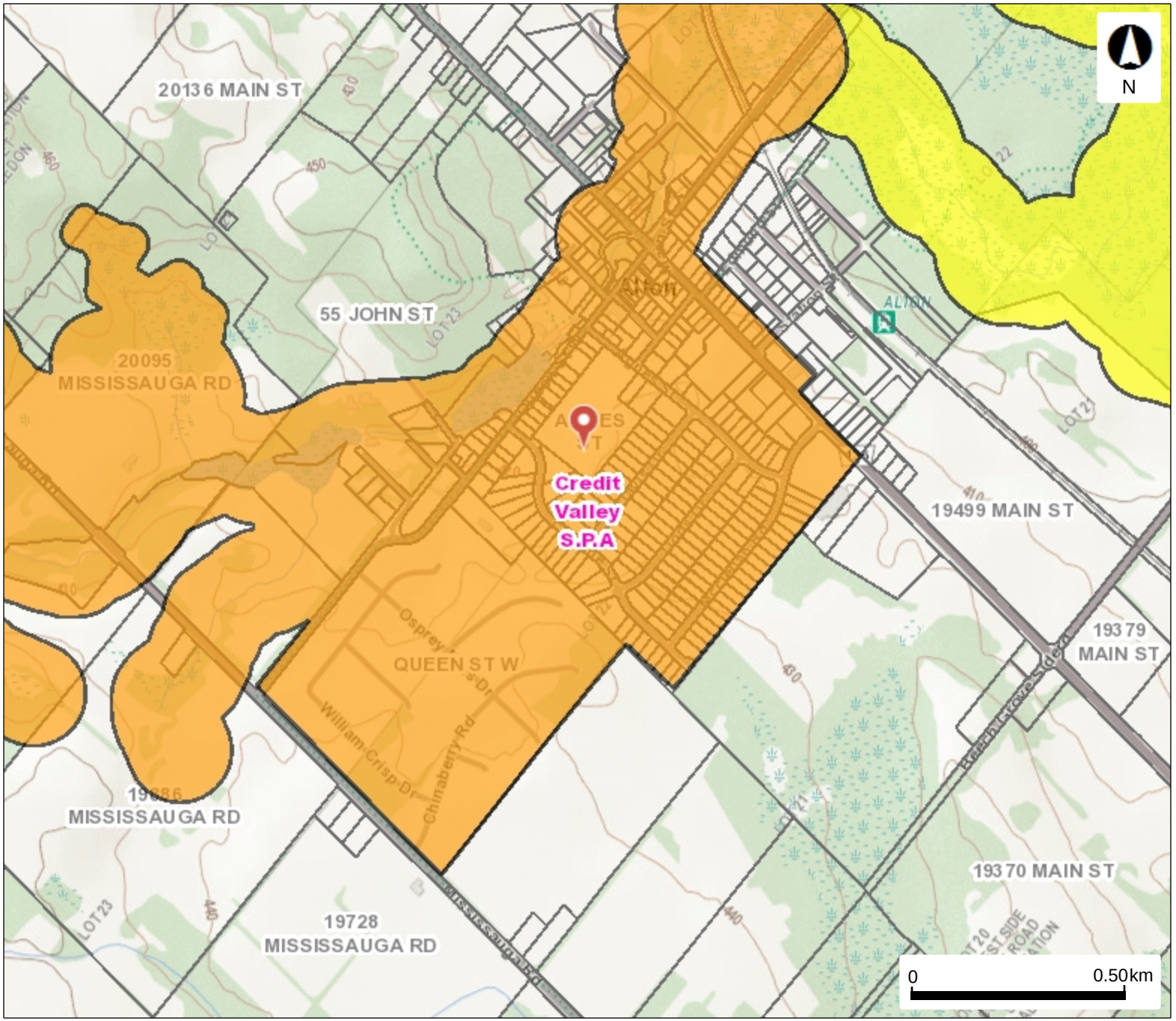
Wellhead Protection Mapping

APPENDIX B

Terraprobe Inc.



-Map Title-



Legend

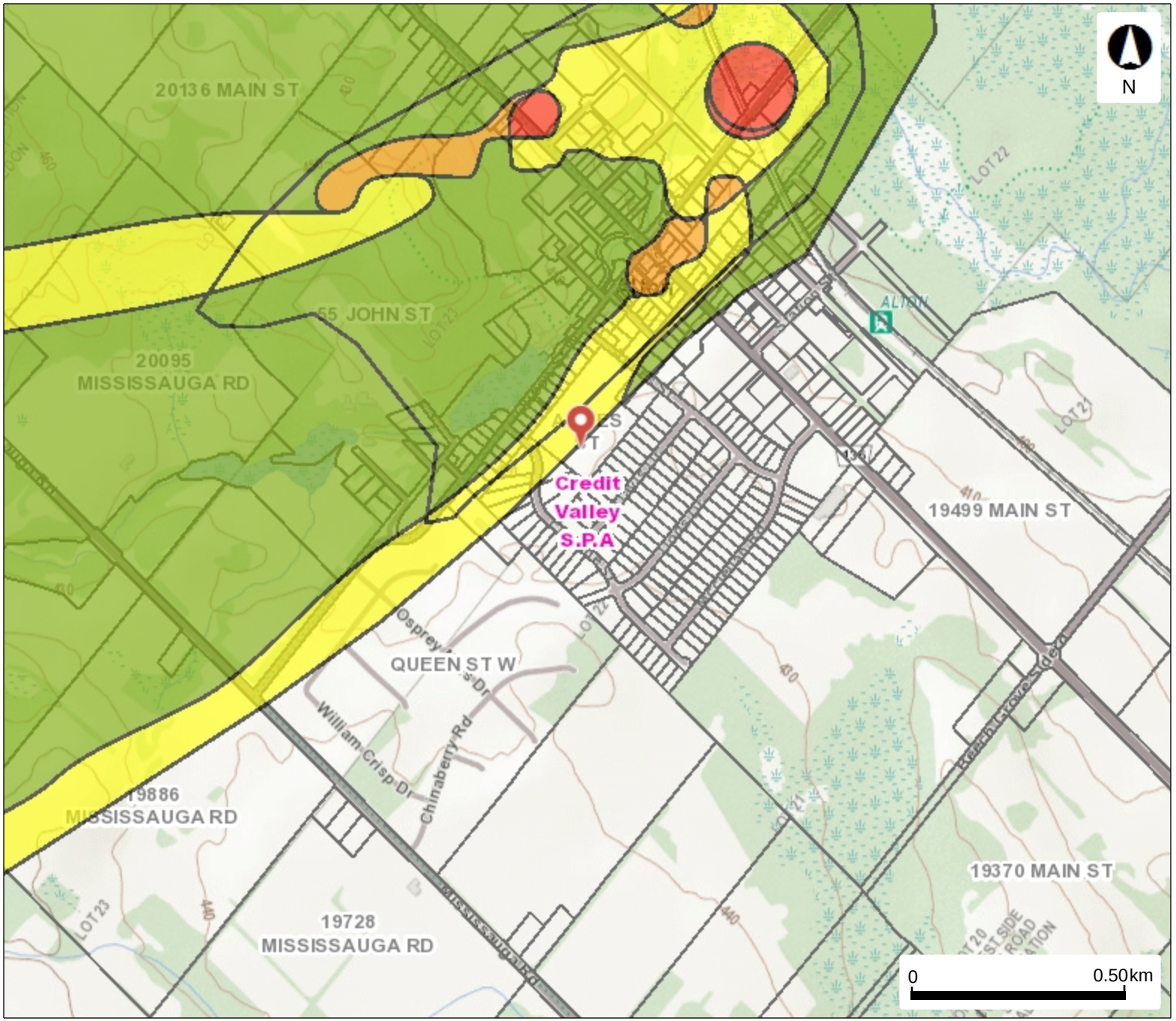
- Source Protection Areas
- Issue Contributing Areas
- Intake Protection Zone 1
- Event Based Areas
- Intake Protection Zone 2
- Vulnerable Scoring Area - Groundwater Under Direct Influence
  - 4.1 - 7.9
  - 8 - 8.9
  - 9 - 10
- Assessment Parcel

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Environment, Conservation and Parks (MECP) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

Ontario

Map Created: 6/3/2020
Map Center: 43.85488 N, -80.07053 W

-Map Title-



Legend

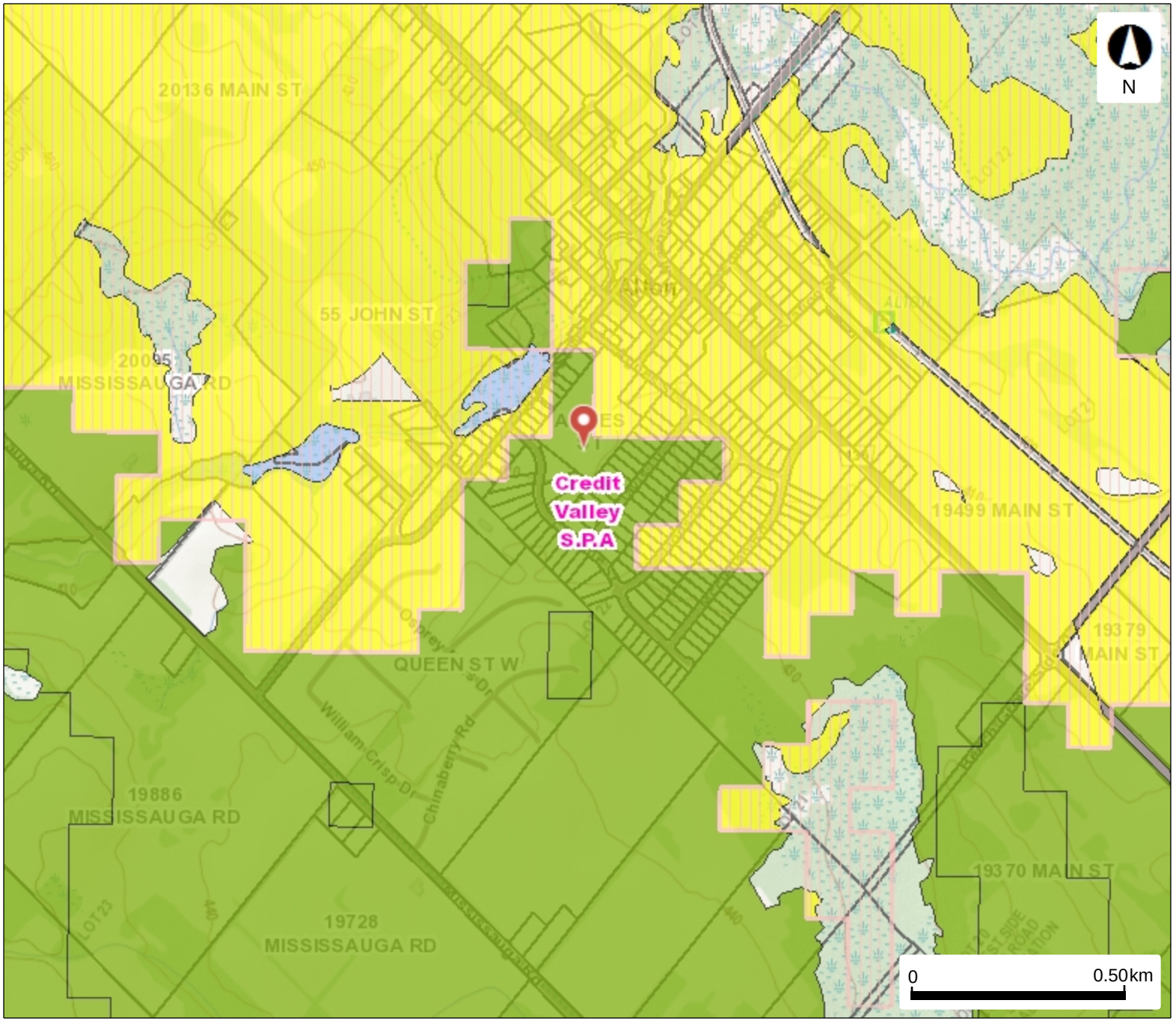
- Source Protection Areas
- Issue Contributing Areas
- Intake Protection Zone 1
- Event Based Areas
- Intake Protection Zone 2
- Vulnerable Scoring Area - Groundwater
  - 2
  - 4
  - 6
  - 8
  - 10
- Assessment Parcel

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Environment, Conservation and Parks (MECP) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

Ontario

Map Created: 6/3/2020
Map Center: 43.85488 N, -80.07045 W

-Map Title-



Legend

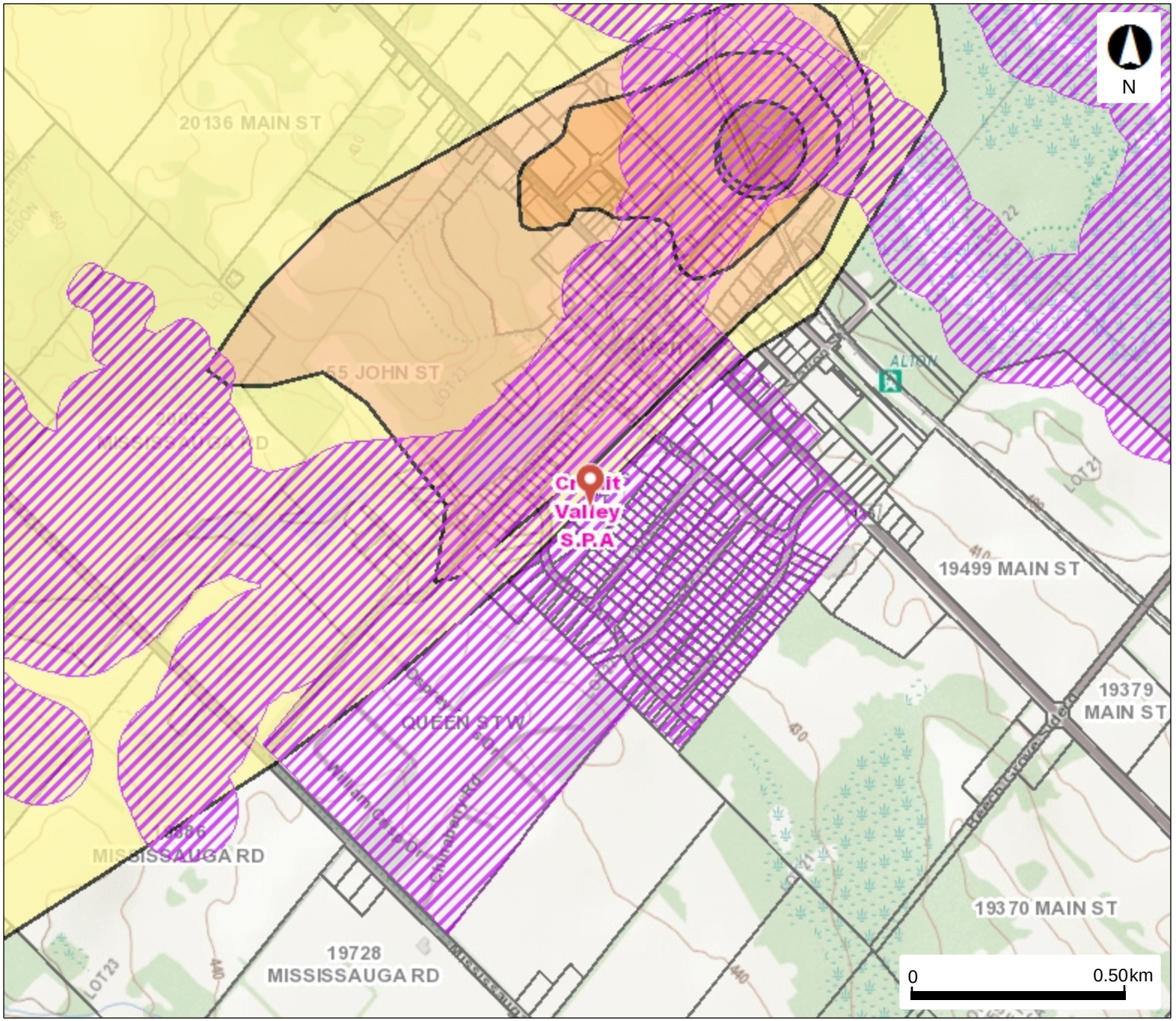
- Source Protection Areas
- Issue Contributing Areas
- Highly Vulnerable Aquifers
- Significant Groundwater Recharge Area
  - 0
  - 2
  - 4
  - 6
- Intake Protection Zone 1
- Event Based Areas
- Intake Protection Zone 2
- Assessment Parcel

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Environment, Conservation and Parks (MECP) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

Ontario

Map Created: 6/3/2020
Map Center: 43.85488 N, -80.07053 W

-Map Title-



Legend

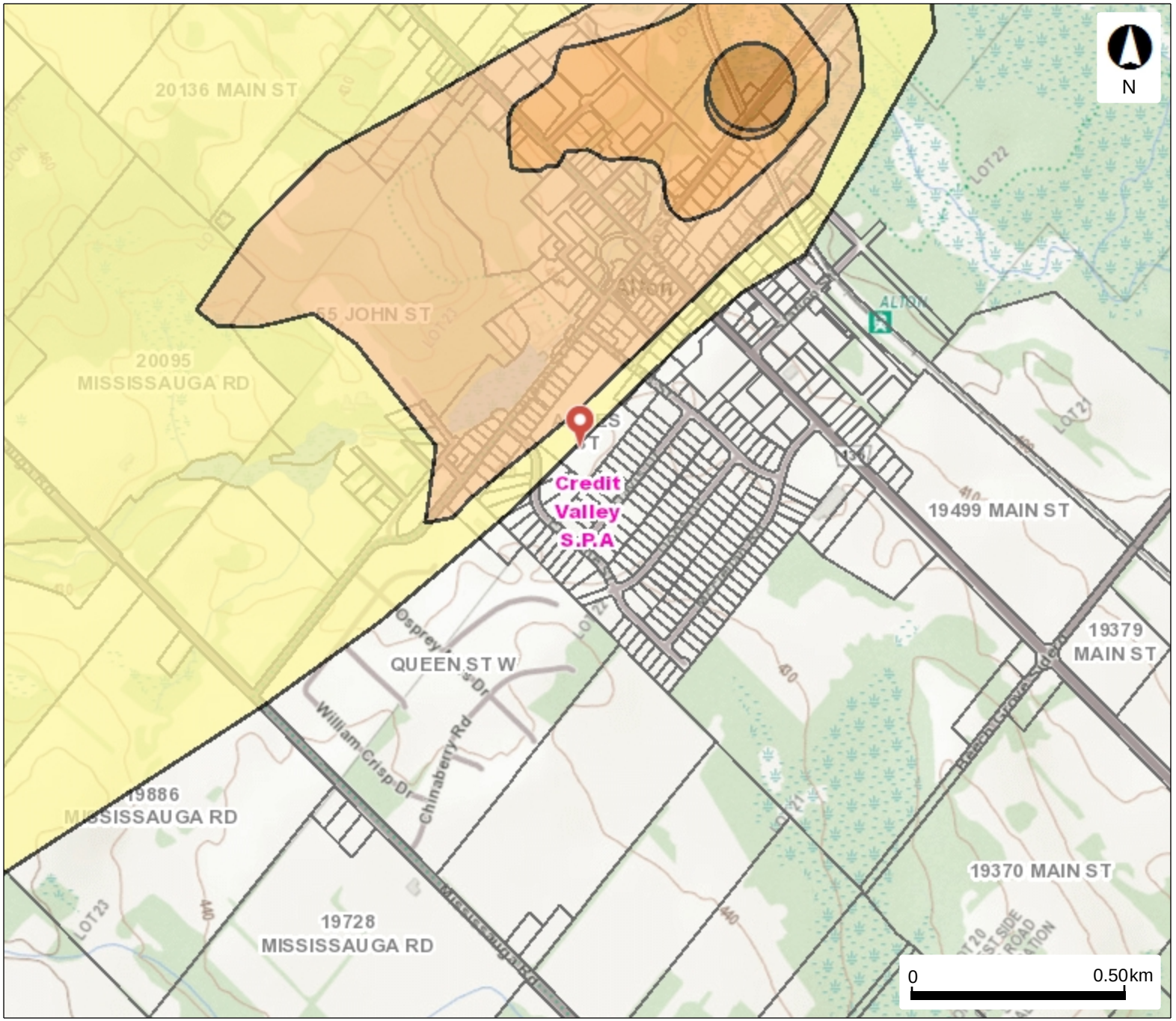
- Source Protection Areas
- Issue Contributing Areas
- WHPA Groundwater Under Direct Influence (WHPA-E)
- Wellhead Protection Area
  - A
  - B
  - C
  - C1
  - D
  - F
- Intake Protection Zone 1
- Event Based Areas
- Intake Protection Zone 2
- Assessment Parcel

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Environment, Conservation and Parks (MECP) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

Ontario

Map Created: 6/3/2020
Map Center: 43.8561 N, -80.07072 W

-Map Title-



Legend

- Source Protection Areas
- Issue Contributing Areas
- Wellhead Protection Area
  - A
  - B
  - C
  - C1
  - D
  - F
- Intake Protection Zone 1
- Event Based Areas
- Intake Protection Zone 2
- Assessment Parcel

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Environment, Conservation and Parks (MECP) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

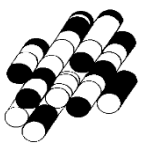
Ontario

Map Created: 6/3/2020
Map Center: 43.85488 N, -80.07043 W

Borehole Logs and Grain Size Analysis

APPENDIX C

Terraprobe Inc.



LOG OF BOREHOLE 1

Terraprobe

Project No. : 7-18-0158-01 | Client : Normaple Development Ltd. and Seaton Foxbridege Corporation | Originated by : JM

Date started : February 7, 2019 | Project : Part of East Half of Lot 22, Concession 4, West of Hurontario St | Compiled by : AF

Sheet No. : 1 of 1 | Location : Caledon, Ontario | Checked by : PC

Position : E: 574695, N: 4856275 (UTM 17T) | Elevation Datum : Geodetic

Rig type : D50, track-mounted | Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	418.2	**GROUND SURFACE**				
		500mm **TOPSOIL**		1	SS	8
	417.7 / 0.5					
1		**SILTY FINE SAND**, trace gravel, loose, brown		2	SS	8
				3	SS	6
2	416.1 / 2.1					
		SILTY SAND and GRAVEL, with occasional cobbles and boulders, compact to very dense, brown		4	SS	21
3				5	SS	62 / 225mm
4						
				6	SS	23
5						
6				7	SS	50 / 25mm
	411.8 / 6.4					

Elevation Scale (m): 418, 417, 416, 415, 414, 413, 412

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) 10, Natural Water Content (MC) 20, Liquid Limit (LL) 30

Headspace Vapour (ppm): 44

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

GR	SA	SI	CL
2	86	4	8

END OF BOREHOLE
Refusal (obstruction in the hole)

Possible cobble or bedrock obstruction in hole.

Unstabilized water level measured at 4.3 m below ground surface; borehole was open upon completion of drilling.

file: 7-18-0158-01 - anges st.gpj

LOG OF BOREHOLE 2

Terraprobe

Project No. : 7-18-0158-01 | Client : Normaple Development Ltd. and Seaton Foxbridege Corporation | Originated by : JM

Date started : February 7, 2019 | Project : Part of East Half of Lot 22, Concession 4, West of Hurontario St | Compiled by : AF

Sheet No. : 1 of 1 | Location : Caledon, Ontario | Checked by : PC

Position : E: 574614, N: 4856342 (UTM 17T) | Elevation Datum : Geodetic

Rig type : D50, track-mounted | Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	415.8	**GROUND SURFACE**				
	415.5	300mm **TOPSOIL**				
	0.3	**FILL**, silty fine sand, trace gravel, loose, brown		1	SS	9
	415.0					
1	0.8	**SILTY SAND and GRAVEL**, with occasional cobbles and boulders, compact to very dense, brown		2	SS	23
				3	SS	56
2				4	SS	20
3				5	SS	16
4				6	SS	28
5				7	SS	50 / 125mm
6	409.1					
	6.7					

Elevation Scale (m): 415, 414, 413, 412, 411, 410

Penetration Test Values (Blows / 0.3m): Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details: W1 W2

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT): GR SA SI CL

END OF BOREHOLE

Refusal (obstruction in the hole)

Possible cobble or bedrock obstruction in hole.

Unstabilized water level measured at 4.4 m below ground surface; borehole was open upon completion of drilling.

W1: 50 mm dia. monitoring well installed.
W2: 50 mm dia. monitoring well installed.

W1 WATER LEVELS

Date	Water Depth (m)	Elevation (m)
Mar 4, 2019	2.3	413.6

W2 WATER LEVELS

Date	Water Depth (m)	Elevation (m)
Mar 4, 2019	2.4	413.4

file: 7-18-0158-01 - anges st.gpj

LOG OF BOREHOLE 3

Terraprobe

Project No. : 7-18-0158-01 | Client : Normaple Development Ltd. and Seaton Foxbridege Corporation | Originated by : JM

Date started : February 7, 2019 | Project : Part of East Half of Lot 22, Concession 4, West of Hurontario St | Compiled by : AF

Sheet No. : 1 of 1 | Location : Caledon, Ontario | Checked by : PC

Position : E: 574728, N: 4856325 (UTM 17T) | Elevation Datum : Geodetic

Rig type : D50, track-mounted | Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	418.0	**GROUND SURFACE**				
		150mm **TOPSOIL**		1	SS	4
	417.5 (0.5)	**SILTY SAND and GRAVEL**, with occasional cobbles and boulders, compact to dense, brown		2	SS	34
1				3	SS	36
2				4	SS	50 / 50mm
3				5	SS	50 / 25mm
4				6	SS	20
5						
6	411.9 (6.1)					

Elevation Scale (m): 418, 417, 416, 415, 414, 413, 412

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit, Natural Water Content, Liquid Limit; PL, MC, LL: 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) — GR SA SI CL

END OF BOREHOLE
Refusal (obstruction in the hole)

Possible cobble or bedrock obstruction in hole.

Borehole was dry and open upon completion of drilling.

file: 7-18-0158-01 - anges st.gpj

LOG OF BOREHOLE 4

Terraprobe

Project No. : 7-18-0158-01 | Client : Normaple Development Ltd. and Seaton Foxbridege Corporation | Originated by : JM

Date started : February 7, 2019 | Project : Part of East Half of Lot 22, Concession 4, West of Hurontario St | Compiled by : AF

Sheet No. : 1 of 1 | Location : Caledon, Ontario | Checked by : PC

Position : E: 574646, N: 4856389 (UTM 17T) | Elevation Datum : Geodetic

Rig type : D50, track-mounted | Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	415.3	**GROUND SURFACE**				
		450mm **TOPSOIL**		1	SS	7
	414.8 / 0.5	**SILTY SAND and GRAVEL**, with occasional cobbles and boulders, dense to very dense, brown		2	SS	58
1				3	SS	37
2				4	SS	50 / 100mm
	412.8 / 2.5	**END OF BOREHOLE** Refusal (obstruction in the hole)				

Elevation Scale (m): 415, 414, 413

Penetration Test Values (Blows / 0.3m): Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Possible cobble or bedrock obstruction in hole.

Borehole was dry and open upon completion of drilling.

file: 7-18-0158-01 - anges st.gpj

LOG OF BOREHOLE 5

Terraprobe

Project No. : 7-18-0158-01 | Client : Normaple Development Ltd. and Seaton Foxbridege Corporation | Originated by : JM

Date started : February 7, 2019 | Project : Part of East Half of Lot 22, Concession 4, West of Hurontario St | Compiled by : AF

Sheet No. : 1 of 1 | Location : Caledon, Ontario | Checked by : PC

Position : E: 574776, N: 4856396 (UTM 17T) | Elevation Datum : Geodetic

Rig type : D50, track-mounted | Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	421.9	**GROUND SURFACE**				
		450mm **TOPSOIL**		1	SS	6
	421.4 / 0.5	**FILL**, silty sand, trace gravel, very loose, brown		2	SS	3
1	420.4 / 1.5	**SILTY FINE SAND**, trace gravel, compact, brown		3	SS	26
2				4	SS	14
3				5	SS	27
	417.9 / 4.0	**SILTY SAND and GRAVEL**, with occasional cobbles and boulders, compact to very dense, brown		6	SS	24
4				7	SS	50 / 25mm
5						
6	415.5 / 6.4					

Elevation Scale (m): 421, 420, 419, 418, 417, 416

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10, 20, 30

Headspace Vapour (ppm): 42

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) — GR SA SI CL

END OF BOREHOLE
Refusal (obstruction in the hole)

Possible cobble or bedrock obstruction in hole.

Borehole was dry and open upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 4, 2019	6.3	415.6

file: 7-18-0158-01 - anges st.gpj

LOG OF BOREHOLE 6

Terraprobe

Project No. : 7-18-0158-01 | Client : Normaple Development Ltd. and Seaton Foxbridege Corporation | Originated by : JM

Date started : February 8, 2019 | Project : Part of East Half of Lot 22, Concession 4, West of Hurontario St | Compiled by : AF

Sheet No. : 1 of 1 | Location : Caledon, Ontario | Checked by : PC

Position : E: 574690, N: 4856454 (UTM 17T) | Elevation Datum : Geodetic

Rig type : D50, track-mounted | Drilling Method : Hollow stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	414.7	**GROUND SURFACE**				
	414.1	600mm **TOPSOIL**		1	SS	4
1	0.6	**FILL**, sand and gravel, trace topsoil, dense, brown		2	SS	37
				3	SS	34
2	412.6					
	2.1	**SILTY FINE SAND**, trace gravel, compact, brown		4	SS	16
3				5	SS	5
	410.9					
4	3.8	**SILTY SAND and GRAVEL**, with occasional cobbles and boulders, very dense, brown		6	SS	50 / 100mm
5	408.9					
	5.8					

Elevation Scale (m): 414, 413, 412, 411, 410, 409

Penetration Test Values (Blows / 0.3m): Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL); 10 20 30

65

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

GR SA SI CL

END OF BOREHOLE
Refusal (obstruction in the hole)

Possible cobble or bedrock obstruction in hole.

Unstabilized water level measured at 2.3 m below ground surface; borehole was open upon completion of drilling.

file: 7-18-0158-01 - anges st.gpj

LOG OF BOREHOLE 7

Terraprobe

Project No. : 7-18-0158-01 | Client : Normaple Development Ltd. and Seaton Foxbridege Corporation | Originated by : JM

Date started : February 8, 2019 | Project : Part of East Half of Lot 22, Concession 4, West of Hurontario St | Compiled by : AF

Sheet No. : 1 of 1 | Location : Caledon, Ontario | Checked by : PC

Position : E: 574703, N: 4856377 (UTM 17T) | Elevation Datum : Geodetic

Rig type : D50, track-mounted | Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	**417.0**	**GROUND SURFACE**				
		600mm **TOPSOIL**		1	SS	6
	416.4 / 0.6	**FILL**, silty fine sand, trace rootlets, topsoil, loose, brown		2	SS	6
1	415.5 / 1.5	**SILTY SAND and GRAVEL**, with occasional cobbles and boulders, compact to very dense, brown		3	SS	18
2				4	AS	
	414.4 / 2.6	**END OF BOREHOLE** Refusal (obstruction in the hole)				

Elevation Scale (m): 417, 416, 415

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) | Natural Water Content (MC) | Liquid Limit (LL) — 10 20 30

62

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Possible cobble or bedrock obstruction in hole.

Borehole was dry and open upon completion of drilling.

file: 7-18-0158-01 - anges st.gpj

LOG OF BOREHOLE 8

Terraprobe

Project No. : 7-18-0158-01 | Client : Normaple Development Ltd. and Seaton Foxbridege Corporation | Originated by : JM

Date started : February 8, 2019 | Project : Part of East Half of Lot 22, Concession 4, West of Hurontario St | Compiled by : AF

Sheet No. : 1 of 1 | Location : Caledon, Ontario | Checked by : PC

Position : E: 574738, N: 4856521 (UTM 17T) | Elevation Datum : Geodetic

Rig type : D50, track-mounted | Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	413.9	**GROUND SURFACE**				
	413.4	450mm **TOPSOIL**		1	SS	8
	0.5	**FILL**, silty fine sand, trace gravel, compact, brown		2	SS	16
1	412.5					
	1.4	**SILTY SAND and GRAVEL**, with occasional cobbles and boulders, compact to very dense, brown		3	SS	16
2				4	SS	26
3				5	SS	39
4	409.3			6	SS	50 / 25mm
	4.6	**END OF BOREHOLE** Refusal (obstruction in the hole)				

Elevation Scale (m): 413, 412, 411, 410

Penetration Test Values (Blows / 0.3m): Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm): 45

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

GR SA SI CL: 27 41 23 9

Possible cobble or bedrock obstruction in hole.

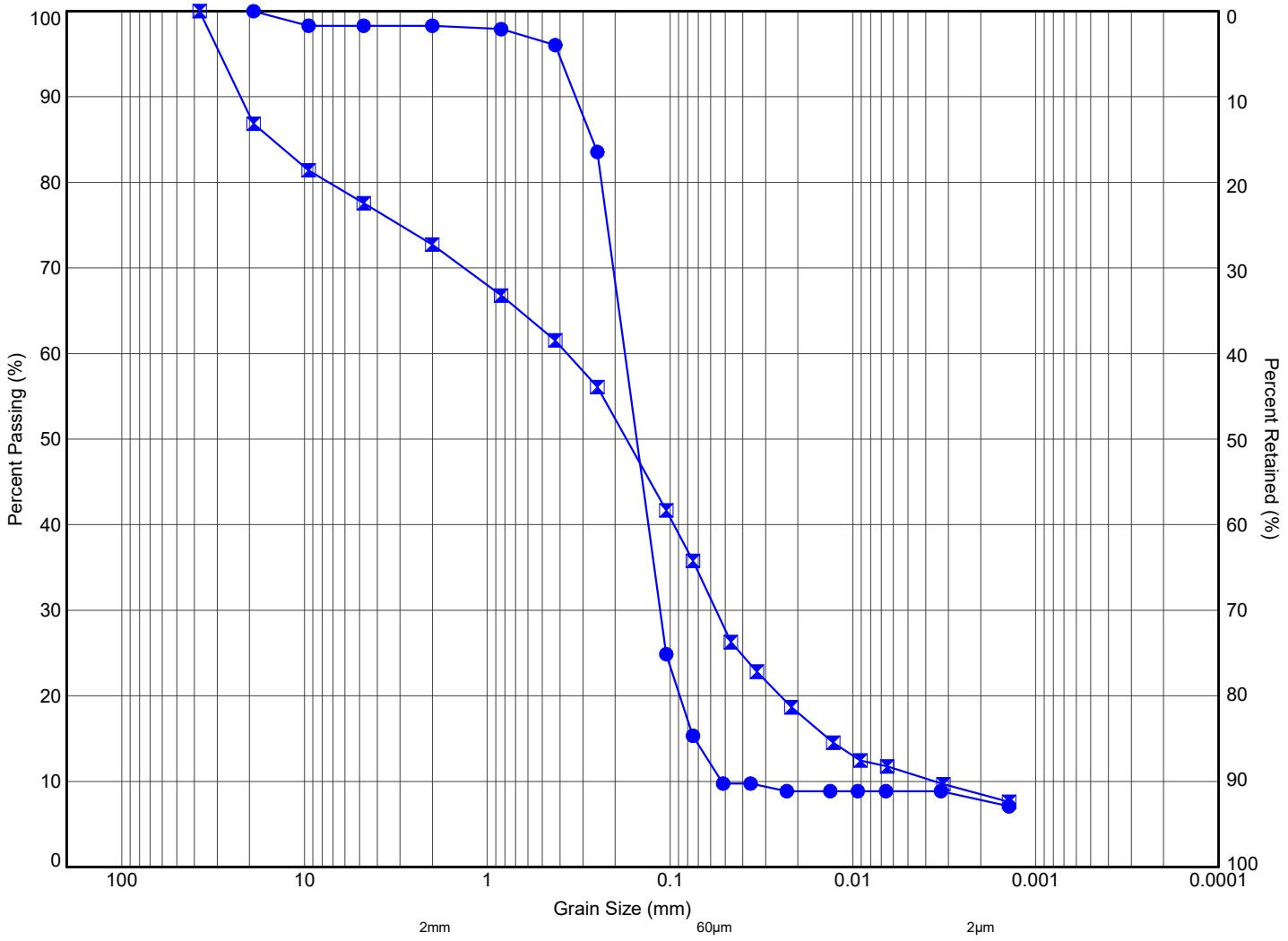
Unstabilized water level measured at 3.2 m below ground surface; borehole was open upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 4, 2019	2.2	411.7

file: 7-18-0158-01 - anges st.gpj



MIT SYSTEM	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

MIT SYSTEM

	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**1**	SS2	1.0	417.2	2	86	4	8	
⊠	**8**	SS3	1.8	412.1	27	41	23	9	

Terraprobe
903 Barton Street, Unit 22, Stoney Creek ON L8E 5P5
(905) 643-7560

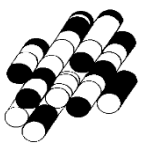
Title: **GRAIN SIZE DISTRIBUTION**

File No.: **7-18-0158-01**

Results of In-Situ Hydraulic Conductivity Testing

APPENDIX D

Terraprobe Inc.



Appendix C: Results of In-Situ Hydraulic Conductivity Testing
Monitoring Well MW2-S
Proposed Residential Development
Anges Street
Alton, Ontario

Test Completed on	25-Apr-19	
well depth	3.06	m
r (casing radius)	0.025	m
L (length of screen)	1.5	m
R (filter pack [borehole] radius)	0.03	m
To (time lag*)	1730	sec
H (initial water level before slug)	1.29	m
Ho (water level at t=0)	2.00	m
h (recorded water level at time t)	See Column F	

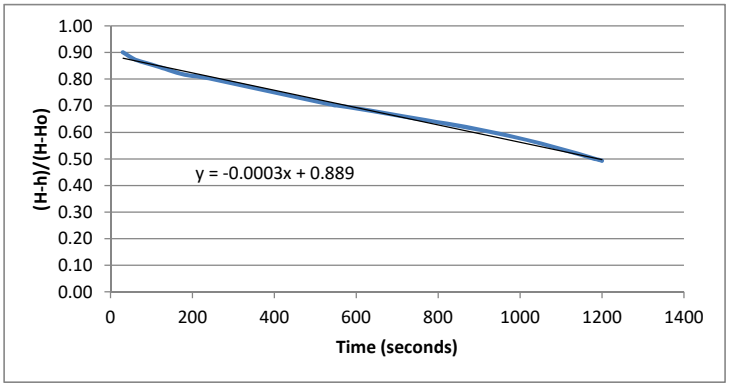
* To = t when (H-h)/(H-Ho) = 0.37 and ln(H-h)/H-Ho)=-1

Hydraulic Conductivity (K) =(r^2 ln(L/R))/(2LTo)

4.71E-07 m/sec

Time lag is defined as the time required for the complete equalization of the head difference if the original rate of inflow were maintained.

Water Level (mbgl)	(H-h)/(H-Ho)	Elapsed Time (s)
1.93	0.90	30
1.91	0.87	60
1.90	0.86	90
1.89	0.85	120
1.87	0.82	180
1.86	0.80	240
1.79	0.70	540
1.78	0.69	600
1.71	0.59	960
1.64	0.49	1200



Appendix C: Results of In-Situ Hydraulic Conductivity Testing
Monitoring Well MW2-D
Proposed Residential Development
Anges Street
Alton, Ontario

Test Completed on	25-Apr-19	
well depth	6.01	m
r (casing radius)	0.025	m
L (length of screen)	1.5	m
R (filter pack [borehole] radius)	0.03	m
To (time lag*)	200	sec
H (initial water level before slug)	1.64	m
Ho (water level at t=0)	6.01	m
h (recorded water level at time t)	See Column F	

* To = t when (H-h)/(H-Ho) = 0.37 and ln(H-h)/H-Ho)=-1

Hydraulic Conductivity (K) =(r^2 ln(L/R))/(2LTo)

4.08E-06 m/sec

Time lag is defined as the time required for the complete equalization of the head difference if the original rate of inflow were maintained.

Water Level (mbgl)	(H-h)/(H-Ho)	Elapsed Time (s)
5.22	0.82	30
4.75	0.71	60
4.30	0.61	90
4.01	0.54	120
3.66	0.46	150
3.44	0.41	180
3.19	0.35	210
3.00	0.31	240
2.82	0.27	270
2.66	0.23	300
2.42	0.18	360
2.28	0.15	420
2.13	0.11	480
2.04	0.09	540
2.02	0.09	600
1.86	0.05	720
1.80	0.04	840
1.75	0.03	960
1.72	0.02	1080
1.69	0.01	1200

Appendix C: Results of In-Situ Hydraulic Conductivity Testing
Monitoring Well MW8
Proposed Residential Development
Anges Street
Alton, Ontario

Test Completed on	25-Apr-19	
well depth	4.29	m
r (casing radius)	0.025	m
L (length of screen)	1.5	m
R (filter pack [borehole] radius)	0.03	m
To (time lag*)	950	sec
H (initial water level before slug)	1.02	m
Ho (water level at t=0)	3.45	m
h (recorded water level at time t)	See Column F	

* To = t when (H-h)/(H-Ho) = 0.37 and ln(H-h)/H-Ho)=-1

Hydraulic Conductivity (K) =(r^2 ln(L/R))/(2LTo)

8.58E-07 m/sec

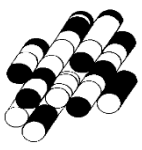
Time lag is defined as the time required for the complete equalization of the head difference if the original rate of inflow were maintained.

Water Level (mbgl)	(H-h)/(H-Ho)	Elapsed Time (s)
3.19	0.89	30
3.02	0.82	60
2.97	0.80	90
2.96	0.80	120
2.93	0.79	180
2.88	0.77	240
2.69	0.69	360
2.50	0.61	480
2.31	0.53	600
2.15	0.47	720
2.02	0.41	840
1.90	0.36	960
1.77	0.31	1080
1.66	0.26	1200
1.51	0.20	1500
1.40	0.16	1800

Laboratory Certificates of Analysis

APPENDIX E

Terraprobe Inc.



Maxxam
A Bureau Veritas Group Company

Your Project #: 7-18-0158-46
Site Location: ANGES STREET PROPERTY
Your C.O.C. #: 703645-01-01

Attention: Paul Raepple

Terraprobe
903 Barton St
Unit 22
Stoney Creek, ON
CANADA L8E 5P5

Report Date: 2019/03/13
Report #: R5627617
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B960393
Received: 2019/03/07, 15:45

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Total Ammonia-N	3	N/A	2019/03/12	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (1)	3	N/A	2019/03/11	CAM SOP-00440	SM 23 4500-NO3I/NO2B
Total Kjeldahl Nitrogen in Water	3	2019/03/11	2019/03/11	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	3	2019/03/11	2019/03/12	CAM SOP-00407	SM 23 4500 P B H m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

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

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

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam
A Bureau Veritas Group Company

Your Project #: 7-18-0158-46
Site Location: ANGES STREET PROPERTY
Your C.O.C. #: 703645-01-01

Attention: Paul Raepple

Terraprobe
903 Barton St
Unit 22
Stoney Creek, ON
CANADA L8E 5P5

Report Date: 2019/03/13
Report #: R5627617
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B960393
Received: 2019/03/07, 15:45

Encryption Key

Ashton Gibson
Project Manager
13 Mar 2019 17:03:53

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ashton Gibson, Project Manager
Email: AGibson@maxxam.ca
Phone# (905) 817-5700

==========

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B960393
Report Date: 2019/03/13

Terraprobe
Client Project #: 7-18-0158-46
Site Location: ANGES STREET PROPERTY
Sampler Initials: JM

RESULTS OF ANALYSES OF WATER

Maxxam ID		JDM163		JDM164	JDM165		
Sampling Date		2019/03/04 11:20		2019/03/04 10:25	2019/03/04 10:15		
COC Number		703645-01-01		703645-01-01	703645-01-01		
	UNITS	BH8	RDL	BH25	BH2-D	RDL	QC Batch
Inorganics							
Total Ammonia-N	mg/L	<0.050	0.050	0.11	<0.050	0.050	6012153
Total Kjeldahl Nitrogen (TKN)	mg/L	0.42	0.10	0.39	0.66	0.10	6012084
Total Phosphorus	mg/L	0.63	0.10	2.8	2.1	1.0	6011753
Nitrite (N)	mg/L	<0.010	0.010	<0.010	<0.010	0.010	6008882
Nitrate (N)	mg/L	2.87	0.10	0.32	0.96	0.10	6008882
Nitrate + Nitrite (N)	mg/L	2.87	0.10	0.32	0.96	0.10	6008882

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B960393
Report Date: 2019/03/13

Terraprobe
Client Project #: 7-18-0158-46
Site Location: ANGES STREET PROPERTY
Sampler Initials: JM

TEST SUMMARY

Maxxam ID: JDM163
Sample ID: BH8
Matrix: Water

Collected: 2019/03/04
Shipped:
Received: 2019/03/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	6012153	N/A	2019/03/12	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6008882	N/A	2019/03/11	Chandra Nandlal
Total Kjeldahl Nitrogen in Water	SKAL	6012084	2019/03/11	2019/03/11	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	6011753	2019/03/11	2019/03/12	Amanpreet Sappal

Maxxam ID: JDM164
Sample ID: BH25
Matrix: Water

Collected: 2019/03/04
Shipped:
Received: 2019/03/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	6012153	N/A	2019/03/12	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6008882	N/A	2019/03/11	Chandra Nandlal
Total Kjeldahl Nitrogen in Water	SKAL	6012084	2019/03/11	2019/03/11	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	6011753	2019/03/11	2019/03/12	Amanpreet Sappal

Maxxam ID: JDM165
Sample ID: BH2-D
Matrix: Water

Collected: 2019/03/04
Shipped:
Received: 2019/03/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	6012153	N/A	2019/03/12	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6008882	N/A	2019/03/11	Chandra Nandlal
Total Kjeldahl Nitrogen in Water	SKAL	6012084	2019/03/11	2019/03/11	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	6011753	2019/03/11	2019/03/12	Amanpreet Sappal

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Maxxam Job #: B960393
Report Date: 2019/03/13

Terraprobe
Client Project #: 7-18-0158-46
Site Location: ANGES STREET PROPERTY
Sampler Initials: JM

GENERAL COMMENTS

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

Package 1	8.3°C

Results relate only to the items tested.

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Maxxam Job #: B960393
Report Date: 2019/03/13

Terraprobe
Client Project #: 7-18-0158-46
Site Location: ANGES STREET PROPERTY
Sampler Initials: JM

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6008882	C_N	Matrix Spike	Nitrite (N)	2019/03/11		105	%	80 - 120
			Nitrate (N)	2019/03/11		NC	%	80 - 120
6008882	C_N	Spiked Blank	Nitrite (N)	2019/03/11		105	%	80 - 120
			Nitrate (N)	2019/03/11		102	%	80 - 120
6008882	C_N	Method Blank	Nitrite (N)	2019/03/11	<0.010		mg/L	
			Nitrate (N)	2019/03/11	<0.10		mg/L	
6008882	C_N	RPD	Nitrite (N)	2019/03/11	2.1		%	20
			Nitrate (N)	2019/03/11	0.048		%	20
6011753	ASP	Matrix Spike	Total Phosphorus	2019/03/12		100	%	80 - 120
6011753	ASP	QC Standard	Total Phosphorus	2019/03/12		99	%	80 - 120
6011753	ASP	Spiked Blank	Total Phosphorus	2019/03/12		96	%	80 - 120
6011753	ASP	Method Blank	Total Phosphorus	2019/03/12	<0.020		mg/L	
6011753	ASP	RPD	Total Phosphorus	2019/03/12	2.6		%	20
6012084	RTY	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2019/03/12		NC	%	80 - 120
6012084	RTY	QC Standard	Total Kjeldahl Nitrogen (TKN)	2019/03/11		107	%	80 - 120
6012084	RTY	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2019/03/11		103	%	80 - 120
6012084	RTY	Method Blank	Total Kjeldahl Nitrogen (TKN)	2019/03/11	<0.10		mg/L	
6012084	RTY	RPD	Total Kjeldahl Nitrogen (TKN)	2019/03/12	0.25		%	20
6012153	COP	Matrix Spike	Total Ammonia-N	2019/03/12		94	%	75 - 125
6012153	COP	Spiked Blank	Total Ammonia-N	2019/03/12		105	%	80 - 120
6012153	COP	Method Blank	Total Ammonia-N	2019/03/12	<0.050		mg/L	
6012153	COP	RPD	Total Ammonia-N	2019/03/12	NC		%	20

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

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

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

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

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

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

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

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Maxxam Job #: B960393
Report Date: 2019/03/13

Terraprobe
Client Project #: 7-18-0158-46
Site Location: ANGES STREET PROPERTY
Sampler Initials: JM

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Anastassia Hamanov, Scientific Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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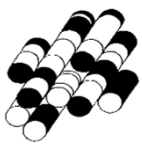
Alton Millpond Hydraulic Characteristics Report

APPENDIX F

Terraprobe Inc.



Alton Millpond Hydraulic Characteristics

Available Head:

Water level at intake pipe: 412.0 m
Water level at outlet: 407.5
Drop: 4.5 m water surface to water surface
Intake pipe diameter: 30 - 45 cm TBD
Intake pipe length: approx. 75 meters

Variable Flows:

As charted below, the water flows are very variable season to season and year to year.

The project includes a fish passage channel which will receive priority for minimum flow periods.

The focus for hydraulic modelling was on ensuring the water was not too fast to prevent fish from migrating up the fish passage during the spawning periods for white sucker and brook trout. It was agreed these flows would be 0.7m^3/s to correspond with typical October - November flows and 1.2m^3/s to correspond with typical April – May flows. In addition, the half bankfull flow of 1.84m^3/s was modelled for comparison. No modelling was attempted to try to determine what minimum flow is required to permit fish passage. It was felt that this will have to be determined empirically once the fish passage is actually built.

Assuming the fish passage would function with about 0.2m^3/s (ie. at existing minimum flows), that would leave an **average flow available to the turbine 9 months a year in the range of about 0.3 to 0.4 m^3/s**. But at times, the flows will be significantly higher, with average maximum flows of 1.5 m^3/s and peaks above that. A turbine that can operate efficiently with a range of flows would be ideal.

Available hydro-technical data

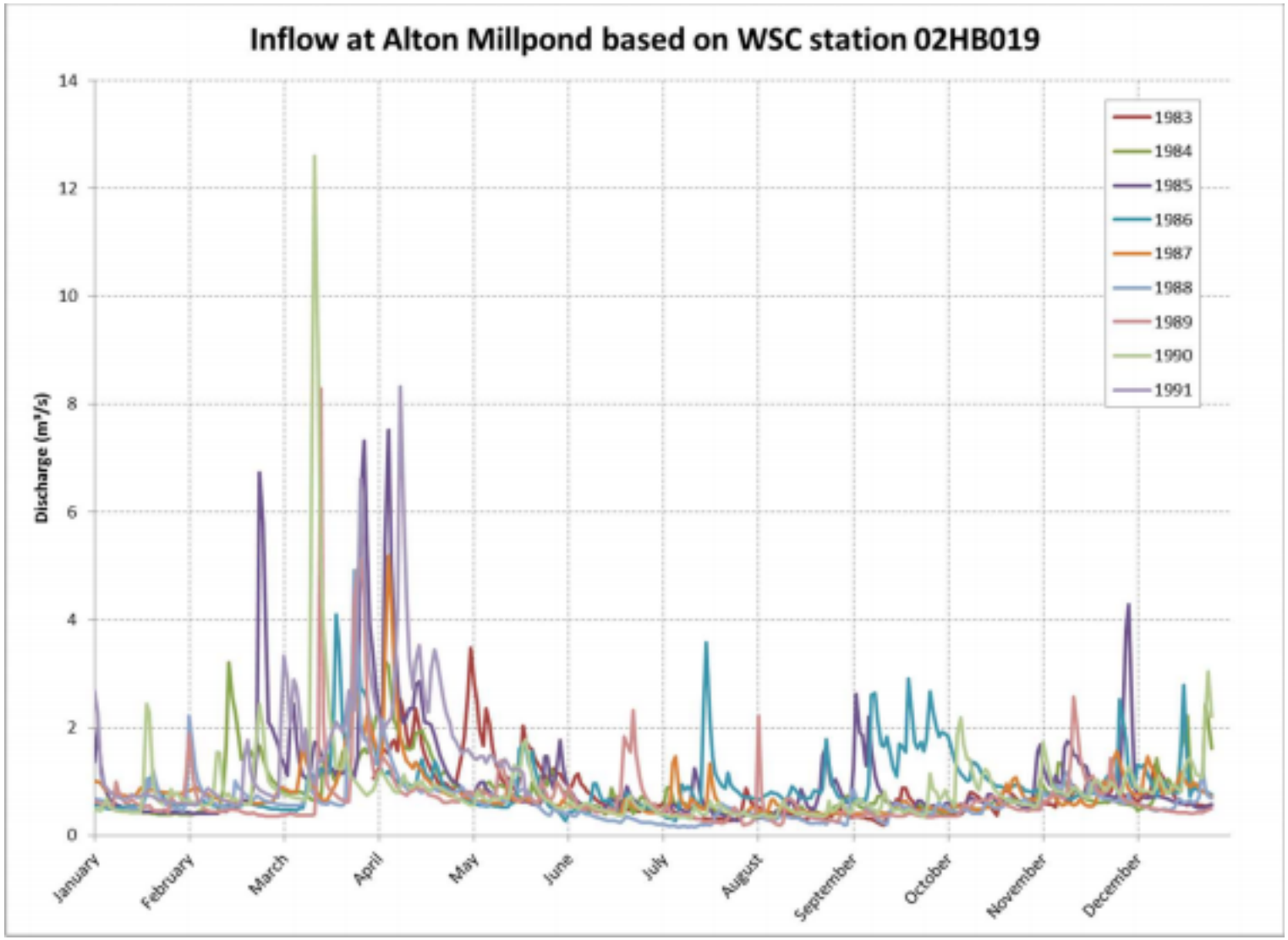
- Site drainage area: 65.8 km² (CVC)
- Data sources
  - Existing WSC gauge 02HB019 (1984-1990, 59.5 km²)
  - Other WSC gauges in the area
    - 02HB001 – Cataract (1915-…, 205 km²)
    - 02HB013 – Orangeville (1967-…, 62.2 km²)
    - 02HB020 – Erin (1983-…, 32.3 km²)
  - Real time flow station u/s of Alton (at Mississauga Rd) (2013-…) ⇦ CVC Water Management Study Update (2007)
  - CVC HEC-RAS model of Shaw's Creek subwatershed
  - OMNR: OFAT, Fisheries, Water temperature, Drawings, …

Table 1 presents average monthly flows for Shaw's Creek over an 8-year period between 1983 and 1991 at Station WSC 02HB019. This station was located approximately 1.5km upstream of the Alton Millpond dam with a catchment of 62.8km^2 or 97% of the site. The flows presented in Table 1 are pro-rated to reflect actual site flows.

Table 1. Average monthly flows within Shaw's Creek at WSC 02HB019.

	Monthly Average (m^3/s)		
January	0.66	July	0.46
February	0.83	August	0.45
March	1.63	September	0.60
April	1.56	October	0.64
May	0.86	November	0.78
June	0.55	December	0.83

Yearly and Seasonal Fluctuations:



Inflow Averages, Lows & Highs

Low flow (m^3/s)				High flow (m^3/s)		
3 days 2-year		0.182	OFAT[1]	2-year	13.1	HEC-RAS model
7 days 2-year		0.229	OFAT[1]	5-year	19.0	HEC-RAS model
June to Nov.	Average min	0.279	WSC 02HB019[2]	10-year	24.1	HEC-RAS model
	Average	0.628	WSC 02HB019[2]	25-year	30.1	HEC-RAS model
	Average max.	1.48	WSC 02HB019[2]	50-year	34.6	HEC-RAS model
	Maximum	3.57	WSC 02HB019[2]	100-year	39.2	HEC-RAS model
1 OFAT: Ontario Flow Assessment Tool III 2 Transposed flow at project site				Regional Flood	112.4	Flood plain mapping