Hydrogeological Investigation
Septic Impact Assessment
Residential Townhouse Subdivision
Agnes Street

TOWN OF CALEDON
PLANNING
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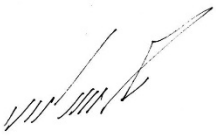
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1 Introduction

1.1 Site Location and Description

Englobe 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 65 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 Universal Transverse Mercator (UTM) coordinates for the centre of the site lies roughly at 574 707 m E, and 4 856 372 m N (Zone 17T). 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 to assess the impacts of the proposed residential development given the proposed density and private sewage disposal systems to be utilized for site servicing on shallow groundwater and to assess constraints on the proposed development to reduce the likelihood of impacts to groundwater due to site development. The hydrogeological investigation provides a summary of the findings of the field study and related ground water monitoring and quality sampling program; including a description of the physical soil and ground water characteristics of the Site; and, summarizes 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. Regulatory requirements and policies review and considered applicable to the Site are as follows:

- Town of Caledon Official Plan
- CTC Source Water Protection, established under the Clean Water Act (2006)
- Ontario Water Resources Act
- Procedure D-5-4 and MOE Sewage Design Guidelines (2008), Section 22.5

The Site is noted to be located outside of the limits of both the Niagara Escarpment and Oak Ridges Moraine planning areas.

2 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. If property owners did not respond to inquiries, staff were sent to physically inspect the wells located immediately down-gradient of the Site along Queen Street. 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 consisting of eight boreholes was completed by Englobe in February 2019 to investigate shallow soil and groundwater conditions, which established a series of four monitoring wells across the site (one location at BH2 consisted of nested monitoring wells) 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 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 northeast 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 mostly vacant lot containing two small storage buildings fronting to Agnes Street to be demolished. 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 northeast 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 65 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. The municipal supply wells for the Village of Alton are completed within overburden deposits.

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

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 within a 500 m radius of the site were reviewed with the study area extending east to include Alton municipal wells. **Table 3-1** provides a detailed summary of well records situated down-gradient of the Site.

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.

Table 3-2 provides a summary of well records situated within a 500 m radius of the Site. The study area was expanded to the east to include Alton municipal wells located approximately 650 metres northeast of the Site:

Table 3-2: Summary of Well Records

Total Number of Wells	127
Overburden	22 (17 %)
Bedrock	61 (48 %)
No Data	44 (35%)
Well Depth	
Less Than 10 m (<30 ft)	19 (15 %)
10 m to 30 m (30 ft to 100 ft)	37 (29 %)
30 m to 60 m (100 ft to 200 ft)	20 (16 %)
Greater Than 60 m (>200 ft)	11 (9 %)
No Data	40 (31 %)
Well Use	
Domestic	52 (41 %)
Municipal/Public Supply	5 (4 %)
Monitoring/Test Hole	26 (20 %)
Decommissioned	42 (33 %)
Commercial	2 (2 %)
Well Yield	
Less Than 18.7 L/min (<5 GPM)	25 (19 %)
18.8 L/min to 37.8 L/min (10 GPM or less)	27 (21 %)
37.9 L/min to 75.6 L/min (10 - 20 GPM)	7 (6 %)
Greater Than 75.6 L/min (more than 20 GPM)	7 (6 %)
No Data	61 (48 %)

Based on a review of geological mapping and stratigraphy records included within well records the following aquifer units were identified:

- *Overburden deposits (Meltwater Channel)*: Sand and Gravel to gravel deposits are prevalent in the vicinity of the East Credit River with overburden deposits extending to depths of 57 to 60 m

below grade. Within the village of Alton west of the East Credit River primarily consist of silty sand to fine-grained silts and clays with boulders (Halton till) to shallow depths between 2 m to 10 m in depth forming a semi-confining layer to underlying bedrock.
- *Amabel Formation* – Forms shallow bedrock deposits consisting of grey to blue-gray medium, crystalline, massively bedded dolomite, with thicknesses of up to 30 m in thickness.
- *Clinton-Cataract Group* – Of the Clinton-Cataract Group the uppermost deposits of the Clinton Group consist of fossiliferous dolostone, approximately 3 m in thickness identified as the Reynales - Fossil Hill Formation, overlying shale deposits of the Cabot Head Formation consisting of greenish grey to red silty shale approximately 10 m in thickness.

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 Formation and the Clinton-Cataract Group, including the Reynales-Fossil Hill and Cabot Head 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. Till deposits range from fine grained silts and clays to silty sand and sand and gravel outwash deposits associated with surface water features, which in the vicinity of Alton would be both Shaw's Creek and the East Credit River. 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 northeast 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 northeast extent of the Site toward Queen Street and Agnes Street at an elevation of approximately 411.2 m, a total elevation change of approximately 10.7 m.

Topography slopes toward the section of Shaws Creek approximately 150 m northeast of the Site based on the identified grading to the northeast. Shaws Creek forms a sub-watershed of the Credit River watershed. Shaws Creek flows to the northeast to form the West Credit River approximately 1.2 km east of the Site. Shallow groundwater flow in the vicinity of the Site is expected to flow separate from Site topography (northeast) and be directed north toward a closer section of Shaws Creek located approximately 120 m north of the Site.

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) associated with the Alton Millpond reservoir is not evaluated as per Ontario Wetland Evaluation System (OWES). This feature is located cross gradient to the Site and is not expected to be impacted by the proposed development.

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 with northern portions of the Site falling within WHPA-C and WHPA-D designation. The Vulnerability Score assigned to the site within the WHPA-E falls within a score of 8 (high vulnerability) 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 identified ground water threats resulting from site development would be septic systems (governed under the Building Code Act) and proposed stormwater management facilities. The following table provides a summary of applicable source water policies, their applicability to the proposed development, and how the development will comply with the intent of these polices:

Table 3-3: Summary of Source Water Protection Policies

Policy		Policy Type	Rationale	Site Applicability
SWG-1	Septic Systems Governed Under the Building Code Act	Specify Action	Manages future septic systems through prioritized septic inspections conducted under the Ontario Building Code Act. Under the Act, the timeline for completing the first inspection is five years.	The proposed inspection and maintenance schedule is bi-annually the first year, and annual thereafter, exceeding the inspection and maintenance schedule required under SWG-1.
SWG-2		Education and Outreach	The use of education and outreach materials for small sewage systems would be provided by the MECP, through the municipality, relating to actions an owner can take in the operation and maintenance of septic systems to protect municipal sources of drinking water. The	Information relating to septic operation and maintenance will not only be available to landowners via the municipality under SWG-2, but under the subdivision/condominium process, information packages will be provided to the individual

Policy		Policy Type	Rationale	Site Applicability
			information will be made available to municipalities for distribution.	homeowners and to the Condominium corporation which will be responsible for operation and maintenance. See Appendix H for more details.
SWG-3		Land Use Planning	The intent of this policy is to ensure that site plan control, as a planning and development control tool, is used to optimize the location and design of septic systems when existing vacant lots of record are proposed to be developed within certain designated vulnerable areas identified in the policy. Under this policy the enactment or amendment of municipal site plan control by-laws is provided to allow for the detailed review of on-site sewage systems for vacant lots to optimize their location and design relative to the designated vulnerable areas present.	The Site is not subject to additional Municipal site plan controls and thereforeSWG-3 is not applicable, however the sewage system systems are optimized via the plan of subdivision process.
SWG-4		Land Use Planning	Policy to limit the creation of new lots requiring a septic system where the septic system would be partially or wholly in WHPA-A. In the remainder of the areas where a septic system would be a significant drinking water threat, the municipality shall review a site-specific hydrogeological assessment to determine if the threat to the municipal drinking water source can be managed.	The Site does not fall within a WHPA-A zone, therefore the policy limiting creation of new lots is not applicable. Since it falls partially within WHPA-C, WHPA-D, and WHPA-E (Vulnerability Score = 8) and the proposed septic systems could be considered a drinking water threat, the hydrogeological investigation was completed to establish effluent treatment targets to manage potential groundwater quality threats to municipal drinking water in accordance with SWG-4
SWG-5		Specify Action	This policy is intended to request that the Ministry of Municipal Affairs and Housing amend the Building Code Act to provide the ability for a municipality to require specific systems where there is a need for additional treatment technologies to protect the source of municipal drinking water beyond the minimum acceptable treatment set out in the Building Code.	Additional treatment technology beyond the minimum acceptable treatment set out in the Building Code is proposed for the Site through the Subdivision and Condominium approval processes. The proposed development would meet the intent of SWG-5.
SWG-6		Specify Action	Under this policy municipalities can pass by-laws under the Municipal Act to require mandatory connections to the municipal sewer system for new developments and existing	SWG-6 would not be applicable to the Site as municipal sewer connections are not available for the proposed development.

Policy		Policy Type	Rationale	Site Applicability
			systems and decommissioning of existing systems, where municipal sanitary sewers and capacity are available.	
SWG-11		Prescribed Instrument	Prohibits future stormwater management facilities designed to discharge stormwater to land or surface water in WHPA-A. These facilities are otherwise managed through the Prescribed Instrument. This policy should be implemented in conjunction with SWG-12. There are additional requirements for stormwater management ponds and discharges that are in an Issue Contributing Area for Sodium or Chloride.	SWG-11 would not be applicable to the Site as the Site does not fall within the WHPA-A, nor does it fall within an issue contributing area for sodium or chloride. The design of the SWM facilities is driven by other standards including the Town's ELI-ECA requirements as detailed in the FSR and Urbanization memo prepared by Greek and Associates.
SWG-12		Land Use Planning	Prohibits future stormwater management facilities designed to discharge stormwater to land or surface water in WHPA-A. Future facilities shall only be permitted subject to an approved Environmental Assessment, or similar planning process. This policy should be implemented in conjunction with SWG-11.	SWG-12 would not be applicable to the Site as it and the Agnes Street storm sewer outlet do not fall within the WHPA-A area Nevertheless a similar planning process has been undertaken for the site and appropriate SWM quality control measures implemented.

The above applicable Source Water Protection policies will be met by the proposed water water/stormwater management program, and on-going proposed inspection. Further information regarding the inspection and monitoring program proposed is provided under the sewage information package included within **Appendix H**.

The identified WHPA-E areas along Shaws Creek and the East Credit River are also associated with municipal wells located along Beech Grove Side Road, approximately 1.7 km southeast of the site. On review of well records for the municipal well (WR 4907753) it was identified that the wells are completed approximately 0.6 m within bedrock at a depth of 78.3 m and intersects approximately 64 m of sand and gravel deposits. It is considered that the Beech Grove Side Road municipal well is completed within the meltwater channel approximately 1.6 km downstream of the Alton municipal wells. Potential impacts for the Beech Grove municipal well are considered negligible, given the distance from Shaws Creek down-gradient of the Site to the Beech Grove Side Road municipal wells. Potential for impacts to the Beech Grove Side Road municipal well are further discussed under Section 5.3.2 below.

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. Given the Site topography and shallow groundwater flow direction to the north, the primary groundwater receptor was considered as Shaws Creek.

Significant subsurface groundwater flows to the municipal wells are not expected, since the municipal wells are situated within overburden deposits at depths of approximately 60 m associated with a meltwater channel along the East Credit River. Overburden deposits in the vicinity of the site consist of silty sand to

clayey silt till deposits overlying bedrock at depths ranging from 2 m to 10 m below grade based on local well records.

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 south property limit to the north property limits, and from the west to east, with overall grading to the northeast 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 which would indicate areas of runoff retention on-site were not observed.

3.8 Private Well Survey

In addition to the MECP well records search, private well surveys were conducted by Englobe on March 17, 2022, and by Gunnell Engineering in June 2022. The private well survey completed by Englobe included properties situated within a 500 m radius of the Site. Further well surveys were completed for the properties immediately north of the site fronting to Queen Street, which included physical confirmation of private wells as shown on the site plan provided in **Appendix A**.

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 were distributed by both Englobe 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 wells. 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 January 17, 2025). The extent of the well survey competed by Englobe is indicated on the attached Figure 5.

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. Potential impacts to private wells were considered based on a mass balance approach for the down-gradient property limit following Procedure D-5-4 and its criteria are met (see section 5.2).

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 Englobe 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 January 17, 2025, 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 3-4**:

Table 3-4: 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 based on a comparison with type curves provided within the Ontario Building Code Supplementary Guidelines SG-6.

Table 3-5 provides a summary of grain size analysis completed by Gunnell Engineering for completed test pits:

Table 3-5: 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 based on information provided within OBC SG-6.

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 3-6** provides a summary of monitoring well locations established at the Site:

Table 3-6: 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 3-7**):

Table 3-7: Summary of Groundwater Monitoring

Location	Water Levels								Observed Seasonal Variation (m)
	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	1.1
MW2-D	2.4	413.4	1.8	414.0	1.6	414.2	2.6	413.2	1.0
MW5	6.3	415.6	6.2	415.7	>6.4	<415.5	6.1	415.8	>0.3
MW8	2.2	411.7	1.6	412.3	1.1	412.8	2.4	411.5	1.3

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 depths at the Site ranged from 1.1 mbgs at MW8 to lower than 6.4 mbgs at MW5. Seasonal variations in groundwater levels were observed between 1.0 to 1.3 m below grade in MW2 and MW8 (MW5 was observed to be dry during monitoring). 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 with horizontal groundwater flows expected to the north to Shaw's Creek. 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 3-8** provides a summary of the results of in-situ hydraulic conductivity testing carried out at the Site:

Table 3-8: 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 3-9**:

Table 3-9: 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

Parameter	Unit	MW2-S	MW2-D	MW8
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 65 residential units within a total of 14 condominium townhouse blocks of 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. Sewage flows were assessed based on OBC Table 8.2.1.3.A for 2 to 3, three-bedroom, three-bathroom units with 24 fixture units with additional flows of 200 L/day based on a floor area of 220 m^2 per unit and fixture units over 20 (1,800 L/day) and two four-bedroom, three-bathroom units with 24 fixture units (2,200 L/day), with additional flows of 200 L/day based on a floor areas of 220 m^2 per unit and contingency flows of 100 L/day per five-unit townhouse block (see Gunnell Drawings SP1-1, SP5-1 and SP9-1 for detailed calcs).

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. Proposed septic systems will be constructed within servicing blocks designated for private septic servicing, leaching beds are not proposed to cross property lines and will be managed by the condominium corporation established for each townhouse block. This approach was confirmed by the Region of Peel who do not communal systems or a Municipal Responsibility Agreement (for systems with greater than 5 residential units). Sewage system design is discussed further in Section 4.0 below and is based on the proposed dispersal bed layout prepared by Gunnell Engineering. For a more detailed explanation of the regulatory context and proposed conditions of approval that will govern the operation of the sewage treatment systems please refer to the “Wastewater Systems Information” document provided under Appendix H.

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 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 followed by silty sand and gravel with occasional cobbles and boulders to the depth of completion. 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 1.1 mbgs at MW8 to lower than 6.4 mbgs at MW5. Seasonal variations in groundwater levels were observed between 1.0 to 1.3 m below grade at in 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 for two lots no response to the survey was received nor physical evidence observed indicating the presence of a well.

- 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 65 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 for the construction of Waterloo Biofilter tertiary treatment sewage systems with Type 'A' Dispersal Beds to service proposed townhouse blocks have been provided by Gunnell Engineering in the Sewage System Brief dated March 14, 2023, revised September 20, 2024. Preliminary design calculations accordance with Part 8 of the OBC and typical sewage system preliminary layouts were provided by Gunnell Engineering for Townhouse Blocks 1, 5, and 9 on the attached site plan Drawings SP1-1, SP5-1, and SP9-1. Design parameters for all the townhouse blocks were summarized on Drawing SP-1, Overall Site Plan: Septic System Layout Criteria included within **Appendix A**. Sewage servicing at the Site for individual sewage systems will not exceed 10,000 L/day. 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 23.5
6	8,000	160.0	7.2 x 23.5
7	8,000	160.0	7.2 x 23.5
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	8,000	160.0	7.2 x 23.5
13	9,900	198.0	7.2 x 32.0
14	8,000	160.0	7.2 x 23.5

*Bed dimensions to be confirmed by Gunnell Engineering

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 or exceed 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.

It is understood that the private wells are reported by the Region of Peel as not in use, and as such are not likely maintained. If the drilled well casings are not watertight the potential exists for unmaintained private wells to provide vertical flow pathways to the underlying bedrock.

As a precautionary measure, in the proposed preliminary design, the potential leaching beds have been repositioned to maximize the setback distances from the noted private wells beyond the minimum and to locate the leaching beds such that effluent plumes are not immediately upgradient of the noted drilled wells given the shallow groundwater flow direction to the north as detailed on Gunnell Engineering drawing SP-1 dated January 17, 2025.

5 Sewage Impact Analysis

5.1 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 Shaw's Creek was further assessed based on a review of the *'Nitrate-Nitrogen Impact Assessment Guideline for Development 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:

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

Where: N is the number of proposed residential units (65);
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 5.3 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.

5.2 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. While it is identified that these private wells do represent down-gradient receptors for sewage effluent, reasonable use criteria are not considered applicable given that municipal water connections were confirmed for all properties surrounding the Site and there is no evidence that the wells are used for potable water.

Notwithstanding the above impacts to shallow groundwater at the downgradient property boundary were assessed following a mass balance approach outlined under Guideline D-5-4 to evaluate the expected increase of nitrate within groundwater based on the treatment targets of 5.2 mg/L for nitrate identified to meet limits of nitrate to surface water of 2.93 mg/L identified within the CWQO. Nitrate impacts were assessed as follows:

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

Where: N is the number of proposed residential units (65);
F is the expected sewage flows per year (365 m^3/yr);
C is the effluent nitrate concentration (5.3 mg/L);
I is the infiltration rate for native soils (0.3 m/yr); and,
A is the Site area (40,000 m^2).

Based on the above criteria, due to the treatment of sewage effluent to meet the nitrate target of 2.93 mg/L in shallow groundwater at Shaw's Creek, the expected increase in nitrate in shallow groundwater at the down-gradient property boundary due to proposed subsurface sewage disposal is calculated at 3.5 mg/L. Given the highest observed background nitrate concentration observed in shallow groundwater at 2.87 mg/L the expected maximum concentration of nitrate at the property boundary was calculated at 6.4 mg/L, well below the maximum boundary nitrate condition of 10 mg/L set by Guideline D-5-4.

Potential concern was raised regarding potentially compromised well casings due to improper maintenance since private wells are reported to not be in use for residential supply. These unused wells have the potential to provide vertical flow pathways for shallow groundwater to the underlying bedrock aquifer.

It should be noted that the proposed Waterloo Biofilter systems will produce highly treated effluent prior to discharge to the type 'A' dispersal beds. Given that the sewage effluent will be treated to exceed D-5-4 standards at the downgradient site boundary, and the leaching beds are positioned such that the effluent plumes are not situated directly upgradient of the noted unused private wells, it is expected that potential impacts to the underlying bedrock aquifer will be effectively mitigated. Further, the bedrock aquifer and existing private supply wells are not used as a source of potable water for either private or municipal uses, hence the on-site sewage disposal is not expected to impact surrounding land use via the underlying bedrock aquifer.

5.3 Impacts to Municipal Wells

5.3.1 Alton 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 1.5×10^{-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 (approximately 400 m northeast of the intersection of Queen Street West and Main Street). 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**.

5.3.2 Beech Grove Side Road Municipal Well

It is identified through the source water protection atlas that the WHPA-E zone indicating GUDI groundwater conditions covers northern portions of the Site extending northeast along Shaws Creek to the Alton municipal wells, and south along the East Credit River to municipal wells situated along Beech Grove Side Road, located approximately 1.7 km southeast of the Site.

Under GUDI conditions the primary source of impacts would be with regards to surface water quality which influences groundwater quality. Given that the municipal well along Beech Grove Side Road is situated approximately 1.6 km downstream of the Alton municipal well, it is expected that nitrate effluent from the proposed residential development discharging to Shaws Creek would be diluted by surface water flows, both within Shaws Creek and the East Credit River.

As discussed in Section 5.3.1, it is expected that sewage effluent flows from the proposed development represent between 0.3 % to 0.1% of average surface water flows at the Alton Millpond, with further dilution expected approximately 2.7 km downstream at the municipal well located along Beech Grove Side Road. Impacts to the Beech Grove Side Road municipal wells are considered negligible.

5.4 Monitoring Recommendations

An ongoing monitoring and maintenance program for each septic system will be completed and will be implemented by the condominium corporation in place for each townhouse block. It is expected that maintenance will be completed on an as needed basis with routine monitoring and maintenance confirming effluent concentrations bi-annually during the first year of operations, and annually thereafter. It is expected that provided treatment targets are maintained that impacts to the natural environment will be maintained within acceptable limits. A groundwater monitoring program is not recommended given the proposed sewage system monitoring and maintenance schedule as summarized under the Sewage Information Package provided in Appendix H.

6 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 grade 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 toward 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 immediate vicinity of the Site, located down-gradient 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 all the properties surrounding the site 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 x 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 65 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 have been 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 and 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. Dispersal bed locations have been adjusted such that effluent plumes are not situated directly upgradient of the identified unused drilled wells.

3. Some properties located to the northwest of the site along Queen Street West were identified as having private wells through completed well surveys and on-site inspections. It was confirmed by the Region of Peel that all the residential properties surrounding the site have installed water meters and are serviced with municipal water supplies. Nitrate concentrations at the down gradient property boundary were assessed at 3.5 mg/L. Impacts to identified private wells reported as not used are expected within the health-related standard of 10 mg/L.

4. It has been determined that private wells for properties immediately north of the Site fronting to Queen Street are not in use for potable supply. Unused supply wells have the potential to not be adequately maintained, and as a result well casings may potentially be compromised over time leading to the potential for vertical flow pathways for treated sewage effluent to reach the underlying bedrock aquifer. Potential impacts to the bedrock aquifer are expected to be limited due to the level of treatment proposed (exceeding D-5-4 requirements) for on-site septic systems, and that leaching beds have been positioned such that they are not located immediately upgradient from noted private

wells. Further, the underlying bedrock aquifer is not used for potable supply for either private or municipal wells within Alton.

5. For the purposes of Sewage Impact Assessment, the closest downgradient receptor of concern 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 below 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 5.3 mg/L.

6. 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.

7. 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 5.3 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. Alton Municipal Wells 3 and 4 are situated approximately 750 m downstream of the Alton Millpond dam (approximately 400 m northeast of the intersection of Queen Street West and Main Street). Impacts to municipal wells are not expected.

7 Resources

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

2. Freeze, A. and Cherry, J., 1979. Groundwater, Prentice-Hall Inc., New Jersey.

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

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

5. Ministry of the Environment, Conservation and Parks, 2020. Source Protection Information Atlas Interactive Map.

6. Ministry of Natural Recourses and Forestry, 2020. Natural Heritage Interactive Map.

7. Credit Valley Conservation, 2020, Online Regulated Area Map.

8. Terzaghi, K., Peck, R., and Mesri, G., Soil Mechanics in Engineering Practice. Wiley, New York, 1996.

8 Statement of Limitation

The design recommendations given in this geotechnical report are applicable only to the project described in the text and only if constructed substantially in accordance with details of alignment and elevations stated in the report. Since all details of the design may not be known, in our analysis certain assumptions had to be made. The actual conditions, however, may vary from those assumed, in which case changes and modifications may be required to our geotechnical recommendations.

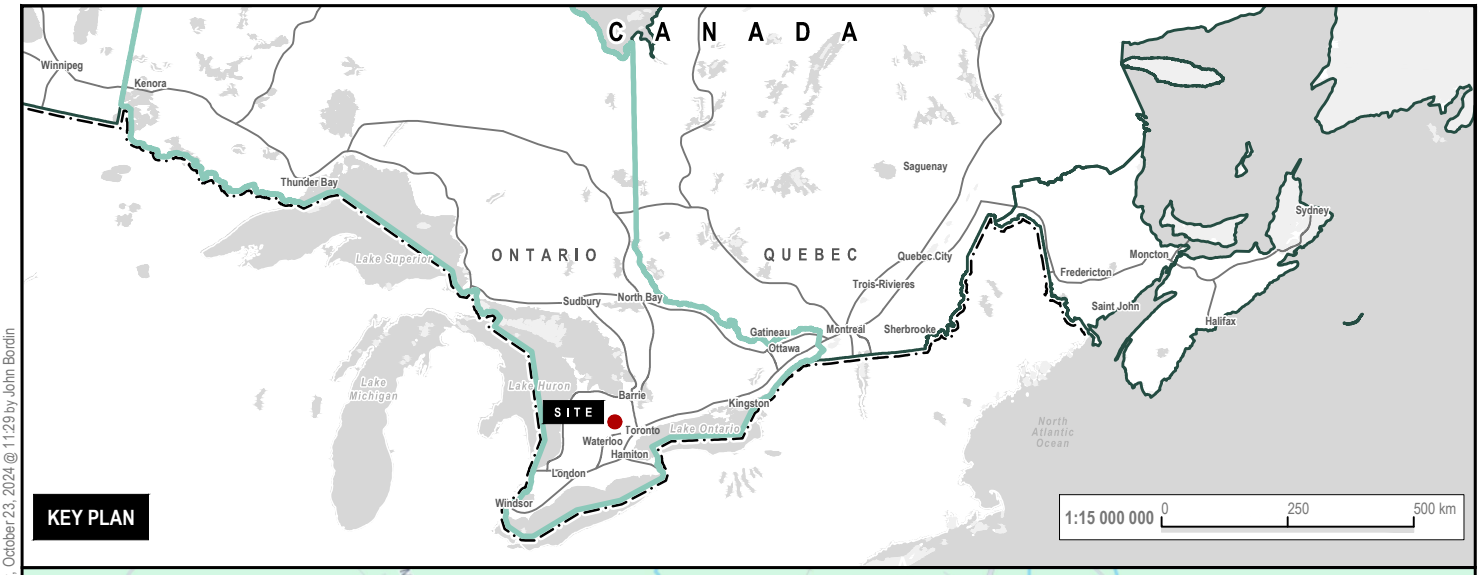
The comments in this report are intended solely for the guidance of the design engineer and address the geotechnical conditions only. The number of boreholes required to determine the localized conditions between boreholes directly affecting construction costs, equipment, scheduling, etc. would in fact be greater than what has been carried out for design purposes. Therefore, contractors bidding on this project or undertaking this work should make their own interpretations of the factual borehole results and carry out further work as they deem necessary to assess the scope of the project.

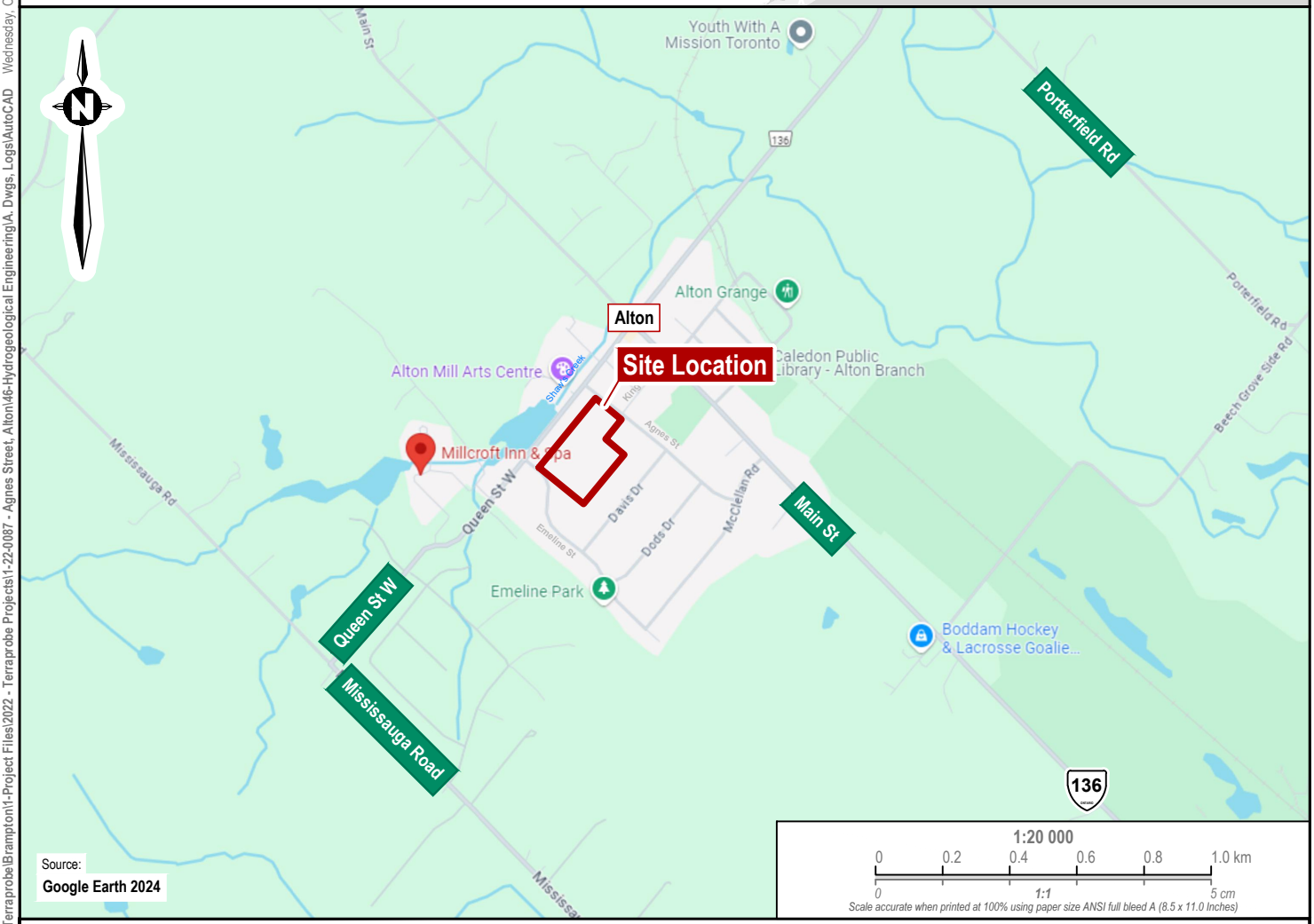
Foundation Design of this report is intended solely for the use of the client and the design team for the detail design of this specific project is not intended to be included in the tender documents; and shall not be used for any other purposes or by any other parties including the construction Contractor.

Figures



ENGLOBE





Note

1. This drawing shall be read in conjunction with the associated technical report.

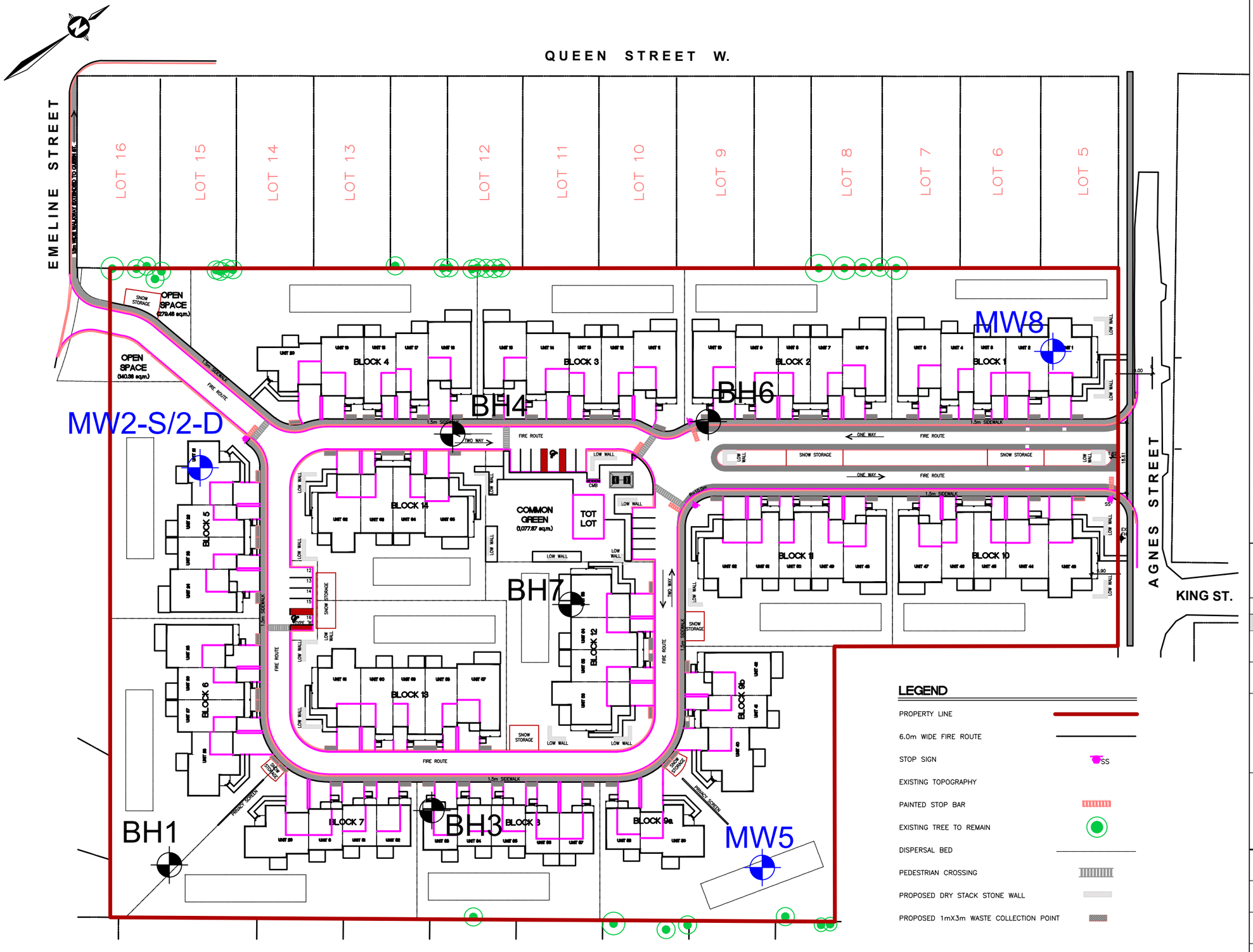
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A		Final	

Client	The Alton Development Inc.
Site	Agnes Street, Alton, Ontario
Report Title	Hydrogeological Investigation
Drawing Title	Site Location Plan
Designed By	P.R
Drawn By	J.B
Approved By	B.W
Scale	As Shown
Date	October 2024
Project No.	T1220087.000
Figure No.	1

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Drawing: T1220087.000 HydroG.dwg Folder: Y:\Shared\CAITerraprobe\Brampton\1-Project Files\2022 - Terraprobe Projects\1-22-0087 - Agnes Street, Alton\46-Hydrogeological Engineering\A. Dwgs, Logs\AutoCAD Wednesday, October 23, 2024 @ 11:29 by John Bordin



Note

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2. Drawing scale may be distorted. Measurements/locations taken from the drawing must be verified in the field.
3. CONCEPT PLAN
   SEATON GROUP
   AGNES STREET TOWNHOMES
   Villate of Alton, Caledon, ON
   Orchard Design Studio Inc.
   Project No. 14948 Drwg A1.01

Legend

- Site Boundary
- Borehole Location
- Monitoring Well Location

1:1 000

0 10 20 30 40 50 m

Revision	Date	Issue	Approval
A		Final	

Client: **The Alton Development Inc.**

Site: **Agnes Street, Alton, Ontario**

Report Title: **Hydrogeological Investigation**

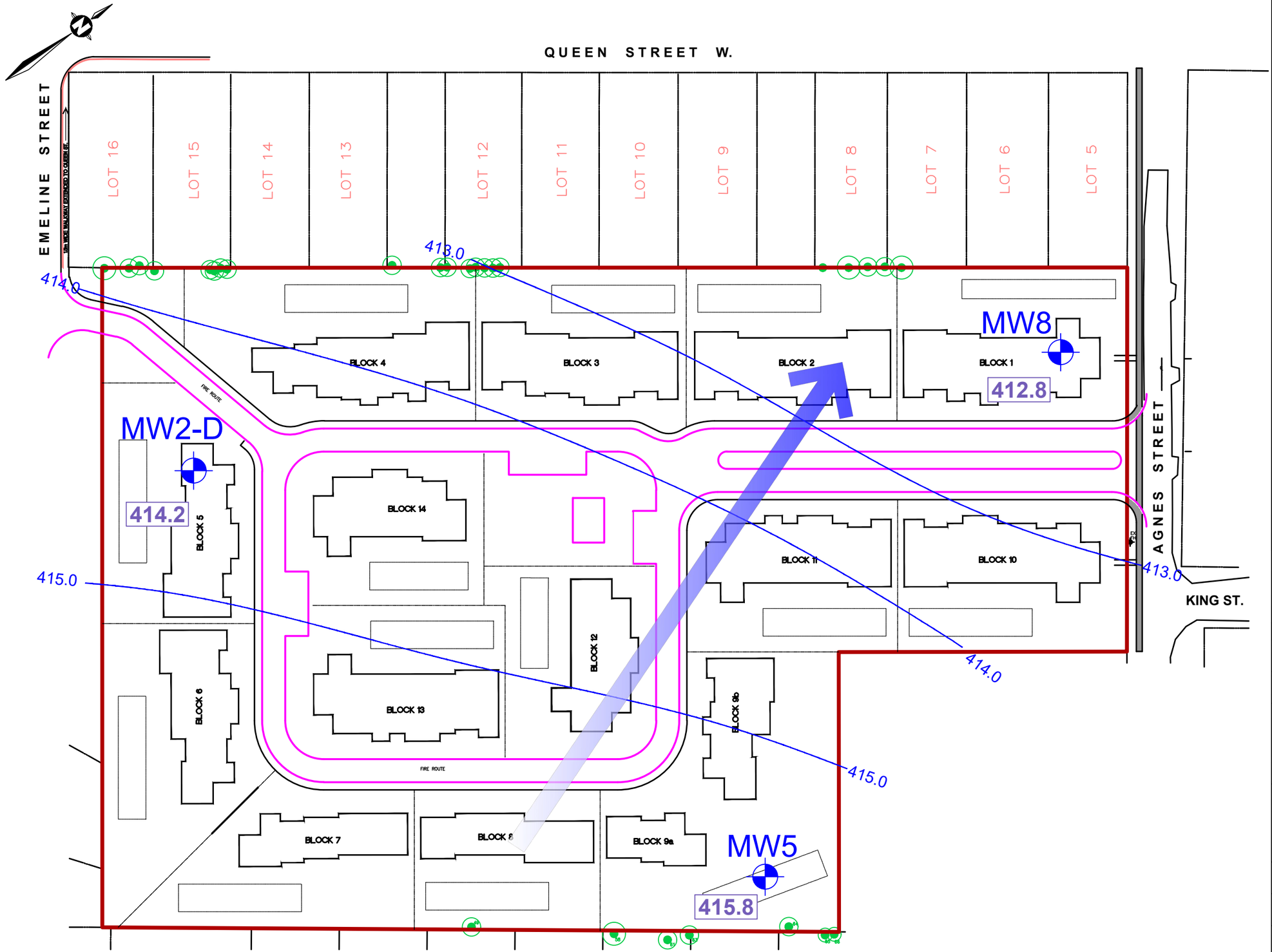
Drawing Title: **Borehole Location Plan**

Designed By	Scale
P.R	As Shown
Drawn By	**Date**
J.B	October 2024
Approved By	**Project No.**
B.W	T1220087.000

Figure No. **2**

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3. CONCEPT PLAN
   SEATON GROUP
   AGNES STREET TOWNHOMES
   Villate of Alton, Caledon, ON
   Orchard Design Studio Inc.
   Project No. 14948 Drwg A1.01

Legend

- Site Boundary
- Monitoring Well Location
- 414.2 Ground Water Elevation(masl) November xx, 202x
- Ground Water Flow Direction
- 415.0 Contour Lines

1:1 000

0 10 20 30 40 50 m

Revision	Date	Issue	Approval
A		Final	

Client: The Alton Development Inc.

Site: Agnes Street, Alton, Ontario

Report Title: Hydrogeological Investigation

Drawing Title: Groundwater Flow Direction Plan

Designed By	Scale
P.R	As Shown
Drawn By	Date
J.B	October 2024
Approved By	Project No.
B.W	T1220087.000

Figure No. 3

Drawing: T1220087.000 HydroG.dwg Folder: Y:\Shared\CAD\Terraprobe\Brampton\1-Project Files\2022 - Terraprobe Projects\1-22-0087 - Agnes Street, Alton\46-Hydrogeological Engineering\A. Dwgs, Logs\AutoCAD Wednesday, October 23, 2024 @ 11:29 by John Bordin

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Legend

- Site Boundary
- Approximate Creek Pathway
- Borehole Location
- Monitoring Well Location
- Attenuation Area

1:2 000

0 20 40 60 80 100 m

Revision	Date	Issue	Approval
A		Final	

Client: **The Alton Development Inc.**

Site: **Agnes Street, Alton, Ontario**

Report Title: **Hydrogeological Investigation**

Drawing Title: **Sewage Attenuation Areas**

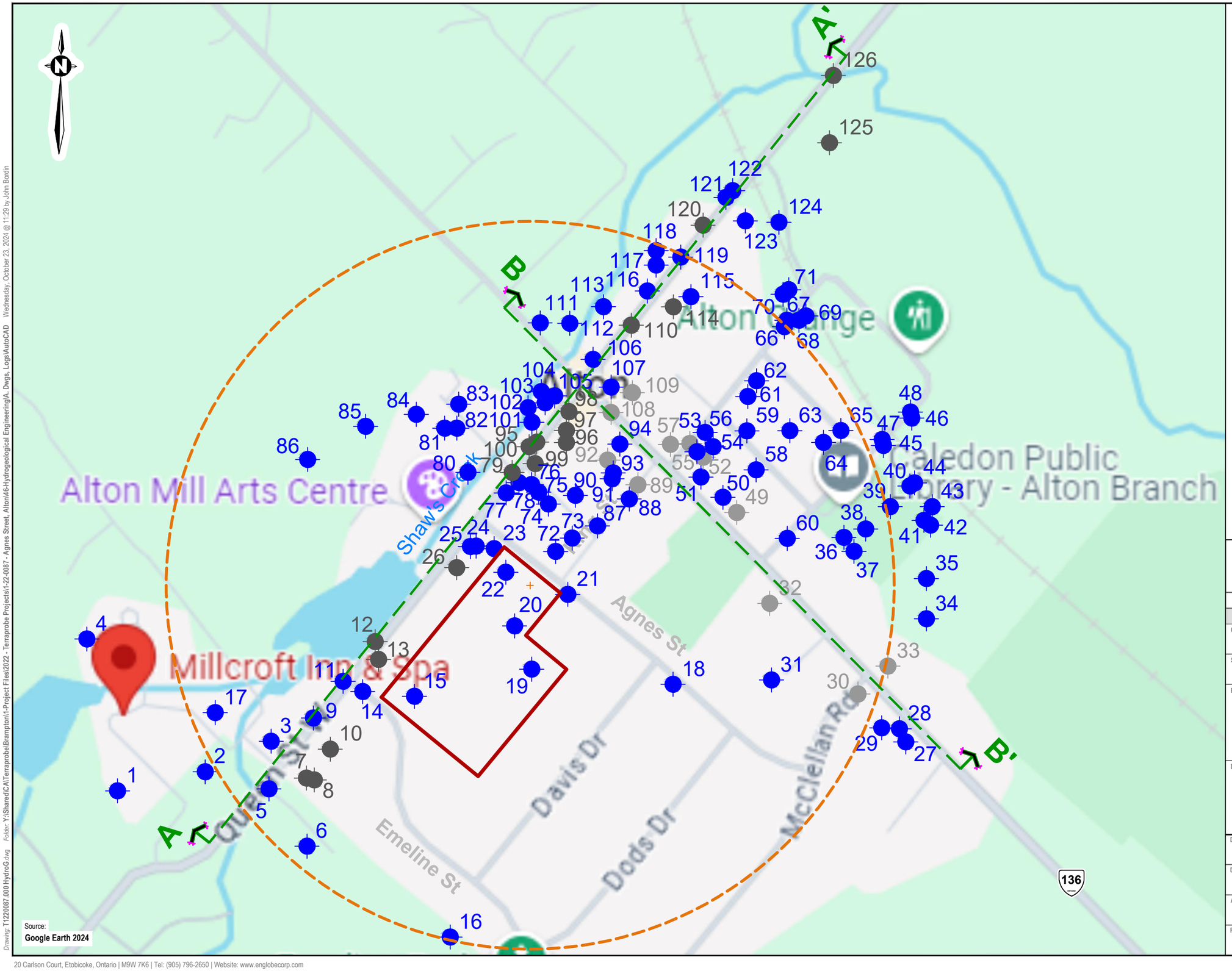
Designed By: P.R	Scale: As Shown
Drawn By: J.B	Date: October 2024
Approved By: B.W	Project No.: T1220087.000

Figure No. **4**

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Note

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Legend

- Site Boundary
- Study Area (500m Radius)
- Well ID Number
- Well ID Used in Section A-A'
- Well ID Used in Section B-B'
- Cross Section Locations

1:5 000

0 50 100 150 200 250 m

Revision	Date	Issue	Approval
A		Final	

Client: The Alton Development Inc.

Site: Agnes Street, Alton, Ontario

Report Title: **Hydrogeological Investigation**

Drawing Title: **MECP Well Record, Cross-Section and Well Survey Location Plan**

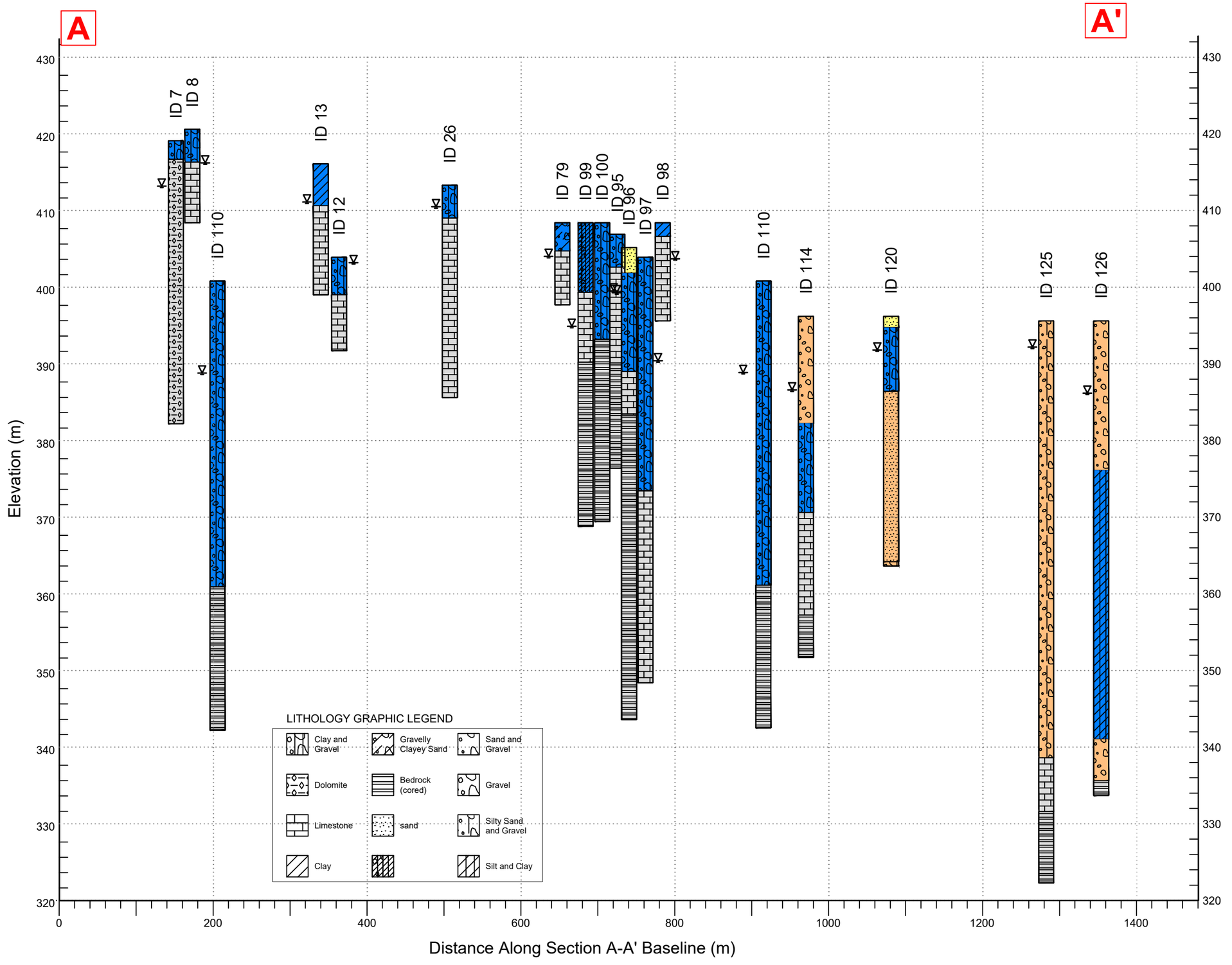
Designed By: P.R	Scale: As Shown
Drawn By: J.B	Date: October 2024
Approved By: B.W	Project No.: T1220087.000

Figure No.: **5**

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Drawing T1220087.000 HydroG.dwg Folder Y:\Shared\CAT\Terraprobe\Brampton\1-Project Files\2022 - Terraprobe Projects\1-22-0087 - Agnes Street, Alton\46-Hydrogeological Engineering\A. Dwgs, Logs\AutoCAD Wednesday, October 23, 2024 @ 11:29 by John Bordin



Note

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Legend

- Gravels
- Cohesive Soils
- Sand
- Bedrock

Revision	Date	Issue	Approval
A		Final	

Client: **The Alton Development Inc.**

Site: **Agnes Street, Alton, Ontario**

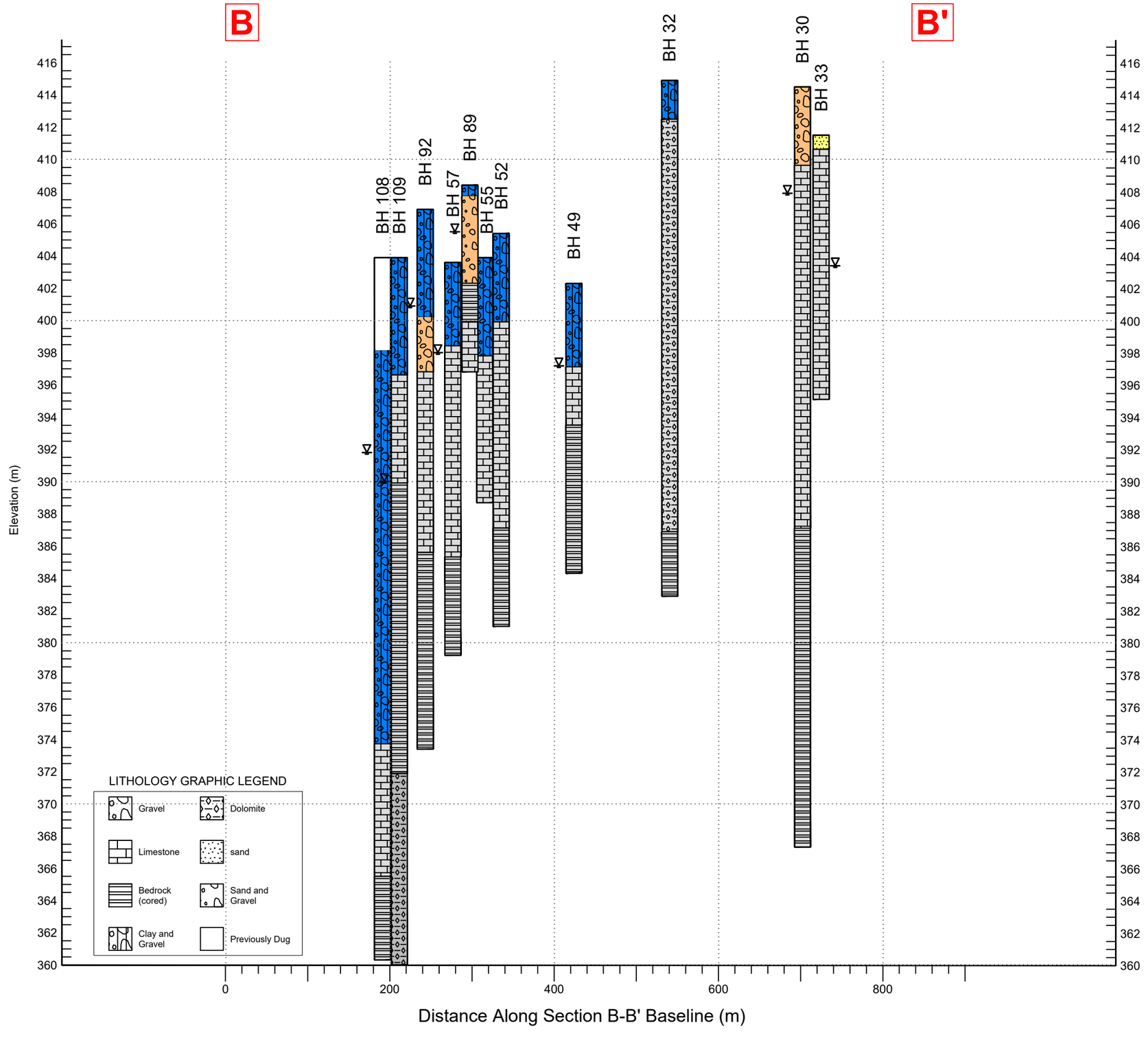
Report Title: **Hydrogeological Investigation**

Drawing Title: **Cross-Section A-A'**

Designed By: **P.R**	Scale: **As Shown**
Drawn By: **J.B**	Date: **October 2024**
Approved By: **B.W**	Project No.: **T1220087.000**
Figure No.: **6**	

Drawing: T1220087.000 HydroG.dwg Folder: Y:\Shared\CA\Terraprobe\Brampton\1-Project Files\2022 - Terraprobe Projects\1-22-0087 - Agnes Street, Alton\4-Hydrogeological Engineering\A. Dwgs, Logs\AutoCAD Wednesday, October 23, 2024 @ 11:29 by John Bordin

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Note

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2. Drawing scale may be distorted. Measurements/locations taken from the drawing must be verified in the field.

Legend

- Gravels
- Cohesive Soils
- Sand
- Bedrock

Revision	Date	Issue	Approval
A		Final	

Client: **The Alton Development Inc.**

Site: **Agnes Street, Alton, Ontario**

Report Title: **Hydrogeological Investigation**

Drawing Title: **Cross-Section B-B'**

Designed By: P.R	Scale: As Shown
Drawn By: J.B	Date: October 2024
Approved By: B.W	Project No.: T1220087.000

Figure No.: **7**

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Drawing: T1220087.000 HydroG.dwg Folder: Y:\Shared\CA\Terraprobe\Brampton\1-Project Files\2022 - Terraprobe Projects\1-22-0087 - Agnes Street, Alton\46-Hydrogeological Engineering\A. Dwgs, Logs\AutoCAD Wednesday, October 23, 2024 @ 11:29 by John Bordin

Appendix A
Site Plans and Septic Design



ENGLOBE

QUEEN STREET W.

EMELINE STREET

1.5m WIDE WALKWAY EXTENDED TO QUEEN ST.

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

OPEN SPACE (279.48 sq.m.)

SNOW STORAGE

OPEN SPACE (140.38 sq.m.)

BLOCK 4 | BLOCK 3 | BLOCK 2 | BLOCK 1

BLOCK 5 | BLOCK 6 | BLOCK 7 | BLOCK 8 | BLOCK 9a | BLOCK 9b | BLOCK 10 | BLOCK 11 | BLOCK 12 | BLOCK 13 | BLOCK 14

COMMON GREEN (1,077.87 sq.m.)

TOT LOT

1.5m SIDEWALK

FIRE ROUTE

TWO WAY

ONE WAY

DECORATIVE HARDSCAPE PAVING STONES

LOW WALL

CMB

TYPE 'B'

5 SP. @ 2.75 = 13.75

5 SP. @ 2.75 = 11.00

PRIVACY SCREEN

AGNES STREET

KING ST.

LOT COVERAGE

BLOCK	COVERAGE
1	35.4%
2	39.2%
3	39.0%
4	29.6%
5	29.3%
6	26.5%
7	22.6%
8	28.4%
9	21.7%
10	35.7%
11	37.7%
12	32.2%
13	37.8%
14	32.8%

LEGEND

- PROPERTY LINE
- 6.0m WIDE FIRE ROUTE
- STOP SIGN
- EXISTING TOPOGRAPHY
- 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	40
# UNITS WITH SINGLE GARAGEGS	25
TOTAL UNITS	65
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	3.266 ha
ROAD, PARKING, SIDEWALKS & CURBS	0.582 ha
COMMON AMENITY & OPEN SPACE (AMENITY AREA, OPEN SPACE AND LANDSCAPED ENTRANCE BOULEVARD)	0.192 ha
TOTAL	4.040 ha
OPEN SPACE & COVERAGE	
YARDS, ABSORPTION BEDS, COMMON GREEN, OPEN SPACE AREAS	2.017 ha (49.9%)
HARD SURFACE AREAS (BUILDINGS, PATIOS, ROADS, WALKWAYS, SIDEWALKS, DRIVEWAYS)	2.028 ha (50.1%)
TOTAL	4.045 ha
PARKING PROVIDED	**TOTAL**
PRIVATE PARKING WITHIN GARAGES	105
PRIVATE PARKING IN DRIVEWAYS	105
COMMON VISITOR PARKING	16
TOTAL	226

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
3	2024.04.02	UPDATE COMMON AMENITY
4	2024.07.24	UPDATE ROADWAY, COMMON AMENITY AREA
5	2024.07.30	UPDATE ROADWAY, COMMON AMENITY AREA
6	2024.08.05	UPDATE ROADWAY, COMMON AMENITY AREA

Sheet Information

CONCEPT PLAN

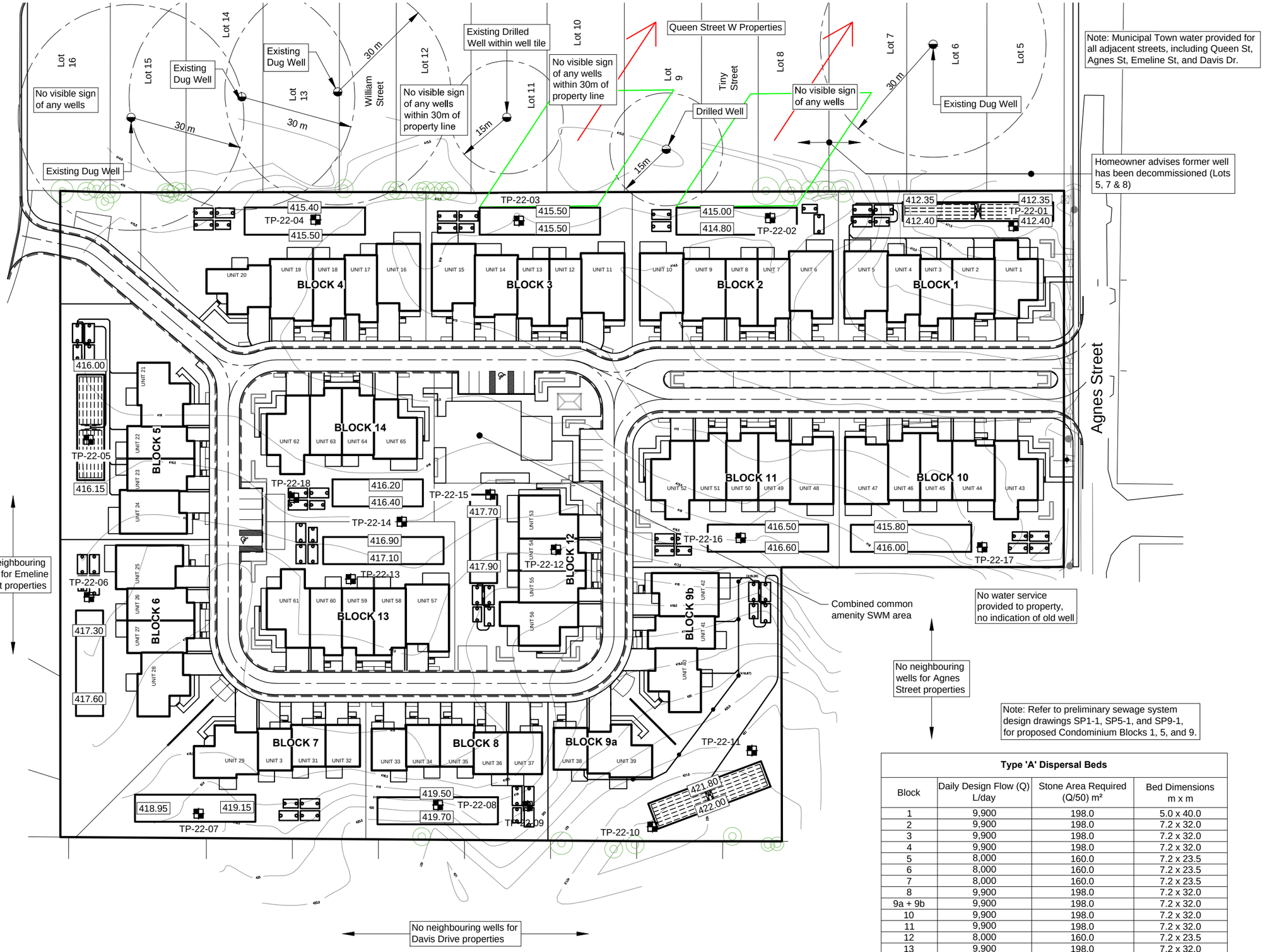
Project No. 14948
Project Start Date: 2023.11.01
File: Agnes Street - Site Plan.dwg
Drawn by: KBR
Scale: 1:400

PRELIMINARY

A1.01

Plot Date | Time - 2024-08-05 11:08:50 AM

P:\1-Projects\Seaton Group\14948 Agnes st\2-Drawings\



Type 'A' Dispersal Beds

Block	Daily Design Flow (Q) L/day	Stone 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 23.5
6	8,000	160.0	7.2 x 23.5
7	8,000	160.0	7.2 x 23.5
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	8,000	160.0	7.2 x 23.5

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

LEGEND

- Existing Known Wells
- Test Pit Locations
- Sub-Surface Groundwater flow direction, per Englobe Hydro-G Reporting
- Effluent Plume Flow Direction

Preliminary

Rev. No.	Date	Description	CAD
Rev. 5	17-Jan-2025	Septic Field Loc. Adjusted Per Peer Reviewer	KB
Rev. 4	26-Aug-2024	Unit count reduced	CS
Rev. 3	28-Nov-2023	Town Comments	JK
Rev. 2	7-Mar-2023	Updated Site Plan	JK
Rev. 1	25-Jul-2022	Updated Well Locations	KD

Agnes Street Townhouse Residential Development Town of Caledon

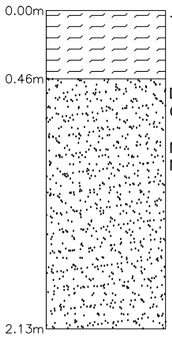
Overall Site Plan: Neighbouring Well Locations Test Pit Locations Sewage System Layouts

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

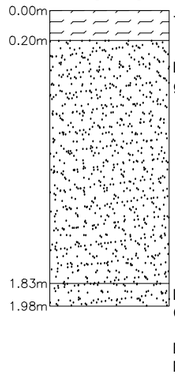
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Plotted On: Mon, 20 Jan 2025 - 10:59am

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

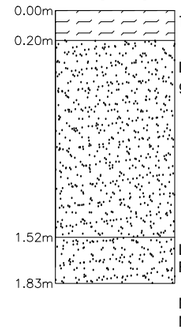
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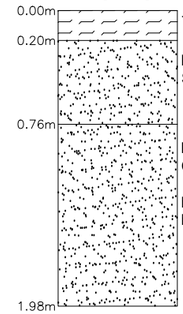
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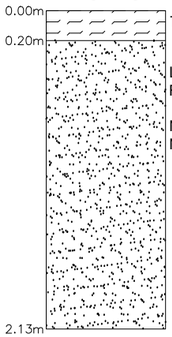
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TP[22-03]



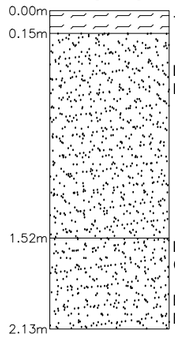
Test Pit
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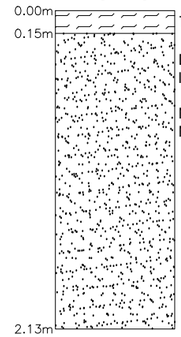
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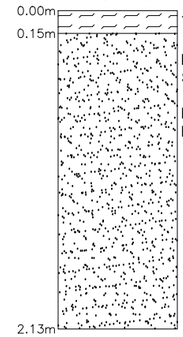
Test Pit
TP[22-06]



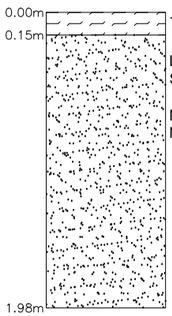
Test Pit
TP[22-07]



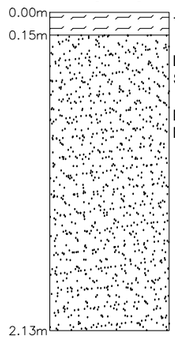
Test Pit
TP[22-08]



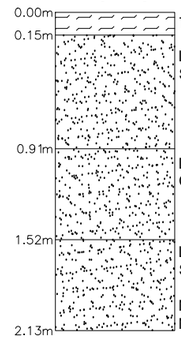
Test Pit
TP[22-09]



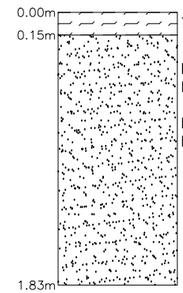
Test Pit
TP[22-10]



Test Pit
TP[22-11]



Test Pit
TP[22-12]



Alton Residential Infill
Agnes Street
Town of Caledon

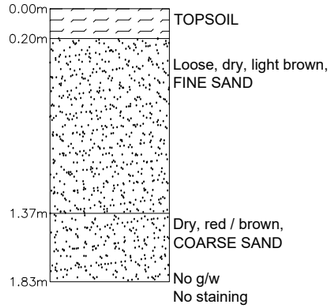
Test Pit Soil Profiles

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

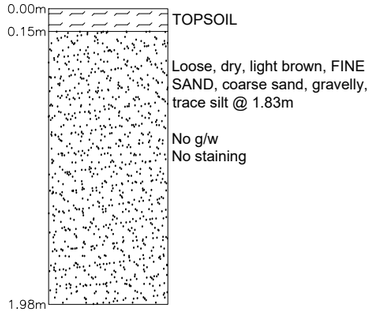
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Plotted On: Tue, 07 Mar 2023 - 10:37am

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

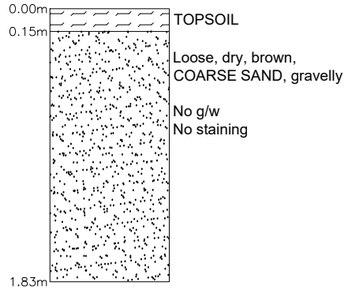
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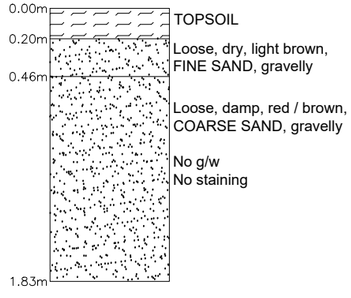
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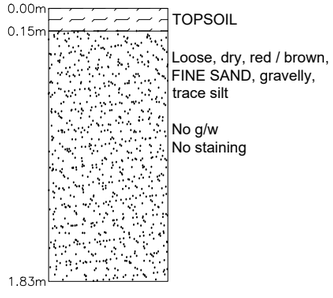
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TP[22-15]



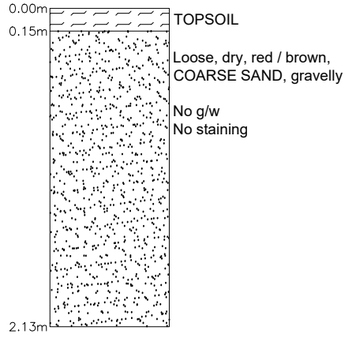
Test Pit
TP[22-16]



Test Pit
TP[22-17]



Test Pit
TP[22-18]



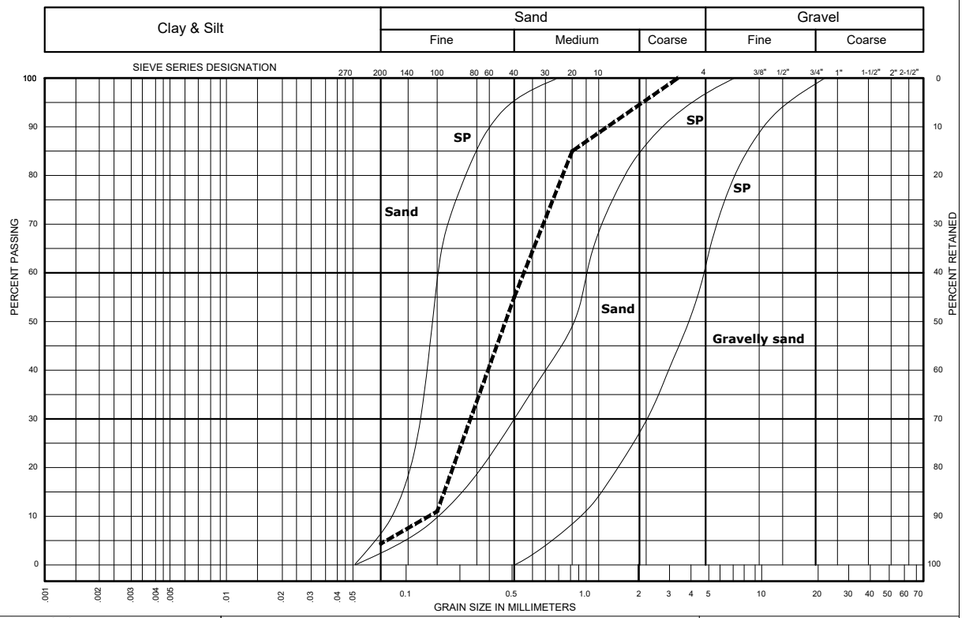
Alton Residential Infill
Agnes Street
Town of Caledon

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

File: \\Gunnell\QNAP\Shared\Gunnell Engineering AutoCAD\D3000 - PROJECTS\D3082 - Alton Residential Infill\CAD\-BB- Updated Site Plan\D3082BB-DT2.dwg
Plotted On: Tue, 07 Mar 2023 - 10:37am

UNIFIED SOIL CLASSIFICATION SYSTEM



Prepared for Gunnell Engineering Ltd.

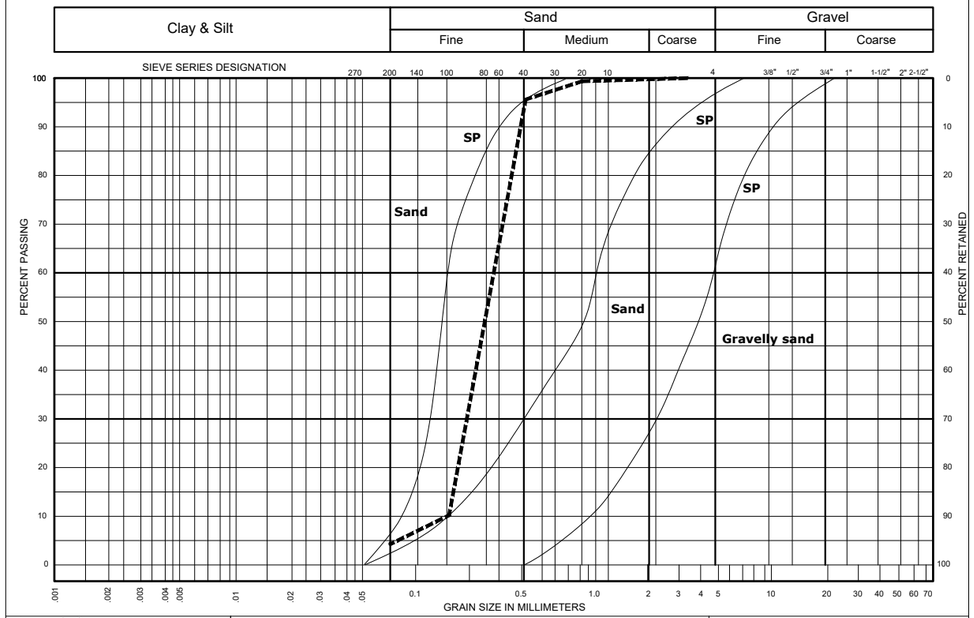
Project: D3082
Sample: TP22-1
Depth: 2.13m
Date Sampled: Aug 11, 2022

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.

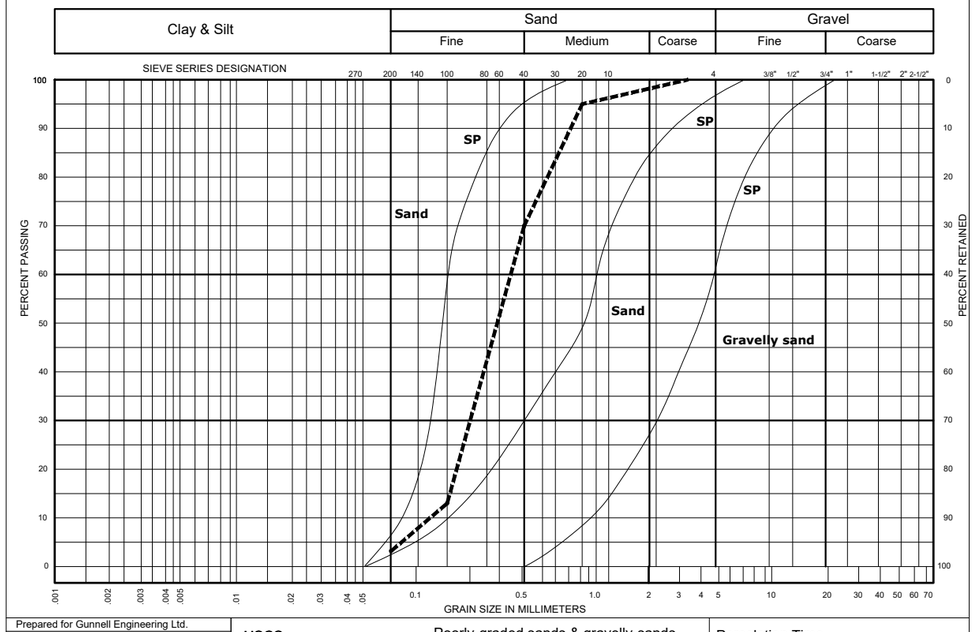
Project: D3082
Sample: TP22-7
Depth: 2.13m
Date Sampled: Aug 11, 2022

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.

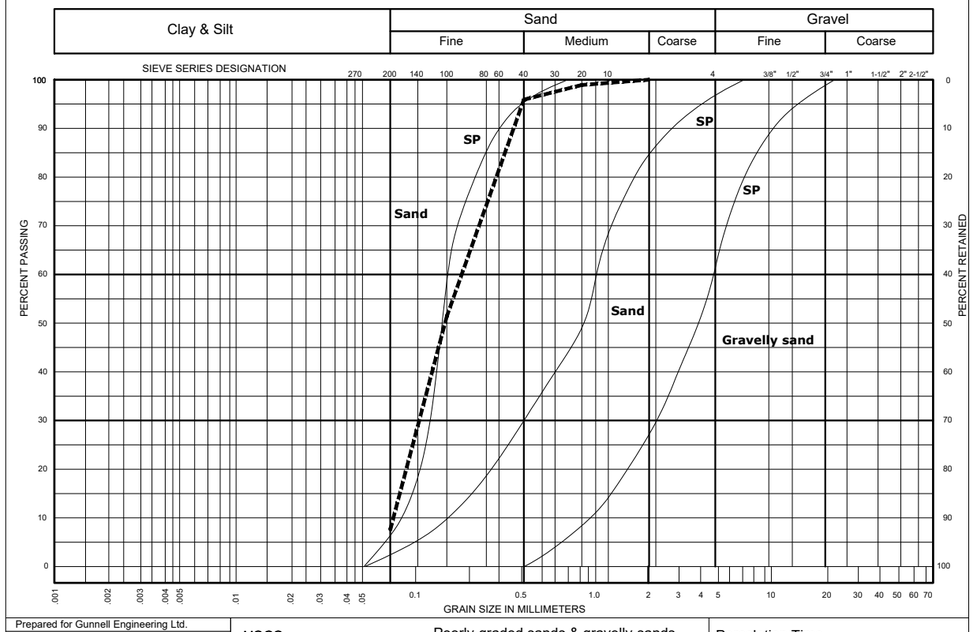
Project: D3082
Sample: TP22-13
Depth: 1.83m
Date Sampled: Aug 11, 2022

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

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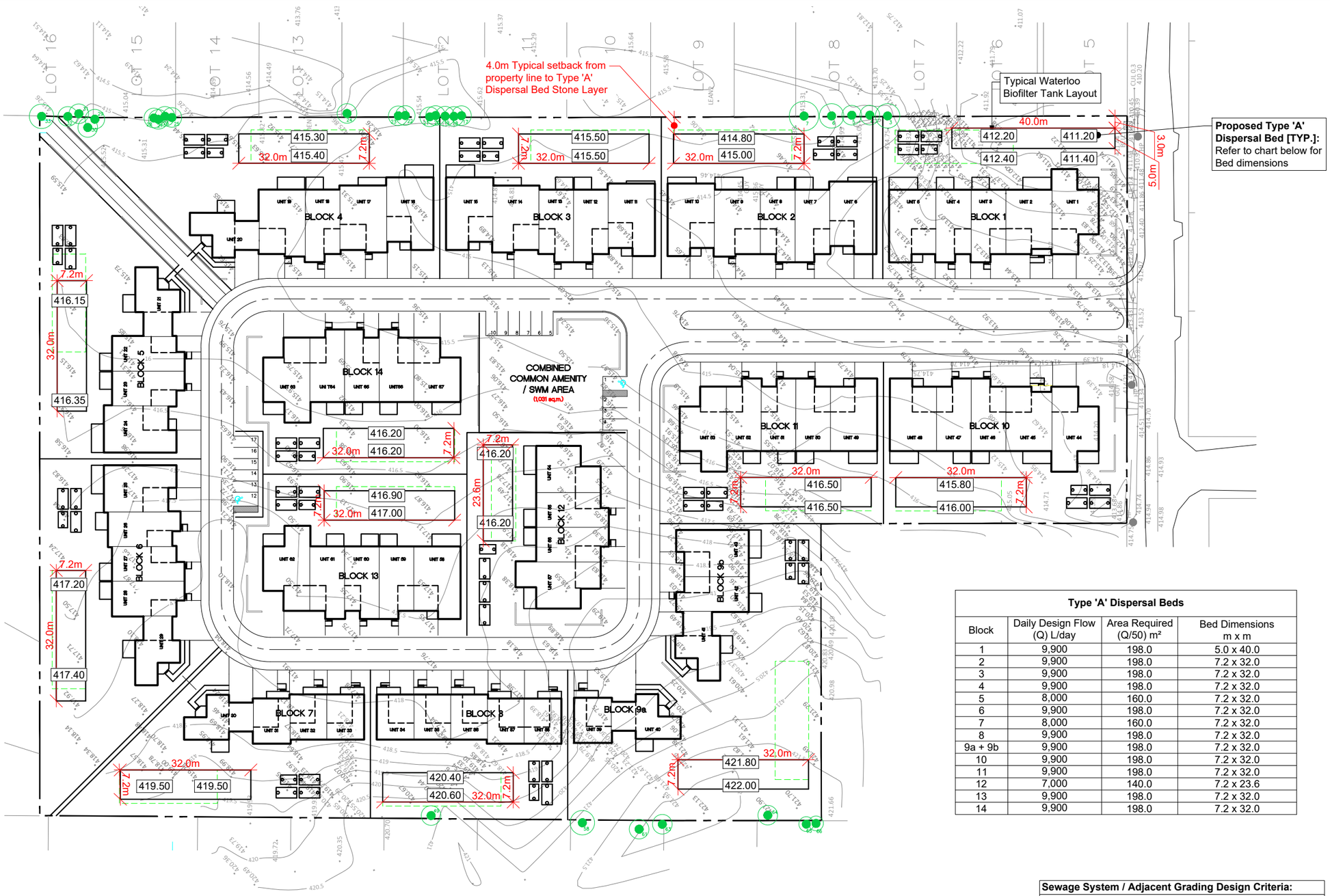


Alton Residential Infill
Agnes Street
Town of Caledon

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

File: \\Gunnell\QNAP\Shared\Gunnell Engineering AutoCAD\D3000 - PROJECTS\D3082 - Alton Residential Infill\CAD\-BB- Updated Site Plan\D3082BB-DT3.dwg
Plotted On: Tue, 07 Mar 2023 - 10:37am



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.

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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

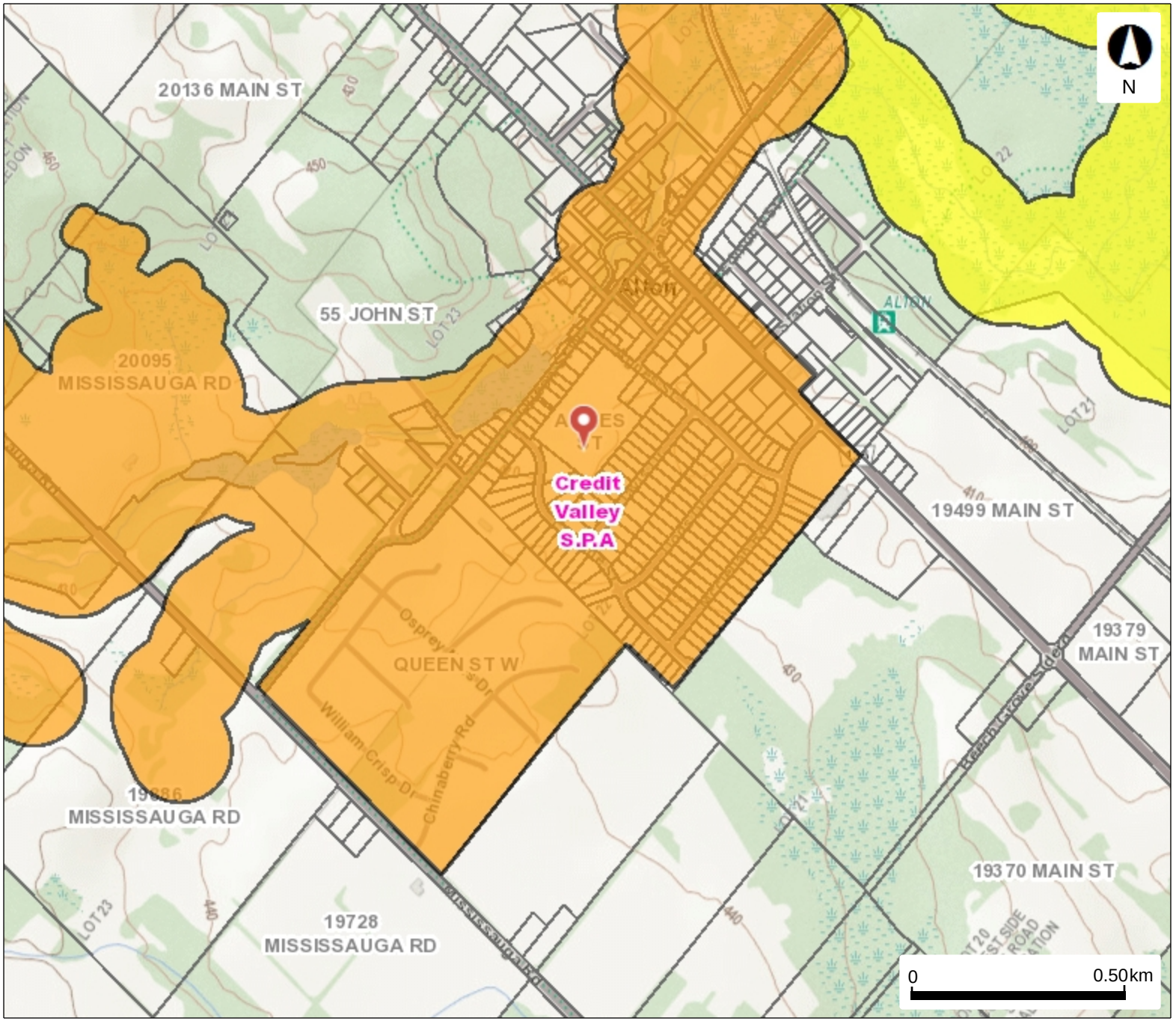
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Plotted On: Fri, 16 Dec 2022 - 7:55am

Appendix B
Well Head Protection Mapping



ENGLOBE

-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

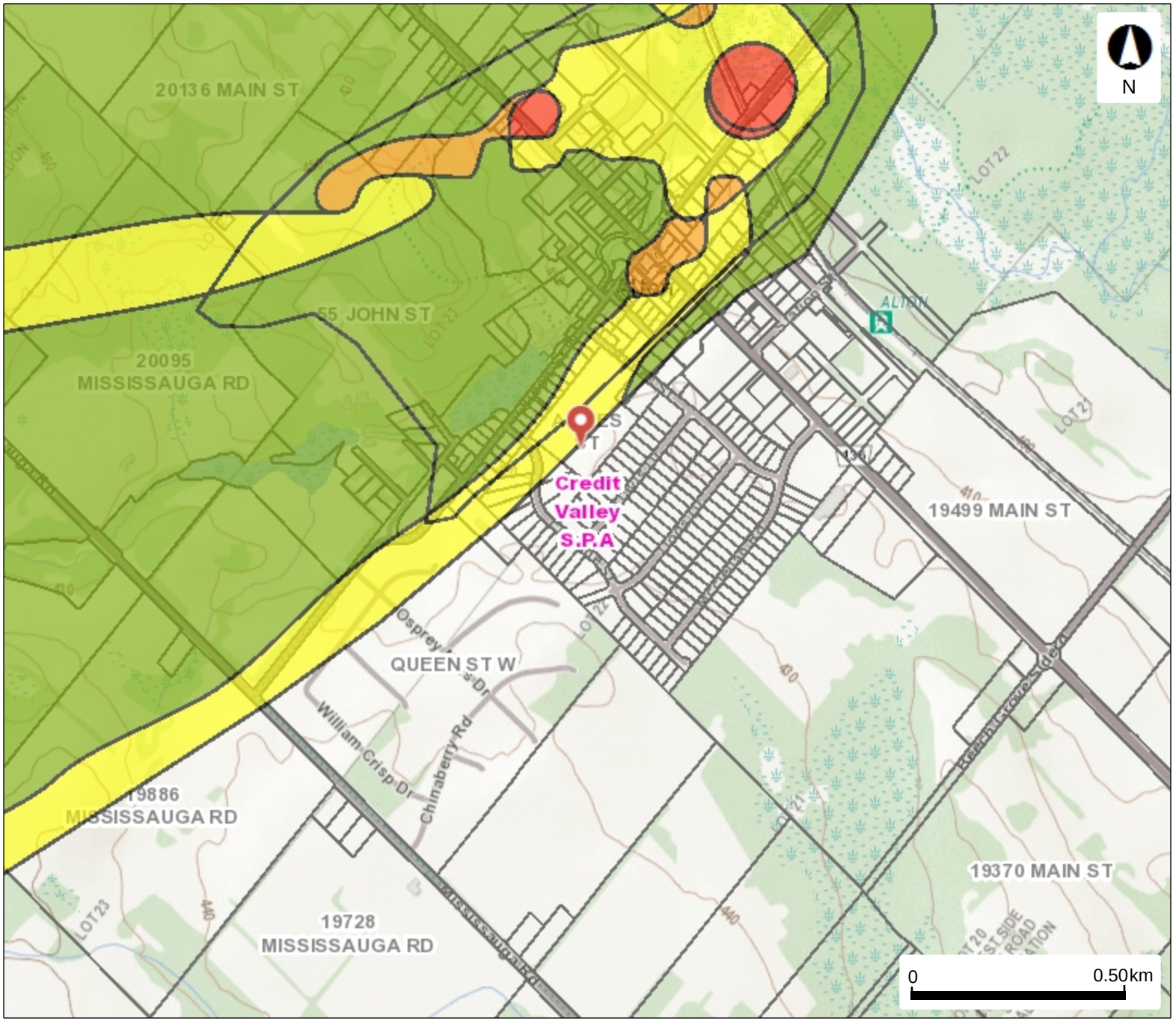
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Ontario

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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

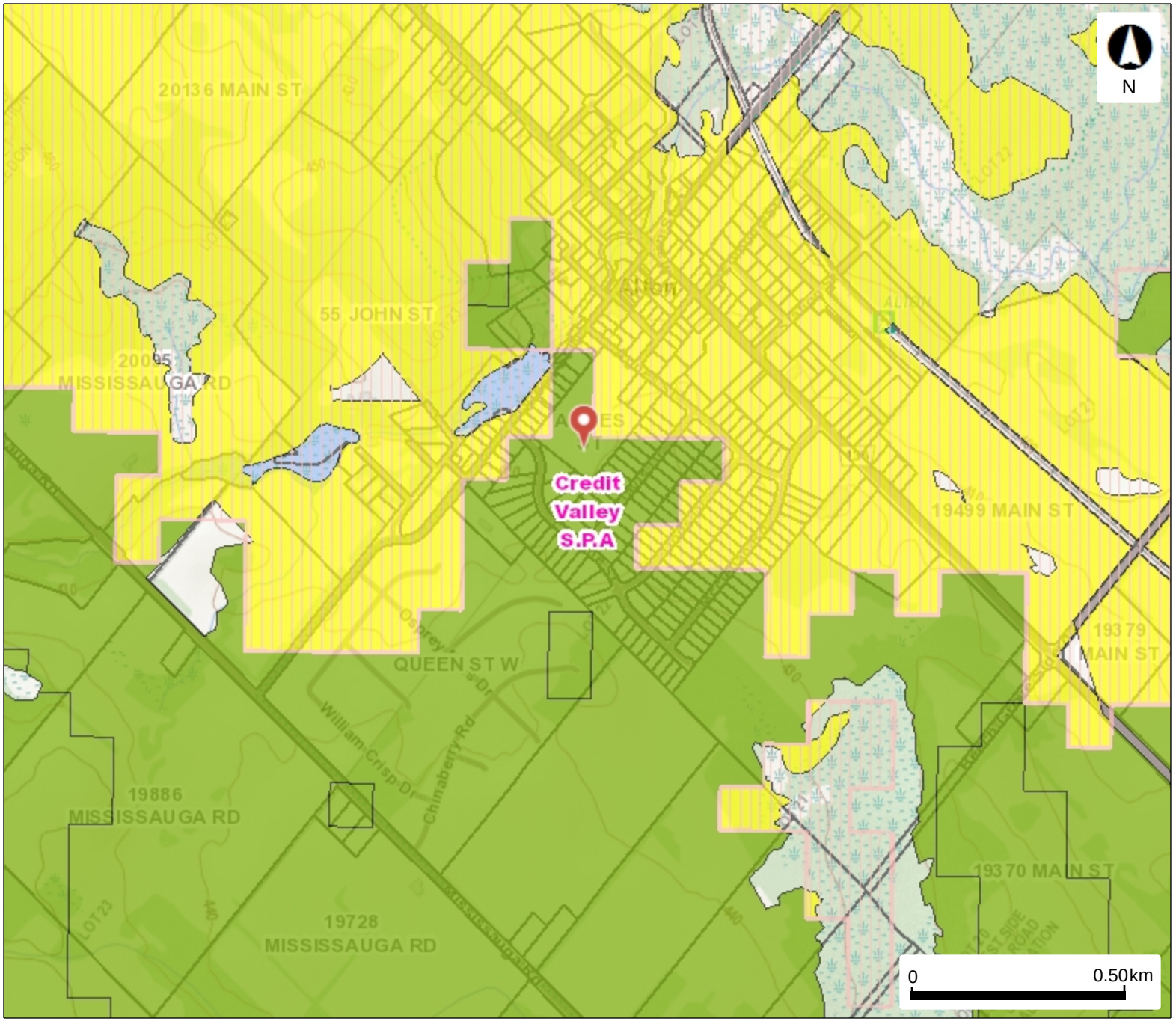
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Map Center: 43.85488 N, -80.07045 W

-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

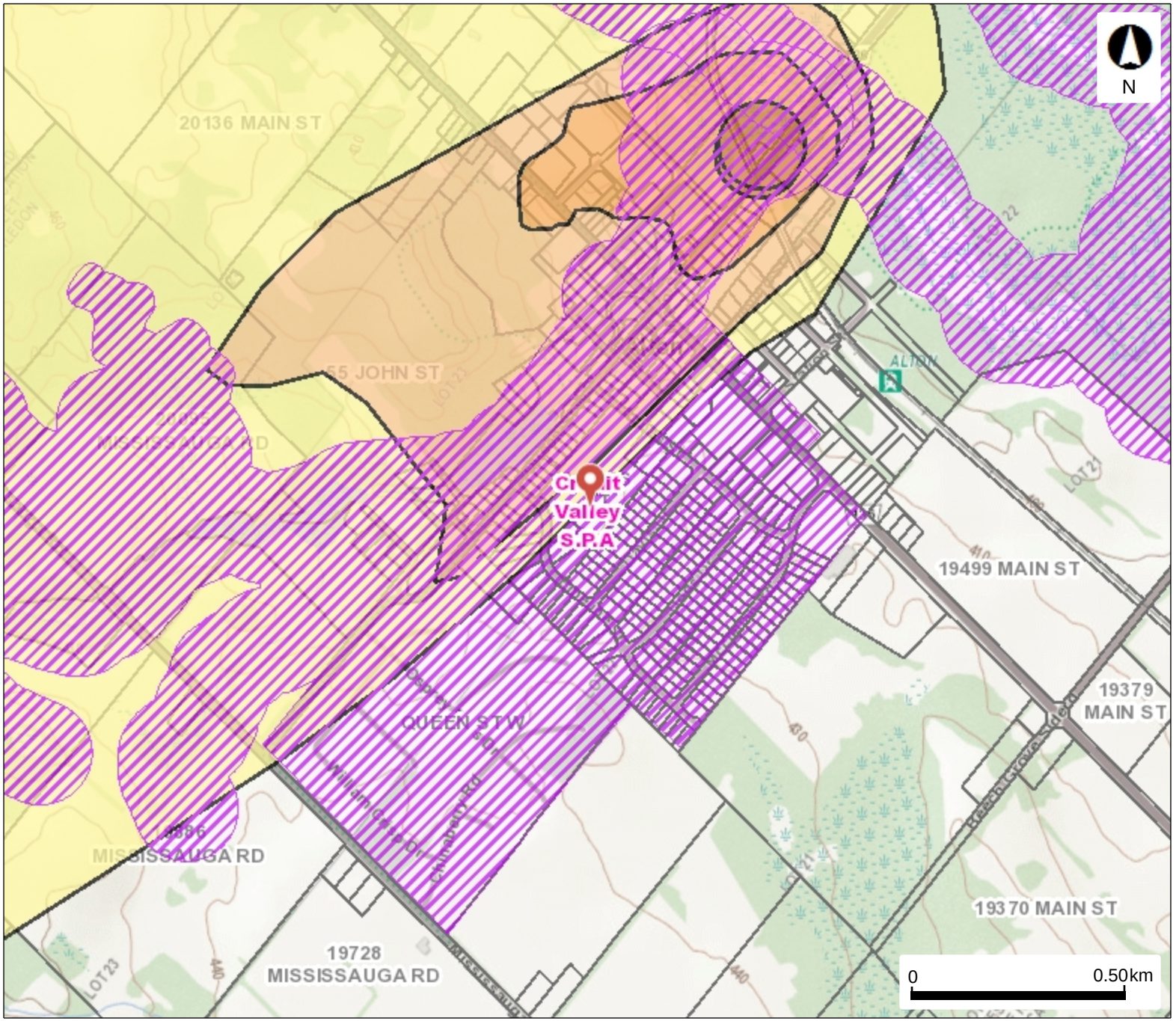
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Map Created: 6/3/2020
Map Center: 43.85488 N, -80.07053 W

-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

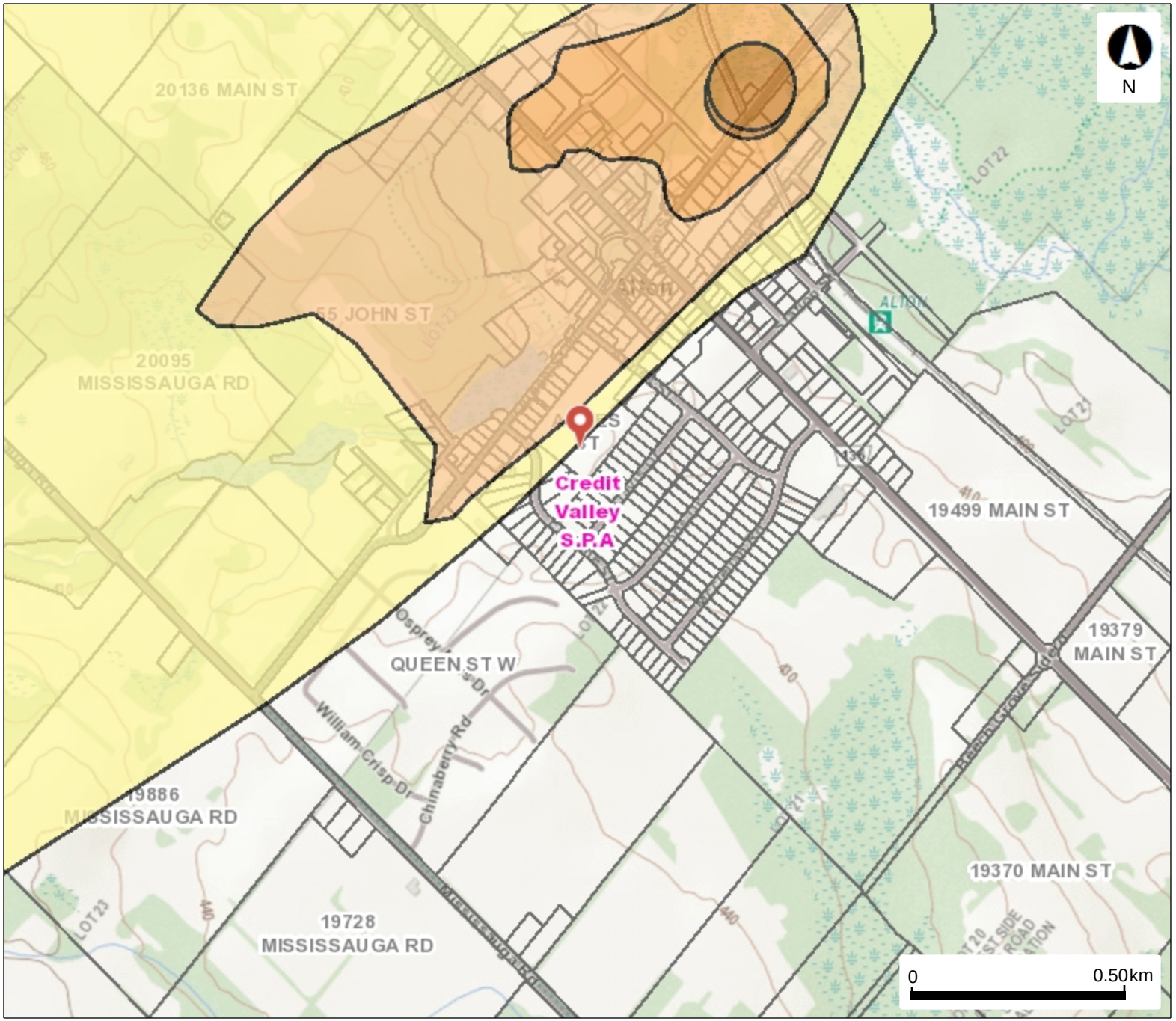
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Map Center: 43.8561 N, -80.07072 W

-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

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Appendix C
Borehole Logas and Grain Size Analysis



ENGLOBE

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.

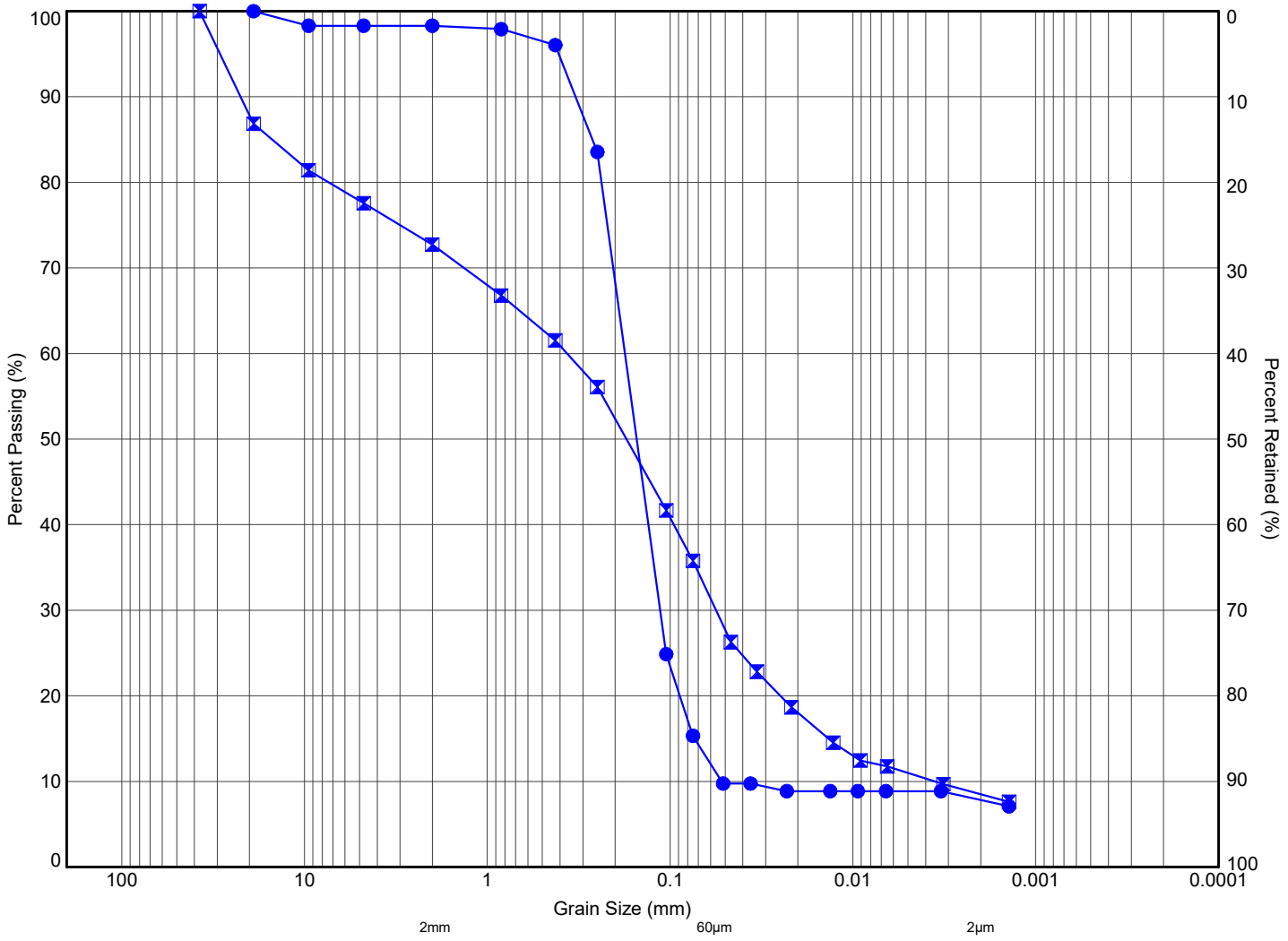
Unstabilized water level measured at 3.2 m below ground surface; borehole was open upon completion of drilling.

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**

Appendix D
Sumary of MECP Well Records



ENGLOBE

Appendix D: MECP Well Record Summary
Agnes Street Residential Development
Alton, ON

Map ID	Well ID	Eastings (m E)	Northings (m N)	Elevation (masl)	Year Constructed	Water Level (m)	Pump Rate (L/min)	Well Use	Stratigraphy (Depth in meters)
1	4904100	574 221	4 856 205	419.1	1973	2.4	18.7	Domestic	Clay/Rocks (6.1) Dolomite (White) (25.0) Dolomite (Grey) (40.5)
2	7284260	574 326	4 856 236	422.8	2017	-	-	Decommission	
3	7399536	574 414	4 856 283	419.7	2021	-	-	Decommission	
4(a)	4905099	574 185	4 856 417	417.6	1977	5.2	15.1	Commercial	Clay/Rocks (2.4) Rock (Brown) (33.5) Rock (Grey) (36.6) Shale (53.3) Rock (Brown) (64.3)
4(b)	4905134	574 185	4 856 417	417.6	1977	4.9	18.7	Domestic	Clay (3.0) Rock (Brown)(30.5) Rock (Grey) (37.5) Shale (56.7) Rock (Brown) (67.1) Shale (68.3)
5	4904964	574 416	4 856 223	419.1	1976	8.1	75.6	Test Hole	No Stratigraphy (48.8)
6	7345208	574 471	4 856 147	425.5	2019	-	-	Decommission	
7	4904075	574 464	4 856 244	419.1	1973	6.1	22.7	Domestic	Clay/Stones (2.4) Dolomite (36.9)
8	4900963	574 472	4 856 235	420.6	1957	4.6	26.5	Domestic	Clay/Stones (4.3) Limestone (12.2)
9	4908954	574 482	4 856 311	417.3	2002	-	-	Decommission	
10	7272520	574 496	4 856 282	419.1	2016	-	-	Decommission	
11	4908785	574 514	4 856 374	416.4	2001	-	-	Decommission	
12	4900964	574 557	4 856 429	403.9	1959	0.9	45.4	Domestic	Clay /Stones (4.9) Limestone (12.2)
13	4900960	574 560	4 856 407	416.1	1957	5.2	5.7	Domestic	Clay (5.5) Limestone (17.1)
14	4904962	574 565	4 856 372	414.5	1976	2.7	27.4	Test Hole	No Stratigraphy (76.2)
15	7330876	574 611	4 856 351	415.7	2019	-	-	Monitoring	Sand/Gravel (6.1) (BH-2)
16	4904963	574 693	4 856 031	431.3	1976	9.0	16.1	Test Hole	No Stratigraphy (106.7)
17	4909346	574 786	4 856 850	423.3	2003	-	-	Monitoring	Sand/Gravel (3.2) Limestone (6.4)
18	4904965	574 357	4 856 384	416.1	1976	5.6	49.1	Test Hole	No Stratigraphy (21.0)
19	7330875	574 774	4 856 388	420.3	2019	-	-	Monitoring	Sand (2.1) Sand/Gravel (6.1) (BH-5)
20	4900957	574 763	4 856 341	417.6	1954	7.6	11.3	Domestic	Gravel (3.4) Limestone (12.8)
21	7251290	574 828	4 856 501	415.1	2015	-	-	Decommission	
22	7330874	574 736	4 856 520	411.8	2019	-	-	Monitoring	Sand/Gravel (4.6) Limestone (4.6) (BH-8)
23	4900967	574 728	4 856 534	413.0	1960	4.3	18.7	Domestic	Clay/Sand/Stones (8.4) Limestone (18.9) Shale (23.8)
24	4900968	574 718	4 856 560	419.1	1962	2.4	45.4	Domestic	Clay/Stones (6.4) Limestone (12.8)
25	7211283	574 740	4 856 563	412.4	2013	-	-	Decommission	
26	4904746	574 698	4 856 533	413.3	1975	3.0	37.8	Domestic	Gravel/Clay/Stones (4.3) Limestone (27.7) Shale (27.7)
27	4906221	575 291	4 856 301	417.6	1984	-	18.7	Domestic	Clay/Boulders to Limestone (19.8)
28	7284263	575 283	4 856 323	417.0	2017	-	-	Decommission	
29	7154442	575 264	4 856 324	417.2	2010	-	-	Monitoring	Sand/Gravel (7.3)
30	4905149	575 214	4 856 367	414.5	1977	6.7	170.1	Test Hole	Stones/Gravel (4.9) Limestone (27.4) Shale (47.2)
31	4908782	575 102	4 856 380	417.6	2001	-	-	Decommission	
32	4906150	575 101	4 856 489	414.9	1977	3.7	45.4	Domestic	Clay/Stones (2.4) Dolomite (28.0) Shale (32.0)
33	4905363	575 262	4 856 400	411.5	1969	8.2	30.2	Domestic	Sand (0.9) Limestone (16.4)
34	4905036	575 319	4 856 470	404.8	1977	-	189	Test Hole	Sand/Gravel (9.7) Sand (20.7) Gravel 21.9) Limestone (21.9)
35	4905039	575 316	4 856 521	406.6	1976	-	37.8	Test Hole	Sand/Gravel (10.7) Sand (19.2) Gravel (21.3) Sand/Gravel (26.2) Shale (27.4)
36	7145561	575 208	4 856 583	405.3	2010	-	-	Decommission	

Appendix D: MECP Well Record Summary
Agnes Street Residential Development
Alton, ON

Map ID	Well ID	Eastings (m E)	Northings (m N)	Elevation (masl)	Year Constructed	Water Level (m)	Pump Rate (L/min)	Well Use	Stratigraphy (Depth in meters)
37	4905172	575 213	4 856 572	402.3	1977	4.3	756	Municipal	Sand/Gravel (15.8) Sand Silt (21.0) Sand/Gravel (22.3) Clay Sand (22.3)
38	7284264	575 234	4 856 594	403.9	2017	-	-	Decommission	
39	7154740	575 232	4 856 589	403.9	2010	-	-	Monitoring	Sand/Gravel (9.8) Sand (10.7)
40	4905196	575 265	4 856 623	400.8	1977	-	-	Test Hole	Sand/Gravel (15.2) Sand/Silt (22.9)
41	7292501	575 321	4 856 596	404.2	2017	-	-	Decommission	
42	4908953	575 324	4 856 617	403.9	2002	-	-	Decommission	
43	7292500	575 319	4 856 604	403.6	2017	-	-	Decommission	
44	4905245	575 314	4 856 621	400.8	1977	11.3	756	Municipal	Sand/Gravel (12.8) Hardpan/Boulders (18.6) Gravel (22.3) Gravel/Clay (27.7)
45	7249497	575 296	4 856 648	403.3	2015	-	-	Decommission	
46	7249496	575 293	4 856 654	403.6	2015	-	-	Decommission	
47	7161629	575 253	4 856 702	401.4	2009	-	-	Decommission	
48	7036352	575 286	4 856 745	401.4	2006	-	-	Monitoring	Silt/Sand (6.1)
49	4900892	575 051	4 856 611	402.3	1991	5.2	15.1	Domestic	Clay/Stones (5.2) Limestone (8.8) Shale (18.0)
50	4907582	575 038	4 856 631	409.0	1957	-	-	Decommission	
51	7168997	575 001	4 856 654	409.3	2011	-	-	Decommission	
52	4900897	574 994	4 856 661	405.4	1960	6.1	22.7	Domestic	Clay/Stones (5.5) Limestone (18.3) Shale (24.4)
53	4908021	575 004	4 856 684	407.8	1996	-	-	Decommission	Sand/Stones (6.1) Limestone (24.4)
54	4908080	575 014	4 856 699	406.6	1996	-	-	Decommission	Sand/Stones (7.6) Limestone (7.6)
55	4908090	574 994	4 856 707	403.9	1956	5.5	30.2	Domestic	Clay/Stones (6.1) Limestone (15.2)
56	7285258	575 009	4 856 725	403.3	2017	-	-	Monitoring	Clay/Stones (9.1)
57	4900887	574 960	4 856 701	403.9	1962	5.2	37.8	Domestic	Clay/Stones (5.2) Limestone (18.3) Shale (24.4)
58	4900891	575 075	4 856 673	405.4	1957	10.1	18.7	Domestic	Clay/Stones (4.0) Limestone (11.0) Shale (19.2)
59	4905587	575 072	4 856 727	403.9	1979	10.7	18.7	Domestic	Sand/Gravel (12.2) Clay/Stones (18.0) Limestone (31.4)
60	4907581	575 119	4 856 577	408.1	1991	-	-	Decommission	
61	4903409	575 065	4 856 772	399.3	1969	7.3	11.3	Domestic	Sand/Gravel (4.9) Clay/Sand (25.9) Limestone (38.4) Shale (42.7)
62	4903607	575 078	4 856 792	399.3	1971	7.6	37.8	Domestic	Clay/Gravel (26.2) Shale (29.6)
63	4900895	575 121	4 856 722	408.8	1960	12.2	22.7	Domestic	Sand/Gravel (15.8) Shale (29.9)
64	7225218	575 170	4 856 709	402.6	2014	-	-	Decommission	
65	4903895	575 189	4 856 722	396.2	1972	9.1	34.0	Domestic	Gravel (19.2)
66	7284259	575 116	4 856 873	397.2	2017	-	-	Decommission	
67	7154742	575 118	4 856 880	397.2	2010	-	-	Monitoring	Fill (3.7) Sand/Gravel (7.0) Sand (9.1)
68	4904101	575 134	4 856 872	396.2	1973	7.6	37.8	Domestic	Sand/Gravel/Clay (13.1) Gravel (14.6)
69	7100174	575 143	4 856 894	398.4	2007	-	-	Decommission	
70	4900886	575 115	4 856 913	396.2	1962	4.6	29.8	Domestic	Clay/Stones (7.9) Shale (27.4)
71	4904949	575 108	4 856 926	396.2	1976	7.6	37.8	Domestic	Clay (25.6) Shale (26.8)
72	7338283	574 842	4 856 557	414.2	2019	-	-	Decommission	
73	4900956	574 838	4 856 560	410.0	1959	5.5	18.7	Domestic	Previously Dug (2.7) Sand/Clay (5.2) Limestone (8.5)

Appendix D: MECP Well Record Summary
Agnes Street Residential Development
Alton, ON

Map ID	Well ID	Eastings (m E)	Northings (m N)	Elevation (masl)	Year Constructed	Water Level (m)	Pump Rate (L/min)	Well Use	Stratigraphy (Depth in meters)
74	4900961	574 826	4 856 571	411.5	1957	6.0	15.1	Domestic	Clay/Stones (7.3) Limestone (10.1)
75	4900969	574 826	4 856 571	411.5	1962	4.3	37.8	Domestic	Clay/Stones (7.6) Limestone (17.9)
76	7212119	574 782	4 856 633	408.4	2013	-	-	Monitoring	Sand/Silt/Stones (3.6) Sand/Silt (4.8) Limestone (9.5)
77	7179906	574 751	4 856 642	408.7	2012	-	-	Monitoring	Fill (1.5) Sand/Slay (4.6)
78	7243504	574 736	4 856 634	408.7	2015	-	-	Decommission	
79	4900962	574 739	4 856 657	408.4	1957	4.6	56.7	Domestic	Sand/Clay/Stones (3.7) Limestone (10.7)
80	4900958	574 673	4 856 659	405.4	1956	12.2	22.7	Domestic	Clay Stones (3.0) Limestone (33.5) Shale (86.3)
81	4900965	574 651	4 856 715	396.2	1959	4.6	37.8	Domestic	Clay/Boulders (7.6) Clay/Gravel (9.1) Sand/Clay (10.7)
82	4904885	574 667	4 856 717	403.9	1975	12.5	15.1	Domestic	Sand/Gravel (12.8) Limestone (19.5) Shale (100.6)
83	7132231	574 670	4 856 752	406.0	2009	-	-	Decommission	
84	4900970	574 607	5 856 736	403.9	1962	3.7	18.7	Domestic	Clay (7.6) Sand/Stones (18.3) Gravel (21.3) Limestone (33.5)
85	4900971	574 540	4 856 723	413.0	1963	8.2	22.7	Domestic	Clay/Stones (9.7) Limestone (18.9)
86	4905443	574 460	4 856 666	426.7	1978	8.2	15.1	Domestic	Clay/Gravel (20.7) Limestone (30.2)
87	4900955	574 863	4 856 591	410.0	1953	4.9	37.8	Domestic	Clay/Stones (9.1) Limestone (4.3)
88	4908784	574 905	4 856 625	408.4	2007	-	-	Decommission	
89	4900966	574 920	4 856 646	408.4	1959	3.0	30.2	Domestic	Clay/Stones (3.7) Sand/Stones (6.1) Shale (8.5) Limestone (11.6)
90	4900959	574 837	4 856 629	406.9	1957	4.9	15.1	Domestic	Previously Dug (1.5) Clay/Stones (3.7) Limestone (10.1)
91	4908781	574 884	4 856 658	409.0	2007	-	-	Decommission	
92	4900972	574 881	4 856 675	406.9	1967	6.1	11.3	Domestic	Clay/Stones (6.7) Gravel (10.1) Limestone (21.3) Shale (33.5)
93	4904343	574 897	4 856 694	405.9	1975	12.2	22.7	Domestic	Clay/Stones (19.2) Limestone (29.6) Shale (59.4)
94	7244360	574 888	4 856 703	407.5	2015	-	-	Decommission	
95	4903139	574 819	4 856 704	406.9	1968	3.0	22.7	Domestic	Clay/Stones (4.3) Limestone (16.8) Shale (30.5)
96	4905647	574 821	4 856 725	403.9	1979	6.1	22.7	Commercial	Sand (3.4) Clay/Stones (16.2) Limestone (21.9) Shale (61.6)
97	4905074	574 821	4 856 725	403.9	1976	13.7	15.1	Domestic	Clay/Stones (30.5) Limestone/Shale (55.5)
98	4900954	574 812	4 856 745	408.4	1952	4.9	45.4	Domestic	Clay (1.8) Limestone (12.8)
99	4900952	574 765	4 856 669	408.4	1950	13.7	113.4	Domestic	Till (9.1) Limestone (18.2) Shale (39.6)
100	4900953	574 774	4 856 678	408.4	1951	9.1	15.1	Domestic	Clay/Stones (15.2) Shale (39.0)
101	7297622	574 771	4 856 712	407.8	2017	-	-	Decommission	
102	4905472	574 763	4 856 722	414.5	1979	11.6	30.2	Domestic	Clay/Boulders (28.0) Shale (41.1)
103	7297623	574 776	4 856 732	408.7	2017	-	-	Decommission	
104	7297625	574 765	4 856 748	408.4	2017	-	-	Decommission	
105	7297624	574 788	4 856 757	407.8	2017	-	-	Decommission	
106	7333518	574 853	4 856 816	404.2	2019	-	-	Decommission	
107	4905648	574 878	4 856 776	405.7	1979	-	-	Decommission	
108	4900896	574 896	4 856 763	403.9	1960	12.2	18.7	Domestic	Previously Dug (5.8) Clay/Stones (30.2) Limestone (38.4) Shale (43.6)
109	4904838	574 914	4 856 769	403.9	1975	14.0	11.3	Domestic	Clay/Stones (7.3) Limestone (14.0) Shale (32.0) Dolomite (43.9)
110	4904699	574 906	4 856 860	400.8	1974	12.2	37.8	Domestic	Clay/Stones (39.9) Shale (68.6)

Appendix D: MECP Well Record Summary
Agnes Street Residential Development
Alton, ON

Map ID	Well ID	Eastings (m E)	Northings (m N)	Elevation (masl)	Year Constructed	Water Level (m)	Pump Rate (L/min)	Well Use	Stratigraphy (Depth in meters)
111	7421516	574 777	4 856 865	403.3	2022	-	-	Decommission	
112	7421515	574 822	4 856 865	400.8	2022	-	-	Decommission	
113	4900900	574 865	4 856 889	400.8	1967	14.0	15.1	Public Supply	Sand (12.2) Clay/Stones (45.7) Shale (76.2)
114	4900893	574 986	4 856 903	396.2	1959	9.8	5.7	Domestic	Sand/Stones (14.0) Clay/Stones (25.6) Limestone (39.0) Shale (44.5)
115	7306604	574 971	4 856 953	401.1	2018	-	-	Monitoring	Sand (9.1)
116	7154741	574 945	4 856 919	400.8	2010	-	-	Monitoring	Sand (10.7)
117	7210874	574 940	4 856 949	400.2	2013	-	-	Monitoring	Sand (8.2)
118	7210872	574 928	4 856 956	399.9	2013	-	-	Monitoring	Sand/Silt (6.6)
119	7210873	574 938	4 856 967	399.6	2013	-	-	Monitoring	Sand (8.2)
120	4900894	574 994	4 856 997	396.2	1959	4.6	37.8	Domestic	Sand (1.5) Clay/Gravel (9.8) Sand (32.0) Gravel (32.6)
121	7324218	575 030	4 857 040	394.4	2018	-	-	Decommission	
122	4909684	575 030	4 857 040	394.4	2005	-	-	Monitoring	Sand (7.3)
123	4908787	575 060	4 857 007	397.5	2001	-	-	Decommission	
124	7408610	575 106	4 857 007	396.6	2021	-	-	Monitoring	Sand (8.5)
125	7302853	575 051	4 857 131	395.6	2018	3.6	530	Municipal	Sand/Silt/Gravel (57.0) Limestone/Shale (64.0) Shale (73.2)
126	7310661	575 119	4 857 208	395.6	2018	9.6	348	Municipal	Sand/Gravel (19.5) Silt/Clay (54.6) Sand/Stones (60.0) Shale (61.9)

Appendix E
Results of In-Situ Hydraulic Conductivity Testing



ENGLOBE

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

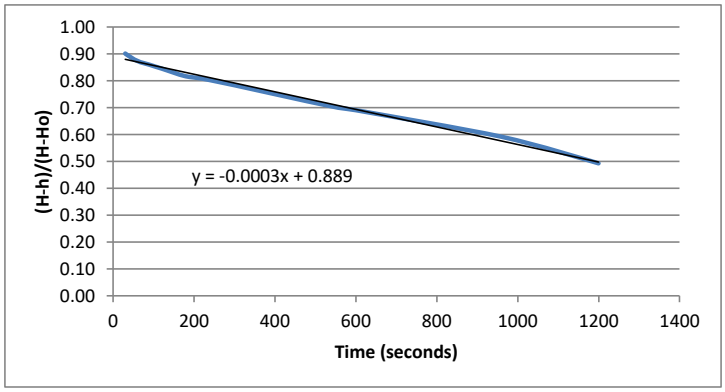
Test Completed on	25-Apr-19	
well depth	3.06	m
r (casing radius)	0.025	m
L (length of screen)	1.5	m
R (filter pack [borehole] radius)	0.03	m
To (time lag*)	1730	sec
H (initial water level before slug)	1.29	m
Ho (water level at t=0)	2.00	m
h (recorded water level at time t)	See Column F	

* 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

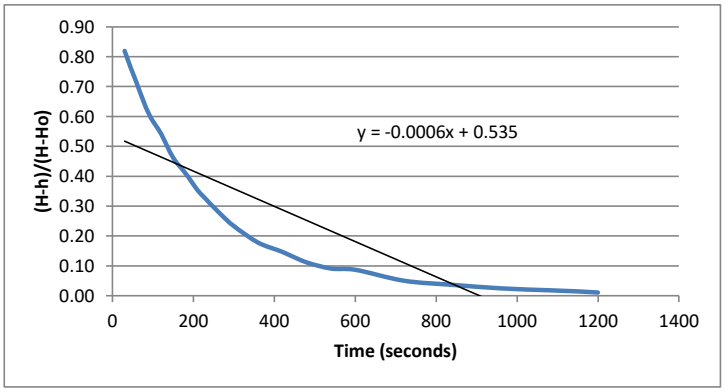
Test Completed on	25-Apr-19	
well depth	6.01	m
r (casing radius)	0.025	m
L (length of screen)	1.5	m
R (filter pack [borehole] radius)	0.03	m
To (time lag*)	200	sec
H (initial water level before slug)	1.64	m
Ho (water level at t=0)	6.01	m
h (recorded water level at time t)	See Column F	

* 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 MW5
Proposed Residential Development
Anges Street
Alton, Ontario

Test Completed on	9-Aug-19	
well depth	6.10	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*)	10170	sec
H (initial water level before slug)	6.10	m
Ho (water level at t=0)	5.67	m
h (recorded water level at time t)	See Column F	

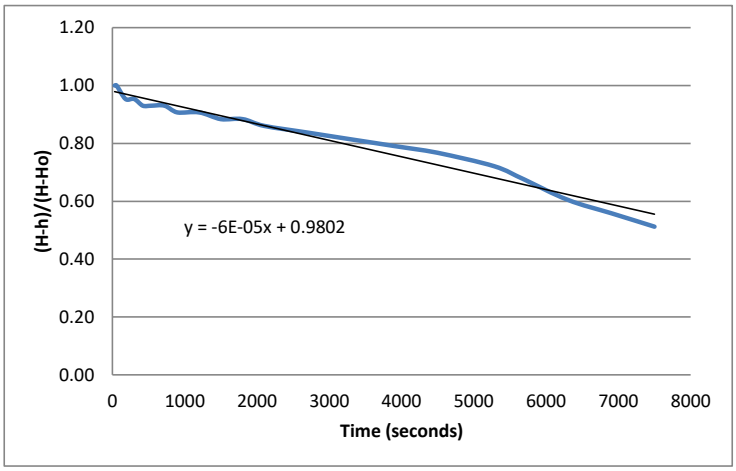
* To = t when (H-h)/(H-Ho) = 0.37 and ln(H-h)/H-Ho)=-1

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

8.01E-08 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)
5.67	1.00	30
5.67	1.00	60
5.69	0.95	180
5.69	0.95	300
5.70	0.93	420
5.70	0.93	540
5.70	0.93	720
5.71	0.91	900
5.71	0.91	1200
5.72	0.88	1500
5.72	0.88	1800
5.73	0.86	2100
5.74	0.84	2700
5.75	0.81	3300
5.76	0.79	3900
5.77	0.77	4500
5.79	0.72	5280
5.81	0.67	5700
5.84	0.60	6300
5.86	0.56	6900
5.88	0.51	7500



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	

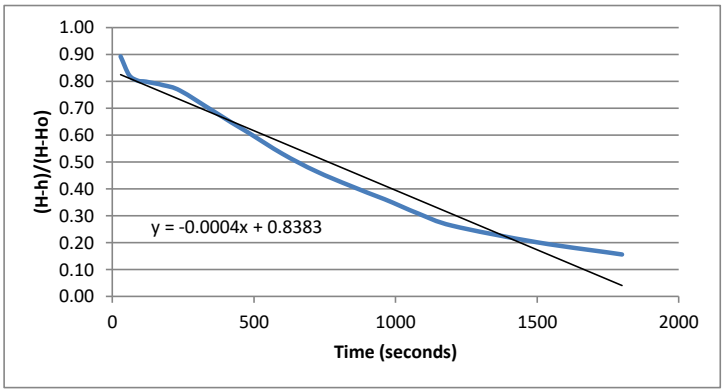
* To = t when (H-h)/(H-Ho) = 0.37 and ln(H-h)/H-Ho)=-1

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



Appendix F
Laboratory Certificates of Analysis



ENGLOBE

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.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

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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

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Appendix G
Alton Millpond Hydraulic Characteristics Report



ENGLOBE

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

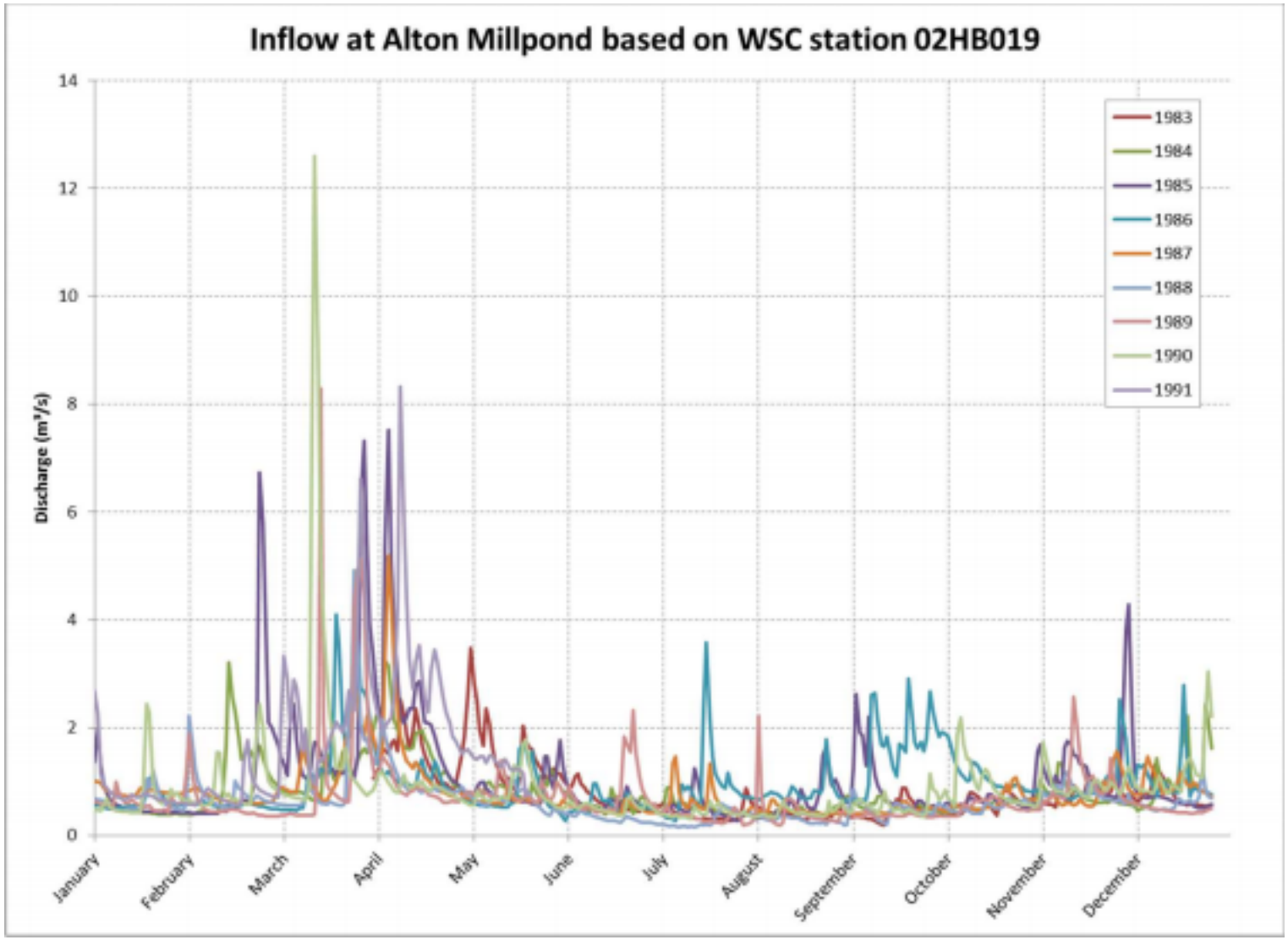
- Site drainage area: 65.8 km² (CVC)
- Data sources
  - Existing WSC gauge 02HB019 (1984-1990, 59.5 km²)
  - Other WSC gauges in the area
    - 02HB001 – Cataract (1915-…, 205 km²)
    - 02HB013 – Orangeville (1967-…, 62.2 km²)
    - 02HB020 – Erin (1983-…, 32.3 km²)
  - Real time flow station u/s of 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

Appendix H
Sewage System Information Package



ENGLOBE

Agnes Street Infill Development

Wastewater Systems Information

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1. Introduction

The Agnes Street Infill development proposal provides an opportunity for the creation of a new form of housing in Alton that will fill a gap in the local housing supply and support local, regional and provincial policies to create more housing. The proposed form of wastewater servicing is fundamental to the proposal and is founded on a significant amount of scientific research and in-field practice. It meets regulatory standards and uses a proven, Ontario-based wastewater treatment technology that has been used in many jurisdictions across North America.

Because there is no municipal wastewater system for the village of Alton nor, as explained below, will Peel Region permit private Communal wastewater systems (servicing more than five (5) residential units and in our case sixty five (65) residential units) in the Region, individual

smaller scale on-site systems are the only alternative. The proposed on-site sewage systems shared four and five townhouse units each, fit within the Ontario regulatory framework and are an innovative and safe way of facilitating a more efficient and affordable housing alternative than the status quo of large single detached homes on individual private septic systems.

This document is intended to provide a factual outline of the regulatory context, hydrogeological / groundwater research undertaken, an overview of the proposed treatment systems and anticipated conditions of approval, operational / maintenance requirements and practices and a summary of possible operational issues and how they will be addressed / mitigated.

This information provides answers to the questions and alleviates concerns raised by the community about how the wastewater treatment aspect of this proposed townhome development will work.

2. Applicable Regulations

On-site Sewage systems of over 10,000 litres per day require an Environmental Compliance Approval (ECA) approval from the Ministry of the Environment, Conservation and Parks (MECP) under the Ontario Water Resources Act. Furthermore, private residential Communal systems of over 10,000 L/day, and where there are greater than 5 residential units, require a Municipal Responsibility Agreement. However, Peel Region's policy is to not take on such an agreement, thus requiring this site to have smaller individual on-site systems.

Individual on-site sewage systems are defined by Provincial regulations to include systems of up to 10,000 L/day serving up to five households, i.e. without the need for a Municipal Responsibility Agreement. Such systems are regulated under Part 8 of the Ontario Building Code ("OBC") and are approved by the municipal Building Department.

In addition to the OBC effluent criteria for advanced treatment systems meeting OBC level IV effluent quality for Biological Oxygen Demand ("$CBOD_5$") and Suspended Solids ("TSS"), there are other regulations in place governing nitrate levels for subsurface discharge. Nitrate levels naturally dissipate as effluent travels through the ground by vegetation and through dilution through infiltrated precipitation. Shallow soils, consisting of silty sand, will provide attenuation and slow the travel time of sewage effluent allowing for additional dilution before discharging to surface waters.

The applicable nitrate regulations come from several different bodies:

- Ontario Ministry of the Environment, Conservation and Parks (MECP) Procedure D-5-4 requires the municipal approval authority to look at cumulative impacts from any privately-serviced multi-lot development such as this one, regardless of whether it is for townhouses or single detached homes. It requires nitrate levels be no more than 10 mg/L at the point where the effluent reaches the property line.

- Credit Valley Conservation (CVC) and Canadian Water Quality Guidelines (CWQG) for nitrate in shallow groundwater require that nitrates have dissipated to less than 3 mg/L at the point where the groundwater containing the treated effluent reaches the receiving watercourse, in this case, Shaws Creek.
- Region of Peel is responsible for the municipal wells and essentially requires negligible impact by the time any diluted effluent in the creek passes by the municipal wells approximately 650 meters downstream of the site.

3. Hydrogeological Report

A hydrogeological study was commissioned from Terraprobe (now part of Englobe), a recognized professional firm. The Town has engaged a third party expert EGIS Canada Ltd. (EGIS) to peer review the report.

- The hydrogeological study began by assessing the existing groundwater conditions across the property through to Shaws Creek. This was done by drilling 8 boreholes with four monitoring wells installations, reviewing neighbouring well records, doing a physical local well survey and reviewing other publicly available data to create a groundwater flow model.
- Once the proposed fourteen (14) leaching / dispersal bed locations were established, a further 18 test pits were dug to confirm soil conditions and high groundwater conditions for each bed location.
- The regulatory criteria for treated effluent discharging to Type 'A' dispersal beds, mentioned above, were identified and the most onerous criteria were adopted. The applicable criteria are:
    - no greater than 10 mg/L for each of $CBOD_5$ and TSS set by the OBC to discharge Level IV (tertiary quality) effluent into the ground.
    - below 3 mg/L for nitrates at Shaws Creek (which is more onerous than the MECP's regulation D-5-4 requirement of 10 mg/L at the property line).
- Taking into account background groundwater flows and nitrate levels, Terraprobe concluded that to meet the applicable guideline for nitrate to surface water (CWQO) at below 3 mg/L to Shaws Creek, the Nitrate / nitrogen level of the treated effluent when it is discharged to the on-site leaching beds must be no more than 5.2 mg/L
- Given this level of pre-treatment for nitrate (5.2 mg/L) the expected nitrate concentration at the downgradient property limit was calculated at 3.5 mg/L. This level of treatment exceeds the MECP Procedure D-5-4 requirement for 10mg/L at the property line.
- Terraprobe concluded that if this level of treatment is attained, the municipal wells would not be affected by either the creek or direct groundwater flows from the site due to the

significant distance travelled and intervening dilution / dissipation effects through infiltrating precipitation and given the documented flow volumes for Shaws Creek.

- EGIS has presented a number of questions and comments on the hydrogeological report which are currently being responded to by Terraprobe. A revised version of the report is being submitted prior to with the final Planning Act application and we are confident that EGIS will be satisfied with it.

4. Wastewater Flows and Occupancy Projections

Wastewater design flows are specified by the OBC taking into account the living area of a home, the number of bedrooms and the number of plumbing Fixture Units. The OBC (under Table 8.2.1.3.A.) designates flows for each of these considerations and the daily design sanitary sewage flow (Q) is established.

Exact flows will be determined at the time of building permit applications based on the final floor plans of the units, but to be conservative, the sewage treatment systems meeting Level IV effluent quality, and leaching / dispersal bed areas have been sized to accommodate systems serving the four-unit blocks with design flows of up to 8,000 litres per day ("LPD") [c/w two 3-bedroom and two 4-bedroom units] and the beds for the five-unit blocks are sized for up to 9,900 LPD [c/w three 3-bedroom units and two 4-bedroom units]. This would allow for finished floor areas of up to 2,360 ft^2 (220m^2) and a mix of three (3) and four (4) bedroom units and twenty-four (24) plumbing fixture units.

Refer to the Gunnell Engineering Functional Servicing Report and the detailed drawings. For 3-bedroom townhouses, the daily design sewage flow is 1,800 L/day. For 4-bedroom townhouses, the daily design sewage flow is 2,200 L/day.

Based on multi-family dwellings, the OBC allocates 275 L per person, and based on the proposed dwellings, this would equate to 6 persons per 3-bedroom unit and 8 persons per 4-bedroom unit (i.e. 2 persons per bedroom).

Empirically, actual sewage flows tend to be approximately 50% of the OBC daily design sewage flows, with the higher conservative OBC flows allowing for periodic peak flows.

5. Treatment Systems

- Waterloo Biofilter (or a regulatory approved equivalent supplier) will provide pre-engineered treatment systems to meet the OBC effluent criteria for treatment of: CBOD5: 10 mg/L and TSS: 10 mg/L for Level IV (tertiary) advanced treatment and advanced treatment to achieve the above-referenced effluent criteria for Nitrate / nitrogen of 5.2 mg/L.

- Gunnell Engineering, which specializes in sewage system design, are designing the overall sewage system, the leaching / dispersal beds and will supervise installation of the treatment systems and the construction of the sewage system's leaching / dispersal beds.

- At the time of construction, each sewage system will require a Building Permit to be issued by the Caledon Building Department.

- A condition of Draft Approval will require that in addition to the normal Building Code effluent criteria, the nitrate / nitrogen treatment criteria detailed above will also be applicable.

- Waterloo Biofilter sewage treatment systems are certified under CAN/BNQ 3680-600 to treat $CBOD_5$ and TSS to the Level IV classification under the OBC, which is 10 mg/L for both parameters. The company has installed over 15,000 systems, of which upwards of 1,000 are commercial and / or multi-unit residential units with flows greater than 5,000 L/day.

- Waterloo Biofilter's WaterNOx-LS denitrifying systems were tested under the CAN/BNQ 3680-600 test protocol achieving greater than 75% Total Nitrogen removal. There are numerous WaterNOx-LS systems installed in the field and regular test results confirm consistently-acceptable results well below the nitrate-nitrogen target of 5.2 mg/L required for this project.

- Thousands of Waterloo Biofilter systems have been operating in Ontario since the 1990s and have proven to be very reliable. They have very stable fixed media to host the bacteriological digestion, handle fluctuating flows well and have very few moving or mechanical parts other than pumps to move the effluent from one stage to the other.

- The Waterloo Biofilter systems have minimal sludge build-up, similar to a septic tank. The first 'Anaerobic Digester' tank typically needs pumping out every 3-5 years. The operator will recommend when pump-outs are needed based on usage and the actual solids build-up observed during the annual inspection.

- There is a 20 year warranty on the primary media on which the sewage-eating bacteria grows. So far since the 1990's none have needed replacement when used within design parameters. Some have required replacement if for example a large amount of paint or acid was discharged into the sewage system.



Waterloo Biofilter System - Filter Medium (Guelph, Ontario manufacturing facility)

- The media for denitrification needs to be replaced approximately every 10 years.
- Construction will be undertaken by an OBC licensed sewage system installer approved by Waterloo Biofilter under the supervision of Gunnell Engineering and Waterloo Biofilter.
- As common elements, the sewage systems are covered by the Tarion warranty. In the first year following registration of the condominium, each Condo Board is required to commission a professional engineer to do a performance audit (technical audit) entailing a detailed inspection of the sewage systems to ensure that they were properly built and are performing according to specifications. This performance audit is submitted to Tarion prior to the end of the 12th month following registration. Any deficiencies would be identified and must be corrected by the Builder by the end of the Builder Repair Period prior to the release of the security lodged with Tarion.



Waterloo Biofilter Standard Layout



Waterloo Biofilter System - landscaped area with access lids

6. Operation and Maintenance Requirements

- Sections 8.6 and 8.9 of the OBC deal with the Operation and Maintenance of all individual on-site Sewage Systems and prohibit the discharge of untreated effluent into the environment. Unlike with septic tanks, the owners of all advanced sewage treatment systems are required to enter into a service and maintenance contract with an operator authorized and provided with operating instructions by the manufacturer. It requires the operator annually to have samples of the treated effluent tested and to report the resulting levels of $CBOD_5$ and TSS to the Chief Building Official of the Town of Caledon.

- Each sewage system will be a common element, owned and operated/ maintained by the condominium corporation that owns the block it serves. There will be one professional management company supporting all 14 condominiums, appointed by the overall common element condominium that owns the roads and Common Green.

- The Condominium Act has safeguards built in to ensure common elements, including sewage systems, are properly operated and maintained. For example, Sections 89 and 90 set out the Condominium's obligations to maintain and repair the common elements, and Section 99 requires the condominium to hold insurance in case of damage or other perils to the common elements. The condominium corporations thus have a statutory obligation to maintain the common element sewage systems in proper order.

- The Condominium regulations also include mandatory Reserve Fund provisions, being Sections 93 and 94 of the Act::

    - A comprehensive reserve fund study must be done by a professional within the first year following registration of the condos and it must be updated every 3 years.

    - These studies ensure that there is a build-up of reserve funds as part of the condo fees each year to ensure there are sufficient funds for any major repairs required and avoid the need for a special assessment at the time a system needs replacement.

- The minimum requirements set out in the Building Code and the Condo Act can be supplemented through the **Conditions of Draft Approval** of the Subdivision and/or the Condominiums. The following specific additional requirements are proposed to be included in the Conditions of Draft Approval, to be implemented through provisions to be written into the Condominium Declarations:

    i. That there will be one overall common element condominium corporation (the "Common Condo") that will own the roads and common green and will be given responsibility for coordinating the selection of a manager for the 14 condominium corporations that own the 14 blocks (the "Block Condos").

    ii. That the Declarations of the 14 Block Condos and the Common Condo provide for there to be one management company engaged to support all the Block Condos, such that the sewage systems shall always be professionally managed. The choice of manager and management company shall be selected by a majority vote of the Boards of the Block Condos. The Declarations of the 14 Block Condos shall further provide that the management company shall be required to arrange a contract with one qualified maintenance and operations contractor for all 14 sewage treatment systems.

    iii. That the sewage system maintenance and operation contracts described in condition (ii) above include a requirement to comply with the following effluent standards:

        - $CBOD_5$: 10 mg/L
        - TSS: 10 mg/L
        - Nitrate-Nitrogen: 5.2 mg/L

    iv. That the sewage system maintenance and operation contracts described in condition (ii) above include a requirement for continuous remote monitoring and an annual on-site inspection / servicing of the system. During the first year the contract shall also call for an interim inspection and effluent samples to be taken from each treatment unit after the first six months of operation following normal commissioning and startup testing procedures.

    v. That the Declarations of the 14 Block Condos provide that if the sampling described in condition (iv) above produces results that are out of compliance with the noted effluent standards for any system, a full inspection of such system shall be done and steps taken to bring the system back into compliance. The cost of such remedial action shall be borne by the individual Block Condo whose system is out of compliance.

    vi. That the Declarations of the 14 Block Condos and the Common Condo provide that the annual inspection report shall include all effluent sampling results and report on any actions taken in response to any out-of-compliance samples. Such report shall be submitted to the Chief Building Official of the Municipality and to

the management company who in turn will be responsible for distributing the report for each individual system to the respective Block Condo.

vii. That the Declarations of the 14 Block Condos provide that a technical Operation and Maintenance Manual be prepared, with copies supplied to the respective Boards, the Manager of the Condominium and the Sewage Systems Operations contractor.

viii. That the Declarations of the 14 Block Condos provide that a User Guide written in non-technical or layman's language be prepared, which provides practical guidance on the proper use of the sewage system. The Declarant shall include the User Guide as part of the closing documents for all agreements of purchase and sale, and the Declarations of the Common Condo and/or Block Condos shall require the User Guide to be given to any tenant.

ix. That the Declarants include the user Guide, described in condition (vii) above, in the Rules of the 14 Block Condos such that the guidelines relating to the sewage system may be enforced by the resulting condominium corporations. For greater certainty, these rules shall include language, to the satisfaction of the Town, providing access to each unit's water meter readings and guidelines for water usage to avoid overloading the systems as well as guidelines as to what substances can or should not be flushed down the drains.

7. Operations and Maintenance Practices

- Gunnell & Waterloo Biofilter will jointly prepare the above-described Operation and Maintenance Manual and User Guide, which includes a Do & Don't Homeowner list of acceptable discharges into the sewage system. Gunnell Engineering will provide the overall context and information about the leaching / dispersal beds and treatment parameters. Waterloo Biofilter will prepare the sections that pertain to the treatment units themselves. Here is a link to a sample standard form of Waterloo Biofilter homeowner manual.

- Each of the Condos will contract with the same service provider - Waterloo Biofilter or another Waterloo Biofilter approved operator for operations, maintenance and service including remote monitoring, and the periodic inspections/ sampling/ reports referred to above.

- Waterloo Biofilter is Guelph-based and has made it a priority to build the O&M side of their business, which allows Waterloo Biofilter to ensure conformity with their CAN / BNQ 3680-600 certification. Waterloo Biofilter is installing their systems for the homes in the new Osprey Mills subdivision presently being built in Alton. The Osprey Mills systems are operated to comply with the effluent and the maintenance / monitoring requirements of the Ontario Building Code. Waterloo Biofilter will have a contract to perform annual inspections there, so it is logical for them to perform the ongoing maintenance in the Agnes Street project as well. (Note: the Osprey Mills systems do not have the extra denitrification requirements that will be applicable to the subject development).

- However should Waterloo Biofilter ever discontinue its operations business or become uncompetitive, the logical alternative at the moment is Clearford Waterworks Inc. Clearford is the largest operator of privately owned communal water and wastewater treatment systems in Ontario, operates sewage systems in Mono and at the Osprey Valley Golf course in Alton, operates Waterloo Biofilter Communal systems in other municipalities and is familiar with their systems. Clearford has indicated it would be quite willing to take on this contract but acknowledges it would be more cost-effective in this context to deal directly with Waterloo Biofilter.
- Both Waterloo Biofilter and Clearford have emergency on-call departments for timely response to a failure. The operator will be able to make adjustments online or if a problem becomes apparent, will make arrangements for on-site service.
- The Condo corporation will have a separate contract with a local sewage hauler for occasional sludge / solids pump-outs and to be on standby in the rare instance where emergency haulage might be needed.

The operating contract will call for a full inspection and system servicing once a year. During the first year of operation an additional visit will be required to inspect the systems and obtain grab samples for laboratory testing of the treated effluent. If the analysis of the effluent sample indicates an out-of-compliance result, that will trigger a full inspection and servicing to ensure the system is put back into compliance.

The services for each full inspection / servicing would include:

- Check condition and safety of all tanks, enclosures, and access hatches.
- Examine anaerobic digester tank health and recommend if the tank needs pumping.
- Clean effluent and inline filter; if required.
- Test operation of all pumps and floats.
- Examine health of Biofilter treatment medium including colour and compaction.
- Clean spray nozzles, ensure even distribution over Biofilter medium.
- Examine the health of WaterNOx-LS denitrification medium and recommend if replacement is needed.
- Check charcoal filters (which reduce/eliminate odours) and recommend if charcoal needs replacing.
- Check Smart Panel operation and settings remotely; check that panel is properly sealed and inspect for corrosion.
- Take grab samples of sewage and final effluent and have them analyzed.
- Check the health of the leaching bed; moisture, grass cover, grading.

- Record findings on Waterloo Biofilter System Maintenance Report.
- Provide a report to the Condominium Corporation summarizing the inspection results and any recommendations or repairs done.
- If necessary; consult with the Condominium Corporation about best management practices.

8. Possible Problem Scenarios and Safeguards / Remedies

Like any human-devised system, it is possible that problems will arise, requiring safeguards and remedies:

- There is negligible risk of hydraulically overloading the sewage systems due to over-occupying the units because of the safety factors built into calculating the design flows as discussed in Section 4 above. Furthermore, there are safety factors built into the design of the systems including balancing of peak flows to enable them to handle temporary surges. Each unit will have a water meter installed, and language will be included in the condominium declaration setting guidelines for water and sewer use. That way, this information can be recorded, and preventative measures can be taken if water readings show signs of excessive use, i.e. a leaking toilet.
- In the event of a power outage or pump failure - sewage stops flowing to the system. There is no risk of discharge of untreated effluent into the beds. The operator will be advised via remote monitoring.
- If a system stops functioning or a tank reaches a critical level, the operator will know via remote monitoring and an audible alarm will go off on the panel mounted on the exterior of each system located within the common area.
- The plans call for two alternating pumps - if one pump fails the other would take over. If a pump failure is detected the operator would send a technician out to replace the non-operating pump.
- The pump stations include storage tanks designed to retain 1 day of daily design flow = in reality 2 - 4 days of actual usage. If operations can’t be resumed within 48 hours, the condo may need to pump out the tanks until service is restored.
- If a tank needs a pump-out, the operator would call the local hauler that the condo has on contract. The residents will also have the hauler’s number in case of emergency.
- If despite the instructions in the User Guide, a deleterious solid substance is flushed into the system, it will go into the first chamber (primary digester tank) and won’t be passed onto the subsequent tank. If anything is observed that shouldn’t be in the first tank, it may necessitate a premature pump-out.

- If despite the instructions in the User Guide, a resident flushes a large-enough quantity of a harmful liquid substance to disrupt the bacteriological process, it may result in unhealthy sewage, smells coming from the system or poor effluent quality, which can be detected visually or through sampling by the service provider. For most substances and quantities, the systems will naturally recover their equilibrium. In the worst case scenario, Waterloo Biofilter may have to clean and seed the system with new start-up bacteria. There is no more harm to be done than if an individual flushes something to disrupt the process in their stand-alone septic tank, except in this case there are 4 or 5 families affected and able to respond. If anything, there is more 'peer pressure' to act responsibly than in the case of a single detached home. And an advantage of having the 4- or 5-unit sewage systems is that poor quality sewage from one residence will have less of a negative impact on the overall sewage system.
- Both the Condominium managers and the homeowners / residents will have copies of the User Guide and be trained to know what to look for and to know when to call the operator.

9. Consulting Team

The sewage system requirements have been assessed by, and the designs and proposed operational parameters and safeguards have been developed by the following team of professionals:

- Hydrogeology and Sewage System Assessment: Terraprobe now Englobe (Brampton)
- Sewage System Overall Design: Gunnell Engineering Ltd. (Newmarket)
- Sewage System Pre-Engineering and Supply: Waterloo Biofilter Systems Inc. (Guelph)
- Condominium Law: Smith Valeriote Law Firm LL (SV Law) (Guelph)
- Condominium Property Management - MF Property Management Ltd. (Guelph)
- Planning Consultant - Weston Consulting (Vaughan & Toronto)

This document has been coordinated by Seaton Group with contributions from all the above consulting team members in their respective areas of expertise.

ATTACHMENTS/ LINKS
Terraprobe/Englobe Hydrogeological Report
Gunnell Sewage System Functional Servicing Report, including drawing details
Waterloo Biofilter NOx-LS Brochure.pdf
Waterloo Biofilter NOx-LS Results.pdf