

Township of Cavan Monaghan

Millbrook Water Storage Class Environmental Assessment

Project File Report

Final

January 26, 2026

Prepared for:

TOWNSHIP OF
CAVAN MONAGHAN
Have it all. Right here.

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RVA 205371

January 26, 2026

Township of Cavan Monaghan

988 County Road 10

Millbrook, ON

L0A 1G0

Attention: Wayne Hancock, P.Eng.

Dear Mr. Hancock:

Re: Millbrook Water Storage Class Environmental Assessment

Please find enclosed the Project File Report for the above referenced project. The report compiles all the information from the previously submitted Technical Memoranda and the evaluation of the preferred alternative for new Water Storage in Millbrook.

If you have any questions or comments, please contact the undersigned.

Yours very truly,

R.V. ANDERSON ASSOCIATES LIMITED

LICENSED PROFESSIONAL ENGINEER
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Jan 23, 2026
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Millbrook Water Storage Class Environmental Assessment

Class Environmental Assessment
Project File Report

Final

Prepared for:
The Township of Cavan Monaghan

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RVA 205371

January 26, 2026

TOWNSHIP OF CAVAN MONAGHAN WATER STORAGE CLASS ENVIRONMENTAL ASSESSMENT

PROJECT FILE REPORT

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EXECUTIVE SUMMARY

The Township of Cavan Monaghan (Township) commenced a Schedule 'B' Class Environmental Assessment (Class EA) in 2024 to plan for additional water storage capacity and associated pumping capacity to service the community of Millbrook. The additional capacity is required to accommodate for growth forecasted in the immediate future and beyond, to 2051.

The publication of this Project File Report (PFR) represents the conclusion of Phase 1 and 2 of the Schedule B Municipal Class Environmental Assessment (MCEA) process. The objective of this PFR is to document the results of the MCEA process pertaining to the project objective, the problem/opportunity statement, findings from the investigation, identification and evaluation of alternatives, design options and recommendation of the preferred alternatives. In addition, communication and consultation with the public, technical and government agencies, First Nation communities and other interested stakeholders completed during the Class EA process are documented in this report.

A Public Information Centre (PIC) was completed during the Class EA process. The PIC was held in-person at the Township of Cavan Monaghan Municipal Office on September 24th, 2025, to provide an opportunity for stakeholders to comment on the following:

- Problem and Opportunity Statement
- Long list and screened short list of alternatives for new water storage location
- Evaluation criteria for assessing the alternative locations and types of tank
- Possible water storage tank types
- Preferred location for new water storage tank

Results from various preliminary investigations, both in relation to the wider study area and the preferred location were considered as part of the evaluation of the location alternatives. The investigations concluded that no significant impacts would result from the implementation of the project at the preferred location.

The relevant recommendations of the Project File Report are as follows:

- The Township should proceed with preliminary and detailed design of an In-Ground Water Storage Reservoir with a volume of 2,900 m^3 at Location #3 (East of County Road 10 and North of Fallis Line, across from the Municipal Office, in a property designated for development).

- Appropriate mitigation measures will be implemented to minimize potential impacts.
- Communications will be conducted throughout the design process with the appropriate technical agencies, stakeholders and Indigenous communities.

This PFR will be placed on the public record for 30 days, during which time, any comments or requests from Indigenous communities, stakeholders, agencies, or concerned parties will be addressed according to the procedures outlined in the Municipal Class EA Manual. In addition, a request may be made to the Ministry of the Environment, Conservation and Parks (MECP) for an order requiring a higher level of study (e.g., requiring a Schedule C Class EA or individual/comprehensive EA approval before being able to proceed), or that conditions be imposed (e.g., require further studies), only on the grounds that the requested order may prevent, mitigate, or remedy adverse impacts on constitutionally protected Aboriginal or Treaty rights that may be impacted by a project. Requests on other grounds will not be considered.

1.0 INTRODUCTION

1.1 Background

R.V. Anderson Associates Limited (RVA) was retained by the Township of Cavan Monaghan (Township) to complete a Water and Wastewater Master Servicing Study (MSS) to support growth to 2051. The MSS identified a new water storage facility in the Village of Millbrook (Millbrook) as the key priority project to accommodate growth forecasted in the immediate future. As a result, a separate Class EA was undertaken to determine the preferred water storage facility type and its location that can meet the Township's long-term servicing requirements considering growth and development.

Expansion of water storage facilities where additional land must be acquired requires completing a Schedule B Class Environmental Assessment (Class EA) under the Environmental Assessment Act.

This document is the Project File Report for the Class Environmental Assessment, which includes a documentation of the following:

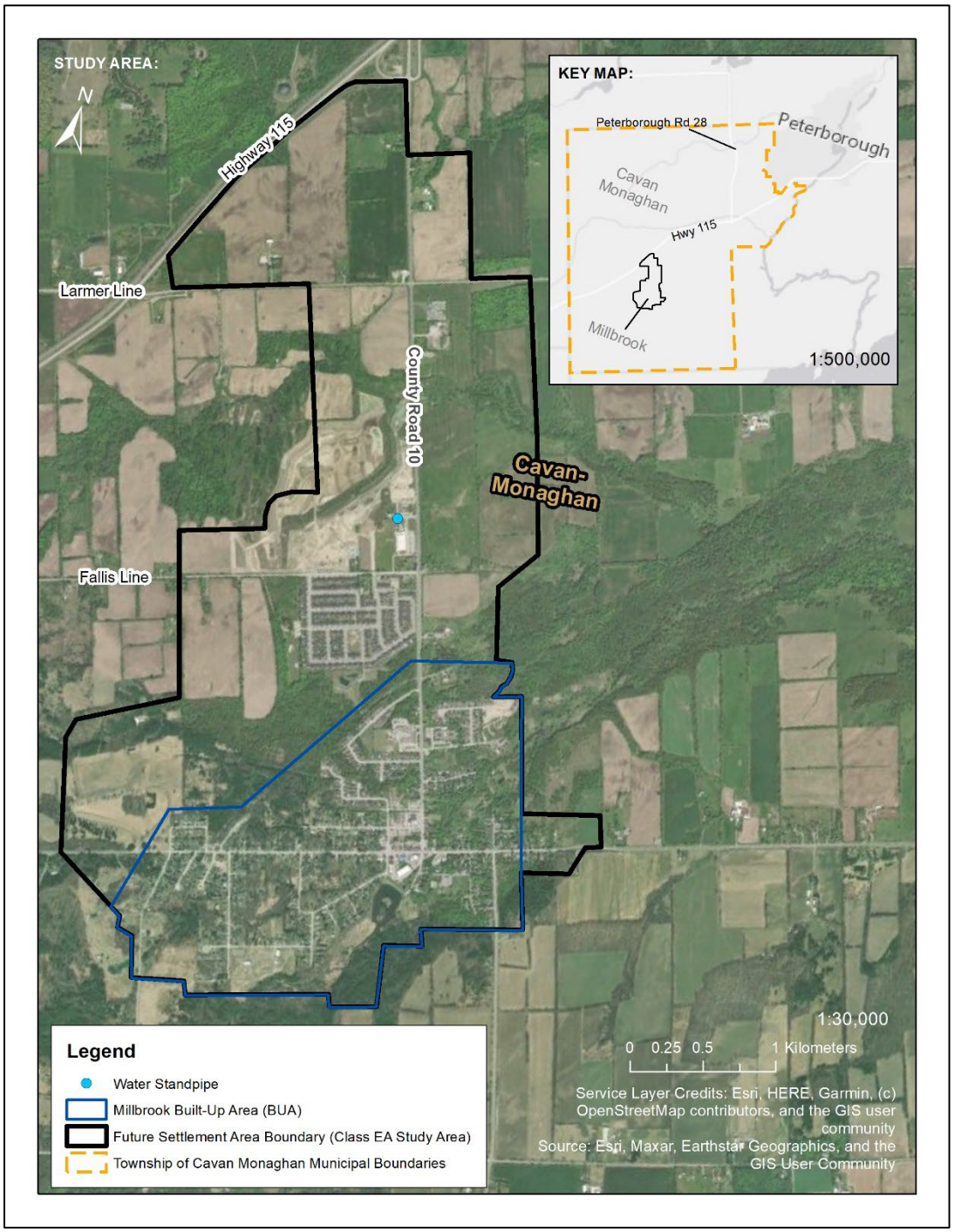
- A reconfirmation of the water storage capacity assessment that was initially completed for the MSS to the year 2051; and
- A desktop review of the existing conditions in the study area from the past supporting studies completed (e.g., natural environmental, archaeological, etc.).
- Identification and evaluation of alternative locations and types for new water storage tank in Millbrook.
- Determination of a preferred solution for new water storage in Millbrook.

1.2 Study Area

The Township undertook a Growth Management Strategy (GMS) study in 2022 to identify the population growth in Millbrook up to the study horizon of 2051. The GMS report provided a Future Settlement Area Boundary to accommodate the future growth that was forecasted to exceed the available capacity within the current village boundary. **Figure 1-1** is an aerial map showing Millbrook's existing Built-Up Area within the existing boundary, and the Settlement Area Boundary as per the Growth Management Study. The area bordered by Settlement Area as per the Growth Management Study was taken as the study area in the MSS and, as such, is the study area for this Class EA.

The Study Area is located in the Otonabee-Peterborough Source Protection Area (S.P.A.) and is composed of various land uses including residential, employment, commercial, institutional, parks and open space. Most of the land planned for future development in Millbrook has been designated as residential land and some for industrial/commercial.

Figure 1-1: Study Area of Millbrook Settlement Boundaries in Township of Cavan Monaghan



1.3 Problem and Opportunity Statement

The problem and opportunity statement describes the objectives of the study and the desired factors in the preferred servicing alternative. This is a useful tool to pre-screen the long list of alternatives so that only feasible and likely alternatives can be evaluated in more detail. The problem and opportunity statement for the Township of Cavan Monaghan's Class Environmental Assessment for Water Storage is as follows:

With the recent connection of Hwy 407 to Hwy 115, there is opportunity for Township of Cavan Monaghan (Township) for improvements and growth in employment, community services and residential living. As such, the Township undertook a Water and Wastewater Master Servicing Study (MSS). The MSS developed a plan to identify key improvements to the existing water and wastewater infrastructure in the Township required to service the current and future needs. One of the key improvements determined by the MSS was to expand the Water Storage capacity in the community of Millbrook by retaining the existing standpipe (by the Municipal Office) and having additional water storage at a new location. The Township of Cavan Monaghan is now undertaking a Schedule B Class Environmental Assessment (Class EA) for an increase to the water storage volume.

The purpose of the study is to confirm the location, capacity, and storage type for the new water storage solution which will service the anticipated growth in the Millbrook Settlement Area as per the Growth Management Study.

While the proposed development poses significant challenges to the Township, Cavan Monaghan is committed to providing efficient and sustainable infrastructure while seeing that development within the community preserves or enhances the environment for the betterment of future generations. Preferred solution(s) will be prioritized and implemented to address immediate needs, intermediate goals, and long-term growth, and shall generally:

- *Comply with applicable regulations to provide adequate water servicing.*
- *Comply with the Official Plan (2021) while accommodating future vision of servicing beyond the Settlement Area boundary as per the Growth Management Study.*
- *Comply with the recommendations from the 2024 MSS.*
- *Consider stakeholder and rights-holder comments and concerns.*
- *Be financially viable.*
- *Be technically feasible and operationally sustainable.*
- *Be socially and environmentally responsible.*

2.0 OVERVIEW OF MUNICIPAL CLASS EA PLANNING PROCESS

2.1 Municipal Class EA

The Municipal Class EA (Municipal Engineers Association, 2000, and as last amended in 2023) outlines an approved planning process for municipal infrastructure projects including water and wastewater projects. Municipal proponents can use the Class EA process to meet the requirements of the Ontario Environmental Assessment Act.

The Class EA process is illustrated in the Class EA **Figure 2 1**. The Class EA process includes mandatory requirements for public and regulatory agency input and provides for the evaluation of alternative solutions to a problem or opportunity.

The MCEA identifies three different categories or "schedules" of projects as follows:

Exempt projects are limited in scale and have minimal adverse effects. These projects are approved and may proceed directly to implementation without any further steps in the Class EA process.

Schedule B projects have the potential for some adverse environmental effects and must be subjected to a screening process, involving consultation with the directly affected public and relevant government agencies, and engagement with Indigenous Communities to provide opportunity for input and to address concerns. If there are no outstanding concerns, then the proponent may proceed to implementation.

Schedule C projects have the potential for significant environmental effects and must proceed under the full planning and documentation procedures specified in the Class EA document. Schedule C projects require evaluation of alternative solutions and alternative design concepts of the preferred solution. The public, agencies and Indigenous Communities are provided several opportunities throughout the process to provide input and comments.

2.2 Municipal Class EA Schedule

The Millbrook Water Storage Class Environmental Assessment will be undertaken as a **Schedule B** project. This will require completion of Phases 1 and 2 of the Class EA process as follows:

- **Phase 1:** Identify the problem or opportunity.

- **Phase 2:** Identify and evaluate alternative solutions to the problem by considering the existing environment and establishing the preferred solution, considering public, Indigenous Communities and agency review input. Document the decisions in a Project File Report.
- **Notice of Completion:** Upon completion of this Project File Report, a Notice of Completion is advertised and issued to the public, Indigenous Communities and agencies interested in the project, for a 30-day review period, during which time, any comments or requests from stakeholders, agencies, or concerned parties will be addressed according to the procedures outlined in the Municipal Class EA Manual (2000, as amended in 2007, 2011, 2015, 2023). In addition, a request may be made to the Ministry of the Environment, Conservation and Parks (MECP) for an order requiring a higher level of study (i.e., requiring an individual/comprehensive EA approval before being able to proceed), or that conditions be imposed (e.g., require further studies), only on the grounds that the requested order may prevent, mitigate or remedy adverse impacts on constitutionally protected Aboriginal and treaty rights. Requests on other grounds will not be considered.
- **Implementation:** Provided that no requests are made to the Minister of the MECP within the 30-day review period, or requests have been addressed, the project is approved and may proceed to detailed design, construction, operation and monitoring if specified. The project would still be subject to all applicable environmental regulations and approvals.

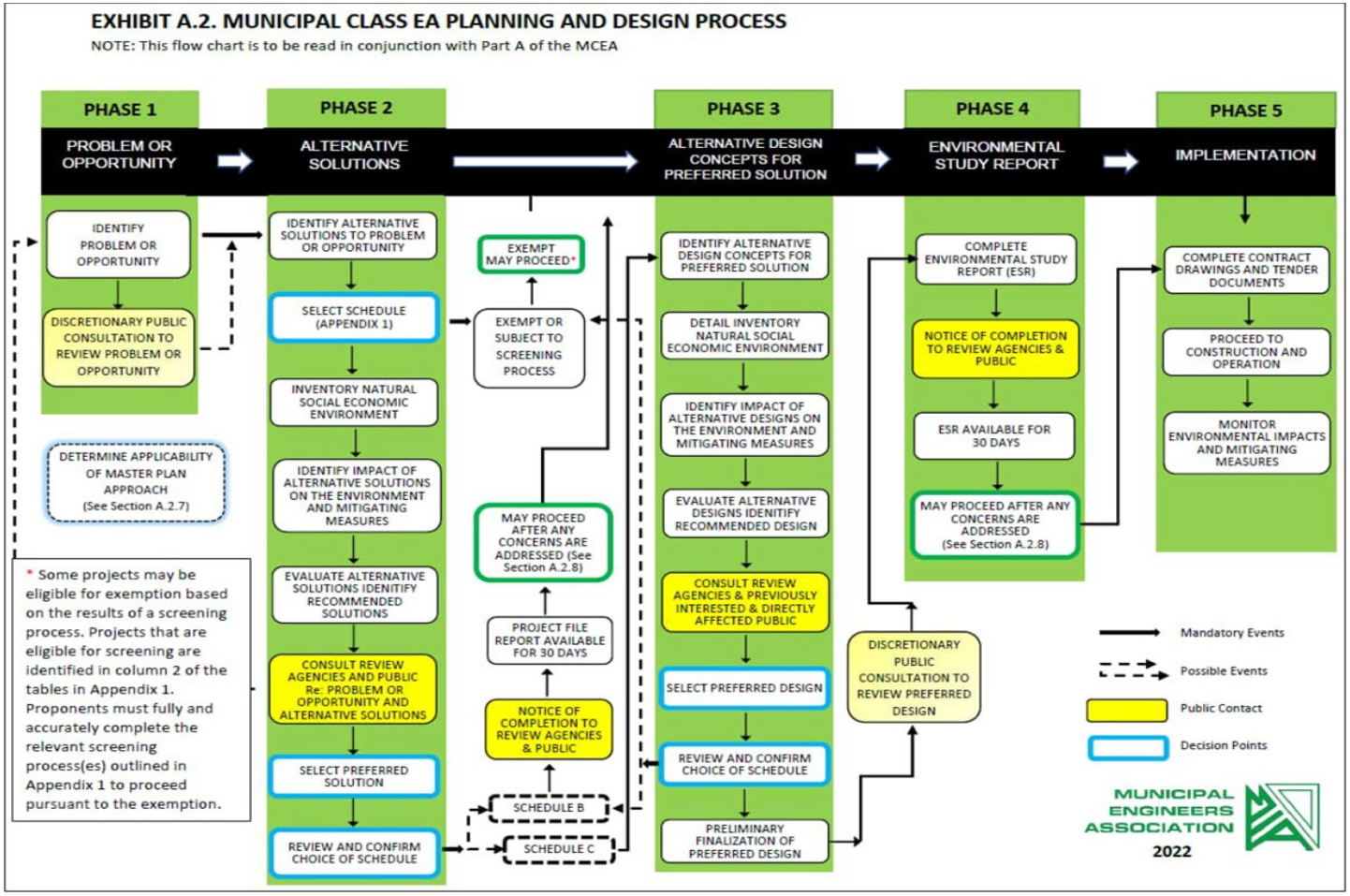


Figure 2-1: Municipal Class EA Process (Municipal Engineers Association, 2022)

3.0 PLANNING AND POLICY CONTEXT

3.1 Federal

3.1.1 Canadian Environmental Protection Act

The Canadian Environmental Protection Act (CEPA), enacted in September 1999, grants the Canadian government authority to safeguard environmental and human health while fostering sustainable development. The CEPA establishes guidelines and standards to control pollutants and target water quality, including mandating the monitoring and regulation of contaminants, setting limits for chemical substances in water, and supporting the development of technologies and practices that minimize environmental impact. Through programs like the National Pollutant Release Inventory (NPRI), CEPA also requires reporting on various substances to aid tracking and manage pollutants that could affect water storage processes.

Relevance to this Project: While the CEPA does not directly apply to municipal water storage, it influences provincial policies by setting guidelines and standards for water quality. This facilitates water storage processes to adhere to high environmental and health standards, guiding the control and monitoring of pollutants in our operations.

3.1.2 Migratory Birds Convention Act

The Migratory Birds Convention Act (MBCA), originally enacted in 1917 and revised in 1994 and 2005, aims to safeguard migratory birds, their nests, and eggs. This legislation enforces the Migratory Birds Convention between Canada and the United States and is administered by Environment Canada. The Act specifies protected bird species and regulates activities that might affect them, including restrictions on when and where such activities can take place.

Relevance to this Project: The project area may provide habitat for migratory and nesting birds, making adherence to the MBCA important to for the protection of these species during project activities.

3.1.3 Species at Risk Act

The Species at Risk Act (SARA) is a key piece of federal legislation designed to prevent the extinction and extirpation of wildlife species in Canada, facilitate their recovery, and protect their habitats. Administered by Environment Canada, the Act identifies species at risk through the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), which

uses scientific data to assess the status of wildlife species and their habitats. Once a species is listed under Schedule 1 of SARA, it is afforded legal protection, including mandatory recovery planning and the prohibition of activities that could harm the species or its critical habitat.

Relevance to this Project: The project must consider compliance with SARA, as it involves areas that may support both terrestrial and aquatic species at risk. This requires thorough environmental assessments and mitigation measures to avoid or minimize impacts on these species and their habitats, potentially necessitating permits under the Act.

3.2 Provincial

3.2.1 Planning Act

The Planning Act governs land use planning in Ontario by detailing how land use can be managed within communities and specifying the roles of provincial and municipal governments. Provincially, there is also the provision of advice on land use planning issues. At the municipal level, the Township are responsible for making decisions on community planning, preparing planning documents like Official Plans and Zoning By-Laws, and attempting to algin local planning with provincial plans. Additionally, these municipalities are tasked with implementing land use controls and approvals as outlined by provincial guidelines.

Relevance to this Project: The Planning Act is relevant to this water project in Cavan Monaghan as it governs land use planning and ensures that local planning decisions, including those related to the project, are consistent with provincial policies and regional plans.

3.2.2 Provincial Planning Statement

The Provincial Planning Statement (PPS) provides policy direction on matters of provincial interest related to land use planning and development. The PPS emphasizes the need for infrastructure to be planned and implemented efficiently and cost-effectively, with due consideration for climate change. It requires that infrastructure be financially sustainable throughout its lifecycle and meet both current and future needs while making the most of existing facilities before constructing new ones. Specifically, the PPS advocates for the efficient use and optimization of existing municipal water and wastewater services to support anticipated growth, in an effort to see that systems are sustainable, compliant with regulations, and protective of both human health and the environment. It also promotes

water conservation and integrates servicing and land use considerations throughout the planning process.

Relevance to this Project: The Provincial Planning Statement emphasizes optimizing existing infrastructure, promoting financial sustainability, and protecting both human health and the environment. It also highlights the importance of integrating water conservation and efficient land use in the planning process.

3.2.3 Ontario Heritage Act

The Ontario Heritage Act (OHA) empowers both provincial and municipal authorities to protect significant cultural and historical sites, including buildings, landscapes, and archaeological resources. Managed by the Ministry of Citizenship and Multiculturalism (MCM), the Act mandates that any impacts on these heritage resources be avoided or minimized.

Relevance to this Project: In accordance with the Class EA, investigations have been conducted to identify any potential cultural heritage resources in the area, so that the chosen project alternative will not adversely affect these resources.

3.2.4 Endangered Species Act

The Endangered Species Act (ESA), established in 1971 and updated in 2008, is designed to protect plant and animal species that are at risk of disappearing from Ontario. Similar to the federal Species at Risk Act (SARA), the ESA aims to preserve these species by listing them as endangered or threatened based on assessments by the Committee on the Status of Species at Risk in Ontario (COSSARO). Once approved by the provincial Ministry of Natural Resources and Forestry (MNRF), these species receive immediate habitat protection.

The ESA outlines procedures for assessing whether human activities, such as construction, could adversely impact these regulated species. It considers the species' biology, behavior, and the potential effects of the activity on their ability to complete essential life processes.

At the time of the writing of this report, the ESA is planned to be superseded by the Species Conservation Act (SCA). As the SCA is not yet in force, the ESA is used as reference for this report.

Relevance to this Project: The Local Study Area may contain both terrestrial and aquatic species at risk. Therefore, it is crucial to assess and mitigate potential impacts to these

species in compliance with the ESA. The project may require permits or be subject to specific regulatory exemptions under the Act.

3.2.5 Ontario Water Resources Act

The Ontario Water Resources Act (OWRA) is a key piece of legislation aimed at managing and protecting the province's water resources. It provides the framework for regulating the use of water, including permits for water withdrawals and discharges. The Act also addresses water pollution and the allocation of water resources for sustainable usage.

Relevance to this Project: The recommended water storage facility must comply with the Ontario Water Resources Act only if there is overflow discharge, or draining discharge of the water storage tank, by securing necessary permits for water use and discharge. It is essential for water withdrawals and any discharges from the storage tank to meet regulatory requirements and to not negatively impact water quality or availability.

3.2.6 Environmental Protection Act

The Environmental Protection Act (EPA) is a cornerstone of Ontario's environmental legislation, aimed at preventing pollution and protecting environmental quality. It establishes regulatory frameworks for controlling emissions into the air, land, and water. The EPA sets limits on contaminants that can be released into the environment, including standards for wastewater discharges and air emissions. It also oversees the management of waste, including the handling and disposal of hazardous materials. The Act makes an effort for all activities potentially impacting the environment, including those related to water storage, to adhere to strict pollution control standards and contribute to the maintenance of environmental health.

Relevance to this Project: The recommended water storage facility must comply with the EPA such that effluents and discharges meet the regulatory standards for pollution control and protect environmental quality.

3.2.7 More Homes Built Faster Act

The More Homes Built Faster Act, enacted on April 14, 2022, aims to significantly boost Ontario's housing supply by facilitating the construction of 1.5 million new homes over the next decade. This Act builds on prior housing strategies and introduces measures to streamline development processes. It targets the reduction of bureaucratic inefficiencies and encourages denser development near transit hubs. Notably, the Act also amends various statutes to expedite housing construction and enhance affordability. Relevant sections of the Act include:

Section 5 – Zoning By-Law Reforms: This section allows for more flexible zoning regulations, which could impact the allocation of land for public utilities, including water storage facilities, and facilitate their integration into new developments.

Section 7 – Development Charges Reforms: This section addresses the reduction of development charges, potentially affecting the financial feasibility and planning of new infrastructure, including water storage systems, in rapidly growing areas.

Relevance to this Project: The More Homes Built Faster Act's provisions for streamlining development approvals and zoning reforms could impact the integration of water storage facilities within new housing developments, potentially affecting project planning, timelines, and regulatory compliance.

3.3 Regional and Municipal Legislation and Policy

3.3.1 Township of Cavan Monaghan Official Plan

The 2021 Official Plan of Cavan Monaghan provides a framework for managing growth and development in the Township while preserving its cultural and natural heritage. This plan is instrumental in guiding land use decisions, infrastructure development, and environmental protection measures. The Official Plan sets out policies to consider sustainable development, promote economic growth, and enhance the quality of life for residents.

Relevance to this Project: The increased water storage Class EA must align with the Official Plan's policies for sustainable development is sustainable that does not compromise the Township's environmental and cultural heritage. The project must consider land use designations, environmental constraints, and community growth projections outlined in the plan. Additionally, infrastructure improvements related to water storage must support the Township's goals for sustainable development and resource management.

4.0 RELATED INVESTIGATIONS AND STUDIES

4.1 List of Studies

The following documents were reviewed in the development of this Class EA report:

- Township of Cavan Monaghan Official Plan (Official Plan) Consolidated Version with Amendments 2021)
- 2021 Cultural Heritage Report, Archaeological Services Inc.
- 2023 Hydrogeological Study for Township of Cavan Monaghan, Thurber Engineering Ltd. (2023 Hydrogeological Study)
- 2024 Archaeological Assessment Cavan-Monaghan MSS, Archaeological Services Inc. (2024 Archaeological Study)
- 2024 Water and Wastewater Master Servicing Study, RVA (MSS)
- 2025 Stage 1-2 Archaeological Assessment Fallis Line and County Road 10, Log 12, Concession 6, Amick Consultants Limited;
- 2025 Natural Constraints Letter, GHD
- 2025 Hydrogeological & Geotechnical Assessment, GHD
- 2025 Phase One Environmental Site Assessment, GHD
- Future development areas as identified in the MSS project.

4.2 Official Plan

The Official Plan provides the following directions for new infrastructure being implemented in response to growth:

- New infrastructure and expansions to existing infrastructure is to align with adjacent land uses and limits social and environmental impact;
- Infrastructure that is energy efficient, promotes water conservation and water efficiencies and limits impacts to air quality is encouraged; and
- The Township's agricultural and cultural heritage resources are to be protected.

The Official Plan also provides the following maps of the Millbrook Settlement Area as per the Growth Management Study which will be used for determining the preferred location of the water storage tank in this Class EA.

1. Map Schedule A-1: Land Use and Transportation map provides designated lands within the Settlement Area boundary of Millbrook as per the Growth Management Study, including potential future development areas that will need to be connected to the Millbrook Drinking Water System (DWS);
2. Map Schedule B-1: Natural Heritage Systems and Environmental Constraints provides areas designated as hazard lands, wetlands, woodlands and flood plain areas. The proposed solution will need to consider minimum impact to these significant areas; and
3. Map Schedule C: Development Constraints map provides locations within Millbrook that may limit development opportunities due to existing environmentally vulnerable or sensitive areas.

4.3 2021 Cultural Heritage Report

The Cultural Heritage Report: Desktop Collection Results, reporting Millbrook's built heritage resources and cultural heritage landscapes was conducted by Archaeological Services Inc. as part of the MSS. Eight potential cultural heritage landscapes (CHLs) were identified within the study area. Only one CHL, CHL 6 - is within the potential locations for the water storage tank (Location #2 in **Figure 4-1**). CHL 6 is the Grace Presbyterian Cemetery located at the northwest corner of County Road 10 and Fallis Line Intersection. Measures to protect CHL's in Location #2 would need to be taken should that site be chosen as the preferred alternative. CHLs such as the Gardiner's Cemetery (CHL 4) and a three farmscapes (CHLs 1, 2 and 3) are roughly half a kilometer from Location #3, and mitigating against moving closer to those CHLs should be noted.

The full report is included as **Appendix 7**.

4.4 2023 Hydrogeological Study

The desktop study was completed as part of the MSS and comprised of reviewing the existing hydrogeological information to support construction of new water supply and servicing infrastructure. The study area included properties outside the boundary of Millbrook, the existing location of the Millbrook WTP, and the Millbrook Wellfield.

The following specific locations based on the corresponding investigations will be considered for the purposes of this Class EA:

1. Hydrogeological investigation conducted at site 825 Fallis Line by GHD as part of the Proposed Residential Development in 2017. The site is within the vicinity of Location #2 and, as such, its hydrogeological conditions can be used for preliminary understanding of the conditions in Location #2. The study found that the stratigraphy consisted of topsoil overlying very loose to very dense till, ranging in composition from silty sand to silty clay. Water level depths in the monitoring wells and piezometers were from 0.9 to 4.8 m.
2. 2014 Geotechnical investigation report for Water Tower and Servicing prepared by Geo-Logic for 988 County Road 10 (Township Municipal Office), Millbrook. This area is located within Location #2. The report indicated that the stratigraphy at the site consisted of topsoil overlying silty sand till in the area of the then proposed water tower and asphalt over fill, overlying gravelly sand to sandy silt till within the proposed servicing areas. Groundwater was measured in open boreholes at depths ranging from approximately 1.1 to 2.6 m below grade.

The study also detailed potential impacts of construction dewatering, including settlement of nearby structures and utilities and reduction of groundwater flow to groundwater users and watercourses. A pre-construction survey within the radius of influence and a monitoring plan is recommended to be undertaken at the location selected for the proposed water storage facility.

The full report is included in **Appendix 4**.

4.5 2024 Stage 1 Archaeological Assessment

A Stage 1 Archaeological Assessment of Millbrook's archaeologically significant sites was conducted by Archaeological Services Inc. as part of the MSS. A few of these sites fall within the potential Location #4 for the water storage tank. The report notes that these sites retain archaeological value or interest. If Location #4 is chosen as the preferred location, then further archaeological studies may be required to confirm actual presence of cultural heritage and archaeological items of interest.

The full report is included as **Appendix 6**.

4.6 Master Servicing Study

The following analysis was completed as part of the MSS:

1. Forecasting population growth to the year 2051 using year 2021 as baseline year due to it being the most recent year where Statistics Canada data on population was available at the time of writing the report;
2. Analysing historical per capita water usage from 2019 – 2021;
3. Using the above information to project water demand and required water storage to the study horizon of 2051;
4. Identifying servicing constraints resulting from growth and development; and
5. Determining the recommended strategy that will address the identified constraints and allow the Township to meet existing and future water demand.

The study showed that Millbrook's required water supply and water storage will be in deficit before the study horizon of 2051. To continue accommodating growth, both water quantity and water storage will need to be expanded. Table 4-1 provides a summary of the parameters used in the study which will be used as a basis for this Class EA.

Table 4-1: Parameters from Master Servicing Study

Parameter	Value
Projected Residential Population 2051	10,455
Projected Total Employees 2051	3,983
Per Capita Average Day Water Demand (litres/capita/day (lpcd))	270
Maximum Day Factor (ratio of Maximum Day Demand to Average Day Demand)	2.0
Fire Flow Rate (l/s)	220
Fire Flow Duration (hours)	3

Based on the above results and to commence this Class EA, a map showing areas of high elevations that may become potential location for an additional water storage facility was developed by RVA and is shown in **Figure 7-1**.

These areas will be further studied in this Class EA, and a suitable location was selected based on the findings from the other background reports. The findings are summarized in the following sections.

4.7 2025 Stage 1-2 Archaeological Assessment

A Stage 1-2 Archaeological Assessment was completed by Amick Consultants Limited for Lot 12, Concession 6 (Location #3 in **Figure 7-1**) within the Township. The study included desktop review of historical usage of the area, a pedestrian survey and test pit survey to confirm the archaeological potential of the area.

During the test pit survey of the south end of the site a total of 12 artifacts were found in 2 isolated findspots as well as 28 artifacts found through 7 isolated test pits including intensified by 1 metre by 1 metre test units. After analysis of the artifacts was completed, it was determined that the Cultural Heritage Value or Interest Value (CHVI) of the isolated finds had been completely documented and were removed from the study area as a result of the standard Stage 2 Property Assessment Procedure. There was no remaining CHVI for the site and no further archaeological assessment of the site is warranted.

During the test pit survey of the north end of the site, no artifacts or archeological sites were found. Consequently, it was recommended by the reporting that no further archaeological assessment of the study area is warranted.

Both the reports for the north and south are not available in the appendices due to third party rights. They are available upon request.

4.8 2025 Natural Conditions & Constraints Letter

A letter describing natural environment conditions and constraints was completed by GHD for Vargas P Inc. in support of a proposed commercial and residential development at the location of Lot 13, Concession 6 (includes Location #3 in **Figure 7-1**), within the Township.

The letter concludes that at the time of writing through desktop research, no provincially significant wetlands or areas of natural or scientific interest (ANSIs) were found on site or within 120 metres of adjacent lands. The Cavan Creek tributary, which functions as a direct fish habitat is present within the study area boundaries. The letter recommends that the

area be protected with a 30-metre setback, and that any near or in-water works are reviewed by a qualified biologist to avoid potential impacts and identify required permits. For areas in and within the 30-metre setback from the tributary, permitting from Department of Fisheries and Oceans (DFO) may be required.

Watercourses, unevaluated wetlands and natural linkage areas were noted in the study area which will be further evaluated by GHD through their ongoing Environmental Impact Study (EIS).

The full letter is included as **Appendix 5**. It should be noted that although there are setback and permitting requirements recommended to protect the identified tributary of Cavan Creek in the study area of the study area for the Natural Conditions and Constraints Letter, alternative Location #3 in the Class EA is outside of the 30m setback recommendation.

4.9 2025 GHD Hydrogeological & Geotechnical Assessment

A Hydrogeological and Geotechnical Assessment was completed by GHD for Vargas P Inc. in support of a proposed commercial and residential development at the location of Lot 13, Concession 6 (Location #3 in **Figure 7-1**), within the Township. The scope of work included a desktop review of available geological and groundwater mapping; a review of the Source Protection Information Atlas; a review of the Ministry of Environment Conservation and Parks (MECP) well records; the drilling of boreholes and excavation of test pits to investigate subsurface conditions; installation of monitoring wells to facilitate water level measurements; completion of a single well response testing to assess hydraulic connectivity of the saturated zones and a computed generic water balance evaluation to establish groundwater infiltration target in support of Low Impact Development strategies (LIDs).

For the purposes of proposed water storage and water infrastructure in the lot studied, the report concludes that underground municipal watermains can be founded on either undisturbed or native soils or a prepared fill subgrade. The suitability of native soils to support buried services will need to be verified by a qualified geotechnical engineer on-site during the design and later installation of such works. Additionally, buried services will be supported on conventional well-graded granular bedding.

Groundwater seepage should be expected during excavation for site services, but dewatering is expected to be effective in the case of groundwater seepage. The reporting additionally recommends trial excavations during construction to determine soil behavior and the extent of dewatering works required.

The full report is included as **Appendix 4**.

4.10 2025 GHD Phase One Environmental Site Assessment

A Phase One Environmental Site Assessment was completed by GHD for Vargas P Inc. in support of a proposed commercial and residential development at the location of Lot 13, Concession 6 (Location #3 in **Figure 7-1**), within the Township. The scope of the Phase One Environmental Site Assessment included site reconnaissance activities, review of surrounding land uses and review of historical documentation. Potentially Contaminating Activities (PCAs) were identified within 250 metres of the study area for the Environmental Site Assessment, at the adjacent County of Peterborough Roads Department for fuel tanks and a dome for sand/salt storage. Upon further review, no spill records from the adjacent lot were found and local groundwater flow direction as inferred to be pointing away from the study area property. The report concluded that the PCAs do not result in areas of potential environmental concern on the study area property, as well as no further Environmental Site Assessment is required.

5.0 MILLBROOK DRINKING WATER SYSTEM

5.1 Drinking Water Treatment Plant

The Village of Millbrook is supplied with drinking water from the existing municipal well site located at 86 King St West, just west of the Turner St. and King St. West intersection. Groundwater is supplied from three wells, each equipped with a submersible vertical turbine well pump. Water treatment comprises of sodium hypochlorite for disinfection with contact time provided in a chlorine contact pipe.

Storage is provided by a Water Storage Standpipe located at 988 County Road 10 by the Township Municipal Office. It has a capacity of 2,600 m^3, of which only 2,115 m^3 is considered usable storage as the remaining volume does not provide adequate pressure to the distribution system. To provide adequate pressure and fire flow to the new subdivisions near Fallis Line, a BPS was installed in 2016 located at 988 County Road 10.

Table 5-1 lists the DWS's infrastructure and associated capacities.

Table 5-1: Millbrook DWS Capacities

Infrastructure	Capacity	Source
Water Treatment Facility		
WTP Rated Capacity	3,000 m^3/day	MDWL# 136-101[1]
Max Water Taking (per day)	3,000 m^3/day (34.7 L/s)	

Infrastructure	Capacity	Source
Max Water Taking (per minute)	1,500 L/min (25 L/s)	PTTW# 1150-CZXQTQ
Submersible Vertical Turbine Pumps (x 3; one in each well)	34.7 L/s[1] at 64.0 m TDH	DWWP# 136-201[1]
Chlorine Contact Pipe	71.0m x 900 mm dia.	
Supply Firm Capacity	3,000 m^3/day	Largest well pump out of service
Water Distribution System		
Storage Standpipe	2,600 m^3	DWWP# 136-201[1]
Usable Storage Standpipe	2,115 m^3	
Booster Pump Station (2 duty, 1 standby)	11 L/s at 28 m TDH	DWWP# 136-201[1]
Vertical in-line Centrifugal High Flow Pumps (1 duty, 1 standby)	120 L/s at 28 m TDH	

1: Drinking Water Permit dated 2021

5.2 Water Demand and Storage Requirements

Water storage requirements depend on serviced population and historic water consumption trends. Per the MSS report, the projected residential population is 10,455 in 2051, and 3,983 total employees in 2051. Assuming that a percentage of the employees will also be residents in Millbrook and their water usage would already be accounted for based on the residential population, it was considered that that three employees' water demand needs combined would equal to one resident's water use. Therefore the equivalent residential population is projected to grow to 11,783 by 2051. It is assumed growth is linear from 2021 to 2051.

Since the water demand projections in the MSS are based off data up to year 2021, the projections were re-checked with 2022 and 2023 data obtained from the Annual Water Reports from the Township's website.

Historical average water demand and associated per capita consumption from the serviced population in 2019-2023 is shown in Table 5-2. For further information refer to Technical Memorandum #1 – Existing Conditions, Design and Analysis Criteria.

Table 5-2: Findings for Historical Water Demand Based on 2019-2023 Data

Demands	Values

Average Day Demand (2019-2023 Historical Average)	236 lpcd
Max. Day Factor (2019-2023 Historical Average)	1.9
Max. Day Demand (2019-2023 Historical Max)	1,796 m^3/day

The Maximum Day Factor provided by the MECP guidelines for the population ranging from 10,001 to 25,000 is also 1.9. Consequently, the Maximum Day Factor used for projecting demand to 2051 is 1.9, updated from the MSS Maximum Day Factor of 2.0.

The Township provided RVA with updates to known development plans in January 2025, which were not available during the 2024 MSS. The Township provided RVA with further updates to these plans in February 2025 and October 2025. These subdivision development plans are approved or anticipated by the Township and, therefore, are required to have municipal water supply capacity committed to them per the **MECP D-5-1 Regulation**, summarized as:

'It is the position of the Province that the number of lots in approved plans of subdivisions, developments committed by virtue of approved zoning, new official plans or site-specific official plan amendments, should not exceed the design capacity of the sewage and/or water system. In order to ensure that capacity is not exceeded it is necessary to determine what uncommitted reserve capacity is available.'

As of 2023, the uncommitted hydraulic reserve capacity of the system (prior to approving the approved or anticipated developments) was 3000 m^3/day – 1,796 m^3/day = 1,204 m^3/d. Based on a per capita consumption of 270 lpcd and a Maximum Day Factor of 1.9, this translates to roughly 2,340 additional people that can be supported by the existing DWS.

Table 5-3 lists the projected populations and water demands for the known subdivision developments (henceforth referred to as approved or anticipated developments in this report). Water demand is calculated by multiplying population for each known development by 270 lpcd and a Maximum Day Factor of 1.9. Commercial development demands are based on an average day demand of 28 m^3/hectare/day and a Maximum Day Factor of 1.9. For further details refer to Technical Memorandum #2 – Water Demand and Storage Analysis based on Approved or Anticipated Developments.

Table 5-3: Population and Water Demand in Approved or Anticipated Developments

Location	Population	Max Day Water Demand (m^3/day)

Residential Developments		
Towerhill North	2,180	1,120
Vargas	920	470
Fallis Line (west of Highlands Blvd) (CSU)	2,030	1,050
Towerhill North (west of School Block)	550	290
Fallis Line North (east of County Road 10) (Vargas North)	1,620	830
Commercial Developments		
963 County Road 10 (north of Fallis Line and east of County Road 10)	9 hectares	480
Institutional Development		
School - Towerhill North	590	300
Total		
Total from Approved or Anticipated Developments	**7,890**	**4,540**

Note: All figures rounded to the nearest 10th

Based on the MECP "Design Guidelines for Drinking-Water Systems", the total treated water storage requirement can be calculated using the formula A + B + C, where:

A = Fire Storage in m^3 (calculated using Table 8-1 from the MECP design guidelines for an equivalent population at a certain suggested fire flow (L/s) for a certain number of hours)

B = Equalization Storage in m^3 (25% of max day demand)

C = Emergency Storage in m^3 (25% of (A + B))

Table 5-4 shows the total water demand and water storage requirements for Approved or Anticipated Developments + Existing Population (as of 2023). This is the water demand and storage required if the Township is to meet the needs of its existing residents and employees as well as the needs of all approved or anticipated developments.

Table 5-4: Water Demand And Storage Requirements for Approved or Anticipated Developments + Existing Population (as of 2023)

Parameter	Value
Total Serviced Population (Existing Population + Approved or Anticipated Developments) (people)	11,213
Maximum Day Demand (m^3/day)	6,336

Fire Flow Storage (m^3)	2,376
Equalization Storage (m^3)	1,584
Emergency Storage (m^3)	990
Required Water Storage to account for Approved or Anticipated Developments + Existing Population (m^3)	**4,950**
Current Available Storage (m^3)	2,115
Storage Deficit (based on Approved or Anticipated Developments, m^3)	**-2,835**

Table 5-5 shows the total water demand and water storage requirements required to meet the needs of all residents and employees to 2051.

Table 5-5: Existing and Future Water Demand Data (up to 2051)

Parameter	Value
Total Serviced Population to 2051 (people)	10,455
Total Number of Employees by 2051 (people)	3,983
Maximum Day Demand[1] (m^3/day)	6,445
Fire Flow Storage (m^3)	2,376
Equalization Storage (m^3)	1,611
Emergency Storage (m^3)	997
Total Water Storage Volume Required for 2051 demands (m3)	**4,984**
Current Available Storage (m^3)	2,115
Storage Deficit (based on 2051 demands, m^3)	**-2,869**

Note 1: 2051 MDD = 2023 MDD of 1,796 (largest historical MDD from 2019-2023) + the projected additional water demand from 2021 to 2051 which is approximately 4,650 m^3/day. Refer to Technical Memorandum #1 for calculation details.

Therefore, based on the water storage volume calculated for both the presently approved or anticipated developments and forecasted into 2051, the required total water storage volume for Millbrook is 4,984 m^3 and the additional storage volume is 2,900 m^3 (rounded). It should be noted that this Class EA is only for the additional water storage and that another separate Class EA will need to be undertaken to address the additional water demand.

As seen in Figure 5-2 required water storage will reach 85% of the current storage capacity by 2025 and will exceed the useable volume capacity by 2028 (assuming the development

progress continues as forecasted during the MSS). Industry best practice recommends planning for the additional storage now and have it completed before/by 2028.

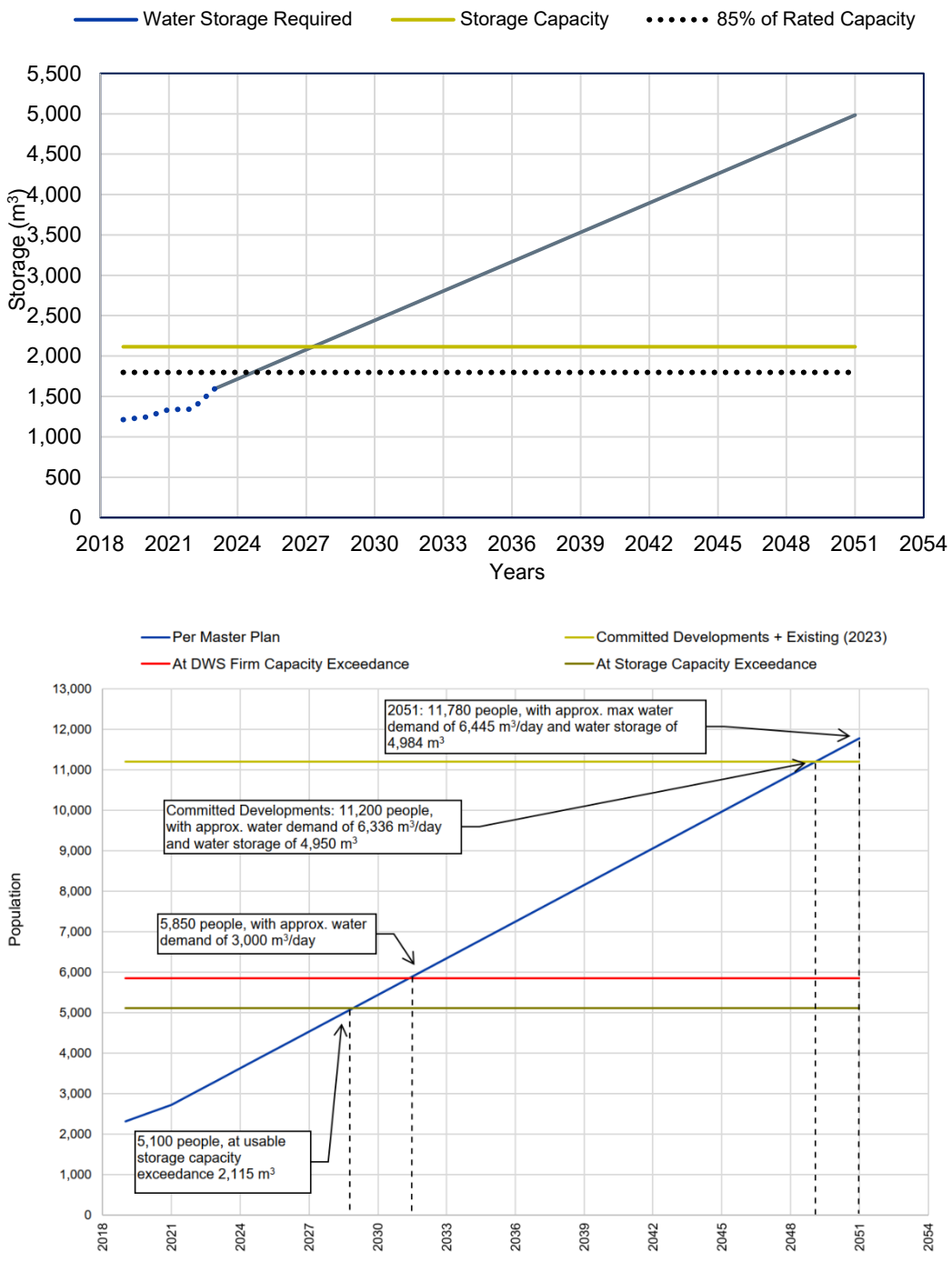


Figure 5-1 Millbrook Water Storage Need Projections to 2051

6.0 CURRENT AND FUTURE PRESSURE ZONES

The high and low ground elevations of key areas within the Millbrook Settlement Boundary are shown in **Figure 6-1**. This helps to understand which areas need to be within which pressure zone in order to provide sufficient pressure to that area. The intention of **Figure 6-1** is not to list out all considered developments, but only the developments where the key watermains along King St or County Road 10 (Tupper St) connect to (either currently or possibly in the future).

The already developed and considered development areas are shown in **Figure 6-2**. This includes the area where the municipal wells are located (at 86 King Street), to where the existing standpipe and Booster Pumping Station are located (by the Municipal Office), all the way until the northern border of the Millbrook Settlement Boundary Area, at Tupper Street (County Road 10) and Highway 115 (shown as Area N in the graphic in **Figure 6-2**). A full-sized version of **Figure 6-2** is available in **Appendix 8**.

The current standpipe, located at 988 County Road 10, has a high-water level of 278 meters. A conservative head loss of 3 meters was calculated between the wells and the standpipe, utilizing a C-factor of 100, along with a length of 1800 meters and additional relevant parameters. At the wells, the total dynamic head is 64 meters (as per the Drinking Water Works Permit), indicating that the standpipe can be filled by the wells, provided the groundwater level remains at or above 216 meters.

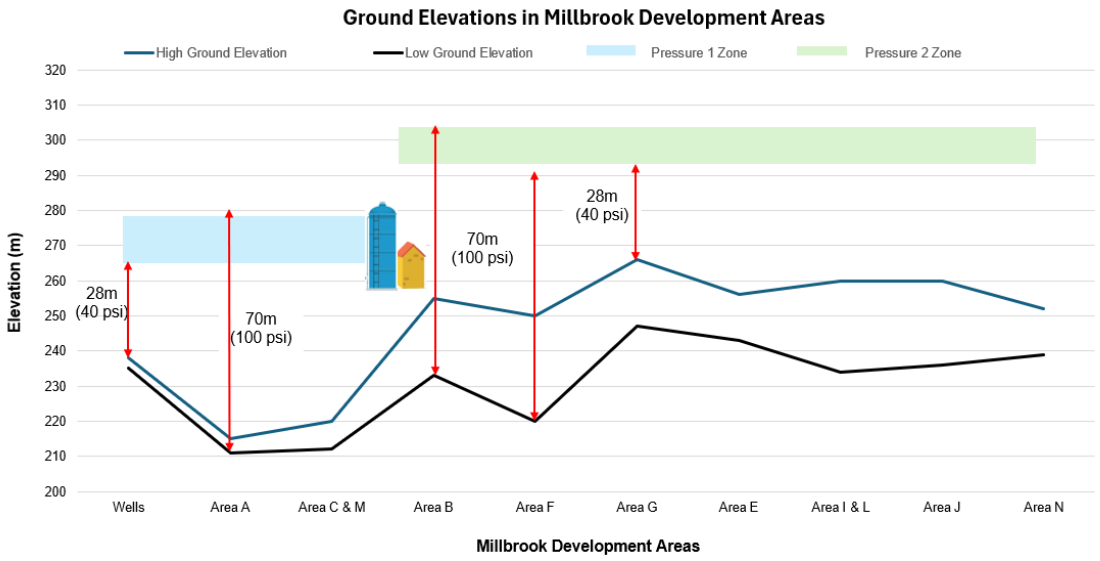


Figure 6-1: Ground Elevations and Pressure Zones for Millbrook Development Areas

According to the Ministry of the Environment Conservation and Parks (MECP) guidelines, a pressure range of 28-70m (40-100 psi) is deemed suitable for water distribution, with ideal pressure ranges being closer to 35-49m (50-70 psi). However, with the vastly varying topographies in Millbrook, achieving that narrow pressure range would be difficult without many more pressure zones. During a fire scenario, pressure is allowed to be as low as 14m (20 psi). As illustrated by the two-coloured rectangles (light blue and light green), the development areas are clustered within 2 pressure zones (Pressure Zone 1 and 2). Pressure Zone 1 (PZ1;elevation range shown in **Figure 6-1** with light blue rectangle) is the Millbrook Built-Up Area (i.e. downtown core and some developments nearby that area. The standpipe acts as floating storage for PZ1 and the water level in the standpipe dictates the pressure for PZ1. Pressure Zone 2 (PZ2; elevation range shown in **Figure 6-1** with light green rectangle) is where the new developments around Fallis Line and the Municipal Office are located. PZ2 is fed by an existing Booster Pumping Station (BPS) that is beside the existing standpipe by the Municipal Office. At the same time, the standpipe provides water for the BPS, but it is the BPS that dictates the pressure for PZ2.

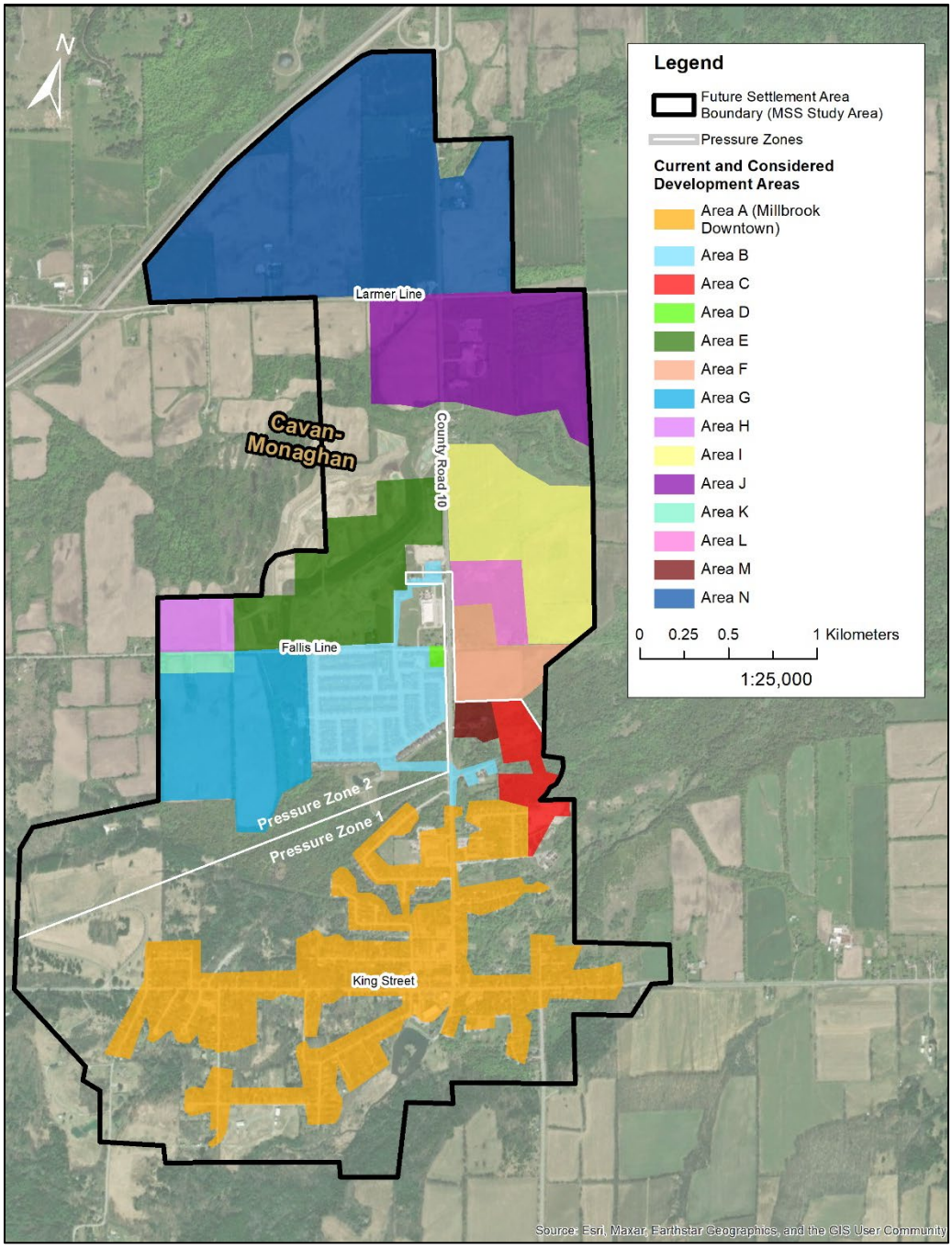


Figure 6-2: Current and Considered Development Areas in Millbrook

Notably, three development areas need special attention in order to fit within one of these two pressure zones, namely Development Areas C, F and M, shown in **Figure 6-2.**

Although Development Areas C, F and M are geographically close together and currently owned by the same developer, there are drastically different elevations between these areas, as shown in **Figure 6-1**. Development Area C have lower ground elevations, similar to that of the Millbrook downtown core and belongs to Pressure Zone 1 but steeply rises as

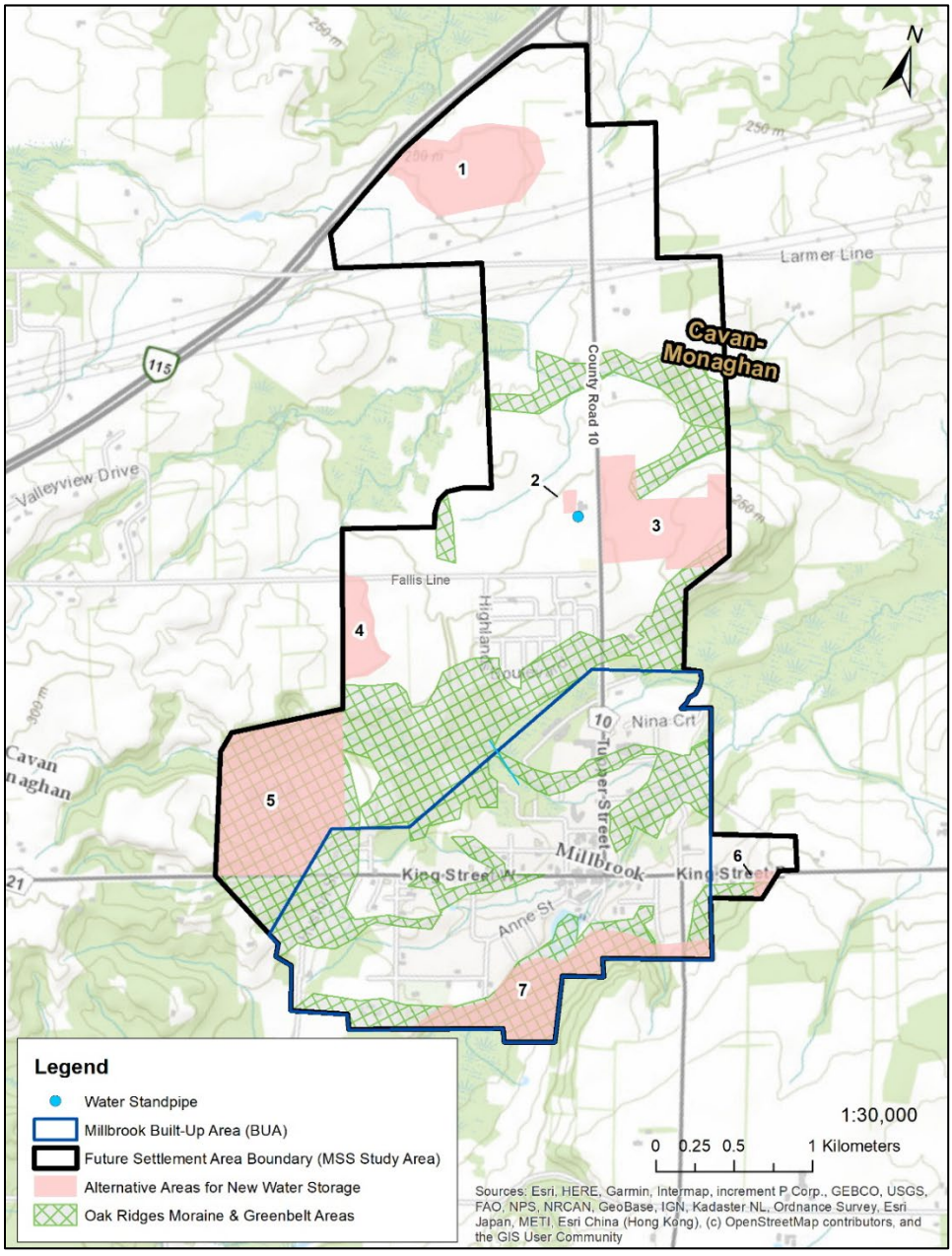
it heads north. Development Areas F and M have higher elevations and wider range of elevations within its property. The highest pressure range in Pressure Zone 1 would not have enough pressure for Development Area F and M. This would require Development Areas F and M to be serviced by the Pressure Zone 2 instead of Pressure Zone 1. However, the lowest elevation within Development Areas F and M may be 'over pressurized' by Pressure Zone 2 and therefore may need those lower elevation areas to be serviced by pressure reducing valve(s) to bring the pressure within MECP guidelines. This would need to be further considered once the development plans and grading for these development areas are better known.

7.0 ALTERNATIVE LOCATIONS FOR STORAGE FACILITY

7.1 Alternative Locations

Figure 7-1 is a Map of Millbrook and shows the existing built-up area and new settlement area boundary. It also marks the location of the existing storage standpipe and the seven areas (shaded in pink) identified in TM#1 as the longlist of possible water storage facility locations. A full-sized version of the map is included as **Appendix 8**.

Figure 7-1: Millbrook Study Area and Long Listed Location Alternatives



7.1.1 Location #1

Location #1 is north of Larmer Line and adjacent to Highway 115. This corresponds with Development Area "N" in **Figure 6-2**. This site is zoned for agricultural use and is planned for future urban employment. Its proximity to major transportation corridors offers good accessibility industrial and commercial land uses. Future developments in Millbrook may extend up to this location, but the timeline for development in this area is currently unknown. Ground elevations in this area reach approximately 250 metres, resulting in this area belonging to Pressure Zone 2. There are currently no municipal water services in this area, and the current water distribution network does not extend to this area. In order to service this area, an extension of the existing watermain by 1-2 km would be required. Prior to detailed design and construction of a new water tank at Location #1, completion of natural environment, archaeological and cultural heritage studies as well as property acquisition by the Township would be required.

7.1.2 Location #2

Location #2 is situated near County Road 10 and Fallis Line, this location contains the Municipal Township office and the existing standpipe and booster pumping station. This location would be close to planned residential and institutional development areas "B" and "E" in **Figure 6-2**. This site is close to the center of major development growth, making it strategically positioned for servicing future growth in the Millbrook. Location #2 is at one of the highest points of elevation in the settlement area boundary and is central to both the existing population in south Millbrook and future population in North Millbrook. The elevation ranges between approximately 250 and 260 metres. Therefore, this area would belong to Pressure Zone 2. Property acquisition would not be required for this site as it is currently owned by the Township. It was previously cleared of natural environment, archaeological and cultural heritage potential by the previous developments on the site. However, this location poses several problems:

1. Township staff had noted there would be limited space for a second storage facility on the remaining property
2. Having two (2) storage tanks on the same site would be a risk to Pressure Zone 2 in case there were key watermain break(s) or BPS issues that would prevent water from the municipal wells to get to these storage tanks and BPS, or out to distribution. This would leave Pressure Zone 2 vulnerable to lack of water storage. Having the second storage tank at Location #2 will not be as beneficial to Millbrook

from a 'storage' resiliency and redundancy perspective compared to having it located elsewhere in town.

7.1.3 Location #3

Location #3 is east of County Road 10 and north of Fallis Line. This site is close to planned residential and commercial developments (Areas "F", "I" and "L" in **Figure 6-2**), making it strategically positioned for servicing future growth in the Township. The existing preliminary natural constraints letter, topographic survey, Phase 1 Environmental Site Assessment (ESA), archaeological and cultural heritage studies were completed by the developer for their development. The results of those studies indicated that the area does not have archaeological or cultural heritage potential. Additionally, the preliminary natural constraints letter noted a lack of environmentally sensitive features across most of the site. The Phase 1 ESA did not note anything of concern. These already completed studies allow for quicker implementation process directly into the design stage after the Class EA is completed. This would be an advantage given how quickly the new water storage tank is needed and to meet the funding deadlines. While property acquisition is required, and may be costly, the site provides opportunities for infrastructure integration and long-term expansion, as well as the timeline which the developer is planning to build is in line with the timing needed for the new water storage. Initial discussions between the Township and the developer on property acquisition have been positive. Ground elevations at Location #3 range from approximately 240 to 250 metres, making this suitable for Pressure Zone 2.

7.1.4 Location #4

Location #4 is positioned west of County Road 10 and south of Fallis Line. This corresponds with Development Areas "G" and "K" in **Figure 6-2** and are planned for residential land use. This site is not as centralized to future growth areas identified in the Growth Management Study. Property acquisition would be required for this site, and the site is currently an active farm, making the acquisition costly. Natural environment, archaeological and cultural heritage studies will be required for this property. Ground elevation in this area ranges from approximately 240 to 250 metres, which would be Pressure Zone 2.

7.1.5 Location #5

Location #5 is northwest of Millbrook's Built-Up Area and close to the existing municipal wells. However, this site falls within the Millbrook Natural Heritage System and the Oak Ridges Moraine and is not centralized to future development in Millbrook. Some of the area within this site is the former Millbrook Correctional Facility lands which are currently owned

by Infrastructure Ontario (IO) and would be subject to additional studies and remedial actions to make it usable. Ground elevations in Location #5 range from approximately 250 to 275 metres. Although this would make it suitable for Pressure Zone 2, the existing water distribution network for Pressure Zone 2 does not reach this area (due to the Oak Ridges Moraine). The existing municipal well facilities are not able to provide the pressures needed to service this area unless upgrades are done to the well pumps.

7.1.6 Location #6

Location #6 is situated on King Street on the southeastern edge of the Millbrook Built-Up Area (Development Area "A" in **Figure 6-2**). This site houses the decommissioned Millbrook standpipe. The ground elevation in this area ranges from approximately 260 metres, making it suitable for servicing the southern end of the settlement area boundary (i.e. Pressure Zone 1) by gravity. However, as noted in TM 2 there are several factors that hinder this location from being the preferred location for a new water storage tank. The existing property is owned by the Township; however, this site has space constraints and shares a common driveway to a private residence. Significant impact to this private residence can be expected during construction. The Township may need to acquire more land from a nearby property to support a new water storage facility on this site. Natural environment, archaeological and cultural heritage studies would need to be completed for any areas purchased. In addition, due to this location being far from Pressure Zone 2 and the watermain from the new storage tank here will need to pass through Pressure Zone 1, this location would need a booster pumping station and a dedicated transmission main (with no local connections to Pressure Zone 1) to feed Pressure Zone 2. Alternatively, if this location was to only feed Pressure Zone 1 and not Pressure Zone 2, then the existing standpipe by the Municipal Office does not have sufficient volume to accommodate all of the growth intended for Pressure Zone 2 and a third storage tank (closer to Pressure Zone 2) would be needed.

7.1.7 Location #7

Location #7 is at the southern boundary of the Millbrook Settlement Area and belongs to Development Area "A" in **Figure 6-2**. Location #7 have ground elevations which range from approximately 215 to 240 metres, making this fall under Pressure Zone 1. The area would require the completion of natural environment, archaeological and cultural heritage studies as well as property acquisition. Much of the area falls within Oak Ridges Moraine and Greenbelt designated areas, making it difficult to obtain permits for construction of water storage facility.

7.2 Evaluation Criteria & Screening

In line with the MSS, the evaluation process will follow a two-step approach with the first step comprising of screening the long list of storage locations to narrow down to a short list that meets the problem and opportunity statement, avoids major technical and economic constraints and provides minimal impact to the surrounding community and water system. Any location marked with an 'X' in any section will be screened out from further consideration.

The shortlisted locations will then be evaluated further using the same evaluation criteria that was developed for the MSS and is based on the following five categories:

- **Social** - represents the local human environment and comprises of impacts to individuals, neighbouring properties and local businesses.
- **Environmental** – represents the degree to which the proposed alternative impacts the natural environment with emphasis on impacts to sensitive areas that are most critical to human or ecological functions that are most likely to be disturbed.
- **Technical** – represents the technical requirements of the proposed alternative and evaluates it based on several factors including technical complexity (design, operation and maintenance), regulatory and approval requirements, and compatibility with existing systems.
- **Cultural Heritage** – represents the effect an alternative will have on known and potential archaeological resources, built heritage resources, cultural heritage landscapes and Indigenous communities.
- **Cost** – represents costs associated with the proposed alternative including capital cost, land acquisition and lifecycle maintenance and operation costs.

Below shows the rating scale that will be used for scoring the proposed alternatives against each of the five categories.

Table 7-1: Legend for Evaluation Criteria

Least Positive/Most Negative	More Negative Than Positive	Moderate	More Positive Than Negative	Most Positive/Least Negative
				

7.3 Screening of Longlisted Location Alternatives

Table 7-2: Screening of Longlisted Location Alternatives

Location	Does the alternative address the Problem & Opportunity Statement?	Is the alternative technically and economically feasible (✓ if yes). Does this pose significant technical constraints or disadvantages (x if yes).	Can the alternative be implemented without significant impacts?	Summary
Location #1	✓	✓	✓	Carried over to shortlist for detailed evaluation
Location #2	✓	✗	✗	Existing storage tank at location, and remaining area is already zoned for institutional. Location reserved by Township for other endeavours. There will be major disturbance to the Municipal Office during construction. Risk in resiliency and redundancy from grouping storage facilities in the same location.
Location #3	✓	✓	✓	Carried over to shortlist for detailed evaluation
Location #4	✓	✗	✓	Not centralized to the future anticipated areas of need. May not have enough space for water storage facility based on current developer plans for the area. Property acquisition required and the current land is occupied by a farm.
Location #5	✓	✗	✗	Location is within Oak Ridges Moraine. Millbrook's Natural Heritage System will be impacted by construction. Environmental investigations and property acquisition required. Possible complications to suitability from remedial actions/investigations related to the former Millbrook Correctional Facility lands.
Location #6	✓	✗	✓	Not centralized to the future anticipated areas of need, as well as operational issues with supplying water to pressure zone 2 from this location. Space constraints and property acquisition required to support storage of an adequate size.
Location #7	✓	✗	✗	Not centralized to the future anticipated areas of need. This area would also require property acquisition and additional infrastructure to service the north end of Millbrook. Location is within Oak Ridges Moraine. Millbrook's Natural Heritage System will be impacted by construction.

7.4 Evaluation of Shortlisted Location Alternatives

Table 7-3: Evaluation of Shortlisted Location Alternatives

Criteria	Location #1	Evaluation	Location #3	Evaluation
Social	• Aesthetic advantage, as a water tower showing the Township's name will be visible from the highway. • Near future employment area rather than residential area		• Near the immediate future development areas but may be less centralized for future northern settlement expansion areas beyond 2051. • Near future commercial and residential area	
Technical	• Further from existing standpipe so there is better storage redundancy coverage in case of a key watermain break. • Will require a new longer watermain to reach Location #1		• Less storage redundancy coverage compared to Location #1 • Near existing watermain and closer to existing BPS to optimize use of existing infrastructure to reduce cost. • Expansion of or upgrades to existing BPS.	
Cultural	• Cultural Heritage and Archaeological potential not currently evaluated, would require additional studies.		• Existing Stage 1-2 Archaeological Assessment and Cultural Heritage study screened out potential/found no items of interest	
Environmental	• Natural environmental studies required to determine impacts. Current agricultural land will be impacted for imminent building of new storage tank even though area will not see development until a long time later		• Environmental conditions previously evaluated in support of planned development in the area • Existing natural environment studies cleared area for construction. Some space constraints due to existing creek	
Cost	• Township will have to front end the cost for long watermain extension from existing distribution network to this location before development occurs here.		• Lower watermain costs due to closer proximity to existing available infrastructure • Upgrades to existing BPS will be relatively low cost	
Summary	**Not Recommended** due to cost, environmental and cultural considerations	✗	**Recommended Water Storage Tank Location**	✓

Least Positive/Most Negative	More Negative Than Positive	Moderate	More Positive Than Negative	Most Positive/Least Negative
				

8.0 DRINKING WATER STORAGE TYPES

The following subsections present three distinct infrastructure alternatives for enhancing water storage and pumping capabilities at Location #3 (preferred storage tank location). Each option is evaluated based on its operational benefits, aesthetic and environmental impacts, technical feasibility and cost considerations. These alternatives aim to support future growth, improve system reliability and optimize the use of existing assets while addressing the needs of Pressure Zone 2.

8.1 Identification of Water Storage Tank Type Alternatives for Millbrook

8.1.1 New Standpipe at Location #3 + New BPS

A standpipe is a water storage tank where the water level ranges from its high-water level to the ground level. Often times, a standpipe would be positioned at a higher ground elevation. Since water is stored starting at the ground elevation, there could be 'unusable' volumes of water due to inadequate pressure. The unusable volume of water could lead to stagnation of water and make it more difficult to 'turn over'/refresh the water. The addition of a BPS as shown in **Figure 8-1** helps to alleviate the problem of unusable volume and achieves the required water pressure for the specific pressure zone. If a new standpipe was to be chosen for the preferred Location #3, it would be fed from the municipal wells and distribution network in Pressure Zone 1. It would have the same high-water level as the existing standpipe. A new BPS would be constructed beside the new standpipe to feed Pressure Zone 2. Whenever the pressure in Pressure Zone 2 drops below the desired pressure range, the pump(s) in the BPS would need to turn on. Pumps with variable frequency drive can provide more operational flexibility and avoid turning on and off rapidly as the system pressure fluctuates.

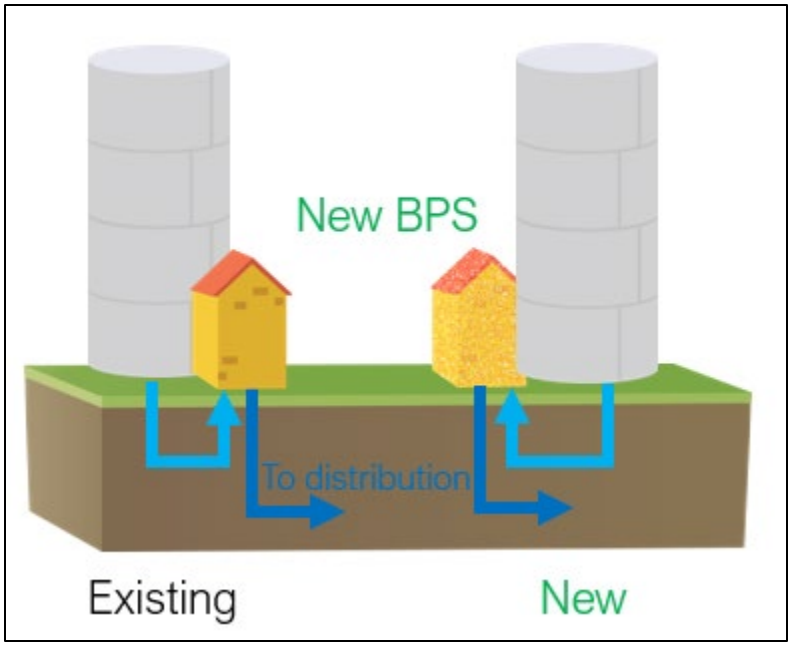


Figure 8-1: Water Standpipe Schematic

Building a new water standpipe at Location #3 maximizes use of the existing infrastructure and supports future proofing. It is another possible location for mounting communication antenna etc. (source of revenue for Township). This alternative also allows for some operational redundancy for the existing standpipe at the municipal office if either storage tank needed to be taken out of service and maintained. In addition, this alternative has the lowest capital costs compared to all other tank options.

Despite the advantages described above, water standpipes can be a visual obstruction for nearby residential neighbours, who may not appreciate having a large municipal structure in the vicinity of residential areas. The alternative could also have shadow impacts to upcoming development area, even though the shadow is transitory throughout the day and seasons. However, once built, standpipes can become a 'landmark' for the community and may also provide revenue opportunities for the municipality from communication companies who may want to play their communication equipment on top.

Despite having the lowest capital costs to implement, a new standpipe and BPS are estimated to have the highest operations and maintenance costs (O&M) over the course of 60 years. This is based on a quote for O&M costs for the standpipe and BPS and due to the maintenance and future replacement of the greatest number of pumps across all the alternatives.

To support this alternative, further geotechnical and hydrogeological investigations would be needed to confirm suitability of a standpipe at Location #3.

8.1.2 New Elevated Water Storage Tank at Location #3 and Upgrades to BPS at Municipal Office

An elevated tank, often seen as a prominent feature in many communities, is a structure where the water storage portion of the tank is raised above ground level to the desired elevation, typically supported by a concrete pedestal or a steel stand as shown in **Figure 8-2**. The tanks can be constructed from welded steel plates or glass-lined steel plates that are bolted together. The water-containing portion of the tank is called the 'bowl' and the portion below this elevation is the support structure for the elevated water tank, which could be made of a concrete pedestal or steel supports. For the style that uses a concrete pedestal, it can house the pipes, valves, recirculation pumps, electrical and control equipment, ladder/stairwell to permit access to the underside of the 'bowl'. Elevated tanks are designed to hold large volumes of water at the desired pressure (elevation) range, which helps manage peak demand and emergencies like fires. The primary function of an elevated tank is to provide 'floating storage' that can manage the hydraulic grade line and water pressure within a pressure zone without pumps from the treatment plant operating continuously to maintain system pressure. Elevated tanks are often located in strategic areas to optimize coverage and pressure in the surrounding distribution network. With construction material and technological advancements, the elevated tank is a popular choice for all sizes of communities.

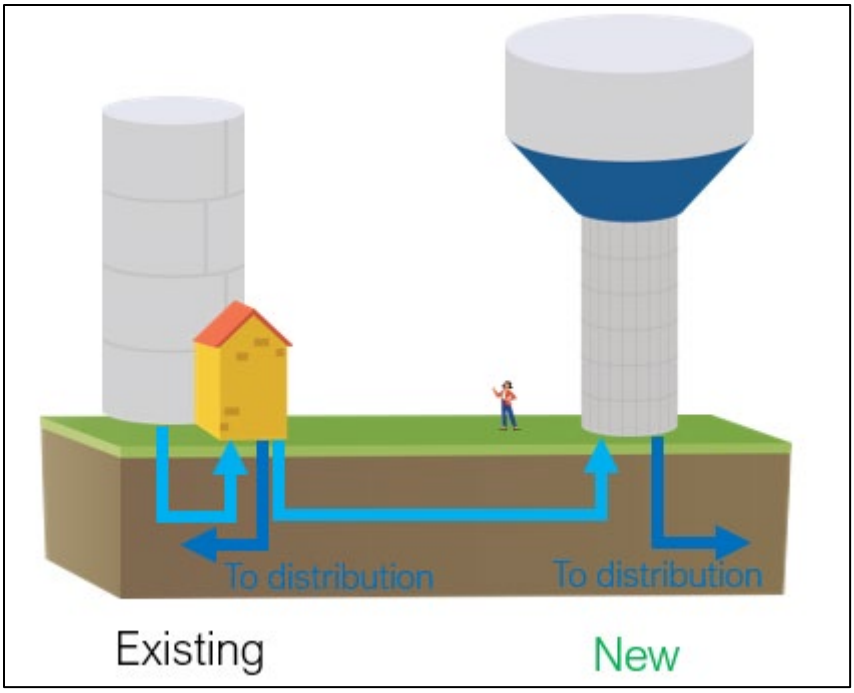


Figure 8-2: Elevated tank Schematic

In this alternative, by utilizing gravity, the new elevated tank at Location #3 would allow water to flow directly to users without requiring additional pumping after the elevated tank. However, given the current Millbrook distribution system and its two (2) pressure zones, in order for the new elevated tank to feed Pressure Zone 2 by gravity, it would need the water to be pumped up to its high-water level. This means that the existing Booster Pumping Station (by the Municipal Office Standpipe) would need to be upsized/expanded and a watermain extended from the existing BPS to the new elevated tank. The existing municipal well pumps do not provide enough pressure to get up to the higher pressures needed for Pressure Zone 2. This alternative ultimately provides 'floating storage' to the Pressure Zone 2 area (instead of pumped storage via existing BPS and standpipe). This better manages the pressure fluctuations in the pressure zone and is not contingent on a pump being on or off. It is also another possible location for mounting communication antenna etc. (source of revenue for the Township).

Despite the advantages described above, this alternative has the greatest aesthetic impacts to surrounding properties (it would be taller than existing standpipe) and has more technical and operational complications due to different storage tank heights. It does not allow for operational redundancy to the existing standpipe because that is still needed for the existing BPS to feed pressurized water to the new elevated tank. The alternative could have shadow impacts to upcoming development area, even though the shadow is transitory throughout the day and seasons. The benefit of this option is that the existing BPS can be used to

house the new pumps and not have a second BPS in the system like the other tank style alternatives. This would mean less assets for the Township to own and maintain.

This alternative has higher capital costs compared to both the standpipe and in-ground reservoir options. However, the O&M costs over 60 years are slightly less than the standpipe option, but not as low as the in-ground reservoir. This is based on a quote for O&M of a new elevated tank and because the elevated tank would not require a new BPS but can have new pumps added within the existing BPS.

Further geotechnical and hydrogeological are needed to confirm suitability of elevated tank at Location #3.

8.1.3 New In-Ground Reservoir with Booster Pumping Station

A water storage tank located below ground level relies on a booster pumping station (BPS) positioned at ground level (as shown in **Figure 8-3**) to supply adequate pressure to the distribution system. Unlike elevated tanks, this configuration cannot depend on gravity and must use mechanical pumping to provide consistent water flow and pressure to its specific pressure zone. The existing municipal well pumps would be able to pump water to the in-ground reservoir, and from there a new BPS would boost the water to the required pressure for Pressure Zone 2. Whenever the pressure in Pressure Zone 2 drops below the desired pressure range, the pump(s) in the BPS(s) would need to turn on. Pumps with variable frequency drive can provide more operational flexibility and avoid turning on and off rapidly as the system pressure fluctuates.

This system is advantageous for areas where above-ground space is limited or where aesthetic concerns make elevated tanks and standpipes less desirable. By burying the reservoir, the system minimizes visual impacts to the area. However, the footprint of the reservoir would be larger than the base of a standpipe or elevated tank pedestal, resulting in higher excavation costs and higher potential for groundwater impacts during construction.

Although the in-ground reservoir and BPS can be placed wherever there is adequate space for these structures, it would be preferred to situate the facility at a high elevation to minimize the amount of additional boosting the pumps would need to achieve the desired pressure for the water users in the specific pressure zone.

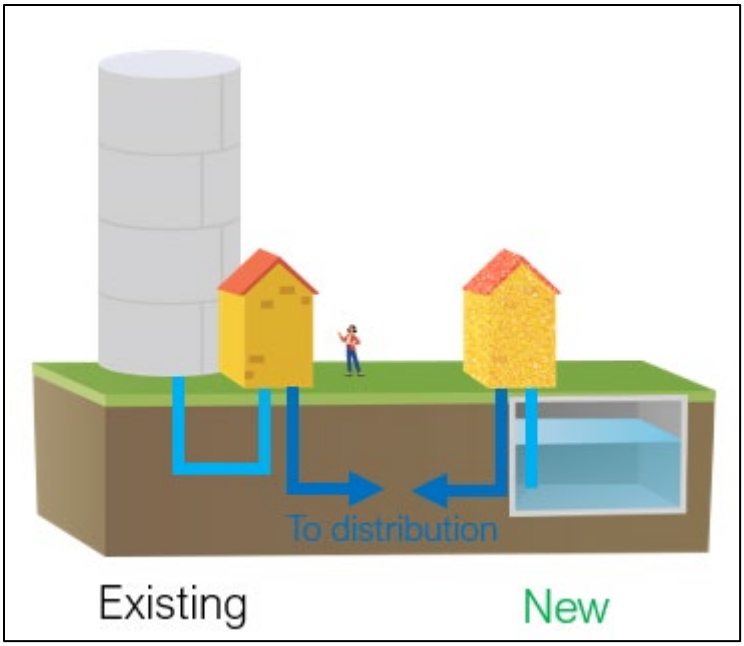


Figure 8-3: In-ground reservoir with BPS Schematic

In this alternative, a new in-ground reservoir would have the minimum negative aesthetic impacts to surrounding properties. Only the pumphouse for the new BPS would be visible, as the tank would be buried. The new BPS pumphouse can be designed to suit neighbouring developments to blend in with other nearby buildings. This alternative allows for some operational redundancy for existing standpipe if it needs to be taken out of service and maintained. In this alternative however, there is no 'floating storage' available for Pressure Zone 2. The pressure in the system would fluctuate with the operation of the pumps at the new and existing BPS'.

This alternative has higher capital costs compared to standpipe option, but less capital costs than the Elevated tank option. This is due to the process of excavating for the reservoir and the construction of the BPS on top. Additionally, this alternative has the lowest O&M costs over 60 years due to the option not requiring major maintenance or repairs of the buried reservoir once in service (no need to repaint/recoat or recaulk). There will still need to be maintenance of the new BPS and replacement of equipment at the end of their useful life.

Further geotechnical and hydrogeological investigations are needed to confirm suitability of inground tank at Location #3. Due to the deeper and larger excavation needed for the in-ground reservoir, there may be more complications due to groundwater, and the construction will take up more space than other alternatives.

8.2 Cost Estimate

Below is a high-level budgetary estimate for the water standpipe, elevated tank and in-ground reservoir options (including associated BPS costs). The standpipe and elevated tank budgetary estimates were provided by Greatario and Landmark Structures in October 2025, respectively. The estimated costs are exclusive of applicable duties, taxes, tariffs and government-imposed fees. The costs also do not include for engineering services (e.g. geotechnical, design, construction administration). These cost estimates include the estimated operations and maintenance (O&M) costs for operating and maintaining the existing Standpipe and BPS along with the new storage solution and associated new BPS (if applicable) over 60 years.

Table 8-1: High Level Cost Estimates for Water Storage Solutions

Storage Type	Estimated Cost	Comments
Standpipe + new BPS	Capital: $4.6 million O&M: $3.6 million	Greatario quote for standpipe. BPS costs based on previous tendered projects.
Elevated Tank (ET) + Expansion of existing BPS	Capital: $13.8 million O&M: $2.7 million	Landmark quote for ET. BPS expansion costs based on previous tendered projects.
In Ground Reservoir + new BPS	Capital: $7.7 million O&M: $2.5 million	Based on previously tendered projects or unit prices.

8.3 Detailed Evaluation of Storage Tank Types at Location #3

Table 8-2: Detailed Evaluation of Storage Tank Types at Location #3

Criteria	New Standpipe at Location #3 + New BPS	Evaluation	New Elevated Tank at Location #3 + BPS Upgrades at Municipal Office	Evaluation	New In-Ground Reservoir + New BPS at Location #3	Evaluation
Social	• Will be built before residential development. Low impact to future neighbours during construction • Moderate aesthetic impacts to surrounding properties		• Will be built before residential development. Low impact to future neighbours during construction • Greater aesthetic impacts to surrounding properties		• Will be built before residential development. Low impact to future neighbours during construction • Lesser aesthetic impacts to surrounding properties due to buried tank • Provides the ability to implement a façade for the BPS which can be integrated with the community aesthetics	
Technical	• Construction of a new BPS required. • Provides some operational redundancy to the water system with the existing standpipe at the Municipal Office across the street		• BPS upgrades at Municipal office or dedicated high pressure watermain from municipal wells required to support higher Hydraulic Grade Line (HGL) • Makes use of existing infrastructure • Provides operational redundancy to the water system with the existing standpipe at the Municipal Office across the street		• In-ground reservoir would require new BPS on top of the new reservoir • Does not maximize use of existing infrastructure • Standalone system not reliant on ex. BPS • Provides operational redundancy to the water system with the existing standpipe at the Municipal Office across the street • Tank will not drain empty by gravity if there is WM break	
Cultural	• Cleared of archaeological and cultural heritage potential by developer studies for the area		• Cleared of archaeological and cultural heritage potential by developer studies for the area		• Cleared of archaeological and cultural heritage potential by developer studies for the area	
Environmental	• Moderate impact to natural environment during construction • Possible space constraints during construction due to existing watercourses.		• Moderate impact to natural environment during construction. • Possible space constraints during construction due to existing watercourses		• Moderate impact to natural environment during construction • Likely to encounter space constraints during construction due to existing watercourses • Allows for more areas to be landscaped and restored.	
Cost	• Most economical capital cost option compared to other storage alternatives • Highest O&M cost over 60 years due to having to maintain 2 standpipes and 2 BPS.		• Highest capital costs compared to standpipe and in-ground reservoir • Lower O&M cost over 60 years, because there is only 1 BPS and 2 tanks to be maintained		• Higher capital costs than standpipe but less than Elevated tank. • Lower O&M cost over 60 years – still need to maintain 1 standpipe and 2 BPS even though the inground tank doesn't need much maintenance	
Summary	**Not Recommended** due to social, and long-term cost considerations	✗	**Not Recommended** due to social, cost and environmental considerations	✗	**Recommended Alternative**	✓

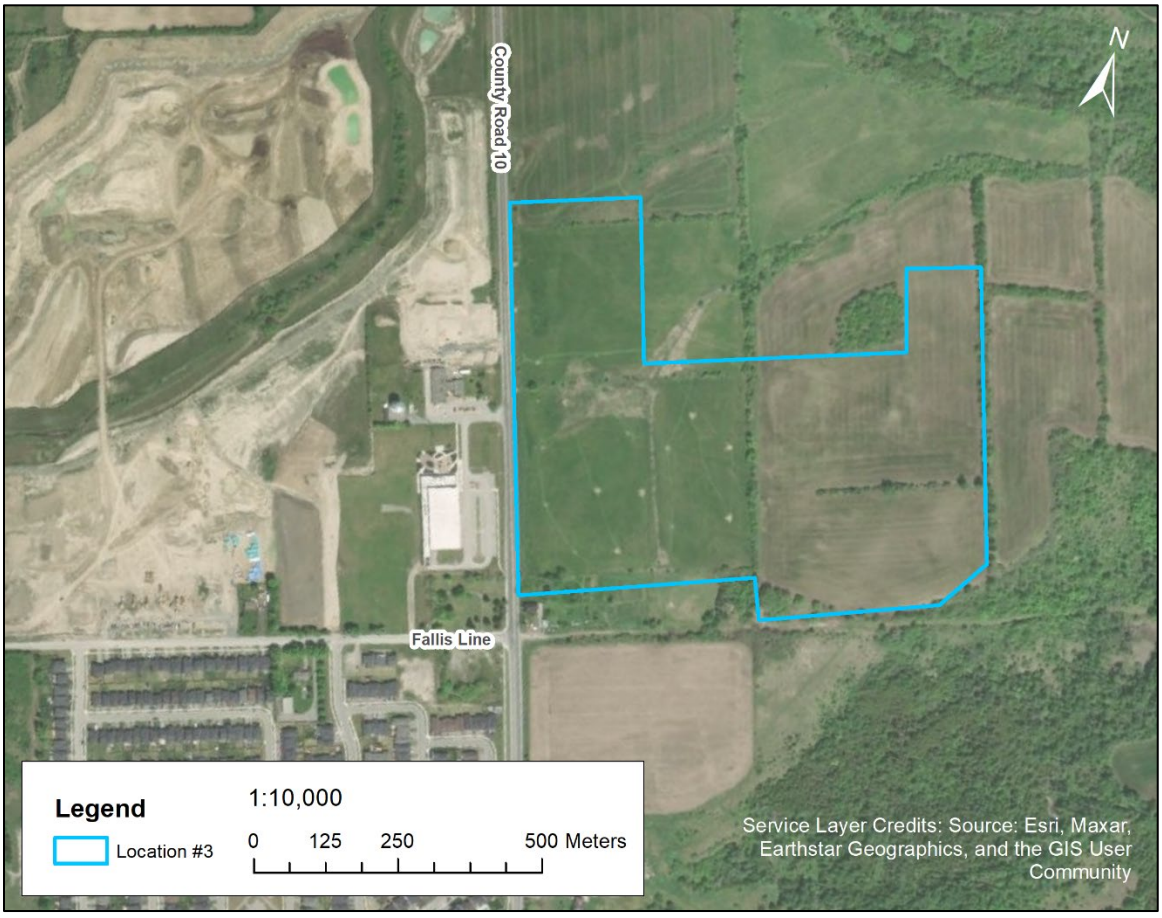
Least Positive/Most Negative	More Negative Than Positive	Moderate	More Positive Than Negative	Most Positive/Least Negative
				

9.0 PREFERRED SOLUTIONS

The preferred solution for new storage in the Township of Cavan Monaghan is an in-ground reservoir and associated BPS at Location #3 as seen in **Figure 9-1**. Location #3 is situated north of Fallis Line, east of County Road 10. The new in-ground reservoir and BPS will support the additional storage volume required for anticipated population growth as identified in the Growth Management Study (GMS) and Master Servicing Study (MSS). It will operate together with the existing Standpipe and BPS by the Municipal Office.

At the time of writing this report, the Township and the developer who owns this property were having property acquisition discussions, however the exact location has yet to be finalized.

Figure 9-1: Preferred location for New Water Storage



10.0 CONSULTATION AND ENGAGEMENT

10.1 Contact List of Interested and Affected Parties

The project contact list is included in **Appendix 9-1** and includes members of the public, agencies, stakeholders and Indigenous communities.

10.2 Notice of Study Commencement

A "Notice of Study Commencement" was first issued on April 15th, 2025. Additionally, the notice was mailed to those on the project contact list, including Indigenous Communities. The notice advised that the Class EA for this project was commencing and that any questions or comments on this project should be submitted to the Township or RVA through the contact information provided on the notice.

Copies of the notice and advertisements are provided in **Appendix 9-2**.

10.3 Public Information Centre (PIC)

On September 11th, 2025, a Notice of Public Information Centre (PIC) was sent out to the project contact list, including Indigenous Communities, indicating that a PIC was planned to provide further information to the public on the Class EA for Water Storage, and to receive input and comments from interested parties. The notice was also posted on the Township website. Copies of the notice are provided in **Appendix 9-2**.

The PIC occurred on September 24th, 2025, at the Township of Cavan Monaghan Municipal Office in Millbrook. Eight (8) public members and members of Council attending the PIC. The Project Team were in attendance to respond to inquiries.

The PIC presented the Problem and Opportunity Statement, Forecasted Population & Storage Requirements, Longlist and Shortlist of Alternative Solutions, Evaluation of Shortlisted Alternatives and Preferred Location for the new Water Storage Tank. The full materials from the PIC are included as **Appendix 9-3**.

10.4 Comments and Input Received

Comments and input on the project were received in response to the Notices and Public Information Centre Materials. All comments and responses to comments are provided in **Appendix 9-4**. All personal and identifying information have been redacted for privacy purposes.

10.5 Notice of Completion

The Notice of Completion is to be published in January 2026 and sent to the full project contact list. The notice will additionally notify all recipients that a finalized version of the report was published to the Township's website for a 30-day review period.

11.0 REFERENCES

1. *Cultural heritage report: desktop collection results*. (2023). Archaeological Services Inc.
2. *Hydrogeological and geotechnical assessment*. (2025). GHD Inc.
3. *Municipal class environmental assessment user's guide*. (2023). Municipal Engineers Association.
4. *Phase one environmental site assessment - proposed development, Fallis line, Township of Cavan-Monaghan, Ontario*. (2025). GHD Inc.
5. *Stage 1 archaeological assessment Cavan Monaghan water and wastewater master servicing study*. (2024). Archaeological Services Inc.
6. *Stage 1-2 archaeological assessment, Fallis line and County road 10, lot 12, concession 6*. (2025). Amick Consultants Limited.
7. *Stage 1-2 archaeological assessment, property located at the northeast corner or Fallis line and County road 10, lot 12, concession 6*. (2025). Amick Consultants Limited.
8. *Technical memorandum desktop hydrogeological study water and wastewater master servicing study*. (2023). Thurber Engineering Ltd.
9. *Township of Cavan Monaghan water and wastewater master servicing study class environmental assessment report*. (2024). R.V. Anderson Associates Limited. https://www.cavanmonaghan.net/live-here/water-and-wastewater-services/master-servicing-plan/
10. *Natural constraints letter, Vargas north, Millbrook subdivision, 963 County road 10 part lot 13, concession 6*. (2025). GHD Inc.

APPENDIX 1

TECHNICAL MEMORANDUM #1



Millbrook Water Storage Class Environmental Assessment

Technical Memorandum #1:
Existing Conditions
Final

Prepared for:

The Township of Cavan Monaghan

This Technical Memorandum is protected by copyright and was prepared by R.V. Anderson Associates Limited for the account of the Township of Cavan Monaghan. It shall not be copied without permission. The material in it reflects our best judgment in light of the information available to R.V. Anderson Associates Limited at the time of preparation. Any use which a third party makes of this Technical Memorandum, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. R.V. Anderson Associates Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this Technical Memorandum.

RVA 205371

January 26, 2026

R.V. Anderson Associates Limited
1750 Courtwood Crescent, Suite 220
Ottawa ON K2C 2B5 Canada
T 613 226 1844 **F** 855 833 4022
rvanderson.com

RVA 205371

January 26, 2026

Township of Cavan Monaghan
988 County Road 10
Millbrook, ON
L0A 1G0

Attention: Wayne Hancock, P.Eng.

Dear Mr. Hancock,

Re: Township of Cavan Monaghan Water Storage Municipal Class Environmental Assessment
Technical Memorandum #1: Existing Conditions

Please find enclosed TM#1 – Existing Conditions for the above referenced project. The report entails a description of the background information, an update of water storage calculations from the MSS, design and analysis criteria, and the evaluation process to be used for this Class EA.

Yours very truly,

R.V. Anderson Associates Limited

LICENSED PROFESSIONAL ENGINEER
R. K. Y. LAW
100130079
Jan 23, 2026
RVA#205371
PROVINCE OF ONTARIO

Rika Law
Digitally signed by Rika Law
DN: cn=Rika Law, c=CA, o=R.V. Anderson Associates Limited, email=rlaw@rvanderson.com
Date: 2026.01.23 16:36:15 -05'00'

Nikash Persaud
Coordinator, Environmental Assessments

Rika Law
Project Manager

Encls.

CANADA BEST MANAGED COMPANIES Platinum member

Millbrook Water Storage Class Environmental Assessment

Technical Memorandum #1: Existing Conditions

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APPENDICES

Appendix A - Potential Development Locations

1.0 INTRODUCTION

1.1 Background

R.V. Anderson Associates Limited (RVA) was retained by the Township of Cavan Monaghan (Township) to complete a Water and Wastewater Master Servicing Study (MSS) to support growth to 2051. The MSS identified a new water storage facility in the Village of Millbrook (Millbrook) as the key priority project to accommodate growth forecasted in the immediate future. As a result, a separate Class EA was undertaken to determine the preferred water storage facility type and its location that can meet the Township's long-term servicing requirements considering growth and development.

Expansion of water storage facilities where additional land must be acquired requires completing a Schedule B Class Environmental Assessment (Class EA) under the Environmental Assessment Act.

This document is Technical Memorandum (TM) #1: *Investigation of Existing Conditions*. It entails the background investigation that will provide the foundation on which the alternative strategies can be developed and assessed. The background investigation will include:

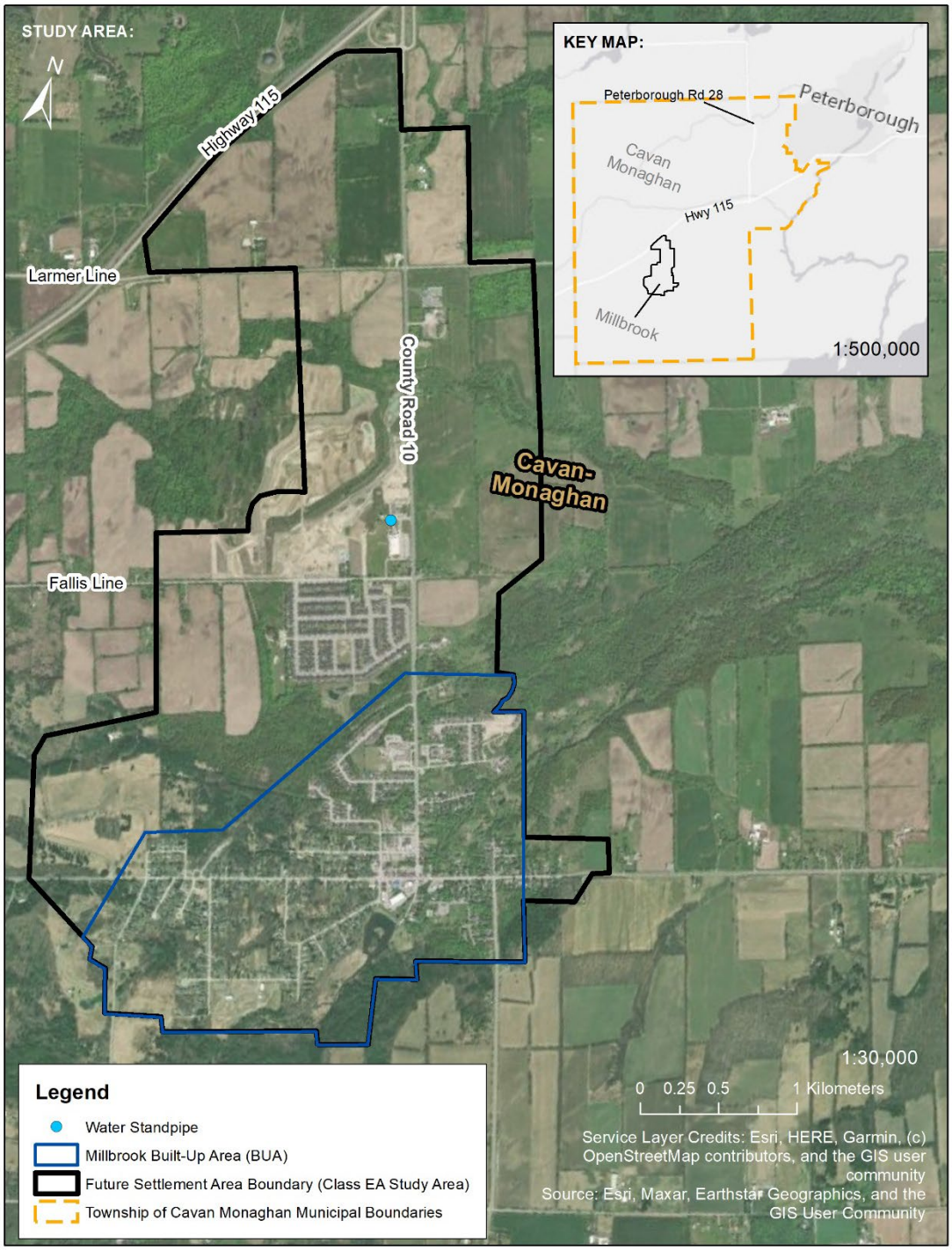
- A reconfirmation of the water storage capacity assessment that was initially completed for the MSS to the year 2051; and
- A desktop review of the existing conditions in the study area from the past supporting studies completed (e.g., natural environmental, archaeological, etc.).

1.2 Study Area

The Township undertook a Growth Management Strategy (GMS) study in 2022 to identify the population growth in Millbrook up to the study horizon of 2051. The GMS report provided a Future Settlement Area Boundary to accommodate the future growth that was forecasted to exceed the available capacity within the current village boundary. Figure 1-1 is an aerial map showing Millbrook's existing Built-Up Area within the existing boundary, and the Settlement Area boundary as per the Growth Management Study. The area bordered by Settlement Area as per the Growth Management Study was taken as the study area in the MSS and, as such, is the study area for this Class EA.

The Study Area is located in the Ontoabee-Peterborough Source Protection Area (S.P.A.) and is composed of various land uses including residential, employment, commercial, institutional, parks and open space. Most of the land planned for future development in Millbrook has been designated as residential land and some for industrial/commercial.

Figure 1-1: Study Area of Millbrook Settlement Boundaries in Township of Cavan Monaghan



2.0 OVERVIEW OF MUNICIPAL CLASS EA PLANNING PROCESS

2.1 Municipal Class EA

The Municipal Class EA (Municipal Engineers Association, 2000, and as last amended in 2023) outlines an approved planning process for municipal infrastructure projects including water and wastewater projects. Municipal proponents can use the Class EA process to meet the requirements of the Ontario Environmental Assessment Act.

The Class EA process is illustrated in the Class EA Figure 2-1. The Class EA process includes mandatory requirements for public and regulatory agency input and provides for the evaluation of alternative solutions to a problem or opportunity.

The MCEA identifies three different categories or "schedules" of projects as follows:

Exempt projects are limited in scale and have minimal adverse effects. These projects are approved and may proceed directly to implementation without any further steps in the Class EA process.

Schedule B projects have the potential for some adverse environmental effects and must be subjected to a screening process, involving consultation with the directly affected public and relevant government agencies, and engagement with Indigenous Communities to provide opportunity for input and to address concerns. If there are no outstanding concerns, then the proponent may proceed to implementation.

Schedule C projects have the potential for significant environmental effects and must proceed under the full planning and documentation procedures specified in the Class EA document. Schedule C projects require evaluation of alternative solutions and alternative design concepts of the preferred solution. The public, agencies and Indigenous Communities are provided several opportunities throughout the process to provide input and comments.

2.2 Municipal Class Environmental Assessment Schedule

The Millbrook Water Storage Class Environmental Assessment will be undertaken as a Schedule B project. This will require completion of Phases 1 and 2 of the Class EA process as follows:

- Phase 1: Identify the problem or opportunity.
- Phase 2: Identify and evaluate alternative solutions to the problem by considering the existing environment and establishing the preferred solution, considering public,

Indigenous Communities and agency review input. Document the decisions in a Project File Report.

- Notice of Completion: Upon completion of this Project File Report, a Notice of Completion is advertised and issued to the public, Indigenous Communities and agencies interested in the project, for a 30-day review period, during which time, any comments or requests from stakeholders, agencies, or concerned parties will be addressed according to the procedures outlined in the Municipal Class EA Manual (2000, as amended in 2007, 2011, 2015, 2023). In addition, a request may be made to the Ministry of the Environment, Conservation and Parks (MECP) for an order requiring a higher level of study (i.e., requiring an individual/comprehensive EA approval before being able to proceed), or that conditions be imposed (e.g., require further studies), only on the grounds that the requested order may prevent, mitigate or remedy adverse impacts on constitutionally protected Aboriginal and treaty rights. Requests on other grounds will not be considered.
- Implementation: Provided that no requests are made to the Minister of the Environment within the 30-day review period, or requests have been addressed, the project is approved and may proceed to detailed design, construction, operation and monitoring if specified. The project would still be subject to all applicable environmental regulations and approvals.

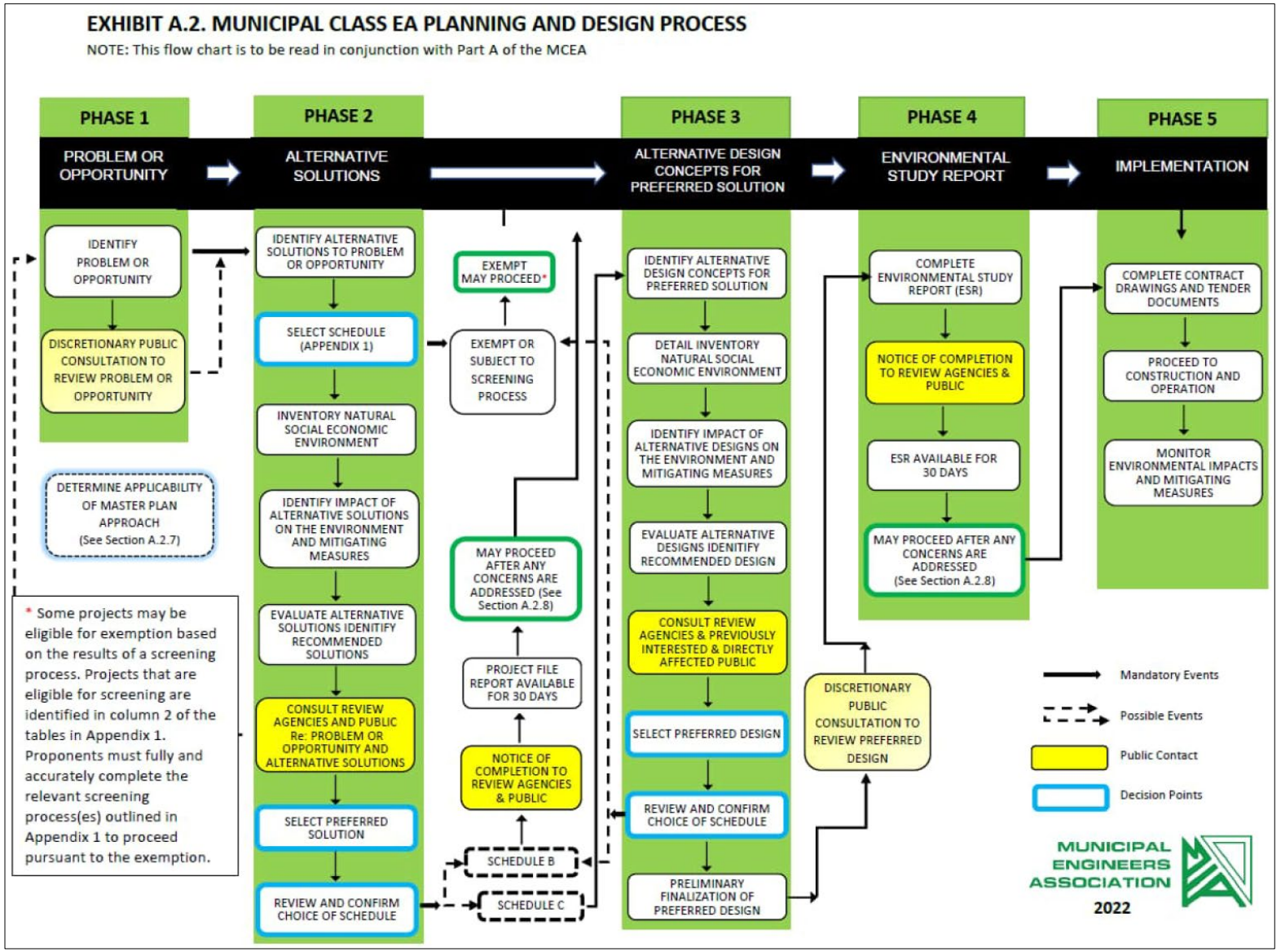


Figure 2-1: Municipal Class EA Process (Municipal Engineers Association, 2023)

3.0 PROBLEM AND OPPORTUNITY STATEMENT

The problem and opportunity statement describes the objectives of the study and the desired factors in the preferred servicing alternative. This is a useful tool to pre-screen the long list of alternatives so that only feasible and likely alternatives can be evaluated in more detail. The problem and opportunity statement for the Township of Cavan Monaghan's Class Environmental Assessment for Water Storage is as follows.

With the recent connection of Hwy 407 to Hwy 115, there is opportunity for Township of Cavan Monaghan (Township) for improvements and growth in terms of employment, community services and residential living. As such, the Township undertook a Water and Wastewater Master Servicing Study (MSS). The MSS developed a plan to identify key improvements to the existing water and wastewater infrastructure in the Township required to service the current and future needs. One of the preferred solutions determined by the MSS was to expand the Water Storage capacity in the community of Millbrook by retaining the existing standpipe (by the Municipal Office) and having additional water storage at a new location. The Township of Cavan Monaghan is now undertaking a Schedule B Class Environmental Assessment (Class EA) for an increase to the water storage volume.

The purpose of the study is to confirm the location, capacity, and storage type for the new water storage solution which will service the anticipated growth in the Millbrook Settlement Area as per the Growth Management Study.

While the proposed development poses significant challenges to the Township, Cavan Monaghan is committed to providing efficient and sustainable infrastructure while seeing that any development within the community preserves or enhances the environment for the betterment of future generations.

Preferred solution(s) will be prioritized and implemented to address immediate needs, intermediate goals, and long-term growth, and shall generally:

- Comply with applicable regulations to provide adequate water servicing.
- Comply with the Official Plan (2021) while accommodating future vision of servicing beyond the Settlement Area boundary as per the Growth Management Study.
- Comply with the recommendations from the 2024 MSS.
- Consider stakeholder and rights-holder comments and concerns.
- Be financially viable.
- Be technically feasible and operationally sustainable.
- Be socially and environmentally responsible.

4.0 BACKGROUND INVESTIGATION

4.1 Planning and Policy Context

4.1.1 Federal

4.1.1.1 Canadian Environmental Protection Act

The Canadian Environmental Protection Act (CEPA), enacted in September 1999, grants the Canadian government authority to safeguard environmental and human health while fostering sustainable development. The CEPA establishes guidelines and standards to control pollutants and target water quality, including mandating the monitoring and regulation of contaminants, setting limits for chemical substances in water, and supporting the development of technologies and practices that minimize environmental impact. Through programs like the National Pollutant Release Inventory (NPRI), CEPA also requires reporting on various substances to aid tracking and manage pollutants that could affect water storage processes.

Relevance to this Project: While the CEPA does not directly apply to municipal water storage, it influences provincial policies by setting guidelines and standards for water quality. This facilitates water storage processes to adhere to high environmental and health standards, guiding the control and monitoring of pollutants in our operations.

4.1.1.2 Migratory Birds Convention Act

The Migratory Birds Convention Act (MBCA), originally enacted in 1917 and revised in 1994 and 2005, aims to safeguard migratory birds, their nests, and eggs. This legislation enforces the Migratory Birds Convention between Canada and the United States and is administered by Environment Canada. The Act specifies protected bird species and regulates activities that might affect them, including restrictions on when and where such activities can take place.

Relevance to this Project: The project area may provide habitat for migratory and nesting birds, making adherence to the MBCA important to for the protection of these species during project activities.

4.1.1.3 Species at Risk Act

The Species at Risk Act (SARA) is a key piece of federal legislation designed to prevent the extinction and extirpation of wildlife species in Canada, facilitate their recovery, and protect their habitats. Administered by Environment Canada, the Act identifies species at risk

through the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), which uses scientific data to assess the status of wildlife species and their habitats. Once a species is listed under Schedule 1 of SARA, it is afforded legal protection, including mandatory recovery planning and the prohibition of activities that could harm the species or its critical habitat.

Relevance to this Project: The project must consider compliance with SARA, as it involves areas that may support both terrestrial and aquatic species at risk. This requires thorough environmental assessments and mitigation measures to avoid or minimize impacts on these species and their habitats, potentially necessitating permits under the Act.

4.1.2 Provincial

4.1.2.1 Planning Act

The Planning Act governs land use planning in Ontario by detailing how land use can be managed within communities and specifying the roles of provincial and municipal governments. Provincially, there is also the provision of advice on land use planning issues. At the municipal level, the Township are responsible for making decisions on community planning, preparing planning documents like Official Plans and Zoning By-Laws, and attempting to algin local planning with provincial plans. Additionally, these municipalities are tasked with implementing land use controls and approvals as outlined by provincial guidelines.

Relevance to this Project: The Planning Act is relevant to this water project in Cavan Monaghan as it governs land use planning and ensures that local planning decisions, including those related to the project, are consistent with provincial policies and regional plans.

4.1.2.2 Provincial Planning Statement

The Provincial Planning Statement (PPS) provides policy direction on matters of provincial interest related to land use planning and development. The PPS emphasizes the need for infrastructure to be planned and implemented efficiently and cost-effectively, with due consideration for climate change. It requires that infrastructure be financially sustainable throughout its lifecycle and meet both current and future needs while making the most of existing facilities before constructing new ones. Specifically, the PPS advocates for the efficient use and optimization of existing municipal water and wastewater services to support anticipated growth, in an effort to see that systems are sustainable, compliant with regulations, and protective of both human health and the environment. It also promotes

water conservation and integrates servicing and land use considerations throughout the planning process.

Relevance to this Project: The Provincial Planning Statement emphasizes optimizing existing infrastructure, promoting financial sustainability, and protecting both human health and the environment. It also highlights the importance of integrating water conservation and efficient land use in the planning process.

4.1.2.3 Ontario Heritage Act

The Ontario Heritage Act (OHA) empowers both provincial and municipal authorities to protect significant cultural and historical sites, including buildings, landscapes, and archaeological resources. Managed by the Ministry of Citizenship and Multiculturalism (MCM), the Act mandates that any impacts on these heritage resources be avoided or minimized.

Relevance to this Project: In accordance with the Class EA, investigations have been conducted to identify any potential cultural heritage resources in the area, so that the chosen project alternative will not adversely affect these resources.

4.1.2.4 Endangered Species Act

The Endangered Species Act (ESA), established in 1971 and updated in 2008, is designed to protect plant and animal species that are at risk of disappearing from Ontario. Similar to the federal Species at Risk Act (SARA), the ESA aims to preserve these species by listing them as endangered or threatened based on assessments by the Committee on the Status of Species at Risk in Ontario (COSSARO). Once approved by the provincial Ministry of Natural Resources and Forestry (MNRF), these species receive immediate habitat protection.

The ESA outlines procedures for assessing whether human activities, such as construction, could adversely impact these regulated species. It considers the species' biology, behavior, and the potential effects of the activity on their ability to complete essential life processes.

At the time of the writing of this report, the ESA is planned to be superseded by the Species Conservation Act (SCA). As the SCA is not yet in force, the ESA is used as reference for this report.

Relevance to this Project: The Local Study Area may contain both terrestrial and aquatic species at risk. Therefore, it is crucial to assess and mitigate potential impacts to these

species in compliance with the ESA. The project may require permits or be subject to specific regulatory exemptions under the Act.

4.1.2.5 Ontario Water Resources Act

The Ontario Water Resources Act (OWRA) is a key piece of legislation aimed at managing and protecting the province's water resources. It provides the framework for regulating the use of water, including permits for water withdrawals and discharges. The Act also addresses water pollution and the allocation of water resources for sustainable usage.

Relevance to this Project: The recommended water storage facility must comply with the Ontario Water Resources Act only if there is overflow discharge, or draining discharge of the water storage tank, by securing necessary permits for water use and discharge. It is essential for water withdrawals and any discharges from the storage tank to meet regulatory requirements and to not negatively impact water quality or availability.

4.1.2.6 Environmental Protection Act

The Environmental Protection Act (EPA) is a cornerstone of Ontario's environmental legislation, aimed at preventing pollution and protecting environmental quality. It establishes regulatory frameworks for controlling emissions into the air, land, and water. The EPA sets limits on contaminants that can be released into the environment, including standards for wastewater discharges and air emissions. It also oversees the management of waste, including the handling and disposal of hazardous materials. The Act makes an effort for all activities potentially impacting the environment, including those related to water storage, to adhere to strict pollution control standards and contribute to the maintenance of environmental health.

Relevance to this Project: The recommended water storage facility must comply with the EPA such that effluents and discharges meet the regulatory standards for pollution control and protect environmental quality.

4.1.2.7 More Homes Built Faster Act

The More Homes Built Faster Act, enacted on April 14, 2022, aims to significantly boost Ontario's housing supply by facilitating the construction of 1.5 million new homes over the next decade. This Act builds on prior housing strategies and introduces measures to streamline development processes. It targets the reduction of bureaucratic inefficiencies and encourages denser development near transit hubs. Notably, the Act also amends various statutes to expedite housing construction and enhance affordability. Relevant sections of the Act include:

Section 5 – Zoning By-Law Reforms: This section allows for more flexible zoning regulations, which could impact the allocation of land for public utilities, including water storage facilities, and facilitate their integration into new developments.

Section 7 – Development Charges Reforms: This section addresses the reduction of development charges, potentially affecting the financial feasibility and planning of new infrastructure, including water storage systems, in rapidly growing areas.

Relevance to this Project: The More Homes Built Faster Act's provisions for streamlining development approvals and zoning reforms could impact the integration of water storage facilities within new housing developments, potentially affecting project planning, timelines, and regulatory compliance.

4.1.3 Regional and Municipal Legislation and Policy

4.1.3.1 Township of Cavan Monaghan Official Plan

The 2021 Official Plan of Cavan Monaghan provides a framework for managing growth and development in the township while preserving its cultural and natural heritage. This plan is instrumental in guiding land use decisions, infrastructure development, and environmental protection measures. The Official Plan sets out policies to consider sustainable development, promote economic growth, and enhance the quality of life for residents.

Relevance to this Project: The increased water storage Class EA must align with the Official Plan's policies for sustainable development is sustainable that does not compromise the Township's environmental and cultural heritage. The project must consider land use designations, environmental constraints, and community growth projections outlined in the plan. Additionally, infrastructure improvements related to water storage must support the township's goals for sustainable development and resource management.

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4.2 Area Studies and Investigation

4.2.1 List of Studies

The following documents were reviewed in the development of this TM:

- 2024 Water and Wastewater Master Servicing Study, RVA (MSS);
- 2023 Hydrogeological Study for Township of Cavan Monaghan, Thurber Engineering Ltd. (2023 Hydrogeological Study);

- 2024 Archaeological Assessment Cavan-Monaghan MSS, Archaeological Services Inc. (2024 Archaeological Study);
- 2021 Cultural Heritage Report, Archaeological Services Inc. (2021 CHR)
- Township of Cavan Monaghan Official Plan (Official Plan) Consolidated Version with Amendments 2021); and
- Future development areas as identified in the MSS project.

4.2.2 Master Servicing Study

The following analysis was completed as part of the MSS:

1. Forecasting population growth to the year 2051 using year 2021 as baseline year;
2. Analysing historical per capita water usage from 2019 – 2021;
3. Using the above information to project water demand and required water storage to the study horizon of 2051;
4. Identifying servicing constraints resulting from growth and development; and
5. Determining the recommended strategy that will address the identified constraints and allow the Township to meet existing and future water demand.

The study showed that Millbrook's required water supply and water storage will be in deficit before the study horizon of 2051. To continue accommodating growth, both water quantity and water storage will need to be expanded. Table 4-1 provides a summary of the parameters used in the study which will be used as a basis for this Class EA.

Table 4-1: 2024 Master Servicing Study Existing And Future Water Demand Data

Parameter	Value
Projected Residential Population 2051	10,455
Projected Total Employees 2051	3,983
Per Capita Average Day Water Demand (litres/capita/day (lpcd))	270
Maximum Day Factor (ratio of Maximum Day Demand to Average Day Demand)	2.0
Fire Flow Rate (l/s)	220
Fire Flow Duration (hours)	3

Based on the above results and to commence this Class EA, a map showing areas of high elevations that can become potential location for an additional water storage facility was developed by RVA and is shown in Figure 4-1. These areas will be further studied in this Class EA and a suitable location will be selected based on the findings from the 2023

Hydrogeological Study, 2024 Archaeological Study, and the 2021 Cultural Heritage Report (as revised in 2023). The findings are summarized in the following sections.

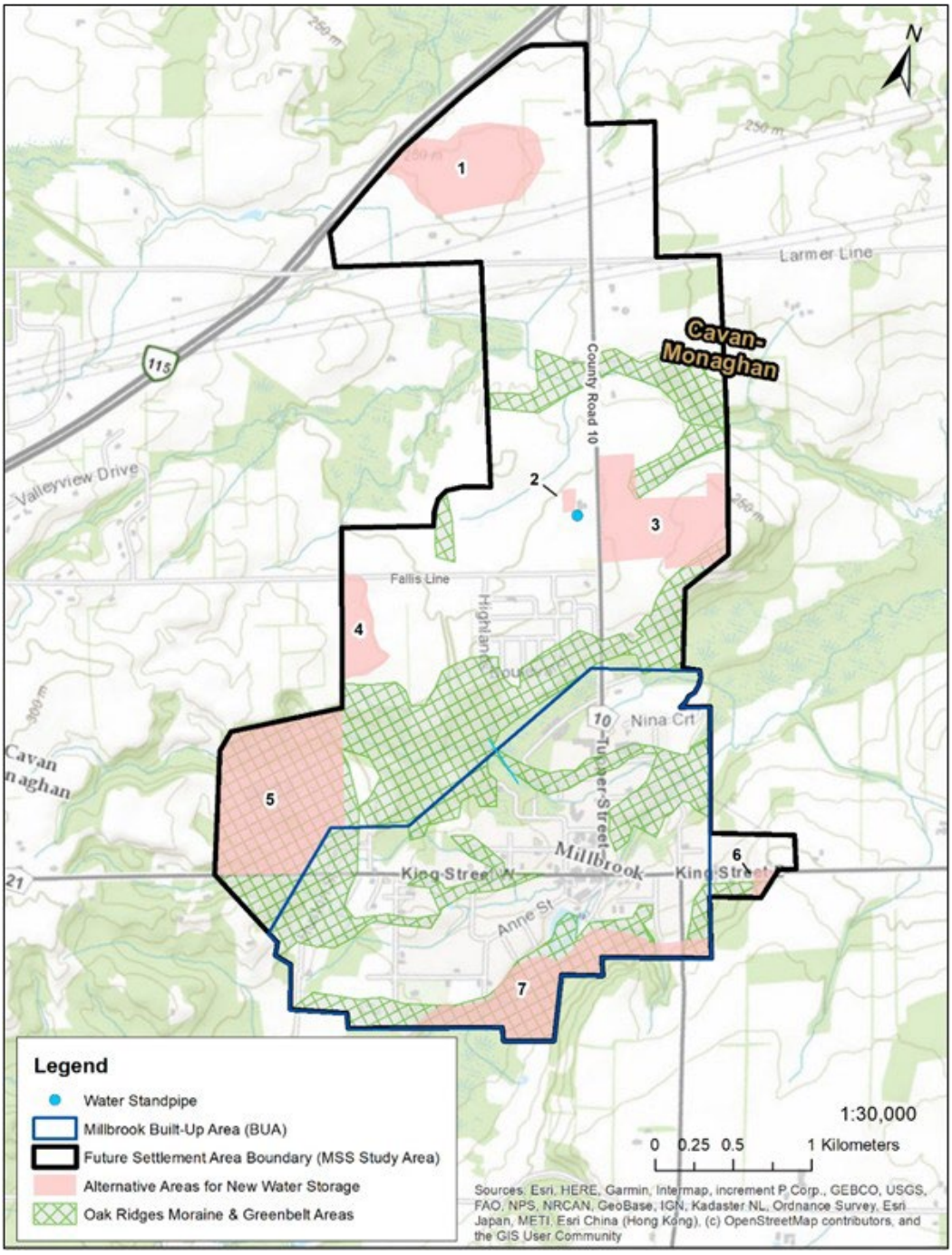


Figure 4-1: Areas of High Elevations for Potential Storage Locations

4.2.3 2023 Hydrogeological Study

The study was completed as part of the MSS and comprised of reviewing the existing hydrogeological information to support construction of new water supply and servicing infrastructure. The study area included properties outside the boundary of Millbrook, the existing location of the Millbrook WTP, and the Millbrook Wellfield.

The following specific locations based on the corresponding investigations will be considered for the purposes of this Class EA:

1. Hydrogeological investigation conducted at site 825 Fallis Line by GHD as part of the Proposed Residential Development in 2017. The site is within the vicinity of Location #2 and, as such, its hydrogeological conditions can be used for preliminary understanding of the conditions in Location #2. The study found that the stratigraphy consisted of topsoil overlying very loose to very dense till, ranging in composition from silty sand to silty clay. Water level depths in the monitoring wells and piezometers were from 0.9 to 4.8 m.
2. 2014 Geotechnical investigation report for Water Tower and Servicing prepared by Geo-Logic for 988 County Road 10 (south of King Street and Duke Street intersection), Millbrook. This area is located within Location 7. The report indicates that the stratigraphy at the site consisted of topsoil overlying silty sand till in the area of the proposed water tower and asphalt over fill, overlying gravelly sand to sandy silt till within the proposed servicing areas. Groundwater was measured in open boreholes at depths ranging from approximately 1.1 to 2.6 m below grade.

The study also detailed potential impacts of construction dewatering, including settlement of nearby structures and utilities and reduction of groundwater flow to groundwater users and watercourses. A pre-construction survey within the radius of influence and a monitoring plan is recommended to be undertaken at the location selected for the proposed water storage facility.

4.2.4 2024 Archaeological Study

A Stage 1 Archaeological Assessment of Millbrook's archaeologically significant sites was conducted by Archaeological Services Inc. as part of the MSS. A few of these sites fall within the potential Location #4 for the water storage tank. The report notes that these sites retain archaeological value or interest. If Location #4 is chosen as the preferred location, then further archaeological studies may be required to confirm actual presence of cultural heritage and archaeological items of interest.

4.2.5 2021 Cultural Heritage Report

The Cultural Heritage Report: Desktop Collection Results, reporting Millbrook's built heritage resources and cultural heritage landscapes was conducted by Archaeological Services Inc. as part of the MSS. Eight potential cultural heritage landscapes (CHLs) were identified within the study area. Only one CHL, CHL 6 - is within the potential locations for the water storage tank (Location #2 in **Figure 4-1**). CHL 6 is the Grace Presbyterian Cemetery located at the northwest corner of County Road 10 and Fallis Line Intersection. Measures to protect CHL's in Location #2 would need to be taken should that site be chosen as the preferred alternative. CHLs such as the Gardiner's Cemetery (CHL 4) and a three farmscapes (CHLs 1, 2 and 3) are roughly half a kilometer from Location #3, and mitigating against moving closer to those CHLs should be noted.

4.2.6 Official Plan

The Official Plan provides the following directions for new infrastructure being implemented in response to growth:

- New infrastructure and expansions to existing infrastructure is to align with adjacent land uses and limits social and environmental impact;
- Infrastructure that is energy efficient, promotes water conservation and water efficiencies and limits impacts to air quality is encouraged; and
- The Township's agricultural and cultural heritage resources are to be protected.

The Official Plan also provides the following maps of the Millbrook Settlement Area as per the Growth Management Study which will be used for determining the preferred location of the water storage tank in this Class EA.

1. Map Schedule A-1: Land Use and Transportation map provides designated lands within the Settlement Area boundary of Millbrook as per the Growth Management Study, including potential future development areas that will need to be connected to the Millbrook Drinking Water System (DWS);
2. Map Schedule B-1: Natural Heritage Systems and Environmental Constraints provides areas designated as hazard lands, wetlands, woodlands and flood plain areas. The proposed solution will need to consider minimum impact to these significant areas; and
3. Map Schedule C: Development Constraints map provides locations within Millbrook that may limit development opportunities due to existing environmentally vulnerable or sensitive areas.

4.2.7 Anticipated and Approved Development

A map of potential development areas within the Settlement Area as per the Growth Management Study is provided in Appendix A – Potential Development Locations. This map was developed during the MSS for estimating future serviced population and corresponding water demand and wastewater flows. Anticipated and Approved Development figures were updated for this Class EA – refer to Technical Memorandum #2 Water Demand and Storage Analysis based on Anticipated and Approved Developments for further details. Updated development details are used in this Class EA, to identify any potential constraints and narrow down the list of proposed locations for the storage facility.

5.0 DESIGN CRITERIA

5.1 Design Guidelines

The 2008 Design Guidelines for Drinking Water Systems (MOE Guidelines, now known as the MECP Guidelines) recommends that water storage site selection is to consider the technical, social, historical/ archaeological, natural environment and economic impacts. This will include:

1. Maintaining separation from residential areas or other non-compatible land uses;
4. Suitability of subsurface and soil conditions;
5. Adequacy for future expansion; and
6. Consideration for functional aspects of facility layout including access roadings, site grading, site drainage etc.

Storage facilities are designed to maintain adequate pressures in the distribution system at average day demand (ADD), so that contamination of the distribution system can be prevented in event of power failure or other emergencies. Therefore, a location on the highest point of the serviced (study) area is preferred to help provide a portion of the height needed to provide the required pressure. To prevent flow reversals which can cause turbidity issues in the distribution system, locations at extremities of the distribution system are typically avoided. However, storage tanks at opposite ends of the water system allows for movement of water, to minimize stagnation in large sections of the distribution system. This facilitates security of water in emergency cases such as critical watermain breaks.

The sizing of the facility is selected such that the tank turn over frequency are adequate to minimize water stagnation and ice build up in the interior of the water storage tank, which causes deterioration of water quality and possibly structural damage, respectively.

Based on the MOE Guidelines, high and low pressures in a water distribution system are kept such that they do not go above 700 kPa (100 psi) nor below 275 kPa (40 psi) during normal operating scenarios. Typically, the levels in the water containing portion of the storage facility are maintained as follows:

- The equalization volume and emergency volume are located between the top water level (TWL) of the storage facility and that elevation necessary to produce a minimum pressure of 275 kPa (40 psi) in the majority of the system under peak hourly flow;
- The fire volume should be located above the elevation necessary to produce a minimum 140 kPa (20 psi) under the maximum day plus fire flow condition.

5.2 Hydraulic Model

The hydraulic model for this Class EA will be developed using the Innovyze InfoWater Pro (version 2024.4) software. A watermain hydraulic model of the Millbrook DWS water distribution network was developed for the MSS and will be used as a baseline for the analysis. The demand conditions will be modeled for the current 2021 and the future 2051 planning horizons. The current 2021 planning horizon will be used for model validation to confirm that the model results reflect real-world conditions which will provide confidence in the accuracy of the hydraulic model. The 2051 planning horizon will be used to analyze the efficiency of the proposed storage systems and alternative locations in meeting the future demands per the population projections based on the Master Servicing Study. The watermain hydraulic analysis will be utilized to determine the most efficient location of the proposed storage by analyzing the system's capacity and performance per alternative location. The hydraulic analysis will also advise if local distribution system improvements are required.

6.0 MILLBROOK DRINKING WATER SYSTEM

6.1 Drinking Water Treatment Plant

The village of Millbrook is supplied with drinking water from the existing municipal well site located at 86 King St West, just west of the Turner St. and King St. West intersection. Raw water is supplied from three wells, each equipped with a submersible vertical turbine well pump. Water treatment comprises of sodium hypochlorite for disinfection with contact time provided in a chlorine contact pipe.

Storage is provided by a Water Storage Standpipe (standpipe) located at 988 County Road 10 by the Township Municipal Office. It has a capacity of 2,600 m^3, of which only 2,115 m^3 is considered usable storage as the remaining volume does not provide adequate pressure to the distribution system. To provide adequate pressure and fire flow to the new subdivisions near Fallis Line, a BPS was installed in 2016 located at 988 County Road 10.

Table 6-1 lists the DWS's infrastructure and associated capacities.

Table 6-1: Millbrook DWS Capacities

Infrastructure	Capacity	Source
Water Treatment Facility		
WTP Rated Capacity	3,000 m^3/day	MDWL# 136-101[1]
Max Water Taking (per day)	3,000 m^3/day (34.7 L/s)	PTTW# 1150-CZXQTQ
Max Water Taking (per minute)	1,500 L/min (25 L/s)	
Submersible Vertical Turbine Pumps (x 3; one in each well)	34.7 L/s[1] at 64.0 m TDH	DWWP# 136-201[1]
Chlorine Contact Pipe	71.0m x 900 mm dia.	
Supply Firm Capacity	3,000 m^3/day	Largest well pump out of service
Water Distribution System		
Storage Standpipe	2,600 m^3	DWWP# 136-201[1]
Usable Storage Standpipe	2,115 m^3	
Booster Pump Station (2 duty, 1 standby)	11 L/s at 28 m TDH	DWWP# 136-201[1]
Vertical in-line Centrifugal High Flow Pumps (1 duty, 1 standby)	120 L/s at 28 m TDH	

1: Drinking Water Permit dated 2021

The water distribution system is divided into two pressure zones; a low-pressure zone comprising of the network within the existing Millbrook Built-Up Area (see Figure 4-1 and a high-pressure zone comprising of the subdivisions by the Standpipe and booster station (near the Municipal Office).

6.2 Water and Storage Requirements

Water storage requirements depend on serviced population and historic water consumption trends.

Water storage requirements depend on serviced population and historic water consumption trends. Per the MSS report, the projected residential population is 10,455 in 2051, and 3,983 total employees in 2051. Assuming that a percentage of the employees will also be residents in Millbrook and their water usage would already be accounted for based on the residential population, it was considered that that three employees' water demand needs combined would equal to one resident's water use. Therefore the equivalent residential population is projected to grow to 11,783 by 2051. It is assumed growth is linear from 2021 to 2051.

Since the water demand projections in the MSS were based off data up to year 2021, the projections were re-checked with 2022 and 2023 data obtained from the Annual Water Reports from the Township's website.

Table 6-2 provides the ADD and maximum daily demand (MDD) from 2019 to 2023 (2019 to 2021 taken from MSS). The 2023 MDD of 1,796 m^3/day comes from the month of October and is not consistent with the MDDs from previous years because;

- MDDs from 2019 to 2022 occurred in summer months; and
- MDDs in the preceding years are much smaller (that is, largest MDD is 1,233m^3/day).

However, since Millbrook has a historically low peaking factor (PF = ratio of MDD to ADD) as compared to the recommended PF in the MECP Guidelines, this MDD is not taken as an anomaly and is included in the historic per capita consumption analysis with the intention to obtain a higher peaking factor. Including this October 2023 MDD raises the PF 5-year average from 1.8 (used in the MSS for projections) to 1.9. The Maximum Day Factor provided by the MECP Guidelines for the population ranging from 10,001 to 25,000 is also 1.9. Consequently, the Maximum Day Factor used for projecting demand to 2051 is 1.9, updated from the MSS Maximum Day Factor of 2.0.

Assuming linear growth the annual additional population growth in Millbrook from 2021 to 2051 is 302 people per year. The corresponding ADD per capita is then calculated to cross-check with the numbers used in the MSS.

Table 6-2: Existing Water Demands for Millbrook from 2019-2023

Year	ADD (m^3/day)	MDD (m^3/day)	PF	Population	ADD (L/cap/d)	ADD (L/unit/d)
2019	552	1,009	1.8	2,312	239	685
2020	541	1,018	1.9	2,516	215	617
2021	689	1,233	1.8	2,719[1]	253	727
2022	722	1,112	1.5	3,021	239	656
2023	772	1,796	2.3	3,323	232	615
Average from 2019-2023	655	1,234	1.9	-	236	660

Note 1: This value is used to obtain the population of 2022 and 2023 (that is, 2022 population = 291 people + 2021 population of 2,719, and likewise for 2023).

Table 6-2 shows that, consistent with the results obtained in the MSS analysis, the historic per capita demand continues to be lower than that typically recommended in the MECP Guidelines (250 to 450 L/cap/day). Hence, a per capita demand of 270 L/cap/day that was used in the MSS to project water demand will be used to provide a conservative analysis that considers possible changes in water usage in the future. As such, the forecasted water demand and storage requirements for 2051 provided in the MSS remain the most up-to-date values that will be used for selecting the location of the water storage. A graphical representation of the historical and projected water storage requirements is shown in Figure 6-1. As seen, required water storage will reach 85% of the current storage capacity by 2025 and will exceed the useable volume capacity by 2028.

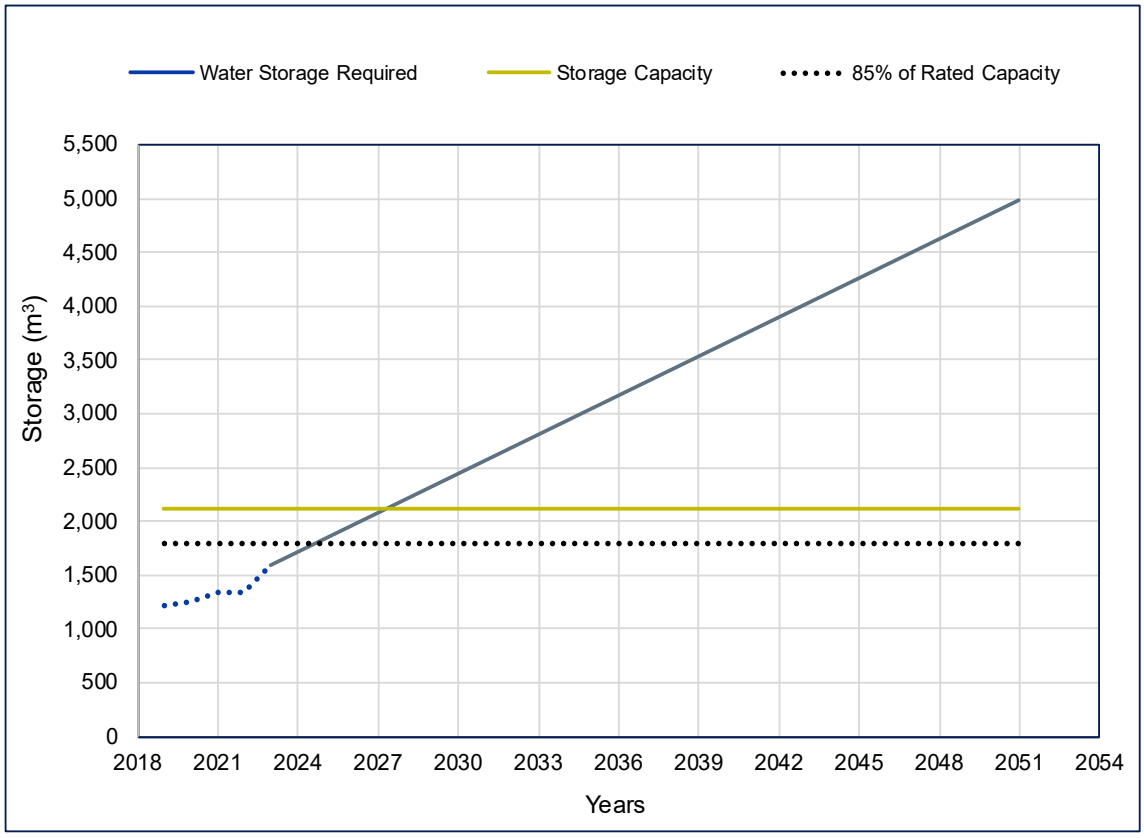


Figure 6-1: Millbrook Water Storage Need Projections to 2051

7.0 EVALUATION CRITERIA

In line with the MSS, the evaluation process will follow a two-step approach with the first step comprising of screening the long-list of locations to narrow down to a short list that meets the problem and opportunity statement and is devoid of major constraints, disadvantages or overall unfeasibility. The shortlisted locations will then be evaluated further using the same evaluation criteria that was developed for the MSS and is based on the following five categories:

- Social - represents the local human environment and comprises of impacts to individuals, neighbouring properties, local businesses and Indigenous communities;
- Financial – represents costs associated with the proposed alternative including capital cost, land acquisition and lifecycle maintenance and operation costs.
- Technical – represents the technical requirements of the proposed alternative and evaluates it based on several factors including technical complexity (design, operation and maintenance), regulatory and approval requirements, and compatibility with existing systems.
- Cultural Heritage – represents the effect an alternative will have on known and potential archaeological resources, built heritage resources and cultural heritage landscapes.
- Natural Environment – represents the degree to which the proposed alternative impacts the natural environment with emphasis on sensitive areas that are most critical to human or ecological functions and are most likely to be disturbed.

Table 7-1 below shows the rating scale that will be used for scoring the proposed alternatives against each of the four categories.

Table 7-1: Legend for Evaluation Criteria

Least Positive/Most Negative	More Negative Than Positive	Moderate	More Positive Than Negative	Most Positive/Least Negative
				

8.0 REFERENCES

Archaeological Services Inc. (ASI). (2021). *Cultural Heritage Report: Desktop Collection Results.* Toronto: Archaeological Services Inc. (ASI).

Archaeological Services Inc. (ASI). (2021). *Stage 1 Archaeological Assessment Cavan Monaghan Water and Wastewater Master Servicing Study.* Toronto: Archaeological Services Inc. (ASI).

R.V. Anderson Associates Limited. (2024). *Township of Cavan Monaghan Water and Wastewater Master Servicing Study.* Toronto: R.V. Anderson Associates Limited.

Thurber Engineering Limited. (2023). *Technical Memorandum Desktop Hydrogeological Study Water and Wastewater Servicing Study Township of Cavan Monaghan, Ontario.* Oakville: Thurber Engineering Limited.

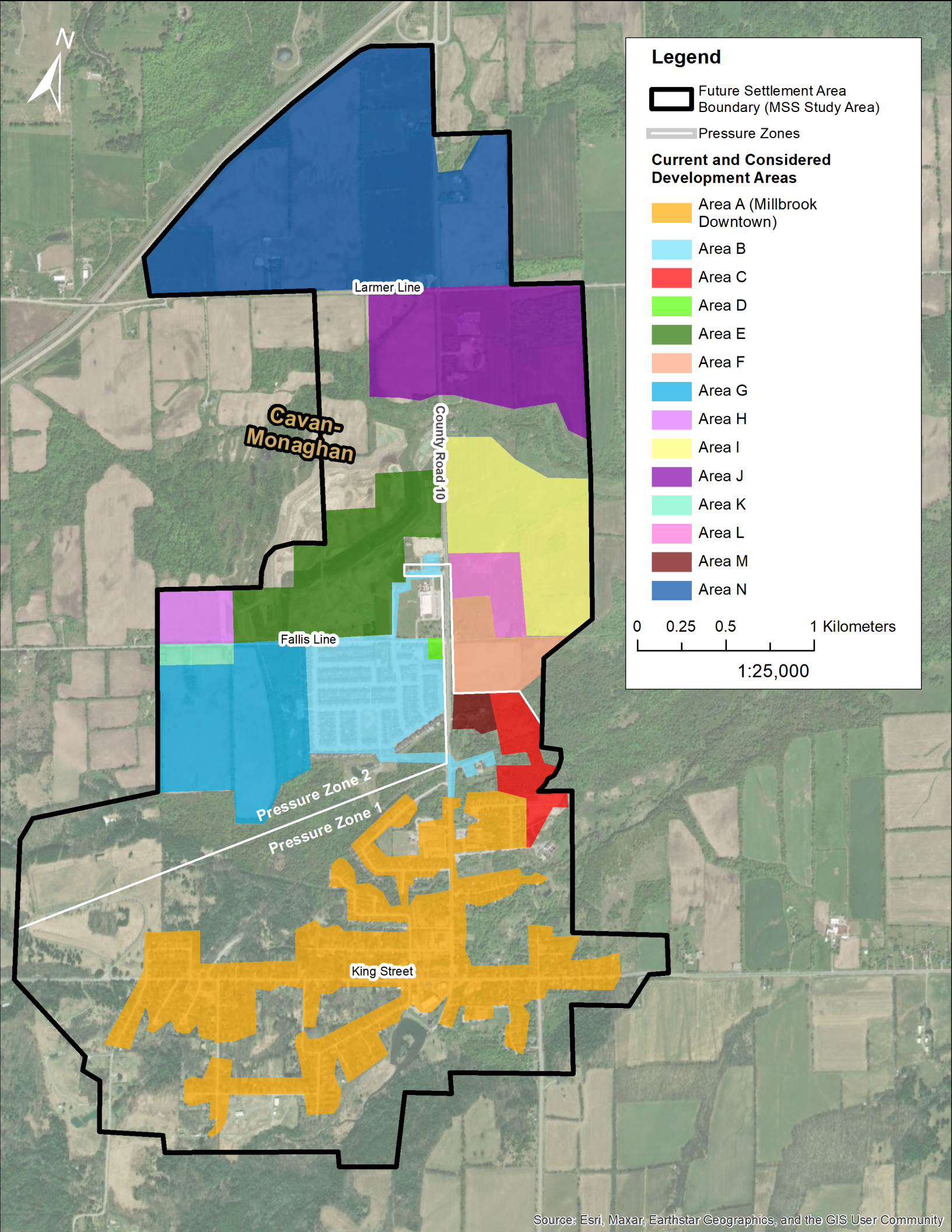
Township of Cavan Monaghan. (2022). *Annual Report for Millbrook Drinking Water System.*

Township of Cavan Monaghan. (2023). *Annual Report for Millbrook Drinking Water System.*

APPENDIX A

Potential Development Locations




N
Legend
Future Settlement Area Boundary (MSS Study Area)
Pressure Zones
Current and Considered Development Areas
Area A (Millbrook Downtown)
Area B
Area C
Area D
Area E
Area F
Area G
Area H
Area I
Area J
Area K
Area L
Area M
Area N
0 0.25 0.5 1 Kilometers
1:25,000
Larmer Line
Cavan-Monaghan
County Road 10
Fallis Line
Pressure Zone 2
Pressure Zone 1
King Street
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

APPENDIX 2

TECHNICAL MEMORANDUM #2



Millbrook Water Storage Class Environmental Assessment

Technical Memorandum #2: Water Demand and Storage Analysis Based on Anticipated or Approved Developments

Prepared for:

The Township of Cavan Monaghan

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RVA 205371

January 26, 2026

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RVA 205371

January 26, 2026

Township of Cavan Monaghan
988 County Road 10
Millbrook, ON
L0A 1G0

Attention: Wayne Hancock, P.Eng.

Dear Mr. Hancock,

Re: Township of Cavan Monaghan Water Storage Municipal Class Environmental Assessment Technical Memorandum 2: Water Demand and Storage Analysis Based on Anticipated or Approved Developments

Please find enclosed TM #2 – Water Demand and Storage Analysis Based on Anticipated or Approved Developments for the above referenced project. The report entails a description of the background information, an update of water storage calculations from the MSS, design and analysis criteria, and the evaluation process to be used for this Class EA.

Yours very truly,

R.V. Anderson Associates Limited

LICENSED PROFESSIONAL ENGINEER
R. K. Y. LAW
100130079
Jan 23, 2026
RVA#205371
PROVINCE OF ONTARIO

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Project Manager

Encls.

CANADA BEST MANAGED COMPANIES Platinum member

Millbrook Water Storage Class Environmental Assessment

Technical Memorandum #2: Water Demand and Storage Analysis Based on Anticipated or Approved Developments

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1.0 INTRODUCTION

1.1 Background

The Township of Cavan Monaghan (Township) retained RVA for the Millbrook Water Storage Class Environmental Assessment (Class EA) project. The project comprises of determining the preferred location and type of water storage facility required to support growth as identified in the 2024 Cavan Monaghan Master Servicing Study (2024 MSS). The scoped deliverables comprise of:

- Technical Memorandum (TM) #1 covering a description of the background information, an update of water storage calculations from the MSS, design and analysis criteria, and the evaluation process to be used for this Class EA;
- Hydraulic modelling of the shortlisted alternative locations;
- TM#3 covering details of alternatives and their evaluation as well as the consultation process;
- A Council Presentation;
- Public consultation and Indigenous engagement through project notices and correspondences
- A Public Information Centre (PIC) covering the study details including alternative strategies analyzed to determine the preferred storage facility and location; and
- A Class EA report combining the above deliverables.

As of March 2025, the following deliverables have been provided to the Township as part of this project:

- Technical Memorandum #1: Existing Conditions, submitted on September 17, 2024 and approved on March 20th, 2025;
- Presentation #1 on November 20th, 2024 to Township on Alternative Locations and Storage Facilities;
- Updated presentation based on Township comments on Presentation #1 on January 30th, 2025; and
- Council Presentation on project progress on March 17th, 2025.

1.2 Additional Tasks

1.2.1 Water Storage Type

The Water Storage Class EA's scope of work included identifying and evaluating water storage site alternatives and modelling based the short-listed locations to identify a preferred location.

Alternative locations are shortlisted based on the MECP guidelines and the following criteria:

- System hydraulics (topography elevation, with preference given to high-elevated areas) including from future development areas;
- Pumping and transmission costs (Choosing high-elevated areas to allow conveyance of water and meet pressure requirements via gravity, and minimizing transmission costs by re-using existing linear infrastructure if possible, instead of having dedicated high pressure transmission mains);
- Proximity to existing infrastructure, future development areas, and existing storage tank
- Safety considerations;
- Aesthetic considerations and public business impact consider;
- Avoiding environmentally sensitive areas
- Property acquisition requirements;
- Future expansion opportunities; and
- Site access and sufficient space.

In the first presentation of TM#1 to the Township (held in 2024), the Township expressed that they would like to explore in-ground reservoirs as opposed to just an Elevated Water Tower. As the Storage Class EA's scope of work was to identify preferred location for the facility based on an elevated tower that can gravity-feed the distribution network (and not require new pumping capabilities), RVA has added to the scope of work an additional criteria of *Preferred Storage Type*, followed by a re-assessment of the long-listed potential locations based on different types of storage facilities. This is further discussed in Technical Memorandum #3 (TM#3).

1.2.2 Modelling and Analysis of Developments

The Township provided RVA with updates to anticipated and approved plans on Thursday, January 30th, 2025, which were not available during the 2024 MSS. The Township provided RVA with further updates to these plans in February 2025 and October 2025. The

subdivision development plans which are approved/registered by the Township are required to have municipal water supply capacity committed to them per the MECP D-5-1 Regulation, summarized as:

'It is the position of the Province that the number of lots in approved plans of subdivisions, developments committed by virtue of approved zoning, new official plans or site-specific official plan amendments, should not exceed the design capacity of the sewage and/or water system. In order to ensure that capacity is not exceeded it is necessary to determine what uncommitted reserve capacity is available.'

MECP D-5-1 provides the following formula for estimating the uncommitted hydraulic reserve capacity of drinking water systems (DWSs):

$$Cu = Cr - L \times F \times \frac{P}{H}$$

Where:

i. Cu = uncommitted hydraulic reserve capacity is obtained by subtracting the equivalent demand commitments to registered and draft approved residential, commercial, and industrial lots from existing hydraulic reserve capacity (units in m^3/day)
ii. Cr = hydraulic reserve capacity, defined as the design capacity minus the actual existing recorded maximum day demand (units in m^3/day)
iii. L = number of committed approved lots
iv. P = existing connected population
v. H = number of households or residential connections
vi. F = Maximum daily flow per capita (m^3/capita/day).

For the purposes of this study the municipal water supply capacity required for the anticipated or approved developments is considered together. The determination of the capacity committed to these anticipated or approved subdivisions will require the following additional tasks:

- Estimation of total population growth resulting from each anticipated or approved development;
- Estimation of additional water demand and storage resulting from each anticipated or approved development;
- Re-forecasting timeline of infrastructure capacity upgrades and capital plan works;
- Updating of the Hydraulic Model (that was developed as part of the 2024 MSS) with the development plans and planned linear works (watermains);

- Reporting on interim findings, including recommendations for all capital works needed to proceed with the anticipated developments.

1.3 Purpose of This Report (TM #2)

The purpose of this TM can be divided into two main parts:

Part A (Section 2): Reconfirm water demands and system needs (including upgrades to the existing BPS) to support the anticipated or approved developments

Part B (Section 3): Address comments provided during the council presentation to:

› Determine two to three shortlisted locations for the new water storage facility that will be modelled; and

› Provide explanation on why Location #2 and Location #6 were screened out.

1.4 Existing System Capacity

1.4.1 Water Supply and Storage

The water supply and storage currently available is listed in Table 1-1.

Table 1-1: Millbrook Water Supply and Storage Capacities

Infrastructure	Capacity	Source
Water Treatment Facility		
Allowed Daily Water Taking	3,000 m^3/day	PTTW# 1150-CZXQTQ
Supply Firm Capacity	3,000 m^3/day	Largest well out of service
Water Distribution System		
Total Volume of Storage Standpipe (by Township Office)	2,600 m^3	DWWP# 136-201 (dated 2021)
Usable Storage Standpipe	2,115 m^3	
Booster Pumps (2 duty/1 standby) with variable frequency drives	11 L/s at 28 m TDH	DWWP# 136-201 (dated 2021)
Fire Flow Pumps (1 duty/1 standby)	120 L/s at 28 m TDH	

1.4.2 Technical Memorandum #1: Existing Conditions Findings

1.4.2.1 Historical Water Demand

Historical average water demand and associated per capita consumption from the serviced population is shown in Table 1-2.

Table 1-2: TM #1 Findings for Historical Water Demand Based on 2019-2023 Data

TM#1 Findings	Values
Average Day Demand (2019-2023 Historical Average)	236 lpcd*
Max. Day Factor (2019-2023 Historical Average)	1.9
Max. Day Demand (2019-2023 Historical Max)	1,796 m^3/day

*lpcd = Litres per capita (person) per day

1.4.2.2 Projected 2051 Water Demand

Millbrook's water storage demand will surpass the available water storage by 2027. To continue accommodating growth, both water supply and water storage will need to be expanded as shown in Table 1-3.

Table 1-3: TM #1 Findings for Projected Water Demand Based on MECP Guidelines

TM#1 Findings	Values
2051 Serviced Population	11,780 people
Average Day Demand per Capita (Based on MECP Guidelines and Master Servicing Plan)	270 lpcd
Max. Day Factor (Based on MECP Guidelines)	1.9
2051 Max. Day Demand[1] (MDD)	6,445 m^3/day

Note 1: 2051 MDD = 2023 MDD of 1,796 (largest historical MDD from 2019-2023) + the projected additional water demand from 2021 to 2051 which is approximately 4,650 m^3/day.
Note that historical max. per capita consumption is 236 lpcd, where as the future water demand per capita is estimated at 270 lpcd (as per the Master Servicing Study).
Refer to TM#1 and Master Servicing Study for calculation details.

1.4.2.3 Uncommitted Hydraulic Reserve Capacity

As of 2023, the uncommitted hydraulic reserve capacity of the system (prior to approving the committed developments) was 3000 m^3/day – 1,796 m^3/day = 1,204 m^3/d. Based on a per capita consumption of 270 lpcd and a MDD peaking factor of 1.9, this translates to roughly **2,340 additional people that can be supported by the existing DWS**.

2.0 PART A: ANALYSIS OF POPULATION AND WATER DEMAND FORECASTS BASED ON APPROVED OR ANTICIPATED DEVELOPMENTS

2.1 Water Supply

The anticipated or approved development subdivision plans provided by the Township in February and October 2025 are attached to Appendix A. These maps and tables provide the number and type (townhouses, single family homes, etc.) units for each development and/or the population of each development. For each development area, the corresponding population and water demand was estimated as follows:

- Persons Per Unit (PPU) used: Where population is provided, these figures have been used in Table 2-1. Where units are provided, the following persons per unit were assumed to calculate each developments' population: 3.4 for single-family developments, 2.5 for townhouses and mixed-use units, and 1.5 for apartments.
- A per person water demand of 270 lpcd and overall water distribution system max. day factor of 1.9 is used, consistent with the Master Servicing Study.
- Commercial development demands are based on an average day demand of 28 m^3/hectare/day, consistent with the MECP Guidelines, and a maximum day factor of 1.9.

The results are shown in Table 2-1.

Table 2-1: Population and Water Demand in Approved or Anticipated Developments (per info. provided in Feb. and Oct. 2025)

Location	Population	Max Day Water Demand (m^3/day)
Residential Developments		
Towerhill North	2,180	1,120
Vargas	920	470
Fallis Road South (west of Highlands Blvd)	2,030	1,050
Towerhill North (west of School Block)	550	290
Fallis Road North (east of County Road 10)	1,620	830
Commercial Developments		
Fallis Road North (east of County Road 10)	9 hectares	480
Institutional Development		
School - Towerhill North	590	300

Location	Population	Max Day Water Demand (m^3/day)
Residential Developments		
Total		
Total from Developments	**7,890**	**4,540**

Note: All figures rounded to the nearest 10th

Table 2-1 shows that the approved or anticipated developments will bring in 7,890 additional residential and institutional population, which is approximately 5,550 (7,890 – 2,340 = 5,550) more people than the existing water system can support as of 2023 (refer to Section Error! Reference source not found..). Additionally, the commercial developments add another 480 m^3/day of water demand from the DWS. Table 2-2 provides the total committed capacity as of 2025 (post approval of the anticipated or approved developments) based on formula D-5-1. As seen, the water supply's firm capacity will be exceeded by approximately 85% if all of these developments were to be included.

Table 2-2: Millbrook DWS Committed Capacity as of 2025

Water Supply	m^3/day
A = 2023 Water Demand (MDD, rounded)	1,800
B = Additional Water Demand from Approved or Anticipated Developments	4,540
C = A + B = Total Committed Capacity (MDD)	6,340
D = Firm Capacity	3,000
D – C = Supply Deficit	(- 3,340)

Note: All figures rounded to the nearest 10th

2.1.1 Water Storage Required

Based on the MECP "Design Guidelines for Drinking-Water Systems", the total treated water storage requirement can be calculated using the formula A + B + C, where:

A = Fire Storage in m^3 (calculated using Table 8-1 from the MECP design guidelines for an equivalent population at a certain suggested fire flow (L/s) for a certain number of hours)

B = Equalization Storage in m^3 (25% of max day demand)

C = Emergency Storage in m^3 (25% of (A + B))

Table 2-3 shows the total water demand and water storage requirements for Anticipated or Approved Developments + Existing Population (as of 2023). This is the water demand

and storage required if the Township is to meet the needs of its existing residents and employees as well as the needs of all Anticipated or Approved Developments.

Table 2-3: Water Demand and Storage Requirements for Anticipated or Approved Developments + Existing Population (as of 2023)

Parameter	Value
Total Serviced Population (Existing Population + Anticipated or Approved Developments) (people)	11,213
Maximum Day Demand (m^3/day)	6,336
Fire Flow Storage (m^3)	2,376
Equalization Storage (m^3)	1,584
Emergency Storage (m^3)	990
Required Water Storage to account for Anticipated or Approved Developments + Existing Population (m^3)	**4,950**
Current Available Storage (m^3)	2,115
Storage Deficit (based on anticipated or approved developments, m^3)	**-2,835**

Table 2-4 shows the total water demand and water storage requirements required to meet the needs of all residents and employees to 2051.

Table 2-4: Existing and Future Water Demand Data (up to 2051)

Parameter	Value
Total Serviced Population to 2051 (people)	10,455
Total Number of Employees by 2051 (people)	3,983
Maximum Day Demand[1] (m^3/day)	6,445
Fire Flow Storage (m^3)	2,376
Equalization Storage (m^3)	1,611
Emergency Storage (m^3)	997
Total Water Storage Volume Required for 2051 demands (m3)	**4,984**
Current Available Storage (m^3)	2,115
Storage Deficit (based on 2051 demands, m^3)	**-2,869**

Note 1: 2051 MDD = 2023 MDD of 1,796 (largest historical MDD from 2019-2023) + the projected additional water demand from 2021 to 2051 which is approximately 4,650 m^3/day. Refer to Technical Memorandum #1 for calculation details.

Therefore, based on the water storage volume calculated for both the presently committed developments and forecasted into 2051, the required total water storage volume for Millbrook is 4,984 m^3 and the additional storage volume is 2,900 m^3 (rounded). It should be noted that this Class EA is only for the additional water storage and that another separate Class EA will need to be undertaken to address any additional water demand.

2.2 Summary of Model Findings

The Hydraulic Model results[1] indicated that the existing booster pumps are inadequate to service the future peak hour demand conditions that is forecasted for the committed developments. The summarized findings and recommendations are:

- The booster pumps be upsized to **41 L/s at 28m** of total dynamic head (unless another booster pumping station is added along with the new storage tank); and
- Existing fire flow pumps are adequate to maintain the current level of service.

Note that the above recommendations are to be considered in conjunction with the final results of the Class EA project TM#3, which will provide the required BPS upgrades to service growth to 2051. This is to avoid undertaking interim (short-term) upgrades that do not consider long-term requirements of the system.

2.3 Comparison to 2024 MSS Findings

The 2024 MSS noted that the Millbrook DWS would reach 85% of its rated capacity by approximately 2029 and firm capacity would be exceeded by 2031 – 2032. The population at the exceedance-year was forecasted to be around 5,850 people.

Figure 2-1 shows that after all the approved and anticipated developments are built-out and populated, Millbrook's population will be approximately 11,200 people which is 95% of the forecasted population growth to 2051. At the current population growth rate, the anticipated year that this population is reached is 2049.

However, irrespective of the timeline of the construction of the approved or anticipated developments, MECP requires DWSs to be sized for the committed population and developments. As such, the recommendations in the MSS regarding implementing **new water supply before 2031 and new water storage by year 2028** remain unchanged, to facilitate the approval of the developments.

[1] Hydraulic Model Report will be submitted as a separate document and is not attached to this report.

The Township is recommended to continue reviewing population growth so that planned capital works are implemented in time to support growth.

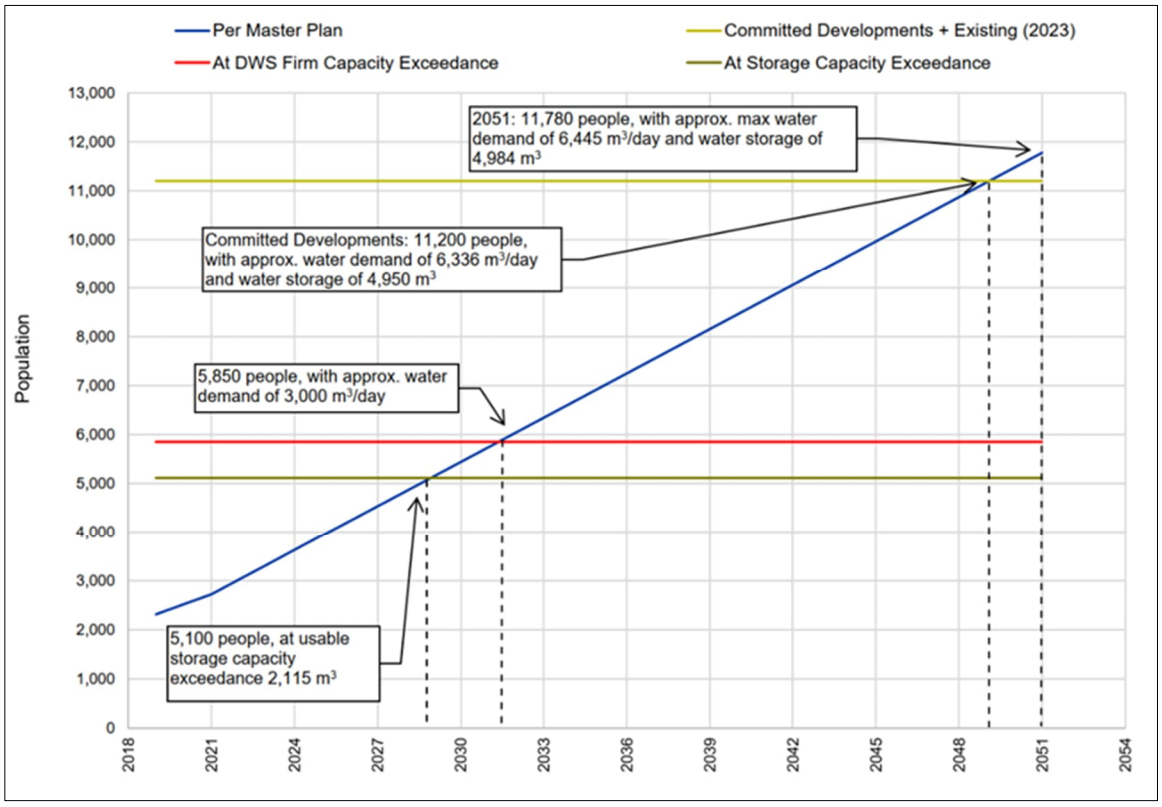


Figure 2-1: Millbrook Population Growth and Corresponding DWS Exceedances

3.0 PART B: ANALYSIS OF LONG LISTED LOCATIONS

3.1 Previously Determined Short-Listed Alternative Locations

Appendix B shows seven (7) long-listed alternative locations for the new water storage facility. After discussion with the Township staff, two (2) locations of the seven, with various storage tank types, were shortlisted as follows:

- Location 1 is suitable for a new elevated water storage tank that will be fed by the existing BPS; and
- Location 3 is suitable for several storage tank options, including:
  - New elevated water tower fed by the existing BPS;
  - New standpipe fed by the existing well pumps and providing pressure to Pressure Zone 2 via the existing or new BPS (in conjunction with the existing standpipe by the Township office); and
  - A new in-ground reservoir and new BPS, where the existing well pumps will feed water to the new in-ground reservoir.

3.2 Re-analysis of Previously Eliminated Alternative Locations

3.2.1 Purpose of Re-Analysis

The Township of Cavan Monaghan (TCM) Council met on March 17th, 2025 for the monthly council meeting, where RVA presented a progress update of the Water Storage Class EA, including the above noted options. The Council asked for re-consideration of Location 2 and Location 6 given that both are Township owned properties and have high elevations.

3.2.2 Location #2 – by the Township Office and Beside Existing Standpipe

Location 2, although already owned by the Township, this location was originally screened out because:

1. Township staff had noted there would be limited space for a second storage facility on the remaining property
2. Having two (2) storage tanks on the same site would be a risk to Pressure Zone 2 in case there were key watermain break(s) or BPS issues that would prevent water from the municipal wells to get to these storage tanks and BPS. This would leave Pressure Zone 2 vulnerable to lack of water storage. Having the second storage tank at Location #2 will not be as beneficial to Millbrook from a 'storage' resiliency and redundancy perspective compared to having it located elsewhere in town.

In order to reconsider this location again, the Township is requested to provide latest available information including (but not limited to) site plan layout, utility drawings, as-built drawings and geotechnical reports, and what the Township plans are for the remaining space.

3.2.3 Location #6 – by Decommissioned Standpipe

3.2.3.1 Option A – Location 6 Dedicated to Pressure Zone 1

The decommissioned standpipe (henceforth Standpipe #2) is in Location 6. The Township Council suggested the decommissioned standpipe to be re-commissioned and used for the lower Pressure Zone 1 (the existing downtown core). Since Standpipe #2 will be dedicated to Pressure Zone 1, its existing volume will likely be enough to meet the MECP water storage requirements for only Pressure Zone 1 (i.e. existing Millbrook Built-Up area). This can be confirmed if the Township decides to proceed with shortlisted Location #6 for the Storage Class EA study.

Since the existing volume will be retained, the re-commissioning of the standpipe would not require rebuilding of foundation. The assumed scope of work would be restoration and rehabilitation as required, subject to a full structural assessment. Then the current operating standpipe (henceforth named Standpipe #1) would be utilized only for the higher-Pressure Zone 2 (Highlands Blvd and the future developments) that is serviced by the existing BPS.

This solution does not address a key issue: the required storage capacity for Pressure Zone 2 by 2051 (based on MSS Future Developments Map in Appendix C) is approximately 3,910 m^3, whereas the existing Standpipe #1 has a usable storage volume of only 2,115 m^3. Therefore, Standpipe #1 cannot meet the storage requirements of Pressure Zone 2 projected to 2051 on its own. Either of the following two options will be required to address this:

i. The existing Standpipe #1 will need to be expanded to meet the projected Pressure Zone #2 storage requirements; OR
ii. A third storage facility needs to be built, which is to be sized for the remaining storage deficit that existing Standpipe #1 cannot meet in Pressure Zone 2.

Both solutions above have a low benefit-cost ratio when compared to building one new storage facility to complement the existing Standpipe #1 and not re-commission Location 6's decommissioned standpipe.

For Option i: The foundation of Standpipe #1, which was designed for a specific load and volume, will have to be checked and possibly replaced in order to accommodate the

expansion. In addition, the Standpipe #1 volume can only be increased by adding additional height (not diameter), therefore the hydraulic grade line of the Standpipe and the water distribution system would need to be checked that it will not result in pressures beyond the MECP guidelines. Any construction work done to Standpipe #1 will result in Pressure Zone 2 having limited to no water storage capacity for the duration of the construction works. This poses operational challenges and risk to the drinking water system.

For Option ii: A third storage facility eliminates any advantage of re-commissioning Location 6's Standpipe since the capital and operational/maintenance cost for three (3) water storage facilities will be more than two (2) water storage facilities. This is not a recommended alternative strategy.

3.2.3.2 Option B – New Upsized Storage Facility in Location 6 to Feed Both Pressure Zones

An alternative strategy would be to use Location 6 for the new storage facility sized for 2051 requirements. The new standpipe in Location 6 will be filled by the municipal wells via watermain on King Street and will then provide water storage to the downtown core (Pressure Zone 1) by gravity. It will also provide the required storage capacity to Pressure Zone 2 by maintaining the same water level in the existing Standpipe #1 (by the Municipal Office), which is connected to the BPS. The existing BPS feeds Pressure Zone 2.

Standpipe #1 will continue to be filled by the municipal wells but will not be used to provide storage capacity back to the downtown core. Instead, a check valve will be added to the watermain from Tupper Street to Standpipe #1, so that Standpipe #1 is dedicated to servicing Pressure Zone 2 only, where the new developments are planned. This check valve will prevent water from going back down to Pressure Zone 1 along the watermain on Tupper Street (County Road 10) in case of a watermain break in the Pressure Zone 1 distribution system.

Although using Location 6 will allow saving on property-acquisition costs, this option will require the following works (but not limited to):

- Demolition of the existing standpipe including the foundation;
- Construction of a new Standpipe in Location 6 sized for 2051 requirements;
- Possible upsizing of the watermain along King Street to reduce pressure losses when feeding the existing Standpipe #1 and BPS; and
- Possible addition of an altitude valve to Standpipe #2 to avoid overflowing this standpipe while Standpipe #1 is being filled, and possible addition of a check valve on watermain in Tupper Street to allow Standpipe #1 to be dedicated to servicing

Pressure Zone 2 only. Further water modeling will be required to confirm these details, should the Township wish to pursue this option further.

However, this strategy poses the following challenges:

- As seen in **Error! Reference source not found.**, Location 6 is in a tight area and any construction work will require coordination with the neighbouring landowners, as the Township owned property shares a common driveway with a private residence.
- There may also need to be some temporary easement and/or land acquisition to allow for construction laydown and to meet MECP recommendations regarding security provisions of water storage facilities; and
- About 95% of the future growth to 2051 and beyond is expected to occur in the Pressure Zone 2, which is north of the existing built-up area of Millbrook. This will eventually make Location 6, which is on the far southeastern part of Millbrook, to be the farthest point away from the expanding water distribution network. This is not ideal for a storage facility in terms of hydraulics and water supply security.



Figure 2-2: Decommissioned Millbrook Standpipe (Location #6)

APPENDIX A

BPS Model Information



1.0 Introduction

The Township has recently focused on the future expansion of the Millbrook North which includes several developments that will be serviced by the current booster pumping station (BPS). These proposed developments include a school, townhouses, single family homes and a commercial development.

The purpose of the technical memorandum is to evaluate the performance of the existing booster pumps located with the Millbrook BPS to meet the future demands related to the proposed development and identify any upgrade requirements to meet the desired level of service.

2.0 Modeling Approach

The steady state model that was built in InfoWater Pro as part of the master plan was utilized for this assessment. The booster pump station is fed by the elevate tank, which supplied through the existing well located in the Millbrook South. It was assumed that there are no limitations/constraints to the water supply from the wells to the elevated tanks, which means that there is sufficient water at the elevated tank that can be used by the BPS to service the future demand conditions.

2.1 Model Update

The future (interim) demands related to the proposed developments within the booster servicing areas (Millbrook North) were reviewed and assigned to the model and are summarized in Table 2.1 below. A breakdown of the areas has been provided in Appendix B. Table 2.2 below provides a summary of the existing and future demands under Average Day Demand (ADD) Maximum Day Demand (MDD) and Peak Hour Demand (PHD) conditions, for the Millbrook North area.

Table 2.1: Model Update Summary – Catchments Added to Model

Area	Average Day Demand (L/s)
Catchment E	8.7
Catchment F	2.4
Catchment G	6.3
Catchment H	1.7
Catchment I	3.7
Total	**22.8**

Table 2.2: Existing and Future Demand Summary

Scenario	Average Day Demand (L/s)	Maximum Day Demand (L/s) PF = 1.9	Peak Hour Demand (L/s) PF = 2.85
Existing	3.0	5.7	10.2
Future	22.8	43.3	65.0
Total	**25.8**	**49.0**	**75.2**

2.2 Existing Booster Pumps

The information related to the existing pumps installed in the BPS is summarized Table 2.3 below.

Table 2.3: Existing Pump Information

Pump Purpose	No. of Pumps	Design Point per Pump
Booster	3 (2 Duty, 1 Standy)	11 L/s at 28 m of TDH
Fire Flow	2 (1 Duty, 1 Standby)	120 L/s at 28 m of TDH

3.0 Results and Conclusions

The model results indicated that the existing booster pumps are inadequate to service the future peak hour demand conditions. The model results further indicated that the existing fire flow pumps are adequate to maintain the current level of service assuming that the minimum fire flow required in the system is approximately 67 L/s (typical value for single family homes).

Therefore, it is recommended that only the booster pumps be upsized to the design points listed in Table 3.1 below. Please note that no changes are required to the fire flow pumps at this time.

Table 3.1: Recommended Pump Design Point

Pump Purpose	No. of Pumps	Design Point per Pump
Booster	3 (2 Duty, 1 Standy)	**40 L/s at 28 m of TDH**

APPENDIX B

Subdevelopment Plans



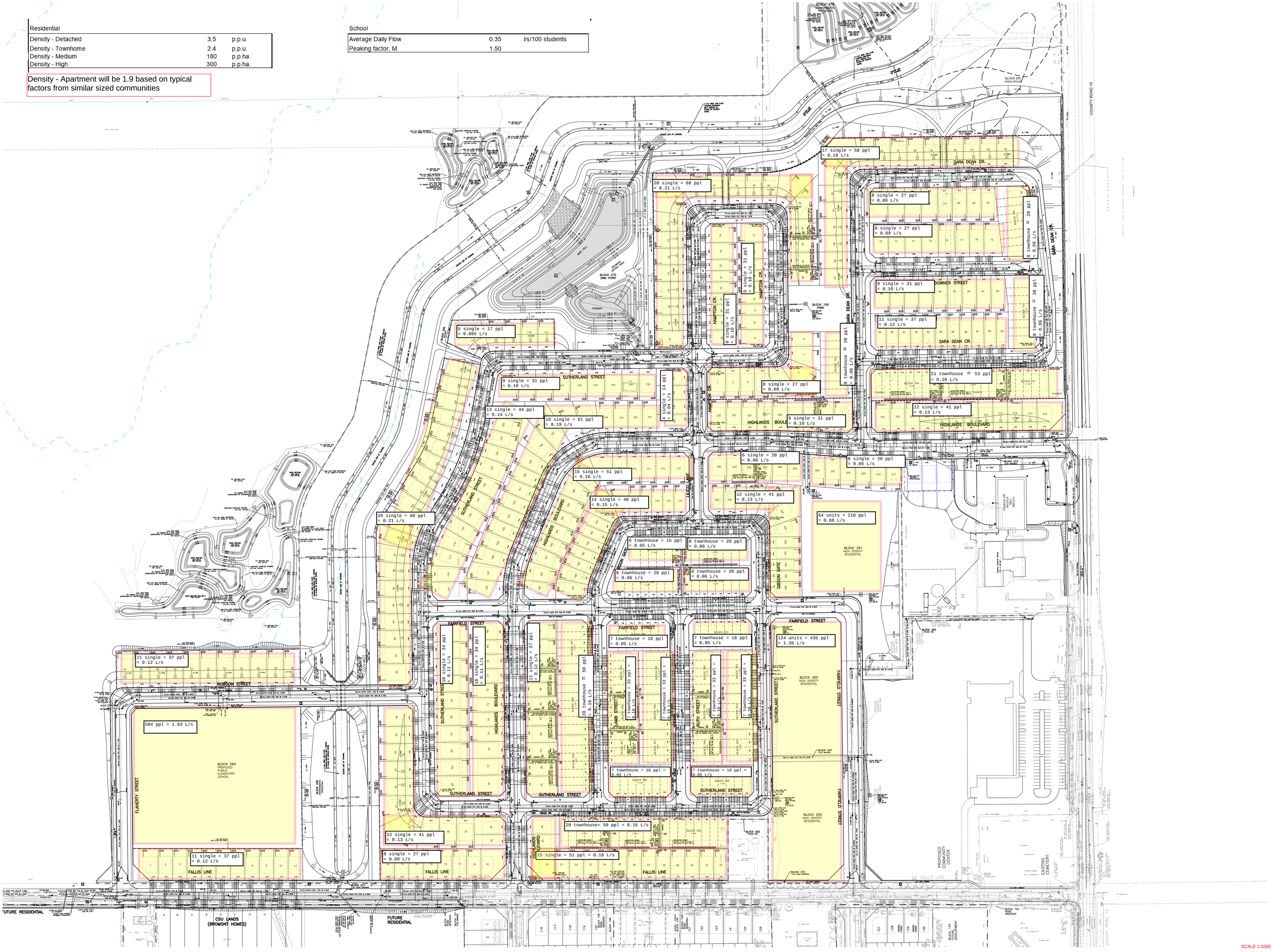
Residential

Density - Detached	3.5	p.p.u.
Density - Townhome	2.4	p.p.u.
Density - Medium	180	p.p.ha.
Density - High	300	p.p.ha.

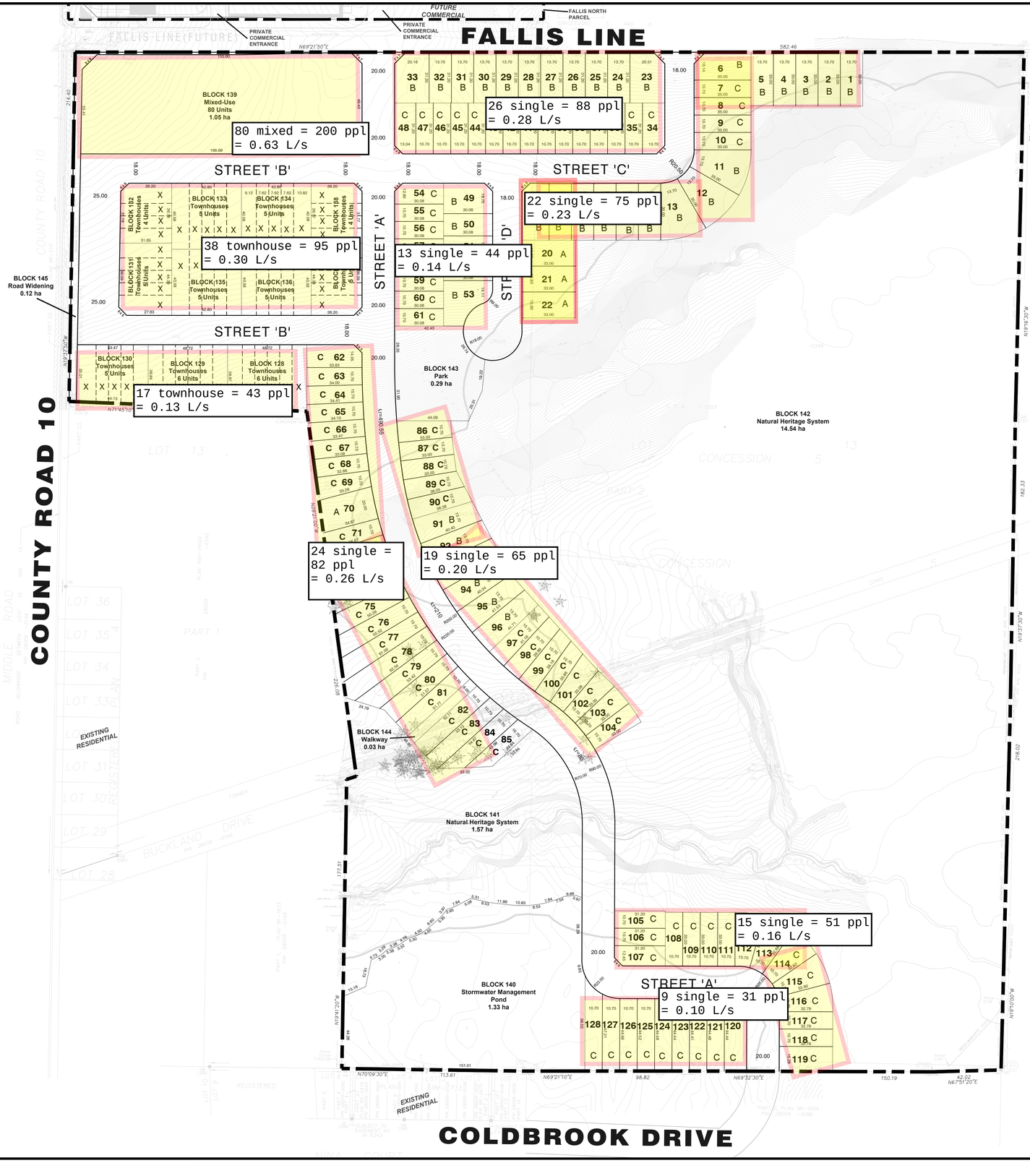
Density - Apartment will be 1.9 based on typical factors from similar sized communities

School

Average Daily Flow	0.35	l/s/100 students
Peaking factor, M	1.50	



SCALE 1:1000



TITLE:

DRAFT PLAN OF SUBDIVISION

LEGAL DESCRIPTION:

DRAFT PLAN OF SUBDIVISION
PART OF LOT 13
CONCESSION 5
TOWNSHIP OF CAVAN
COUNTY OF PETERBOROUGH

KEY PLAN:



REQUIRED INFORMATION:

AS REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT R.S.O. 1990.

(a) SEE PLAN
(b) SEE PLAN
(c) SEE KEY MAP
(d) SEE SCHEDULE OF LAND USE
(e) SEE PLAN
(f) SEE PLAN
(g) SEE PLAN
(h) PIPED WATER TO BE PROVIDED
(i) CLAY LOAM SOIL
(j) SEE PLAN
(k) SANITARY & STORM SEWERS TO BE PROVIDED
(l) SEE PLAN
NOTE: CONTOURS RELATE TO CANADIAN GEODETIC DATUM

SURVEYOR'S CERTIFICATE:

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AS SHOWN ON THIS PLAN AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATE AND CORRECTLY SHOWN IN ACCORDANCE WITH A PLAN OF SURVEY PREPARED BY IBW SURVEYORS

December 13, 2023
DATE

DAVID COMERY
ONTARIO LAND SURVEYOR

IBW SURVEYORS
71 MEARNS COURT, BOWMANVILLE, ONTARIO, L1C 4N4
IBWSURVEYORS.COM | 1.800.667.0696

OWNER'S CERTIFICATE:

I HEREBY AUTHORIZE THE BIGLIERI GROUP LTD. TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO THE COUNTY OF PETERBOROUGH

December 13, 2023
DATE

FALLIS LINE
PETERBOUROUGH COUNTY

APPROVAL STAMP:

Schedule of Land Use

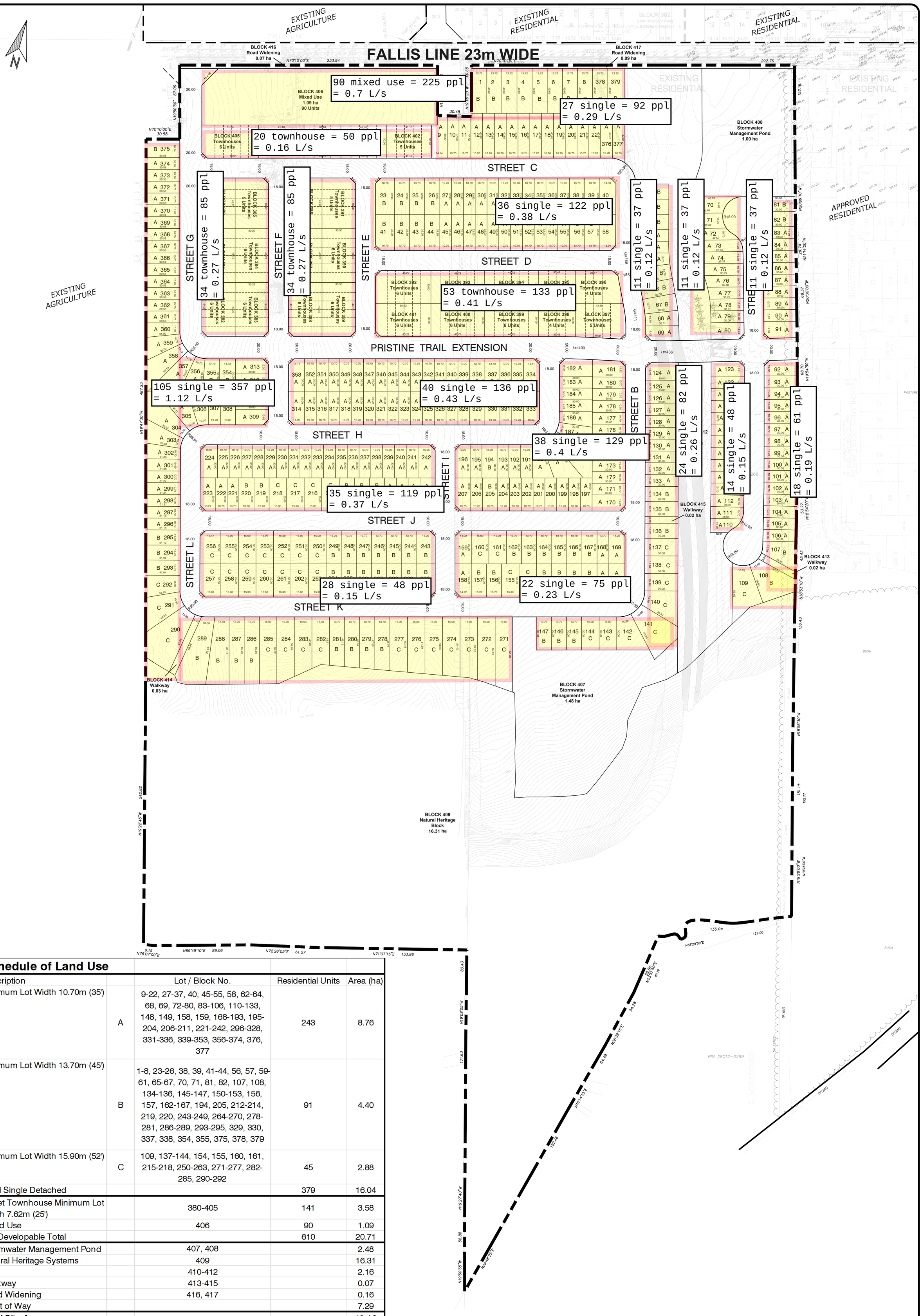
Description		Lot / Block No.	Residential Units	Area (ha)
Minimum Lot Width 10.7m (35')	C	7-10, 34-48, 54-69, 71-90, 97-128	87	3.64
Minimum Lot Width 13.7m (45')	B	1-6, 11-19, 23-33, 49-53, 91-96	37	1.89
Minimum Lot Width 15.9m (52')	A	20-22, 70	4	0.22
Total Single Detached			128	5.75
Street Townhouse Minimum Lot Width 7.62m (24')		128-138	55	1.74
Mixed-Use		139	80	1.05
Net Developable Total			263	8.54
Stormwater Management Pond		140		1.33
Natural Heritage Systems		141, 142		16.11
Park		143		0.29
Walkway		144		0.03
Road Widening		145		0.12
Right of Way		Streets A-D		3.05
Total Site Area				**29.47**

REVISIONS

No.	Description	Date	Int.
5	Created Connection to Coldbrook Drive	2023 11 02	EC
4	Revision	2023 07 25	EC
3	Revision	2022 11 29	EC
2	Revision	2022 02 09	JS
1	Issues for DPS Revision	2022 02 09	JS

PROJECT No.: 20699
DATE: November 29, 2022
SCALE: 1:2500
DRAFTED BY: EC
CHECKED BY: MP
DRAWING No.: **DP-01**

BIGLIERI GROUP
2472 Kingston Rd, Toronto
21 King Street W, Suite 1502, Hamilton
(416) 693-9155
thebiglierigroup.com



Schedule of Land Use

Description		Lot / Block No.	Residential Units	Area (ha)
Minimum Lot Width 10.70m (35')	A	9-22, 27-37, 40, 45-55, 58, 62-64, 68, 69, 72-80, 83-106, 110-133, 148, 149, 158, 159, 168-193, 195-204, 206-211, 221-242, 296-328, 331-336, 339-353, 356-374, 376, 377	243	8.76
Minimum Lot Width 13.70m (45')	B	1-8, 23-26, 38, 39, 41-44, 56, 57, 59-61, 65-67, 70, 71, 81, 82, 107, 108, 134-136, 145-147, 150-153, 156, 157, 162-167, 194, 205, 212-214, 219, 220, 243-249, 264-270, 278-281, 286-289, 293-295, 329, 330, 337, 338, 354, 355, 375, 378, 379	91	4.40
Minimum Lot Width 15.90m (52')	C	109, 137-144, 154, 155, 160, 161, 215-218, 250-263, 271-277, 282-285, 290-292	45	2.88
Total Single Detached			379	16.04
Street Townhouse Minimum Lot Width 7.62m (25')		380-405	141	3.58
Mixed Use		406	90	1.09
Net Developable Total			610	20.71
Stormwater Management Pond		407, 408		2.48
Natural Heritage Systems		409		16.31
Park		410-412		2.16
Walkway		413-415		0.07
Road Widening		416, 417		0.16
Right of Way				7.29
Total Site Area				**49.18**

TITLE:

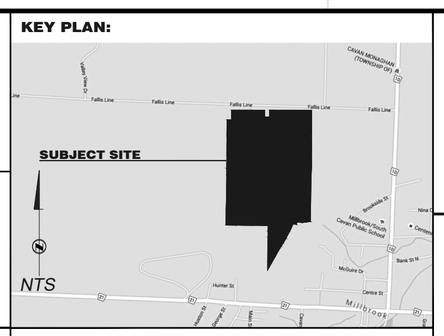
DRAFT PLAN OF SUBDIVISION

LEGAL DESCRIPTION:

DRAFT PLAN OF PROPOSED SUBDIVISION
PART OF LOT 11, CONCESSION 5
(Geographic Village of Millbrook, Township of Cavan)
PART OF LOT 11, CONCESSION 5 (Geographic Township of Cavan)
TOWNSHIP OF CAVAN-MONAGHAN
NORTH MONAGAN
(COUNTY OF PETERBOROUGH)

787 - 825 Fallis Line West
Township of Cavan Monaghan

KEY PLAN:



NOTE:
DISTANCES AND/OR COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AS SHOWN ON THIS PLAN AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATE AND CORRECTLY SHOWN IN ACCORDANCE WITH A PLAN OF SURVEY PREPARED BY:SURVEYOR_COMPANY

DAVID COMERY
IBW SURVEYORS

2023/06/30
DATE

OWNER'S CERTIFICATE

I HEREBY AUTHORIZE THE BIGLIERI GROUP LTD. TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO THE MUNICIPALITY

SAVERIO MONTEMARANO
CS4 DEVELOPMENT

2023/06/30
DATE

REQUIRED INFORMATION

AS REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT R.S.O. 1990.

(a) SEE PLAN
(b) SEE PLAN
(c) SEE KEY MAP
(d) SEE SCHEDULE OF LAND USE
(e) SEE PLAN
(f) SEE PLAN
(g) SEE PLAN
(h) MUNICIPAL WATER AND SEWAGE AVAILABLE
(i) SANDY SILT / SILTY SAND TO CLAYEY SILT / SILTY CLAY
(j) SEE PLAN
(k) MUNICIPAL WATER AND SEWAGE AVAILABLE
(l) SEE PLAN

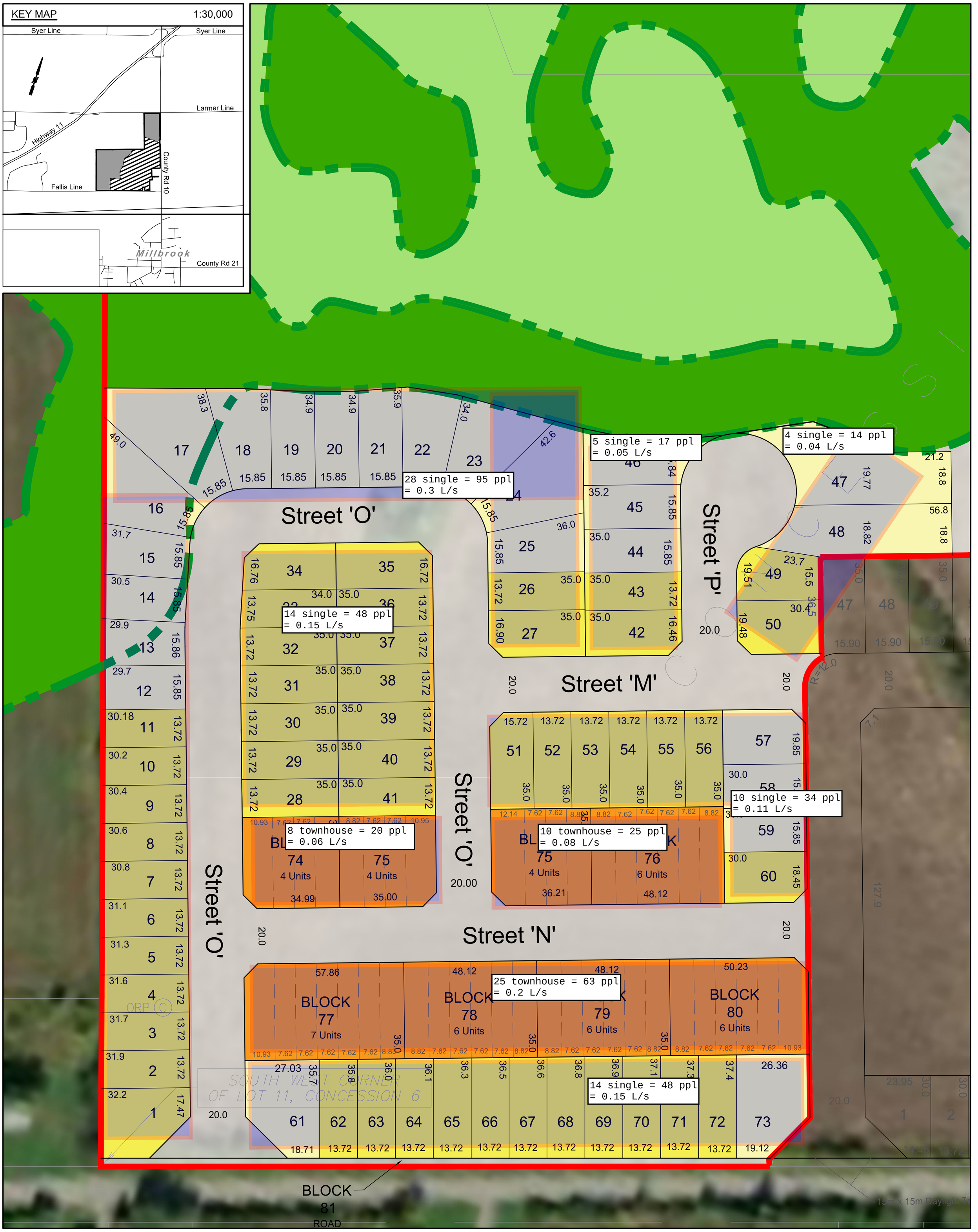
NOTE: CONTOURS RELATE TO CANADIAN GEODETIC DATUM

REVISIONS

No.	Description	Date	Int.
3	Prepared for Third Submission	23/06/30	EC
2	Prepared for Second Submission	22/10/03	EC
1	Stormwater Management Pond Revision	21/12/15	JS

PROJECT No.:	20697
DATE:	November 3, 2022
SCALE:	1:1500
DRAFTED BY:	EC
CHECKED BY:	MT
DRAWING No.:	DP-01

BIGLIERI GROUP
2472 Kingston Rd, Toronto
126 Catharine Street North, Hamilton
(416) 693-9155
thebiglierigroup.com



Natural Linkage Area
(Official Plan - Schedule 'A')

Natural Core Area
(Official Plan - Schedule 'A')

LEGEND

Subject Lands
(32.18 ha / 79.5 ac.)

43 — Residential Units - Townhouses
(7.62m / 25')

49 — Residential Units - Single Detached
(13.72m / 45')

24 — Residential Units - Single Detached
(15.85m / 52')

116 — Residential Units - Total

848.8m / 2,784.8' — ROW Length
(Streets M, N, O & P)

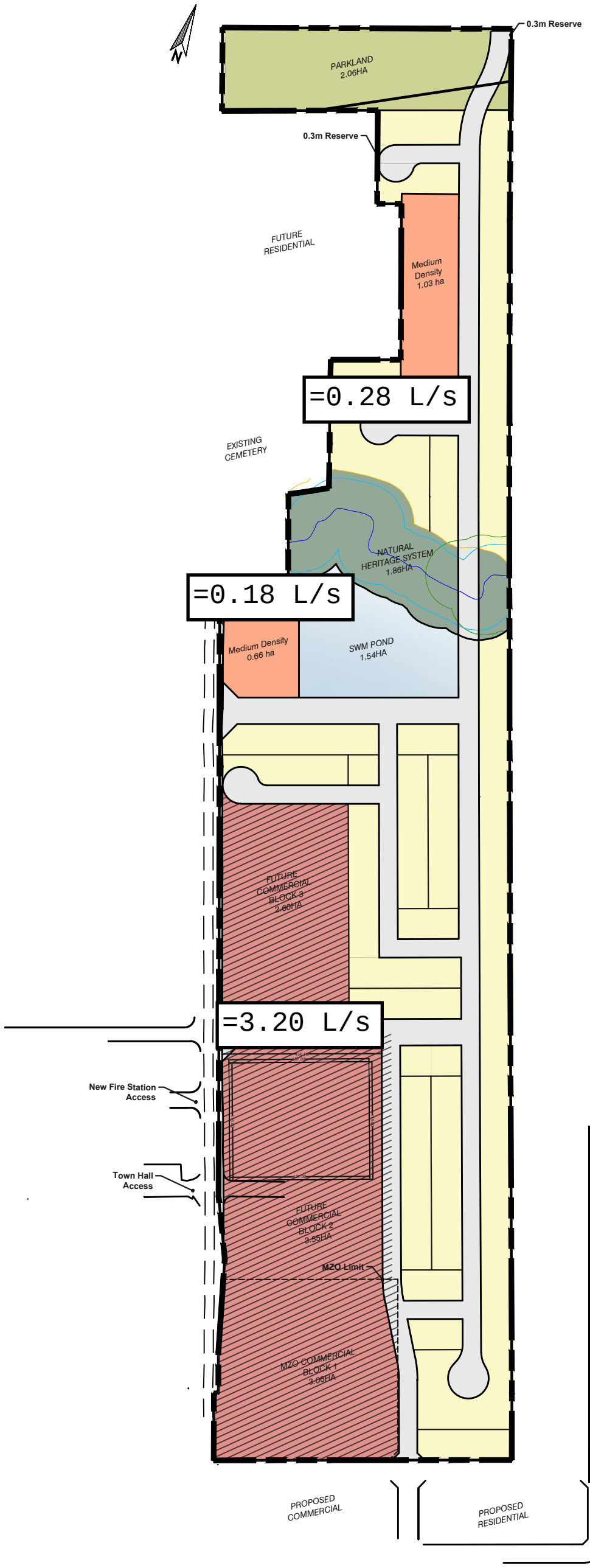
TOWERHILL NORTH
WEST OF SCHOOL BLOCK

PART OF LOTS 11 & 12, CONCESSION 6
AND PART OF LOT 12, CONCESSION 5
GEOGRAPHIC TOWNSHIP OF CAVAN
IN THE
TOWNSHIP OF CAVAN-MILLBROOK-NORTH MONAGHAN
COUNTY OF PETERBOROUGH

0 25 50 75 100 125 150m

IPS
INNOVATIVE PLANNING SOLUTIONS
PLANNERS • PROJECT MANAGERS • LAND DEVELOPERS
647 WELHAM RD., UNIT 9A, BARRIE, ONTARIO, L4N 0B7
tel: 705 • 812 • 3281 fax: 705 • 812 • 3438 e: info@ipsconsultinginc.com www.ipsconsultinginc.com

FILE:	18-783	SCALE:	1 : 750
DATE :	November 8, 2024	DRAWN BY:	BH



TOTAL COMMERCIAL AREA
9.88 ha

Site Statistics		
Proposed Use	Area (ha)	%
Residential Area		
Residential	12.71	56%
Roads	6.13	27%
Road Widening	0.22	1%
Parkland and Trails	2.10	9%
Stormwater Management Pond	1.54	7%
NET TOTAL	**22.70**	**92%**
Natural Heritage Systems	1.86	8%
SUBTOTAL	**24.56**	**100%**
Commercial - Future	6.00	
Commercial - MZO Commercial	3.06	
TOTAL	**33.62**	

CONCEPTUAL BLOCK PLAN
Option 3

ADDRESS:
FALLIS ROAD (NORTH)

Project No:
20698

January 15, 2024

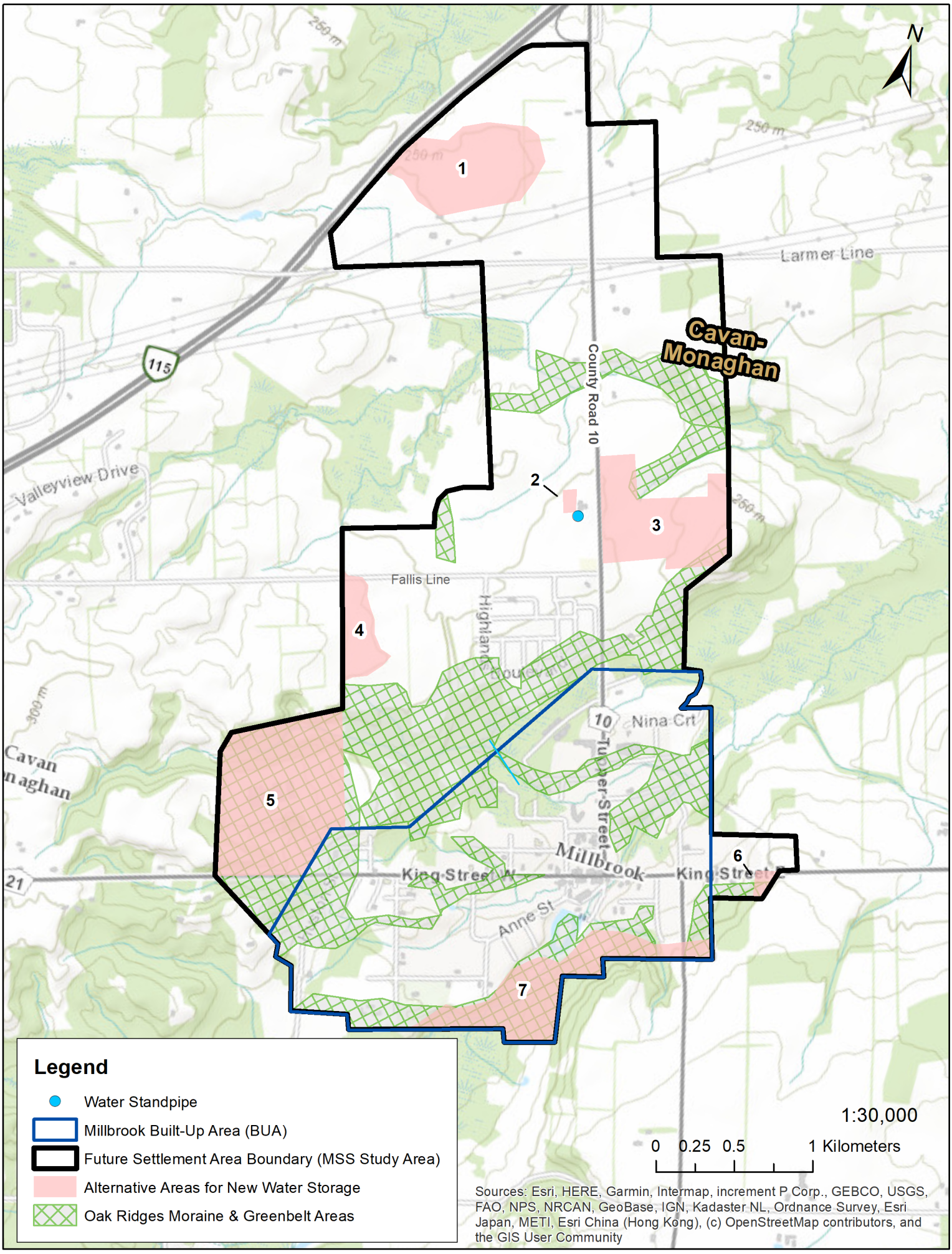
Designed By: EC

BIGLIERI GROUP

APPENDIX C

Longlisted Locations Map

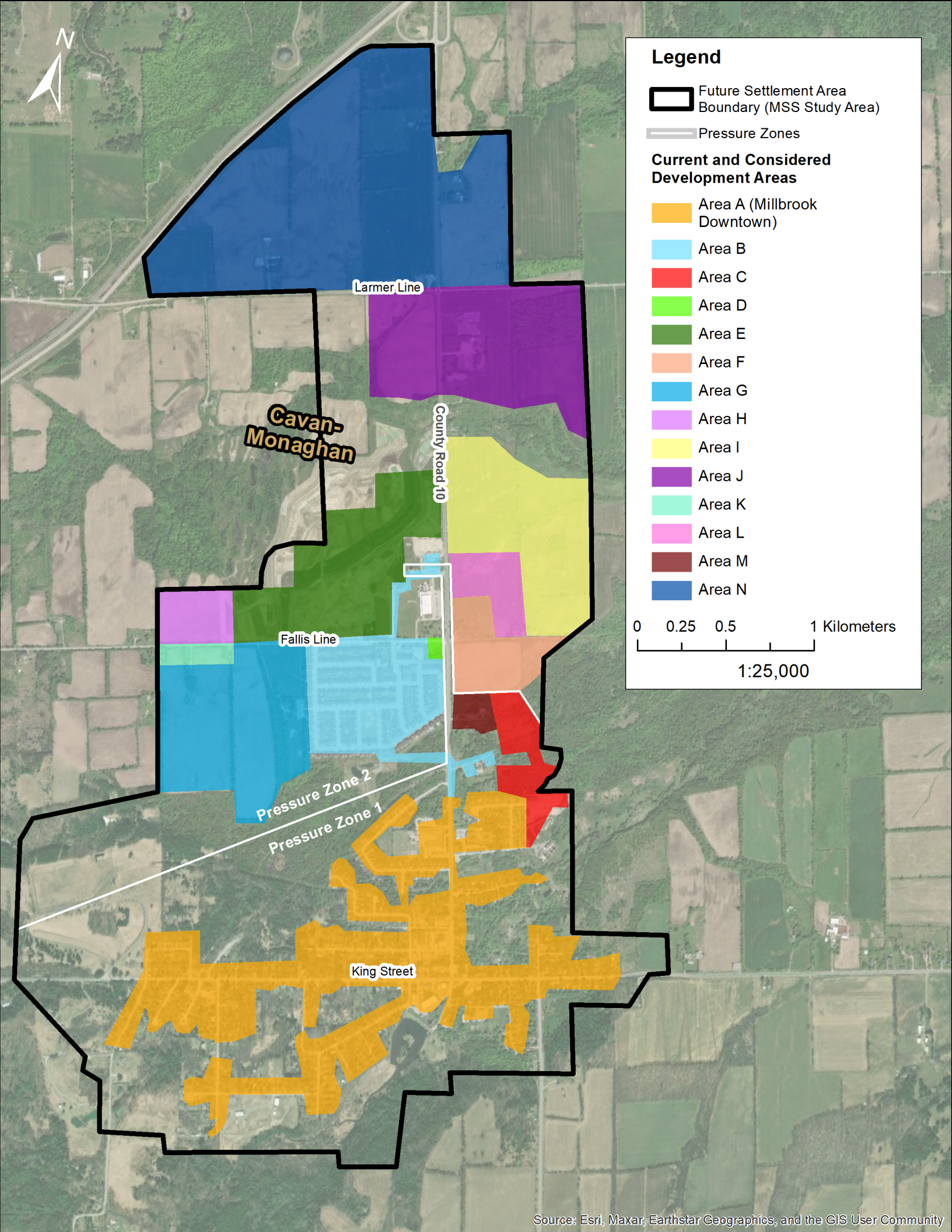



N
1
2
3
4
5
6
7
Larmer Line
Cavan-
Monaghan
County Road 10
115
Valleyview Drive
Fallis Line
Highland
Nina Crt
10
Tupper Street
Millbrook
King Street W
King Street E
21
Anne St
Cavan
naghan
250 m
300 m
Legend
Water Standpipe
Millbrook Built-Up Area (BUA)
Future Settlement Area Boundary (MSS Study Area)
Alternative Areas for New Water Storage
Oak Ridges Moraine & Greenbelt Areas
1:30,000
0 0.25 0.5 1 Kilometers
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

APPENDIX D

Approved or Anticipated Developments Map




N
Legend
Future Settlement Area Boundary (MSS Study Area)
Pressure Zones
Current and Considered Development Areas
Area A (Millbrook Downtown)
Area B
Area C
Area D
Area E
Area F
Area G
Area H
Area I
Area J
Area K
Area L
Area M
Area N
0 0.25 0.5 1 Kilometers
1:25,000
Larmer Line
Cavan-Monaghan
County Road 10
Fallis Line
Pressure Zone 2
Pressure Zone 1
King Street
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

APPENDIX 3

TECHNICAL MEMORANDUM #3



Millbrook Water Storage Class Environmental Assessment

Technical Memorandum #3: Identification and Evaluation of Alternative Water Storage Locations and Types

Final

Prepared for:

The Township of Cavan Monaghan

This Technical Memorandum is protected by copyright and was prepared by R.V. Anderson Associates Limited for the account of the Township of Cavan Monaghan. It shall not be copied without permission. The material in it reflects our best judgment in light of the information available to R.V. Anderson Associates Limited at the time of preparation. Any use which a third party makes of this Technical Memorandum, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. R.V. Anderson Associates Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this Technical Memorandum.

RVA 205371

January 26, 2026

R.V. Anderson Associates Limited
1750 Courtwood Crescent, Suite 220
Ottawa ON K2C 2B5 Canada
T 613 226 1844 **F** 855 833 4022
rvanderson.com

RVA 205371.00

January 26, 2026

Township of Cavan Monaghan
988 County Road 10
Millbrook, ON
L0A 1G0

Attention: Wayne Hancock, P.Eng.

Dear Mr. Hancock,

Re: Township of Cavan Monaghan Water Storage Municipal Class Environmental Assessment Technical Memorandum #3: Identification and Evaluation of Alternative Water Storage Location and Types

Please find enclosed Technical Memorandum #3 for the above referenced project. The report outlines the evaluation of locations and storage types, as well as the details of these alternatives.

Please do not hesitate to contact the undersigned if you have any questions.

Yours very truly,

R.V. Anderson Associates Limited

LICENSED PROFESSIONAL ENGINEER
R. K. Y. LAW
100130079
Jan 23, 2026
RVA#205371
PROVINCE OF ONTARIO

Rika Law
Digitally signed by Rika Law
DN: cn=Rika Law, c=CA, o=R.V. Anderson Associates Limited, email=rlaw@rvanderson.com
Date: 2026.01.23 15:17:24 -05'00'

Nikash Persaud
Coordinator, Environmental Assessments

Rika Law
Principal, Project Manager

Encls.

CANADA'S BEST MANAGED COMPANIES Platinum member

Millbrook Water Storage Class Environmental Assessment

TM #3: Identification and Evaluation of Alternative Water Storage Location and Types

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APPENDICES

APPENDIX A Current and Considered Development Areas Map
APPENDIX B Full Sized Study Area & Alternative Locations Map

1.0 Introduction

1.1 Background

The need for increased water storage capacity was identified in the Cavan Monaghan Master Servicing Study (MSS) and reconfirmed in Technical Memorandum #1: Investigation of Existing Conditions. The existing storage standpipe can provide up to 2,115 m^3 of useable storage. This current storage volume would only be enough for growth up to year 2028. By 2051, a total of 4,820 m^3 water storage is needed to meet the projected water demand, to provide fire protection, and to provide emergency storage. Therefore, an additional new storage tank of approximately 2,700 m^3 would be required by 2028 to allow Millbrook to continue to grow as projected in the Growth Management Study (GMS) and the Master Servicing Study.

1.2 Purpose of Technical Memorandum #3

As per the Problem and Opportunity Statement, the projected water storage deficit in the Millbrook Urban Settlement Area, and the anticipated growth identified in the Township of Cavan Monaghan's Growth Management Study (GMS) and Master Servicing Study (MSS), additional water storage infrastructure is required to meet servicing needs through to the year 2051.

This technical memorandum provides evaluation of the water storage location alternatives and possible water storage types — standpipe, elevated tank and in-ground reservoir. Some of these water storage options require a new Booster Pumping Station (BPS) or expansion/upgrade to the existing BPS. The findings will inform the subsequent design phases of the project.

2.0 CURRENT AND FUTURE PRESSURE ZONES

The high and low ground elevations of key areas within the Millbrook Settlement Boundary are shown in **Figure 2-1**. This helps to understand which areas need to be within which pressure zone in order to provide sufficient pressure to that area. The intention of **Figure 2-1** is not to list out all considered developments, but only the developments where the key watermains along King St or County Road 10 (Tupper St) connect to (either currently or possibly in the future).

The already developed and considered development areas are shown in **Figure 2-2**. This includes the area where the municipal wells are located (at 86 King Street), to where the existing standpipe and Booster Pumping Station are located (by the Municipal Office), all the way until the northern border of the Millbrook Settlement Boundary Area at Tupper Street (County Road 10) and Highway 115 (shown as Area N in the graphic in **Figure 2-2**). A full-sized version of **Figure 2-2** is available as **Appendix A**.

The current standpipe, located at 988 County Road 10, has a high-water level of 278 meters. A conservative head loss of 3 meters was calculated between the wells and the standpipe, utilizing a C-factor of 100, along with a length of 1800 meters and additional relevant parameters. At the wells, the total dynamic head is 64 meters (as per the Drinking Water Works Permit), indicating that the standpipe can be filled by the wells, provided the groundwater level remains at or above 216 meters.

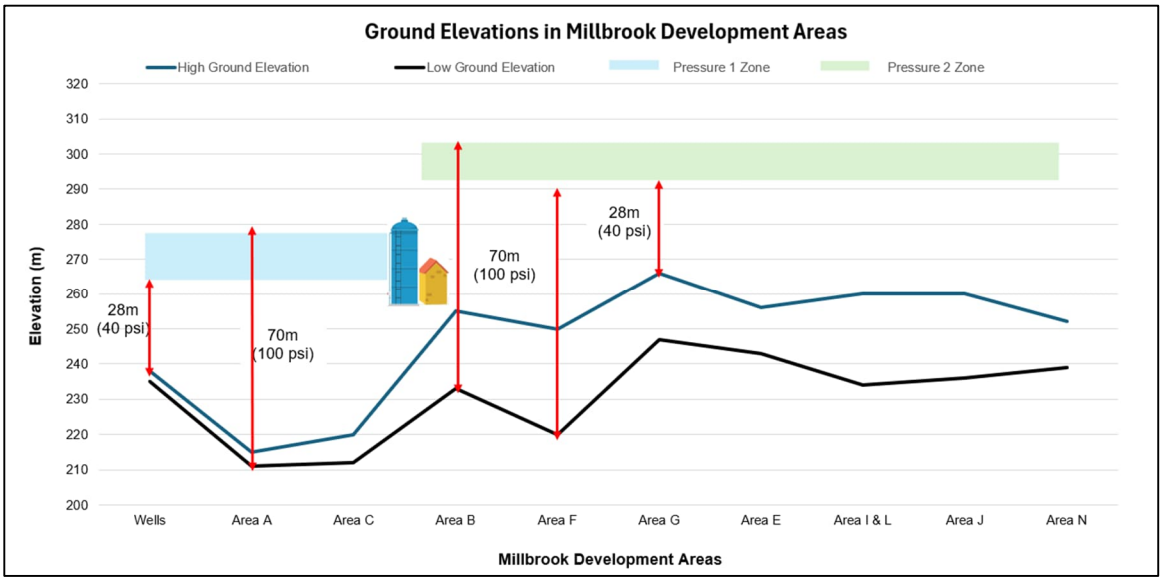


Figure 2-1: Ground Elevations and Pressure Zones for Millbrook Development Areas

According to the Ministry of the Environment Conservation and Parks (MECP) guidelines, a pressure range of 28-70m (40-100 psi) is deemed suitable for water distribution, with ideal pressure ranges being closer to 35-49m (50-70 psi). However, with the vastly varying topographies in Millbrook, achieving that pressure range would be difficult without many more pressure zones. During a fire scenario, pressure is allowed to be as low as 14m (20 psi). As illustrated by the two-coloured rectangles, the development areas are clustered within 2 pressure zones (light blue and light green). The first pressure zone (PZ1 – in light blue) is the Millbrook Built-Up Area (i.e. downtown core and some developments nearby that area. The standpipe acts as floating storage for PZ1 and the water level in the standpipe dictates the pressure for PZ1. The second pressure zone (PZ2 – in light green) is where the new developments around Fallis Line and the Municipal Office are located. PZ2 is fed by an existing Booster Pumping Station (BPS) that is beside the existing standpipe by the Municipal Office. At the same time, the standpipe provides water for the BPS, but it is the BPS that dictates the pressure for PZ2 (grey line).

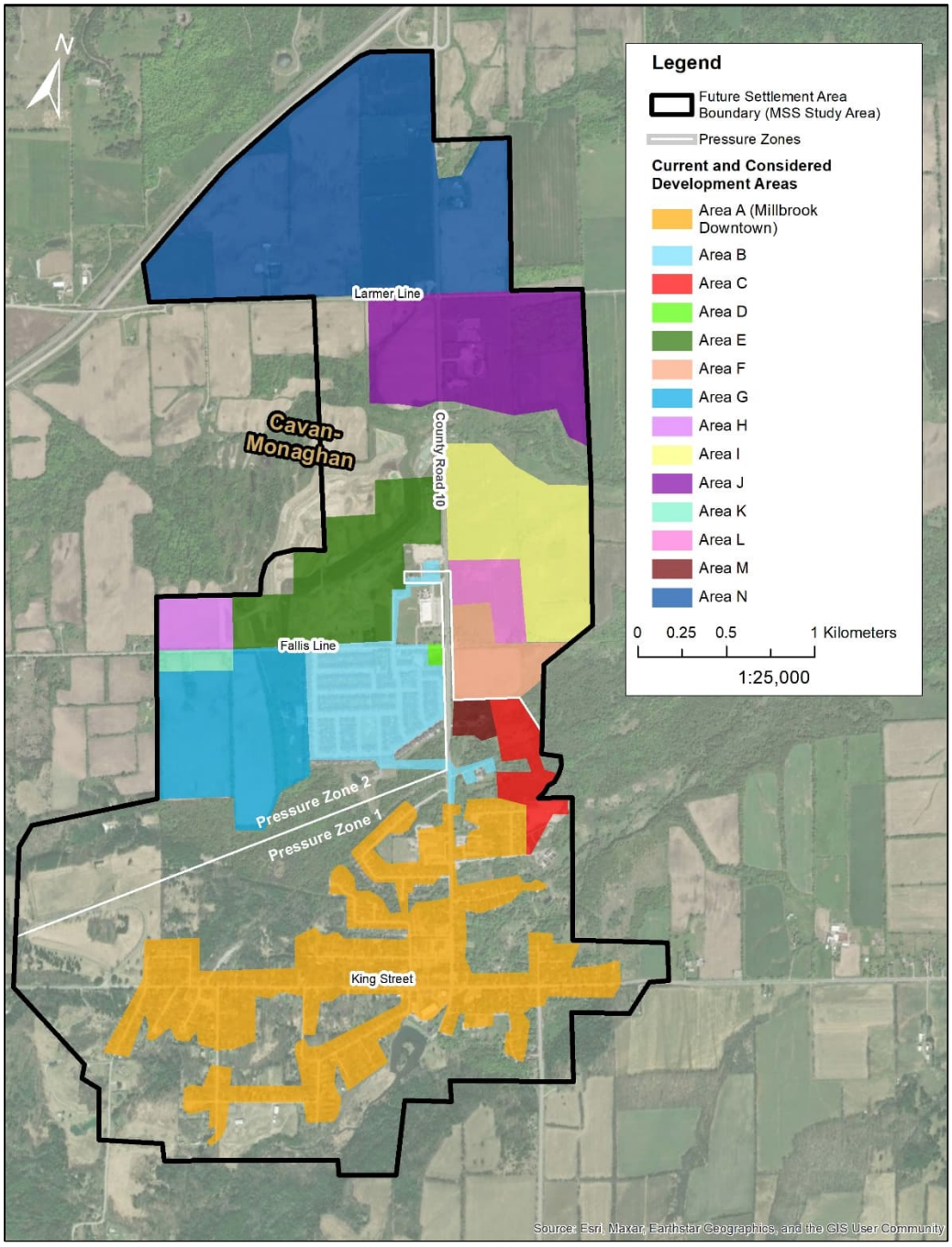


Figure 2-2: Current and Considered Development Areas in Millbrook

Notably, two development areas need special attention in order to fit within one of these two pressure zones, namely Development Area C and Development Area F, shown in **Figure 2-2.**

Although Development Area C and Development Area F are geographically close together and currently owned by the same developer, there are drastically different elevations between the two areas, as shown in **Figure 2-1**. Development Area C has lower ground

elevations, similar to that of the Millbrook downtown core and belongs to Pressure Zone 1. Development Area F have higher elevations and wider range of elevations within its property. The lowest pressure range in Pressure Zone 1 would not have enough pressure for Development Area F. This would require Development Area F to be serviced by the Pressure Zone 2 instead of Pressure Zone 1. However, the lowest elevation within Development Area F would be 'over pressurized' by Pressure Zone 2 and therefore may need those lower elevation areas to be serviced by pressure reducing valve(s) to bring the pressure within MECP guidelines.

3.0 ALTERNATIVE LOCATIONS FOR NEW STORAGE LOCATION

Figure 3-1 is a Map of Millbrook and shows the existing built-up area and new settlement area boundary. It also marks the location of the existing storage standpipe and the seven areas (shaded in pink) identified in TM#1 as the longlist of possible water storage facility locations. A full-sized version of the map is included as **Appendix B**.

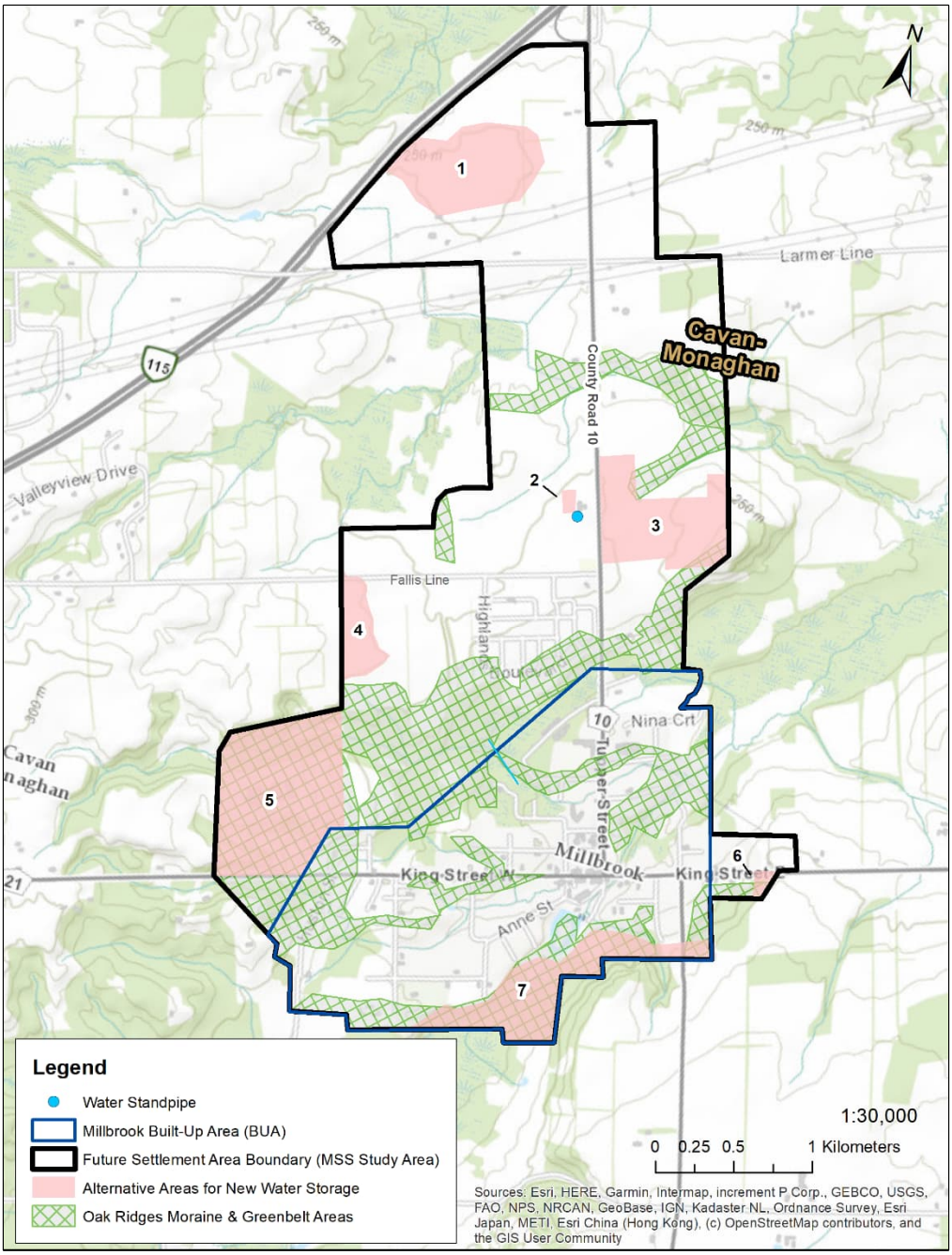


Figure 3-1: Map of Millbrook with Water Storage Tank Location Alternatives

3.1.1 Location #1

Location #1 is north of Larmer Line and adjacent to Highway 115. This corresponds with Development Area "N". This site is zoned for agricultural use and is planned for future urban employment. Its proximity to major transportation corridors offers good accessibility industrial and commercial land uses. Future developments in Millbrook may extend up to this location, but the timeline for development in this area is currently unknown. Ground elevations in this area reach approximately 250 metres, resulting in this area belonging to Pressure Zone 2. There are currently no municipal water services in this area, and the current water distribution network does not extend to this area. In order to service this area, an extension of the existing watermain by 1-2 km would be required. Prior to detailed design and construction of a new water tank at Location #1, completion of natural environment, archaeological and cultural heritage studies as well as property acquisition by the Township would be required.

3.1.2 Location #2

Location #2 is situated near County Road 10 and Fallis Line, this location contains the Municipal Township office and the existing standpipe and booster pumping station. This location would be close to planned residential and institutional development areas "B" and "E". This site is close to the center of major development growth, making it strategically positioned for servicing future growth in the Millbrook. Location #2 is at one of the highest points of elevation in the settlement area boundary and is central to both the existing population in south Millbrook and future population in North Millbrook. The elevation ranges between approximately 250 and 260 metres. Therefore, this area would belong to Pressure Zone 2. Property acquisition would not be required for this site as it is currently owned by the Township. It was previously cleared of natural environment, archaeological and cultural heritage potential by the previous developments on the site. However, this location poses several problems:

1. Township staff had noted there would be limited space for a second storage facility on the remaining property
2. Having two (2) storage tanks on the same site would be a risk to Pressure Zone 2 in case there were key watermain break(s) or BPS issues that would prevent water from the municipal wells to get to these storage tanks and BPS, or out to distribution. This would leave Pressure Zone 2 vulnerable to lack of water storage. Having the second storage tank at Location #2 will not be as beneficial to Millbrook

from a 'storage' resiliency and redundancy perspective compared to having it located elsewhere in town.

3.1.3 Location #3

Location #3 is east of County Road 10 and north of Fallis Line. This site is close to planned residential and commercial developments (Areas "F", "I" and "L"), making it strategically positioned for servicing future growth in the Township. Existing natural environment, topographic survey, Phase 1 Environmental Site Assessment (ESA), archaeological and cultural heritage studies were completed by the developer for their development. The results of those studies indicated that the area does not have archaeological or cultural heritage potential. Additionally, the natural environment studies noted a lack of environmentally sensitive features across most of the site. The Phase 1 ESA did not note anything of concern. These already completed studies allow for quicker implementation process directly into the design stage after the Class EA is completed. This would be an advantage given how quickly the new water storage tank is needed and to meet the funding deadlines. While property acquisition is required, and may be costly, the site provides opportunities for infrastructure integration and long-term expansion, as well as the timeline which the developer is planning to build is in line with the timing needed for the new water storage. Initial discussions between the Township and the developer on property acquisition have been positive. Ground elevations at Location #3 range from approximately 240 to 250 metres, making this suitable for Pressure Zone 2.

3.1.4 Location #4

Location #4 is positioned west of County Road 10 and south of Fallis Line. This corresponds with Development Areas "G" and "K" and is planned for residential land use. This site is not as centralized to future growth areas identified in the Growth Management Study. Property acquisition would be required for this site, and the site is currently an active farm, making the acquisition costly. Natural environment, archaeological and cultural heritage studies will be required for this property. Ground elevation in this area ranges from approximately 240 to 250 metres, which would be Pressure Zone 2.

3.1.5 Location #5

Location #5 is northwest of Millbrook's Built-Up Area and close to the existing municipal wells. However, this site falls within the Millbrook Natural Heritage System and the Oak Ridges Moraine and is not centralized to future development in Millbrook. Some of the area within this site is the former Millbrook Correctional Facility lands which are currently owned

by Infrastructure Ontario (IO) and would be subject to additional studies and remedial actions to make it usable. Ground elevations in Location #5 range from approximately 250 to 275 metres. Although this would make it suitable for Pressure Zone 2, the existing water distribution network for Pressure Zone 2 does not reach this area (due to the Oak Ridges Moraine). The existing municipal well facilities are not able to provide the pressures needed to service this area unless upgrades are done to the well pumps.

3.1.6 Location #6

Location #6 is situated on King Street on the southeastern edge of the Millbrook Built-Up Area (Development Area "A"). This site houses the decommissioned Millbrook standpipe. The ground elevation in this area ranges from approximately 260 metres, making it suitable for servicing the southern end of the settlement area boundary (i.e. Pressure Zone 1) by gravity. However, as noted in TM 1.5, there are several factors that hinder this location from being the preferred location for a new water storage tank. The existing property is owned by the Township; however, this site has space constraints and shares a common driveway to a private residence. Significant impact to this private residence can be expected during construction. The Township may need to acquire more land from a nearby property to support a new water storage facility on this site. Natural environment, archaeological and cultural heritage studies would need to be completed for any areas purchased. In addition, due to this location being far from Pressure Zone 2 and the watermain from the new storage tank here will need to pass through Pressure Zone 1, this location would need a booster pumping station and a dedicated transmission main (with no local connections to Pressure Zone 1) to feed Pressure Zone 2. Alternatively, if this location was to only feed Pressure Zone 1 and not Pressure Zone 2, then the existing standpipe by the Municipal Office does not have sufficient volume to accommodate all of the growth intended for Pressure Zone 2 and a third storage tank (closer to Pressure Zone 2) would be needed.

3.1.7 Location #7

Location #7 is at the southern boundary of the Millbrook Settlement Area and belongs to Development Area "A". Location #7 have ground elevations which range from approximately 215 to 240 metres, making this fall under Pressure Zone 1. The area would require the completion of natural environment, archaeological and cultural heritage studies as well as property acquisition. Much of the area falls within Oak Ridges Moraine and Greenbelt designated areas, making it difficult to obtain permits for construction of water storage facility.

3.2 Evaluation Criteria & Screening

In line with the MSS, the evaluation process will follow a two-step approach with the first step comprising of screening the long list of storage locations to narrow down to a short list that meets the problem and opportunity statement, avoids major technical and economic constraints and provides minimal impact to the surrounding community and water system. Any location marked with an 'X' in any section will be screened out from further consideration.

The shortlisted locations will then be evaluated further using the same evaluation criteria that was developed for the MSS and is based on the following five categories:

- **Social** - represents the local human environment and comprises of impacts to individuals, neighbouring properties and local businesses.
- **Environmental** – represents the degree to which the proposed alternative impacts the natural environment with emphasis on impacts to sensitive areas that are most critical to human or ecological functions that are most likely to be disturbed.
- **Technical** – represents the technical requirements of the proposed alternative and evaluates it based on several factors including technical complexity (design, operation and maintenance), regulatory and approval requirements, and compatibility with existing systems.
- **Cultural Heritage** – represents the effect an alternative will have on known and potential archaeological resources, built heritage resources, cultural heritage landscapes and Indigenous communities.
- **Cost** – represents costs associated with the proposed alternative including capital cost, land acquisition and lifecycle maintenance and operation costs.

Below shows the rating scale that will be used for scoring the proposed alternatives against each of the five categories.

Table 3-1: Legend for Evaluation Criteria

Least Positive/Most Negative	More Negative Than Positive	Moderate	More Positive Than Negative	Most Positive/Least Negative
				

3.3 Screening of Long List of Location Alternatives

Table 3-2: Screening of Long List of Location Alternatives

Location	Does the alternative address the Problem & Opportunity Statement?	Is the alternative technically and economically feasible (✓ if yes). Does this pose significant technical constraints or disadvantages (x if yes).	Can the alternative be implemented without significant impacts?	Summary
Location 1	✓	✓	✓	Carried over to shortlist for detailed evaluation
Location 2	✓	✗	✗	Existing storage tank at location, and remaining area is already zoned for institutional. Location reserved by Township for other endeavours. There will be major disturbance to the Municipal Office during construction. Risk in resiliency and redundancy from grouping storage facilities in the same location.
Location 3	✓	✓	✓	Carried over to shortlist for detailed evaluation
Location 4	✓	✗	✓	Not centralized to the future anticipated areas of need. May not have enough space for water storage facility based on current developer plans for the area. Property acquisition required and the current land is occupied by a farm.
Location 5	✓	✗	✗	Location is within Oak Ridges Moraine. Millbrook's Natural Heritage System will be impacted by construction. Environmental investigations and property acquisition required. Possible complications to suitability from remedial actions/investigations related to the former Millbrook Correctional Facility lands.
Location 6	✓	✗	✓	Not centralized to the future anticipated areas of need, as well as operational issues with supplying water to pressure zone 2 from this location. Space constraints and property acquisition required to support storage of an adequate size.
Location 7	✓	✗	✗	Not centralized to the future anticipated areas of need. This area would also require property acquisition and additional infrastructure to service the north end of Millbrook. Location is within Oak Ridges Moraine. Millbrook's Natural Heritage System will be impacted by construction.

3.4 Evaluation of Shortlisted Location Alternatives

Table 3-3: Evaluation of Shortlisted Location Alternatives

Criteria	Location #1	Evaluation	Location #3	Evaluation
Social	• Aesthetic advantage, as a water tower showing the Township's name will be visible from the highway. • Near future employment area rather than residential area		• Near the immediate future development areas but may be less centralized for future northern settlement expansion areas beyond 2051. • Near future commercial and residential area	
Technical	• Further from existing standpipe so there is better storage redundancy coverage in case of a key watermain break. • Will require a new longer watermain to reach Location #1		• Less storage redundancy coverage compared to Location #1 • Near existing watermain and closer to existing BPS to optimize use of existing infrastructure to reduce cost. • Expansion of or upgrades to existing BPS.	
Cultural	• Cultural Heritage and Archaeological potential not currently evaluated, would require additional studies.		• Existing Stage 1-2 Archaeological Assessment and Cultural Heritage study screened out potential/found no items of interest	
Environmental	• Natural environmental studies required to determine impacts. Current agricultural land will be impacted for imminent building of new storage tank even though area will not see development until a long time later		• Environmental conditions previously evaluated in support of planned development in the area • Existing natural environment studies cleared area for construction. Some space constraints due to existing creek	
Cost	• Township will have to front end the cost for long watermain extension from existing distribution network to this location before development occurs here.		• Lower watermain costs due to closer proximity to existing available infrastructure • Upgrades to existing BPS will be relatively low cost	
Summary	**Not Recommended** due to cost, environmental and cultural considerations	✗	**Recommended Water Storage Tank Location**	✓

Least Positive/Most Negative	More Negative Than Positive	Moderate	More Positive Than Negative	Most Positive/Least Negative
				

4.0 DRINKING WATER STORAGE TYPES

4.1 Identification of Storage Types & Shortlist of Alternatives

The following subsections present three distinct infrastructure alternatives for enhancing water storage and pumping capabilities at Location #3 (preferred storage tank location). Each option is evaluated based on its operational benefits, aesthetic and environmental impacts, technical feasibility and cost considerations. These alternatives aim to support future growth, improve system reliability and optimize the use of existing assets while addressing the needs of Pressure Zone 2.

4.1.1 New Standpipe at Location #3 + New BPS

A standpipe is a water storage tank where the water level ranges from its high-water level to the ground level. Often times, a standpipe would be positioned at a higher ground elevation. Since water is stored starting at the ground elevation, there could be 'unusable' volumes of water due to inadequate pressure. The unusable volume of water could lead to stagnation of water and make it more difficult to 'turn over'/refresh the water. The addition of a BPS as shown in **Figure 4-1** helps to alleviate the problem of unusable volume and achieves the required water pressure for the specific pressure zone. If a new standpipe was to be chosen for the preferred Location #3, it would be fed from the municipal wells and distribution network in Pressure Zone 1. It would have the same high-water level as the existing standpipe. A new BPS would be constructed beside the new standpipe to feed Pressure Zone 2. Whenever the pressure in Pressure Zone 2 drops below the desired pressure range, the pump(s) in the BPS would need to turn on. Pumps with variable frequency drive can provide more operational flexibility and avoid turning on and off rapidly as the system pressure fluctuates.

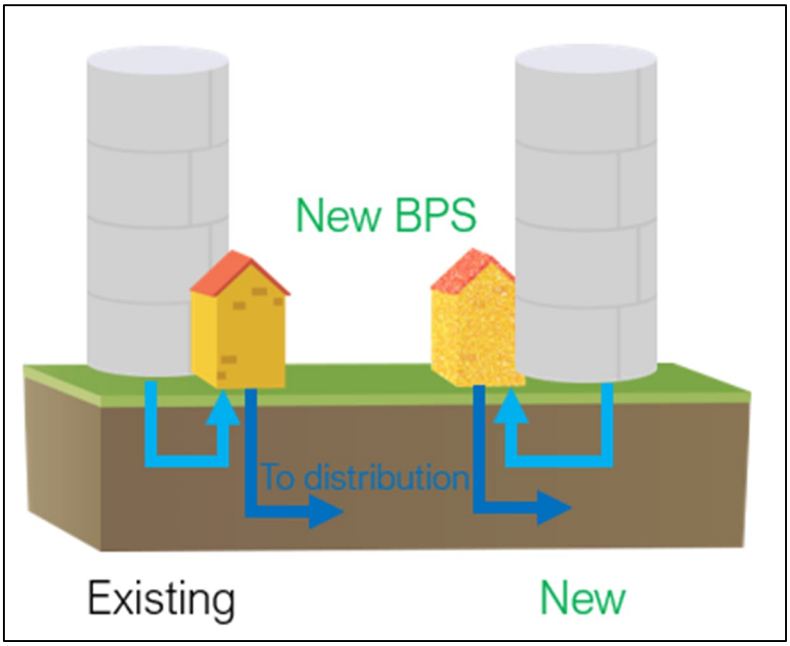


Figure 4-1: Water Standpipe Schematic

Building a new water standpipe at Location #3 maximizes use of the existing infrastructure and supports future proofing. It is another possible location for mounting communication antenna etc. (source of revenue for Township). This alternative also allows for some operational redundancy for the existing standpipe at the municipal office if either storage tank needed to be taken out of service and maintained. In addition, this alternative has the lowest capital costs compared to all other tank options.

Despite the advantages described above, water standpipes can be a visual obstruction for nearby residential neighbours, who may not appreciate having a large municipal structure in the vicinity of residential areas. The alternative could also have shadow impacts to upcoming development area, even though the shadow is transitory throughout the day and seasons. However, once built, standpipes can become a 'landmark' for the community and may also provide revenue opportunities for the municipality from communication companies who may want to play their communication equipment on top.

Despite having the lowest capital costs to implement, a new standpipe and BPS are estimated to have the highest operations and maintenance costs (O&M) over the course of 60 years. This is based on a quote for O&M costs for the standpipe and BPS and due to the maintenance and future replacement of the greatest number of pumps across all the alternatives.

To support this alternative, further geotechnical and hydrogeological investigations would be needed to confirm suitability of a standpipe at Location 3.

4.1.2 New Elevated Water Storage Tank at Location #3 and Upgrades to BPS at Municipal Office

An elevated tank, often seen as a prominent feature in many communities, is a structure where the water storage tank is raised above ground level to the desired elevation, typically supported by a concrete pedestal or a steel stand as shown in **Figure 4-2**. The tanks can be constructed from welded steel plates or glass-lined steel plates that are bolted together. The water-containing portion of the tank is called the 'bowl' and the portion below this elevation is the support structure for the elevated water tank, which could be made of a concrete pedestal or steel supports. For the style that uses a concrete pedestal, it can house the pipes, valves, recirculation pumps, electrical and control equipment, ladder/stairwell to permit access to the underside of the 'bowl'. Elevated tanks are designed to hold large volumes of water at the desired pressure (elevation) range, which helps manage peak demand and emergencies like fires. The primary function of an elevated tank is to provide 'floating storage' that can manage the hydraulic grade line and water pressure within a pressure zone without pumps from the treatment plant operating continuously to maintain system pressure. Elevated tanks are often located in strategic areas to optimize coverage and pressure in the surrounding distribution network. With construction material and technological advancements, the elevated tank is a popular choice for all sizes of communities.

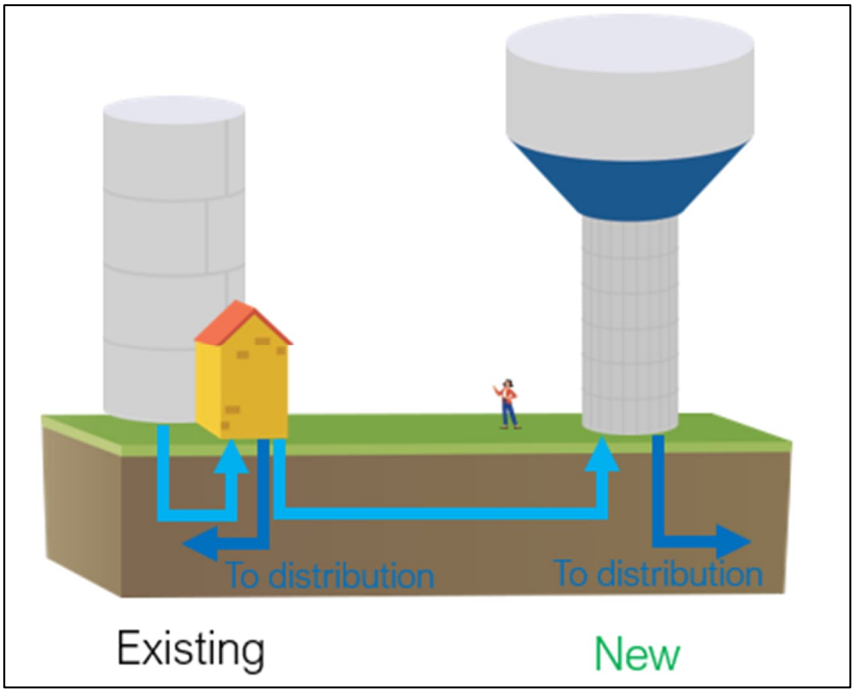


Figure 4-2: Elevated tank Schematic

In this alternative, by utilizing gravity, the new elevated tank at Location #3 would allow water to flow directly to users without requiring additional pumping after the elevated tank. However, given the current Millbrook distribution system and its two (2) pressure zones, in order for the new elevated tank to feed Pressure Zone 2 by gravity, it would need the water to be pumped up to its high-water level. This means that the existing Booster Pumping Station (by the Municipal Office Standpipe) would need to be upsized/expanded and a watermain extended from the existing BPS to the new elevated tank. The existing municipal well pumps do not provide enough pressure to get up to the higher pressures needed for Pressure Zone 2. This alternative ultimately provides 'floating storage' to the Pressure Zone 2 area (instead of pumped storage via existing BPS and standpipe). This better manages the pressure fluctuations in the pressure zone and is not contingent on a pump being on or off. It is also another possible location for mounting communication antenna etc. (source of revenue for the Township).

Despite the advantages described above, this alternative has the greatest aesthetic impacts to surrounding properties (it would be taller than existing standpipe) and has more technical and operational complications due to different storage tank heights. It does not allow for operational redundancy to the existing standpipe because that is still needed for the existing BPS to feed pressurized water to the new elevated tank. The alternative could have shadow impacts to upcoming development area, even though the shadow is transitory throughout

the day and seasons. The benefit of this option is that the existing BPS can be used to house the new pumps and not have a second BPS in the system like the other tank style alternatives. This would mean less assets for the Township to own and maintain.

This alternative has higher capital costs compared to both the standpipe and in-ground reservoir options. However, the O&M costs over 60 years are slightly less than the standpipe option, but not as low as the in-ground reservoir. This is based on a quote for O&M of a new elevated tank and because the elevated tank would not require a new BPS but can have new pumps added within the existing BPS.

Further geotechnical and hydrogeological are needed to confirm suitability of elevated tank at Location 3.

4.1.3 New In-Ground Reservoir with Booster Pumping Station

A water storage tank located below ground level relies on a booster pumping station (BPS) positioned at ground level (as shown in **Figure 4-3**) to supply adequate pressure to the distribution system. Unlike elevated tanks, this configuration cannot depend on gravity and must use mechanical pumping to provide consistent water flow and pressure to its specific pressure zone. The existing municipal well pumps would be able to pump water to the in-ground reservoir, and from there a new BPS would boost the water to the required pressure for Pressure Zone 2. Whenever the pressure in Pressure Zone 2 drops below the desired pressure range, the pump(s) in the BPS(s) would need to turn on. Pumps with variable frequency drive can provide more operational flexibility and avoid turning on and off rapidly as the system pressure fluctuates.

This system is advantageous for areas where above-ground space is limited or where aesthetic concerns make elevated tanks and standpipes less desirable. By burying the reservoir, the system minimizes visual impacts to the area. However, the footprint of the reservoir would be larger than the base of a standpipe or elevated tank pedestal, resulting in higher excavation costs and higher potential for groundwater impacts during construction.

Although the in-ground reservoir and BPS can be placed wherever there is adequate space for these structures, it would be preferred to situate the facility at a high elevation to minimize the amount of additional boosting the pumps would need to achieve the desired pressure for the water users in the specific pressure zone.

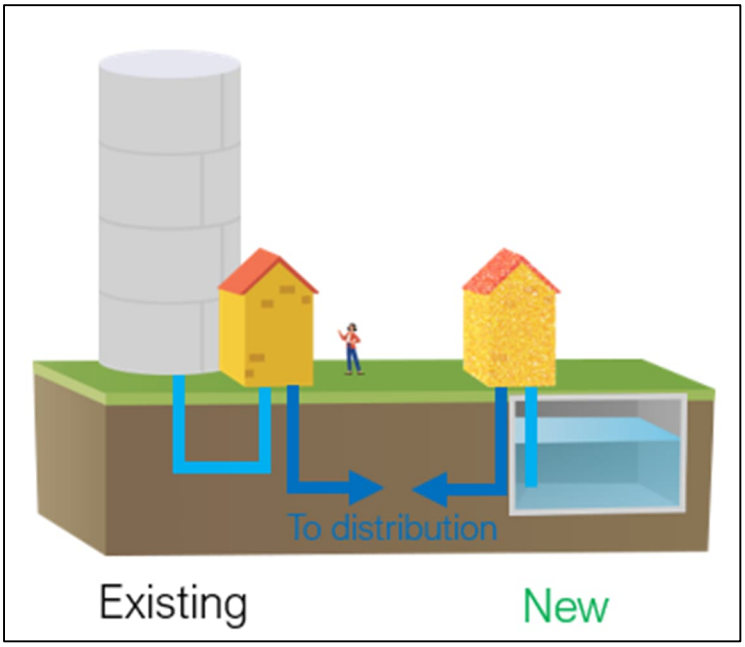


Figure 4-3: In-ground reservoir with BPS Schematic

In this alternative, a new in-ground reservoir would have the minimum negative aesthetic impacts to surrounding properties. Only the pumphouse for the new BPS would be visible, as the tank would be buried. The new BPS pumphouse can be designed to suit neighbouring developments to blend in with other nearby buildings. This alternative allows for some operational redundancy for existing standpipe if it needs to be taken out of service and maintained. In this alternative however, there is no 'floating storage' available for Pressure Zone 2. The pressure in the system would fluctuate with the operation of the pumps at the new and existing BPS'.

This alternative has higher capital costs compared to standpipe option, but less capital costs than the Elevated tank option. This is due to the process of excavating for the reservoir and the construction of the BPS on top. Additionally, this alternative has the lowest O&M costs over 60 years due to the option not requiring major maintenance or repairs of the buried reservoir once in service (no need to repaint/recoat or recaulk). There will still need to be maintenance of the new BPS and replacement of equipment at the end of their useful life.

Further geotechnical and hydrogeological investigations are needed to confirm suitability of inground tank at Location 3. Due to the deeper and larger excavation needed for the in-ground reservoir, there may be more complications due to groundwater, and the construction will take up more space than other alternatives.

4.2 Cost Estimate

Below is a high-level budgetary estimate for the water standpipe, elevated tank and in-ground reservoir options (including associated BPS costs). The standpipe and elevated tank budgetary estimates were provided by Greatario and Landmark Structures in October 2025, respectively. The estimated costs are exclusive of applicable duties, taxes, tariffs and government-imposed fees. The costs also do not include for engineering services (e.g. geotechnical, design, construction administration). These cost estimates also include the estimated operations and maintenance (O&M) costs for running the new storage solution over 60 years.

Table 4-1: High Level Cost Estimates for Water Storage Solutions

Storage Type	Estimated Cost	Comments
Standpipe + new BPS	Capital: $4.6 million O&M: $3.6 million	Greatario quote for standpipe. BPS costs based on previous tendered projects.
Elevated Tank (ET) + Expansion of existing BPS	Capital: $13.8 million O&M: $2.7 million	Landmark quote for ET. BPS expansion costs based on previous tendered projects.
In Ground Reservoir + new BPS	Capital: $7.7 million O&M: $2.5 million	Based on previously tendered projects or unit prices.

4.3 Detailed Evaluations of Storage Tank Types at Location #3

Table 4-2: Detailed Evaluation of Storage Tank Types at Location #3

Criteria	New Standpipe at Location #3 + New BPS	Evaluation	New Elevated Tank at Location #3 + BPS Upgrades at Municipal Office	Evaluation	New In-Ground Reservoir + New BPS at Location #3	Evaluation
Social	• Will be built before residential development. Low impact to future neighbours during construction • Moderate aesthetic impacts to surrounding properties		• Will be built before residential development. Low impact to future neighbours during construction • Greater aesthetic impacts to surrounding properties		• Will be built before residential development. Low impact to future neighbours during construction • Lesser aesthetic impacts to surrounding properties due to buried tank • Provides the ability to implement a façade for the BPS which can be integrated with the community aesthetics	
Technical	• Construction of a new BPS required. • Provides some operational redundancy to the water system with the existing standpipe at the Municipal Office across the street		• BPS upgrades at Municipal office or dedicated high pressure watermain from municipal wells required to support higher Hydraulic Grade Line (HGL) • Makes use of existing infrastructure • Provides operational redundancy to the water system with the existing standpipe at the Municipal Office across the street		• In-ground reservoir would require new BPS on top of the new reservoir • Does not maximize use of existing infrastructure • Standalone system not reliant on ex. BPS • Provides operational redundancy to the water system with the existing standpipe at the Municipal Office across the street • Tank will not drain empty by gravity if there is WM break	
Cultural	• Cleared of archaeological and cultural heritage potential by developer studies for the area		• Cleared of archaeological and cultural heritage potential by developer studies for the area		• Cleared of archaeological and cultural heritage potential by developer studies for the area	
Environmental	• Moderate impact to natural environment during construction • Possible space constraints during construction due to existing watercourses.		• Moderate impact to natural environment during construction. • Possible space constraints during construction due to existing watercourses		• Moderate impact to natural environment during construction • Likely to encounter space constraints during construction due to existing watercourses • Allows for more areas to be landscaped and restored.	
Cost	• Most economical capital cost option compared to other storage alternatives • Highest O&M cost over 60 years due to having to maintain 2 standpipes and 2 BPS.		• Highest capital costs compared to standpipe and in-ground reservoir • Lower O&M cost over 60 years, because there is only 1 BPS and 2 tanks to be maintained		• Higher capital costs than standpipe but less than Elevated tank. • Lower O&M cost over 60 years – still need to maintain 1 standpipe and 2 BPS even though the inground tank doesn't need much maintenance	
Summary	**Not Recommended** due to social, and long-term cost considerations	✗	**Not Recommended** due to social, cost and environmental considerations	✗	**Recommended Alternative**	✓

Least Positive/Most Negative	More Negative Than Positive	Moderate	More Positive Than Negative	Most Positive/Least Negative
				

5.0 PREFERRED SOLUTIONS

The preferred solution for new storage in the Township of Cavan Monaghan is an in-ground reservoir and associated BPS at Location #3 as seen in **Figure 5-1**. Location #3 is situated north of Fallis Line, east of County Road 10. The new in-ground reservoir and BPS will support the additional storage volume required for anticipated population growth as identified in the Growth Management Study (GMS) and Master Servicing Study (MSS). It will operate together with the existing Standpipe and BPS by the Municipal Office.

At the time of writing this report, the Township and the developer who owns this property were having property acquisition discussions, however the exact location was not finalized.

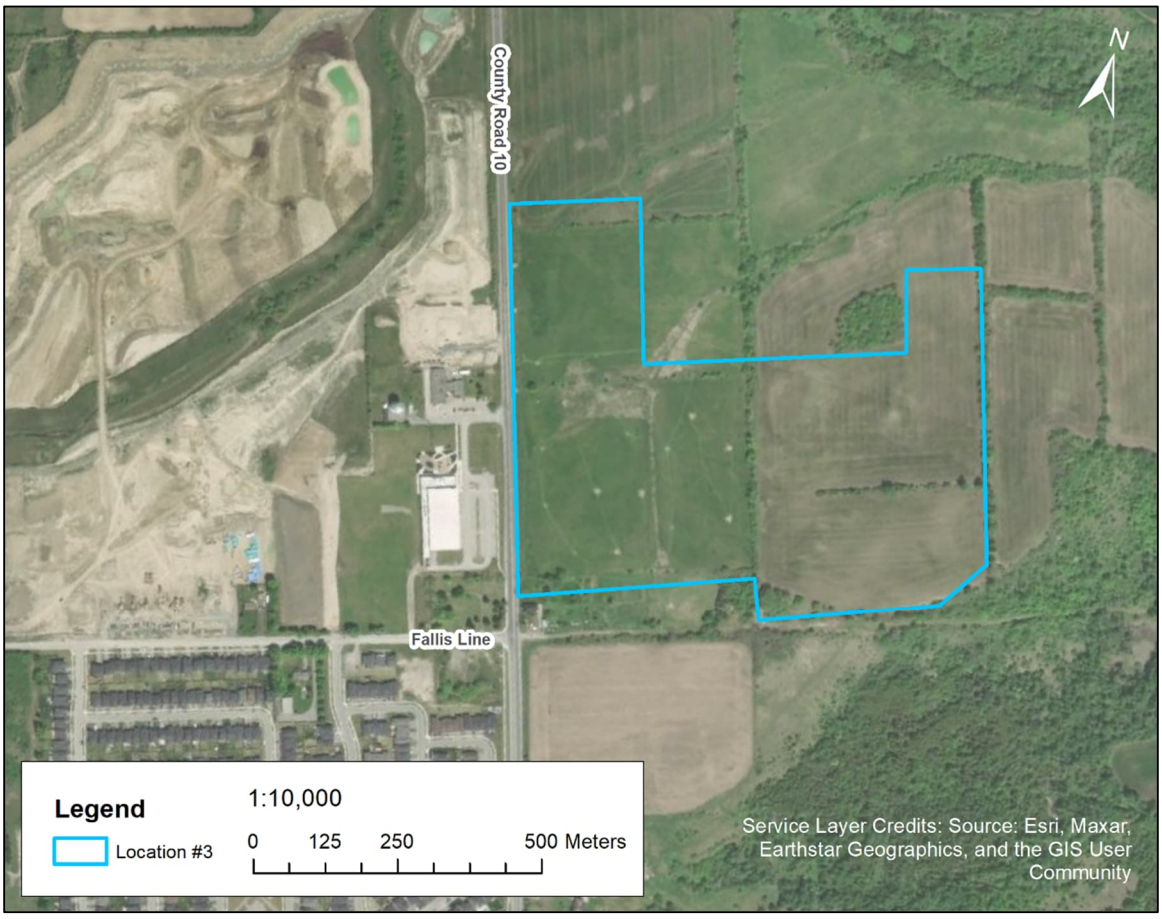
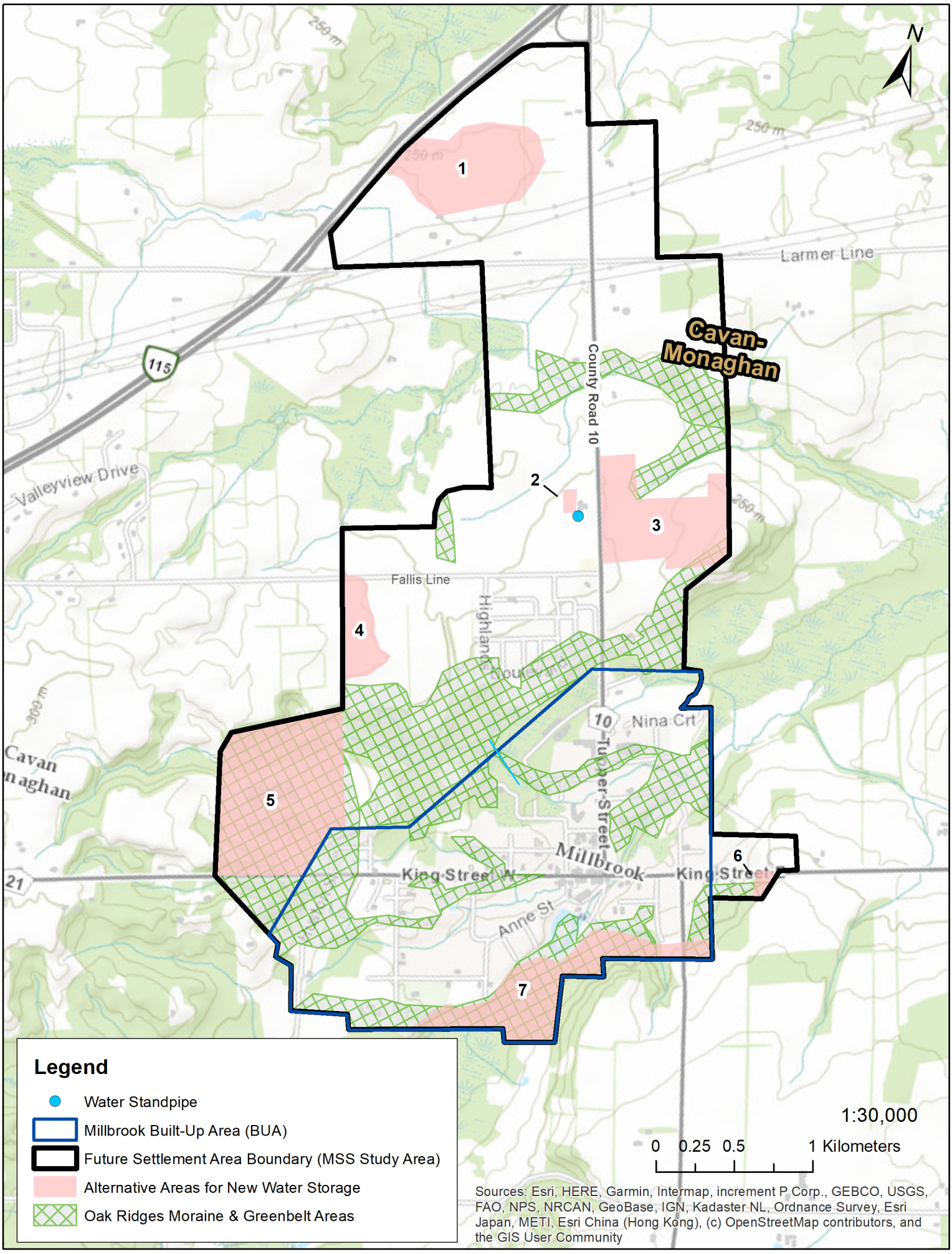


Figure 5-1: Map of Location 3

APPENDIX A

Longlisted Locations Map

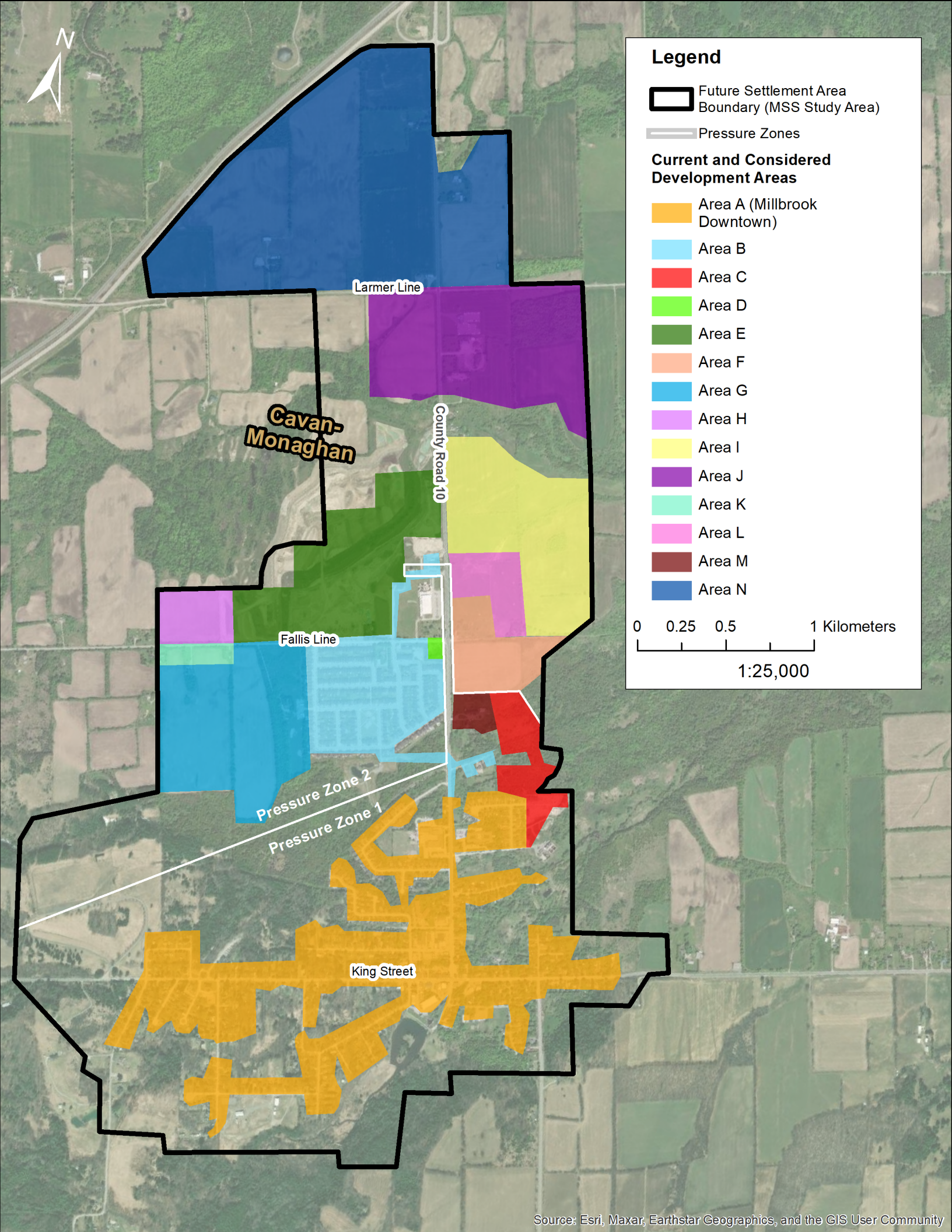



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Larmer Line
Cavan-
Monaghan
County Road 10
115
Valleyview Drive
Fallis Line
Highland
Nina Crt
10
Tupper Street
Millbrook
King Street W
King Street E
21
Anne St
Cavan
naghan
250 m
300 m
Legend
Water Standpipe
Millbrook Built-Up Area (BUA)
Future Settlement Area Boundary (MSS Study Area)
Alternative Areas for New Water Storage
Oak Ridges Moraine & Greenbelt Areas
1:30,000
0 0.25 0.5 1 Kilometers
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

APPENDIX B

Approved or Anticipated Developments Map




N
Legend
Future Settlement Area Boundary (MSS Study Area)
Pressure Zones
Current and Considered Development Areas
Area A (Millbrook Downtown)
Area B
Area C
Area D
Area E
Area F
Area G
Area H
Area I
Area J
Area K
Area L
Area M
Area N
0 0.25 0.5 1 Kilometers
1:25,000
Larmer Line
Cavan-Monaghan
County Road 10
Fallis Line
Pressure Zone 2
Pressure Zone 1
King Street
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

APPENDIX 4

HYDROGEOLOGICAL & GEOTECHNICAL REPORTS



THURBER ENGINEERING LTD.

To: Rika Law, P.Eng., PMP
R.V. Anderson Associates Ltd.

October 2, 2023

From: Paul Coulson, P.Geo.
David Hill, P.Eng., P.Geo.

Thurber File No.: 29561

TECHNICAL MEMORANDUM
DESKTOP HYDROGEOLOGICAL STUDY
WATER AND WASTEWATER SERVICING STUDY
TOWNSHIP OF CAVAN MONAGHAN, ONTARIO

Thurber Engineering Limited (Thurber) has been retained by R.V. Anderson Associates Ltd. (RVA) to conduct a desktop study in support of the Township of Cavan Monaghan Water and Wastewater Master Servicing Study.

It is a condition of this memorandum that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

1. OBJECTIVES

The objectives of the Desktop Hydrogeological Study are to provide a review of existing hydrogeological information and to provide future hydrogeological considerations for the following potential needs:

- Additional water supply, whether from the existing Millbrook Wellfield or elsewhere.
- Construction of new infrastructure related to additional water supply and servicing.

2. SITE DESCRIPTION

The project Study Area is shown on Figure 1 and includes the entire Township of Cavan Monaghan, located in the County of Peterborough in Southern Ontario, southwest of the City of Peterborough. The Study Area is generally bounded by Hogsback Road, Hillview Drive, Dranoel Road, Glamorgan Road, and Cold Springs Camp Road to the west, the City of Pickering, the Onotobee River, and Highway 28 to the east, Hayes Line and Parkhill Road West to the north, and Line Road 1 to the south. Within the Study Area, four project Focus Areas are discussed with more detail within this report and are shown on Figure 1.

The four project Focus Areas are as follows:

1. Syer Line and Highway 115: Highway interchange. The Township is interested in the potential to provide water service to this area.

2. 1256 Syer Line: Property on north side of Syer Line, east of Syer Line and Highway 115. Based on satellite imagery, a dirt laneway, farmhouse and barn, wooded areas, watercourses, and wetlands are present on the property. The Township is interested in the potential to provide water service to this area.
3. Millbrook Wastewater Treatment Plant: The Millbrook Wastewater Treatment Plant was replaced in 2015 and is rated for 2,521 m^3/day with a peak capacity of 8,242 m^3/day.
4. Millbrook Wellfield: The Millbrook Water Treatment Plant sources its water on-site from three drilled wells located in a tight cluster on the north side of Highway 21 east of Queen Street (Millbrook Wellfield), which are reported to have high quality and quantity of water. The Permit to Take Water (PTTW) was amended in 2018 to allow removal of up to 3,000 m^3/day.

3. REVIEW OF AVAILABLE INFORMATION

3.1 Site Physiographic, Geologic, and Hydrogeologic Settings

The Study Area is situated within two physiographic regions generally known as the Peterborough Drumlin Field and the Oak Ridges Moraine (Chapman and Putnam, 1984). A physiographic region map of the Study Area is shown on Figure 2. The Peterborough Drumlin Field covers the majority of the Study Area and is comprised of a rolling till plain with a belt of approximately 3,000 drumlins in addition to many drumlinoid hills and surface flutings of the till sheet. The drumlins are generally comprised of highly calcareous till. Near the southern border with the Oak Ridges Moraine the till is somewhat sandier. The Oak Ridges Moraine physiographic region is located in the southwestern corner of the Study Area. The surface topography of the Oak Ridges Moraine is described as hilly with knob-and-basin relief. In general, the hills of the Oak Ridges Moraine are sandy or gravelly; however, in some areas the hills are comprised of till above the sand. The predominant physiographic landforms found within the Study Area include sand plains, till plains (drumlinized), clay plains, drumlins, kame moraines, eskers, and peat and muck. The project Focus Areas are all within the Peterborough Drumlin Field physiographic region and are all situated on sand plains.

According to available geologic mapping obtained from the Ontario Geological Survey (OGS), the surface geology of the Study Area is predominantly underlain by stone-poor, carbonate-derived silty to sandy till. Other significant areas within the Study Area include massive to well laminated fine-textured glaciolacustrine deposits, glaciolacustrine-derived silty to clayey till, organic deposits (peat, muck, and marl), modern alluvial deposits, older alluvial deposits, ice contact stratified deposits, glaciofluvial deposits, foreshore-basinal deposits, and eolian deposits. The mapped surficial geology of the Study Area is illustrated on Figure 3.

The Millbrook Wastewater Treatment Plant is situated on modern alluvial deposits. The Millbrook Wellfield is situated on older alluvial deposits. The Focus Area at Syer Line and Highway 115 is located on massive to well laminated fine-textured glaciolacustrine deposits and foreshore-

basinal deposits. The Focus Area at 1256 Syer Line is underlain by massive to well laminated fine-textured glaciolacustrine deposits, modern alluvial deposits, and foreshore-basinal deposits.

Quaternary mapping obtained from the OGS shows that the Study Area is predominantly underlain by predominantly sandy silt to silt matrix undifferentiated till, commonly rich in clasts and often high in total matrix carbonate content. Smaller areas of the Study Area are underlain by glaciofluvial ice contact deposits, glaciomarine deposits, glaciofluvial outwash deposits, and organic deposits. The Millbrook Wastewater Treatment Plant and 1256 Syer Line Focus Areas are underlain by glaciomarine deposits composed of sand, gravelly sand, and gravel nearshore and beach deposits. The focus area at Syer line and Highway 115 is underlain by sandy silt to silt matrix undifferentiated till, commonly rich in clasts and often high in total matrix carbonate content. The Millbrook Wellfield is underlain by glaciofluvial ice-contact deposits composed of gravel and sand with minor till, including esker, kame, end moraine, ice-marginal delta and subaqueous fan deposits.

Published bedrock mapping obtained from the OGS indicates that the Study Area is underlain by limestone of the Lindsay and Verulam Formations. The four Focus Areas are situated within the Lindsay Formation area. The mapped bedrock geology of the Study Area is illustrated on Figure 4.

The majority of the Study Area and specifically the project Focus Areas are located within the Otonabee Region Watershed, which falls under the jurisdiction of the Otonabee Region Conservation Authority (ORCA). The regional topography is undulating with small hills and valleys. Generally, the topography slopes easterly toward the Otonabee River, which eventually drains into Rice Lake. The Otonabee River flows generally in a southerly direction from Katchewanooka Lake, approximately 16 km to the northeast of the Study Area, to Rice Lake, approximately 2.3 km southeast of the Study Area. The Otonabee River flows directly adjacent to the east boarder of the Study Area from Highway 115 to Whitfield Road. Tributaries of the Otonabee River transect the Study Area, including Baxter Creek, Cavan Creek, Jackson Creek, and Squirrel Creek. Jackson Creek is connected to Best's Pond, which is located north of Highway 9 and west of Best Road. The tributaries flow in a general easterly direction towards the Otonabee River.

Groundwater flow is interpreted to follow the existing topography, with the Study Area draining generally easterly to the Otonabee River.

3.2 Previous Investigations and Reports

Existing available subsurface information was compiled for the Study Area from previous investigations carried out by others. The following reports were reviewed in the assessment of site conditions for the Study Area and the findings are discussed in the following paragraphs.

THURBER

A. Geotechnical Investigation Report. Millbrook Waste Water Treatment Plant Expansion. Prepared by Geo-Logic Inc. Dated May 2014.

The above report details a geotechnical investigation at the Millbrook Wastewater Treatment Plant for the reconstruction that occurred in 2015. In general terms, the encountered stratigraphy consisted of topsoil or asphalt occasionally overlying fill, overlying till, then silty clay, and then sandy silt. Water levels were measured from monitoring wells installed in four boreholes. Groundwater level depths in the monitoring wells ranged from 1.6 m below grade to 1.0 m above grade, suggesting that artesian groundwater conditions exist at the site. Slug tests were carried out in two of the monitoring wells and yielded hydraulic conductivity values of 8×10^{-8} m/s for silty clay and 1×10^{-7} m/s for silty clay/sandy silt. One groundwater sample was collected from a monitoring well and analyzed in comparison to Peterborough Storm Sewer Use By-Law Limits. The groundwater quality sample generally met the limits with the expectation of total suspended solids (TSS).

B. Review and Comments on Existing Reports. Prepared by R, Betcher, dated March 2016.

The above report summarizes and details multiple reports that discuss the geological and hydrogeological conditions of the Millbrook Area. Key findings from the report include details about the Millbrook Wellfield:

- The average daily withdrawal rate of the Millbrook Wellfield at the time the report was written in March 2016 was approximately 540 m^3/day.
- The original two wells at the wellfield were installed in 1976 and were screened in a confined artesian aquifer.
- The static water level in the wells was approximately 4.9 m above ground.
- A pumping test was conducted at each well at a constant pumping rate of 1,360 L/min for 24 hours for both tests.
- The water taking limit of the original PTTW was for 2,060 m^3/day.
- A third well was installed at the Millbrook Wellfield in 2002 and a 24-hour pumping test was conducted at the new well at constant rate of 1,590 L/min. One of the older wells was operating at a rate of 1,450 L/min for part of the test. The PTTW was revised to allow removal of up to 3,000 m^3/day.
- An assessment was carried out by Golder in 2009 to determine if 5,000 m^3/day of water taking was feasible. Golder conducted a 72-hour pumping test at the wellfield at a pumping rate of approximately 5,060 m^3/day.

Golder provided the opinion that the Millbrook Wellfield could sustainably provide a maximum daily rate of 5,374 m^3/day.

- The water quality information from the wells did not suggest any significant drinking water concerns.
- The wellfield has operated sustainably for the past 40 years and water levels in the pumping wells have not been observed to decline over this time period.

C. 2018 Groundwater Monitoring Report. Former Millbrook Correctional Centre. Millbrook, Ontario. Prepared by Cole Engineering Group Ltd., Dated 2019.

The above report discusses a groundwater monitoring program conducted in 2018 for a site located at the former Millbrook correctional centre, located at 706 County Road, Millbrook, Ontario. The site is located approximately 400-450 m northwest from the Millbrook Wellfield. Previous groundwater monitoring investigations were conducted on-site in 2015, 2016, and 2017. The groundwater onsite is impacted by tetrachloroethylene, also known as perchloroethylene (PCE), a volatile organic compound (VOC). Based on groundwater level measurements, the inferred groundwater flow direction generally follows topography and flows in a general easterly direction. The report indicates three distinct hydrostratigraphic layers. Layer 1 is an unconfined water table aquifer comprised of recent deposits and the Oak Ridges Aquifer Complex. Layer 2 is the upper Newmarket Till consisting of clay and is considered an aquitard. Layer 3 is the Inter-Newmarket Sediment (INS) Aquifer comprised of sand and gravel. The INS Aquifer supplies the Millbrook Wellfield.

Groundwater samples were collected and analyzed for VOCs. Groundwater quality samples collected from Layer 1 had a maximum concentration of PCE of 1.3 µg/L, which is below the applicable Ontario Regulation 153/04 Table 2 Site Condition Standard of 1.6 µg/L. Within Layer 2, no samples detected concentrations of PCE. Within Layer 3 (the INS Aquifer), at the downgradient site boundary, concentrations of PCE in groundwater samples exceeded Table 2 standards with a maximum concentration of PCE of 3.1 µg/L. Based on previous years of monitoring, the authors of the report interpreted that the PCE concentration appears to be trending lower. Groundwater samples collected did not exceed Table 2 standards for any of the other tested parameters.

D. Hydrogeological Monitoring Report (2019) – Town of Millbrook, Township of Cavan Monaghan. Prepared by Cambium Inc. Dated July 15, 2020.

The above report details water level monitoring in and around the Millbrook Wellfield to quantify the drawdown caused by pumping in the municipal wells. Water level measurements were taken from March 2017 to September 2019. The

monitoring program included a private well survey, monitoring of select residential and public wells using datalogger pressure transducers, and monitoring of surface water monitoring using two stream staff gauges. The findings indicated daily drawdown events from the wellfield temporarily influenced two nearby private water wells located at 710 Carveth Drive and 29 Huston Street; however, the influence was not considered significant because the water level in both wells recovered shortly following cessation of pumping. Long-term water level monitoring suggests that pumping is not causing permanent lowering of the water table.

E. Hydrogeologic Assessment Report – Proposed Residential Development, 825 Fallis Line, Millbrook, Ontario. Prepared by GHD dated October 25, 2017.

The above report details a hydrogeological investigation at a site at 825 Fallis Line. The site is approximately 1 km northwest of the Millbrook Wastewater Treatment Plant, 0.7 km north of the Millbrook Wellfield, 2.9 km south of the Focus Area at Syer Line and Highway 115, and 4.2 km southwest of the Focus Area at 1256 Syer Line.

The investigation consisted of drilling 12 boreholes, ranging from 6.1 to 6.6 m. Monitoring wells were installed in three boreholes and piezometers were installed in two boreholes. One hydraulic conductivity test (slug test) was conducted. Constant head permeameter tests were completed at two locations to test infiltration rates. A door-to-door water well survey and water balance were conducted as part of the investigation.

In general terms, the encountered stratigraphy consisted of topsoil overlying very loose to very dense till, ranging in composition from silty sand to silty clay. Dense to very dense silty sand was encountered below the till in some boreholes. Water level depths in the monitoring wells and piezometers were from 0.9 to 4.8 m. The slug test indicated the hydraulic conductivity of the till to be in the order of 10^{-7} m/s. Infiltration testing results suggested an infiltration rate of 12 to 50 mm/hour for the shallow unsaturated soils.

F. Geotechnical Investigation Report. Water Tower and Servicing. Millbrook, Ontario. Prepared by Geo-Logic Inc. Dated October 2014.

The above report details a geotechnical investigation located at 988 Country Road 10, in Millbrook Ontario, for proposed construction of a water tower and servicing. In general terms, the stratigraphy at the site consisted of topsoil overlying silty sand till in the area of the proposed water tower and asphalt over fill, overlying gravelly sand to sandy silt till within the proposed servicing areas. Groundwater was measured in open boreholes at depths ranging from approximately 1.1 to 2.6 m.

G. Millbrook Drinking Water System 2019-20 Compliance Inspection Report 1-L4FKG, prepared by the Ministry of Environment, Conservation and Parks.

The above report details conditions at the three wells at the Millbrook Wellfield. The report describes the three wells as 250 mm diameter, 30 metre steel cased drilled wells, with stainless steel screens located at depths of approximately 26 to 30.5 m, installed within the clay and gravel overburden material. All three wells are described as flowing artesian wells. Review of pumping records indicated that the maximum daily taking was 949.04 m^3, which is approximately 32% of the rated capacity. Water quality samples were collected for parameters listed under Ontario Regulation 169/03: Ontario Drinking Water Quality Standards (ODWS) and no tested parameters exceeded the ODWS.

3.3 Well Records and Existing Permits

A search of the Ministry of the Environment, Conservation and Parks (MECP) well records database conducted for the Study Area in December 2020 returned a total of 2,959 well records, of which 2,558 were listed as water supply, 121 as abandoned, two as dewatering, 65 as monitoring and test holes, 61 as observation wells, 137 as having an unknown status, and 15 as having other status.

Of the 2,959 total well records within the Study Area, 86 of the wells are located within 500 m of the project Focus Areas. Twenty well records are located within the 500 m search radius around the Focus Area of 1256 Syer Line, of which 13 were indicated as water supply, three as abandoned, two as monitoring and test holes, and two as observation wells. The average static water level found within 500 m of the Focus Area of 1256 Syer Line is 8.5 m.

Twenty-seven well records were identified within the 500 m search radius around Syer Line and Highway 115, of which 11 were indicated as water supply, one as abandoned, 10 as monitoring and test holes, four as observation wells, and one as having an unknown status. The average static water level found within 500 m of the Focus Area of Syer Line and Highway 115 is 5.2 m.

There were 39 well records within 500 m search radius of the Millbrook Wastewater Treatment Plant, with 23 listed as water supply wells, seven as abandoned, two as dewatering wells, one as a monitoring and test hole, and six as having an unknown status. Four of the well records had water levels above ground surface, ranging from 0.1 m above ground surface to 0.6 m above ground surface, suggesting groundwater under artesian pressure within this Focus Area. The average static water level found within the Focus Area of the Millbrook Wastewater Treatment Plant is 3.7 m below ground.

Within a 500 m radius of the Millbrook Wellfield, 24 well records were found. Six of the well records within 500 m of the Millbrook Wellfield Focus Area had water levels above ground surface, ranging from 4.9 to 7 m above ground surface, and the average static water level found in the wells within 500 m of the Millbrook Wellfield is 0.84 m above ground surface, suggesting groundwater is under artesian pressure within this Focus Area.

A summary of the well records within 500 m of each Focus Area is included in Tables 1 – 4 in Attachment B. The locations of the well records in the Study Area and Focus Areas are shown on Figure 5.

Well record 5119299 was found near the location of the Millbrook Wellfield. The well record details the subsurface conditions at the location of the wellfield, which consists of topsoil underlain by clay to sandy clay with stones or gravel, underlain by sand, to sand & gravel, to gravel & sand, underlain by clay. The well record indicates a well was screened from approximately 26 m to 31 m, in a gravel with some sand layer. A 24-hour pumping test was conducted at the well at approximately 1,590 litres per minute (LPM). Based on the pumping test, a pumping rate of 1,590 LPM was recommended. The well was completed on November 21, 2002. Well record 5119299 is included in Attachment B.

A search of water taking permits conducted in December 2020 identified 18 active PTTW records within the Study Area. Three active PTTW records were found at the location of the Millbrook Wellfield, all under the same permit number 7704-AW7HJF. The permit is for up to 3,000,000 litres per day, is registered under the Corporation of the Township of Cavan Monaghan, and the purpose is for water supply for municipal use. No active PTTWs were found within 500 m of the other Focus Areas. The locations of the active PTTWs in the Study Area and Focus Areas are shown on Figure 5 and are summarized in Table 5 in Attachment B.

A search of MECP's Access Environment mapping returned no Environmental Activity and Sector Registry (EASR) registrations for water taking within the Study Area.

3.4 Environmental Setting

Based on regional-scale source protection mapping, the Study Area is located in the Ontoabee-Peterborough Source Protection Area (S.P.A.). Within the Study Area, there is a wellhead protection area (WHPA) centred around the Millbrook Wellfield and extending to the west. There is a WHPA centred east of Highway 7 on the south side of Landsdowne Street West extending to the northwest and there is a WHPA Groundwater Under Direct Influence (WHPA-E) area directly overlapping and adjacent to this WHPA area. Both WHPAs are subdivided into WHPA-A, WHPA-B, WHPA-C, and WHPA-D. WHPA-A is the 100 m radius around the wellfield, WHPA-B is for a 0-2 year groundwater travel time to the well, WHPA-C is for a 2-5 year groundwater travel time to the well, and WHPA-D is for a 5-25 year groundwater travel time to the well. The location of the WHPAs is shown on Figure 6.

Based on the Oak Ridges Moraine Conservation Plan, the southwestern section of the Study Area is considered apart of the Oak Ridges Moraine (ORM) Conservation Area. The ORM regulation area is considered an environmentally sensitive geological landform and certain regulations apply for developments within the Oak Ridges Moraine Conservation Area. The Oak Ridges Moraine Conservation Act, 2001, provides more detail.

Based on a review of Ministry of Natural Resources and Forestry (MNRF) online mapping, natural features in the vicinity of the project Focus Areas include the following:

a) Otonabee River runs adjacent east of the Study Area and tributaries of the Otonabee river traverse the Study Area. Baxter Creek flows adjacent to the Millbrook Wastewater Treatment Plant along the south of the property. A tributary of Baxter Creek flows adjacent to the Millbrook Wellfield. At the location of Syer Line and Highway 115, a tributary of Cavan Creek flows adjacent to Syer Line on the north side. At 1256 Syer Line, two tributaries of Cavan Creek transect the Focus Area.

b) Multiple Areas of Natural Scientific Interest (ANSIs) are found throughout the Study Area. A provincially Significant Earth Science ANSI known as Cavan Swamp Wildlife Area is located north of Highway 5, south of Highway 9, and east of Highway 7. A Provincially Significant Life Science ANSI is located north of Hooton Drive and west of Preston Road. A provincially Significant Earth Science ANSI located east of Dranoel Road and south of Highway 7A. A provincially Significant Earth Science ANSI located at the northwestern corner of the Study Area, west of Ski Hill Road. The land adjacent to Cavan Creek throughout the Study Area is considered an ANSI. Areas in southwest of Study Area adjacent to Baxter Creek are considered ANSIs.

c) Natural Heritage Areas are located throughout the entire Study Area, generally in areas around the watercourses and wetlands. The entire area within the property at 1256 Syer Line is classified as a Natural Heritage Area. The area directly north of The Millbrook Wastewater Treatment Plant is recorded as a Natural Heritage Area. Lands adjacent to Syer Line and Highway 115 to the northeast and southwest are listed as Natural Heritage Areas.

d) Wetlands are located throughout the Study Area and are classified as Provincially Significant Wetlands (evaluated), Non-Provincially Significant Wetlands (evaluated) and Unevaluated Wetlands. Multiple wetlands are located within the property at 1256 Syer Line and are classified as Provincially Significant Wetlands (Evaluated) and unevaluated wetlands. An unevaluated wetland is directly adjacent to the north of the Millbrook Wastewater Treatment Plant. Provincially significant wetlands are present in the lands adjacent to Syer Line and Highway 115.

e) Large areas of woodlands also exist throughout the Study Area. Woodlands can be found within the property at 1256 Syer Line.

The Areas of Natural Significance within the Study Area are illustrated on Figure 6.

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4. ASSESSMENT

4.1 Water Supply

Based on available data, there is potential to increase the water taking from the pre-existing wells at the Millbrook Wellfield which are supplying the Millbrook Water Treatment Plant. Based on existing reports, the average pumping rate at the Wellfield was 540 m^3/day, which is much lower than the currently allowed water taking rate of 3,000 m^3/day. As discussed in section 2.2 above, previous reports indicate a pumping rate of 5,374 m^3/day was possible and sustainable. In addition, previous reports indicate that no long-term decrease in the groundwater table has been observed due to long-term pumping at the wellfield. It seems likely that an increase to the pumping rate would be sustainable; however, further investigation would be required. Uncertainties remain in regard to long-term sustainability of a higher flow rate, potential migration of contaminant plumes, surface water and groundwater interaction, potential impacts to private wells, and geotechnical impacts such as settlement.

Other areas of the Township may be considered for the potential to obtain groundwater for new potential water treatment plants. Based on the available background information, the sand & gravel confined aquifer known as the Inter-Newmarket Sediment Aquifer exists below the town of Millbrook that could be used as a reliable water source. A regional cross-section of the hydrostratigraphic units is presented in the above-mentioned report *2018 Groundwater Monitoring Report, Former Millbrook Correctional Centre, Millbrook, Ontario,* Prepared by Cole Engineering Group Ltd. and dated 2019. The cross-section shows the Inter-Newmarket Sediment Aquifer extending over a distance of at least 6 km along a west-east section through Millbrook. The thickness of the aquifer ranges from 50 m in the west-southwest to as thin as 2 m in the east-northeast. In the Millbrook area, the aquifer thickness ranges from approximately 24 m to 10 m. The aquifer generally dips down towards the east. Considerations for selecting a location for a new municipal well include presence of coarse-grained soils in the subsurface, proximity of potentially contaminating activities, location of recharge zones and vulnerability of recharge zones to contamination, presence of nearby private wells or water bodies which may be affected by pumping, and logistical concerns such as proximity to treatment facilities. Prior to installation and commissioning of a new municipal well, field investigations would need to be carried out at the proposed site, as further discussed in Section 4.3.

4.2 Construction Dewatering

Construction of infrastructure below grade may require dewatering if the excavation penetrates below the groundwater table. Within the construction dewatering zone of influence, potential impacts such as ground settlement, reduction in groundwater flow to groundwater users and watercourses, and other impacts must be considered. The potential impacts and potential monitoring and mitigation measures are discussed in the following sub-sections.

4.2.1 Geotechnical Impacts

Drawdown of the groundwater table during construction dewatering poses a risk of settlement of nearby structures and utilities. It is recommended that a pre-construction survey be developed by a geotechnical engineer to determine pre-construction elevations of any settlement-sensitive structures and utilities within the radius of influence and to recommend a monitoring plan during construction.

4.2.2 Impact to Surface Water and Natural Environment

The primary potential impact to surface water is from the discharge of water that is of poor quality, or from erosion caused by poorly controlled discharge flow. The Water Taking Plan and Discharge Plan in the case of an EASR registration or the Hydrogeological Study in the case of a Category 3 PTTW would identify operating conditions, monitoring requirements, and a contingency plan in terms of the taking and discharging of water. The PTTW may stipulate additional terms and conditions that must be followed.

The operational conditions may include performance criteria that need to be met, such as maintaining the water taking rate below the permitted value, and target concentrations for particular parameters in the discharge, such as a total suspended solids (TSS) limit and other parameters (e.g. PWQO limits). Discharge to land surface is typically required to be at least 30 metres from a receiving water body such as a creek.

If dewatering is required, a monitoring plan may be developed, which would recommend tasks to be completed at indicated frequencies. These may include visual inspections of the discharge location and water quality, measurements of turbidity, measurements of water quality parameters to ensure compliance with discharge requirements and recording of water taking volumes.

A contingency plan may also be developed, if dewatering is required, which would provide recommended actions, or a series of actions, to initiate when an operating condition or monitored parameter is not in compliance with the project requirements.

Reductions of flows to surface water from groundwater may also be a potential concern if the construction dewatering rate is significant and is in close proximity to a surface water body. Investigation and analysis would be required to ascertain the potential level of impact, and depending on the outcome of the analysis, monitoring and mitigation measures may be required.

4.2.3 Impact to Water Well Users

Dewatering activities may impact water well users within the radii of influence, including impacting the quality or quantity of drinking water. The magnitude of any drawdown and the relative impact is anticipated to decrease as the distance between the well and the edge of the excavation increases.

If a desktop study indicates that private wells may be located within a construction dewatering zone of influence, a door-to-door survey of private wells and a well monitoring program may be required. A door-to-door survey of private well users consists of canvassing properties near the proposed construction within the estimated dewatering radius of influence or 500 m (whichever is larger) to assess interest and participation in the well monitoring program and to confirm the location of private wells. A well monitoring program should consist of pre-construction, construction, and post-construction monitoring of the water level in private wells as well as basic water quality testing in comparison to ODWS. The results of the monitoring program would assist in verifying potential impacts on well users and provide the data required to document the effects, where permission is given by residents to monitor their wells. Remedial measures that the Township may consider for affected well users include the provision of potable water or assistance with improving or restoring well productivity.

4.2.4 Migration of Contaminants

With prolonged dewatering activities there can be potential for inorganic or organic chemical compounds present within the dewatering radius of influence to migrate and to enter open excavations where sufficient flow rate and time permit. Based on the background review, it is known there is VOC-impacted groundwater at the location of the former Millbrook Correctional Centre. Further identification of potential contaminants to groundwater would require further study, such as a contaminant overview study.

The quality of groundwater discharge should be monitored for changes in water quality. Visual inspection of the discharge for excessive sediment or contamination such as chemical product or sheen should be conducted. Collection of discharge samples compared to discharge criteria should be conducted prior to and during dewatering activities. If any contaminated groundwater is collected from the dewatering operations, it should be treated to meet specified discharge criteria or disposed of at a facility licensed to handle such materials.

4.3 Future Hydrogeological Considerations

Once preliminary planning has been completed and potential locations for water supply or infrastructure have been determined, further investigation and analysis may be required. This work may consist of a series of investigations as options are investigated and detailed design is conducted. The following sub-sections discuss hydrogeological investigation and analysis that may need to be considered.

4.3.1 Water Supply

If greater water taking at the Millbrook Wellfield is being evaluated, a detailed review of existing pumping test and monitoring data to assess hydraulic performance at higher flow rates, to assess the potential implications of a higher sustained flow rate, and to identify data gaps and additional investigation if required should be considered. Considerations include the following:

- Aquifer hydraulics, including drawdown at the well, zone of influence in multiple directions and within multiple geologic units, drawdown at private wells in the area and potential hydraulic connections to surface water within the anticipated radius of influence.
- A private well survey may be conducted prior increasing the pumping rate to obtain background water level and water quality data of private water wells in proximity to the wellfield. If additional pumping tests are conducted, monitoring should be conducted frequently to observe any impacts related to quality or quantity of private well water.
- Surface water monitoring of nearby creeks should be conducted prior to increased pumping and frequently during any pumping test to observe any decrease in surface water flows due to the increased water taking. Should regular use pumping start at a new higher rate, regular surface water monitoring should be conducted (e.g., quarterly).
- Contaminant mobilization – An increased pumping rate may have the potential to mobilize VOC impact from Millbrook Correctional Centre located approximately 400-450 m to the northwest. Further investigation of potential mobilization of the VOC impact should be investigated, including sampling of private wells and the Millbrook Wellfield for PCE.

If other areas are being considered for new municipal wells, a detailed field investigation should be conducted at the location prior to construction and commissioning of the municipal well. Boreholes should be drilled and monitoring wells should be screened at the same target depth as the proposed municipal well. A review of the borehole stratigraphy should target the most permeable units for potential areas for the well to be screened in. Stabilized groundwater levels in the monitoring wells should be monitored and in-situ hydraulic conductivity testing should be completed to estimate the permeability of the screened soils. Groundwater quality samples should be conducted from the monitoring wells and compared to the ODWS to assess if the location is expected to have adequate water quality for municipal water supply purposes. Once the municipal well is installed, a pumping test should be conducted to determine the well yield and the appropriate pumping rate. Observation wells should be installed at various distances and depths to monitor the drawdown cone, which will assist in assessing aquifer properties. Additional groundwater samples should be collected from the pumping well and analyzed in comparison to the ODWS.

4.3.2 Construction Dewatering

Based on the Township of Cavan Monaghan Water and Wastewater Master Servicing Study Request for Proposal, construction of various infrastructure, including watermain, sewers, water towers, treatment plants, and new municipal wells, is being considered throughout the Study Area. As designs progress, field hydrogeological investigations should be conducted in the areas of potential construction in order to establish baseline hydrogeological conditions, assess groundwater conditions, evaluate construction dewatering requirements, assess the potential impacts that the proposed construction works may have on the local groundwater quality and quantity, determine water taking permit requirements, and develop a groundwater monitoring program.

Infrastructure requiring excavations below grade, such as watermains, sewers, treatment plants, and other structures may require construction dewatering. A representative number of boreholes should be drilled at the locations of proposed construction to characterize the subsurface geology. Monitoring wells should be installed in the boreholes and stabilized groundwater levels in the monitoring wells should be monitored. If groundwater conditions indicate the potential need for dewatering, additional stabilized water levels should be measured at the monitoring wells and in-situ hydraulic conductivity testing should be completed to estimate the permeability of the screened soils. Groundwater quality sampling from the monitoring wells should also be undertaken for preliminary assessment of groundwater disposal options and potential treatment, if required. Groundwater quality samples should be analyzed against the Provincial Water Quality Objectives (PWQOs) for select metals and inorganics criteria, Peterborough Sewer Use by-Law Limits, as well as for any anthropogenic contaminants if there are visual or olfactory signs of impact from the investigation.

Basal stability of excavations must be assessed due to potential basal heave or boiling where uplift from groundwater may exceed soil resistance, especially in areas of known artesian conditions. As noted previously, artesian groundwater has been observed within and near the Millbrook Wellfield and the Millbrook Wastewater Treatment Plant Focus Areas. In such cases, the potential for depressurization of underlying soils by dewatering may need to be considered. Depressurization may need to be considered in non-artesian conditions as well, depending on aquifer water levels and anticipated excavation depths.

Following completion of the field investigation, a report or several reports summarizing the findings of the hydrogeological investigation should be prepared. The reports would characterize the existing geological and hydrogeological setting and provide recommendations for the requirement of an EASR registration or Category 3 PTTW based on detailed design for areas requiring construction dewatering. Potential short-term and long-term impacts to the natural features and groundwater users as a result of construction related activities need to be investigated.

If it is determined that an EASR or PTTW is required, preparation of an application and supporting report should be undertaken. To support application for PTTW, a detailed hydrogeological assessment report must be completed outlining detailed monitoring and reporting requirements along with any required mitigation and management measures. Potential environmental impacts to streams from construction dewatering may require assessment by additional experts, including fluvial geomorphologists and aquatic biologists.

The details of the proposed hydrogeological field investigation should be developed by a professional hydrogeologist or hydrogeological engineer following review of any preliminary or detailed designs.

5. CLOSURE

We trust this memo meets your requirements. If you have any questions or require further information, please do not hesitate to contact us.

Yours truly,

Thurber Engineering Limited



Paul Coulson, P.Geo.
Hydrogeologist



David Hill, M.A.Sc., P.Eng., P.Geo.
Senior Hydrogeologist/Review Engineer

Attachments

Attachment A Figures

Site Location Plan
Physiographic Regions
Surficial Geology
Bedrock Geology
MECP Well Records
Natural Heritage Areas and Wellhead Protection Areas

Attachment B MECP Well Records

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6. REFERENCES

Betcher, R. Review and Comments on Existing Repots on the Millbrook Well Field Including Comments on the Need for Additional Studies. (2016).

Cambium Inc. Hydrogeological Monitoring Report (2019) – Town of Millbrook, Township of Cavan Monaghan. (2020).

Chapman, L.J. and Putnam, D.F. The Physiography of Southern Ontario, Third Edition. Ontario Geological Survey, Ontario Ministry of Natural Resources. (1984).

Cole Engineering Group Ltd. 2018 Groundwater Monitoring Report. Former Millbrook Correctional Centre. Millbrook, ON. (2019).

Geo-Logic Inc. Geotechnical Investigation Report. Millbrook Waste Water Treatment Plant Expansion. 25 Centennial Lane, Millbrook, Ontario. Project No. G024581A2. (2014).

Geo-Logic Inc. Geotechnical Investigation Report. Water Towner and Servicing. Millbrook, Ontario. Project No. G030141A1. (2014).

GHD Limited. Hydrogeologic Assessment Report. Proposal Residential Development. 825 Fallis Line. Millbrook, Ontario. (2017).

Ministry of Environment, Conservation and Parks. Millbrook Drinking Water System 2019-20 Compliance Inspection Report 1-L4FKG. (2019).

Ministry of the Environment, Conservation and Parks. 2020. Source Intake Protection Atlas.

Ministry of the Environment, Conservation and Parks. 2019. Permit to Take Water Database.

Ministry of the Environment, Conservation and Parks. 2019. Water Well Information System.

Ministry of Natural Resources and Forestry, Natural Heritage Information Centre database – Make a Heritage Map. Accessed November 2016, Queen's Printer for Ontario, 2015.

Ontario Geological Survey. Bedrock Geology of Ontario Seamless Coverage Data Set 6. (2005).

Ontario Geological Survey. Quaternary geology, seamless coverage of the province of Ontario: Ontario Geological Survey, Data Set 14. (1997).

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STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

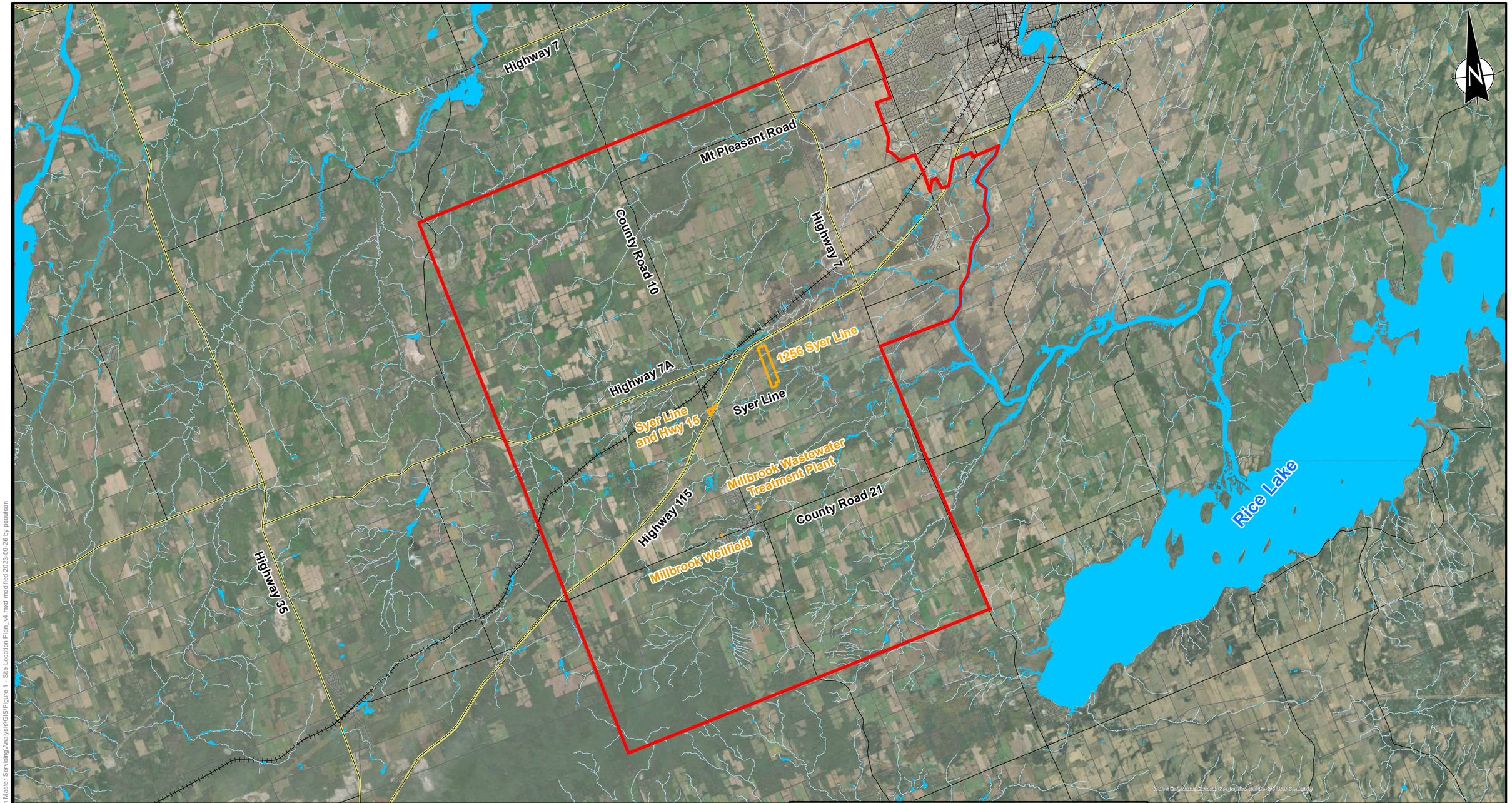
7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

THURBER

Attachment A

Figures



LEGEND:

- Study Area
- Focus Areas
- Waterbody
- Watercourse
- Railway

Road Class

- Arterial
- Expressway / Highway
- Street

1,000 500 0 1,000 2,000 m

UTM 17 NAD 83

R.V. ANDERSON ASSOCIATES LIMITED

DESKTOP HYDROGEOLOGICAL STUDY
WATER AND WASTEWATER MASTER SERVICING STUDY
TOWNSHIP OF CAVAN MONAGHAN, ONTARIO

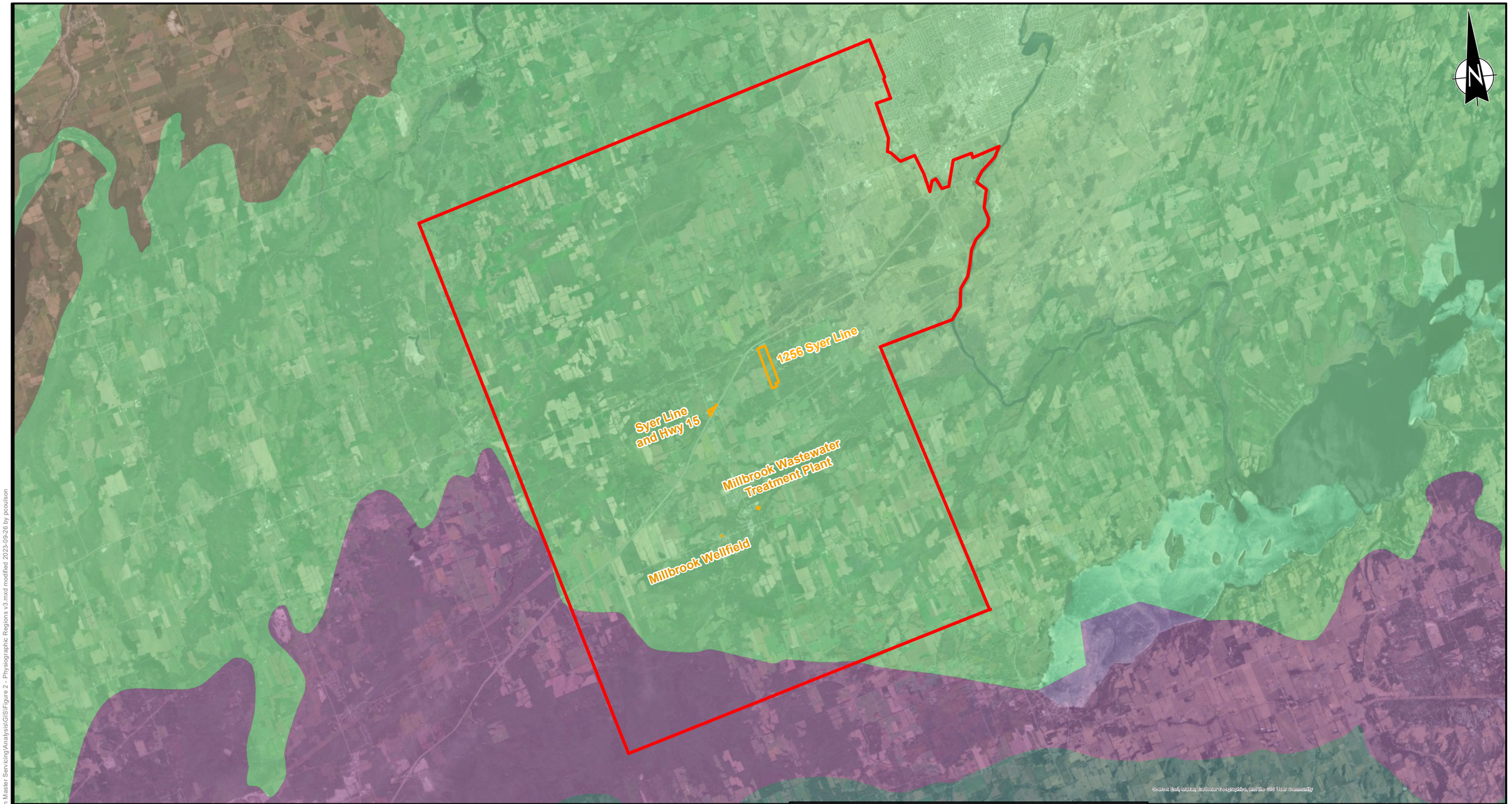
SITE LOCATION PLAN

PROJECT No. 29561

THURBER ENGINEERING LTD.

DESIGNED:	DRAWN:	APPROVED:
AH	AH	DH
DATE: SEPTEMBER 26, 2023	SCALE: 1:130,000	FIGURE NO. 1

H:\29000-29999\29000-29999\29561 Cavan Monaghan Master Servicing\Analysis\GIS\Figure 1 - Site Location Plan_v4.mxd modified 2023-09-26 by pcoulson



H:\20000-29999\29000-29999\29561 Cavan Monaghan Master Servicing\Analysis\GIS\Figure 2 - Physiographic Regions v3.mxd modified 2023-09-26 by pculson

LEGEND:

- Study Area
- Focus Areas

REGION

- Oak Ridges Moraine
- Peterborough Drumlin Field
- Schomberg Clay Plains
- South Slope

1,000 500 0 1,000 2,000 m

UTM 17 NAD 83

Data Source: Ontario Geological Survey (OGS)

R.V. ANDERSON ASSOCIATES LIMITED

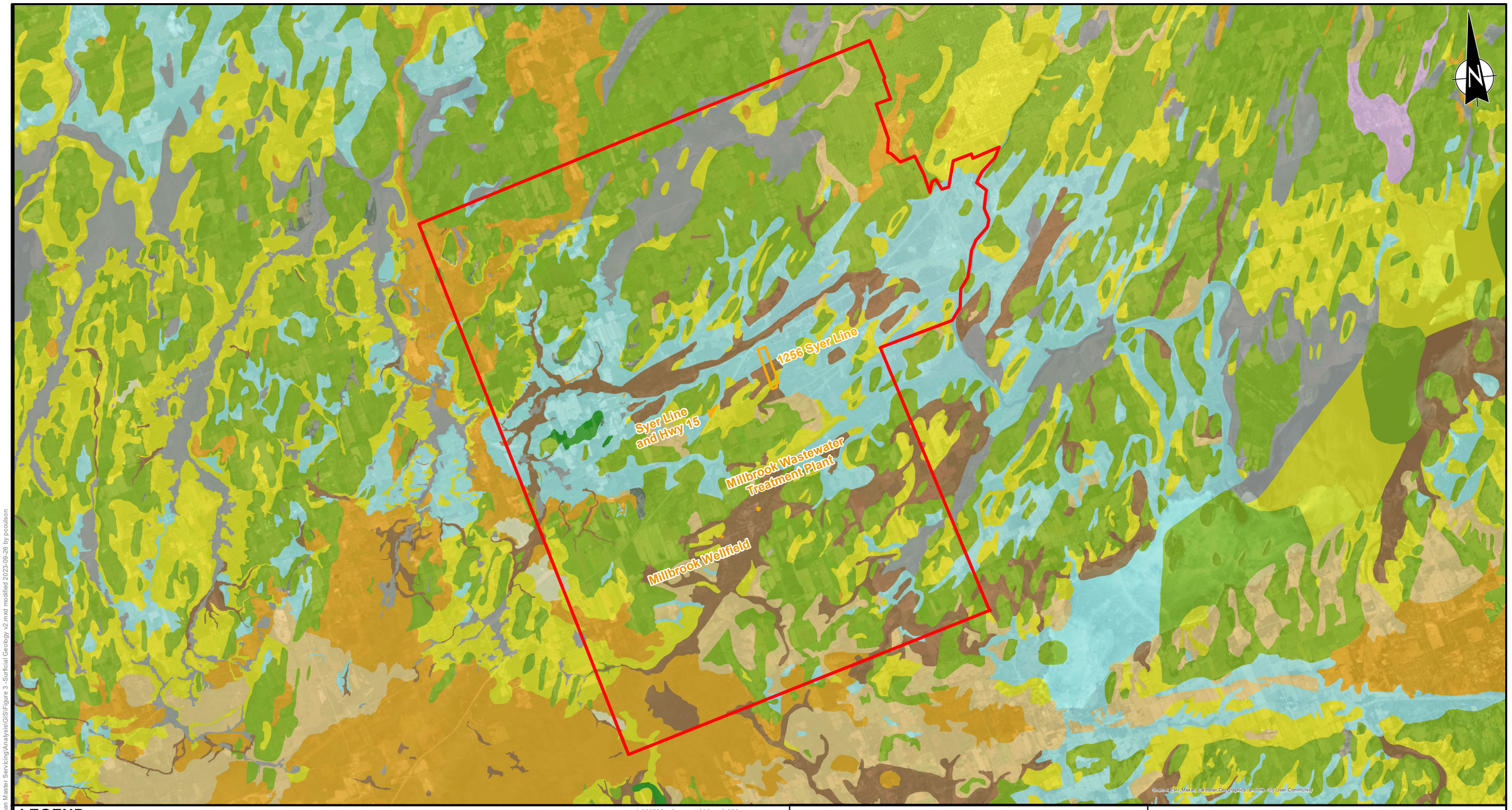
DESKTOP HYDROGEOLOGICAL STUDY
WATER AND WASTEWATER MASTER SERVICING STUDY
TOWNSHIP OF CAVAN MONAGHAN, ONTARIO

PHYSIOGRAPHIC REGIONS

PROJECT No. **29561**

THURBER ENGINEERING LTD.

DESIGNED:	DRAWN:	APPROVED:
AH	AH	DH
DATE: SEPTEMBER 26, 2023	SCALE: 1:130,000	FIGURE NO. 2



LEGEND:

Study Area

Focus Areas

4: Paleozoic bedrock-drift complex

5b: Stone-poor, carbonate-derived silty to sandy till

5d: Glaciolacustrine-derived silty to clayey till

6: Ice-contact stratified deposits

7: Glaciofluvial deposits

8a: Massive-well laminated

9c: Foreshore-basinal deposits

17: Eolian deposits

12: Older alluvial deposits

19: Modern alluvial deposits

20: Organic deposits

Data Source: Ontario Geological Survey (OGS)

1,000 500 0 1,000 2,000 m

UTM 17 NAD 83

R.V. ANDERSON ASSOCIATES LIMITED

DESKTOP HYDROGEOLOGICAL STUDY
WATER AND WASTEWATER MASTER SERVICING STUDY
TOWNSHIP OF CAVAN MONAGHAN, ONTARIO

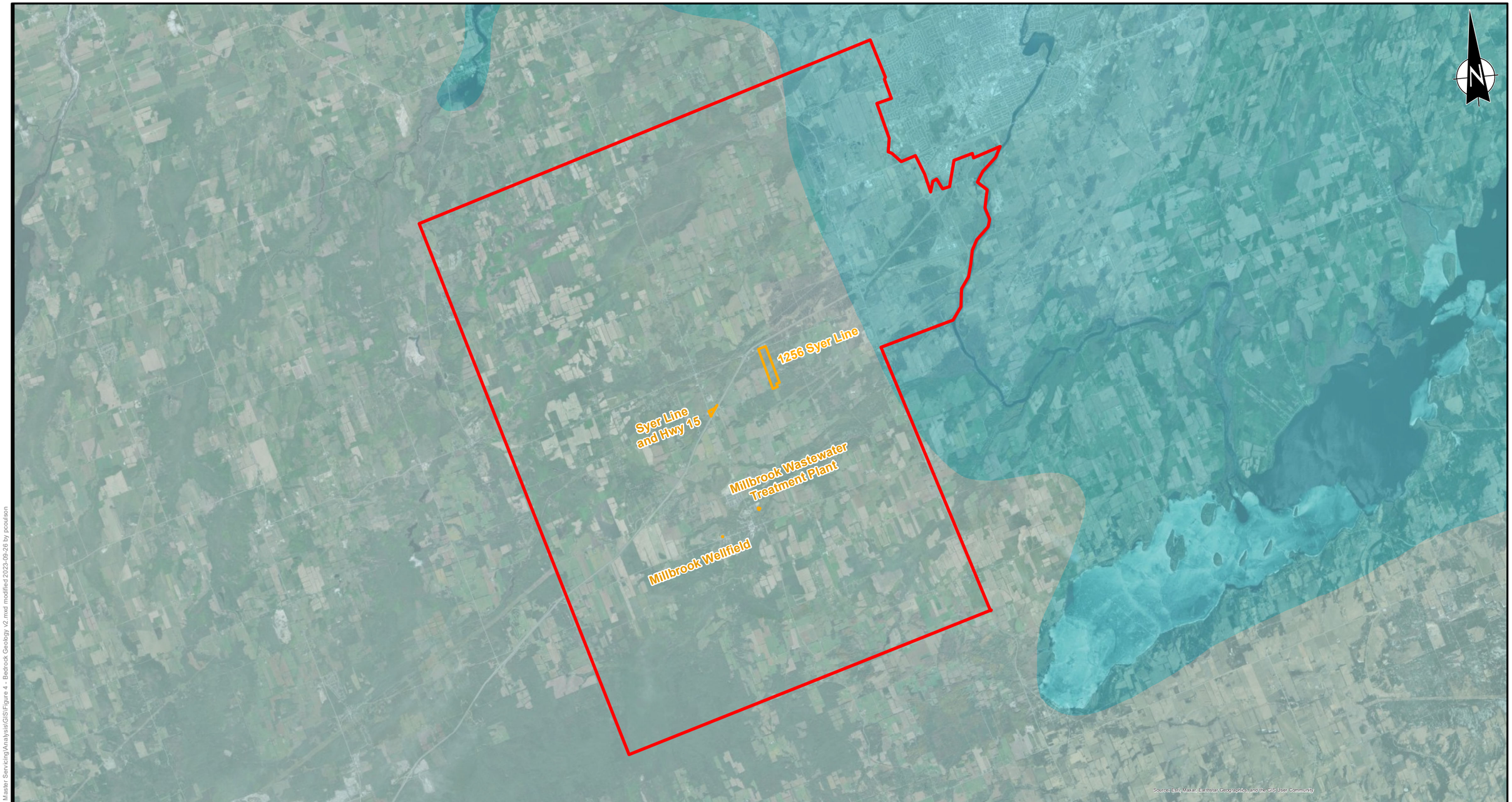
SURFICIAL GEOLOGY

PROJECT No. **29561**

THURBER ENGINEERING LTD.

DESIGNED:	DRAWN:	APPROVED:
AH	AH	DH
DATE: SEPTEMBER 26, 2023	SCALE: 1:130,000	FIGURE NO. 3

H:\20000-29999\29000-29999\29561 Cavan Monaghan Master Servicing\Analysis\GIS\Figure 3 - Surficial Geology v2.mxd modified 2023-09-26 by pcoulson



LEGEND:

- Study Area
- Focus Areas

FORMATION

- Lindsay
- Verulam

1,000 500 0 1,000 2,000 m

UTM 17 NAD 83

Data Source: Ontario Geological Survey (OGS)

R.V. ANDERSON ASSOCIATES LIMITED

DESKTOP HYDROGEOLOGICAL STUDY
WATER AND WASTEWATER MASTER SERVICING STUDY
TOWNSHIP OF CAVAN MONAGHAN, ONTARIO

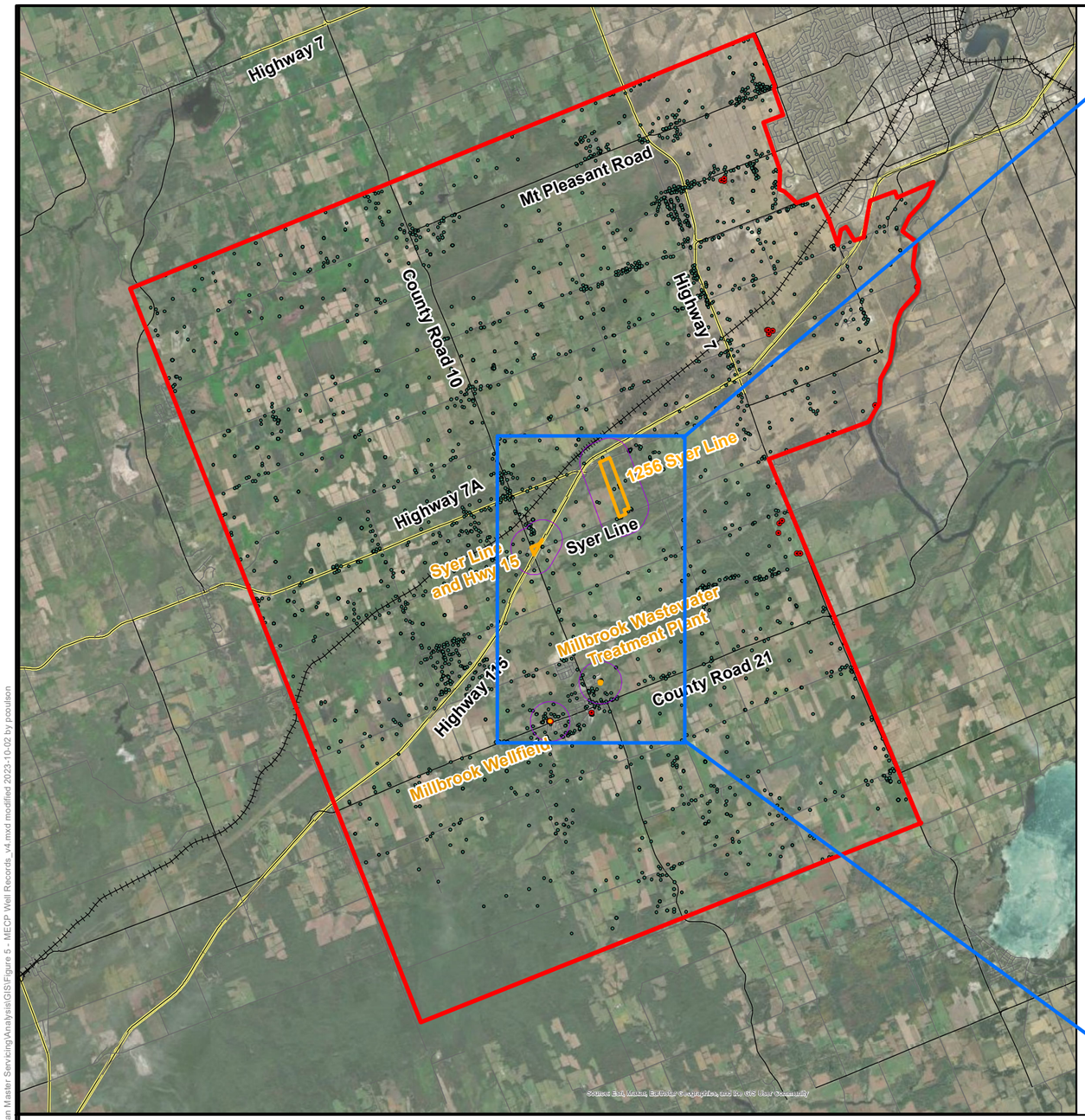
BEDROCK GEOLOGY

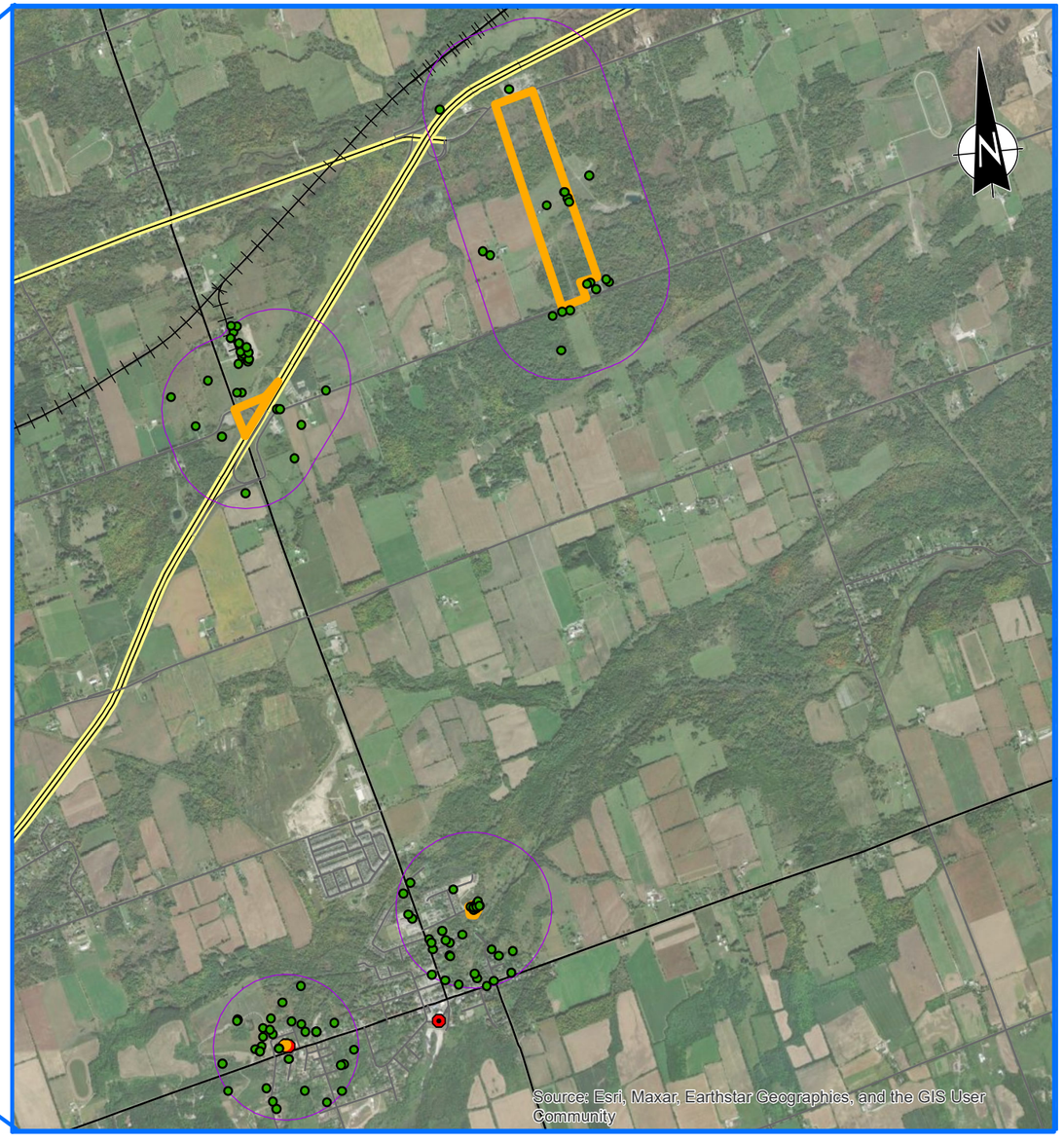
PROJECT No. **29561**

THURBER ENGINEERING LTD.

DESIGNED:	DRAWN:	APPROVED:
AH	AH	DH
DATE: SEPTEMBER 26, 2023	SCALE: 1:130,000	FIGURE NO. 4

H:\20000-29999\29000-29999\29561 Cavan Monaghan Master Servicing\Analysis\GIS\Figure 4 - Bedrock Geology v2.mxd modified 2023-09-26 by pcoulson





LEGEND:

- Study Area
- Focus Areas
- Focus Areas (500 m Buffer)
- PTTW
- MECP Well Records
- Railway

Road Class

- Arterial
- Street
- Expressway / Highway

1,000 500 0 1,000 2,000 m

UTM 17 NAD 83

Data Source: Ministry of the Environment, Conservation and Parks Well Records

R.V. ANDERSON ASSOCIATES LIMITED

DESKTOP HYDROGEOLOGICAL STUDY
WATER AND WASTEWATER MASTER SERVICING STUDY
TOWNSHIP OF CAVAN MONAGHAN, ONTARIO

MECP WELL RECORDS

PROJECT No. 29561

THURBER ENGINEERING LTD.

DESIGNED:	DRAWN:	APPROVED:
AH	AH	DH
DATE:	SCALE:	FIGURE NO.
OCTOBER 2, 2023	1:130,000	5

H:\20000-29999\29000-29999\29561 Cavan Monaghan Master Servicing\Analysis\GIS\Figure 5 - MECP Well Records_v4.mxd modified 2023-10-02 by psoulsen

Highway 7
Best's Pond
Mt Pleasant Road
Jackson Creek
County Road 10
Highway 7
Cavan Creek
1256 Syer Line
Highway 7A
Syer Line
Syer Line and Hwy 15
Millbrook Wastewater Treatment Plant
Highway 115
County Road 21
Millbrook Well Field
Baxter Creek
Squirrel Creek
Rice Lake
Highway 35

LEGEND:

- Study Area
- Focus Areas
- Watercourse
- Waterbody
- Wetland
- ANSI
- Railway
- NHS
- Wooded Area

Road Class

- Arterial
- Street
- Expressway / Highway

- WHPA-A
- WHPA-B
- WHPA-C
- WHPA-D

2,500 0 2,500 5,000m

SCALE 1:125,000

Data Source: Ontario Minstry of Natural Resources and Forestry (ws.lioservices.lrc.gov.on.ca)

R.V. ANDERSON ASSOCIATES LIMITED

DESKTOP HYDROGEOLOGICAL STUDY
WATER AND WASTEWATER
MASTER SERVICING STUDY
TOWNSHIP OF CAVAN MONAGHAN, ONTARIO
NATURAL HERITAGE & WELLHEAD PROTECTION AREAS
JOB# 29561

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
AH	MFA	DH
DATE :	SCALE :	DRAWING No.
SEPTEMBER 2023	1:125,000	FIGURE 6

FILENAME: H:\Drafting\29000\29561\TES-29561-HGPL.dwg
PLOTDATE: Sep 29, 2023 - 2:08 PM

THURBER

Attachment B

MECP Well Records

Well ID	UTM Zone	Easting	Northing	Well Depth (m)	Depth to Bedrock (m)	Static Water Level (m)	Purpose
7256988	17	704350	4892429	-	-	-	Abandoned-Other
7256986	17	704350	4892429	-	-	-	Unknown
5113303	17	704212.2	4892553	30.8	29.9	1.8	Water Supply
7231144	17	704350	4892429	-	-	-	Abandoned-Other
7158468	17	704184	4892097	4	-	-	Unknown
7236982	17	704331	4892434	-	-	-	Unknown
1902417	17	704061.2	4891965	9.1	-	-	Water Supply
7256991	17	704350	4892414	-	-	-	Unknown
1902419	17	704045.2	4892210	27.4	-	3.7	Water Supply
1902400	17	703925.2	4892351	30.8	30.5	2.7	Water Supply
1902427	17	704621.2	4892128	32.3	-	10.4	Water Supply
7256987	17	704350	4892429	-	-	-	Abandoned-Other
1902431	17	704440.2	4891887	26.5	-	-	Water Supply
7236981	17	704393	4892442	21.3	-	-0.2	Dewatering
1902433	17	704187.2	4892186	37.5	-	6.1	Water Supply
7256989	17	704371	4892435	-	-	-	Abandoned-Other
7256985	17	704365	4892423	-	-	-	Abandoned-Other
1902403	17	704373.2	4891940	41.5	-	-0.3	Water Supply
1903557	17	704155.2	4892203	36.9	-	4.9	Water Supply
1902411	17	704133.2	4892267	14	-	-	Water Supply
1902426	17	704488.2	4891921	26.5	-	-	Water Supply
1902405	17	704249.2	4891898	40.5	36.6	0	Water Supply
7256984	17	704349	4892429	-	-	-	Abandoned-Supply
1902424	17	704153.2	4891925	20.1	-	-0.6	Water Supply
1902438	17	704070.2	4892140	29.3	-	2.7	Water Supply
1902434	17	704270.2	4892240	37.8	-	6.1	Water Supply
7159632	17	704191	4892091	7	-	4	Test Hole
7256983	17	704366	4892451	-	-	-	Unknown
7256990	17	704371	4892435	-	-	-	Abandoned-Other
1902407	17	703913.2	4892601	36.9	33.5	-	Water Supply
1902422	17	703898.2	4892380	39.3	-	3	Water Supply
1903385	17	704355.2	4891973	42.4	39.3	9.1	Water Supply
1902404	17	704474.2	4892138	27.4	-	12.2	Water Supply
1902415	17	704521.2	4892096	17.7	-	-	Water Supply
1902410	17	703865.2	4892527	32.3	-	-	Water Supply
7236980	17	704381	4892470	-	-	-0.1	Dewatering
1902420	17	704058.2	4892188	30.5	-	2.4	Water Supply
1902437	17	704611.2	4891979	32.3	-	3	Water Supply
7256982	17	704392	4892439	-	-	-	Unknown

Well ID	UTM Zone	Easting	Northing	Well Depth (m)	Depth to Bedrock (m)	Static Water Level (m)	Purpose
1903184	17	704465.2	4896923	8.2	-	7.3	Water Supply
5120003	17	705144	4897470	21	-	4.5	Test Hole
7167834	17	705153	4896731	48.8	17.1	-	Abandoned-Supply
5109762	17	705015.2	4896543	36	32	15.2	Water Supply
1903268	17	704415.2	4896948	28.4	26.5	7	Water Supply
5120099	17	704998	4897315	23.5	-	4.2	Observation Wells
7209860	17	705283	4896735	8.3	-	1.6	Water Supply
5120100	17	704998	4897315	23.5	-	4	Observation Wells
5119922	17	705006	4897288	23.2	-	2.7	Test Hole
1902723	17	704115.1	4897923	25.9	25.6	-	Water Supply
1900452	17	704951.2	4896263	55.8	48.8	33.5	Water Supply
7209876	17	705265	4896757	25.6	10.4	-	Abandoned-Supply
1903805	17	704855.2	4897263	21.3	-	5.5	Water Supply
5118505	17	704972.6	4897355	12.2	-	1.5	Water Supply
7170162	17	705192	4896687	39	14.6	3.7	Water Supply
7167848	17	704959	4896532	-	-	20.7	Abandoned-Supply
5108938	17	704595.1	4898063	23.5	21.6	3	Water Supply
5108635	17	704895.2	4896503	40.8	31.1	12.2	Water Supply
7160636	17	705131	4896722	45.7	20.7	9.8	Water Supply
5116141	17	704975.2	4897355	27.4	24.4	7.6	Water Supply

Well ID	UTM Zone	Easting	Northing	Well Depth (m)	Depth to Bedrock (m)	Static Water Level (m)	Purpose
1900449	17	703164.2	4895753	12.8	-	6.7	Water Supply
5108968	17	703115.2	4895523	40.8	-	14.6	Water Supply
5120331	17	702756	4896228	-	-	-	Observation Wells
7156713	17	702737	4896316	15.2	-	-	Observation Wells
1900460	17	702522.1	4896057	24.4	-	12.2	Water Supply
7216956	17	703333	4895990	23.8	22.6	4.4	Water Supply
7102051	17	702765	4896240	5.1	-	-	Observation Wells
1902623	17	702755.1	4895973	21	-	2.1	Water Supply
1902714	17	702265.1	4895943	7	-	3	Water Supply
5110926	17	702995.1	4895863	24.7	21.3	4.6	Water Supply
5109276	17	702615.1	4895673	12.2	-	0	Water Supply
1902716	17	702435.1	4895743	6.7	-	-	Water Supply
5120734	17	702794	4896188	-	-	-	Abandoned-Other
1904092	17	703015.1	4895863	18.9	-	6.7	Water Supply
1902531	17	702720.1	4895973	21	-	2.1	Water Supply
7138896	17	702733	4896316	9.1	-	6.1	Test Hole
7138896	17	702730	4896173	-	-	2.4	Test Hole
7138896	17	702743	4896253	-	-	6.1	Test Hole
7138896	17	702800	4896251	-	-	4.6	Test Hole
7138896	17	702786	4896289	-	-	3.7	Test Hole
5120675	17	702779	4895284	9	-	-	Observation Wells
7116458	17	702680	4896349	-	-	-	Test Hole
7116458	17	702697	4896395	-	-	-	Test Hole
7116458	17	702720	4896432	-	-	-	Test Hole
7116458	17	702678	4896350	9.1	-	4.2	Test Hole
7116458	17	702680	4896435	-	-	-	Test Hole

Well ID	UTM Zone	Easting	Northing	Well Depth (m)	Depth to Bedrock	Static Water Level (M)	Purpose
1902408	17	702889.2	4891471	29.9	-	1.8	Water Supply
1902398	17	703390.2	4891634	23.8	-	1.8	Water Supply
5108216	17	703265.2	4891573	33.5	-	-	Water Supply
5108280	17	703265.2	4891573	31.1	-	-6.1	Test Hole
1902439	17	702966.2	4891091	23.2	-	1.5	Water Supply
7262813	17	702725	4891659	-	-	-	Observation Wells
7233409	17	702899	4891537	17.9	-	-	Observation Wells
1902393	17	702846.2	4891450	30.5	-	1.2	Test Hole
5108215	17	703265.2	4891573	32	-	-4.9	Water Supply
1903739	17	703075.2	4891383	24.4	-	0	Water Supply
5108279	17	703265.2	4891573	33.8	-	-4.9	Test Hole
5119300	17	703008	4891459	8.8	-	-	Abandoned-Quality
7233407	17	702901	4891596	26.8	-	-	Observation Wells
5119299	17	703009	4891456	32.3	-	-5.2	Water Supply
1902527	17	703165.2	4891623	50	48.8	-7	Water Supply
1902436	17	702924.2	4891185	48.8	-	3	Water Supply
7182017	17	703044	4890960	32	-	-	Water Supply
1900356	17	703189.2	4891166	31.1	-	12.2	Water Supply
7251394	17	702949	4891587	-	-	-	Observation Wells
1902529	17	703190.2	4891573	36	-	-7	Test Hole
7233408	17	702722	4891649	30.5	-	-	Observation Wells
7254536	17	702877	4891437	-	-	-	Abandoned-Other
7254535	17	702881	4891439	-	-	1.8	Abandoned-Other
7251393	17	702955	4891666	-	-	-	Observation Wells

Permit Number	Permit Holder Name	Water Taking Category	Purpose	Permit Expiry Date	Permit Issue Date	UTM Zone	Easting	Northing	Max LPD	Days/year of Water Taking	Max Hours/Day of Water Taking	Max LPM
0130-A2VQVQ	233859 Ontario Limited	Water Supply	Other - Water Supply	2025-09-30	2015-10-05	17	707860	4904930	8000	365	24	30
0331-A4MM2Q	1078815 Ontario Inc.	Commercial	Other - Commercial	2025-10-31	2015-12-15	17	704110	4891649	227300	50	2	909
3167-ANDFEV	1131551 Ontario Limited o/a Keystone Links Golf and Country Club	Commercial	Golf Course Irrigation	2027-06-30	2017-08-01	17	708822	4901151	650000	150	24	452
4474-BMZK9A	Baxter Creek Country Club Ltd.	Water Supply	Communal	2030-04-02	2020-04-17	17	709401	4895507	48960	365	24	34
7704-AW7HJF	The Corporation of the Township of Cavan-Monaghan	Water Supply	Municipal	2024-03-31	2018-02-23	17	703051	4891483	3000000	365	24	1500
0130-A2VQVQ	233859 Ontario Limited	Commercial	Golf Course Irrigation	2025-09-30	2015-10-05	17	707787	4904956	216000	153	9	400
3167-ANDFEV	1131551 Ontario Limited o/a Keystone Links Golf and Country Club	Miscellaneous	Other - Miscellaneous	2027-06-30	2017-08-01	17	708971	4901121	16560	275	12	23
4474-BMZK9A	Baxter Creek Country Club Ltd.	Water Supply	Communal	2030-04-02	2020-04-17	17	709486	4895500	33120	365	24	23
7704-AW7HJF	The Corporation of the Township of Cavan-Monaghan	Water Supply	Municipal	2024-03-31	2018-02-23	17	703057	4891480	3000000	365	24	1500
0130-A2VQVQ	233859 Ontario Limited	Commercial	Golf Course Irrigation	2025-09-30	2015-10-05	17	707861	4904994	432000	153	9	800
3167-ANDFEV	1131551 Ontario Limited o/a Keystone Links Golf and Country Club	Water Supply	Other - Water Supply	2027-06-30	2017-08-01	17	708869	4901043	66250	365	12	46
4474-BMZK9A	Baxter Creek Country Club Ltd.	Commercial	Golf Course Irrigation	2030-04-02	2020-04-17	17	708988	4896273	665280	213	24	462
7704-AW7HJF	The Corporation of the Township of Cavan-Monaghan	Water Supply	Municipal	2024-03-31	2018-02-23	17	703073	4891472	3000000	365	24	1500
3167-ANDFEV	1131551 Ontario Limited o/a Keystone Links Golf and Country Club	Commercial	Golf Course Irrigation	2027-06-30	2017-08-01	17	708861	4901147	1000000	150	8	2200
4474-BMZK9A	Baxter Creek Country Club Ltd.	Commercial	Golf Course Irrigation	2030-04-02	2020-04-17	17	709050	4896344	4367520	213	24	3033
6887-AAXQKU	1078815 Ontario Inc.	Commercial	Other - Commercial	2025-11-30	2016-06-24	17	712629	4902114	454600	200	4	1818
4474-BMZK9A	Baxter Creek Country Club Ltd.	Commercial	Golf Course Irrigation	2030-04-02	2020-04-17	17	708953	4896042	363960	213	24	3033
6887-AAXQKU	1078815 Ontario Inc.	Commercial	Other - Commercial	2025-11-30	2016-06-24	17	711484	4899175	454600	200	4	1818

Ontario Ministry of the Environment

The Ontario Water Resources Act
WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11 (1 2) **5119299**

Municipality 51024 (10 14) Con. CON 05 (15 22 23 24)

County or District	Township/Borough/City/Town/Village	Con block tract survey, etc.	Lot (25-27)
Peterborough	Cavan Twp., Town of Millbrook	Con.5	Pt.10

[redacted]

Address: 1 King St.E., Millbrook,Ont.L0A 1G0

Date completed (48-53): 21 day 11 month 02 year

21 (1 2) UTM (10) Northing (12 17 18 24) RC (25) Elevation (26) RC (30) Basin Code (31 47) i ii iii iv

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	Depth - feet To
Black	Topsoil			0	1½
Gray	Clay & stones		hard	1½	5
Gray	Sandy clay & gravel		soft	5	28
Brown	Sand	some gravel	water bearing	28	33
Brown	Coarse sand & gravel		water bearing	33	74
Brown	Gravel	some sand	water bearing	74	105
Gray	Clay & gravel			105	106
		* Finished depth 102 ft.			

31 (10 14 15 21)

32 (32 43 54 65 75 80)

41 WATER RECORD

Water found at - feet (10-13)	Kind of water	
86-101	1 ☒ Fresh 2 ☐ Salty (UNTESTED) 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas	14
15-18	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas	19
20-23	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas	24
25-28	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas	29
30-33	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas	34 60

51 CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth - feet From	Depth - feet To
10-11	1 ☒ Steel 12 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic			13-16
10		.380	+3	85
17-18	1 ☒ Steel 19 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic			20-23
14		.380	+1	20
24-25	1 ☐ Steel 26 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic			27-30

SCREEN

Sizes of opening (Slot No.) (31-33)	Diameter (34-38)	Length (39-40)
80	10 inches	15 feet

Material and type	Depth at top of screen (41-44)	
S.S. Telescoping	86 feet	30

61 PLUGGING & SEALING RECORD

☒ Annular space ☐ Abandonment

Depth set at - feet From (10-13)	To (14-17)	Material and type (Cement grout, bentonite, etc.)
0	20	Cement (outside 14")
0 (18-21)	20 (22-25)	Bentonite grout
26-29	30-33	80 (inside 14")

71 PUMPING TEST

Pumping test method (10): 1 ☒ Pump 2 ☐ Bailer

Pumping rate (11-14): 350 GPM

Duration of pumping (15-16 Hours, 17-18 Mins): 24 Hours

Static level (19-21): +16.50 feet

Water level end of pumping (22-24): +2.82 feet

25 Water levels during: 1 ☒ Pumping 2 ☐ Recovery

15 minutes (26-28)	30 minutes (29-31)	45 minutes (32-34)	60 minutes (35-37)
+11.94 feet	+10.84 feet	+10.47 feet	+10.60 feet

If flowing give rate (38-41): +350 GPM

Pump intake set at: 40 feet

Water at end of test (42): ☒ Clear ☐ Cloudy

Recommended pump type: ☐ Shallow ☒ Deep

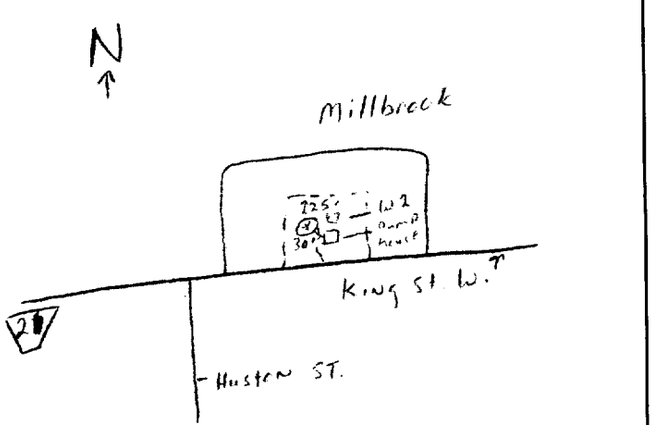
Recommended pump setting (43-45): 40 feet

Recommended pump rate (46-49): 350 GPM

50-53

LOCATION OF WELL

In diagram below show distances of well from road and lot line.
Indicate north by arrow.



252383

FINAL STATUS OF WELL (54)

1 ☒ Water supply
2 ☐ Observation well
3 ☐ Test hole
4 ☐ Recharge well
5 ☐ Abandoned, insufficient supply
6 ☐ Abandoned, poor quality
7 ☐ Abandoned (Other)
8 ☐ Dewatering
9 ☐ Unfinished
10 ☐ Replacement well

WATER USE (55-56)

1 ☐ Domestic
2 ☐ Stock
3 ☐ Irrigation
4 ☐ Industrial
5 ☒ Commercial
6 ☒ Municipal
7 ☐ Public supply
8 ☐ Cooling & air conditioning
9 ☐ Not use
10 ☐ Other

METHOD OF CONSTRUCTION (57)

1 ☐ Cable tool
2 ☒ Rotary (conventional)
3 ☐ Rotary (reverse)
4 ☒ Rotary (air)
5 ☐ Air percussion
6 ☐ Boring
7 ☐ Diamond
8 ☐ Jetting
9 ☐ Driving
10 ☐ Digging
11 ☐ Other

Name of Well Contractor	Well Contractor's Licence No.
G.Hart & Sons Well Drilling Ltd.	2662

Address: Box 850, Fenelon Falls, ON

Name of Well Technician	Well Technician's Licence No.
Bryan Watson	T-2441

Signature of Technician/Contractor: Bryan Watson

Submission date: day mo yr

MINISTRY USE ONLY

Data source (58) | Contractor (59-62): 2662 | Date received (63-68): FEB 19 2003 (80)

Date of inspection | Inspector

Remarks: CSS.ES3

0506 (07/00) Front Form 9

2 - MINISTRY OF THE ENVIRONMENT COPY

Hydrogeological and Geotechnical Assessment

Proposed Residential and Commercial Development; Fallis Line, Millbrook, ON

Vargas P Inc.

24 June 2025

→ **The Power of Commitment**



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1. Introduction

GHD Limited (GHD) was retained by the Vargas P Inc. (Client) to conduct a hydrogeological assessment and geotechnical investigation of a proposed commercial and residential development at the location of Lot 13, Concession 6 within the Township of Cavan-Monaghan, Ontario ("the Site") located between Fallis Line and Larmer Line. The location of the Site is presented on **Figure 1**.

The Site encompasses an area of 33.62 hectares (ha) (83.1 acres) and currently supports agricultural fields. The Site is proposed to be developed into mixed commercial and residential use subdivision with low and medium density residential blocks, commercial blocks, an internal road network, a stormwater management pond (SMWP) block, and a parkland area block. The proposed development will be municipally serviced for water and sewer. New development to the west is also municipally serviced for water and sewer while existing lots along County Road 10 and Larmer Line are privately serviced with well and septic. The Draft Plan of Subdivision[1] showing the proposed development is presented on **Figure 2**.

The purpose of the hydrogeological assessment was to define and characterize the subsurface soil and groundwater conditions of the Site including groundwater depth, flow direction, an assessment of construction dewatering, a preliminary infiltration characterization, and a generic water balance. The purpose of the geotechnical investigation was to obtain subsurface information regarding the soil and groundwater conditions at the test hole locations and provide geotechnical engineering recommendations regarding earthwork construction, backfilling, bearing capacity and foundations design, slab-on-grade design, service installation (bedding and backfill), and pavement structure for the internal road network.

The scope of work included a desktop review of available geological and groundwater mapping; a review of the Source Protection Information Atlas; a review of the Ministry of the Environment, Conservation and Parks (MECP) well records; the drilling of boreholes and excavation of test pits to investigate the subsurface conditions; installation of monitoring wells to facilitate water level measurements; completion of single well response testing to assess the hydraulic conductivity of the saturated zones; and a computed a generic water balance evaluation to establish groundwater infiltration targets (i.e. pre- and post-development runoff / infiltration conditions) in support of Low Impact Development strategies (LIDs). GHD notes that the water balance evaluation does not include tasks associated with a storm water study and / or related design work. As the work at this stage is investigative, this report does not include any applications for Permits to Take Water (PTTW), Environmental Activity and Sector Registry (EASR) permits for construction dewatering, sewer use by-law testing, excess soil etc.

This report is organized into the following sections:

Section 1.0 – Introduction: Outlines the purpose, objectives and scope of work, and presents the report organization.

Section 2.0 – Background: Provides a description of the existing Site conditions, background information and surrounding land uses. The regional environmental setting including the physiography, topography, surface water features, and surficial, Quaternary and bedrock geology is presented. This section of the report also considers a review of the Source Protection Information Atlas. The source protection information for the Site is based upon information current as of April 23, 2025.

Section 3.0 – Methodology: Describes the field activities and methodologies used to assess the hydrogeological and geotechnical conditions and to evaluate potential impacts associated with the undertaking.

Section 4.0 – Field Investigation Results: Provides a detailed description of the Site geology, hydrogeology and hydraulic properties of the underlying stratigraphy.

[1] Biglieri Group "Draft Plan of Subdivision". Drawing No. DP-01, dated 2025.06.18.

Section 5.0 – Discussion and Recommendations: Discusses the hydrostatic units and flow direction; single well response testing, and potential dewatering related to expected construction activities. A generic water balance evaluation was completed providing calculations of the expected pre- and post-development infiltration values to establish an infiltration target for the development. The water balance was based upon the Draft Plan of Subdivision provided to GHD. This section also provides geotechnical recommendations for the proposed development based on the soil and groundwater conditions encountered at the test hole locations.

Section 6.0 – Conclusions and Closure: Provides the overall conclusion of the report based upon the assessment findings and closure of the document. This section is followed by a Statement of Limitations.

2. Background

2.1 Site Description

The Site is located at Lot 13, Concession 6 within the Township of Cavan-Monaghan, Ontario and encompasses a total area of 33.62 ha (83.1 acres). At the time of GHD's field investigation, the Site is being used for agricultural purposes. A creek runs through the middle of the Site from west to east and two residential structures are present on the Site. There are also two (2) seasonal drainage areas that will drain overland flow and shallow water toward the east. It is understood by GHD that the Site will be municipally serviced for water and sanitary services.

The Site is within the Otonabee-Peterborough Source Protection Area and the Site is zoned as Agricultural (A) and Natural Linkage (NL) as per the Township of Cavan Monaghan Zoning By-Law 2018-58. The surrounding land use consists of:

– North – Larmer Line, Agricultural fields
– East – Agricultural fields
– South – Fallis Line, Future mixed-use development
– West – County Rd 10, Commercial, residential, municipal properties.

The planned development will involve the removal of the existing residential structures on Site. The proposed development will include commercial properties along County Road 10, low and medium density residential housing, an internal road network, a stormwater management pond, and a parkland area. Design details, such as a grading plan and building design loads, were not available GHD at the time of writing this report.

2.2 Regional Setting

The regional topography, as presented on **Figure 3,** is of rolling to hilly terrain. Local topography across the Site is undulating with gentle to steep slopes and relatively flat ridges. Low-lying areas and a valley area that bisects the Site contain seasonal and perennial watercourses. In the southern area of the Site, the lands to the east of the Site slope toward the west, and, from County Road 10 the topography slopes to the east creating a low-lying area through the middle of the Site in this area. This area was also noted to be wet during our site visits in the spring of 2025. The middle portion of the Site slopes toward the creek and to the east with another wet area noted. The far northern extent of the Site also has a localized area that slopes toward the west. It is assumed that the creek that bisects the Site flowing from west to east is a perennial stream. No other permanent water courses or bodies were observed on the Site.

The Site is situated within the physiographic region known as the Peterborough Drumlin Field[2], as presented on **Figure 4**. Locally, the Site is within a sand plains.

[2] Chapman and Putnam, 1984. The Physiography of Southern Ontario, 3rd Edition. Ministry of Natural Resources.

According to the Surficial Geology of Southern Ontario[3], as presented on **Figure 5**, the surface soils at the Site consists of stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain overlain by coarse textured glaciolacustrine deposits of sand, gravel, minor silt and clay, and modern alluvial deposits of clay, silt, sand, gravel and organic remains.

Based upon the Quaternary Geology of Ontario[4], as presented on **Figure 6**, most of the Site is defined as organic deposits, consisting of peat, muck and marl. Sections in the north and south ends of the Site are classified as till consisting of undifferentiated, predominantly sandy silt to silt matrix, commonly rich in clasts and often high in total matrix carbonate content.

According to the Bedrock Geology of Ontario[5], as presented on **Figure 7**, the bedrock of the area consists of limestone, dolostone, shale, arkose, and sandstone and belongs to the to the Simcoe Group of the Upper Ordovician Era. Based upon the well records within the vicinity, bedrock in the area ranges in depth from 63 m to 69 m.

2.3 Existing Local Water Supplies

New development to the west is municipally serviced for water and sewer while existing lots along County Road 10 and Larmer Line are privately serviced with well and septic. The locations of water wells and their corresponding data recorded by the MECP within 500 m of the Site are shown in **Appendix A**. Based on the review of the well records, there are nineteen (19) records within 500 m of the Site. The well record information indicates that there are:

- Twelve (12) drilled overburden well records;
- Three (3) bedrock well records;
- One dug / bored well record; and,
- Three (3) abandonment well records.

One (1) of the abandonment well records, an overburden well, was identified to be a flowing artesian well, drilled to a depth of 32.6 m. The depth to where groundwater was encountered was:

– Overburden wells: 7.6 to 65.8 m (average depth of 27.7 m).
– Bedrock wells: 63.7 to 68.6 m (average depth of 66 m).
– Dug / bored well: 8.5 m.

Based upon this data, the groundwater aquifers targeted for domestic usage in this area is typically found at depth from 7.6 m to nearly 70 m.

Other data from the well records reviewed is summarized in **Table 1**.

Table 1 MECP Well Record Data

Well Use	Well Type/Unit	No. of Records	Well Depth Min – Max (Avg) (m)	Static WL Min – Max (m)	Yield Min – Max (L/min)
Water Supply	Overburden – Drilled	12	10.4 – 68.9 (28.6)	1.8 – 22.9 (10.6)	11.3 – 226.8 (51.3)
Water Supply	Dug /Bored	1	15.2	7.9	15.1
Water Supply	Bedrock – Drilled	3	64 – 72.2 (68.8)	20.1 – 25 (22.1)	7.6 – 15.1 (11.3)
Total		**16**			
Abandonment	Unknown	3	5.2 – 16.2 (12.0)	-0.3 – 13.1 (6.4)	NA

[3] Ontario Geological Survey, 2010. Surficial Geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release-Data 128 – Revised.
[4] Ontario Geological Survey, 1997. Quaternary Geology, Seamless Coverage of the Province of Ontario: Ontario Geological Survey, Data Set 14.
[5] Ontario Geological Survey, 2011. 1:250 000 scale Bedrock Geology of Ontario; Ontario Geological Survey, Miscellaneous Release–Data 126 - Revision 1.

2.4 Source Water Protection

Where proposed developments are being planned, it is important to assess the Site for areas that are protected under the Clean Water Act (2006). These include the presence of Significant Groundwater Recharge Areas (SGRAs), Highly Vulnerable Aquifers (HVAs) and Wellhead Protection Areas (WHPAs). These features are considered by reviewing the "Source Protection Information Atlas" (SPIA) that is currently available through the MECP website. The published information is dated current as of April 23, 2025. The Site falls withing the Otonabee-Peterborough Source Protection Area.

In general, SGRAs are defined as areas where water seeps into an aquifer from rain and melting snow, supplying water to the underlying aquifer. A HVA aquifer occurs where the subsurface material offers limited protection from contamination resulting from surface activities. A WHPA is defined as the surface and subsurface area surrounding a water well or well field that supplies a municipal residential system through which contaminants are reasonably likely to move so as to eventually reach the water well. WHPA-A is a 100 m radius around the wellhead. WHPA-B is an area where water and any pollution that may be present can reach the well within 2 years. WHPA-C is an area where water and any pollution that may be present can reach the well within 2 to 5 years. WHPA-D is an area where water and any pollution that may be present can reach the well within 5 to 25 years. WHPA-E is an area where the groundwater is under the direct influence of surface water, meaning that there may be direct pathways from the ground surface to the well, making the drinking water source vulnerable to contamination from the ground surface.

Based on the information reviewed from the SPIA, a portion of the Site, mostly around the onsite creek, is within a SGRA (score of 2) as presented on **Figure 8.** The Site is not within a HVA or WHPA.

2.4.1 Other Source Water Protection Considerations

The Site is not within a Wellhead Protection Area Q1 or Q2 (WHPA Q1/Q2). WHPA Q1/Q2 (moderate risk level) means that activities that take water without returning it to the same source may be a threat (Q1) and activities that reduce recharge may be a threat (Q2). Activities that take water would include construction dewatering or other groundwater pumping. Pumping or dewatering activities may require appropriate permitting from the MECP; however, are not a concern from a Source Water Protection perspective.

3. Methodology

To achieve the purpose and objectives of this hydrogeological and geotechnical investigation, the following activities and tasks were undertaken:

- Prepared and implemented a Health and Safety Plan for the field activities and completed underground utility locate clearances including public and private locates.
- Conducted a walkover inspection of the Site.
- Advanced boreholes for obtaining hydrogeological and geotechnical parameters and installation of monitoring wells to facilitate the collection of groundwater levels to evaluate groundwater flow conditions.
- Obtained groundwater levels from the monitoring wells to evaluate depth to groundwater and flow direction.
- Completed test pits for obtaining further hydrogeological and geotechnical information.
- Surveyed ground elevations of the monitoring wells and borehole locations.
- Conducted Single Well Response Tests (SWRTs) to assess the horizontal hydraulic conductivity and groundwater flux of the saturated stratigraphic deposits investigated.
- Completed geotechnical laboratory testing in accordance with the latest editions of the ASTM Standards.
- Prepared this geotechnical and hydrogeological investigation report providing factual data, analysis and recommendations including a generic water balance for assessing pre- and post-construction infiltration values.

3.1 Health and Safety

For projects that incorporate field activities, GHD conducts Health and Safety planning. For this project, a site-specific Health and Safety Plan (HASP) was prepared and implemented during the field activities. The HASP presents the visually observed Site conditions to identify potential physical hazards to field personnel. Required personal protective equipment was also listed in the HASP. It is mandatory for GHD personnel involved in the field program, to read and have a copy of the HASP available at the Site.

3.2 Utility Clearance

GHD completed a pre-drilling Site visit to review the Site conditions and access restrictions. Based on the limits of approach, the test holes were positioned appropriately to avoid potential obstructions and were placed in the field based on the proposed concept plan at that time.

Prior to initiating the subsurface investigation activities, the applicable utility companies (gas, hydro, network cables, water, waste water, etc.) were contacted, to demarcate the location of their respective underground utilities to ensure that service lines would not be damaged during the investigative works.

GHD also retained a specialist private services locator (Utility Marx) to locate any underground private utilities that could potentially be present at the Site within the areas of intrusive work. The test holes were positioned at appropriate locations to avoid existing service lines.

3.3 Subsurface Exploration

A subsurface investigation was conducted by GHD through the advancement of boreholes between March 11 and 13 2024 and test pits were carried out on March 24, 2025. The work associated with the test holes was carried out under the full-time supervision of a GHD technical representative and included the installation of monitoring wells.

A summary of the observations made during the subsurface exploration program are presented below in the following sections.

3.3.1 Test Holes and Monitoring Well Installation

A total of fourteen (14) boreholes and seven (7) test pits were advanced with monitoring wells installed at six (6) of the borehole locations to evaluate the Site subsurface conditions. The boreholes were advanced to depths ranging between 6.2 to 6.7 mbgs and monitoring wells were installed to depths ranging between 3.1 to 6.1 mbgs. The test pits were each excavated to a depth of 3.1 mbgs.

The locations of the boreholes, test pits, and monitoring wells are presented on **Figure 2**. Following their installation, the monitoring wells were documented with the MECP and became the property of the Site's owner. Monitoring wells were installed at boreholes MW1-25, MW3-25, MW4-25, MW6-25, MW9-25, and MW11-25. One (1) nested well was installed at borehole MW6-25 (deep and shallow monitoring wells) for a total of seven (7) monitoring wells installed at the Site.

The boreholes were advanced by a track-mounted conventional drilling rig, supplied and operated by G.E.T. Drilling, a MECP-licensed well driller, under the full-time supervision of a GHD experienced technical representative. The monitoring wells were installed by the well driller consistent with the requirements of Ontario Regulation (O. Reg.) 903 – Wells (R.R.O 1990). The test pits were dug by a CAT 315 tracked excavator supplied and operated by Leahy Excavating, under the full-time supervision of a GHD experienced technical representative. The test hole information is provided in **Table 2** and the monitoring well completion details are presented in **Table 6.** The stratigraphy logs of the test holes and monitoring wells are presented in **Appendix B.**

The boreholes were advanced using continuous solid stem augers and soil samples were collected using a 50-millimetre (mm) outside diameter split spoon sampler in general accordance with the specifications of the Standard

Penetration Test (SPT) procedure described in ASTM D1586[6]. The relative density or consistency of the subsurface soil layers were measured using the Standard Penetration Test (SPT) method, by counting the number of blows ('N') required to drive a conventional split barrel soil sampler 300 mm in depth. Disturbed samples of the strata penetrated by the test pits were collected from the excavator's bucket. Groundwater level observations and measurements were made in the boreholes as drilling proceeded and upon completion of drilling and from the test pits during the excavation operations.

The GHD technical representative logged the material encountered in the test holes and examined the samples as they were obtained. The recovered samples were sealed in clean, airtight containers and transferred to GHD's laboratory, where they were reviewed by a geotechnical engineer.

Monitoring wells were constructed with 50 mm (2-inch) Schedule 40 PVC screen and casing. The well screens are 1.5 m in length and pre-slotted (No. 10 slot) (refer to **Table 6**). Silica sand pack was placed at the bottom of the monitoring well screen and typically extended 0.3 m above the screen. The remaining annular space was sealed with bentonite and the wells were completed with steel protective monument style casings. The installation details for each monitoring well are provided in the respective borehole logs. The installed monitoring wells will need to be abandoned in accordance with O. Reg. 903 once no longer required.

The as-drilled test hole locations were surveyed by GHD staff using an EOS Arrow Gold Plus Global Navigation Satellite System (GNSS) that streams to the Real Time Kinetic (RTK) Network. The test hole locations are shown in UTM Coordinates, Zone 17 with NAD 83 Datum (Original), northing and easting coordinates and ground surface elevations at the test hole locations are referenced to a Geodetic Datum. The ground elevations are provided for engineering analysis purposes only and should be confirmed by a licensed surveyor.

A summary of the test hole and monitoring locations, depths and ground surface elevations of the test holes is provided in **Table 2** below.

Table 2 Summary of Advanced Test Holes

Test Hole ID	Location – UTM Coordinates System		Ground Surface Elevation (m)	Test Hole Depth	
	Northing	Easting		mbgs	m
MW01-25	4894422	703316	241.76	6.4	235.36
BH02-25	4894434	703482	243.44	6.2	237.24
MW03-25	4894308	703528	244.70	6.4	238.30
MW04-25	4894130	703482	243.77	6.2	237.57
BH05-25	4894073	703615	238.75	6.7	232.05
MW06-25S	4893930	703553	238.17	3.1	235.07
MW06-25D	4893929	703551	238.15	6.7	231.45
BH07-25	4893877	703677	243.84	6.3	237.54
BH08-25	4893682	703556	244.99	6.7	238.29
MW09-25	4893733	703752	242.52	6.7	235.82
BH10-25	4893581	703652	244.73	6.4	238.33
MW11-25	4893460	703611	250.28	6.5	243.78
BH12-25	4893489	703852	244.32	6.7	237.62
BH13-25	4893396	703806	243.12	6.7	236.42
BH14-25	4893218	703705	252.28	6.7	245.58
TP01-25	4894441	703346	242.01	3.0	239.01

[6] ASTM D1586-11 - Standard Test Method for Standard Penetration Test and Split-Barrel Samplings of the soil, ASTM International, West Conshohocken, PA 2015

Test Hole ID	Location – UTM Coordinates System		Ground Surface Elevation (m)	Test Hole Depth	
	Northing	Easting		mbgs	m
TP02-25	4894284	703533	245.05	2.5	242.55
TP03-25	4894123	703491	243.06	3.1	239.96
TP04-25	4893893	703589	240.66	3.1	237.56
TP05-25	4893645	703780	242.79	3.1	239.69
TP06-25	4893381	703825	243.44	3.0	240.44
TP07-25	4893268	703903	246.48	3.1	243.38
"S" refers to "shallow" monitoring well; "D" refers to "deep" monitoring well.					

It should be noted that the provided coordinates and elevations are approximate and should not be used for construction purposes.

3.4 Physical Laboratory Testing

The physical laboratory testing was conducted in accordance with the American Society for Testing and Materials (ASTM) and Canadian Council of Independent Laboratories (CCIL) applicable standards. Laboratory testing consisted of moisture content tests on all recovered soil samples and grain size distribution analyses (sieve and hydrometer) on seven (7) selected soil samples and Atterberg limits testing on four (4) cohesive soil samples to assess soil plasticity index properties.

The results of the moisture content and grain size distribution testing results are reported on the boreholes logs presented in **Appendix B**. The grain size distribution curves are provided in **Appendix C**.

The soil testing program and soil classification conformed to the latest edition of the following standards:

- ASTM D2216: Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D6913 Standard Test Method for Particle Size Distribution (Gradation) of Soils using Sieve Analysis
- MTO LS-702 Standard Test Method for Particle Size Analysis of Soils (Hydrometer Analysis)
- ASTM D2487 Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils

3.5 Single Well Response Testing

Single well response testing (SWRTs) was conducted at seven (7) monitoring wells to estimate the horizontal hydraulic conductivity of the saturated geologic deposits underlying the Site. SWRTs were completed on monitoring wells MW01-25, MW03-25, MW04-25, MW06-25S, MW06-25D, MW09-25 and MW11-24.

SWRTs involve the injection or removal of a known volume of water into / from the well and measuring the water level response in the well until it returns to static or near static conditions (i.e., falling / rising head test). The results of the hydraulic testing were analyzed using the Bouwer-Rice (1976) solution for an unconfined aquifer condition as provided in the software package AQTESOLV™.

These solutions were used to determine the horizontal hydraulic conductivity of the saturated soils within the immediate vicinity of the screened interval of each monitoring well. The SWRTs conducted are summarized in **Table 8**. The results of the testing are presented in **Appendix D**.

3.6 Water Balance

To understand the pre- and post-infiltration components, a water budget analysis was undertaken for the Site to evaluate the amount of water surplus generated for the existing and proposed Site conditions and assess the potential impacts that may occur in the recharge / discharge characteristics related to the proposed development. The Site encompasses an area of 33.62 ha and supports agricultural fields. It is our opinion that groundwater infiltration should be maintained to the greatest extent possible.

The Site was subdivided into two (2) subcatchments for purposes of the water balance. The subcatchments (i.e. “north subcatchment” and “south subcatchment” refer to north and south of the creek) were based upon local topography and the creek that runs through the centre of the Site. It is our opinion that groundwater infiltration should be maintained to support any potential baseflow to the creek as this area is within a SGRA.

This evaluation is based upon the Draft Plan of Subdivision provided to GHD consisting of commercial properties along County Road 10, low and medium density residential housing, an internal road network, a stormwater management pond, and a parkland area. GHD understands that the removal of the existing residential structures on Site is proposed.

The objective of this water balance is to illustrate that post-development infiltration within the developable area can meet or be close to pre-development values. GHD utilized the Thornthwaite Method to complete this water balance. Based upon monthly temperature and precipitation average values, the method calculates the water surplus. Infiltration rate into the subsurface is based upon soil types, land cover and topography and is based upon MOEE Hydrogeological Technical Information Requirements for Land Development Applications, April 1995. The computations have used detailed parameters such as precipitation (Peterborough composite weather station using data from 1991 to 2020 was used), regional evapotranspiration, infiltration and runoff. Weather data from Peterborough (composite station metadata 6166418, 6166420, and 6166415) was selected as it was the closest weather station to the Site (~10 km away) using the most updated weather normalized data. The detailed water balance calculations are provided in **Appendix E**.

3.7 Groundwater Level Monitoring

Manual groundwater levels were collected using a Solinst water level meter. Groundwater levels were collected and are documented in this report from the monitoring wells on March 24, 2025. The water levels are summarized in **Table 5**.

4. Field Investigation Results

The following sections provide a detailed description of the field activities completed including geology and hydrogeology of the Site based on the results of the investigation completed and on the available background information. Detailed stratigraphy is shown on the test hole logs.

It should be noted that the subsurface conditions are only confirmed at the borehole locations and may vary between and beyond the borehole locations. The boundaries between the various strata, as shown on the borehole logs are based on non-continuous sampling and drilling resistance noted and observed at the time of drilling. These boundaries represent an inferred transition between the various strata, rather than precise planes of geological change.

4.1 Subsurface Conditions

The detailed subsurface soil and groundwater conditions as encountered in the test holes advanced during the investigation and the results of the laboratory tests carried out on selected soil samples are presented on the test hole logs provided in **Appendix B**. The results of the geotechnical laboratory testing are presented in **Appendix C**.

The stratigraphic boundaries shown on the borehole logs are inferred from non-continuous sampling, observations of drilling process and the results of the SPT. These boundaries, therefore, represent transitions between soil types rather than exact planes of geological change. Furthermore, subsurface conditions will vary between and beyond the borehole locations.

In summary, the test holes generally encountered surficial topsoil over native sandy silt underlain by cohesive and non-cohesive glacial till deposits. The non-cohesive glacial till was generally comprised of silty sand / sandy silt with varying amounts of clay and gravel. The cohesive glacial till was generally comprised of a clayey silt / silty clay with varying amounts of sand and gravel.

Detailed descriptions of subsurface conditions of the advanced test holes are provided in the following sections of this report.

4.1.1 Topsoil

A surficial layer of topsoil was encountered in all test holes and was observed to range between approximately 200 to 690 mm in thickness. This soil was observed to be in a damp, loose state, with a silty, highly organic content. As such, it is expected to be devoid of any structural engineering properties.

4.1.2 Sandy Silt

A layer of native sandy silt or silt was encountered in boreholes BH01-25 to BH07-25, BH11-25 and BH14-25 as well as within test pits TP01-25 to TP05-25 and TP07-25. The sandy silt / silt was encountered immediately beneath the surficial topsoil and extended to depths ranging from 0.6 mbgs to 3.0 mbgs. The native sandy silt contained varying amounts of gravel and clay. The SPT ‘N’ values recorded within the sandy silt material ranged from 5 blows per 300 mm of penetration to 37 blows per 300 mm of penetration indicating a loose to dense in-situ state of relative density. Samples of this material were visually described as moist. Measured moisture contents ranged between 9% to 22% by weight.

4.1.3 Non-Cohesive Till Deposit

A non-cohesive till deposit generally consisting of light brown to grey sandy silt / silty sand with varying amounts of clay and gravel and occasional cobbles was encountered initially at depths ranging from 0.8 mbgs to 4.6 mbgs. The non-cohesive till deposit extended to depths ranging between 3.1 mbgs to 6.7 mbgs. The non-cohesive till was encountered within all boreholes (except for MW06-25 and BH13-25) and within test pit TP01-25 to TP05-25. The SPT ‘N’ values recorded within the non-cohesive till ranged from 20 blows per 300 mm of penetration to 96 blows per 300 mm of penetration, with several spoons encountering refusal, indicating a compact to very dense relative density. Samples of the non-cohesive till material were visually described to be in a generally moist to wet condition. Measure moisture contents ranged between 3% to 25% by weight.

Grain size distribution testing was conducted on four (4) representative soil samples of the non-cohesive till deposit. Based upon grain size distribution analysis, the non-cohesive till consisted of 5 to 32% gravel, 6 to 38% sand, 24 to 69% silt, and 11 to 20% clay-sized particles by weight. The results are provided in **Appendix C** of this report and are summarized below in **Table 3**.

4.1.4 Cohesive Till Deposit

A cohesive till deposit generally consisting of light brown to grey clayey silt / silty clay with varying amounts of sand and gravel and occasional cobbles was encountered initially at depths ranging from 0.3 mbgs to 6.1 mbgs. The cohesive till deposit extended to depths ranging between 2.5 mbgs to 6.7 mbgs. The cohesive till was encountered within boreholes MW06-25, BH08-25, MW09-25, BH10-25, BH12-25 and BH13-25, as well as within all test pits TP06-25 and TP07-25. The SPT 'N' values recorded within the cohesive till ranged from 5 blows per 300 mm of penetration to 69 blows per 300 mm of penetration indicating a firm to hard consistency. Samples of the cohesive till material were visually described to be in a generally moist to wet condition. Measure moisture contents ranged between 8% to 33% by weight.

Grain size distribution testing was conducted on three (3) representative soil samples of the cohesive till deposit. Based upon grain size distribution analysis, the cohesive till consisted of 9 to 11% gravel, 13 to 32% sand, 33 to 34% silt, and 24 to 44% clay-sized particles by weight. The results are provided in **Appendix C** of this report and are summarized below in **Table 3**.

4.2 Physical Laboratory Testing Results

A total of seven (7) samples collected from the soils encountered at the Site were selected for testing of grain size distribution analyses and four (4) samples of the cohesive soils were also tested for Atterberg limits. The laboratory test results are summarized in the following tables and detailed test results are presented in **Appendix C**.

Table 3 Physical Laboratory Sieve and Hydrometer Testing Results

Borehole ID	Sample ID	Sample Depth (mbgs)	Grain Size (%)				Wn (%)	Soil Description (USCS Symbol)
			Gravel	Sand	Silt	Clay-size[1]		
BH01-25	SS4	2.3 – 2.9	9	35	37	19	7	Sandy Silt Till (ML)
BH05-25	SS7	6.1 – 6.7	5	6	69	20	17	Silt Till (ML[2])
BH06-25	SS6	4.6 – 5.2	9	13	34	44	17	Silty Clay Till (CL[2])
BH07-25	SS3	1.5 – 2.1	32	33	24	11	7	Gravelly Silty Sand Till (SM)
BH10-25	SS4	2.3 – 2.9	11	18	36	35	21	Silty Clay Till (CL[2])
BH13-25	SS6	4.6 – 5.2	11	32	33	24	14	Sandy Clayey Silt Till (CL-ML[2])
BH14-25	SS4	2.3 – 2.9	14	38	30	18	7	Silty Sand Till (SM)

[1] Soil particles <2 µm
Wn - natural water content
[2] USCS symbol based on Atterberg limits result below (**Table 4**)

The Atterberg limit test results from the cohesive deposit are summarized in **Table 4**.

Table 4 Atterberg Limits Results – Cohesive Deposits

Sample Identification	Depth (mbgs)	Atterberg Results (%)			Natural Moisture Content (%)	Soil Description (USCS Classification Symbol)
		Liquid Limit	Plastic Limit	Plasticity Index		
BH05-25 / SS7	6.1 – 6.7	19	16	3	17.1	Silt Till (ML)
BH06-25 / SS6	4.6 – 5.2	29	18	11	17.4	Silty Clay Till (CL)
BH10-25 / SS4	2.3 – 2.9	32	15	17	21.2	Silty Clay Till (CL)
BH13-25 / SS6	4.6 – 5.2	18	11	7	13.6	Sandy Clayey Silt Till (CL-ML)

4.3 Monitoring Wells and Groundwater Monitoring

4.3.1 Depth to Groundwater

During the drilling and the excavating process, the depth where water / wet and / or grey soils were encountered was noted. Upon completion of drilling, groundwater measurements were also collected from the open boreholes. Water / wet soils were encountered within eleven (11) of the twenty-one (21) test holes during the drilling / excavation process. A summary of the depths to water / wet and / or grey soils and the water levels measured upon completion of drilling is summarized in **Table 5**.

Table 5 Summary of Groundwater During Drilling / Excavating

Location	Depth to Water / Wet / Grey Soils Encountered (mbgs / m)	Water Level Upon Completion of Drilling (mbgs / m)
MW01-25	Wet / Grey at 4.6 mbgs (237.2 m)	4.0 mbgs / 237.8 m
BH02-25	Sand seam and wet at 2.4 mbgs (241.0 m)	2.4 mbgs / 241.0 m
MW03-25	Wet at 2.1 mbgs (242.6 m)	0.3 mbgs / 244.4 m
MW04-25	Wet at 4.6 mbgs (239.2 m)	2.9 mbgs / 240.9 m
BH05-25	Wet at 1.5 mbgs (237.3 m) / Grey at 2.3 mbgs (236.5 m)	4.3 mbgs / 234.5 m
MW06-25S	None encountered to 235.1 m	Dry to 235.1 m
MW06-25D	No water. Grey soils at 3.05 mbgs (235.1 m)	Dry to 231.5 m
BH07-25	None encountered to 237.5 m	4.0 mbgs /239.8 m
BH08-25	No water. Grey soils at 3.05 mbgs (241.9 m)	Dry to 238.3 m
MW09-25	No water. Grey soils at 4.6 mbgs (237.9 m)	Dry to 235.8 m
BH10-25	No water. Grey soils at 4.6 mbgs (240.1 m)	1.8 mbgs / 242.9 m
MW11-25	No water. Grey soils at 6.1 mbgs (244.2 m)	4.6 mbgs / 239.7 m
BH12-25	Sand seam and wet at 2.9 mbgs (241.4 m)	2.4 mbgs / 241.9 m
BH13-25	Wet / Grey at 2.3 mbgs (240.8 m)	0.6 mbgs / 242.5 m
BH14-25	None encountered to 245.6 m	Dry to 245.6 m
TP01-25	Water seepage at 1.7 mbgs (240.3 m)	Test pit backfilled. Water level not measured after excavation.
TP02-25	Water seepage at 0.9 mbgs (244.1 m)	
TP03-25	Water seepage at 1.1 mbgs (242.0 m)	
TP04-25	None encountered to 237.6 m	
TP05-25	None encountered to 239.7 m	
TP06-25	None encountered to 240.4 m	
TP07-25	Water seepage at 1.0 mbgs (245.5 m)	
Notes: “S” refers to “shallow” monitoring well; “D” refers to “deep” well.		

Based upon the table above, water and wet soils during drilling and excavation activities were observed from 0.9 to 4.6 mbgs and between elevations 237.2 m to 245.5 m at various locations. Grey soils were observed from 3.1 to 6.1 mbgs (235.1 m to 244.2 m) at various test holes. Grey soils are typically indicative of poorly draining soil where frequent saturation may be found. At six (6) locations (i.e. 27% of the test holes), no water / wet soils / grey soils were observed.

At some locations such as at BH07-25, BH10-25, and MW11-25, wet soils were not observed during the drilling process; however, a water level was measured within the open borehole after drilling was completed. This suggests that groundwater seepage may be occurring from small seams / lenses that were not readily observed during the drilling process. At these locations, groundwater appears to be migrating within the overburden although it is expected to be of low volume.

The following table provides the monitoring well installation details regarding the ground elevation, screened intervals and the soil that was screened. A monitoring well was installed within six (6) borehole locations including MW01-25, MW03-25, MW04-25, MW06-25, MW09-25, and MW11-25 to facilitate groundwater level measurements. A nested well was installed at borehole MW06-25 denoted as MW06-25S and MW06-25D for a total of seven (7) monitoring wells installed at the Site. The material screened was predominantly a glacial till. Four (4) existing monitoring wells, BH-14, MW-1, MW-2 and MW-3, were also observed on Site and were included for groundwater level measurements.

Table 6 Monitoring Well Information

Location	Ground Elevation (m)*	Well Pipe Stick Up (m)	Screened Interval		Sandpack Interval (effective screen)		Screened Material
			Depth (mbgs)	Elevation (m)	Depth (mbgs)	Elevation (m)	
BH-14	--	1.00	Well details are not known. Well depth 6.0 mbgs.				
MW-1	249.9	0.77	Well details are not known. Well depth 4.4 mbgs (245.5 m)				
MW-2	250.3	0.77	Well details are not known. Well depth 5.8 mbgs (244.5 m)				
MW-3	243.3	0.76	Well details are not known. Well depth 3.5 mbgs (239.8 m)				
MW01-25	241.8	0.81	3.1 – 1.5	238.7 – 240.3	3.1 – 1.2	238.7 – 240.6	Sandy Silt / Sandy Silt Till
MW03-25	244.7	0.80	3.1 – 1.5	241.6 – 243.2	3.1 – 1.2	241.6 – 243.2	Sandy Silt / Sandy Silt Till
MW04-25	243.8	0.81	3.1 – 1.5	240.7 – 242.3	3.1 – 1.2	240.7 – 242.6	Gravelly Silty Sand Till
MW06-25S	238.2	0.89	3.1 – 1.5	235.1 – 236.7	3.1 – 1.2	235.1 – 236.7	Silt, some sand
MW06-25D	238.2	0.88	6.1 – 4.6	232.1 – 233.6	6.1 – 3.1	232.1 – 235.1	Silty Clay Till
MW09-25	242.5	0.90	3.1 – 1.5	239.4 – 241.0	3.1 – 1.2	239.4 – 241.3	Clayey Silt / Silty Sand Till
MW11-25	250.3	1.05	3.1 – 1.5	247.2 – 248.8	3.1 – 1.2	247.2 – 249.1	Silty Sand Till

Notes:

m = metres; mbgs = metres below ground surface

(*) Ground elevations were measured using an EOS Arrow Gold Plus GPS system and, are for the purposes of evaluating groundwater elevation and flow direction and should not be relied upon as a legal survey or topographic elevation survey.

“S” refers to “shallow” monitoring well; “D” refers to “deep” well.

GHD collected groundwater levels on March 4, 2025 before the 2025 drilling program at the existing wells and all monitoring wells on March 25, 2025. The water level data from the monitoring event is summarized in **Table 7:**

Table 7 Groundwater Levels and Elevations

Monitoring Well ID	Ground Surface Elevation (m)*	Water Levels			
		March 4, 2025		March 25, 2025	
		mbgs	m	mbgs	m
BH-14	--	4.7	--	1.24	--
MW-1	249.9	2.92	247.0	0.15	249.7
MW-2	250.3	3.21	247.1	2.25	248.0
MW-3	243.3	Dry to 239.8 m		0.08	243.2

Monitoring Well ID	Ground Surface Elevation (m)*	Water Levels			
		March 4, 2025		March 25, 2025	
		mbgs	m	mbgs	m
MW01-25	241.8	Not drilled at this time		0.38	241.4
MW03-25	244.7			0.52	244.2
MW04-25	243.8			0.98	242.8
MW06-25S	238.2			0.42	237.7
MW06-25D	238.2			0.65	237.5
MW09-25	242.5			0.41	242.1
MW11-25	250.3			0.63	249.7

On March 4, 2025 prior to the snow melt, the water levels at BH-14, MW-1, MW-2 and MW-3 ranged from 2.9 to 4.7 mbgs and also included a dry well. On March 25, 2025 after the snow melt, the water levels at BH-14, MW-1, MW-2 and MW-3 ranged from 0.1 to 2.3 mbgs (groundwater elevations ranged from 243.2 to 249.7 m).

Groundwater levels from the monitoring wells installed by GHD as part of this investigation ranged from about 0.4 to 1.0 mbgs on March 25, 2025 after the snow melt (groundwater elevations ranged from 237.5 to 249.7 m) in these wells.

These seasonal groundwater elevations represent potentiometric groundwater levels. Test pits were also excavated at TP01-25, TP02-25, TP03-25, TP05-25 and TP06-25 in close proximity to MW01-25, MW03-25, MW04-25, MW09-25 and MW-3, respectively. At each location, the water level in the monitoring well was higher than the depth to where groundwater was encountered in the test pit. This indicates that the depth of the seasonal groundwater observed seeping into the test pit was deeper than the water levels in **Table 7** suggest.

It should be noted that ground surface elevations are for the purposes of evaluating groundwater elevation and flow direction and should not be relied upon as a legal survey, as a topographic elevation survey or for construction purposes. Also, that the groundwater levels are subject to seasonal fluctuations and precipitation events and should be expected to be higher during wet periods of the year, after significant storm events or after the snow melts. Perched groundwater conditions could develop in the shallower soils and fill materials after heavy precipitation and/or during spring thaw; however, would be expected to be temporary.

4.4 Single Well Response Testing

Single well response testing (SWRTs) was completed at each monitoring well. The monitoring wells are screened within the overburden. The data from the SWRTs are provided in **Appendix D** and are summarized in the following table:

Table 8 Single Well Response Test Results

Monitoring Well	Unit Tested	Test Type / Number	Analysis Method	Horizontal Hydraulic Conductivity – K_H (each test) (m/sec)	Geometric Mean Horizontal Hydraulic* Conductivity – K_H (m/sec)
MW01-25	Sandy Silt / Sandy Silt Till	Falling Head	Bouwer-Rice	1.2×10^{-8}	1.2×10^{-8}
MW03-25	Sandy Silt / Sandy Silt Till	Falling Head		9.2×10^{-7}	9.5×10^{-7}
		Rising Head		9.8×10^{-7}	
MW04-25		Falling Head 1		2.6×10^{-4}	3.2×10^{-4}

Monitoring Well	Unit Tested	Test Type / Number	Analysis Method	Horizontal Hydraulic Conductivity – K_H (each test) (m/sec)	Geometric Mean Horizontal Hydraulic* Conductivity – K_H (m/sec)
	Gravelly Silty Sand Till	Rising Head 1		3.5×10^{-4}	
		Falling Head 2		3.1×10^{-4}	
		Rising Head 2		3.7×10^{-4}	
		Falling Head 3		2.8×10^{-4}	
		Rising Head 3		3.6×10^{-4}	
		Falling Head 4		2.9×10^{-4}	
		Rising Head 4		3.7×10^{-4}	
MW06-25D	Silty Clay Till	Falling Head		1.6×10^{-9}	1.6×10^{-9}
MW06-25S	Silt, some sand	Falling Head 1		8.1×10^{-6}	7.6×10^{-6}
		Rising Head 1		6.9×10^{-6}	
		Falling Head 2		7.9×10^{-6}	
		Rising Head 2		7.3×10^{-6}	
MW09-25	Clayey Silt / Silty Sand Till	Falling Head		1.8×10^{-9}	1.8×10^{-9}
MW11-25	Silty Sand Till	Falling Head		1.6×10^{-10}	1.6×10^{-10}
GEOMETRIC MEAN (all tests)				**4.8×10^{-6}**	

The SWRT results range from 3.7×10^{-4} m/s at MW4-25 to 1.6×10^{-10} m/s at MW11-25. The geometric mean of all tests is 4.6×10^{-6} m/s and falls within the range of the expected hydraulic conductivity of a glacial till.

5. Discussion and Recommendations

5.1 Hydrogeology

5.1.1 Hydrostratigraphic Units

The primary hydrostratigraphic units (i.e. aquifer / aquitard units) underlying the Site include the following:

- **Topsoil** – unsaturated
- **Sandy Silt** – unsaturated to minor groundwater seepage (anticipated to be seasonal)
- **Till** – unsaturated with some water within sand seams expected within the till (aquitard)

Based on the subsurface investigation, the shallow sandy silt is generally expected to be unsaturated with seepage expected to be encountered periodically across the Site, particularly in the southern low-lying area of the Site. Seasonally or during significant storm events, surface water may infiltrate the topsoil and into the shallow sandy silt material and may also become perched upon the underlying till deposit. Particularly in the southern low-lying central area, which was observed to be very wet due to poor drainage in this area. The till deposit is generally expected to act as an aquitard underlying the Site with minimal vertical groundwater flow. The horizontal gradient in the southern

area appears to be toward the middle low-lying area and is relatively flat to the east from this area. Thus shallow, seasonal groundwater in the southern area does not drain well and collects in this area before draining / flowing to the east. Fill material to raise the grades or improved drainage should be considered in this area.

The underlying till is considered to be an aquitard; however, there were sand seams with water encountered throughout the till unit. The volume of groundwater from these seams is generally expected to be of relatively low volume; however, there could be zones / layers with higher permeabilities that could potentially yield higher groundwater flows.

Based upon the data collected, it is our opinion there does not appear to be a continuous, permanent groundwater table across the Site. The shallow groundwater above the till will be seasonally perched or present periodically due to significant storm events, particularly in the southern area of the Site. It is recommended that long-term groundwater monitoring be conducted to confirm the seasonal water levels / trends for future Low Impact Development strategies and for assessment of residential basements and other subsurface structures related to water levels.

5.1.2 Flow Direction and Gradients

Based upon the water levels measured by GHD, the groundwater elevations indicate that, in close proximity of the creek, there is localized groundwater flow towards this feature. Further away from the creek, the flow direction is generally expected to be in an easterly direction. In the southern area of the Site, shallow water is expected to collect in the low-lying area before flowing to the east / northeast. The groundwater elevations and flow direction are presented on **Figure 9.** Based upon the nested well, there is a small vertical gradient indicating that the groundwater is moving down through the soil profile. It should be noted that groundwater levels are transient and tend to fluctuate with the seasons, periods of precipitation and temperature.

Based upon the groundwater elevations at MW09-25 and MW11-25, the average horizontal groundwater gradient in the direction of flow is estimated to be on the order of 0.02 metres per metre (m/m).

The results of the SWRTs indicate that the horizontal hydraulic conductivity of the screened intervals of the monitoring wells tested range from 3.7×10^{-4} m/s at MW04-25 to 1.6×10^{-10} m/s at MW11-25 depending upon the subsurface material screened. The average geometric mean hydraulic conductivity (K_h) based upon the testing completed is 4.8×10^{-6} m/s. The average groundwater flux (per square metre) in the deposit can be estimated using the following relationship:

$q = Ki$

where:

q = groundwater flux (per square metre)
K = average hydraulic conductivity (4.8×10^{-6} m/s)
i = hydraulic gradient (0.02 m/m)

Therefore, the estimated average groundwater flux in the native till deposit where groundwater was encountered is estimated to be 1.8×10^{-9} m/s, per square metre (4.8×10^{-6} m/s x 0.02 m/m = 9.6×10^{-8} m/s). The flow rate per square metre is approximately 5.8×10^{-3} L/min (9.6×10^{-8} m/s x 60 sec/minute x 1,000 L/m^3 = 5.8×10^{-3} L/min). Based upon the SWRT completed, the flow rate per square meter ranges from 0.44 L/min at MW4-25 to 1.9×10^{-7} L/min at MW11-25.

Overall, the till exhibits a low flow rate and low hydraulic conductivity characteristics which are supported by the SWRT results. Note that slight variations in the soil stratigraphy may cause variations in the permeability / transmissivity of the soil in both vertical and horizontal orientations, that could result in K-values outside the stated range if pockets or seams of soils with different grain size and permeabilities (e.g. coarse sand / gravel seams / layers) are encountered.

5.1.3 Preliminary Infiltration Rates

The plotted gradation curves for the soil samples tested were compared to the gradation curves and descriptions in the Supplementary Guidelines to the Ontario Building Code[7] to determine the infiltration rates for the soils. The estimated coefficient of permeability and corresponding estimated infiltration rate ranges for the soils encountered in the Site are provided in the table below:

Table 9 Preliminary Infiltration Rate Ranges based on Site Soils

Soil Description (USCS Symbol)*	Coefficient of Permeability, K (cm/sec)	Percolation Time, T (mins/cm) **	Range of Estimated Infiltration Rates 1/T (mm/hr)
Non-Cohesive Sand Till (SM)	10^{-3} to 10^{-5}	8 to 20	30 to 75
Non-Cohesive Silt Till (ML)	10^{-5} to 10^{-6}	20 to 50	12 to 30
Cohesive Clay Till (CL)	Less than 10^{-6}	Over 50	Less than 12
*Soils encountered at the Site **Provided in the Supplementary Guidelines (Ontario Ministry of Municipal Affairs and Housing, August 15, 2006)			

The infiltration rates provided above are suitable for preliminary design; however, in-situ infiltration testing is recommended once design details for the Low Impact Development (LID) infiltration facilities are available.

It is noted that slight variations in the soil stratigraphy may cause variations in the permeability of the soil in both vertical and horizontal orientations.

A safety correction factor from Appendix C of the Low Impact Storm Water Management Planning and Design Guide must be applied to the measured in-situ infiltration rates.

LIDs can be applied to any soil type; however, it is recommended that more permeable zones are targeted and that sub-grade infiltration locations be kept away from private lands. LIDs require maintenance and long-term care. If possible, naturally occurring infiltration strategies such as roof water discharged via downspouts to sodded lawns with adequate topsoil depths and maximized flow path distances are recommended.

5.1.4 Construction Dewatering

Excavations are expected to extend into the underlying glacial till deposit for this development. Based upon our subsurface investigation, groundwater seepage will be encountered at depth. Dewatering to remove groundwater seepage as well as surface water runoff and precipitation to ensure safe and dry working conditions may be required depending on the depth of the excavation and the time of the year. Pumping from collection sumps to an acceptable outlet will control this expected groundwater infiltration.

It is recommended that prior to commencing the construction of the site servicing, consideration be given to the excavation of a series of trial excavations along the alignment of the proposed sewers / watermains to determine more accurately the soil behaviour and if any dewatering works are required.

Should any excavations require more intensive dewatering or groundwater control, the use of filtered sumps, or other suitable method of dewatering is recommended. If short-term pumping of groundwater at volumes greater than 50,000 L/day and less than 400,000 L/day is required during the construction stage, the Environmental Activity and Sector Registry (EASR) must be completed. If the projected construction dewatering volumes exceed 400,000 L/day, then a Category 3 Permit to Take Water (PTTW) will be required from the MECP.

It is not the purpose of this report to assess the planned water taking related to any required dewatering work. Once the detailed design drawings have been prepared, a water taking assessment can be completed to determine

[7] Ontario Ministry of Municipal Affairs and Housing – Building and Development Branch. Supplementary Standard SB-6. Percolation Time and Soil Descriptions. August 15, 2006.

requirements of dewatering and recommendations for an EASR or PTTW application, should they be needed. At the construction stage of the development, any monitoring wells at the Site are to be decommissioned in accordance with O. Reg. 903 by a licensed and experienced contractor.

5.1.5 Water Balance

The following subsections describe the water balance and establish a post-development infiltration target for the proposed development based upon the referenced Draft Plan of Subdivision. For purposes of the water balance, the Site has been divided into "North Subcatchment" and "South Subcatchment" for completion of the water balance calculations. The subcatchment areas are based upon the environmental protection area and creek which runs through the Site.

The Thornthwaite Method calculations are provided in **Appendix E.1** and are summarized in **Table 10**.

Table 10 Summary of Thornthwaite Method Calculations

Station	Precipitation (mm/yr)	Adjusted ET (mm/yr)	Surplus (mm/yr)
Peterborough (1991 – 2020)	839.8	562.6	277.2

The calculations indicate that 277.2 mm/year of water is available as either runoff or infiltration.

5.1.5.1 Pre-Development Water Balance

The pre-development water balance incorporated the existing soils, slope and agricultural areas. The infiltration factor for the area was calculated from the table of values presented in the "Land Development Guidelines"[8]. It is based on three sub-factors which are:

- Topography sub-factor;
- Soil sub-factor; and
- Cover sub-factor.

The slope of the Site was considered to be an intermediate value (0.15) between "rolling" (slope of 2.8 to 3.8 m per km) to "hilly" (average slope of 28 to 47 m per km). The soil factor was assigned a value of 0.25 based upon the soils encountered at the Site. The land cover factor considered agricultural, naturalized, gravel driveway and rooftop areas. The existing vegetation factor for the pre-development site ranged from agriculture (0.1) to naturalized areas (0.175). The existing residential structures were also considered in the pre-development calculations (see **Appendix E.2** for a breakdown of the areas). The Site subcatchment areas included "North Subcatchment" comprising about 8.8 ha north of the creek and "South Subcatchment" comprising nearly 25 ha south of the creek. **Table 11** summarizes the expected pre-development water balance values for the Site. Based upon the values presented below, 99.7% of the Site is pervious and 0.3% is impervious.

Table 11 Pre-Development Land Use Summary

Land Use	Area (m^2)
North Subcatchment	
Agricultural	78,023
Treed / Naturalized	9,600
Sub-Total – North Subcatchment	**87,623**
South Subcatchment	
Agricultural	238,003

[8] MOEE Hydrogeological Technical Information Requirements for Land Development Applications. April 1995.

Land Use	Area (m^2)
Treed / Naturalized	9,600
Existing Residential -Rooftops -Driveway	 -575 -400
Sub-Total – South Subcatchment	**248,578**
TOTAL AREA	**336,200**

Table 12 summarizes the pre-development water balance calculations:

Table 12 Pre-Development Water Balance Results

ID	Area (m^2)	Area for Recharge (m^2)	Precipitation (m^3/yr)	ET (m^3/yr)	Runoff (m^3/yr)	Infiltration (m^3/yr)
NSC	87,623	87,623	73,585	49,297	11,878	12,410
% of Precipitation in this Subcatchment				67.0%	16.1%	16.9%
SSC	248,578	247,603	208,755	139,466	34,508	34,782
% Precipitation in this Subcatchment				66.8%	16.5%	16.7%
Site	336,200	335,225	282,341	188,763	46,386	47,192
% of Total Precipitation				66.9%	16.4%	16.7%

Note: NSC refers to North Subcatchment. SSC refers to South Subcatchment.

It was assumed that the stormwater runoff from existing rooftops will have an infiltration factor of 37.5% (i.e. 37.5% of the rooftop runoff will be infiltrated). Based upon these values, the Site infiltrates on the order of 47,192 m^3/year (~140 mm/year) or about 16.7% of the precipitation that falls on the Site each year. Further, the pre-development catchments north and south infiltrate an estimated 12,410 m^3 per year and 34,782 m^3 per year, respectively. In our opinion, the infiltration volume of these pre-development catchments is to be maintained to support downgradient receptors such as the creek that bisects the Site.

5.1.5.2 Post-Development Water Balance (No Infiltration Enhancements)

The computation of the water budget was repeated for the proposed development assuming no infiltration enhancements, that is, runoff from impervious surfaces is unrecoverable and not infiltrated into the ground. The anticipated impact of the development is related to increased runoff from imperious surfaces such as building rooftops and asphalt surfaces. These are assumed to be impervious surfaces with zero infiltration capacity in this model.

The post-development water balance was based upon the Draft Plan of Subdivision provided to GHD and indicated single detached residential lots, street townhouses, medium density residential buildings, commercial lots, a stormwater management pond, asphalt roads, a park area, and an environmental protection area. The purpose of these post-development calculations with no infiltration enhancements is to illustrate that based upon these calculations that the post-development conditions will require LIDs to mitigation the expected additional stormwater runoff and anticipated reduction of pre-development infiltration.

Several assumptions were made to develop the post-development water balance. These assumptions include:

– Asphalt has 0% infiltration capacity
– Evaporation from impervious surfaces assumed to be 20% of precipitation
– Residential single lots
    - Assumed rooftops cover 55% of the lot
    - Assumed driveways cover 10% of the lot

- Assumed lawns cover 35% of the lot

– Townhouse lots
  - Assumed rooftops cover 65% of the lot
  - Assumed driveways cover 10% of the lot
  - Assumed lawns cover 25% of the lot
– Commercial
  - Assumed rooftops cover 20% of the lot
  - Assumed asphalt covers 65% of the lot
  - Assumed landscaping covers 15% of the lot

The areas of the north and south catchments were maintained within the post-development calculations. The detailed calculations are provided in **Appendix E.3**. A summary of the computations is provided in **Table 13**.

Table 13 Post-Development Summary (No Enhancements)

Description / Parameter	Value
Site Area	336,200 m^2
Pervious Areas -Lawn / Grass -Park -Environmental Protection area (EP)	127,695 m^2 (38.0% of the Site area) -88,895 m^2 -19,300 m^2 -19,500 m^2
Impervious Areas -Rooftops -Asphalt roadways and driveways -Stormwater pond	208,505 m^2 (62.0% of the Site area) -102,035 m^2 -106,470 m^2 -8,150 m^2
Total Water Surplus -Percent of Precipitation – 62.2%	175,479 m^3/yr
Evapotranspiration -Percent of Precipitation – 37.8%	106,862 m^3/yr
Total Estimated Infiltration -Percent of Precipitation – 7.0% Infiltration % Difference (pre- vs post-)	19,899 m^3/yr (-58%) (decrease)
North Catchment Estimated Infiltration Infiltration % Difference (pre- vs post-)	7,741 m^3/yr (-38%) (decrease)
South Catchment Estimated Infiltration Infiltration % Difference (pre- vs post-)	12,159 m^3/yr (-65%) (decrease)
Total Estimated Runoff -Percent of Precipitation – 55.1% Runoff % Difference (pre- vs post-)	155,579 m^3/yr (235%) (increase)

Under this scenario, impervious surfaces increased by 62%; the total infiltration volume decreased by about 58% and runoff volume increased by 235%. Based upon this scenario, mitigative strategies are required to minimize infiltration losses and reduce storm water runoff.

5.1.5.3 Post-Development Water Balance (With Downspout Disconnection)

Based on the calculations presented above, infiltration and recharge to the shallow groundwater regime will be reduced by about 27,293 m^3/year from the pre-development site compared to post-development site and based upon the Draft Plan of Subdivision provided. The reduction does not consider the incorporation of LID strategies. The post-construction water budget computations were repeated considering enhanced infiltration options which are also known as LID technologies. The water balance provides generic infiltration and runoff values that was completed solely for demonstration purposes to illustrate that pre-development conditions can be maintained. Specific LID design criteria and selection of actual LID technologies will be the responsibility of the stormwater engineer for the development. These technologies include and are not restricted to rainwater harvesting, downspout disconnection, infiltration trenches, vegetated filter strips, bioretention, permeable pavement, enhanced grass swales, dry swales and perforated pipe systems in order to balance the water budget.

The post-development water balance was modelled to show that stormwater from building roof tops can be directed via downspouts (disconnected from storm sewers) to sodded areas or undeveloped areas (e.g. open spaces) for infiltration. Downspout disconnection, for example, can reduce runoff by 25% to 50% based on LID documentation developed by the Credit Valley Conservation and Toronto and Region Conservation Authority. For this Site, based upon the shallow underlying soils, the reduction of 37.5% of the stormwater via downspout disconnection was assumed.

A summary of the post-construction water budget with downspout disconnection mitigation from each rooftop was modelled. The data summary is presented in **Table 14**.

Table 14 Post-Development Summary with Enhanced Infiltration – Downspout Disconnection

Description / Parameter	Value
Site Area	336,200 m^2
Rooftop Infiltration Target	27,293 m^3/yr
Rooftop Stormwater Surplus Available -Single Detached Lot rooftops -Medium Density rooftops -Townhouse rooftops -Commercial rooftops	63,076 m^3/yr 26,272 m^3/yr 7,555 m^3/yr 17,075 m^3/yr 12,174 m^3/yr
Infiltration via Pervious Surfaces (grass, EP area etc.)	19,899 m^3/yr
Downspout Disconnection Infiltration	23,653 m^3/yr
Total Estimated Infiltration using Downspout Disconnection (based upon 37.5% rooftop runoff reduction)	43,553 m^3/yr (3,640 m^3/yr LESS than pre-development)
North Catchment Estimated Infiltration using LIDs Infiltration % Difference (pre- vs post-)	13,763 m^3/yr (10.9%) (increase)
South Catchment Estimated Infiltration using LIDs Infiltration % Difference (pre- vs post-)	29,788 m^3/yr (-14.4%) (decrease)

Assuming that rooftop runoff can be reduced by 37.5% using downspout disconnection, the water balance calculations (using downspout disconnection only) show that there can be an infiltration surplus in the north area and an infiltration deficit in the southern area. Overall, infiltration reduction will be on the order of about 7.7% when compared with pre-development values.

Based upon the water balance calculations with downspout disconnection only, additional infiltration measures would be required to maintain post-development infiltration values at pre-development levels from a quantity perspective.

5.1.5.4 Post-Development Water Balance (With Enhanced Infiltration – Downspout Disconnection and Soakaway Pits)

The post-construction water budget computations were repeated considering additional infiltration measures. Downspout disconnection can reduce runoff by 25% to 50% and soakaway pits can reduce runoff by 85%, as outlined within LID documentation developed by the Credit Valley Conservation and Toronto and Region Conservation Authority.

In our model, GHD assumed the following LIDs for this enhanced example:

– Rooftop runoff for single detached lots within the north and south catchments was directed to sodded areas / lawn via downspout disconnection assuming an infiltration factor of 37.5%
– Rooftop runoff for medium density residential lots and townhouses within the north and south catchments was directed to soakaway pits assuming an infiltration factor of 85%
– Rooftop runoff for the commercial areas within the south catchment was directed to soakaway pits assuming an infiltration factor of 85%

Stormwater runoff from road surfaces and driveways is assumed to be lost and not infiltrated. As noted previously, this is a generic water balance to illustrate that there is sufficient surplus water to be infiltrated to match pre-development values. The actual LIDs selected will be at the discretion of the stormwater design team.

A summary of the post-construction water budget with mitigation measures for infiltration is presented in the following table:

Table 15 Post-Development Summary with Enhanced Infiltration – Downspout Disconnection and Soakaway Pits

Description / Parameter	Value
Site Area	336,200 m^2
Rooftop Stormwater Surplus Available -Single Detached Lot rooftops -Medium Density rooftops -Townhouse rooftops -Commercial rooftops	63,076 m^3/yr 26,272 m^3/yr 7,555 m^3/yr 17,075 m^3/yr 12,174 m^3/yr
Infiltration via Pervious Surfaces (grass, EP etc.)	19,899 m^3/yr
Downspout Disconnection Infiltration	9,852 m^3/yr
Soakaway Pit Infiltration	31,283 m^3/yr
Total Estimated Infiltration using LIDs -Percent of Precipitation – 21.6% Infiltration % Difference (pre- vs post-)	61,034 m^3/yr (29.3%) (increase)
North Catchment Estimated Infiltration using LIDs Infiltration % Difference (pre- vs post-)	15,901 m^3/yr (28.1%) (increase)
South Catchment Estimated Infiltration using LIDs Infiltration % Difference (pre- vs post-)	45,133 m^3/yr (29.8%) (increase)
Total Estimated Runoff -Percent of Precipitation – 40.5% Runoff % Difference (pre- vs post-)	114,444 m^3/yr (147%) (increase)

Based upon the data modelled, the overall infiltration values are shown to **exceed** the pre-development values for the north and south catchments. The calculations illustrate that there is sufficient stormwater available that, if it can be infiltrated, will meet the pre-development values. At the detailed design stage, the use of downspouts and infiltration chambers can be finalized to ensure the water balance is maintained.

The following bullets are provided as potential options that could be further evaluated for feasibility at the Site and are for consideration only to improve infiltration (this were not considered in this water balance):

- Reduction of grading to 0.5 – 1.0% slopes and swales to allow for additional evapotranspiration and infiltration.
- Scarification, or tilling of the soil to a depth of approximately 300 mm, would enhance evapotranspiration and infiltration within landscaped areas to overcome soil compaction that occurs during construction. Also, adding topsoil to a minimum depth of 300 mm to promote increased infiltration.

For further reducing stormwater runoff, landscaped areas could include the plantings of trees (for example), resulting in greater evapotranspiration and further decreasing runoff.

5.2 Geotechnical

The Site encompasses an area of 33.62 ha (83.1 acres) and supports agricultural fields and is proposed to be re-developed into mixed commercial and residential use with an internal road network, a stormwater management pond (SMWP), and a parkland area. The proposed development will be municipally serviced for water and sewer. The Draft Plan of Subdivision[9] showing the proposed development is presented on **Figure 2** and includes low and medium density residential blocks, commercial blocks, the SMWP block, and the parkland area block.

It should be noted that the recommendations provided herein are intended for use by designers only. Contractors bidding on or undertaking any work at the site should examine the factual results of the assessment, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data given above as it affects their proposed construction techniques, equipment capabilities, costs, sequencing, and other related issues. Where comments are made on construction, they are provided to highlight those aspects that could affect the design of the project. Comments, techniques, or recommendations pertaining to construction should not be considered as instructions to the contractor. On-going liaison with GHD during the final design and construction phase of the project is recommended to ensure that the recommendations in this report are applicable and / or correctly interpreted and implemented.

Based upon the above comments and the test hole information, and assuming them to be representative of the subsoil conditions across the Site, the following comments and recommendations are offered.

5.2.1 Site Preparation, Grading and Backfill

Based on the subsurface conditions encountered in the test holes, the Site is generally consisted surficial topsoil over native sandy silt underlain by cohesive and non-cohesive glacial till deposits. The non-cohesive glacial till was generally comprised of silty sand / sandy silt with varying amounts of clay and gravel. The cohesive glacial till was generally comprised of a clayey silt / silty clay with varying amounts of sand and gravel.

Any topsoil, vegetation, disturbed earth, fill, organic and organic-bearing material should be removed from the footprint of the proposed building areas and from within pavement areas prior to site grading activities. If native materials are encountered and contains topsoil / organics or rootlets, the material should not be used as backfill.

Prior to removing any excess soils from the Site, it is recommended that such materials be subjected to chemical testing to characterize the excess soils for handling and disposal purposes.

Prior to Site grading activity, the subgrade soils exposed after the removal of the surficial topsoil and loose native material within the proposed building footprints and pavement areas should be visually inspected, compacted if required, and proof rolled using large axially loaded equipment. Any loose, soft, organic, or unacceptable areas should be subexcavated and removed as directed by the Geotechnical Engineer and replaced with suitable fill materials compacted to a minimum of 98 percent Standard Proctor Maximum Dry Density (SPMDD). Clean earth fill used to raise grades should be placed in thin layers (200 mm thick or less) and compacted by a heavy appropriate

[9] [9] Biglieri Group “Draft Plan of Subdivision”. Drawing No. DP-01, dated 25.06.18.

roller to 98 percent SPMDD. Installation of engineered fill must be continuously monitored on a full-time basis by qualified geotechnical personnel.

The native soils encountered at the Site are generally suitable for reuse as backfill to raise site grades where required, to be used as trench backfill during installation of buried services, or as pavement subgrade, provided they are free of organic material, compactable with the subgrade soils and are within the optimum moisture content. Control of moisture content during placement and compaction will be essential for maintaining adequate compaction. Based on moisture content measurements of the recovered soi samples, the native soils are generally found to be moist to wet. They may be left aside to dry, or mixed with drier material that is to be used as backfill within settlement sensitive areas. It should be noted that during compaction of the cohesive soil additional effort will be required to adjust the moisture content. A final review and approval to reuse any soils should be made at the time of construction. If site soils cannot be reused as backfill, then an OPSS Granular B Type 1 material is recommended for general backfilling.

Backfill for basement foundation walls, should be accomplished using well graded Granular “B” Type I material complying with Ontario Provincial Standard Specifications (OPSS) 1010.

Installation of engineered fill, where required, must be continuously monitored on a full-time basis by qualified geotechnical personnel.

5.2.2 Depth of Frost Penetration

It is recommended that the building perimeter foundations and those foundations within unheated areas should be protected from frost effects by at least 1.2 m of earth cover or equivalent insulation. All exterior footings, footings beneath unheated areas, and foundations exposed to freezing temperatures should have at least such earth cover or equivalent synthetic insulation for frost protection. During winter construction exposed surfaces to support foundations must be protected against freezing by means of loose straw and tarpaulins, heating, etc.

5.2.3 Seismic Site Classification

The latest Ontario Building Code (OBC) requires the assignment of a Seismic Site Class for calculations of earthquake design forces and the structural design based on a two percent probability of exceedance in 50 years. According to the latest OBC, the Seismic Site Class is a function of soil profile and is based on the average properties of the subsoil strata to a depth of 30 m below the ground surface. The OBC provides the following three methods to obtain the average properties for the top 30 m of the subsoil strata:

– Average shear wave velocity.
– Average Standard Penetration Test (SPT) values (uncorrected for overburden).
– Average undrained shear strength.

For design purposes, based on the criteria listed in Table 4.1.8.4.A. of the OBC and the results obtained from standard penetration resistance of the underlying subsurface conditions and our knowledge of the regional geology, a Seismic **Site Class ‘D’** can be used for the design of the proposed residential and commercial buildings.

The values of seismic hazard parameters shown in **Table 16** were derived from the 2020 National Building Code of Canada Seismic Hazard Tool, sourced from the Earthquakes Canada website.

Table 16 Peak Ground Acceleration (PGA), Peak Ground Speed (PGV), and Design Spectral Acceleration (S) Values

Seismic Hazard Values	10% Exceedance in 50 years (475-year return period) Site Class D	5% Exceedance in 50 years (975-year return period) Site Class D	2% Exceedance in 50 years (2,475-year return period) Site Class D
PGA (g)	0.0729	0.113	0.181
PGV (m/s)	0.0713	0.117	0.2
S (0.2) (g)	0.129	0.199	0.315
S (0.5) (g)	0.127	0.195	0.311
S (1.0) (g)	0.0719	0.114	0.188
S (2.0) (g)	0.0322	0.0528	0.0903
S (5.0) (g)	0.00748	0.0132	0.0241
S (10.0) (g)	0.00237	0.00414	0.00757

5.2.4 Foundation Design

The common practice for the Serviceability Limit States (SLS) design of most structures and building foundations is to limit the total and differential foundation settlements to 25 mm and 19 mm, respectively. However, other serviceability criteria for the proposed buildings may be determined by the structural engineer considering tolerable settlement that would not restrict the use of operation of the facility.

It is understood that the proposed development includes three (3) to four (4) storey residential buildings, 157 residential lots, and a commercial development comprising of multiple single-storey buildings.

Based on the available geotechnical data, it is expected that structural loading for the proposed residential and commercial structures may be supported on spread and continuous strip footings founded on the approved compact / very stiff native soils, dense / hard native soils or on engineered fill constructed on the approved native soils. The Minimum depths and maximum elevation at which the compact / stiff and dense / hard native soils were encountered at each borehole is summarized in **Table 17** below.

Table 17 Minimum Depth (mbgs) / Elevation to Compact / Very Stiff and Very Dense / Hard Native Soils

Borehole ID	Minimum Depth (mbgs) / Maximum Elevation to Compact / Very Stiff Native Soils	Minimum Depth (mbgs) / Maximum Elevation to Dense / Hard Native Soils
MW01-25	0.8 / 241.0	1.8 / 239.9
BH02-25	0.8 / 242.4	2.1 / 241.3
MW03-25	2.1 / 242.6	4.6 / 240.1
MW04-25	0.8 / 243.0	1.5 / 242.3
BH05-25	0.8 / 237.9	1.5 / 237.3
MW06-25	2.3 / 235.9	Not Encountered
BH07-25	0.8 / 243.0	2.3 / 241.5
BH08-25	0.8 / 244.2	3.0 / 241.9
MW09-25	0.8 / 241.7	2.3 / 240.2
BH10-25	1.5 / 243.2	4.6 / 240.2
MW11-25	0.8 / 249.5	1.5 / 248.8
BH12-25	0.8 / 243.5	2.3 / 242.0

Borehole ID	Minimum Depth (mbgs) / Maximum Elevation to Compact / Very Stiff Native Soils	Minimum Depth (mbgs) / Maximum Elevation to Dense / Hard Native Soils
BH13-25	1.5 / 241.6	Not Encountered
BH14-25	1.5 / 250.8	2.3 / 250.0

For design purposes, it is recommended that footings constructed on approved compact / very stiff native soils, dense / hard native soils (as per minimum depths / maximum elevation provided in the table above) or engineered fill be proportioned using the following bearing capacities:

Table 18 Preliminary Bearing Pressure for Foundation Design

Parameter	Bearing Pressure	
	Compact / Very Stiff Undisturbed Native Soils or Engineered Fill(2)	Dense / Hard Undisturbed Native Soils
Factored Bearing Capacity at ULS (1)	225 kPa	300 kPa
Bearing Capacity at SLS	150 kPa	200 kPa

Notes:
(1) Resistance factor Φ =0.5 applied to the ULS bearing pressure for design purposes.
(2) At least 0.3 m of Granular or Earth Borrow fill. Quality of material is to be approved prior to use as engineered fill.

These capacities assume a minimum footing width of 0.5 m, maximum footing width of 3.0 m and vertical and concentric loadings only. The perimeter foundations and those foundations within unheated areas should be protected from frost effects by at least 1.2 m of earth cover or equivalent insulation.

Under no circumstances should the foundations be placed above organic materials, loose, frozen subgrade, construction debris, or within ponded water. Prior to forming, all foundation excavations must be inspected and approved by a member of GHD's geotechnical group. This will ensure that the foundation bearing material has been prepared properly at the foundation subgrade level and that the soils exposed are similar to those encountered during this investigation.

Should basement or otherwise subgrade areas be incorporated into any of the buildings' designs, it is recommended that for drainage purposes, perimeter drains be installed about the structure in accordance with the Ontario Building Code (OBC). The subdrains would serve to drain seepage water that infiltrates the backfill, intersect any groundwater that may be present, and help relieve hydrostatic pressures due to any seasonally high groundwater levels. The drains should consist of a perforated pipe, at least 100 mm in diameter, surrounded by clear, crushed stone and suitable filter protection. The drain should discharge to a positive sump or other permanent frost-free outlet. It is also strongly recommended that the building's foundation walls be sealed and waterproofed.

Backfill to basement foundation walls, should be accomplished using well graded Granular "B" Type I material complying with Ontario Provincial Standard Specifications (OPSS) 1010.

5.2.4.1 Engineering Fill Construction for Footings

Any engineered fill upon which footings are placed must be a minimum thickness corresponding to the notes that accompany the above table. Footings (and foundation walls) placed on engineered fill must be suitably reinforced; as a minimum, and where not already specified in the design drawings, this reinforcing should use 2 continuous runs of 15M rebar throughout the footings, and 2 runs of 15M rebar throughout near the top and bottom of the foundation walls.

The following is recommended for the construction of any engineered fill for the footings:

1. Remove any and all existing vegetation, topsoil, fill, organics, and organic-bearing soils to the competent, undisturbed native soil from within the area of the proposed engineered fill.
2. The area of the engineered fill should extend horizontally 1m beyond the outside edge of the building foundations and then extend downward at a 1:1 slope to the competent native soil.
3. The base of the engineered fill area must be approved by a member of GHD prior to placement of any fill, to ensure that all unsuitable materials have been removed, that the materials encountered are similar to those observed, and that the subgrade is suitable for the engineered fill.
4. All engineered fill material is to be approved by GHD at the time of construction.
5. Place approved engineered fill, in maximum 200 mm lifts, compacted to 100 percent of its SPMDD. Any fill material placed under wet conditions should consist of an approved, rock-based fill, with the inclusion of appropriate geotextile fabric around the rock-based fill should the rock fill contain enough voids to warrant. Rock-based fill material should be compacted by a plate tamper and visually inspected by a geotechnical engineer to confirm appropriate compaction.
6. Full time testing and inspection of the engineered fill will be required, to ensure compliance with material and compaction specifications.

The engineered fill should not be placed during winter months when freezing ambient temperatures occur persistently or intermittently.

5.2.5 Slab-On-Grade Construction

Floors may generally be constructed as normal slabs-on-grade, on granular or 19 mm clear stone over native, inorganic subsoils. The floor slab should be formed over a base course consisting of at least 150 mm of Granular “A” backfill as per OPSS compacted to a minimum of 100 percent of its SPMDD or 150 mm of 19 mm angular clear stone material underneath basement areas, compacted by a plate tamper as per OBC requirements. All grade increases or infilling below the granular “A” or clearstone should be constructed in accordance with the engineered fill steps provided in **Section 5.2.4.1** of this report.

If the groundwater table is intersected by any basement excavations, the floor slabs should incorporate under slab drains, and a vapour barrier should be installed beneath the slab to prevent migration of moisture vapour. The drain should discharge to a positive sump or other permanent frost-free outlet.

All fill placed as engineered fill must be inspected, approved and compaction verified by personnel from GHD.

5.2.6 Basement and Retaining Walls

It is recommended that free draining backfill consisting of Granular “B” Type I material complying with Ontario Provincial Standard Specifications (OPSS) 1010, to basement and retaining walls be provided. Walls may be designed for lateral earth pressures using the following equation:

$$P = K [\gamma (h-h_w) + \gamma' h_w + q] + \gamma_w.h_w$$

where:

P = the horizontal pressure at depth, h (m)
K = the earth pressure coefficient,
γ = the bulk unit weight of soil, (kN/m^3)
γ' = the submerged unit weight of soil, (kN/m^3)
γ_w = the unit weight of water, (kN/m^3)
h_w = the depth below the groundwater level (m)
q = the surcharge loading (kPa)

Where elevated groundwater level is not anticipated to be present or that a perimeter drainage system is used to eliminate hydrostatic pressures on the soil retaining structure, the above noted expression will be simplified as follows:

$P = K (\gamma h + q)$

If required and depending on the type of shoring used during construction, the temporary shoring system for excavation support can be designed for the lateral earth pressures provided in the Canadian Foundation Engineering Manual (CFEM 2023). Surcharge loads and hydrostatic pressures should be considered as appropriate.

The following table summarizes the recommended soil parameters to be used for lateral earth pressure calculations.

Table 19 Summary of Soil Parameters for Lateral Earth Pressure Calculations

Soil Type	Bulk Unit Weight	Effective Friction Angle	Coefficient of Lateral Earth Pressure		
	γ (kN/m^3)	ϕ' (°)	K_a	K_o	K_p
Imported Granular Fill (Granular A or B Type II)	21	34	0.28	0.44	3.54
Compact Native Sandy Silt and Non-Cohesive Till	20	30	0.33	0.50	3.00
Dense to Very Dense Non-Cohesive Till	21	32	0.31	0.47	3.25
Fim to Stiff Cohesive Till	18	26	0.42	0.59	2.37
Very Stiff to Hard Cohesive Till	20	30	0.33	0.50	3.00

Surcharge and hydrostatic pressures should be considered as appropriate. The above-noted earth pressure coefficients apply only to horizontal surfaces behind the walls/supports as well as vertical back face of the wall and smooth wall-backfill interface.

It is noted that large deformation will be required prior to the full mobilization of passive earth pressure and mobilization of full active or passive resistance requires a measurable and significant wall movement or rotation. Therefore, unless the structural element can tolerate these deflections, the at-rest earth pressure should be used in design. Where movement sensitive services exist close to the shoring, the lateral pressure should also be computed using the coefficient of earth pressure at rest, K_0.

Free draining material should be placed behind the foundation wall and a minimum compaction surcharge of 12 kPa should be included in the lateral earth pressures for the structural design of the walls. Care must be taken during the compaction operation not to overstress the wall. Heavy construction equipment should be maintained at a distance of at least 1 m away from the walls while the backfill soils are being placed. Hand operated compaction equipment should be used to compact the backfill soils immediately behind the walls as per OPSS.MUNI 501 (Compacting).

The recommended value for the coefficient for sliding friction between the soil and the concrete is 0.4.

5.2.7 Site Servicing

Underground municipal watermains and sewers can be founded on either undisturbed native soils or a prepared fill subgrade. The suitability of the native soils to provide adequate support for buried services must be verified on site by qualified geotechnical personnel experienced in such works. Buried services will be ultimately supported on conventional well-graded granular bedding. Where disturbance of the trench base has occurred, due to the presence of soft cohesive soils or groundwater seepage, the disturbed soils should be sub-excavated and replaced with suitably compacted granular fill.

Based on the installed monitoring wells and our monitoring data, levels ranged from about 0.1 to 2.3 mbgs with corresponding elevations ranged from about 249.72 m at MW-1 to 237.50 at MW6-25D.

Groundwater seepage should be expected during excavation for installation of proposed site servicing. Provided the groundwater control measures are undertaken in conjunction with the excavation works, the base of all excavations are expected to be relatively stable, although some disturbed conditions could develop within the base of the

excavations if the dewatering is not totally effective at lowering perched groundwater or saturated cohesive materials are encountered.

It is recommended that prior to commencing the construction of the site servicing, consideration be given to the excavation of a series of trial excavations along the alignment of the proposed sewers / watermains to determine more accurately the soil behaviour and if any dewatering works are required.

The bedding for the trenched services should consist of material meeting the Township's specifications. The bedding and sand cover materials should be adequately compacted to provide support and protection to the service pipes. Provided the base area of the sewer pipes and watermains are free of all loose and deleterious materials, the pipe bedding should comply with a Class B bedding configuration as per the requirements of OPSD 802.030 (rigid pipe) and / or OPSD 802.010 (flexible pipe).

Backfilling of trenches can be accomplished by reusing the excavated soils or similar fill material provided the moisture content is maintained within 2 percent of optimum and the fill is free of topsoil, organics and any deleterious material. The fill placed in excavated trenches should be in loose lifts not exceeding 200 mm thick and compacted to not less than 95 percent of its SPMDD.

Alternatively, if the excavated soils are not suitable for backfilling, the bedding and pipe zone backfill material may consist of OPSS Granular "A" material compacted to at least 95% of its SPMDD. However, if some limited depths of standing water are present, High Performance Bedding (HPB) and/or HL6 clear stone wrapped in geo-textile may be adopted as bedding material below the pipe to provide stabilization. All backfill materials should be placed and compacted in thin lifts not exceeding 200 mm in thickness to achieve at least 95% of its SPMDD throughout.

It is recommended that trench plugs be installed at appropriate locations along the trench alignment (in particular, the main north/south alignments of the storm and sanitary sewers) to minimize and control any flow of groundwater along the trench bedding and backfill materials. It should be noted that concrete trench plugs for shallower watermain trench are susceptible to differential movement and heaving in relation to surrounding soils, particularly where plugs are located within the frost penetration depth. Clay plugs should be used in such instances, utilizing frost tapers to minimize movement within the frost zones.

5.2.8 Excavation and Temporary Shoring

The Occupational Health and Safety Act (OHSA) regulations require that if workers must enter an excavation deeper than 1.2 m, the excavation must be suitably sloped and / or braced in accordance with the OHSA requirements. OHSA specifies maximum slope of the excavations for four (4) broad soil types as summarized in the following table:

Table 20 Soil Types and Slope Information

Soil Type	Base of Slope	Maximum Slope Inclination
1	Within 1.2 metres of bottom	1 horizontal to 1 vertical
2	Within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
3	From bottom of excavation	1 horizontal to 1 vertical
4	From bottom of excavation	3 horizontal to 1 vertical

The native soils underlying the Site are considered Type 3 soils above the groundwater level, and Type 4 if affected by surface water or groundwater seepage. If the above recommended excavation side slopes cannot be maintained due to lack of space or any other reason, the excavation side slopes must be supported by an engineered shoring system.

The excavation for the underground parking structure will likely need to be supported with an engineered shoring system. The shoring system should be designed in accordance with CFEM 2023 and the OHSA Regulations for Construction Projects. Required soil parameters for the design of the engineered shoring system is provide in **Section 5.2.6** of this report. Shoring systems must be designed by a Professional Engineer taking into consideration not only the lateral earth pressures but also loads from adjacent structures, and any possible surcharge loadings through construction (i.e., trucks, equipment, stockpiles, etc.), and vibrations caused by construction methods.

Based on the groundwater level observations during the investigation, groundwater is expected in the excavated areas for the underground parking and building foundations. Water quantities will depend on seasonal conditions, depth of excavations, and the duration that excavations are left open. Watertight shoring systems are recommended to reduce the groundwater seepage. Pumping from collection sumps to an acceptable outlet is expected to control this estimated groundwater infiltration.

An examination of the slopes should be carried out by qualified soils personnel before any worker enters the excavation. The exposed fill material and native soil should be protected against erosion from water run-off or rain.

5.2.9 Pavement Structures

Based on the results of this investigation, we would recommend the following procedures be implemented to prepare the proposed asphalt pavement areas for its construction:

1. Remove any saturated or frozen earth, and boulders larger than 150 mm in diameter encountered at subgrade elevation for the full width of construction. It is expected that some of the excavated soils may be suitable for reuse as trench backfill, conditional upon suitable moisture content (within 2 % of optimum) and final review and approval by an experienced geotechnical engineer or representative at the time of construction.
2. Proof roll the subgrade for the purpose of detecting possible zones of overly wet or soft subgrade. Any unstable areas thus delineated should be reinforced with woven geotextile approximately equivalent to Terrafix 200W, or replaced with acceptable granular material compacted to a minimum of 98 percent of its SPMDD.
3. Contour the subgrade surface to prevent ponding of water during the construction and to promote rapid drainage of the sub-base and base course materials.
4. To maximize drainage potential, and ensure satisfactory pavement performance, 150 mm diameter perforated pipe subdrains should be installed along any curb lines. The pipe should be encased in filter fabric and surrounded by clear stone aggregate or another suitable free-draining material. It is recommended that the subdrains outlet to the storm sewer system.
5. Construct transitions between varying depths of granular base materials at a rate of 1:10 minimum.

Depending on the final proposed grades, the subgrade soils for the proposed new roadways are expected to consist of native sandy silt or glacial till. For overall pavement design purposes, the frost susceptibility of the native soils is assessed as being generally moderate to high. The Township's pavement structures standard (for both asphalt depths and granular depths) are considered sufficient. In this regard, the following minimum flexible pavement structure is recommended for the construction of the new roadways.

Table 21 Recommended Pavement Structure for New Roadways

Profile	Material	Minimum Thickness (mm)		In Conformance with Form
		Local Residential	Collectors & Arterial	
Asphalt Surface	H.L.4	40	40	OPSS 1150
Asphalt Base	H.L.8	40	50	
Granular Base	Granular "A"	150		OPSS 1010
Granular Subbase	Granular "B"	450		

It is expected that the proposed asphalt paved parking lot and access driveway areas for the proposed commercial and multi-storey building will experience relatively low traffic volumes consisting of passenger vehicles and occasional heavy service trucks. In this regard, based on the subgrade soils encountered in our test holes the following minimum flexible pavement structure is recommended for these areas.

Table 22 Recommended Pavement Structure for Private Access Driveways and Parking Lot Areas

Profile	Material	Minimum Thickness (mm)		In Conformance with Form
		Light Duty	Heavy Duty	
Asphalt Surface	H.L.4	40	40	OPSS 1150
Asphalt Base	H.L.8	50	50	
Granular Base	Granular "A"	150	150	OPSS 1010
Granular Subbase	Granular "B"	300	450	

The following steps are recommended for optimum construction of paved areas:

1. The Granular "A" and "B" courses should be compacted to a minimum 100 percent of their respective SPMDD's.
2. All asphaltic concrete courses should be placed, spread and compacted conforming to OPSS 310 or equivalent. All asphaltic concrete should be compacted to a minimum 92.0 percent of their respective laboratory Maximum Relative Density (MRD).
3. Adequate drainage should be provided to ensure satisfactory pavement performance.

It is recommended that all fill material be placed in uniform lifts not exceeding 200 mm in thickness before compaction. It is suggested that all granular material used as fill should have an in-situ moisture content within 2 percent of their optimum moisture content. All granular materials should be compacted to 100 percent SPMDD. Granular materials should consist of Granular "A" and Granular "B" conforming to the requirements of OPSS.MUNI 1010 or equivalent.

The performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved as much as practically possible. It is noted that the above recommended pavement structures are for the end use of the project. The most severe loading conditions on pavement areas and the subgrade may occur during construction. As such, during construction of the project, the recommended granular depths may not be sufficient to support loadings encountered. Consequently, special provisions such as restricted lanes, half-loads during paving, etc. may be required, especially if construction is carried out during unfavourable weather.

5.2.10 Storm Water Management Pond

It is GHD's understanding that a Storm Water Management Pond (SWMP) is proposed in the central area of the Site (south of the creek) and is to be located within the area of boreholes MW6D-25 and MW6S-25 as shown on the Test Hole Plan. The proposed base elevation of the SWMP is not known at the time of writing this report; however, it is expected that the bottom of the SWMP will consist of stiff silty clay glacial till native soils. The hydraulic conductivity of the silty clay till is expected to be on the order of about 1 $x10^{-9}$ m/sec based on the SWRT completed at MW06-25D. It is noted, however, that slight variations in the soil stratigraphy may cause variations in the permeability of the soil in both vertical and horizontal orientations.

Based on the soils observed, and the assumed base elevations, it appears that construction of the SWMP in this area is feasible. In general, excavation of the soils for the SWMP is expected to be straightforward, provided that appropriate measures are taken during construction to minimize any overland or near-surficial flow of water into the area. Groundwater and surficial water inflow into the open SWMP excavation may be encountered depending on the time of the year in which construction is conducted, however this is expected to be controlled by pumping from within the excavation, along with further measures if required including up-gradient cutoff trenching with appropriate drainage outletting.

It is recommended that the SWMP subgrade surfaces be proof rolled, and a representative of GHD approve the subgrade prior to construction of the berms. Construction of the berms may utilize excavated soils, such as the sand and silt till native soils. Such operations should place soils in lifts no thicker than 150 mm prior to compaction and compacted to at least 95 percent SPMDD.

The native, undisturbed stiff silty clay till soils are expected to have a sufficiently low permeability where they could substitute for a liner. An inspection of the excavated and exposed SWMP surface should be performed at the time of construction, to assess whether any discrete or localized areas of increased hydraulic conductivity (such as sand and/or gravelly seams typically encountered within till soils) are present within the exposed soils, in which case such areas may be lined with a more suitable (i.e. less hydraulically conductive) material.

For the purpose of the proposed SWMP, the soils observed should be stable from slip circle failure if sloped at 3 horizontal to 1 vertical (3H:1V) or flatter in the long term both above and below the water table. Between the stable water level and the expected high-water level, it is recommended that the slopes be lessened to 4H:1V (or flatter) to guard against erosion by wavelet action. The native material will require vegetative root mass (or otherwise suitable erosion protection) to minimize erosional forces on exposed slopes.

Slopes and berms of the SWMP should be constructed to reduce or eliminate the effects of surficial erosion. Features to do so may include slope vegetation, installation of erosion or gabion mats, rip rap, and/or other acceptable stabilizing features.

5.2.11 Construction Monitoring

The foundation installations and any Engineered Fill placement must be closely monitored and inspected by qualified personnel to ensure consistency with the design bearing. The on-site review of the condition of the foundation soil as the foundations are constructed is an integral part of the geotechnical design function and is required by Section 6.2.2 of the OBC.

Qualified Geotechnical personnel should inspect and test all stages of the proposed development. Specifically, they should ensure that the materials and conditions comply with this geotechnical assessment report. In addition, qualified geotechnical personnel should provide material testing services prior to and during backfilling and/or grade raising operation. Should soil conditions be encountered that vary from those described in this report, our office should be informed immediately such that the proper measures are undertaken.

In addition to the typical quality control and construction reviews, it is also recommended to establish project specific monitoring, including monitoring of the existing shoring systems during construction, grade raise settlement monitoring and ground movement monitoring in the vicinity of new excavations.

6. Conclusions and Closure

Supporting data upon which our recommendations are based have been presented in the foregoing sections of this report and are governed by the physical properties of the subsurface materials that were encountered at the Site and assume that they are representative of the overall site conditions.

It is our opinion that the results of this hydrogeological and geotechnical investigation support the proposed development at the location of Lot 13, Concession 6, Township of Cavan-Monaghan, Ontario.

We trust this report meets your immediate needs. Should any questions arise regarding any aspect of our report, please contact our office.

All of Which is Respectfully Submitted,

GHD



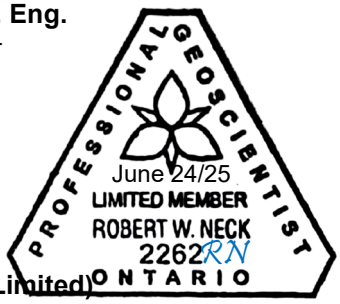
Michael Nieukirk, P. Eng.
Geotechnical Engineer



Kathleen Goodman, P. Eng.
Environmental Engineer



Leandro Ramos, P.Eng.
Senior Geotechnical Engineer



Robert Neck, P.Geo. (Limited)
Senior Geoscientist, Project Director

Statement of Limitations

This report is intended solely for Vargas P Inc and their designers and is prohibited for use by others without GHD's prior written consent. This report is considered GHD's professional work product and shall remain the sole property of GHD. Any unauthorized reuse, redistribution of or reliance on the report shall be at the Client and recipient's sole risk, without liability to GHD. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and appendices.

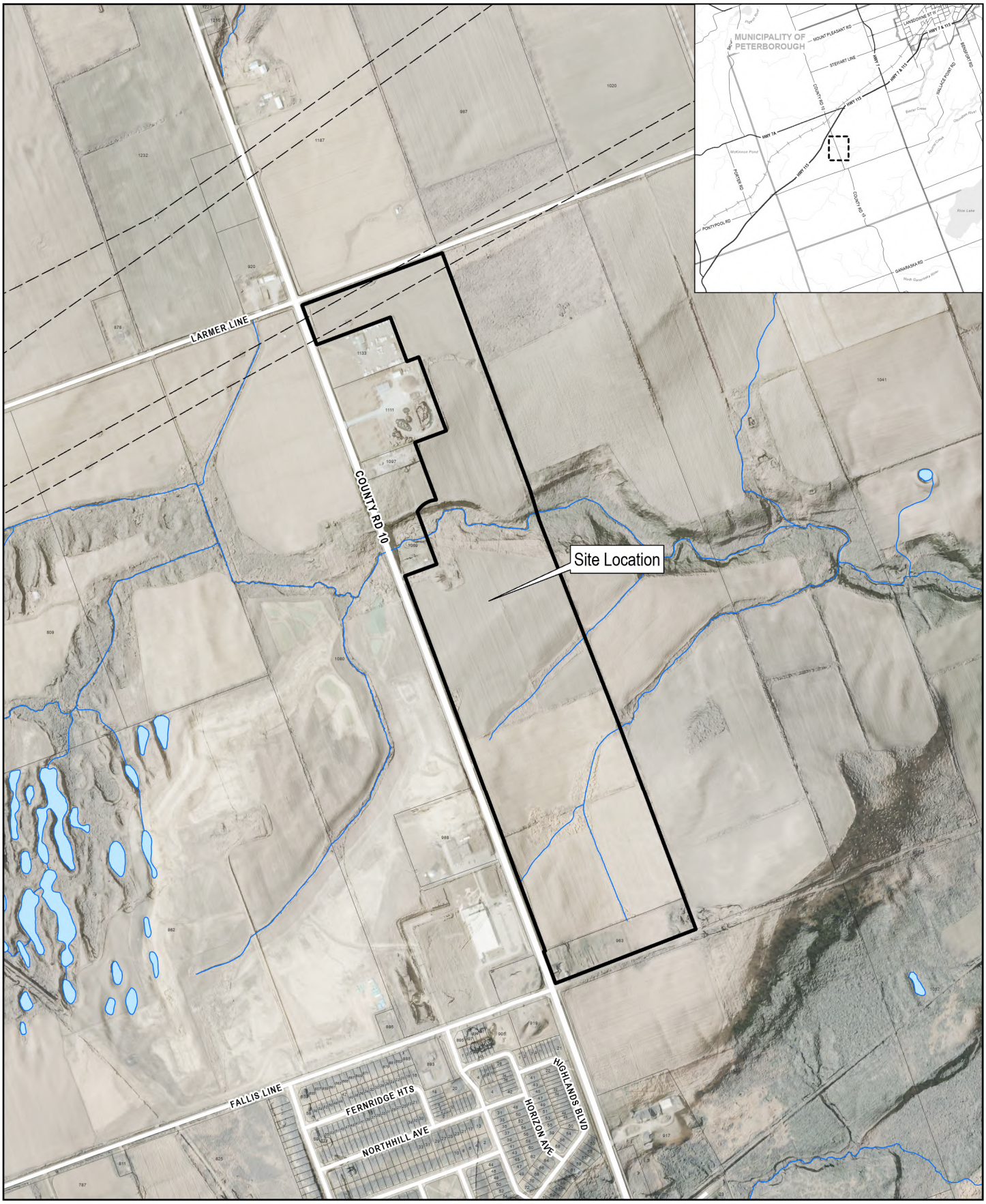
The recommendations made in this report are in accordance with our present understanding of the project, the current site use, ground surface elevation and conditions, and are based on the work scope approved by the Client and described in the report. The services were performed in a manner consistent with that level of care and skill ordinarily exercised by members of geotechnical engineering professions currently practicing under similar conditions in the same locality. No other representations, and no warranties or representations of any kind, either expressed or implied, are made. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

All details of design and construction are rarely known at the time of completion of a geotechnical or hydrogeological assessment. The recommendations and comments made in the study report are based on our subsurface investigation and resulting understanding of the project, as defined at the time of the study. We should be retained to review our recommendations when the drawings and specifications are complete. Without this review, GHD will not be liable for any misunderstanding of our recommendations or their application and adaptation into the final design.

By issuing this report, GHD is the geotechnical engineer of record. It is recommended that GHD be retained during construction of all foundations and during earthwork operations to confirm the conditions of the subsoil are actually similar to those observed during our study. The intent of this requirement is to verify that conditions encountered during construction are consistent with the findings in the report and that inherent knowledge developed as part of our study is correctly carried forward to the construction phases.

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments included in this report are based on the results obtained at the test locations only. The subsurface conditions confirmed at the test locations may vary at other locations. The subsurface conditions can also be significantly modified by the construction activities on site (e.g., excavation, dewatering and drainage, blasting, pile driving, etc.). These conditions can also be modified by exposure of soils or bedrock to humidity, dry periods or frost. Soil and groundwater conditions between and beyond the test locations may differ both horizontally and vertically from those encountered at the test locations and conditions may become apparent during construction which could not be detected or anticipated at the time of our investigation. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations. If changed conditions are identified during construction, no matter how minor, the recommendations in this report shall be considered invalid until sufficient review and written assessment of said conditions by GHD is completed.

Figures



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

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North of Fallis Line, Lot 13, Concession 6
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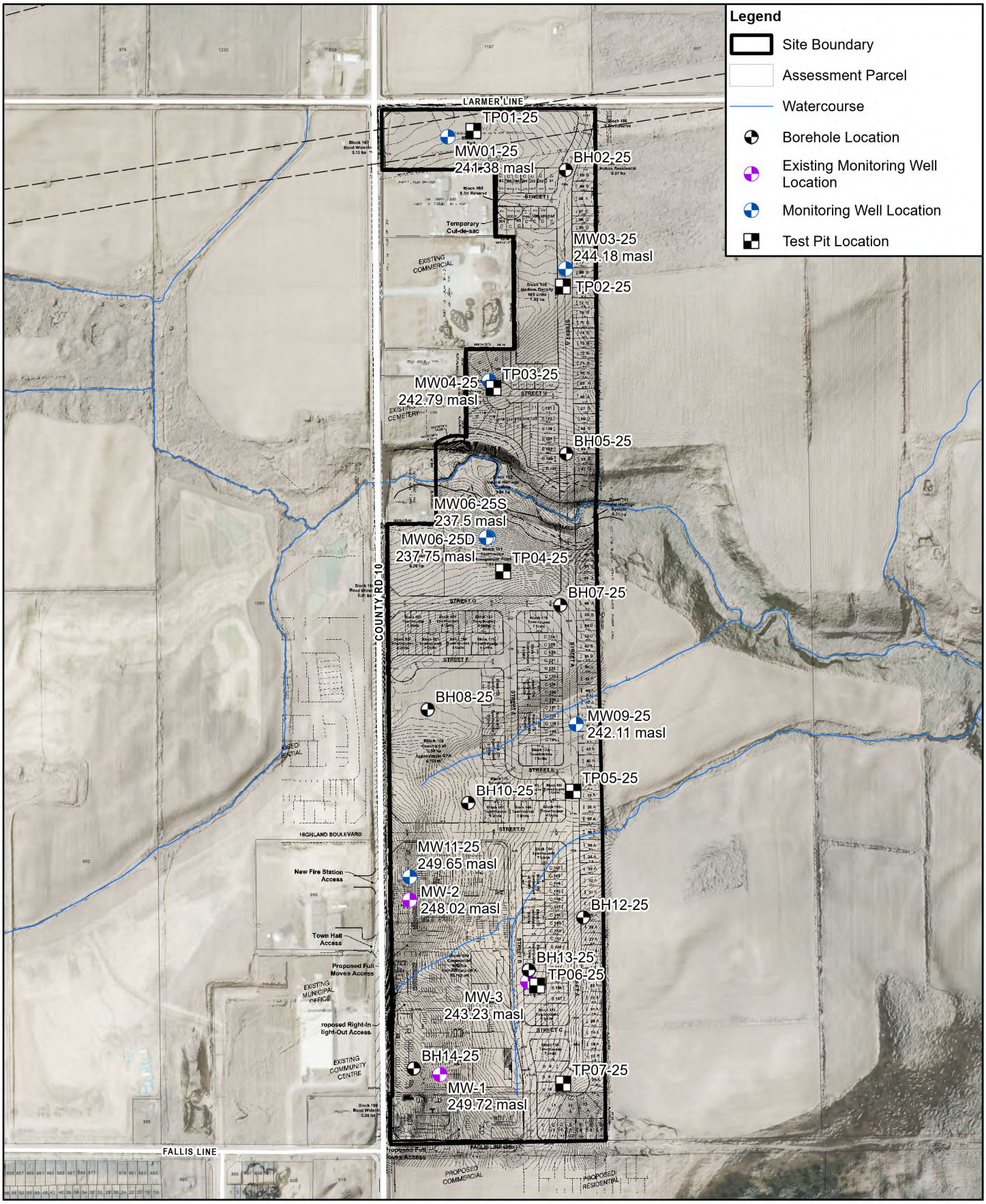
Site Location Plan

Project No. 12662348
Revision No.
Date Apr 29, 2025

Figure 1

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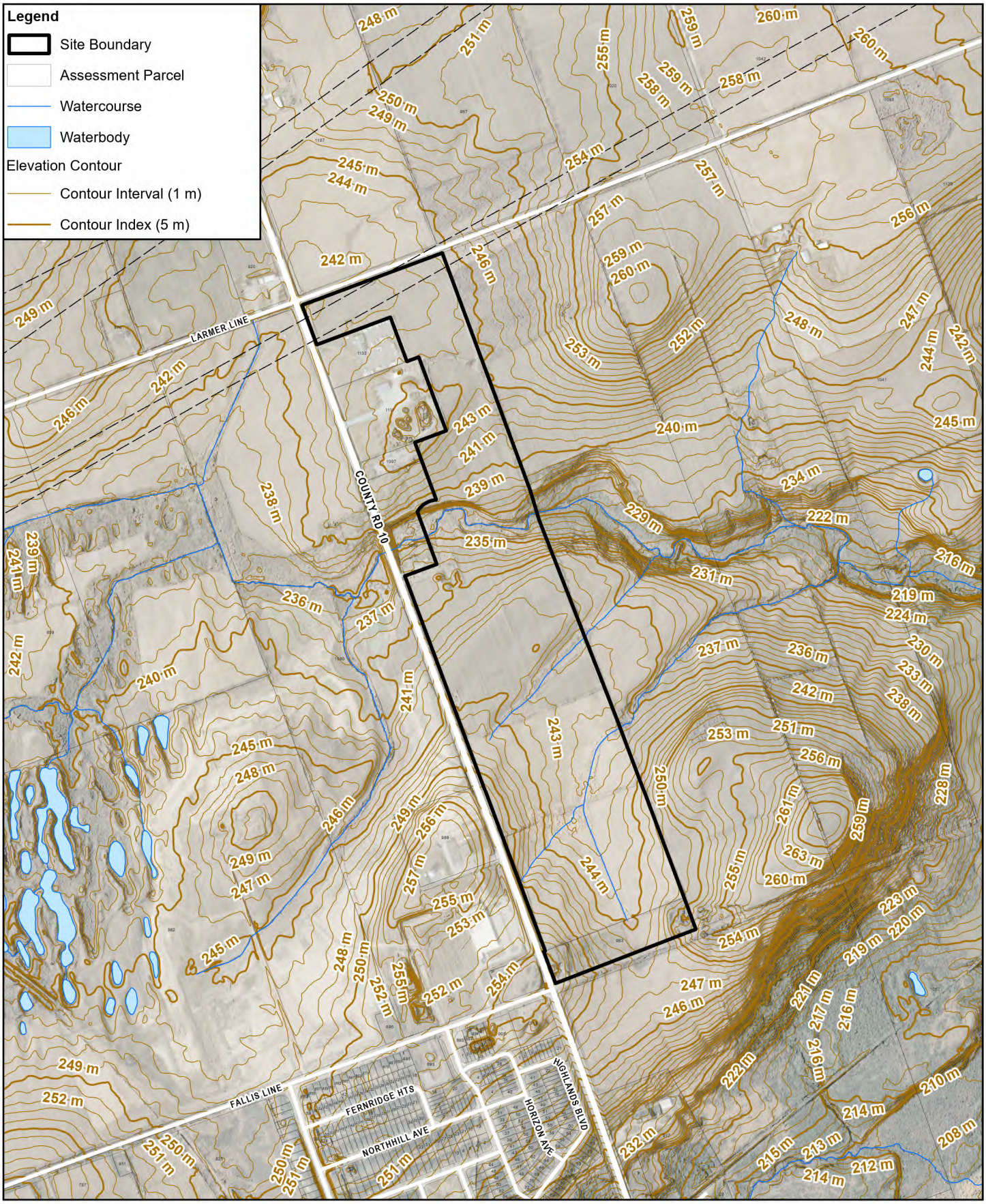
Test Hole Plan

Project No. 12662438
Revision No.
Date Jun 24, 2025

Figure 2

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Revision No.
Date Apr 29, 2025

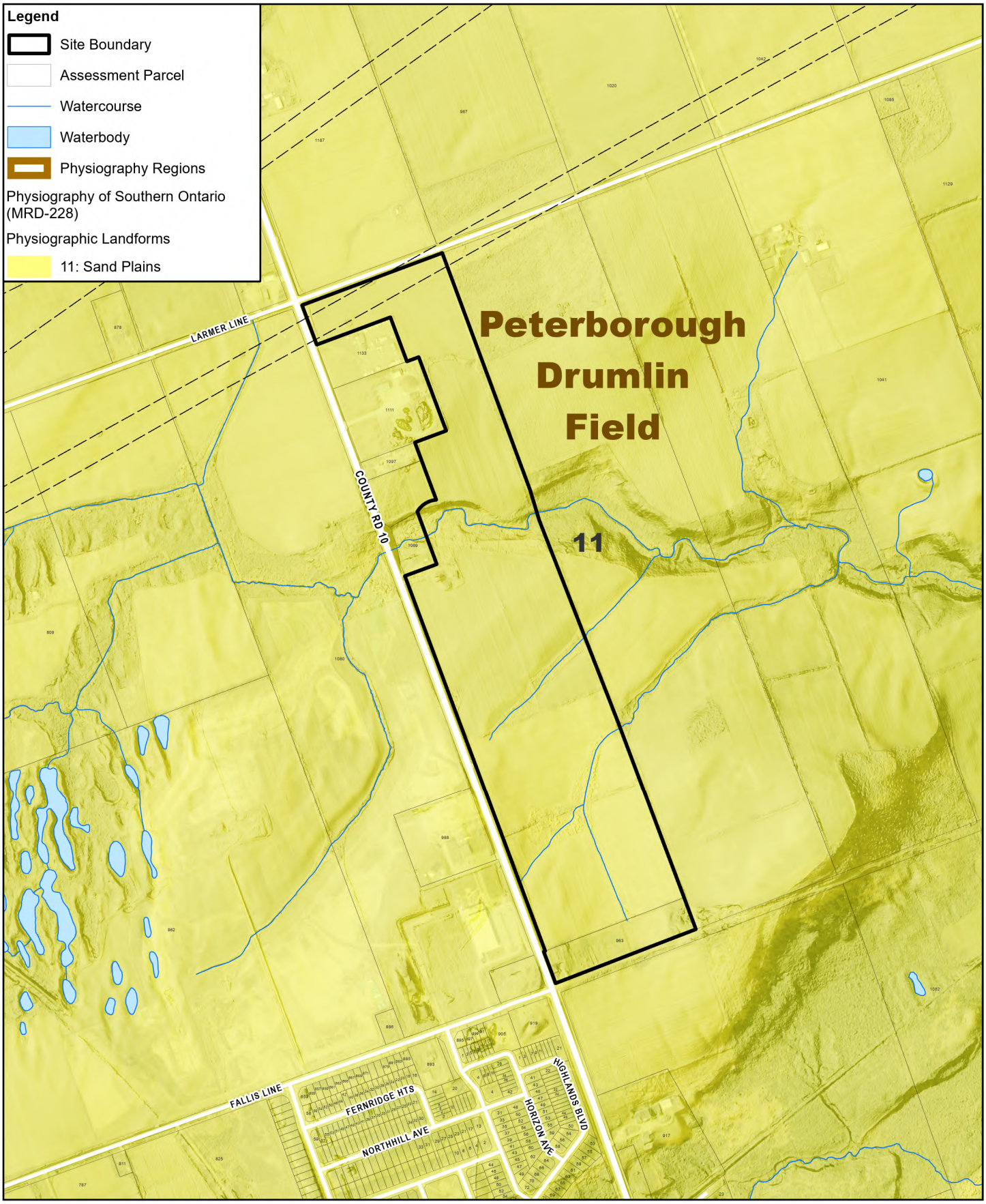
Hydrogeological and Geotechnical Investigation Report

Regional Topography

Figure 3

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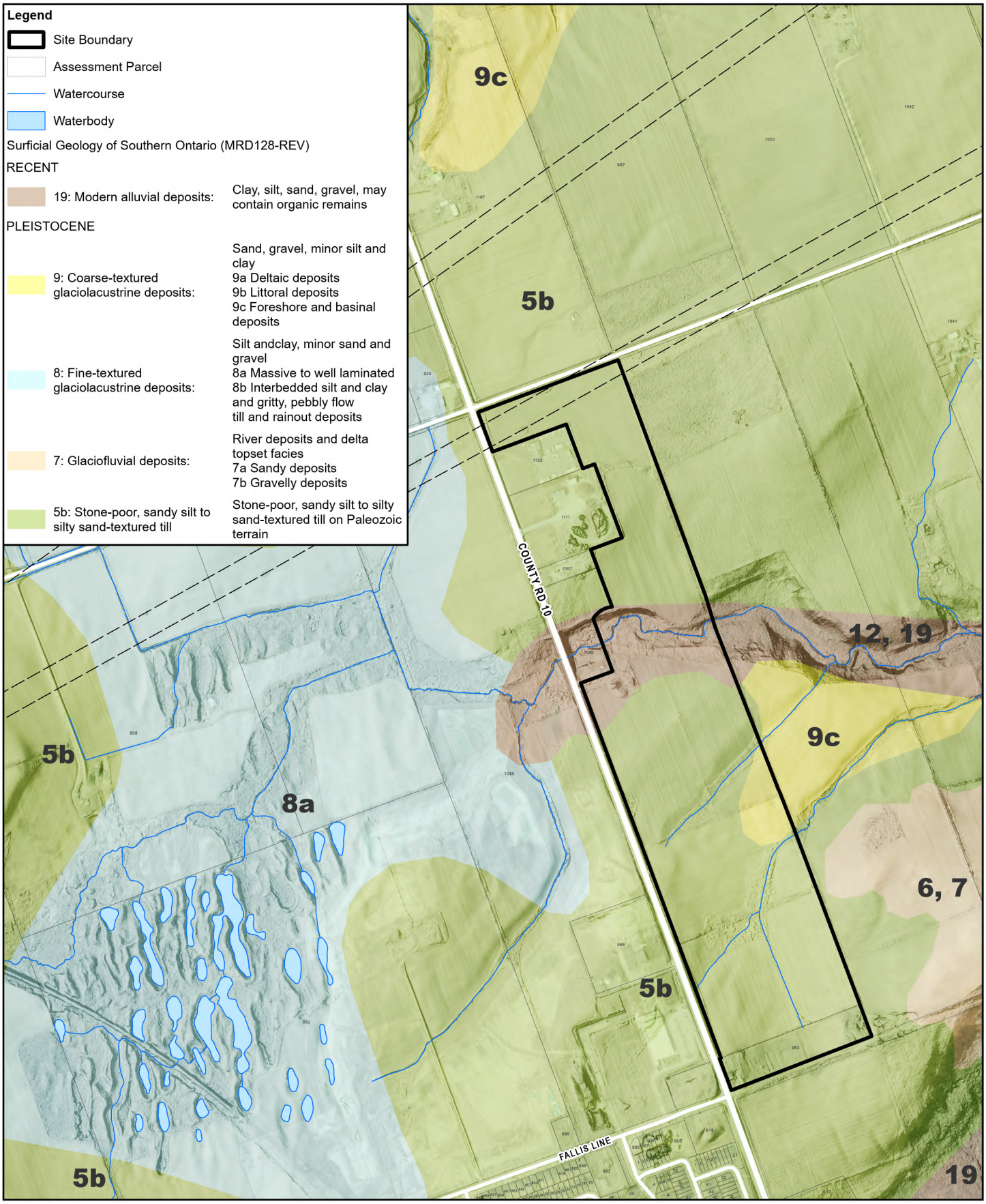
Physiography

Project No. 12662348
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Date Apr 29, 2025

Figure 4

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Attribution: Chapman, L.J. and Putnam, D.F. 2007. Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 228 ISBN 978-1-4249-5158-1.; Imagery accessed from the Ontario Imagery Web Map Service on Apr 29, 2025; Produced by GHD Limited under Licence with the Ontario Ministry of Natural Resources and Forestry© King's Printer for Ontario, 2024.



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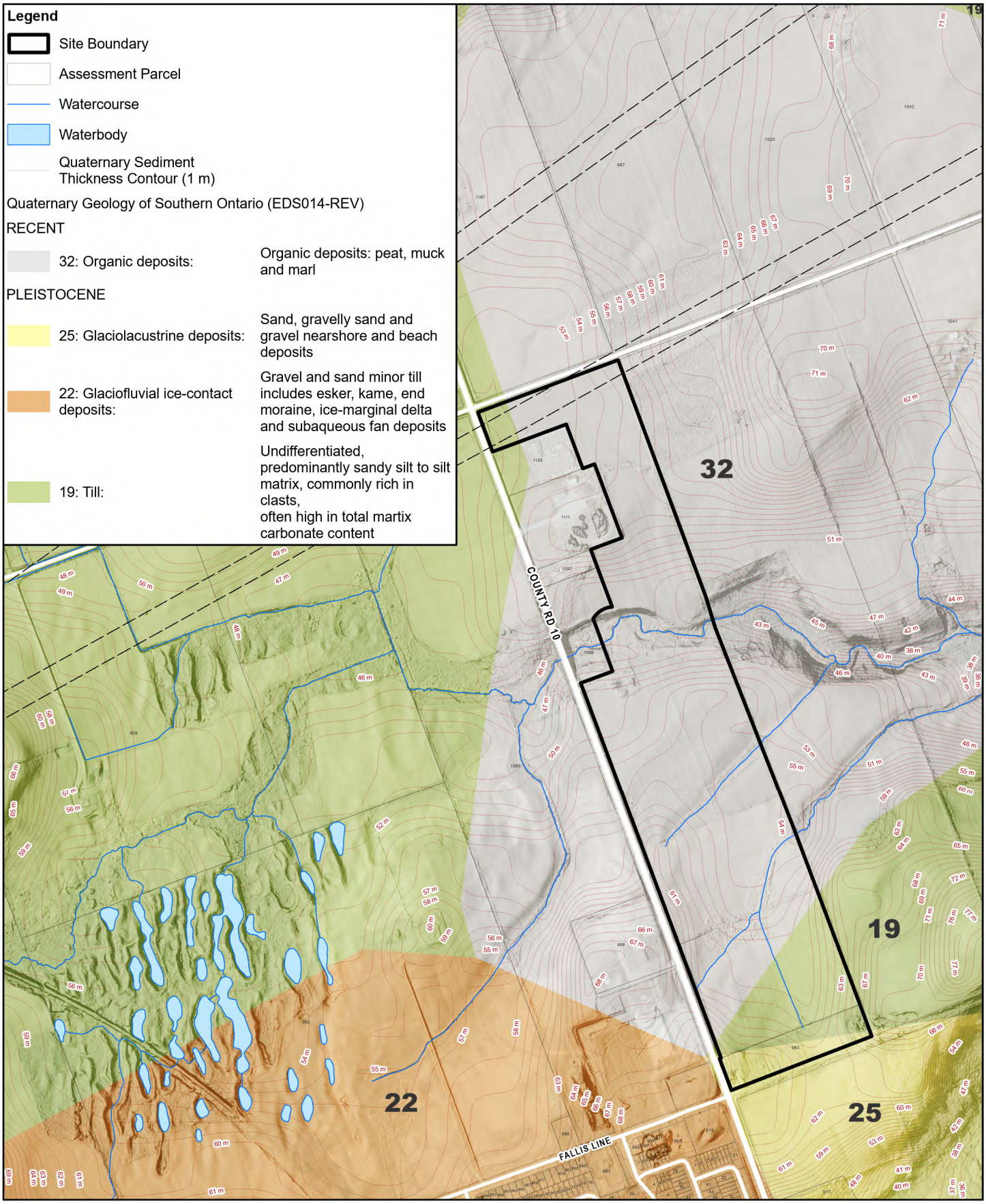
Surficial Geology

Project No. 12662348
Revision No.
Date Apr 29, 2025

Figure 5

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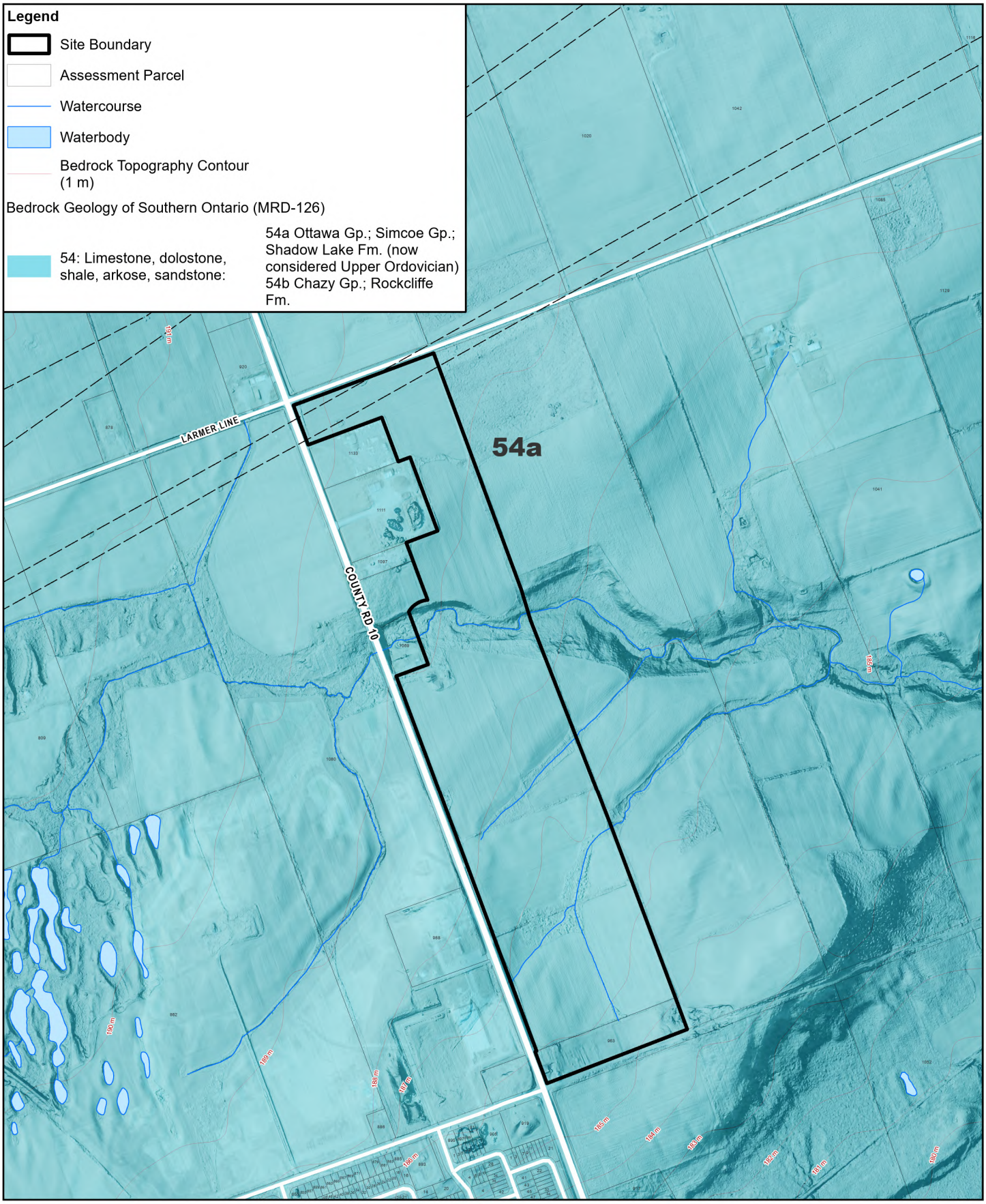
Quaternary Geology

Project No. 12662348
Revision No.
Date Apr 29, 2025

Figure 6

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Attribution: EDS014-REV. Ontario Geological Survey, 1997. Quaternary geology, seamless coverage of the province of Ontario: Ontario Geological Survey, Data Set 14.; Quaternary Sediment Thickness Contour, ORMGP, 2022.; Imagery accessed from the Ontario Imagery Web Map Service on Apr 29, 2025; Produced by GHD Limited under Licence with the Ontario Ministry of Natural Resources and Forestry© King's Printer for Ontario, 2024.



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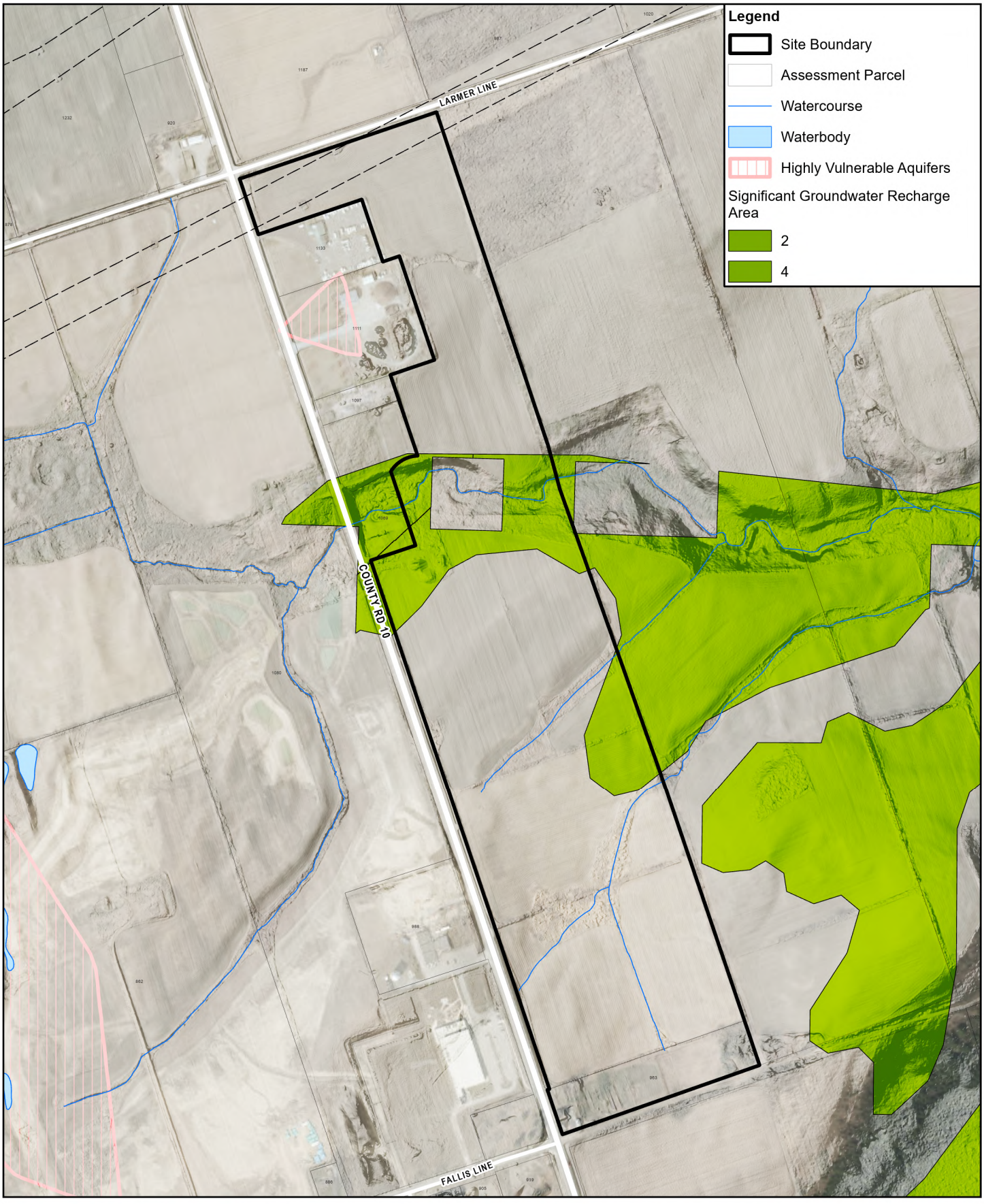
Bedrock Geology

Project No. 12662348
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Date Apr 29, 2025

Figure 7

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Attribution: MRD126-REV. Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release—Data 126-Revision 1.; Bedrock Topography Contours, ORMGP, 2022; Imagery accessed from the Ontario Imagery Web Map Service on Apr 29, 2025; Produced by GHD Limited under Licence with the Ontario Ministry of Natural Resources and Forestry© King's Printer for Ontario, 2024.



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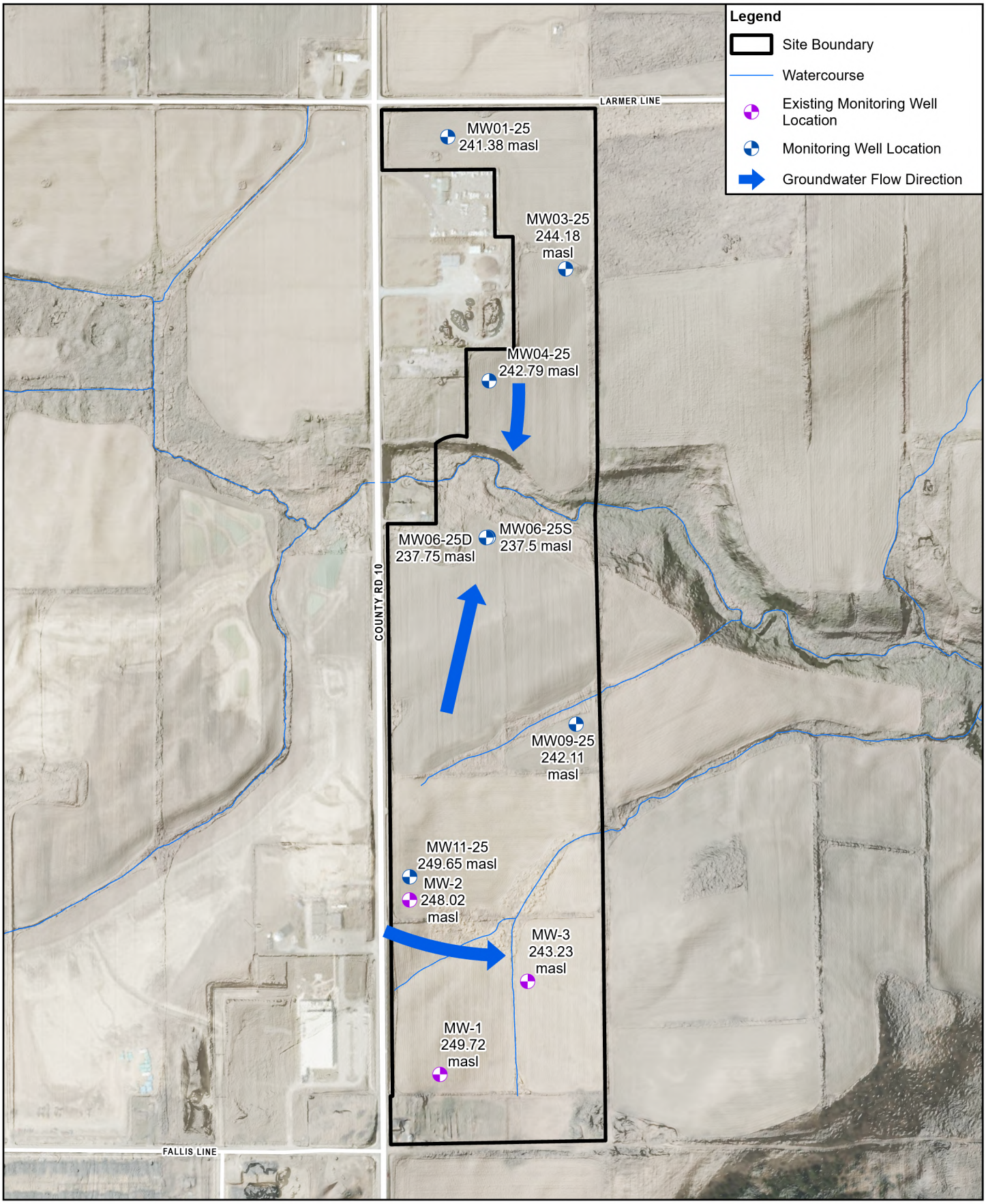
Source Water Protection

Project No. 12662438
Revision No.
Date Apr 29, 2025

Figure 8

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0 70 140 210

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

Vargas P Inc.
North of Fallis Line, Lot 13, Concession 6
Township of Cavan-Monaghan, Ontario

Hydrogeological and Geotechnical Investigation Report

Groundwater Flow Direction

Project No. 12662438
Revision No.
Date Apr 29, 2025

Figure 9

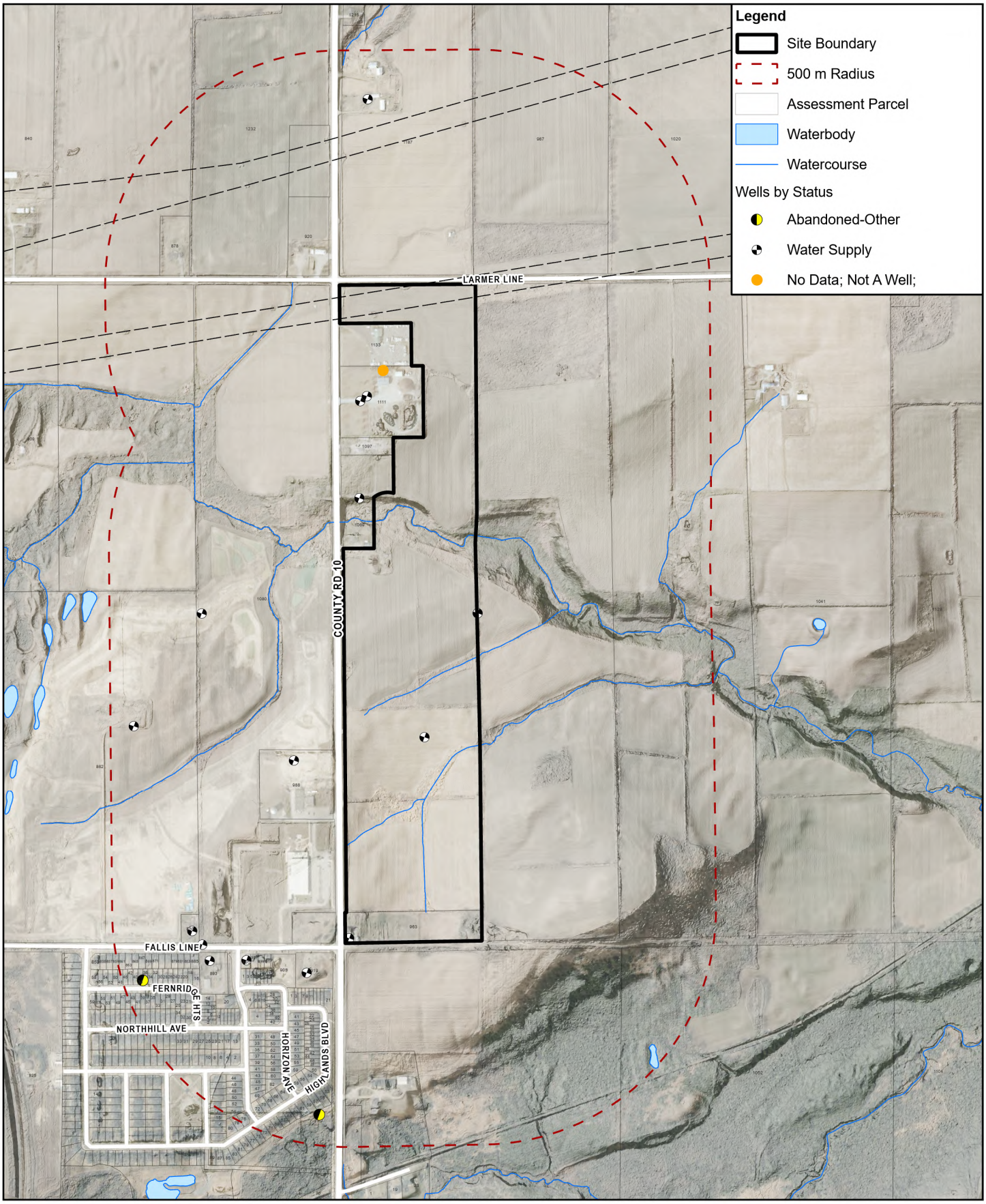
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Print date: 29 Apr 2025 - 12:56

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Appendices

Appendix A

MECP Well Records



1:11,000

0 110 220 330

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

Vargas P Inc.
North of Fallis Line, Lot 13, Concession 6
Township of Cavan-Monaghan, Ontario

Hydrogeological and Geotechnical Investigation Report

MECP Well Location Plan

Project No. 12662438
Revision No.
Date Apr 29, 2025

Appendix A

Q:\GIS\PROJECTS\12662000s\12662438\GIS\Maps\Deliverables\202503_HydrogeologicalAndGeotechnicalInvestigationReport\12662438_HydrogeologicalAndGeotechnicalInvestigationReport.aprx
Print date: 29 Apr 2025 - 12:55

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MECP WELL RECORD LISTINGS

Ministry of the Environment, Conservation & Parks (MECP)

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Powered by Location Intelligence

DISCLAIMER: All effort has been taken to ensure the accuracy of the data is the same as the source. There are instances where the original PDF document is different and in those cases, the PDF should be used instead.

17

Easting:	703525.20
Northing:	4893004.00
Elev (masl):	253.44

Latitude: 44.161885
Longitude: -78.454554

Well ID: 1900380

LOCATION

Lot:	012	Tag:	
Con:	05	Audit No:	
Municipality:	PETERBOROUGH	Contractor License:	4713
Township:	CAVAN TOWNSHIP	Well Completion Date:	12-09-1953
Street:		Received Date:	02-22-1954
City:	n/a		

WELL

Well Status:	Water Supply	Well Depth (m):	16.4592
Prim. Use:	n/a	Depth to Bedrock (m):	n/a
Sec. Use:	n/a	Depth to Water:	ft
Boring Method:	Cable Tool	Water Kind:	FRESH

PUMP TEST

Test Method:	CLEAR	Pipe ID:	10618018
Pump Set (m):	n/a	Pump Test ID	991900380
SWL (ft)	40	Flowing:	N
Final Level:	44 ft	Pump Duration (hr):	2
Pump Rate:	12 GPM	Pump Duration (m):	0
Recom. Rate:	n/a GPM		

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930126682	6	inch	STEEL	n/a	54 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	n/a	0	2 ft
2	CLAY	MEDIUM SAND	STONES	BROWN	2	20 ft
3	CLAY	STONES	n/a	BLUE	20	53 ft
4	GRAVEL	n/a	n/a	n/a	53	54 ft

End of Record

17

Easting:	703474.20
Northing:	4893440.00
Elev (masl):	254.24

Latitude: 44.16582
Longitude: -78.455023

Well ID: 1900416

LOCATION

Lot:	012	Tag:	
Con:	06	Audit No:	
Municipality:	PETERBOROUGH	Contractor License:	2113
Township:	CAVAN TOWNSHIP	Well Completion Date:	01-24-1964
Street:		Received Date:	05-04-1964
City:	n/a		

WELL

Well Status:	Water Supply	Well Depth (m):	70.7136
Prim. Use:	n/a	Depth to Bedrock (m):	n/a
Sec. Use:	n/a	Depth to Water:	ft
Boring Method:	Cable Tool	Water Kind:	FRESH

PUMP TEST

Test Method:	CLEAR	Pipe ID:	10618054
Pump Set (m):	n/a	Pump Test ID	991900416
SWL (ft)	65	Flowing:	N
Final Level:	202 ft	Pump Duration (hr):	24
Pump Rate:	40 GPM	Pump Duration (m):	0
Recom. Rate:	30 GPM		

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CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930126721	6	inch	STEEL	n/a	217 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	n/a	0	1 ft
2	CLAY	MEDIUM SAND	STONES	BROWN	1	45 ft
3	CLAY	MEDIUM SAND	STONES	GREY	45	207 ft
4	GRAVEL	COARSE SAND	CLAY	n/a	207	216 ft
5	GRAVEL	n/a	n/a	BROWN	216	220 ft
6	CLAY	STONES	n/a	GREY	220	227 ft
7	GRAVEL	n/a	n/a	BROWN	227	232 ft

End of Record

17

Easting:	703719.20
Northing:	4893582.00
Elev (masl):	242.62

Latitude: 44.167029
Longitude: -78.451906

Well ID: 1900417

LOCATION

Lot: 013
Con: 06
Municipality: PETERBOROUGH
Township: CAVAN TOWNSHIP
Street:
City: n/a

Tag:
Audit No:
Contractor License: 2501
Well Completion Date: 11-22-1952
Received Date: 01-19-1953

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: Domestic
Boring Method: Cable Tool

Well Depth (m): 32.6136
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: CLEAR
Pump Set (m): n/a
SWL (ft) n/a
Final Level: n/a ft
Pump Rate: 60 GPM
Recom. Rate: n/a GPM

Pipe ID: 10618055
Pump Test ID 991900417
Flowing: Y
Pump Duration (hr): n/a
Pump Duration (m): n/a

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930126722	5	inch	STEEL	n/a	107 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	PREVIOUSLY DUG	n/a	n/a	n/a	0	30 ft
2	CLAY	BOULDERS	n/a	GREY	30	107 ft

End of Record

17

Easting:	703414.20
Northing:	4894013.00
Elev (masl):	237.58

Latitude: 44.170991
Longitude: -78.455551

Well ID: 1900418

LOCATION

Lot: 013
Con: 06
Municipality: PETERBOROUGH
Township: CAVAN TOWNSHIP
Street:
City: n/a

Tag:
Audit No:
Contractor License: 1904
Well Completion Date: 01-11-1967
Received Date: 05-16-1967

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: Domestic
Boring Method: Cable Tool

Well Depth (m): 10.3632
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind: FRESH

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PUMP TEST

Test Method:	CLOUDY	Pipe ID:	10618056
Pump Set (m):	n/a	Pump Test ID	991900418
SWL (ft)	18	Flowing:	N
Final Level:	25 ft	Pump Duration (hr):	4
Pump Rate:	20 GPM	Pump Duration (m):	0
Recom. Rate:	5 GPM		

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930126723	6	inch	STEEL	n/a	24 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	PREVIOUSLY DUG	n/a	n/a	n/a	0	24 ft
2	CLAY	n/a	n/a	n/a	24	26 ft
3	GRAVEL	BOULDERS	n/a	n/a	26	34 ft

End of Record

17

Easting:	703140.20
Northing:	4894818.00
Elev (masl):	245.25

Latitude: 44.178307
Longitude: -78.458664

Well ID: **1900450**

LOCATION

Lot:	013	Tag:	
Con:	07	Audit No:	
Municipality:	PETERBOROUGH	Contractor License:	2113
Township:	CAVAN TOWNSHIP	Well Completion Date:	07-31-1963
Street:		Received Date:	10-07-1963
City:	n/a		

WELL

Well Status:	Water Supply	Well Depth (m):	22.2504
Prim. Use:	n/a	Depth to Bedrock (m):	n/a
Sec. Use:	Domestic	Depth to Water:	ft
Boring Method:	Cable Tool	Water Kind:	FRESH

PUMP TEST

Test Method:	CLEAR	Pipe ID:	10618088
Pump Set (m):	n/a	Pump Test ID	991900450
SWL (ft)	37	Flowing:	N
Final Level:	65 ft	Pump Duration (hr):	3
Pump Rate:	3 GPM	Pump Duration (m):	0
Recom. Rate:	3 GPM		

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930126761	6	inch	STEEL	n/a	73 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	n/a	0	1 ft
2	CLAY	n/a	n/a	BROWN	1	10 ft
3	CLAY	BOULDERS	n/a	GREY	10	50 ft
4	CLAY	MEDIUM SAND	STONES	GREY	50	67 ft
5	MEDIUM SAND	STONES	CLAY	n/a	67	73 ft

End of Record

17

Easting:	703425.20
Northing:	4893003.00
Elev (masl):	252.56

Latitude: 44.161903
Longitude: -78.455804

Well ID: **1903021**

LOCATION

Lot:	012	Tag:	
Con:	05	Audit No:	
Municipality:	PETERBOROUGH	Contractor License:	4713
Township:	CAVAN TOWNSHIP	Well Completion Date:	09-17-1970
Street:		Received Date:	02-04-1971
City:	n/a		

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WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Cable Tool

Well Depth (m): 72.2376
Depth to Bedrock (m): 215
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: CLEAR
Pump Set (m): n/a
SWL (ft) 66
Final Level: 230 ft
Pump Rate: 3 GPM
Recom. Rate: 3 GPM

Pipe ID: 10620643
Pump Test ID 991903021
Flowing: N
Pump Duration (hr): 1
Pump Duration (m): 0

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930129615	6	inch	STEEL	n/a	216 ft
2	930129616	n/a	inch	OPEN HOLE	n/a	237 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	CLAY	STONES	n/a	BROWN	0	27 ft
2	CLAY	STONES	n/a	BLUE	27	130 ft
3	CLAY	MEDIUM SAND	n/a	BLUE	130	135 ft
4	CLAY	STONES	n/a	BLUE	135	215 ft
5	LIMESTONE	n/a	n/a	GREY	215	237 ft

End of Record

17

Easting:	703715.20
Northing:	4893123.00
Elev (masl):	254.12

Latitude: 44.162902
Longitude: -78.452134

Well ID: **1903540**

LOCATION

Lot: 013
Con: 06
Municipality: PETERBOROUGH
Township: CAVAN TOWNSHIP
Street:
City: n/a

Tag:
Audit No:
Contractor License: 4814
Well Completion Date: 11-13-1972
Received Date: 04-09-1973

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Cable Tool

Well Depth (m): 70.104
Depth to Bedrock (m): 225
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: CLEAR
Pump Set (m): n/a
SWL (ft) 70
Final Level: 225 ft
Pump Rate: 2 GPM
Recom. Rate: 2 GPM

Pipe ID: 10621152
Pump Test ID 991903540
Flowing: N
Pump Duration (hr): 8
Pump Duration (m): 0

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930130162	6	inch	STEEL	n/a	225 ft
2	930130163	6	inch	OPEN HOLE	n/a	230 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	n/a	0	1 ft
2	CLAY	STONES	n/a	BROWN	1	45 ft
3	CLAY	STONES	n/a	GREY	45	135 ft
4	FINE SAND	CLAY	n/a	n/a	135	144 ft
5	FINE SAND	GRAVEL	CLAY	n/a	144	155 ft
6	GRAVEL	FINE SAND	CLAY	n/a	155	170 ft
7	FINE SAND	CLAY	GRAVEL	n/a	170	225 ft
8	LIMESTONE	n/a	n/a	GREY	225	230 ft

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End of Record

17

Easting:	703345.20
Northing:	4894208.00
Elev (masl):	244.17

Latitude: 44.172764
Longitude: -78.456338

Well ID: **1904211**

LOCATION

Lot:	013	Tag:	
Con:	06	Audit No:	
Municipality:	PETERBOROUGH	Contractor License:	4713
Township:	CAVAN TOWNSHIP	Well Completion Date:	12-26-1974
Street:		Received Date:	03-13-1975
City:	n/a		

WELL

Well Status:	Water Supply	Well Depth (m):	15.24
Prim. Use:	n/a	Depth to Bedrock (m):	n/a
Sec. Use:	n/a	Depth to Water:	ft
Boring Method:	Cable Tool	Water Kind:	FRESH

PUMP TEST

Test Method:	n/a	Pipe ID:	10621775
Pump Set (m):	n/a	Pump Test ID	991904211
SWL (ft)	8	Flowing:	N
Final Level:	40 ft	Pump Duration (hr):	2
Pump Rate:	12 GPM	Pump Duration (m):	30
Recom. Rate:	10 GPM		

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930130855	6	inch	STEEL	n/a	47 ft
2	930130856	6	inch	OPEN HOLE	n/a	50 ft
3	930130857	n/a	inch	<null>	n/a	500 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	CLAY	BOULDERS	n/a	BROWN	0	40 ft
2	CLAY	GRAVEL	n/a	BLUE	40	48 ft
3	GRAVEL	SAND	n/a	BROWN	48	50 ft

End of Record

17

Easting:	703128.20
Northing:	4893392.00
Elev (masl):	250.37

Latitude: 44.165485
Longitude: -78.459365

Well ID: **1904212**

LOCATION

Lot:	012	Tag:	
Con:	06	Audit No:	
Municipality:	PETERBOROUGH	Contractor License:	2104
Township:	CAVAN TOWNSHIP	Well Completion Date:	03-13-1975
Street:		Received Date:	04-08-1975
City:	n/a		

WELL

Well Status:	Water Supply	Well Depth (m):	10.9728
Prim. Use:	n/a	Depth to Bedrock (m):	n/a
Sec. Use:	n/a	Depth to Water:	ft
Boring Method:	Cable Tool	Water Kind:	FRESH

PUMP TEST

Test Method:	CLEAR	Pipe ID:	10621776
Pump Set (m):	n/a	Pump Test ID	991904212
SWL (ft)	15	Flowing:	N
Final Level:	21 ft	Pump Duration (hr):	3
Pump Rate:	10 GPM	Pump Duration (m):	0
Recom. Rate:	10 GPM		

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930130858	6	inch	STEEL	n/a	36 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth

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1	TOPSOIL	n/a	n/a	n/a	0	1	ft
2	SAND	GRAVEL	n/a	BROWN	1	12	ft
3	CLAY	STONES	n/a	WHITE	12	34	ft
4	GRAVEL	n/a	n/a	BROWN	34	36	ft

End of Record

17

Easting:	726565.10
Northing:	4924523.00
Elev (masl):	244.29

Latitude: 44.172896
Longitude: -78.456207

Well ID: **5110032**

LOCATION

Lot:	013	Tag:	
Con:	06	Audit No:	
Municipality:	PETERBOROUGH	Contractor License:	2104
Township:	CAVAN TOWNSHIP	Well Completion Date:	11-20-1980
Street:		Received Date:	12-16-1980
City:	n/a		

WELL

Well Status:	Water Supply	Well Depth (m):	23.1648
Prim. Use:	n/a	Depth to Bedrock (m):	n/a
Sec. Use:	n/a	Depth to Water:	ft
Boring Method:	Cable Tool	Water Kind:	FRESH

PUMP TEST

Test Method:	CLEAR	Pipe ID:	10886685
Pump Set (m):	n/a	Pump Test ID	995110032
SWL (ft)	6	Flowing:	N
Final Level:	38 ft	Pump Duration (hr):	9
Pump Rate:	10 GPM	Pump Duration (m):	10
Recom. Rate:	10 GPM		

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930558442	6	inch	STEEL	n/a	73 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	SOFT	n/a	BROWN	0	1 ft
2	CLAY	STONES	PACKED	BROWN	1	12 ft
3	SAND	GRAVEL	STONES	BROWN	12	26 ft
4	GRAVEL	CLAY	STONES	BROWN	26	69 ft
5	COARSE SAND	GRAVEL	LOOSE	BROWN	69	76 ft
6	CLAY	GRAVEL	DENSE	BROWN	76	76 ft

End of Record

17

Easting:	733805.10
Northing:	4914084.00
Elev (masl):	251.75

Latitude: 44.162092
Longitude: -78.456171

Well ID: **5110451**

LOCATION

Lot:	012	Tag:	
Con:	06	Audit No:	
Municipality:	PETERBOROUGH	Contractor License:	2104
Township:	CAVAN TOWNSHIP	Well Completion Date:	04-16-1982
Street:		Received Date:	05-11-1982
City:	n/a		

WELL

Well Status:	Water Supply	Well Depth (m):	64.008
Prim. Use:	n/a	Depth to Bedrock (m):	208
Sec. Use:	n/a	Depth to Water:	ft
Boring Method:	Cable Tool	Water Kind:	FRESH

PUMP TEST

Test Method:	CLEAR	Pipe ID:	10887098
Pump Set (m):	n/a	Pump Test ID	995110451
SWL (ft)	82	Flowing:	N
Final Level:	199 ft	Pump Duration (hr):	2
Pump Rate:	5 GPM	Pump Duration (m):	40
Recom. Rate:	4 GPM		

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

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Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930558950	6	inch	STEEL	n/a	210 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	CLAY	STONES	PACKED	BROWN	0	16 ft
2	SAND	GRAVEL	LOOSE	GREY	16	37 ft
3	MEDIUM SAND	CLAY	MEDIUM GRAVEL	GREY	37	98 ft
4	SAND	SOFT	n/a	BLACK	98	123 ft
5	CLAY	GRAVEL	PACKED	GREY	123	129 ft
6	SAND	SOFT	n/a	GREY	129	146 ft
7	MEDIUM SAND	MEDIUM GRAVEL	CLAY	GREY	146	208 ft
8	SHALE	GRAVEL	LOOSE	BLACK	208	209 ft
9	UNKNOWN TYPE	n/a	n/a	n/a	209	210 ft

End of Record

17

Easting:	730265.10
Northing:	4935273.00
Elev (masl):	252.88

Latitude: 44.162019
Longitude: -78.452923

Well ID: **5110516**

LOCATION

Lot: 012
Con: 05
Municipality: PETERBOROUGH
Township: CAVAN TOWNSHIP
Street:
City: n/a

Tag:
Audit No:
Contractor License: 4635
Well Completion Date: 06-03-1981
Received Date: 07-09-1982

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Cable Tool

Well Depth (m): 36.2712
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: n/a
Pump Set (m): n/a
SWL (ft) 49
Final Level: 113 ft
Pump Rate: 6 GPM
Recom. Rate: n/a GPM

Pipe ID: 10887163
Pump Test ID 995110516
Flowing: N
Pump Duration (hr): 4
Pump Duration (m): 0

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930559015	6	inch	STEEL	n/a	119 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	n/a	0	1 ft
2	CLAY	STONES	n/a	WHITE	1	37 ft
3	COARSE GRAVEL	n/a	n/a	BROWN	37	44 ft
4	CLAY	n/a	n/a	WHITE	44	102 ft
5	FINE GRAVEL	FINE SAND	n/a	BROWN	102	119 ft

End of Record

17

Easting:	698065.10
Northing:	4903323.00
Elev (masl):	241.23

Latitude: 44.167943
Longitude: -78.458584

Well ID: **5111244**

LOCATION

Lot: 012
Con: 06
Municipality: PETERBOROUGH
Township: CAVAN TOWNSHIP
Street:
City: n/a

Tag:
Audit No:
Contractor License: 1413
Well Completion Date: 11-09-1984
Received Date: 12-14-1984

VELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use:

Well Depth (m): 20.4216
Depth to Bedrock (m): n/a
Depth to Water: ft

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WELL

Boring Method: Rotary (Convent.)

Water Kind: FRESH

PUMP TEST

Test Method:	CLEAR	Pipe ID:	10887870
Pump Set (m):	n/a	Pump Test ID	995111244
SWL (ft)	60	Flowing:	N
Final Level:	62 ft	Pump Duration (hr):	2
Pump Rate:	4 GPM	Pump Duration (m):	0
Recom. Rate:	4 GPM		

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930559797	6	inch	STEEL	n/a	67 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	CLAY	STONES	HARD	BROWN	0	30 ft
2	GRAVEL	DRY	n/a	BROWN	30	58 ft
3	SAND	GRAVEL	LOOSE	BROWN	58	67 ft

End of Record

17

Easting:	715347.20
Northing:	4910436.00
Elev (masl):	241.91

Latitude: 44.169606
Longitude: -78.451595

Well ID: 5114057

LOCATION

Lot:	013	Tag:	
Con:	06	Audit No:	54924
Municipality:	PETERBOROUGH	Contractor License:	3129
Township:	CAVAN TOWNSHIP	Well Completion Date:	08-24-1989
Street:		Received Date:	09-14-1989
City:	n/a		

WELL

Well Status:	Water Supply	Well Depth (m):	15.24
Prim. Use:	n/a	Depth to Bedrock (m):	28
Sec. Use:	n/a	Depth to Water:	ft
Boring Method:	Boring	Water Kind:	FRESH

PUMP TEST

Test Method:	CLEAR	Pipe ID:	10890672
Pump Set (m):	n/a	Pump Test ID	995114057
SWL (ft)	26	Flowing:	N
Final Level:	34 ft	Pump Duration (hr):	1
Pump Rate:	8 GPM	Pump Duration (m):	0
Recom. Rate:	4 GPM		

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930562935	30	inch	CONCRETE	n/a	50 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	n/a	0	1 ft
2	CLAY	STONES	HARD	BROWN	1	20 ft
3	SAND	GRAVEL	ROCK	n/a	20	28 ft
4	CLAY	ROCK	HARD	GREY	28	50 ft

End of Record

17

Easting:	713824.00
Northing:	4926480.00
Elev (masl):	241.91

Latitude: 44.169606
Longitude: -78.451595

Well ID: 5117311

LOCATION

Lot:	013	Tag:	
Con:	06	Audit No:	166446
Municipality:	PETERBOROUGH	Contractor License:	3367
Township:	CAVAN TOWNSHIP	Well Completion Date:	09-16-1996
Street:		Received Date:	10-18-1996
City:	n/a		

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WELL

Well Status:	Water Supply	Well Depth (m):	23.7744
Prim. Use:	n/a	Depth to Bedrock (m):	n/a
Sec. Use:	n/a	Depth to Water:	ft
Boring Method:	Cable Tool	Water Kind:	Not stated

PUMP TEST

Test Method:	CLEAR	Pipe ID:	10893910
Pump Set (m):	n/a	Pump Test ID	995117311
SWL (ft)	8	Flowing:	N
Final Level:	60 ft	Pump Duration (hr):	6
Pump Rate:	7 GPM	Pump Duration (m):	0
Recom. Rate:	5 GPM		

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930566876	6	inch	STEEL	n/a	78 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	SOFT	n/a	BROWN	0	2 ft
2	CLAY	DENSE	n/a	BROWN	2	18 ft
3	CLAY	GRAVEL	PACKED	GREY	18	77 ft
4	COARSE GRAVEL	SAND	WATER-BEARING	BROWN	77	78 ft

End of Record

17

Easting:	737301.20
Northing:	4910737.00
Elev (masl):	243.85

Latitude: 44.173459
Longitude: -78.45601

Well ID: 5120398

LOCATION

Lot:	013	Tag:	
Con:	06	Audit No:	Z29375
Municipality:	PETERBOROUGH	Contractor License:	3367
Township:	CAVAN TOWNSHIP	Well Completion Date:	07-14-2005
Street:	COUNTY RD #10	Received Date:	09-20-2005
City:	MILLBROOK		

WELL

Well Status:	<null>	Well Depth (m):	0
Prim. Use:	n/a	Depth to Bedrock (m):	n/a
Sec. Use:	n/a	Depth to Water:	
Boring Method:	n/a	Water Kind:	

PUMP TEST

Test Method:		Pipe ID:	
Pump Set (m):		Pump Test ID	
SWL (ft)		Flowing:	
Final Level:		Pump Duration (hr):	
Pump Rate:		Pump Duration (m):	
Recom. Rate:			

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth

End of Record

---

n/a

Easting:	<null>
Northing:	<null>
Elev (masl):	252.59

Latitude: 44.161653
Longitude: -78.45548

Well ID: 7170060

TION

Lot:	012	Tag:	A108386
Con:	05	Audit No:	Z128143
Municipality:		Contractor License:	1413

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LOCA

Township: PETERBOROUGH CAVAN TOWNSHIP
Street: 893 FALLIS LINE
City: MILLBROOK

Well Completion Date: 07-12-2011
Received Date: 10-14-2011

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Rotary (Convent.)

Well Depth (m): 63.3984
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: CLEAR
Pump Set (m): 175
SWL (ft) 75
Final Level: 175 ft
Pump Rate: 10 GPM
Recom. Rate: 8 GPM

Pipe ID: 1004007579
Pump Test ID 1004007580
Flowing: n/a
Pump Duration (hr): 1
Pump Duration (m): n/a

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	1004007590	6.25	inch	STEEL	0	203 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	CLAY	STONES	HARD	BROWN	0	15 ft
2	SAND	GRAVEL	LOOSE	BROWN	15	38 ft
3	CLAY	HARD	DENSE	GREY	38	110 ft
4	SILT	CLAY	SOFT	GREY	110	168 ft
5	CLAY	n/a	HARD	GREY	168	195 ft
6	FINE SAND	SILT	n/a	GREY	195	203 ft
7	SAND	n/a	FINE-GRAINED	GREY	203	208 ft

End of Record

---

n/a

Easting:	<null>
Northing:	<null>
Elev (masl):	

Latitude: 44.160895
Longitude: -78.457013

Well ID: **7311533**

LOCATION

Lot: 012
Con: 05
Municipality: PETERBOROUGH
Township: CAVAN TOWNSHIP
Street: 879 FALLIS LINE
City: MILLBROOK

Tag:
Audit No: Z277113
Contractor License: 7067
Well Completion Date: 03-26-2018
Received Date: 05-25-2018

WELL

Well Status: Abandoned-Other
Prim. Use: n/a
Sec. Use: Livestock
Boring Method: n/a

Well Depth (m): 0
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind:

PUMP TEST

Test Method: n/a
Pump Set (m): n/a
SWL (ft) 43
Final Level: n/a ft
Pump Rate: n/a GPM
Recom. Rate: n/a GPM

Pipe ID: 1007277962
Pump Test ID 1007277963
Flowing: n/a
Pump Duration (hr): n/a
Pump Duration (m): n/a

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	1007277967	6.25	inch	STEEL	0	53 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
0	n/a	n/a	n/a	n/a	n/a	n/a ft

End of Record

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n/a		
	Easting:	<null>
	Northing:	<null>
	Elev (masl):	

Latitude: 44.15951
Longitude: -78.45142

Well ID: 7311534

LOCATION

Lot:	012
Con:	05
Municipality:	PETERBOROUGH
Township:	CAVAN TOWNSHIP
Street:	919 FALLIS LINE
City:	MILLBROOK

Tag:	
Audit No:	Z277114
Contractor License:	7067
Well Completion Date:	03-26-2018
Received Date:	05-25-2018

WELL

Well Status:	Abandoned-Other
Prim. Use:	n/a
Sec. Use:	Livestock
Boring Method:	n/a

Well Depth (m):	0
Depth to Bedrock (m):	n/a
Depth to Water:	ft
Water Kind:	

PUMP TEST

Test Method:	n/a
Pump Set (m):	n/a
SWL (ft)	-1
Final Level:	n/a ft
Pump Rate:	n/a GPM
Recom. Rate:	n/a GPM

Pipe ID:	1007277977
Pump Test ID	1007277978
Flowing:	n/a
Pump Duration (hr):	n/a
Pump Duration (m):	n/a

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	1007277982	36	inch	CONCRETE	-2.5	17 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
0	n/a	n/a	n/a	n/a	n/a	n/a ft

End of Record

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Appendix B

Test Hole Logs

STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

MW01-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 11/03/2025

Drilling Company: GET

Drilling Method(s): Solid Stem Auger

Hole Diameter(s): 152 mm

Northing: 4894422 m

Easting: 703316 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 241.76 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: C. Ayrheart

Reviewed By: M. Nieukirk

Final Depth: 6.38 m

Depth (m) / Elev. (m)	Strata	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	'N'/RQD Value	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Fines %	Moisture Content %	PL% - LL%	Plasticity Index (%)
0.00 / 241.76														
0.36 / 241.40		TOPSOIL (360 mm)	SS1A	62	1-2-5-6	7						35		
		SANDY SILT, trace clay, loose to dense, brown, moist	SS1B									29		
			SS2	42	6-7-30-13	37						10		
1.83 / 239.93			SS3A	67	9-20-38-44	58						15		
		SANDY SILT (Till), some clay, trace gravel, very dense, brown, moist	SS3B									5		
			SS4	~~100~~	25-43-49-46	92	9	35	37	19		7		
			SS5	100	19-50/50 mm	R						9		
		- grey, wet at 4.57m BGS	SS6	96	38-46-50/125 mm	96						12		
6.38 / 235.38			SS7	100	28-50/125 mm	R						9		
		End of Hole at 6.38 m BGS												

Plasticity Index (%): 20

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL — w — LL
40 60 80

Water Level(s)

Monitoring Well

Cuttings 0.15 / 241.61
Bentonite
1.22 / 240.54 T.O.S.
1.52 / 240.24
#3 Sand
3.05 / 238.71 B.O.S.
3.05 / 238.71

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Drilling:**

▼ **Upon Completion of Drilling:** 3.96 m **on** 11/03/2025

▽ **Last Water Level Taken:** 25/03/2025

N Value: R - Refusal

Well - Reference Elevation(s)	
Location	Elevation (m)
MW01-25	242.76

T.O.S.: Top of Screen
B.O.S.: Bottom of Screen
Screen Diameter: 51 mm
Screen Slot Size:
Material: PVC

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit
25/03/2025	0.38	

STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

BH02-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 11/03/2025

Drilling Company: GET

Drilling Method(s): Solid Stem Auger

Hole Diameter(s): 152 mm

Northing: 4894434 m

Easting: 703482 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 243.44 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: C. Ayrheart

Reviewed By: M. Nieukirk

Final Depth: 6.23 m

Depth Scale (m)	Depth (m) / Elev. (m)	Strata	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	'N'/RQD Value	Grain Size Analysis (Gravel %, Sand %, Silt %, Clay %, Fines %)	Moisture Content %	PL% - LL%	Plasticity Index (%)	● SPT N-Value ▼ DCPT Value (blows 100mm) Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak □ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual ○ Moisture Content (%) PL w LL	Water Level(s)	Backfill Details
	0.00 / 243.44										20	40 60 80		
	0.30		TOPSOIL (300 mm)	SS1A					32					
	243.14		SANDY SILT, trace clay, trace gravel, loose to compact, brown, moist	SS1B	21	2-4-5-5	9		24					
1				SS2	75	15-11-16-16	27		11					
2	2.13			SS3	100	8-15-13-17	28		9					
	241.31		SANDY SILT (Till), trace clay, trace gravel, very dense, brown, wet - sand seam at 2.44m BGS	SS4	92	27-34-32-28	66		10					
3				SS5	85	41-38-46-34	84		9					
4														
				SS6	100	50/125 mm	R		9					
5														
6	6.23			SS7	100	50/125 mm	R		10					
	237.21		End of Hole at 6.23 m BGS											
7														
8														
9														

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Drilling:**

▼ **Upon Completion of Drilling:** 2.40 m **on** 11/03/2025

▽ **Last Water Level Taken:**

N Value: R - Refusal

Well - Reference Elevation(s)	
Location	Elevation (m)

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit

STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

MW03-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 11/03/2025

Drilling Company: GET

Drilling Method(s): Solid Stem Auger

Hole Diameter(s): 152 mm

Northing: 4894308 m

Easting: 703528 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 244.70 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: C. Ayrheart

Reviewed By: M. Nieukirk

Final Depth: 6.37 m

Depth (m) / Elev. (m)	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	'N'/RQD Value	Moisture Content %	PL% - LL%	Plasticity Index (%)
0.00 / 244.70								
0.36 / 244.34	TOPSOIL (360 mm)							
	SANDY SILT, trace gravel, trace clay, occasional cobbles, loose to compact, brown, moist	SS1	38	2-2-5-3	7	32		
		SS2	29	5-5-5-8	10	39		
		SS3	67	5-5-4-12	9	9		
2.13 / 242.57	SANDY SILT (Till), trace gravel, trace clay, very dense, brown, wet	SS4	100	21-18-23-50 /75 mm	41	17		
	- compact at 3.00m BGS	SS5	100	17-12-13-17	25	10		
		SS6	100	50/125 mm	R	14		
6.37 / 238.33	End of Hole at 6.37 m BGS	SS7	100	16-50/125 mm	R	15		

Grain Size Analysis: Gravel %, Sand %, Silt %, Clay %, Fines %

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL w LL

Water Level(s)

Monitoring Well

Cuttings 0.15 / 244.55
Bentonite
1.22 / 243.48 T.O.S.
1.52 / 243.18
#3 Sand
3.05 / 241.65 B.O.S.
3.05 / 241.65

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

At Time of Drilling:

Upon Completion of Drilling: 0.30 m **on** 11/03/2025

Last Water Level Taken: 25/03/2025

N Value: R - Refusal

Well - Reference Elevation(s)	
Location	Elevation (m)
MW03-25	245.70

T.O.S.: Top of Screen
B.O.S.: Bottom of Screen
Screen Diameter: 51 mm
Screen Slot Size:
Material: PVC

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit
25/03/2025	0.52	

Created with OpenGround Template: GHD-CA-GEO-Overburden-Rev02 / Strip Set: GHD-CA-GEO-Overburden-Log-V5 29/4/25

STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

MW04-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 11/03/2025

Drilling Company: GET

Drilling Method(s): Solid Stem Auger

Hole Diameter(s): 152 mm

Northing: 4894130 m

Easting: 703482 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 243.77 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: C. Ayrheart

Reviewed By: M. Nieukirk

Final Depth: 6.15 m

Depth (m) / Elev. (m)	Strata	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	'N'/RQD Value	Grain Size Analysis (Gravel % / Sand % / Silt % / Clay % / Fines %)	Moisture Content %	PL% - LL%	Plasticity Index (%)
0.00 / 243.77										
0.53		TOPSOIL (530 mm)	SS1	67	1-2-2-2	4		29		
243.24		SANDY SILT, some clay, trace gravel, occasional cobbles, compact to very dense, light brown, moist	SS2	100	4-6-9-12	15		14		
1.50										
242.27		SANDY SILT (Till), with gravel, with clay, occasional cobbles and boulder, light brown, very dense	SS3	100	18-50/25 mm	R		10		
		- very dense, spoon refusal (inferred boulder) at 1.52m BGS								
		- auger grinding at 2.13m BGS	SS4	100	50/75 mm	R		3		
		- cobble crushed by spoon at 2.29m BGS								
		- auger grinding at 3.05m BGS	SS5	100	38-50/75 mm	R		5		
		- wet at 4.57m BGS	SS6	75	8-20-32	52		14		
6.15			SS7	100	50/50 mm	R		8		
237.62		End of Hole at 6.15 m BGS								

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL w LL

Water Level(s)

Monitoring Well

Cuttings 0.15 243.62
Bentonite
1.22 242.55
T.O.S. 1.52 242.25
#3 Sand
3.05 240.72
B.O.S. 3.05 240.72

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Drilling:**

▼ **Upon Completion of Drilling:** 2.90 m **on** 11/03/2025

▼ **Last Water Level Taken:** 25/03/2025

N Value: R - Refusal

Well - Reference Elevation(s)	
Location	Elevation (m)
MW04-25	244.77

T.O.S.: Top of Screen
B.O.S.: Bottom of Screen
Screen Diameter: 51 mm
Screen Slot Size:
Material: PVC

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit
25/03/2025	0.98	

STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

BH05-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 11/03/2025

Drilling Company: GET

Drilling Method(s): Solid Stem Auger

Hole Diameter(s): 152 mm

Northing: 4894073 m

Easting: 703615 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 238.75 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: C. Ayrheart

Reviewed By: M. Nieukirk

Final Depth: 6.71 m

Depth (m) / Elev. (m)	Strata	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	'N'/RQD Value	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Fines %	Moisture Content %	PL% - LL%	Plasticity Index (%)	Water Level(s)	Backfill Details
0.00 / 238.75																
0.41 / 238.34		TOPSOIL (410 mm)	SS1	54	1-1-4-4	5						28				
		SANDY SILT, some clay, compact, brown, moist														
1.52 / 237.23		SANDY SILT (Till), with clay, trace gravel, dense to compact, brown, wet	SS2	100	2-4-8-14	12						17				
		- grey at 2.29m BGS	SS3	100	1-25-17-14	42						13				
			SS4	96	6-8-12-20	20						10				
			SS5	92	14-14-19-22	33						7				
			SS6	100	5-9-11-7	20						11				
6.10 / 232.65		SILT (Till), with clay, trace sand, trace gravel, grey, wet, very stiff	SS7	83	5-8-15-13	23	5	6	69	20		17	16-19	3		
6.71 / 232.04		End of Hole at 6.71 m BGS														

Plasticity Index (%): 20

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL w LL

40 60 80

LL=19
PL=16

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Drilling:**

▼ **Upon Completion of Drilling:** 4.27 m **on** 11/03/2025

▼ **Last Water Level Taken:**

Well - Reference Elevation(s)	
Location	Elevation (m)

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit

STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

MW06D-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 12/03/2025

Drilling Company: GET

Drilling Method(s): Solid Stem Auger

Hole Diameter(s): 152 mm

Northing: 4893929 m

Easting: 703551 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 238.15 m

Elevation Datum: MAMSL

Logged By: C. Ayrheart

Reviewed By: M. Nieukirk

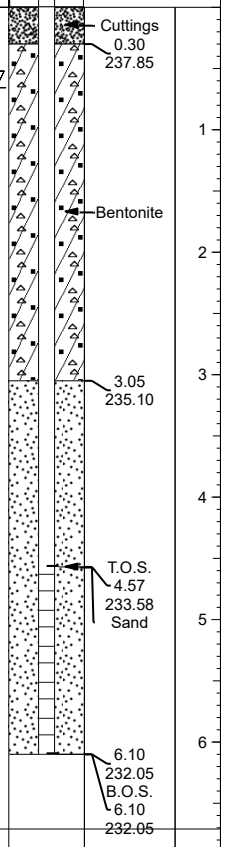
Final Depth: 6.71 m

Coordinates and Elevation Values are Approximate

Depth (m) / Elev. (m)	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	'N'/RQD Value	Grain Size Analysis (Gravel % / Sand % / Silt % / Clay % / Fines %)	Moisture Content %	PL% - LL%	Plasticity Index (%)	Water Level(s)
0.00 / 238.15									20	
0.28 / 237.87	TOPSOIL (280 mm)									
	SANDY SILT, trace clay, trace gravel, loose to compact, brown, moist	SS1	42	3-2-4-4	6		32			
		SS2	100	3-2-3-4	5		22			
	- sand seam at 1.22m BGS	SS3	52	4-5-6-11	11		11			
		SS4	100	5-6-12-14	18		11			
3.05 / 235.10	SILTY CLAY (Till), with sand, trace gravel, stiff, grey, moist	SS5	100	6-11-15-17	26		13			
		SS6	96	3-6-8-6	14	9 / 13 / 34 / 44	17	18-29	11	
	- very stiff at 6.10m BGS	SS7	100	11-12-17-17	29		10			
6.71 / 231.44	End of Hole at 6.71 m BGS									

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL — w — LL
40 60 80

LL=29
PL=18



Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Drilling:**

▼ **Upon Completion of Drilling:** Dry

▼ **Last Water Level Taken:** 25/03/2025

Well - Reference Elevation(s)	
Location	Elevation (m)
MW06D-25	239.15

T.O.S.: Top of Screen
B.O.S.: Bottom of Screen
Screen Diameter: 51 mm
Screen Slot Size:
Material: PVC

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit
25/03/2025	0.65	

STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

MW06S-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 12/03/2025

Drilling Company: GET

Drilling Method(s): Solid Stem Auger

Hole Diameter(s): 152 mm

Northing: 4893930 m

Easting: 703553 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 238.17 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: C. Ayrheart

Reviewed By: M. Nieukirk

Final Depth: 3.05 m

Depth (m) / Elev. (m)	Strata	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	'N'/RQD Value	Grain Size Analysis (Gravel %, Sand %, Silt %, Clay %, Fines %)	Moisture Content %	PL% - LL%	Plasticity Index (%)	Water Level(s)	Monitoring Well
0.00 / 238.17												
0.28 / 237.89		TOPSOIL (280 mm)	SS1									
		SANDY SILT, trace clay, trace gravel, loose, brown, moist										
		- sand seam at 1.22m BGS	SS2									
			SS3									
			SS4									
3.05 / 235.12		End of Hole at 3.05 m BGS										

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL w LL

20 40 60 80

Cuttings 0.30 / 237.87
Bentonite
1.22 / 236.95
T.O.S. 1.52 / 236.65
#3 Sand
B.O.S. 3.05 / 235.12

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

At Time of Drilling:

Upon Completion of Drilling: Dry

Last Water Level Taken: 25/03/2025

Well - Reference Elevation(s)	
Location	Elevation (m)
MW06S-25	239.17

T.O.S.: Top of Screen
B.O.S.: Bottom of Screen
Screen Diameter: 51 mm
Screen Slot Size:
Material: PVC

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit
25/03/2025	0.42	

STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

BH07-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 12/03/2025

Drilling Company: GET

Drilling Method(s): Solid Stem Auger

Hole Diameter(s): 152 mm

Northing: 4893877 m

Easting: 703677 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 243.84 m

Elevation Datum: MAMSL

Logged By: C. Ayrheart

Reviewed By: M. Nieukirk

Final Depth: 6.30 m

Coordinates and Elevation Values are Approximate

Depth (m) / Elev. (m)	Strata	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	'N'/RQD Value	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Fines %	Moisture Content %	PL% - LL%	Plasticity Index (%)	Water Level(s)	Backfill Details
0.00 / 243.84														20		
0.28 / 243.56		TOPSOIL (280 mm)														
		SANDY SILT, trace clay, trace gravel, compact, brown, moist	SS1	38	1-2-3-4	5						30				
			SS2	54	7-6-8-9	14						18				
1.37 / 242.47		GRAVELLY SILTY SAND (Till), with clay, compact, brown, moist														
			SS3	75	11-11-17-22	28	32	33	24	11		7				
		- very dense at 2.30m BGS	SS4	100	22-30-42-42	72						7				
			SS5	67	10-28-50/75 mm	78						7				
			~~SS6~~	~~100~~	~~50/25 mm~~	R						~~7~~				
6.30 / 237.54		End of Hole at 6.30 m BGS	SS7	100	11-50/50 mm	R						11				

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL w LL

40 60 80

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Drilling:**

▼ **Upon Completion of Drilling:** 3.96 m **on** 12/03/2025

▽ **Last Water Level Taken:**

N Value: R - Refusal

Well - Reference Elevation(s)	
Location	Elevation (m)

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit

STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

BH08-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 12/03/2025

Drilling Company: GET

Drilling Method(s): Solid Stem Auger

Hole Diameter(s): 152 mm

Northing: 4893682 m

Easting: 703556 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 244.99 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: C. Ayrheart

Reviewed By: M. Nieukirk

Final Depth: 6.71 m

Depth Scale (m)	Depth (m) / Elev. (m)	Strata	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	'N'/RQD Value	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Fines %	Moisture Content %	PL% - LL%	Plasticity Index (%)	Water Level(s)	Backfill Details
	0.00 / 244.99																
	0.33		TOPSOIL (330 mm)														
	244.66		SILTY CLAY (Till), with sand, trace gravel, stiff to very stiff, brown, moist	SS1	54	7-1-2-2	3						44				
1				SS2	100	2-5-6-8	11						25				
2				SS3	100	6-8-15-12	23						22				
				SS4	92	1-5-10-15	15						21				
3	3.05		- sand seam at 2.87m BGS														
	241.94		SILTY SAND (Till), trace clay, trace gravel, compact, grey, moist - dense at 3.10m BGS	SS5	100	6-14-18-26	32						8				
4																	
5				SS6	100	9-10-15-15	25						8				
6			- dense at 6.10m BGS														
	6.71			SS7	100	13-20-22-21	42						10				
	238.28		End of Hole at 6.71 m BGS														
7																	
8																	
9																	

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL w LL

Plasticity Index (%): 20

Moisture Content %: 40 60 80

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Drilling:**

▼ **Upon Completion of Drilling:** Dry

▽ **Last Water Level Taken:**

Well - Reference Elevation(s)	
Location	Elevation (m)

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit

STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

MW09-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 12/03/2025

Drilling Company: GET

Drilling Method(s): Solid Stem Auger

Hole Diameter(s): 152 mm

Northing: 4893733 m

Easting: 703752 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 242.52 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: C. Ayrheart

Reviewed By: M. Nieukirk

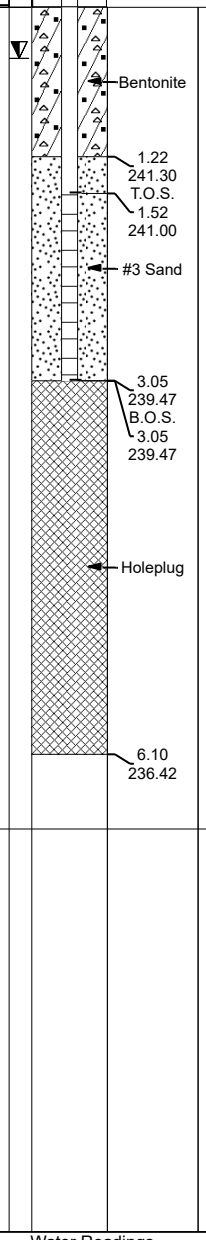
Final Depth: 6.71 m

Depth Scale (m)	Depth (m) / Elev. (m)	Strata	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	'N'/RQD Value	Grain Size Analysis (Gravel % / Sand % / Silt % / Clay % / Fines %)	Moisture Content %	PL% - LL%	Plasticity Index (%)
	0.00 / 242.52										20
	0.21 / 242.31		TOPSOIL (210 mm)	SS1A					26		
1			SILTY CLAY (Till), with sand, trace gravel, stiff to very stiff, brown, moist	SS1B	29	2-2-3-3	5		15		
				SS2	71	5-5-6-9	11		12		
2				SS3	100	4-6-15-10	21		10		
	2.29 / 240.23		SILTY SAND (Till), trace clay, dense, brown, moist	SS4	100	10-15-18-20	33		9		
3				SS5	100	7-35-15-19	50		9		
4											
5			- compact, grey at 4.57m BGS	SS6	100	4-9-18-19	27		6		
6			- very dense at 6.10m BGS	SS7	100	12-32-30-45	62		12		
	6.71 / 235.81		End of Hole at 6.71 m BGS								
7											
8											
9											

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL w LL
20 40 60 80

Water Level(s)

Monitoring Well



Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Drilling:**

▼ **Upon Completion of Drilling:** Dry

▼ **Last Water Level Taken:** 25/03/2025

Well - Reference Elevation(s)	
Location	Elevation (m)
MW09-25	243.52

T.O.S.: Top of Screen
B.O.S.: Bottom of Screen
Screen Diameter: 51 mm
Screen Slot Size:
Material: PVC

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit
25/03/2025	0.41	

STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

BH10-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 12/03/2025 **Northing:** 4893581 m **Logged By:** C. Ayrheart

Drilling Company: GET **Easting:** 703652 m **Reviewed By:** M. Nieukirk

Horizontal Datum: NAD83 / UTM zone 17N

Drilling Method(s): Solid Stem Auger **Elevation:** 244.73 m **Final Depth:** 6.38 m

Hole Diameter(s): 152 mm **Elevation Datum:** MAMSL

Coordinates and Elevation Values are Approximate

Depth (m) / Elev. (m)	Strata	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	'N'/RQD Value	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Fines %	Moisture Content %	PL% - LL%	Plasticity Index (%)	Water Level(s)	Backfill Details
0.00 / 244.73		TOPSOIL (690 mm)	SS1	42	1-1-1-2	2						35				
0.69 / 244.04		SILTY CLAY (Till), with sand, trace gravel, stiff to very stiff, brown, moist	SS2	100	2-3-5-5	8						25				
			SS3	100	6-8-10-12	18						16			▼	
			SS4	25	6-7-7-9	14	11	18	36	35		21	15-32	17		
			SS5	100	4-6-12-12	18						15				
4.57 / 240.16		SILTY SAND (Till), trace clay, trace gravel, dense, grey, moist	SS6	83	13-13-19-17	32						11				
6.38 / 238.35		- very dense at 6.10m BGS End of Hole at 6.38 m BGS	SS7	100	12-50/125 mm	R						12				

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL w LL

20 40 60 80

LL=32
PL=15

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Drilling:**

▼ **Upon Completion of Drilling:** 1.83 m **on** 12/03/2025

▽ **Last Water Level Taken:**

N Value: R - Refusal

Well - Reference Elevation(s)	
Location	Elevation (m)

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit

STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

MW11-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 13/03/2025

Drilling Company: GET

Drilling Method(s): Solid Stem Auger

Hole Diameter(s): 152 mm

Northing: 4893460 m

Easting: 703611 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 250.28 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: C. Ayrheart

Reviewed By: M. Nieukirk

Final Depth: 6.51 m

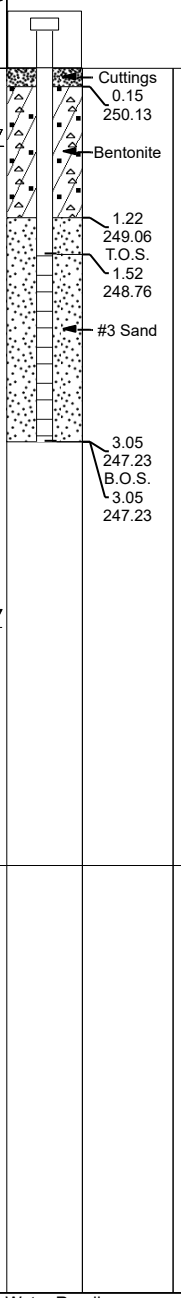
Depth Scale (m)	Depth (m) / Elev. (m)	Strata	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	'N'/RQD Value	Grain Size Analysis (Gravel %, Sand %, Silt %, Clay %, Fines %)	Moisture Content %	PL% - LL%	Plasticity Index (%)
0	0.00 / 250.28										
	0.46 / 249.82		TOPSOIL (460 mm)	SS1	33	0-1-1-1	2		30		
1			SANDY SILT, trace clay, trace gravel, dense, brown, moist	SS2	100	4-11-20-33	31		10		
	1.52 / 248.76		SILTY SAND (Till), with clay, trace gravel, dense to very dense, brown, moist	SS3	100	27-29-32-30	61		8		
2				SS4	33	9-17-15-23	32		12		
3				SS5	100	27-29-32-30	61		9		
4				SS6	100	50/125 mm	R		12		
5											
6			- grey at 6.10m BGS	SS7	99	44-49-50/10 0 mm	99		20		
	6.51 / 243.77		End of Hole at 6.51 m BGS								
7											
8											
9											

20 40 60 80

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL w LL

Water Level(s)

Monitoring Well



Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Drilling:**

▼ **Upon Completion of Drilling:** 4.57 m **on** 13/03/2025

▼ **Last Water Level Taken:** 25/03/2025

N Value: R - Refusal

Well - Reference Elevation(s)	
Location	Elevation (m)
MW11-25	251.28

T.O.S.: Top of Screen
B.O.S.: Bottom of Screen
Screen Diameter: 51 mm
Screen Slot Size:
Material: PVC

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit
25/03/2025	0.63	

STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

BH12-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 13/03/2025

Drilling Company: GET

Drilling Method(s): Solid Stem Auger

Hole Diameter(s): 152 mm

Northing: 4893489 m

Easting: 703852 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 244.32 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: C. Ayrheart

Reviewed By: M. Nieukirk

Final Depth: 6.66 m

Depth (m) / Elev. (m)	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	'N'/RQD Value	Grain Size Analysis (Gravel % / Sand % / Silt % / Clay % / Fines %)	Moisture Content %	PL% - LL%	Plasticity Index (%)	Water Level(s)	Backfill Details
0.00 / 244.32	TOPSOIL (360 mm)	SS1A	100	1-2-2-4	4		27				
0.36 / 243.96	SILTY CLAY (Till), with sand, trace gravel, soft to very stiff, brown, moist	SS1B					28				
		SS2	100	5-6-6-8	12		21				
		SS3	100	6-7-11-13	18		22				
2.30 / 242.02	SILTY SAND (Till), with clay, trace gravel, dense to very dense, grey, moist to wet	SS4	100	7-10-33-29	43		25				
	- sand seam, black at 2.87m BGS	SS5	100	18-33-42-34	75		8				
		SS6	100	14-32-18-19	50		9				
		SS7	100	5-26-46-50/ 100 mm	72		7				
6.66 / 237.66	End of Hole at 6.66 m BGS										

Plasticity Index (%): 20

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL w LL

Moisture Content % axis: 40 60 80

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

At Time of Drilling:

Upon Completion of Drilling: 2.44 m **on** 13/03/2025

Last Water Level Taken:

Well - Reference Elevation(s)	
Location	Elevation (m)

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit

STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

BH13-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 13/03/2025

Drilling Company: GET

Drilling Method(s): Solid Stem Auger

Hole Diameter(s): 152 mm

Northing: 4893396 m

Easting: 703806 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 243.12 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: C. Ayrheart

Reviewed By: M. Nieukirk

Final Depth: 6.71 m

Depth (m) / Elev. (m)	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	'N'/RQD Value	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Fines %	Moisture Content %	PL% - LL%	Plasticity Index (%)
0.00 / 243.12													
0.36 / 242.76	TOPSOIL (360 mm)												
	SILTY CLAY (Till), with sand, trace gravel, firm, brown, moist	SS1	67	2-1-1-2	2						34		
		SS2	100	0-2-3-6	5						19		
	- very stiff at 1.52m BGS	SS3	100	7-7-9-11	16						23		
2.30 / 240.82	SANDY CLAYEY SILT (Till), some gravel, very stiff, grey, wet	SS4	100	7-11-15-16	26						8		
	- hard at 3.10m BGS	SS5	79	16-19-50/100 mm	69						15		
	- very stiff at 4.57m BGS	SS6	58	7-8-13-13	21	11	32	33	24		14	11-18	7
		SS7	67	4-8-9-10	17						33		
6.71 / 236.41	End of Hole at 6.71 m BGS												

20 40 60 80

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL w LL

LL=18
PL=11

Water Level(s)

Backfill Details

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Drilling:**

▼ **Upon Completion of Drilling:** 0.61 m **on** 13/03/2025

▽ **Last Water Level Taken:**

Well - Reference Elevation(s)	
Location	Elevation (m)

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit

STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

BH14-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 12/03/2025

Drilling Company: GET

Drilling Method(s): Solid Stem Auger

Hole Diameter(s): 152 mm

Northing: 4893218 m

Easting: 703705 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 252.28 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: C. Ayrheart

Reviewed By: M. Nieukirk

Final Depth: 6.68 m

Depth Scale (m)	Depth (m) / Elev. (m)	Strata	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	'N'/RQD Value	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Fines %	Moisture Content %	PL% - LL%	Plasticity Index (%)	Water Level(s)	Backfill Details
0	0.00 / 252.28																
	0.23 / 252.05		TOPSOIL (230 mm)	SS1A	62	1-2-3-4	5						24				
			SANDY SILT, trace clay, trace gravel, loose to compact, brown, moist	SS1B									18				
1				SS2	100	4-4-3-6	7						13				
2	2.29 / 249.99			SS3	52	3-4-6-6	10						14				
			SILTY SAND (Till), with clay, with gravel, very dense, brown, moist	SS4	70	17-27-27-24	54	14	38	30	18		7				
3			- dense at 3.10m BGS	SS5	100	15-16-18-19	34						8				
4																	
5				SS6	100	9-17-19-19	36						9				
6			- very dense at 6.10m BGS	SS7	100	19-30-48-50 /125 mm	78						8				
	6.68 / 245.60		End of Hole at 6.68 m BGS														
7																	
8																	
9																	

Plasticity Index (%): 20

Moisture Content %: ● SPT N-Value; ▼ DCPT Value (blows 100mm); Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak; □ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual; ○ Moisture Content (%); PL — w — LL; 40 60 80

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

At Time of Drilling:

Upon Completion of Drilling: Dry

Last Water Level Taken:

Well - Reference Elevation(s)	
Location	Elevation (m)

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit

TEST PIT STRATIGRAPHIC RECORD

TP01-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 24/03/2025

Drilling Company: Leahy Excavation

Drilling Method(s): Backhoe

Northing: 4894441 m

Easting: 703346 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 242.01 m

Elevation Datum: MAMSL

Logged By: C. Baggesen

Reviewed By: M. Nieukirk

Final Depth: 3.02 m

Dimension:

Coordinates and Elevation Values are Approximate

Depth Scale (m)	Depth (m) / Elev. (m)	Strata	Description	Remarks	Sample Number	Grain Size Analysis (Gravel %, Sand %, Silt %, Clay %, Fines %)	Moisture Content %	Water Level(s)	Backfill Details
	0.00 / 242.01								
	0.23 / 241.78		TOPSOIL (230 mm)						
	0.67 / 241.34		SANDY SILT, trace gravel, brown, reddish, moist		GS1		32		
1			SANDY SILT (Till), some clay, trace gravel, occasional cobble, light brown, moist		GS2		29		
2			- groundwater seepage at 1.74m BGS - trace clay at 2.13m BGS						
	3.02 / 238.99				GS3		11		
3			End of Test Pit at 3.02 m BGS						
4									
5									
6									
7									
8									
9									

Moisture Content %: ● SPT N-Value; ▼ DCPT Value (blows 100mm); Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak; □ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual; ○ Moisture Content (%); PL w LL

Moisture Content % scale: 20, 40, 60, 80

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Excavation:**

▼ **Upon Completion of Excavation:**

Well - Reference Elevation(s)	
Location	Elevation (m)

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit

TEST PIT STRATIGRAPHIC RECORD

TP02-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 24/03/2025

Drilling Company: Leahy Excavation

Drilling Method(s): Backhoe

Northing: 4894282 m

Easting: 703533 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 245.05 m

Elevation Datum: MAMSL

Logged By: C. Baggesen

Reviewed By: M. Nieukirk

Final Depth: 2.53 m

Dimension:

Coordinates and Elevation Values are Approximate

Depth Scale (m)	Depth (m) / Elev. (m)	Strata	Description	Remarks	Sample Number	Grain Size Analysis (Gravel %, Sand %, Silt %, Clay %, Fines %)	Moisture Content %	Water Level(s)	Backfill Details
	0.00 / 245.05								
	0.30 / 244.75		TOPSOIL (300 mm)						
			SANDY SILT, trace gravel, trace organics, reddish brown, moist		GS1		26		
1	1.01 / 244.04		- water seepage at 0.91m BGS SANDY SILT (Till), some clay, trace gravel, occasional cobble, light brown, moist		GS2		22		
2			- trace clay at 2.23m BGS						
	2.53 / 242.52		End of Test Pit at 2.53 m BGS		GS3		4		
3									
4									
5									
6									
7									
8									
9									

Moisture Content %: 20

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL w LL
40 60 80

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Excavation:**

▼ **Upon Completion of Excavation:**

Well - Reference Elevation(s)	
Location	Elevation (m)

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit

TEST PIT STRATIGRAPHIC RECORD

TP03-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 24/03/2025

Drilling Company: Leahy Excavation

Drilling Method(s): Backhoe

Northing: 4894123 m

Easting: 703491 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 243.06 m

Elevation Datum: MAMSL

Logged By: C. Baggesen

Reviewed By: M. Nieukirk

Final Depth: 3.05 m

Dimension:

Coordinates and Elevation Values are Approximate

Depth Scale (m)	Depth (m) / Elev. (m)	Strata	Description	Remarks	Sample Number	Grain Size Analysis (Gravel %, Sand %, Silt %, Clay %, Fines %)	Moisture Content %	Water Level(s)	Backfill Details
	0.00 / 243.06								
	0.46 / 242.60		TOPSOIL (460 mm)						
	0.76 / 242.30		SANDY SILT, trace organics, trace gravel, reddish brown		GS1		23		
1			SILTY SAND (Till), with clay, trace gravel, light brown, moist - groundwater seepage at 1.07m BGS		GS2		12		
2			- trace clay at 1.83m BGS		GS3		21		
3	3.05 / 240.01		End of Test Pit at 3.05 m BGS						

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL w LL

Moisture Content % scale: 20, 40, 60, 80

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Excavation:**

▼ **Upon Completion of Excavation:**

Well - Reference Elevation(s)	
Location	Elevation (m)

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit

TEST PIT STRATIGRAPHIC RECORD

TP04-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 24/03/2025

Drilling Company: Leahy Excavation

Drilling Method(s): Backhoe

Northing: 4893893 m

Easting: 703589 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 240.66 m

Elevation Datum: MAMSL

Logged By: C. Baggesen

Reviewed By: M. Nieukirk

Final Depth: 3.05 m

Dimension:

Coordinates and Elevation Values are Approximate

Depth Scale (m)	Depth (m) / Elev. (m)	Strata	Description	Remarks	Sample Number	Grain Size Analysis (Gravel %, Sand %, Silt %, Clay %, Fines %)	Moisture Content %	Water Level(s)	Backfill Details
	0.00 / 240.66								
	0.27 / 240.39		TOPSOIL (230 mm)						
	0.55 / 240.11		SANDY SILT, trace gravel, trace clay, trace organics, reddish brown, moist		GS1		36		
1			SANDY SILT (Till), with clay, trace gravel, occasional cobbles, light brown, moist		GS2		33		
2									
3	3.05 / 237.61		End of Test Pit at 3.05 m BGS		GS3		30		
4									
5									
6									
7									
8									
9									

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL w LL

Moisture Content % scale: 20, 40, 60, 80

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Excavation:**

▼ **Upon Completion of Excavation:**

Well - Reference Elevation(s)	
Location	Elevation (m)

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit

TEST PIT STRATIGRAPHIC RECORD

TP05-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 24/03/2025

Drilling Company: Leahy Excavation

Drilling Method(s): Backhoe

Northing: 4893645 m

Easting: 703780 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 242.79 m

Elevation Datum: MAMSL

Logged By: C. Baggesen

Reviewed By: M. Nieukirk

Final Depth: 3.05 m

Dimension:

Coordinates and Elevation Values are Approximate

Depth Scale (m)	Depth (m) / Elev. (m)	Strata	Description	Remarks	Sample Number	Grain Size Analysis (Gravel %, Sand %, Silt %, Clay %, Fines %)	Moisture Content %	Water Level(s)	Backfill Details
	0.00 / 242.79								
	0.30		TOPSOIL (300 mm)						
	242.49		SANDY SILT, trace gravel, trace clay, trace organics, reddish brown, moist		GS1		37		
	0.73 / 242.06		SANDY SILT (Till), with clay, trace gravel, occasional cobbles, light brown, moist		GS2		19		
3	3.05 / 239.74		End of Test Pit at 3.05 m BGS		GS3		13		

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL w LL

Moisture Content % scale: 20, 40, 60, 80

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Excavation:**

▼ **Upon Completion of Excavation:**

Well - Reference Elevation(s)	
Location	Elevation (m)

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit

TEST PIT STRATIGRAPHIC RECORD

TP06-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 24/03/2025

Drilling Company: Leahy Excavation

Drilling Method(s): Backhoe

Northing: 4893381 m

Easting: 703825 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 243.44 m

Elevation Datum: MAMSL

Logged By: C. Baggesen

Reviewed By: M. Nieukirk

Final Depth: 3.02 m

Dimension:

Coordinates and Elevation Values are Approximate

Depth Scale (m)	Depth (m) / Elev. (m)	Strata	Description	Remarks	Sample Number	Grain Size Analysis (Gravel %, Sand %, Silt %, Clay %, Fines %)	Moisture Content %	● SPT N-Value ▼ DCPT Value (blows 100mm) Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak □ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual ○ Moisture Content (%) PL w LL	Water Level(s)	Backfill Details
	0.00 / 243.44						20	40 60 80		
	0.23		TOPSOIL (200 mm)							
	243.21		SANDY CLAYEY SILT (Till), trace gravel, reddish brown, moist		GS1		28	○		
1			- light brown at 0.84m BGS							
					GS2		28	○		
2										
			- trace clay at 2.44m BGS		GS3		9	○		
3	3.02 / 240.42		End of Test Pit at 3.02 m BGS							
4										
5										
6										
7										
8										
9										

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Excavation:**

▼ **Upon Completion of Excavation:**

Well - Reference Elevation(s)	
Location	Elevation (m)

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit

TEST PIT STRATIGRAPHIC RECORD

TP07-25

Project Number: 12662438

Client: Vargas P Inc.

Project: Geotechnical and Hydrogeological, Fallis Line

Location: Lot 13, Concession 6, Township of Cavan-Monaghan

Date Range (dd/mm/yyyy): 24/03/2025

Drilling Company: Leahy Excavation

Drilling Method(s): Backhoe

Northing: 4893268 m

Easting: 703903 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 246.48 m

Elevation Datum: MAMSL

Logged By: C. Baggesen

Reviewed By: M. Nieukirk

Final Depth: 3.05 m

Dimension:

Coordinates and Elevation Values are Approximate

Depth Scale (m)	Depth (m) / Elev. (m)	Strata	Description	Remarks	Sample Number	Grain Size Analysis (Gravel %, Sand %, Silt %, Clay %, Fines %)	Moisture Content %	Water Level(s)	Backfill Details
	0.00 / 246.48								
	0.30		TOPSOIL (300 mm)						
	246.18		SANDY SILT, with clay, trace organics, trace gravel, reddish brown, moist		GS1		35		
	0.88								
1	245.60		SANDY CLAYEY SILT (Till), trace gravel, light brown, moist - groundwater seepage at 1.01m BGS		GS2		14		
2									
3	3.05				GS3		19		
	243.43		End of Test Pit at 3.05 m BGS						
4									
5									
6									
7									
8									
9									

Grain Size Analysis: Gravel %, Sand %, Silt %, Clay %, Fines %

Moisture Content %: 20

● SPT N-Value
▼ DCPT Value (blows 100mm)
Δ Peak Undrained Shear Strength (vane), C_u (kPa)-Peak
□ Remoulded Undrained Shear Strength (Vane), C_u (kPa)-Residual
○ Moisture Content (%)
PL w LL
40 60 80

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▽ **At Time of Excavation:**

▼ **Upon Completion of Excavation:**

Well - Reference Elevation(s)	
Location	Elevation (m)

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit

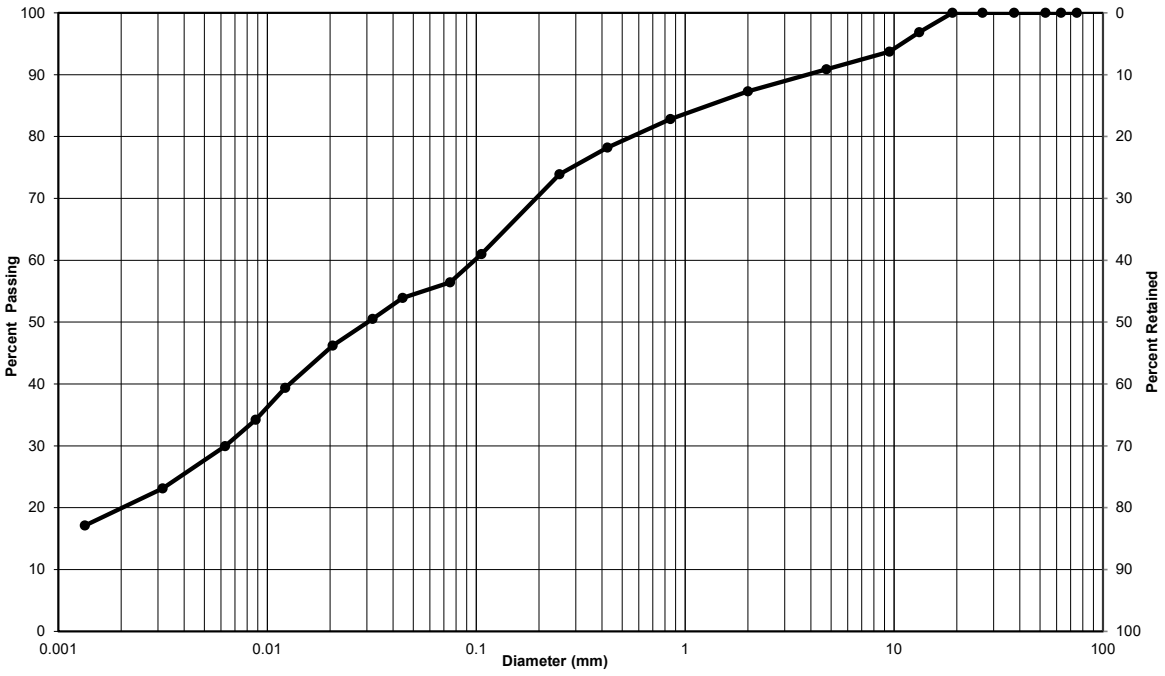
Appendix C

Geotechnical Laboratory Testing Results

Particle-Size Analysis of Soils

MTO LS-702/ASTM D422 (Geotechnical)

Client:	Vargas P Inc.	**Lab No.:**	SS-25-26
Project/Site:	Fallis Line, Millbrook, ON	**Project No.:**	12662438-01
Borehole No.:	BH1-25	Sample No.:	SS4
Depth:	2.3-2.9m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sandy silt, some clay, trace gravel	9	35	56
Silt-size particles (%) :	37		
Clay-size particles (%) (<0.002 mm):	19		

Additional laboratory reporting information available upon request.

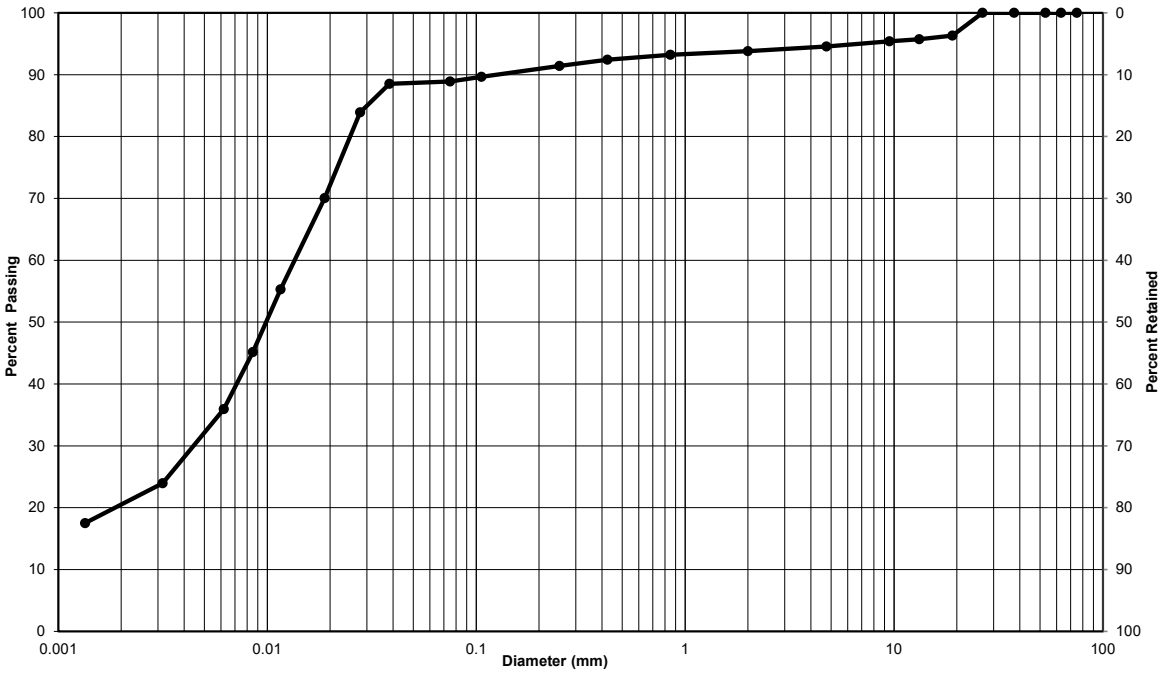
Remarks:

Performed by:	Alex Fawcett	**Date:**	April 9, 2025
Verified by:	Joe Sullivan	**Date:**	April 9, 2025
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Particle-Size Analysis of Soils

MTO LS-702/ASTM D422 (Geotechnical)

Client:	Vargas P Inc.	**Lab No.:**	SS-25-26
Project/Site:	Fallis Line, Millbrook, ON	**Project No.:**	12662438-01
Borehole No.:	BH5-25	Sample No.:	SS7
Depth:	6.1-6.7m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silt, some clay, trace sand and gravel	5	6	89
Silt-size particles (%) :	69		
Clay-size particles (%) (<0.002 mm):	20		

Additional laboratory reporting information available upon request.

Remarks:

Performed by:	Alex Fawcett	**Date:**	April 9, 2025
Verified by:	Joe Sullivan	**Date:**	April 9, 2025
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Liquid Limit, Plastic Limit and Plasticity Index of Soils

(ASTM D4318, MTO LS-703/704)

Client:	Vargas P. Inc.	**Lab no.:**	SS-25-26
Project/Site:	Fallis Line, Millbrook, ON	**Project no.:**	12662438-01

Borehole no.:	BH5-25	Sample no.:	SS7	Sample Depth:	6.1-6.7m
Soil Description:				Date sampled:	-

Apparatus:	Hand Crank	Balance no.:	10	Porcelain bowl no.:	1
Liquid limit device no.:	1	Oven no.:	B23-002667	Spatula no.:	1
Sieve no.:	0.425	Glass plate no.:	1		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	15	22	32
Water Content:			
Tare no.	17	737	132
Wet soil+tare, g	34.34	29.75	33.44
Dry soil+tare, g	32.22	28.35	31.64
Mass of water, g	2.12	1.40	1.80
Tare, g	21.67	21.19	22.06
Mass of soil, g	10.55	7.16	9.58
Water content %	20.1%	19.6%	18.8%

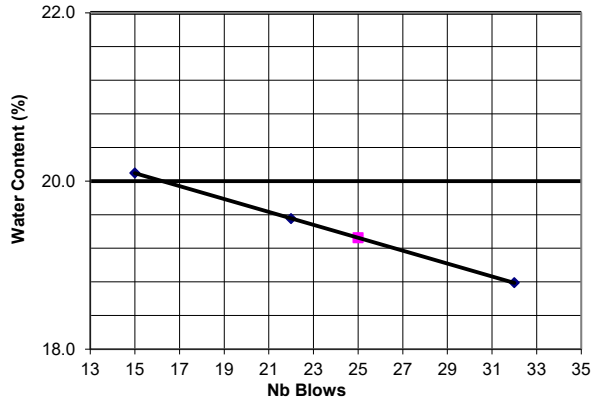
Plastic Limit (PL) - Water Content:		
Tare no.	24	142
Wet soil+tare, g	29.39	28.98
Dry soil+tare, g	28.33	27.97
Mass of water, g	1.06	1.01
Tare, g	21.59	21.51
Mass of soil, g	6.74	6.46
Water content %	15.7%	15.6%
Average water content %	15.7%	

Natural Water Content (W^n):		
Tare no.	BOWL	
Wet soil+tare, g	1083.43	
Dry soil+tare, g	954.20	
Mass of water, g	129.23	
Tare, g	197.50	
Mass of soil, g	756.70	
Water content %	17.1%	

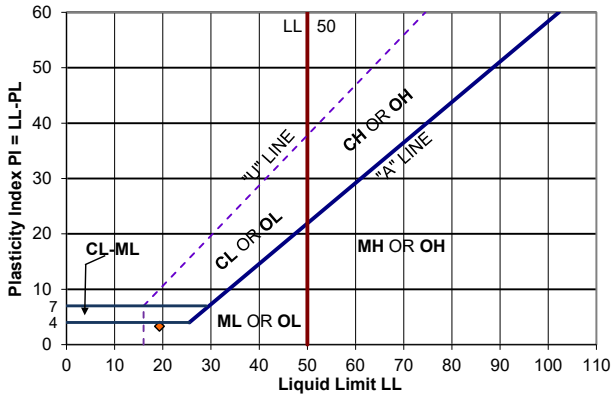
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation (oven dried))
- ☐ Dry preparation (air dried)
- ☐ Wet preparation

Results



Soil Plasticity Chart ASTM D2487



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content Wn
19	16	3	17.1

Plasticity Chart based on ASTM D2487. Additional laboratory reporting information available upon request.

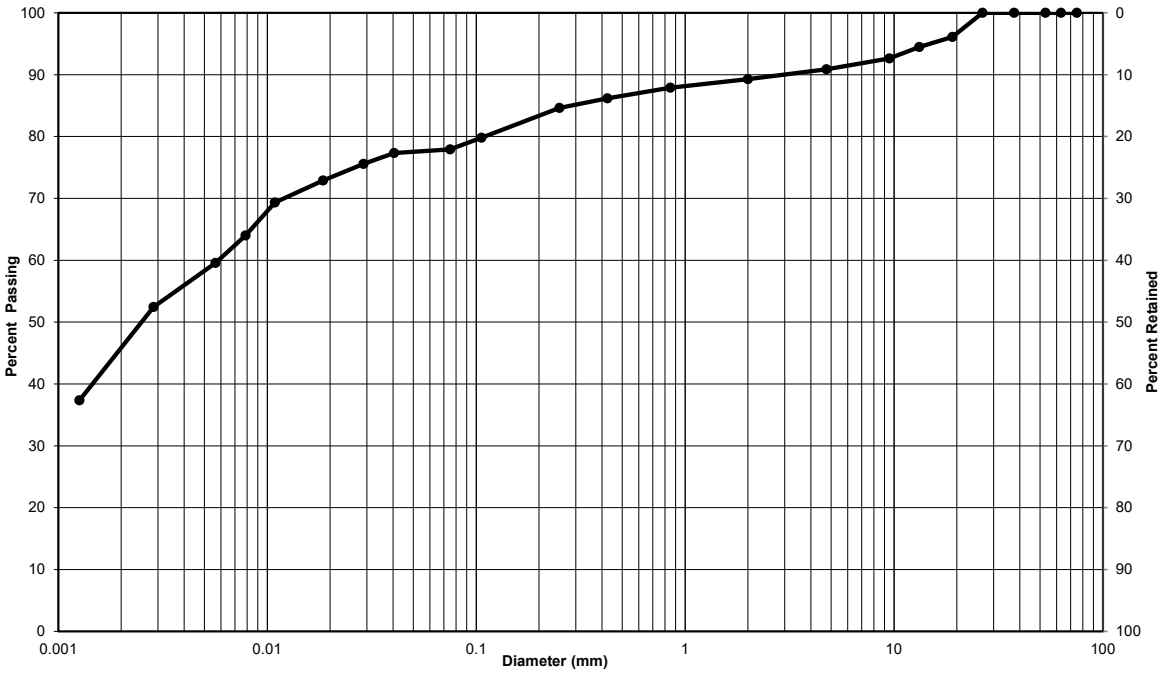
Remarks:

Performed by:	Josh Sullvan	**Date:**	April 9, 2025
Reviewed by:	Joe Sullivan	**Date:**	April 9, 2025
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Particle-Size Analysis of Soils

MTO LS-702/ASTM D422 (Geotechnical)

Client:	Vargas P Inc.	**Lab No.:**	SS-25-26
Project/Site:	Fallis Line, Millbrook, ON	**Project No.:**	12662438-01
Borehole No.:	BH6-25	Sample No.:	SS6
Depth:	4.6-5.2m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty clay, some sand, trace gravel	9	13	78
Silt-size particles (%) :	34		
Clay-size particles (%) (<0.002 mm):	44		

Additional laboratory reporting information available upon request.

Remarks:

Performed by:	Alex Fawcett	**Date:**	April 9, 2025
Verified by:	Joe Sullivan	**Date:**	April 9, 2025
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Liquid Limit, Plastic Limit and Plasticity Index of Soils

(ASTM D4318, MTO LS-703/704)

Client:	Vargas P. Inc.	**Lab no.:**	SS-25-26
Project/Site:	Fallis Line, Millbrook, ON	**Project no.:**	12662438-01

Borehole no.:	BH6-25	Sample no.:	SS6	Sample Depth:	4.6-5.2m
Soil Description:				Date sampled:	-

Apparatus:	Hand Crank	Balance no.:	10	Porcelain bowl no.:	1
Liquid limit device no.:	1	Oven no.:	B23-002667	Spatula no.:	1
Sieve no.:	0.425	Glass plate no.:	1		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	35	29	19
Water Content:			
Tare no.	1	71	401
Wet soil+tare, g	31.55	28.33	30.46
Dry soil+tare, g	29.41	26.70	28.30
Mass of water, g	2.14	1.63	2.16
Tare, g	21.68	21.05	21.21
Mass of soil, g	7.73	5.65	7.09
Water content %	27.7%	28.8%	30.5%

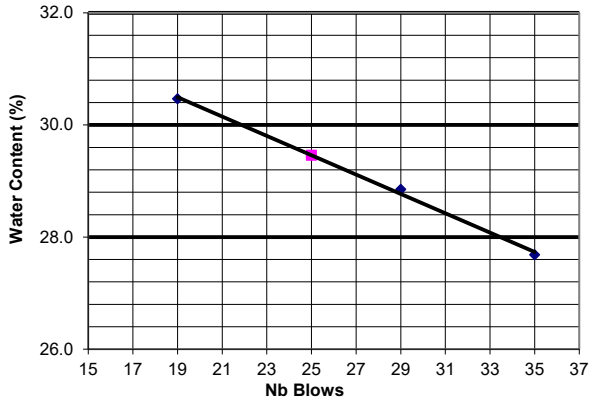
Plastic Limit (PL) - Water Content:		
Tare no.	326	330
Wet soil+tare, g	30.13	29.87
Dry soil+tare, g	28.77	28.57
Mass of water, g	1.36	1.30
Tare, g	21.11	21.07
Mass of soil, g	7.66	7.50
Water content %	17.8%	17.3%
Average water content %	17.5%	

Natural Water Content (W^n):		
Tare no.	BOWL	
Wet soil+tare, g	1252.80	
Dry soil+tare, g	1095.82	
Mass of water, g	156.98	
Tare, g	193.48	
Mass of soil, g	902.34	
Water content %	17.4%	

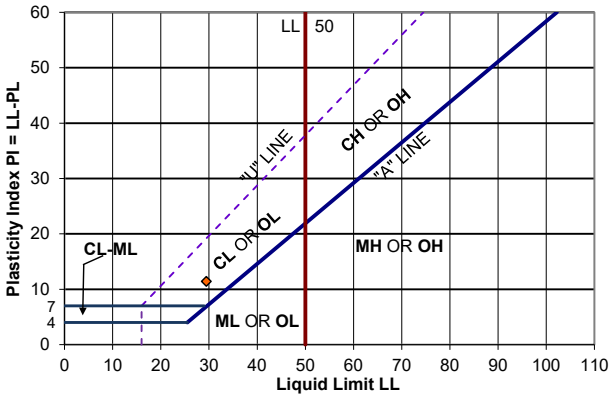
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation (oven dried))
- ☐ Dry preparation (air dried)
- ☐ Wet preparation

Results



Soil Plasticity Chart ASTM D2487



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content Wn
29	18	11	17.4

Plasticity Chart based on ASTM D2487. Additional laboratory reporting information available upon request.

Remarks:

Performed by: Josh Sullvan **Date:** April 9, 2025

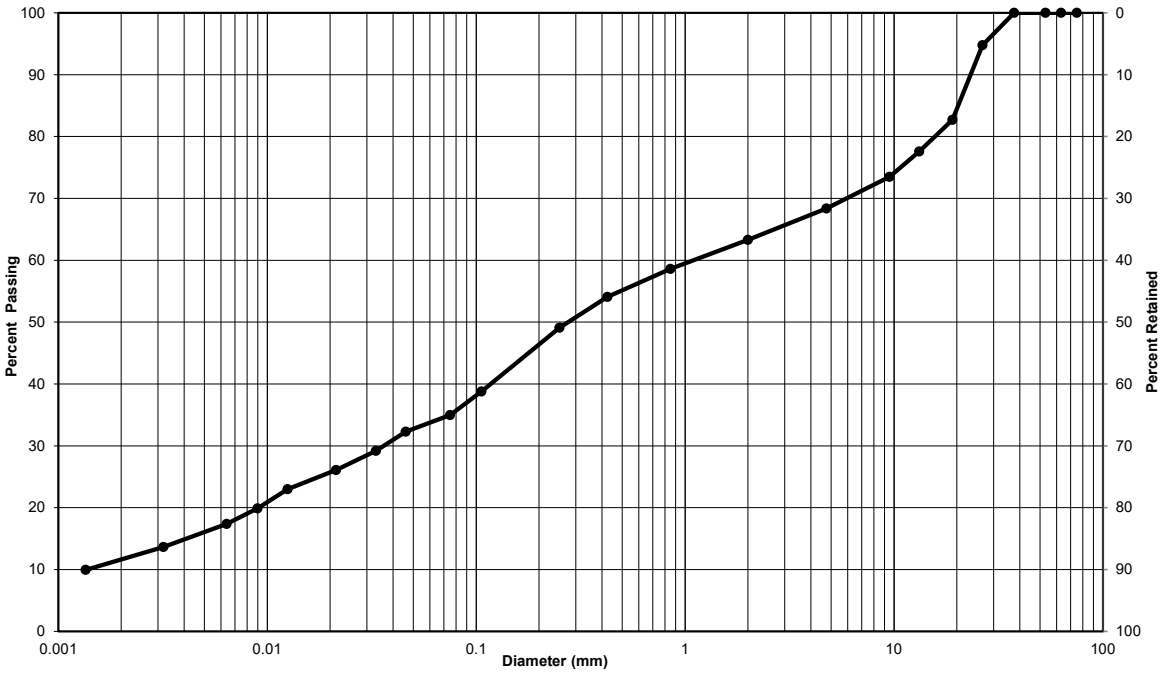
Reviewed by: Joe Sullivan **Date:** April 9, 2025

Laboratory Location: GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON

Particle-Size Analysis of Soils

MTO LS-702/ASTM D422 (Geotechnical)

Client:	Vargas P Inc.	**Lab No.:**	SS-25-26
Project/Site:	Fallis Line, Millbrook, ON	**Project No.:**	12662438-01
Borehole No.:	BH7-25	Sample No.:	SS3
Depth:	1.5-2.1m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Gravelly, silty sand, some clay	32	33	35
Silt-size particles (%) :	24		
Clay-size particles (%) (<0.002 mm):	11		

Additional laboratory reporting information available upon request.

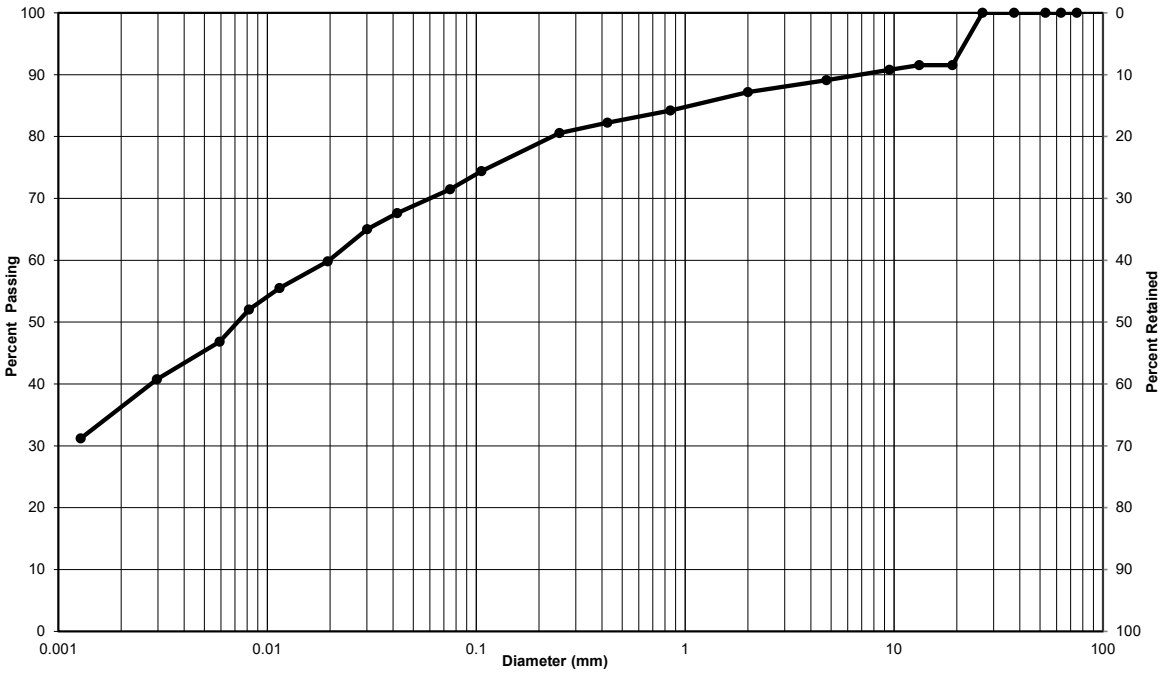
Remarks:

Performed by:	Alex Fawcett	**Date:**	April 9, 2025
Verified by:	Joe Sullivan	**Date:**	April 9, 2025
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Particle-Size Analysis of Soils

MTO LS-702/ASTM D422 (Geotechnical)

Client:	Vargas P Inc.	**Lab No.:**	SS-25-26
Project/Site:	Fallis Line, Millbrook, ON	**Project No.:**	12662438-01
Borehole No.:	BH10-25	Sample No.:	SS4
Depth:	2.3-2.9m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silt and clay, some sand and gravel	11	18	71
Silt-size particles (%) :	36		
Clay-size particles (%) (<0.002 mm):	35		

Additional laboratory reporting information available upon request.

Remarks:

Performed by:	Alex Fawcett	**Date:**	April 9, 2025
Verified by:	Joe Sullivan	**Date:**	April 9, 2025
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Liquid Limit, Plastic Limit and Plasticity Index of Soils

(ASTM D4318, MTO LS-703/704)

Client:	Vargas P. Inc.	**Lab no.:**	SS-25-26
Project/Site:	Fallis Line, Millbrook, ON	**Project no.:**	12662438-01

Borehole no.:	BH10-25	Sample no.:	SS4	Sample Depth:	2.3-2.9m
Soil Description:				Date sampled:	-

Apparatus:	Hand Crank	Balance no.:	10	Porcelain bowl no.:	1
Liquid limit device no.:	1	Oven no.:	B23-002667	Spatula no.:	1
Sieve no.:	0.425	Glass plate no.:	1		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	35	21	15
Water Content:			
Tare no.	317	320	325
Wet soil+tare, g	29.83	28.87	29.42
Dry soil+tare, g	27.79	26.97	27.31
Mass of water, g	2.04	1.90	2.11
Tare, g	21.20	21.15	21.06
Mass of soil, g	6.59	5.82	6.25
Water content %	31.0%	32.6%	33.8%

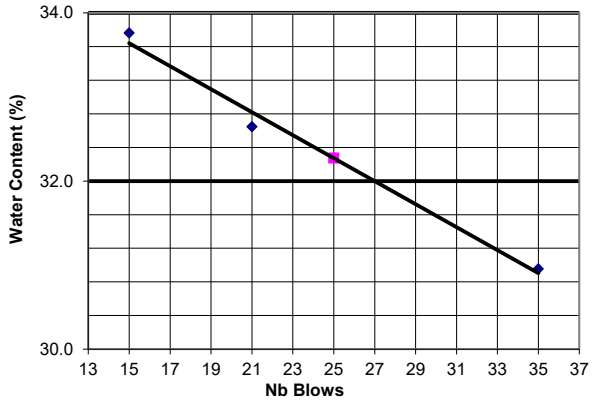
Plastic Limit (PL) - Water Content:		
Tare no.	10	17
Wet soil+tare, g	30.17	31.37
Dry soil+tare, g	29.07	30.12
Mass of water, g	1.10	1.25
Tare, g	21.59	21.79
Mass of soil, g	7.48	8.33
Water content %	14.7%	15.0%
Average water content %	14.9%	

Natural Water Content (W^n):		
Tare no.	BOWL	
Wet soil+tare, g	490.85	
Dry soil+tare, g	432.76	
Mass of water, g	58.09	
Tare, g	158.96	
Mass of soil, g	273.80	
Water content %	21.2%	

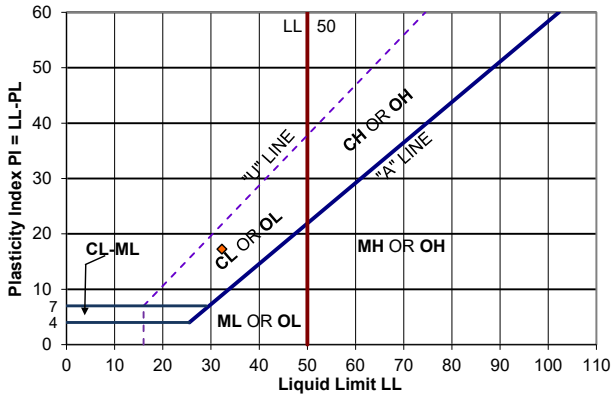
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation (oven dried))
- ☐ Dry preparation (air dried)
- ☐ Wet preparation

Results



Soil Plasticity Chart ASTM D2487



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content Wn
32	15	17	21.2

Plasticity Chart based on ASTM D2487. Additional laboratory reporting information available upon request.

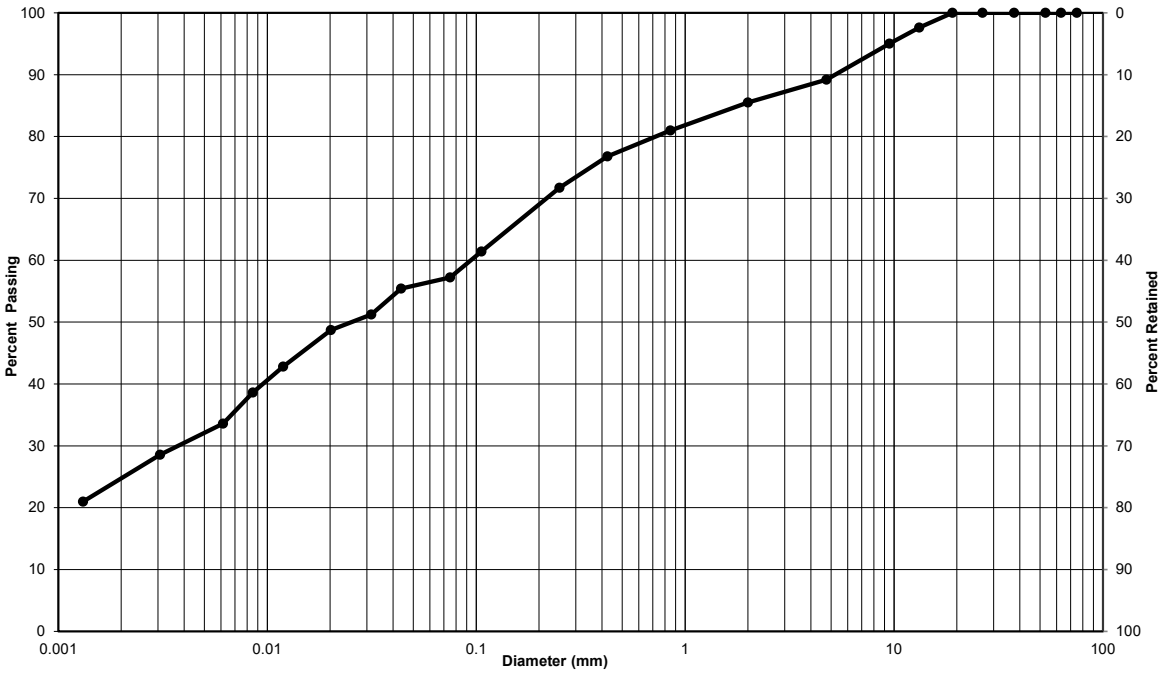
Remarks:

Performed by:	Josh Sullvan	**Date:**	April 9, 2025
Reviewed by:	Joe Sullivan	**Date:**	April 9, 2025
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Particle-Size Analysis of Soils

MTO LS-702/ASTM D422 (Geotechnical)

Client:	Vargas P Inc.	**Lab No.:**	SS-25-26
Project/Site:	Fallis Line, Millbrook, ON	**Project No.:**	12662438-01
Borehole No.:	BH13-25	Sample No.:	SS6
Depth:	4.6-5.2m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sandy, clayey silt, some gravel	11	32	57
Silt-size particles (%) :	33		
Clay-size particles (%) (<0.002 mm):	24		

Additional laboratory reporting information available upon request.

Remarks:

Performed by:	Alex Fawcett	**Date:**	April 9, 2025
Verified by:	Joe Sullivan	**Date:**	April 9, 2025
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Liquid Limit, Plastic Limit and Plasticity Index of Soils

(ASTM D4318, MTO LS-703/704)

Client:	Vargas P. Inc.	**Lab no.:**	SS-25-26
Project/Site:	Fallis Line, Millbrook, ON	**Project no.:**	12662438-01

Borehole no.:	BH13-25	Sample no.:	SS6	Sample Depth:	4.6-5.2m
Soil Description:				Date sampled:	-

Apparatus:	Hand Crank	Balance no.:	10	Porcelain bowl no.:	1
Liquid limit device no.:	1	Oven no.:	B23-002667	Spatula no.:	1
Sieve no.:	0.425	Glass plate no.:	1		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	15	24	29
Water Content:			
Tare no.	118	303	324
Wet soil+tare, g	30.76	31.74	29.82
Dry soil+tare, g	29.27	30.16	28.53
Mass of water, g	1.49	1.58	1.29
Tare, g	21.78	21.49	21.20
Mass of soil, g	7.49	8.67	7.33
Water content %	19.9%	18.2%	17.6%

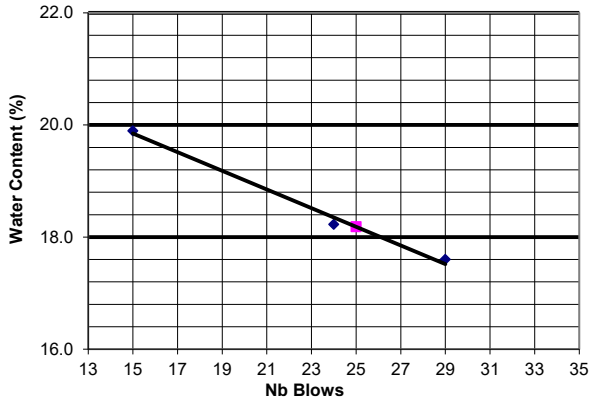
Plastic Limit (PL) - Water Content:		
Tare no.	321	322
Wet soil+tare, g	30.33	30.15
Dry soil+tare, g	29.39	29.23
Mass of water, g	0.94	0.92
Tare, g	21.14	21.16
Mass of soil, g	8.25	8.07
Water content %	11.4%	11.4%
Average water content %	11.4%	

Natural Water Content (W^n):		
Tare no.	BOWL	
Wet soil+tare, g	783.23	
Dry soil+tare, g	714.83	
Mass of water, g	68.40	
Tare, g	210.91	
Mass of soil, g	503.92	
Water content %	13.6%	

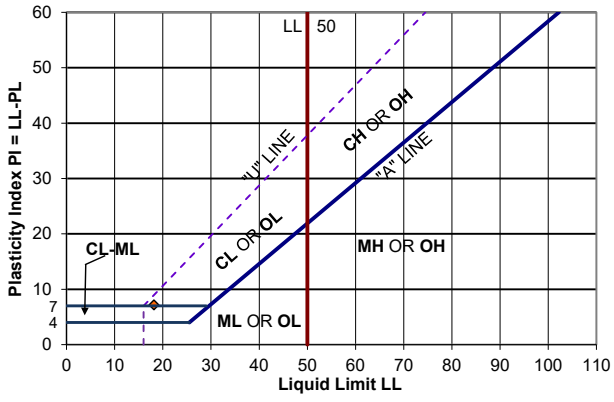
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation (oven dried))
- ☐ Dry preparation (air dried)
- ☐ Wet preparation

Results



Soil Plasticity Chart ASTM D2487



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content Wn
18	11	7	13.6

Plasticity Chart based on ASTM D2487. Additional laboratory reporting information available upon request.

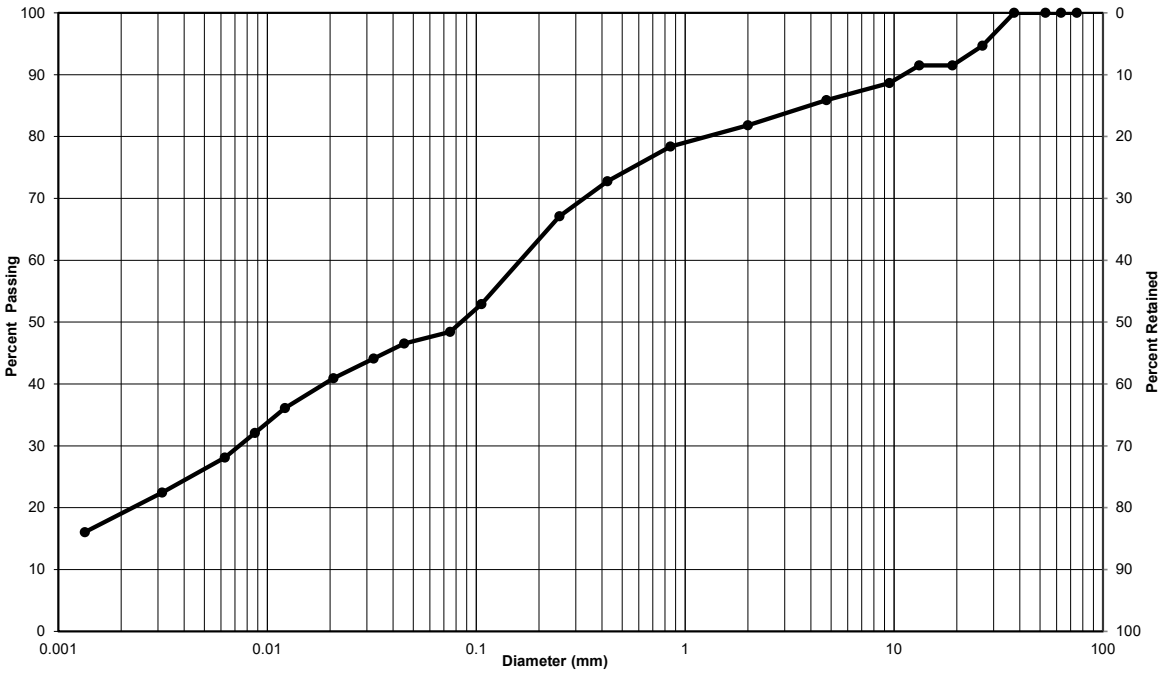
Remarks:

Performed by:	Josh Sullvan	**Date:**	April 9, 2025
Reviewed by:	Joe Sullivan	**Date:**	April 9, 2025
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Particle-Size Analysis of Soils

MTO LS-702/ASTM D422 (Geotechnical)

Client:	Vargas P Inc.	**Lab No.:**	SS-25-26
Project/Site:	Fallis Line, Millbrook, ON	**Project No.:**	12662438-01
Borehole No.:	BH14-25	Sample No.:	SS4
Depth:	2.3-2.9m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty sand, some clay and gravel	14	38	48
Silt-size particles (%) :	30		
Clay-size particles (%) (<0.002 mm):	18		

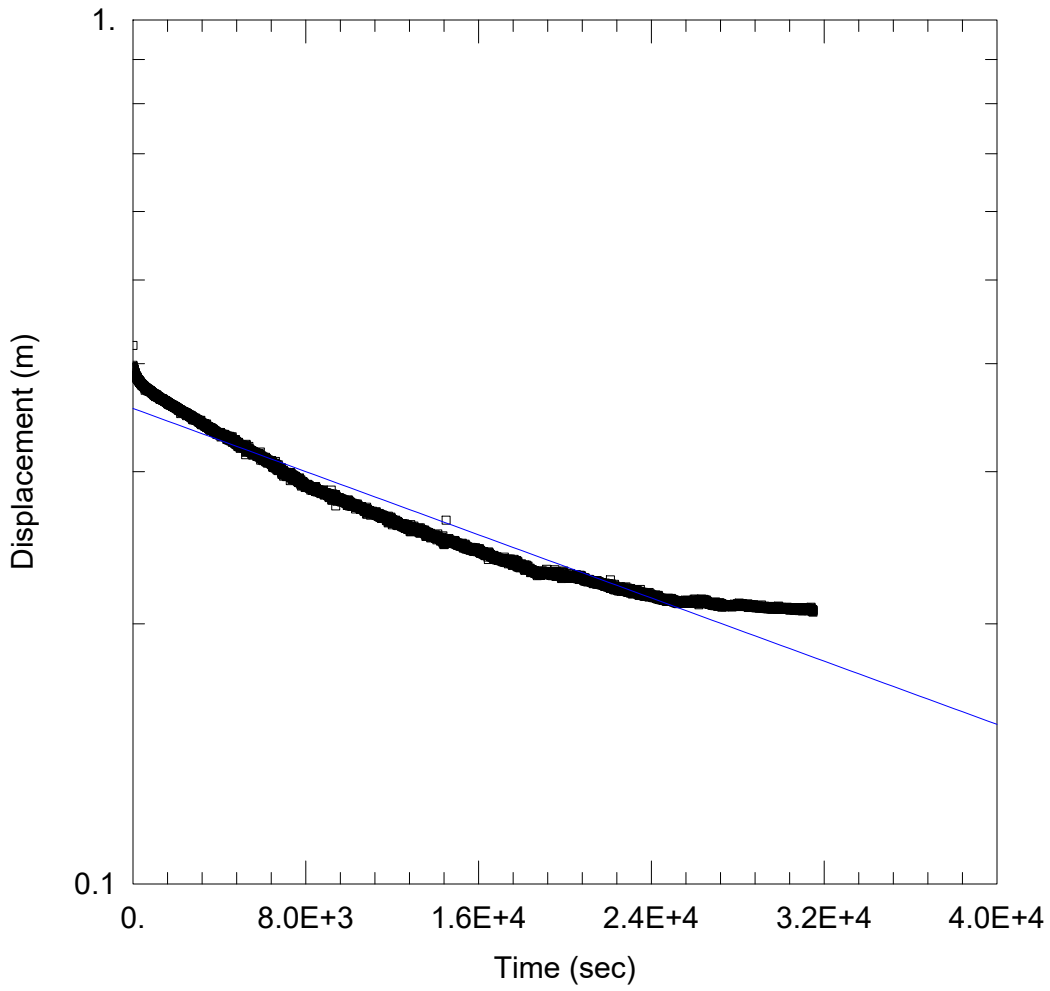
Additional laboratory reporting information available upon request.

Remarks:

Performed by:	Alex Fawcett	**Date:**	April 9, 2025
Verified by:	Joe Sullivan	**Date:**	April 9, 2025
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Appendix D

Single Well Response Testing Results



MW1-25: FALLING HEAD TEST

Data Set: N:\...\12662438-SWRT-MW1-25-FH.aqt
Date: 04/29/25 Time: 10:08:23

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW1-25
Test Date: 25/03/24

AQUIFER DATA

Saturated Thickness: 2.43 m Anisotropy Ratio (Kz/Kr): 1.

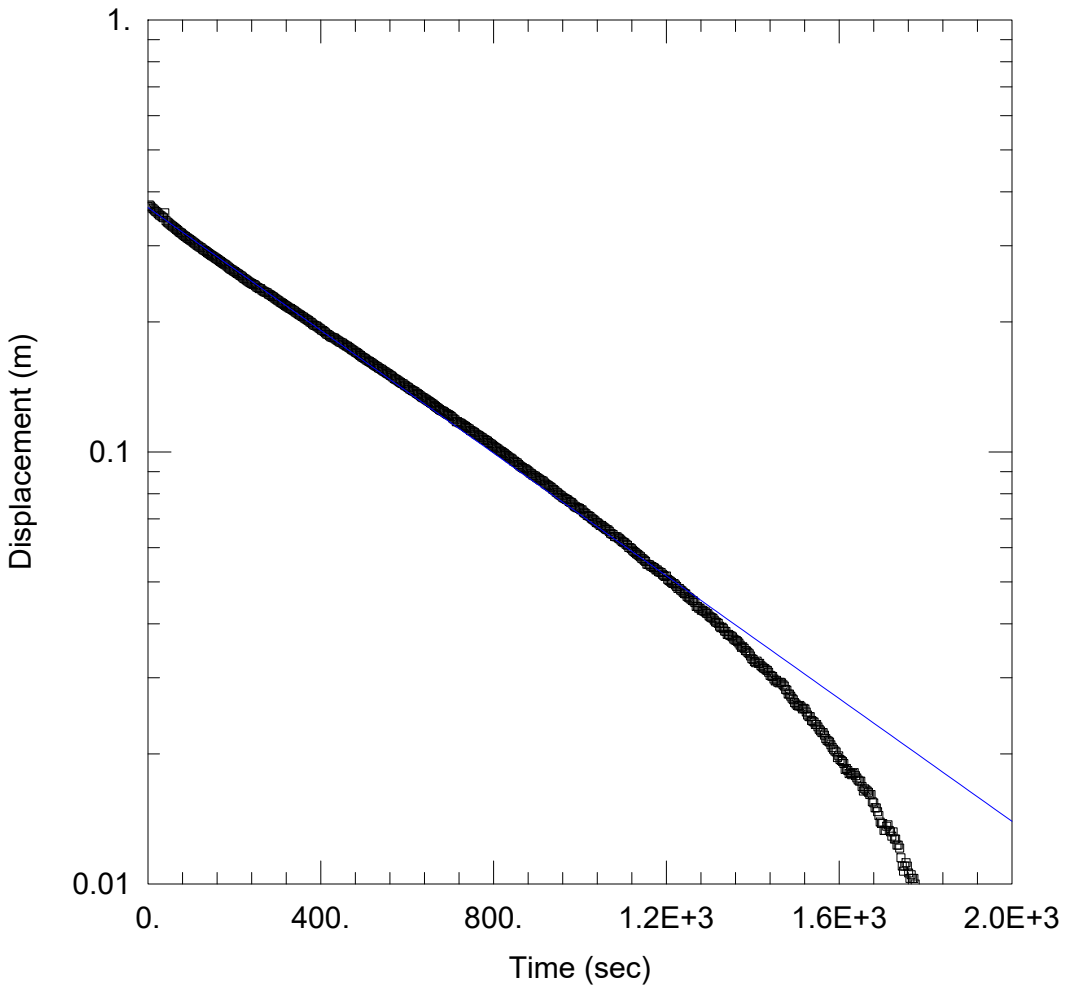
WELL DATA (MW1-25)

Initial Displacement: 0.42 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.43 m
Screen Length: 1.51 m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.178E-8 m/sec y0 = 0.3551 m



MW3-25: FALLING HEAD TEST

Data Set: N:\...\12662438-SWRT-MW3-25-FH.aqt
Date: 04/29/25 Time: 10:11:11

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW3-25
Test Date: 25/03/24

AQUIFER DATA

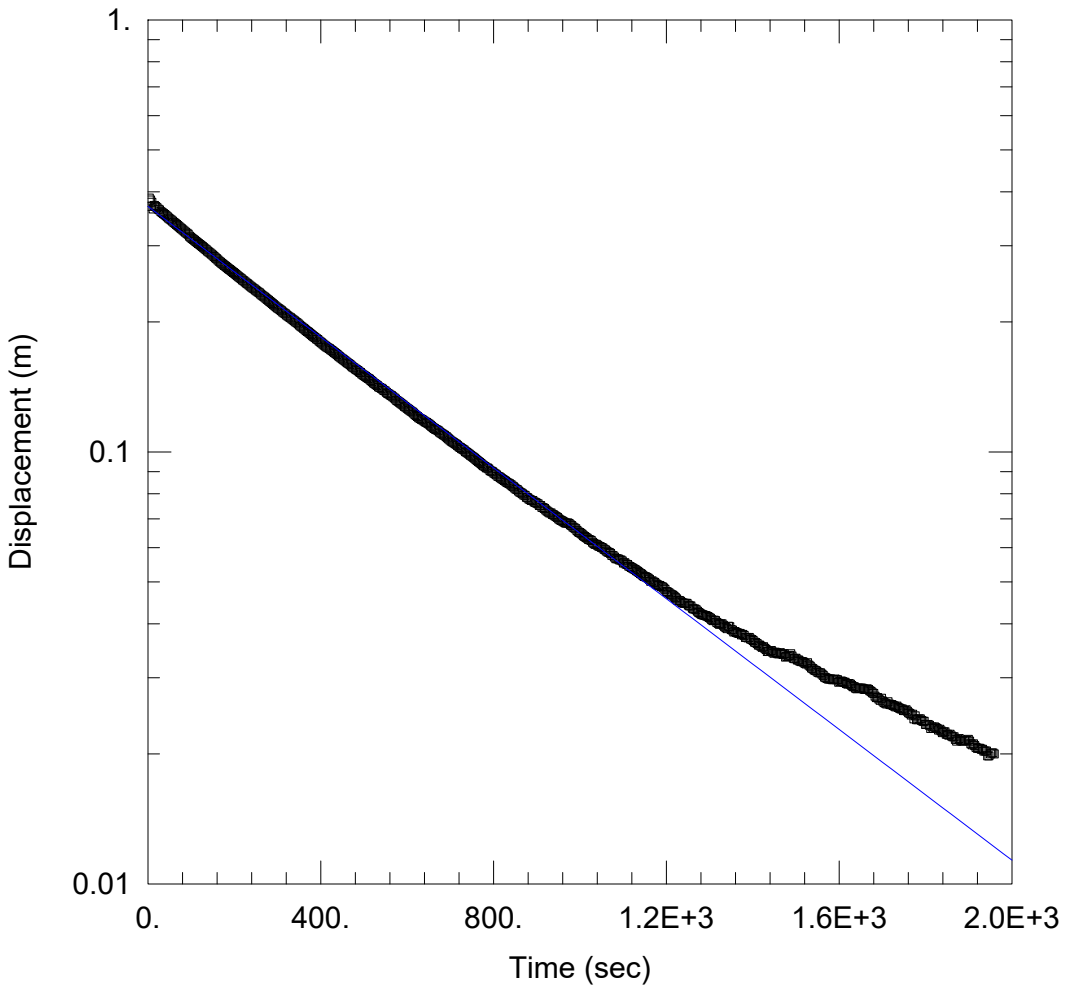
Saturated Thickness: 2.57 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW3-25)

Initial Displacement: 0.37 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.57 m
Screen Length: 1.51 m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 9.156E-7 m/sec
y0 = 0.3678 m



MW3-25: RISING HEAD TEST

Data Set: N:\...\12662438-SWRT-MW3-25-RH.aqt
Date: 04/29/25 Time: 10:12:08

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW3-25
Test Date: 25/03/24

AQUIFER DATA

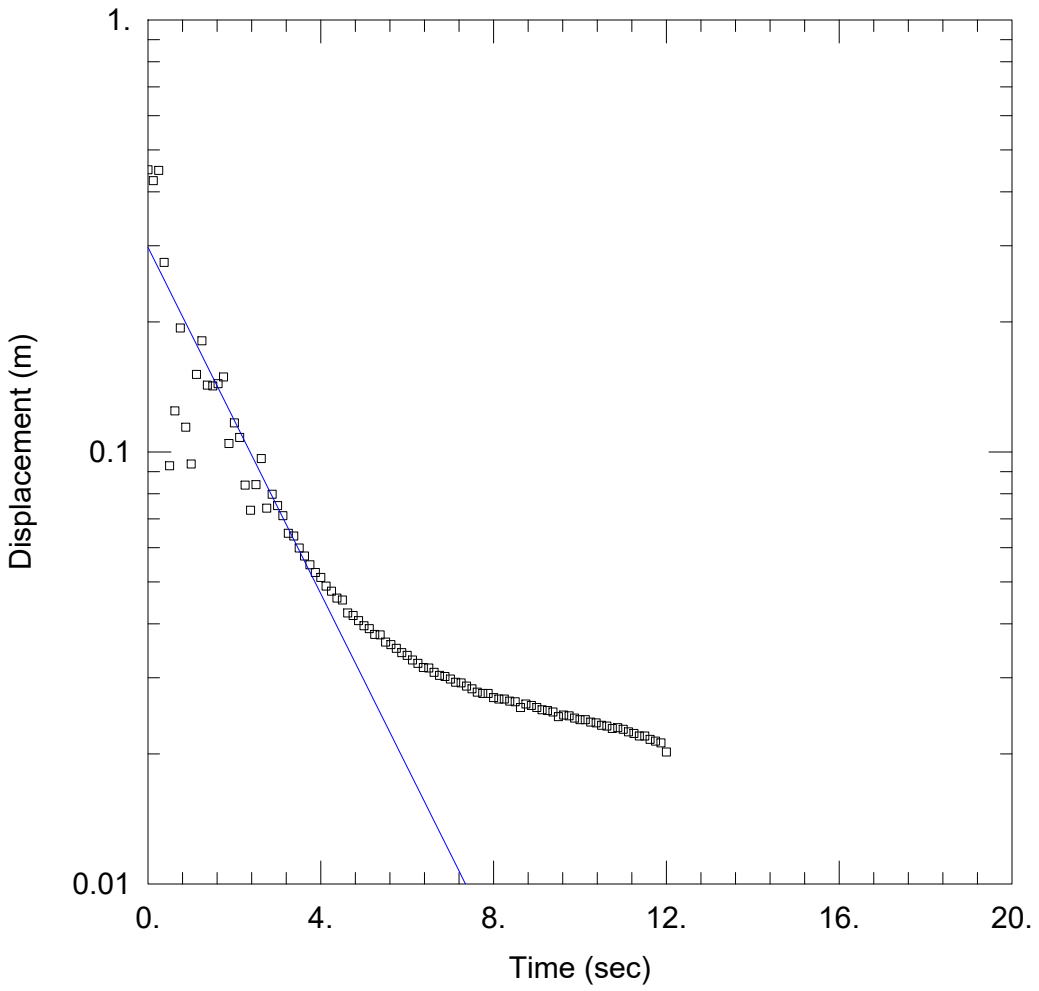
Saturated Thickness: 2.57 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW3-25)

Initial Displacement: 0.37 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.57 m
Screen Length: 1.51 m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 9.754E-7 m/sec
y0 = 0.3701 m



MW4-25: FALLING HEAD TEST 1

Data Set: N:\...\12662438-SWRT-MW4-25-FH1.aqt
Date: 04/29/25 Time: 10:13:19

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW4-25
Test Date: 25/03/24

AQUIFER DATA

Saturated Thickness: 2.15 m Anisotropy Ratio (Kz/Kr): 1.

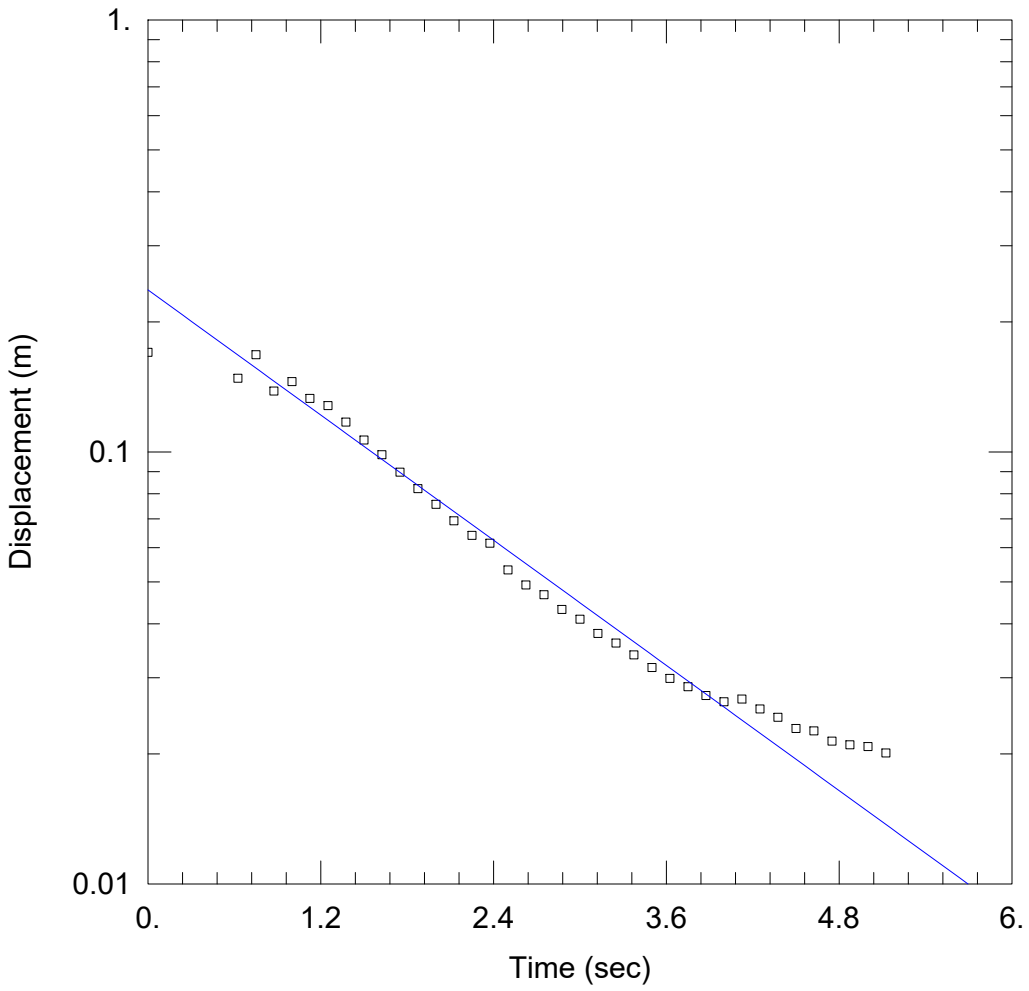
WELL DATA (MW4-25)

Initial Displacement: 0.45 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.15 m
Screen Length: 1.51 m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0002584 m/sec
y0 = 0.2976 m



MW4-25: FALLING HEAD TEST 2

Data Set: N:\...\12662438-SWRT-MW4-25-FH2.aqt
Date: 04/29/25 Time: 10:14:20

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW4-25
Test Date: 25/03/24

AQUIFER DATA

Saturated Thickness: 2.15 m Anisotropy Ratio (Kz/Kr): 1.

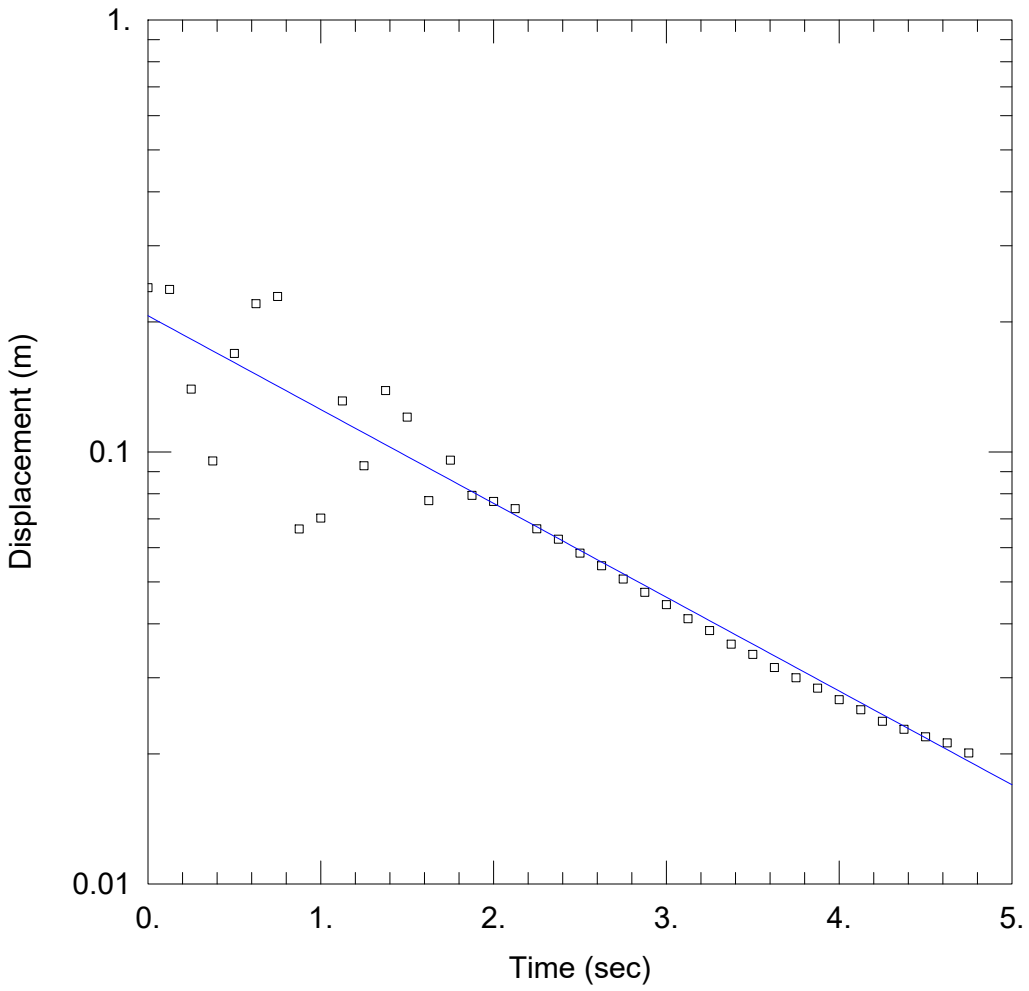
WELL DATA (MW4-25)

Initial Displacement: 0.17 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.15 m
Screen Length: 1.51 m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0003112 m/sec
y0 = 0.2371 m



MW4-25: FALLING HEAD TEST 3

Data Set: N:\...\12662438-SWRT-MW4-25-FH3.aqt
Date: 04/29/25 Time: 10:15:28

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW4-25
Test Date: 25/03/24

AQUIFER DATA

Saturated Thickness: 2.15 m Anisotropy Ratio (Kz/Kr): 1.

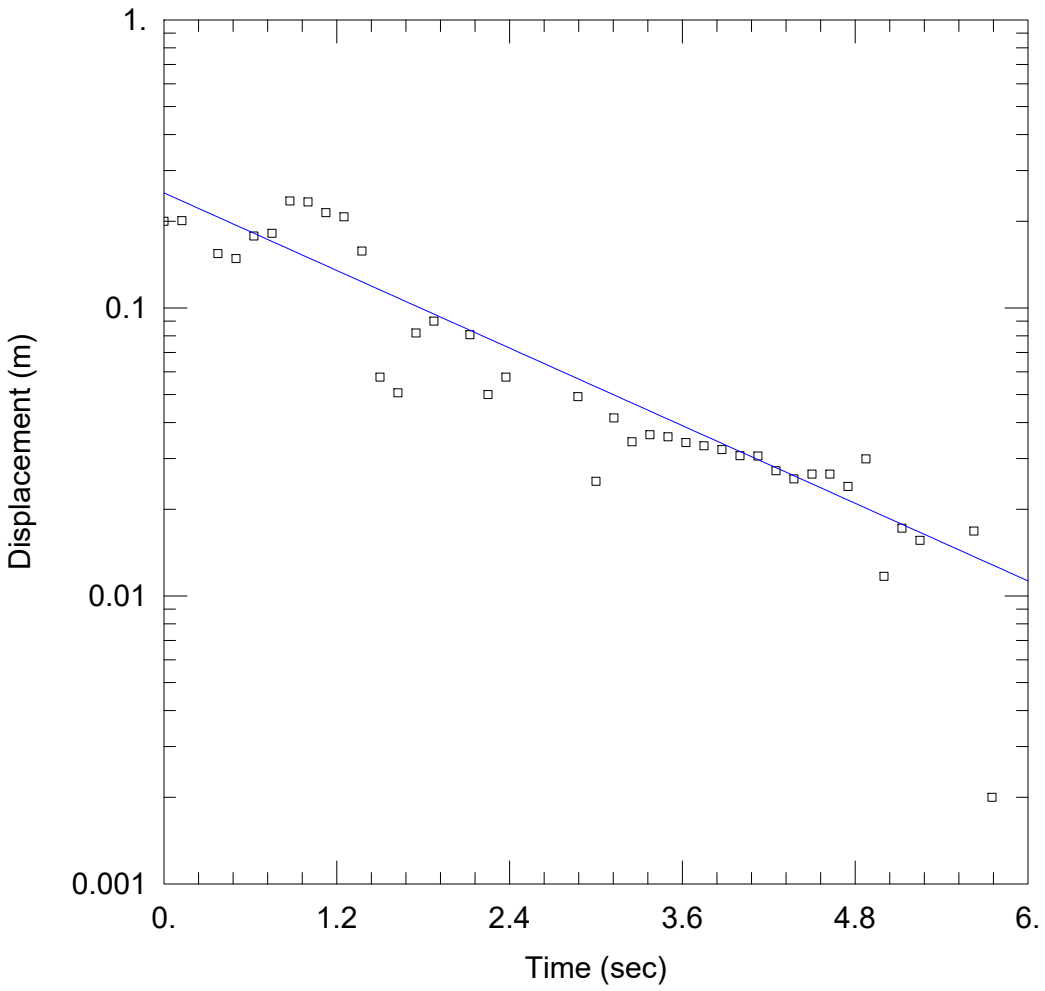
WELL DATA (MW4-25)

Initial Displacement: 0.24 m Static Water Column Height: 2.15 m
Total Well Penetration Depth: 3.05 m Screen Length: 1.51 m
Casing Radius: 0.0254 m Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0002798 m/sec y0 = 0.2066 m



MW4-25: FALLING HEAD TEST 4

Data Set: N:\...\12662438-SWRT-MW4-25-FH4.aqt
Date: 04/29/25 Time: 10:16:19

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW4-25
Test Date: 25/03/24

AQUIFER DATA

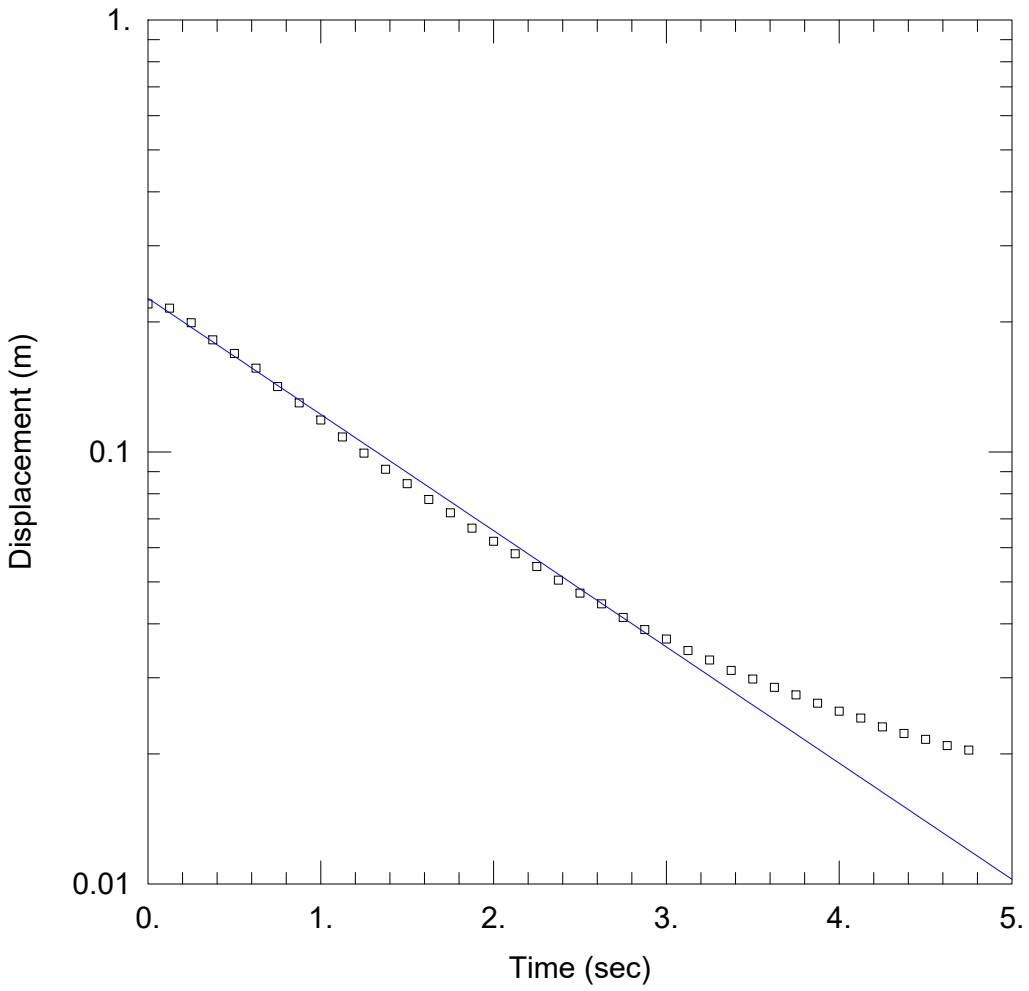
Saturated Thickness: 2.15 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW4-25)

Initial Displacement: 0.2 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.15 m
Screen Length: 1.51 m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0002893 m/sec
y0 = 0.2508 m



MW4-25: RISING HEAD TEST 1

Data Set: N:\...\12662438-SWRT-MW4-25-RH1.aqt
Date: 04/29/25 Time: 10:17:17

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW4-25
Test Date: 25/03/24

AQUIFER DATA

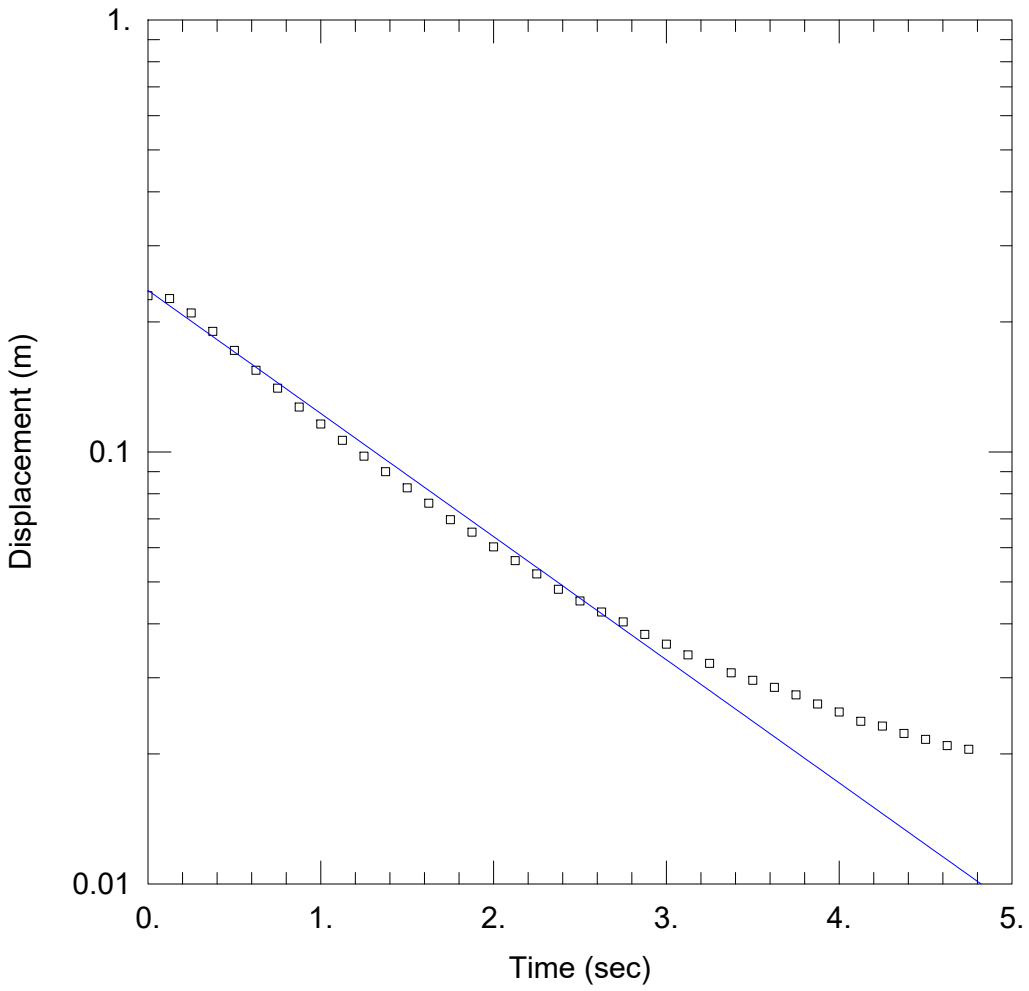
Saturated Thickness: 2.15 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW4-25)

Initial Displacement: 0.22 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.15 m
Screen Length: 1.51 m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0003467 m/sec
y0 = 0.2268 m



MW4-25: RISING HEAD TEST 2

Data Set: N:\...\12662438-SWRT-MW4-25-RH2.aqt
Date: 04/29/25 Time: 10:18:12

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW4-25
Test Date: 25/03/24

AQUIFER DATA

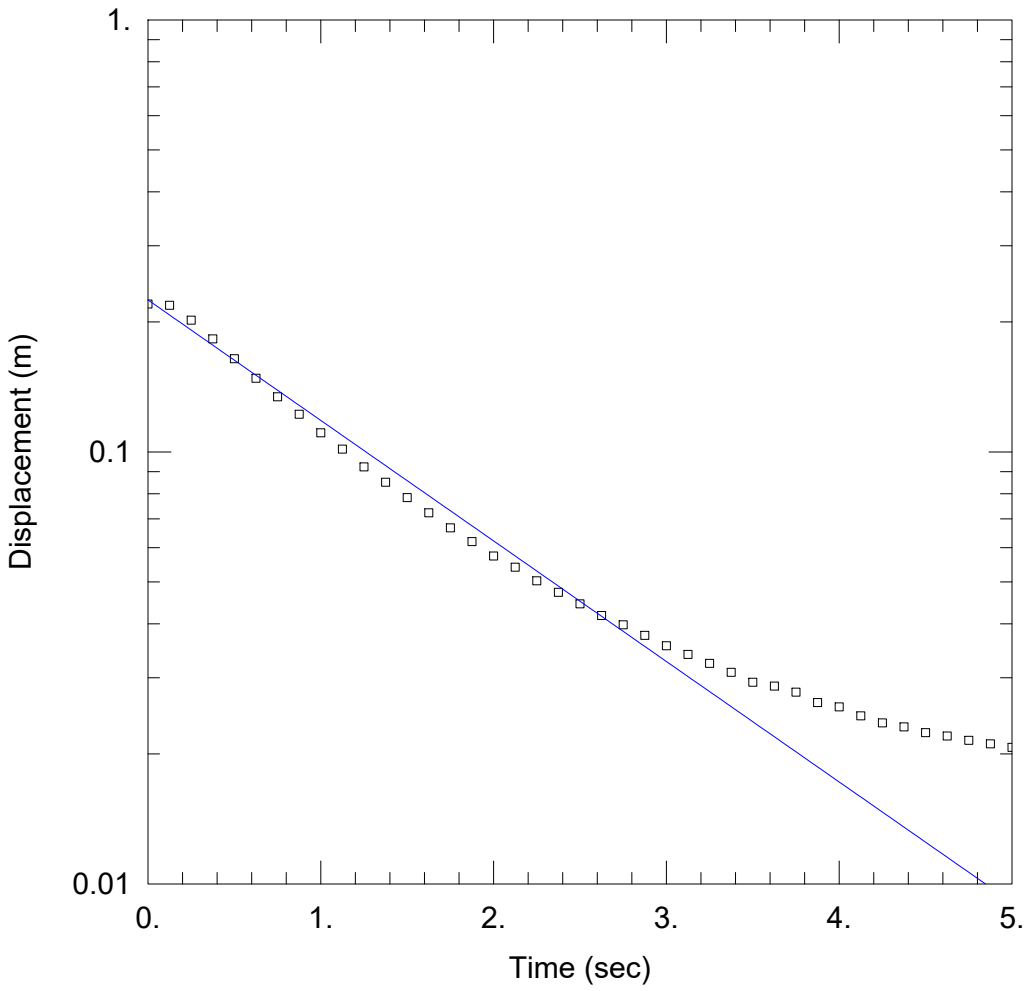
Saturated Thickness: 2.15 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW4-25)

Initial Displacement: 0.23 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.15 m
Screen Length: 1.51 m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0003673 m/sec
y0 = 0.2366 m



MW4-25: RISING HEAD TEST 3

Data Set: N:\...\12662438-SWRT-MW4-25-RH3.aqt
Date: 04/29/25 Time: 10:19:03

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW4-25
Test Date: 25/03/24

AQUIFER DATA

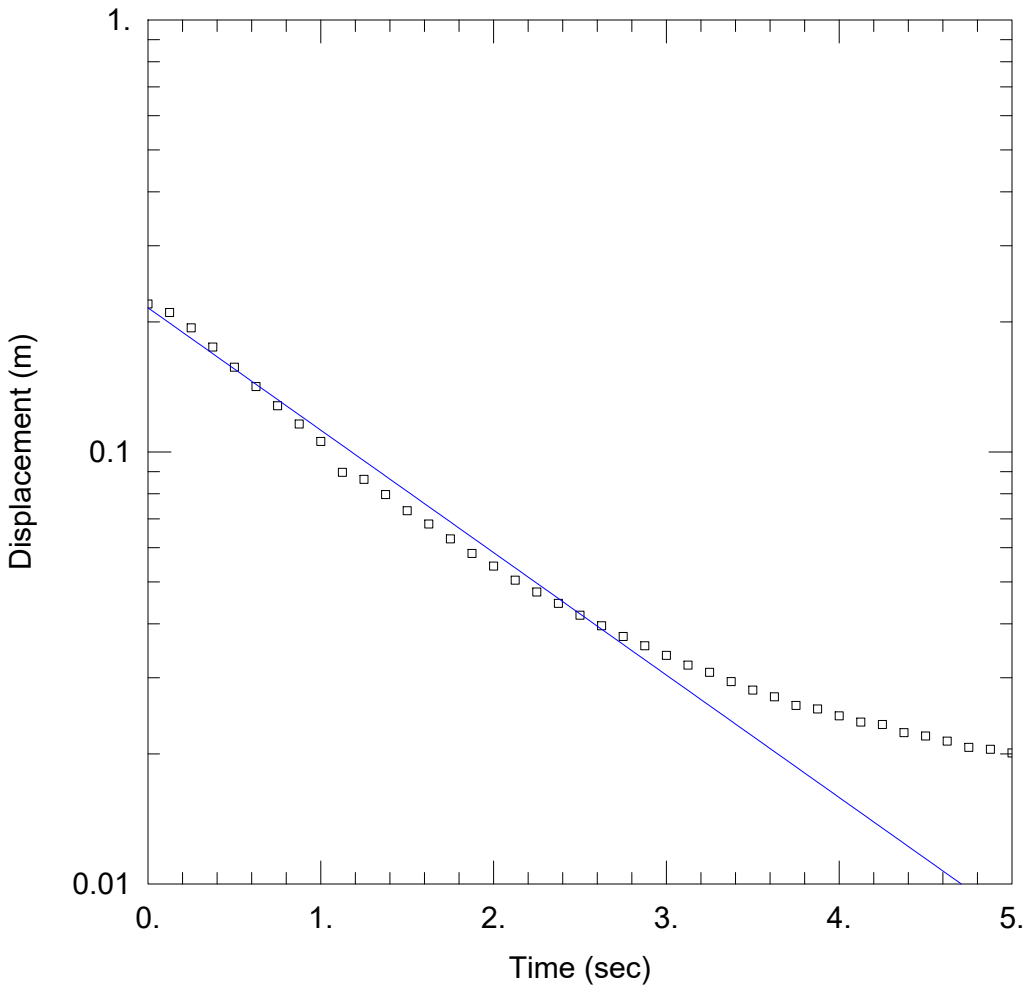
Saturated Thickness: 2.15 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW4-25)

Initial Displacement: 0.22 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.15 m
Screen Length: 1.51 m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0003594 m/sec
y0 = 0.2248 m



MW4-25: RISING HEAD TEST 4

Data Set: N:\...\12662438-SWRT-MW4-25-RH4.aqt
Date: 04/29/25 Time: 10:19:58

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW4-25
Test Date: 25/03/24

AQUIFER DATA

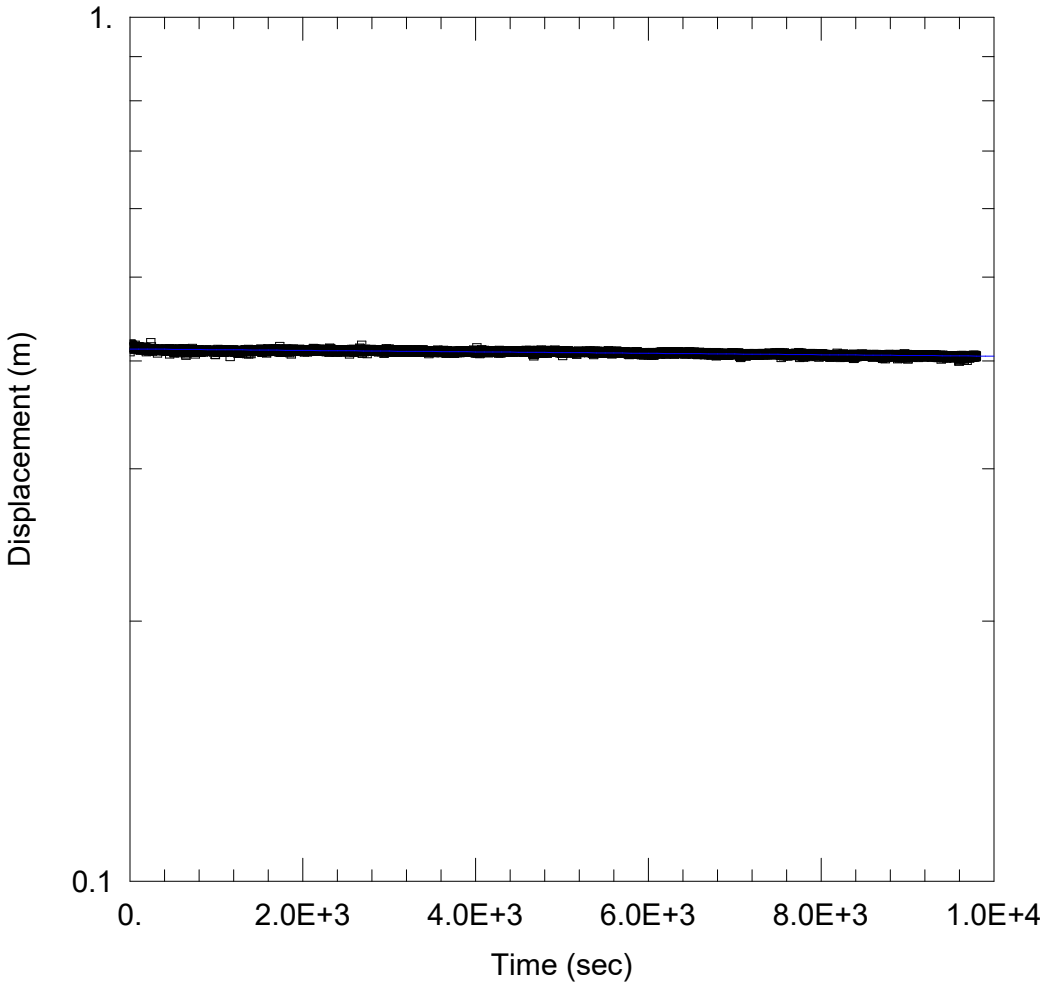
Saturated Thickness: 2.15 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW4-25)

Initial Displacement: 0.22 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.15 m
Screen Length: 1.51 m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0003652 m/sec
y0 = 0.2156 m



MW6-25D: FALLING HEAD TEST

Data Set: N:\...\12662438-SP-19-MW6-25D.aqt
Date: 03/25/25 Time: 13:40:12

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW6-25D
Test Date: 25/03/24

AQUIFER DATA

Saturated Thickness: 5.31 m Anisotropy Ratio (Kz/Kr): 1.

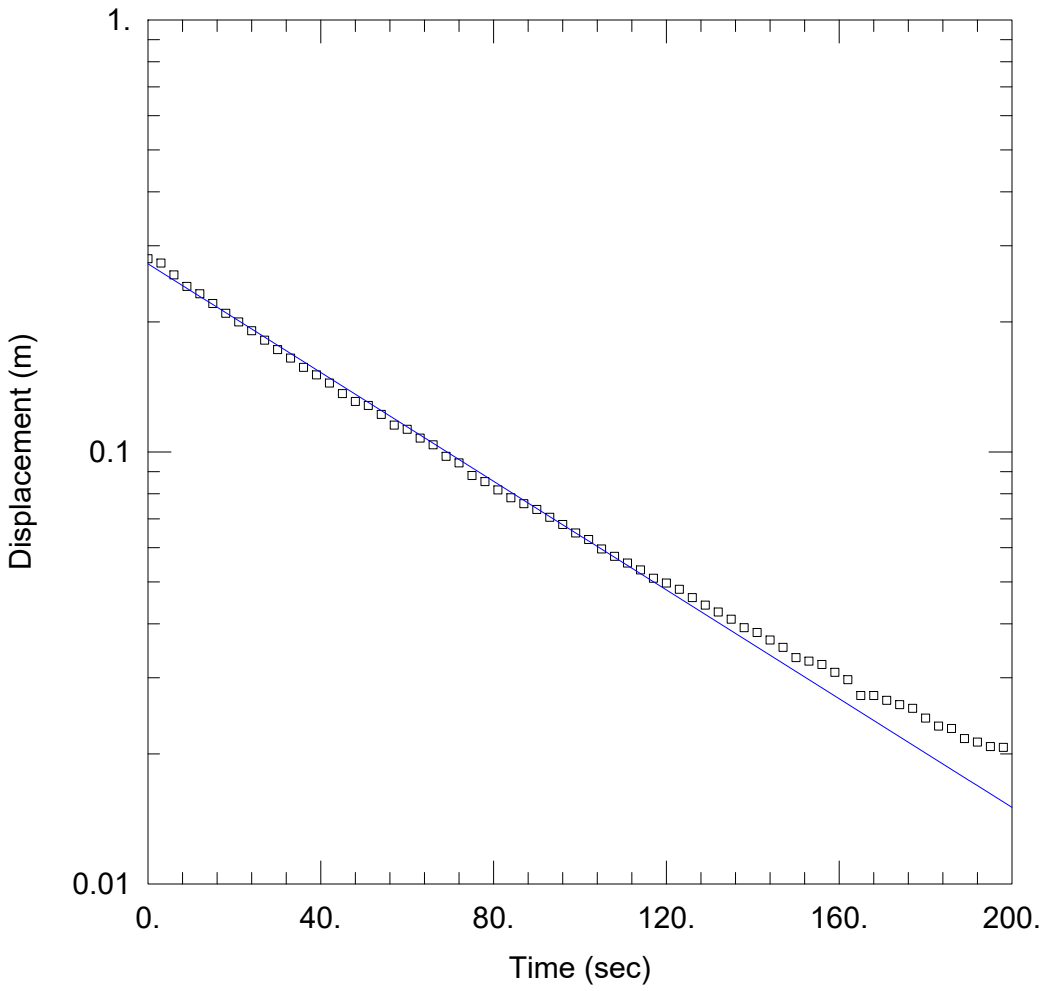
WELL DATA (MW6-25D)

Initial Displacement: 0.41 m
Total Well Penetration Depth: 5.31 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.31 m
Screen Length: 1.51 m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.603E-9 m/sec y0 = 0.413 m



MW6-25S: FALLING HEAD TEST 1

Data Set: N:\...\12662438-SWRT-MW6-25S FH1.aqt
Date: 04/29/25 Time: 10:21:24

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW6-25S
Test Date: 25/03/24

AQUIFER DATA

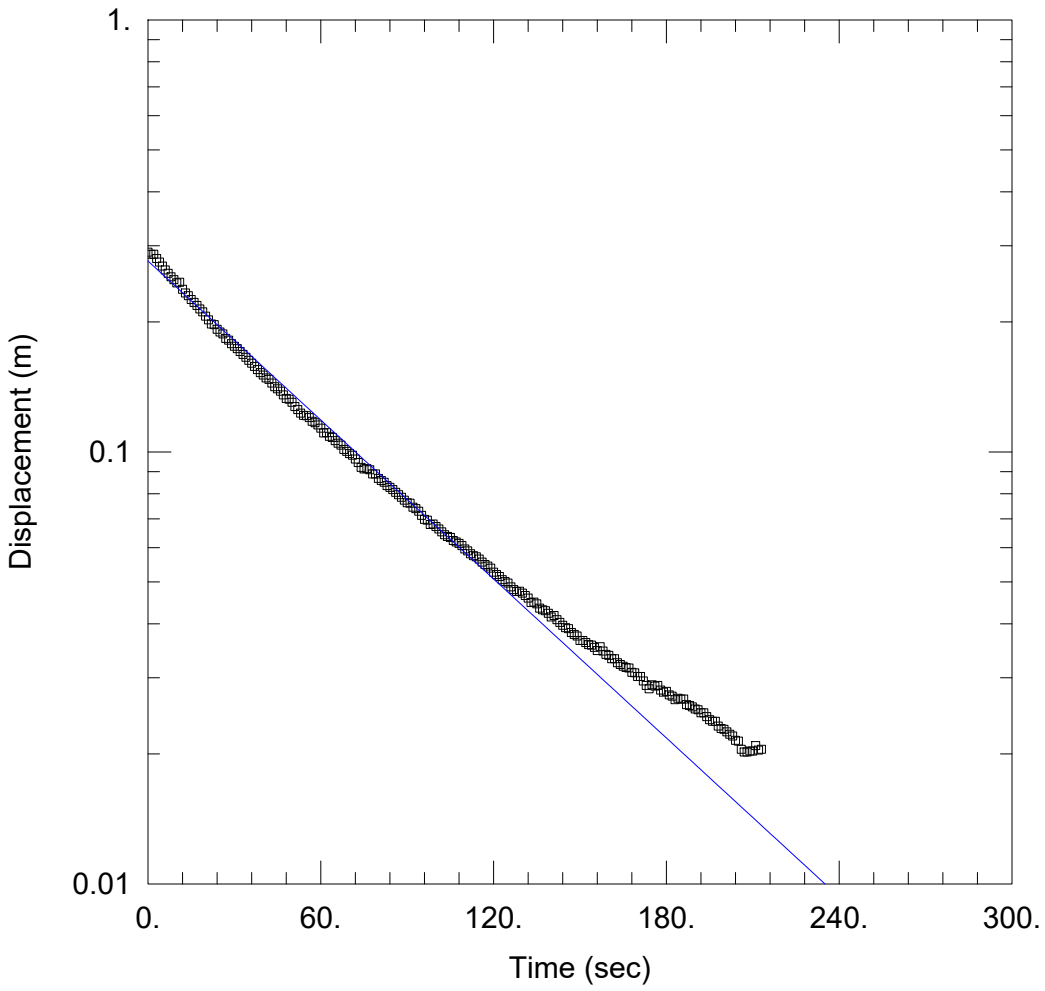
Saturated Thickness: 2.5 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW6-25S)

Initial Displacement: 0.28 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.5 m
Screen Length: 1.51 m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 8.11E-6 m/sec
y0 = 0.2726 m



MW6-25S: FALLING HEAD TEST 2

Data Set: N:\...\12662438-SWRT-MW6-25S FH2.aqt
Date: 04/29/25 Time: 10:22:46

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW6-25S
Test Date: 25/03/24

AQUIFER DATA

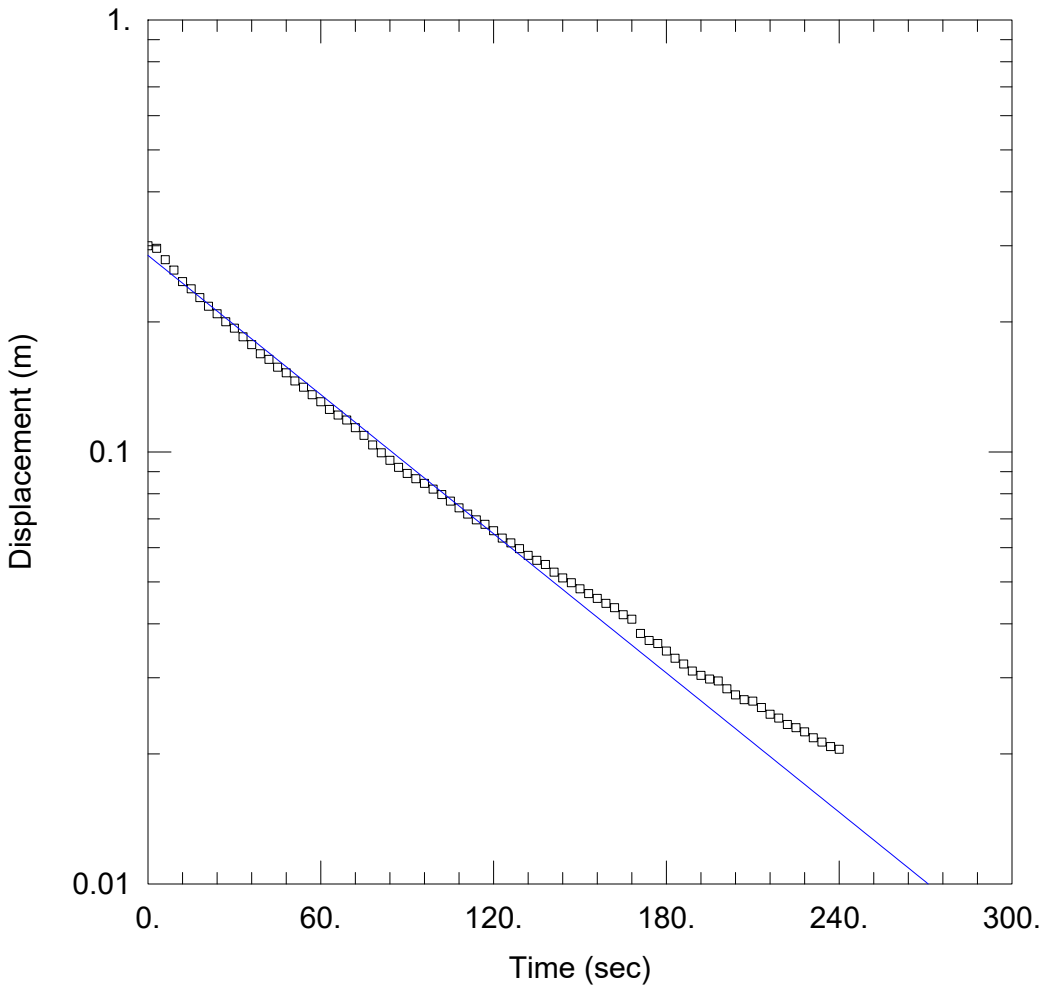
Saturated Thickness: 2.5 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW6-25S)

Initial Displacement: 0.29 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.5 m
Screen Length: 1.51 m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 7.906E-6 m/sec
y0 = 0.2766 m



MW6-25S: RISING HEAD TEST 1

Data Set: N:\...\12662438-SWRT-MW6-25S RH1.aqt
Date: 04/29/25 Time: 10:24:09

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW6-25S
Test Date: 25/03/24

AQUIFER DATA

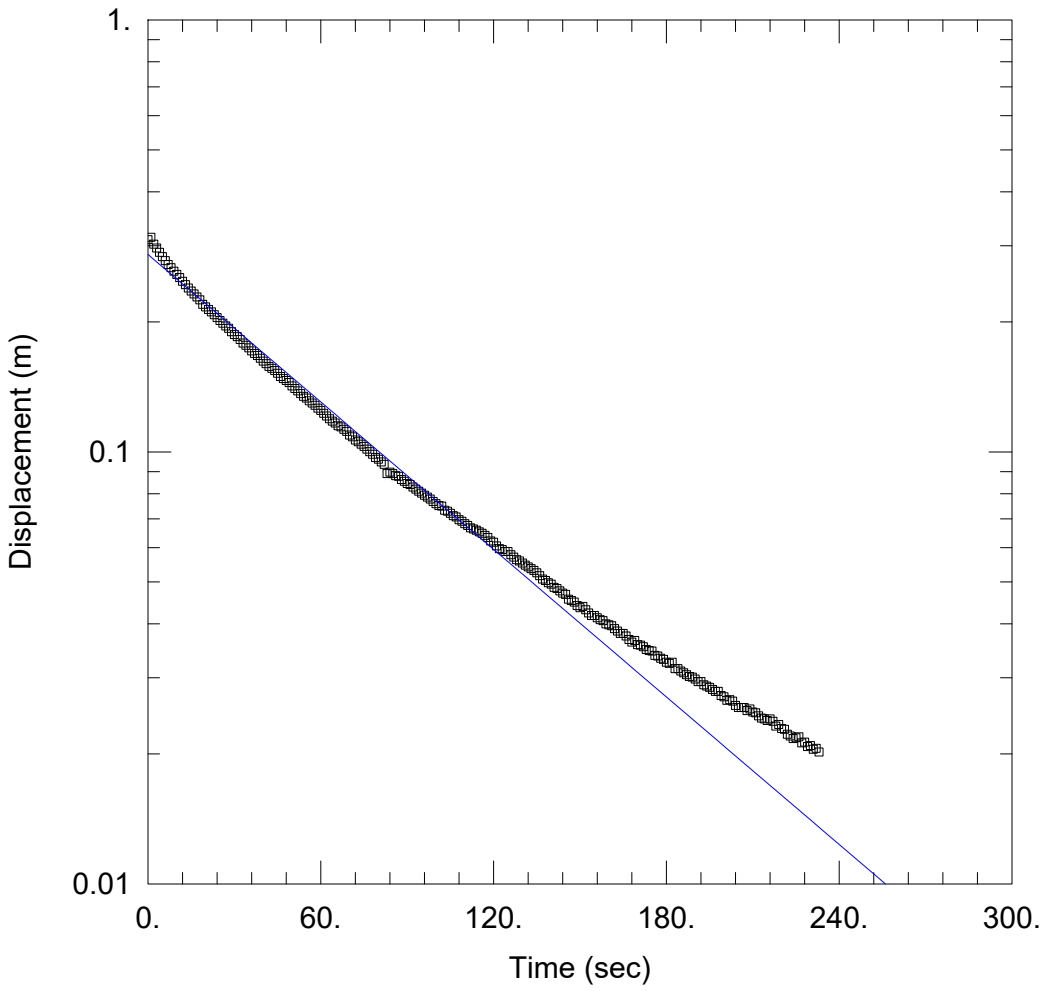
Saturated Thickness: 2.5 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW6-25S)

Initial Displacement: 0.3 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.5 m
Screen Length: 1.51 m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 6.922E-6 m/sec
y0 = 0.2851 m



MW6-25S: RISING HEAD TEST 2

Data Set: N:\...\12662438-SWRT-MW6-25S RH2.aqt
Date: 04/29/25 Time: 10:25:20

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW6-25S
Test Date: 25/03/24

AQUIFER DATA

Saturated Thickness: 2.5 m Anisotropy Ratio (Kz/Kr): 1.

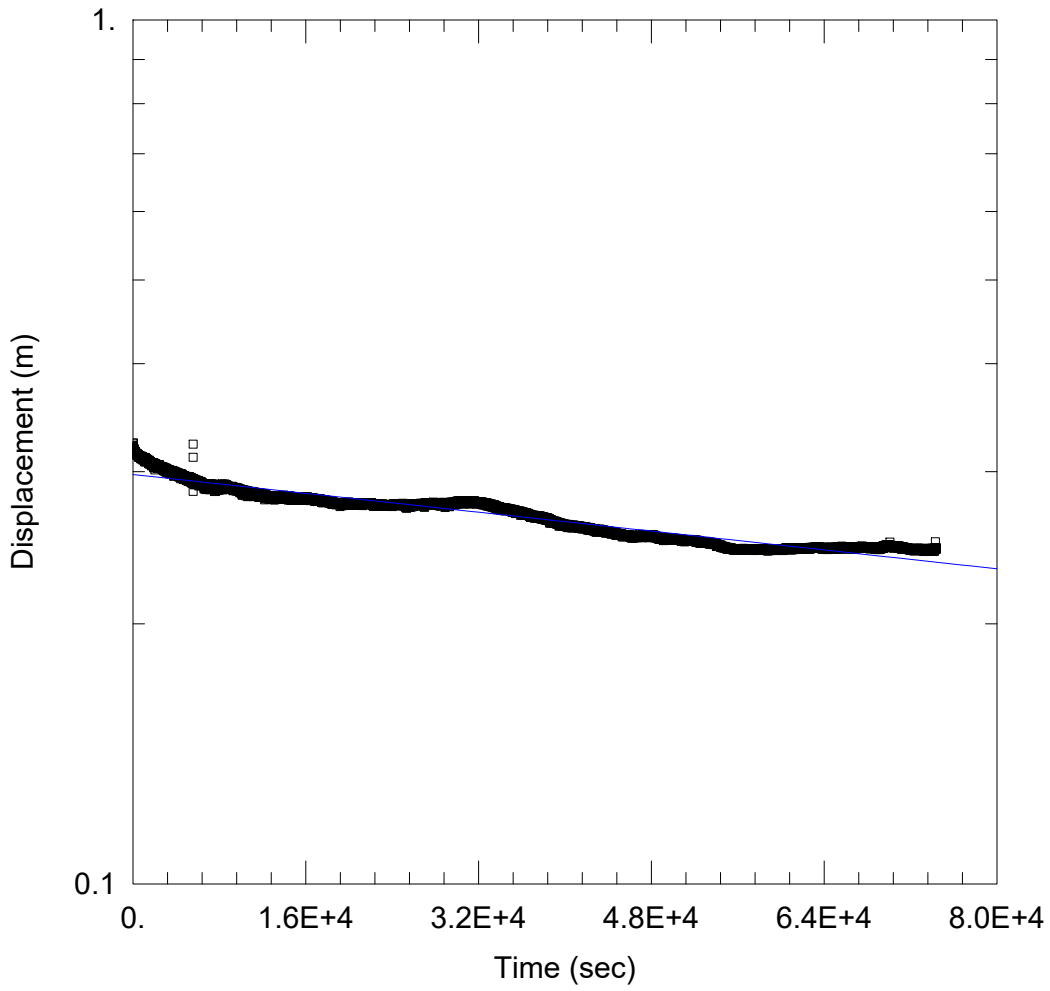
WELL DATA (MW6-25S)

Initial Displacement: 0.31 m Static Water Column Height: 2.5 m
Total Well Penetration Depth: 3.05 m Screen Length: 1.51 m
Casing Radius: 0.0254 m Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 7.334E-6 m/sec y0 = 0.2864 m



MW9-25: FALLING HEAD TEST

Data Set: N:\...\12662438-SWRT-MW9-25 FH.aqt
Date: 04/29/25 Time: 10:27:30

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW9-25
Test Date: 25/03/24

AQUIFER DATA

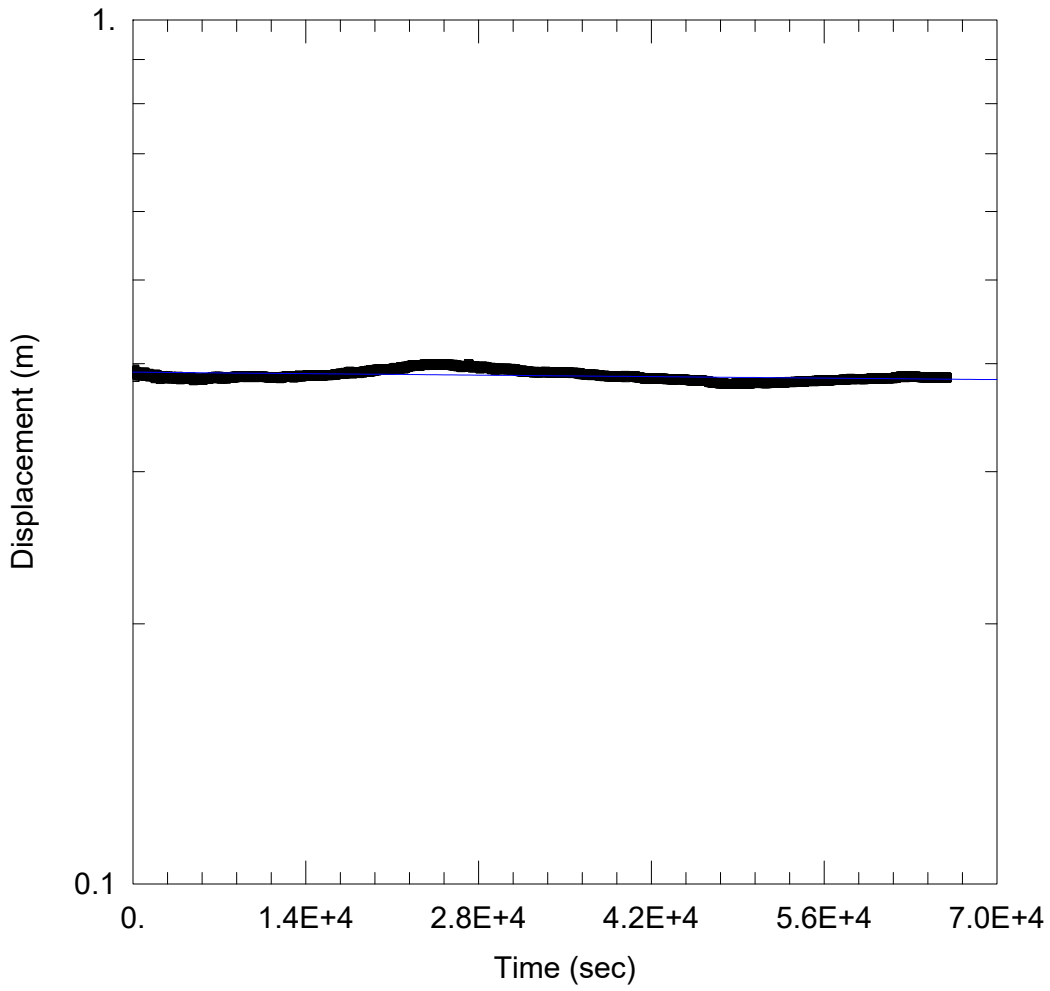
Saturated Thickness: 2.63 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW9-25)

Initial Displacement: 0.32 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.63 m
Screen Length: 1.51 m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.759E-9 m/sec
y0 = 0.2978 m



MW11-25: FALLING HEAD TEST

Data Set: N:\...\12662438-SWRT-MW11-25 FH.aqt
Date: 04/29/25 Time: 10:29:05

PROJECT INFORMATION

Company: GHD Ltd
Client: Bromont Group
Project: 12662438
Location: Fallis Line, Millbrook
Test Well: MW11-25
Test Date: 25/03/24

AQUIFER DATA

Saturated Thickness: 2.2 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW11-25)

Initial Displacement: 0.39 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.2 m
Screen Length: 1.51 m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.584E-10 m/sec
y0 = 0.3911 m

Appendix E

Water Balance Calculations

Appendix E.1

Water Budget (Thornthwaite Method) - Average Values 1991-2020*

Composite Weather Station Name: Peterborough

Composite Station Metadata #: 6166418, 6166420, 6166415 **Elevation:** 191.4 masl **Distance Away:** ~9.9 km

Month	Mean Temperature (°C)	Heat Index	Unadjusted Potential ET (mm)	Daylight Correction Factor	Adjusted ET (mm)	Total Precipitation (mm)	Surplus (mm)	Deficit (mm)
January	-7.6	0	0	0.78	0	66.5	66.50	
February	-7.3	0	0	0.88	0	42.3	42.30	
March	-1.5	0	0	0.99	0	53.6	53.60	
April	5.7	1.22	27.1	1.12	30.4	72.7	42.33	
May	12.5	4.00	61.4	1.22	74.9	79.4	4.49	
June	17.4	6.61	86.6	1.28	110.9	87.8	0.00	23.09
July	19.7	7.97	98.6	1.25	123.2	69.1	0.00	54.13
August	18.6	7.31	92.9	1.15	106.8	77.6	0.00	29.19
September	14.4	4.96	71.1	1.04	74.0	75.7	1.71	
October	8	2.04	38.6	0.92	35.5	74.7	39.20	
November	1.9	0.23	8.6	0.8	6.9	76.3	69.39	
December	-3.9	0	0	0.76	0	64.1	64.10	
TOTAL	6.5	34.3	485.0		562.6	839.8	383.6	106.4

TOTAL WATER SURPLUS: 277.2 mm

Notes:

*Average values of precipitation were used. Average values of temperature were also used.

Appendix E.2

Water Budget: Pre-Development

Catchment Designation →	PRE-DEVELOPMENT SITE						TOTAL
	North Catchment		South Catchment				
General Description →	Naturalized	Agricultural	Agricultural	Naturalized	Existing Residential		
Detailed Description →					Rooftops	Gravel Drive	
Area (m^2)	9600	78023	238003	9600	575	400	336200
Pervious Area (m^2)	9600	78023	238003	9600	0	0	335225
% Pervious	2.9%	23.2%	70.8%	2.9%	0%	0%	99.7%
Impervious Area (m^2)	0	0	0	0	575	400	975
% Impervious	0%	0%	0%	0%	0.2%	0.1%	0.3%
INFILTRATION FACTORS							
Topography Infiltration Factor	0.15	0.15	0.15	0.15	0	0.2	
Soil Infiltration Factor	0.25	0.25	0.25	0.25	0	0.25	
Land Cover Infiltration Factor	0.175	0.1	0.1	0.175	0	0	
MECP Infiltration Factor	0.575	0.5	0.5	0.575	0	0.45	
Actual Infiltration Factor	0.6	0.5	0.5	0.6	0.375	0.2	
Runoff Coefficient	0.4	0.5	0.5	0.4	0.625	0.8	
Runoff from Impervious Surfaces*	0	0	0	0	0.8	0.8	
INPUTS (PER UNIT AREA)							
Precipitation (mm/yr)	840	840	840	840	840	840	840
Run On (mm/yr)	0	0	0	0	0	0	0
Other Inputs (mm/yr)	0	0	0	0	0	0	0
Total Inputs (mm/yr)	840	840	840	840	840	840	840
OUTPUTS (PER UNIT AREA)							
Precipitation Surplus (mm/yr)	277	277	277	277	672	672	278
Net Surplus (mm/yr)	277	277	277	277	672	672	278
Evaportranspiration (mm/yr)	563	563	563	563	168	168	561
Infiltration (mm/yr)	166	139	139	166	0	134	140
Rooftop Infiltration (mm/yr)	0	0	0	0	252	0	0.4
Total Infiltration (mm/yr)	166	139	139	166	252	134	140
Runoff Pervious Areas	111	139	139	111	0	0	137
Runoff Impervious Areas	0	0	0	0	420	537	1
Total Runoff (mm/yr)	111	139	139	111	420	537	138
Total Outputs (mm/yr)	840	840	840	840	840	840	840
Difference (Inputs - Outputs)	0	0	0	0	0	0	0
INPUTS (VOLUMES)							
Precipitation (m^3/yr)	8062	65523	199874	8062	483	336	282341
Run On (m^3/yr)	0	0	0	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0	0	0	0
Total Inputs (m^3/yr)	8062	65523	199874	8062	483	336	282341
OUTPUTS (VOLUMES)							
Precipitation Surplus (m^3/yr)	2661	21628	65973	2661	386	269	93578
Net Surplus (m^3/yr)	2661	21628	65973	2661	386	269	93578
Evaportranspiration (m^3/yr)	5401	43896	133901	5401	97	67	188763
Infiltration (m^3/yr)	1597	10814	32987	1597	0	54	47048
Rooftop Infiltration (m^3/yr)	0	0	0	0	145	0	145
Total Infiltration (m^3/yr)	1597	10814	32987	1597	145	54	47192
Runoff Pervious Areas (m^3/yr)	1064	10814	32987	1064	0	0	45929
Runoff Impervious Areas (m^3/yr)	0	0	0	0	241	215	456
Total Runoff (m^3/yr)	1064	10814	32987	1064	241	215	46386
Total Outputs (m^3/yr)	8062	65523	199874	8062	483	336	282341
Difference (Inputs - Outputs)	0	0	0	0	0	0	0

Notes:

Catchment areas refer to areas North and South of the environmental protection block / creek

Naturalized areas are open, vacant areas that are not used for agriculture and are not forested areas

Assume 37.5% of rooftop runoff infiltrates the ground in this scenario.

Appendix E.3

Generic Water Budget: Post-Development - No Mitigation Strategies

| | POST-DEVELOPMENT SITE | | |

Appendix E.4

Generic Water Budget Post-Development - With Downspout Disconnection Strategy Only

| | POST-DEVELOPMENT SITE | | |

Appendix E.5

Generic Water Budget Post-Development - With Downspout Disconnection and Soakaway Pit Mitigation Strategy

	POST-DEVELOPMENT SITE																																				
Catchment Designation	**North Sub-Catchment**																				**South Sub-Catchment**																	
General Description →	**Residential - Single Detached**			**Med. Density**			**Road ROWs**		**Parkland**	**0.3 m Reserve**	**Road Widening**	**Future Residential**	**Env. Protection**	**Med. Density**			**Residential - Single Detached**			**Env. Protection**	**Road ROWs**		**Road Widening**	**SWM Pond**	**Commercial**			**Townhouses**			**TOTAL**							
Detailed Description →	Lawns	Rooftops	Driveways	Lawns	Rooftops	Asphalt/Concrete	Asphalt	Grass	Grass	Grass	Asphalt	Grass	Naturalized	Lawns	Rooftops	Asphalt	Lawns	Rooftops	Driveways	Naturalized	Asphalt	Grass	Asphalt	Pond	Grass	Lawns	Rooftops	Asphalt	Lawns	Rooftops	Driveways							
Blocks →	Lot/Block 61B-67B, 68A, 69B-82B, 83C-87C, 88A, 89B-90B, 91C-121C, 122B-127B, 200C-201C			Block 186			Streets A-G		Block 190	Block 195 & 196	Block 197	Block 194	Blocks 192 & 193	Block 187			Lot/Block 1C-3C, 4B-11B, 12A-50A, 51B-54B, 55A-57A, 58B-60B			Blocks 192 & 193	Streets A, H-I		Blocks 198 & 199	Block 191	Blocks 188 & 189			Blocks 158 - 185										
Area (m^2)	10954	17214	3130	1545	6695	2060	7637	7637	19300	0	1000	700	9750	1050	4550	1400	13931	21891	3980	9750	21563	21563	2900	8150	8150	13590	18120	58890	9775	25415	3910	336200							
Pervious Area (m^2)	10954	0	0	1545	0	0	0	7637	19300	0	0	700	9750	1050	0	0	13931	0	0	9750	0	21563	0	0	8150	13590	0	0	9775	0	0	127695							
% Pervious	3.3%	0%	0%	0%	0%	0%	0%	2.3%	5.7%	0.0%	0%	0.2%	2.9%	0%	0%	0%	4.1%	0%	0%	2.9%	0%	6.4%	0%	0%	2.4%	4.0%	0%	0%	2.9%	0%	0%	38.0%							
Impervious Area (m^2)	0	17214	3130	0	6695	2060	7637	0	0	0	1000	0	0	0	4550	1400	0	21891	3980	0	21563	0	2900	8150	0	0	18120	58890	0	25415	3910	208505							
% Impervious	0%	5.1%	0.9%	0%	2.0%	0.6%	2.3%	0%	0%	0%	0.3%	0%	0%	0%	1.4%	0.4%	0%	6.5%	1.2%	0%	6.4%	0%	0.9%	2.4%	0%	0%	5.4%	17.5%	0%	7.6%	1.2%	62.0%							
INFILTRATION FACTORS																																					
Topography Infiltration Factor	0.15	0	0	0.15	0	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0	0.15	0.15	0	0.15	0.15	0.15	0.15	0.15	0	0.1	0.15	0	0.15	0.15	0	0.15							
Soil Infiltration Factor	0.25	0	0	0.25	0	0	0	0.25	0.25	0.25	0	0.25	0.25	0.25	0	0	0.25	0	0	0.25	0	0.25	0	0	0.25	0.25	0	0	0.25	0	0							
Land Cover Infiltration Factor	0.15	0	0	0.15	0	0	0	0.15	0.15	0.15	0	0.15	0.175	0.15	0	0	0.15	0	0	0.175	0	0.15	0	0	0.15	0.15	0	0	0.15	0	0							
MECP Infiltration Factor	0.55	0	0	0.55	0	0.15	0.15	0.55	0.55	0.55	0.15	0.55	0.575	0.55	0	0.15	0.55	0	0.15	0.575	0.15	0.55	0.15	0	0.5	0.55	0	0.15	0.55	0	0.15							
Actual Infiltration Factor	0.55	0	0	0.55	0	0	0	0.55	0.55	0.55	0	0.55	0.6	0.55	0	0	0.55	0	0	0.6	0	0.55	0	0.05	0.5	0.55	0	0	0.55	0	0							
Runoff Coefficient	0.45	1	1	0.45	1	1	1	0.45	0.45	0.45	1	0.45	0.4	0.45	1	1	0.45	1	1	0.4	1	0.45	1	0.95	0.5	0.45	1	1	0.45	1	1							
Runoff from Impervious Surfaces*	0	0.8	0.8	0	0.8	0.8	0.8	0	0	0	0.8	0	0	0	0.8	0.8	0	0.8	0.8	0	0.8	0	0.8	0.8	0	0	0.8	0.8	0	0.8	0.8							
INPUTS (PER UNIT AREA)																																					
Precipitation (mm/yr)	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840							
Run On (mm/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
Other Inputs (mm/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
Total Inputs (mm/yr)	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840							
OUTPUTS (PER UNIT AREA)																																					
Precipitation Surplus (mm/yr)	277	672	672	277	672	672	672	277	277	277	672	277	277	277	672	672	277	672	672	277	672	277	672	672	277	277	672	672	277	672	672							
Net Surplus (mm/yr)	277	672	672	277	672	672	672	277	277	277	672	277	277	277	672	672	277	672	672	277	672	277	672	672	277	277	672	672	277	672	672							
Evapotranspiration (mm/yr)	563	168	168	563	168	168	168	563	563	563	168	563	563	563	168	168	563	168	168	563	168	563	168	168	563	563	168	168	563	168	168							
Infiltration (mm/yr)	152	0	0	152	0	0	0	152	152	152	0	152	166	152	0	0	152	0	0	166	0	152	0	34	139	152	0	0	152	0	0							
Downspout Disconnection % Runoff Reduction	--	37.5%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	37.5%	--	--	--	--	--	--	--	--	--	--	--	--	--							
Rooftop Infiltration (mm/yr)	0	252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	252	0	0	0	0	0	0	0	0	0	0	0	0	0							
Soakaway Pit % Runoff Reduction	--	--	--	--	85%	--	--	--	--	--	--	--	--	--	85%	--	--	--	--	--	--	--	--	--	--	--	85%	--	--	85%	--							
Soakaway Pit Infiltration (mm/yr)	0	0	0	0	571	0	0	0	0	0	0	0	0	0	571	0	0	0	0	0	0	0	0	0	0	0	571	0	0	571	0							
Total Infiltration (mm/yr)	152	252	0	152	0	0	0	152	152	152	0	152	166	152	0	0	152	252	0	166	0	152	0	34	139	152	0	0	152	0	0							
Runoff Pervious Areas	125	0	0	125	0	0	0	125	125	125	0	125	111	125	0	0	125	0	0	111	0	125	0	0	139	125	0	0	125	0	0							
Runoff Impervious Areas	0	420	672	0	101	672	672	0	0	0	672	0	0	0	101	672	0	420	672	0	672	0	672	638	0	0	101	672	0	101	672							
Total Runoff (mm/yr)	125	420	672	125	101	672	672	125	125	125	672	125	111	125	101	672	125	420	672	111	672	125	672	638	139	125	101	672	125	101	672							
Total Outputs (mm/yr)	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840	840							
Difference (Inputs - Outputs)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
INPUTS (VOLUMES)																																					
Precipitation (m^3/yr)	9200	14456	2628	1297	5622	1730	6413	6413	16208	0	840	588	8188	882	3821	1176	11699	18384	3343	8188	18109	18109	2435	6844	6844	11413	15217	49456	8209	21344	3284	282341							
Run On (m^3/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
Other Inputs (m^3/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
Total Inputs (m^3/yr)	9200	14456	2628	1297	5622	1730	6413	6413	16208	0	840	588	8188	882	3821	1176	11699	18384	3343	8188	18109	18109	2435	6844	6844	11413	15217	49456	8209	21344	3284	282341							
OUTPUTS (VOLUMES)																																					
Precipitation Surplus (m^3/yr)	3037	11565	2103	428	4498	1384	5131	2117	5350	0	672	194	2703	291	3057	941	3862	14707	2674	2703	14487	5977	1948	5475	2259	3767	12174	39565	2710	17075	2627	175479							
Net Surplus (m^3/yr)	3037	11565	2103	428	4498	1384	5131	2117	5350	0	672	194	2703	291	3057	941	3862	14707	2674	2703	14487	5977	1948	5475	2259	3767	12174	39565	2710	17075	2627	175479							
Evapotranspiration (m^3/yr)	6163	2891	526	869	1124	346	1283	4296	10858	0	168	394	5485	591	764	235	7837	3677	669	5485	3622	12132	487	1369	4585	7646	3043	9891	5499	4269	657	106862							
Infiltration (m^3/yr)	1670	0	0	236	0	0	0	1164	2942	0	0	107	1622	160	0	0	2124	0	0	1622	0	3287	0	274	1130	2072	0	0	1490	0	0	19899							
Rooftop to Downspout Disconnection Infiltration (m^3/yr)	0	4337	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9852						
Rooftop to Soakaway Pit Infiltration (m^3/year)	0	0	0	0	3823	0	0	0	0	0	0	0	0	0	2598	0	0	0	0	0	0	0	0	0	0	0	10348	0	0	14514	0	31283							
Total Infiltration (m^3/yr)	1670	4337	0	236	3823	0	0	1164	2942	0	0	107	1622	160	2598	0	2124	5515	0	1622	0	3287	0	274	1130	2072	10348	0	1490	14514	0	61034							
Runoff Pervious Areas (m^3/yr)	1366	0	0	193	0	0	0	953	2407	0	0	87	1081	131	0	0	1738	0	0	1081	0	2690	0	0	1130	1695	0	0	1219	0	0	15771							
Runoff Impervious Areas (m^3/yr)	0	7228	2103	0	675	1384	5131	0	0	0	672	0	0	0	459	941	0	9192	2674	0	14487	0	1948	5202	0	0	1826	39565	0	2561	2627	98673							
Total Runoff (m^3/yr)	1366	7228	2103	193	675	1384	5131	953	2407	0	672	87	1081	131	459	941	1738	9192	2674	1081	14487	2690	1948	5202	1130	1695	1826	39565	1219	2561	2627	114444							
Total Outputs (m^3/yr)	9200	14456	2628	1297	5622	1730	6413	6413	16208	0	840	588	8188	882	3821	1176	11699	18384	3343	8188	18109	18109	2435	6844	6844	11413	15217	49456	8209	21344	3284	282341							
Difference (Inputs - Outputs)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							

Notes:

Lot / Block Areas based upon "Draft Plan of Subdivision" Drawing No. DP-01 (May 6, 2025) prepared by Biglieri Group

*Evaporation from impervious areas was assumed to be 20% of precipitation. Asphalt has 0% infiltration capability.

Catchment areas refer to areas North and South of the environmental protection block / creek

Env. Protection refers to Natural Heritage areas

Residential Single Lots: Assume rooftops cover about 55% of the lot. Driveways cover about 10% of the lot; Grass (lawns) cover about 35% of the lot.

Townhouse Lots: Assume rooftops cover about 65% of the lot. Driveways cover about 10% of the lot; Grass (lawns) cover about 25% of the lot.

Commercial Lots: Assume rooftops covers about 20% of the lot. Asphalt parking covers about 65% of the lot; Landscaping covers about 15% of the lot.

Appendix E.6
Water Budget Summary

PARAMETER	SITE																			
	Pre-Development			Post-Development (no mitigation)						Post-Development (with downspout LID mitigation strategy only)						Post-Development (with downspout AND soakaway pit LID mitigation strategies)					
	TOTAL	*North Sub-Catchment*	*South Sub-Catchment*	*TOTAL*	*Difference Pre- vs. Post-*	*North Sub-Catchment*	*Difference Pre- vs. Post-*	*South Sub-Catchment*	*Difference Pre- vs. Post-*	*Post-Development With Mitigation*	*Difference Pre- vs. Post-*	*North Sub-Catchment*	*Difference Pre- vs. Post-*	*South Sub-Catchment*	*Difference Pre- vs. Post-*	*Post-Development With Mitigation*	*Difference Pre- vs. Post-*	*North Sub-Catchment*	*Difference Pre- vs. Post-*	*South Sub-Catchment*	*Difference Pre- vs. Post-*
INPUTS (VOLUMES)																				
Precipitation (m^3/yr)	282341	73585	208755	282341	0%	73585	0%	208756	0%	282341	0%	73585	0%	208756	0%	282341	0%	73585	0%	208756	0%
Run On (m^3/yr)	0	0	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Other Inputs (m^3/yr)	0	0	0	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Total Inputs (m^3/yr)	282341	73585	208755	282341	0%	73585	0%	208756	0%	282341	0%	73585	0%	208756	0%	282341	0%	73585	0%	208756	0%
OUTPUTS (VOLUMES)																				
Precipitation Surplus (m^3/yr)	93578	24289	69290	175479	88%	39181	61%	136298	97%	175479	88%	39181	61%	136298	97%	175479	88%	39181	61%	136298	97%
Net Surplus (m^3/yr)	93578	24289	69290	175479	88%	39181	61%	136298	97%	175479	88%	39181	61%	136298	97%	175479	88%	39181	61%	136298	97%
Evapotranspiration (m^3/yr)	188763	49297	139466	106862	-43%	34404	-30%	72458	-48%	106862	-43%	34404	-30%	72458	-48%	106862	-43%	34404	-30%	72458	-48%
Infiltration (m^3/yr)	47048	12410	34637	19899	-58%	7741	-38%	12159	-65%	19899	-58%	7741	-38%	12159	-65%	19899	-58%	7741	-38%	12159	-65%
%Rooftop Infiltration Factor	37.5%	--	37.5%	--	--	--	--	--	--	37.5%	--	37.5%	--	37.5%	--	37.5%	--	37.5%	--	37.5%	--
Rooftop Infiltration (m3/yr)	145	0	145	--	--	--	--	--	--	23653	16228%	6024	--	17630	12070%	9852	6701%	4337	--	5515	3707%
%Soakaway Pit Infiltration Factor	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	85%	--	85%	--	85%	--
Soakaway Pit Infiltration (m^3/yr)	--	--	--	0	--	0	--	0	--	0	--	0	--	0	--	31283	--	3823	--	27460	--
Total Infiltration (m^3/yr)	47192	12410	34782	19899	-58%	7741	-38%	12159	-65%	43553	-7.7%	13764	10.9%	29788	-14.4%	61034	29.3%	15901	28.1%	45133	29.8%
Runoff Pervious Areas (m^3/yr)	45929	11878	34051	15771	-66%	6088	-49%	9684	-72%	15771	-66%	6088	-49%	9684	-72%	15771	-66%	6088	-49%	9684	-72%
Runoff Impervious Areas (m^3/yr)	456	0	456	139808	204%	25352	0%	114456	24976%	116155	25348%	19329	0%	96826	21114%	98673	21518%	17192	0%	81481	17752%
Total Runoff (m^3/yr)	46386	11878	34508	155579	235%	31440	165%	124139	260%	131926	184%	25416	114%	106510	209%	114444	147%	23280	96%	91165	164%
Total Outputs (m^3/yr)	282341	73585	208755	282341	0%	73585	0%	208756	0%	282341	0%	73585	0%	208756	0%	282341	0%	73585	0%	208756	0%

Appendix F

NBC 2020 Seismic Hazard Tool

Government of Canada Gouvernement du Canada

Canada.ca › Natural Resources Canada › Earthquakes Canada

2020 National Building Code of Canada Seismic Hazard Tool

This application provides seismic values for the design of buildings in Canada under Part 4 of the National Building Code of Canada (NBC) 2020 as prescribed in Article 1.1.3.1. of Division B of the NBC 2020.

Seismic Hazard Values

User requested values

Code edition	NBC 2020
Site designation X_S	X_D
Latitude (°)	44.168
Longitude (°)	-78.453

Please select one of the tabs below.

NBC 2020 | Additional Values | Plots | API | Background Information

The 5%-damped spectral acceleration (S_a(T,X), where T is the period, in s, and X is the site designation) and peak ground acceleration (PGA(X)) values are given in units of acceleration due to gravity (g, 9.81 m/s^2). Peak ground velocity (PGV(X)) values are given in m/s. Probability is expressed in terms of percent exceedance in 50 years. Further information on the calculation of seismic hazard is provided under the *Background Information* tab.

The 2%-in-50-year seismic hazard values are provided in accordance with Article 4.1.8.4. of the NBC 2020. The 5%- and 10%-in-50-year values are provided for additional performance checks in accordance with Article 4.1.8.23. of the NBC 2020.

See the *Additional Values* tab for additional seismic hazard values, including values for other site designations, periods, and probabilities not defined in the NBC 2020.

NBC 2020 - 2%/50 years (0.000404 per annum) probability

$S_a(0.2, X_D)$	$S_a(0.5, X_D)$	$S_a(1.0, X_D)$	$S_a(2.0, X_D)$	$S_a(5.0, X_D)$	$S_a(10.0, X_D)$	$PGA(X_D)$	$PGV(X_D)$
0.315	0.311	0.188	0.0903	0.0241	0.00757	0.181	0.2

The log-log interpolated 2%/50 year $S_a(4.0, X_D)$ value is : **0.0332**

▼ Tables for 5% and 10% in 50 year values

NBC 2020 - 5%/50 years (0.001 per annum) probability

$S_a(0.2, X_D)$	$S_a(0.5, X_D)$	$S_a(1.0, X_D)$	$S_a(2.0, X_D)$	$S_a(5.0, X_D)$	$S_a(10.0, X_D)$	$PGA(X_D)$	$PGV(X_D)$
0.199	0.195	0.114	0.0528	0.0132	0.00414	0.113	0.117

The log-log interpolated 5%/50 year $S_a(4.0, X_D)$ value is : **0.0185**

NBC 2020 - 10%/50 years (0.0021 per annum) probability

$S_a(0.2, X_D)$	$S_a(0.5, X_D)$	$S_a(1.0, X_D)$	$S_a(2.0, X_D)$	$S_a(5.0, X_D)$	$S_a(10.0, X_D)$	$PGA(X_D)$	$PGV(X_D)$
0.129	0.127	0.0719	0.0322	0.00748	0.00237	0.0729	0.0713

The log-log interpolated 10%/50 year $S_a(4.0, X_D)$ value is : **0.0107**

Download CSV

← Go back to the seismic hazard calculator form

Date modified: 2021-04-06



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The Power of Commitment

APPENDIX 5

NATURAL CONSTRAINTS LETTER



347 Pido Road, Unit 29
Peterborough, Ontario K9J 6X7
Canada
ghd.com

Our ref: 12662580

08 July 2025

Saverio Montemarano
Bromont Homes
60 Saramia Crescent, Unit 7
Concord, ON L4K 4J7

Subject: **Vargas North, Millbrook Subdivision, 963 County Road 10**
Part Lot 13, Concession 6
Township of Cavan- Monaghan, County of Peterborough

Natural Environment Constraints Letter

Dear Saverio Montemarano,

1. Introduction

GHD Limited (GHD) was retained by Bromont Homes (the 'Client') to complete an Environmental Impact Study (EIS) for a proposed residential development located along County Road 10 between Fallis Line and Larmer Line, also known as Part of Lot 13, Concession 6 in the Township of Cavan- Monaghan (the 'Site').

The Site is located at 963 Peterborough County Road 10 within the Township of Cavan-Monaghan, Ontario and encompasses a total area of 33.6 ha (83.1 acres). At the time of GHD's field investigation, the Site is being used for agricultural purposes. A creek runs through the northern portion of the Site flowing from west to east and two residential structures are present on the Site. It is understood by GHD that the Site will be municipally serviced for water and sanitary services.

A pre-consultation meeting was held on April 1, 2025 with the applicant, Township, County and Otonabee Conservation (ORCA) in attendance.

A total of 9.21 hectares of commercial lands are being proposed adjacent to County Road 10, inclusive of the 3.06 hectares that are subject to a Minister Zoning Order (MZO), being referenced as "Phase-1". The commercial land use will be constructed prior to any residential uses on the subject site. 12.7 hectares of residential uses are proposed mainly along the interior of the site, and rear to the commercial uses, including two (2) medium density parcels. Several additional blocks have been integrated into the concept plan, inclusive of parkland, stormwater management/retention, and natural heritage system. The subject lands are located within the urban settlement area boundary of Millbrook, in the Township of Cavan Monaghan.

The County of Peterborough also noted the natural heritage requirements:

As per Section 4.1.3.4 of the County OP, development of lands adjacent to key natural heritage features will require an assessment to demonstrate that the ecological function of the adjacent lands have been evaluated and determined that there will be no negative impacts on the natural features or on their ecological functions. Data and mapping available to the County indicates that the subject lands are adjacent to Significant

Woodlands. Therefore, and in concert with Section 4.1.3.4 of the County OP, an environmental impact study (EIS) will be required.

The following report summarizes the background review information and site data collected to date on the natural heritage features. As well as the preliminary development constraints identified by GHD.

A comprehensive EIS will be prepared to accompany the draft plan of subdivision application for the proposed residential and commercial land use and to support agency permitting requirements. The field work started in spring of 2025 is still ongoing. The final EIS being provided in the Fall of 2025 and is intended to be submitted with the second submission of materials. The EIS report will follow the County and ORCA EIS Guideline requirements, and include details on our survey methodologies, field data, mapping, buffer recommendations and mitigation measures.

The EIS will include compliance statements regarding ORCA regulatory and planning requirements, Fisheries Act, Township of Cavan Monaghan Official Plan, County of Peterborough Official Plan, Provincial Planning Statement, Endangered Species Act and the Migratory Birds Convention Act.

2. Background

Prior to site assessments, GHD reviewed all available background information on the Site including, recent air photography, Ministry of Natural Resources (MNR) key natural features GIS mapping, wetland mapping, Official plan schedules and other correspondence or files available from the Township of Cavan-Monaghan, Otonabee Conservation Authority (ORCA), MNR, Department of Fisheries and Oceans (DFO), Natural Heritage Information Center(NHIC) make-a-map, as well as several on-line data sources.

The background review identified several natural heritage features that will be confirmed as part of our current field work schedule.

A desktop review found that several natural heritage features may be associated with the Site, including a watercourse, unevaluated wetland, a Natural Linkage Area identified in the Township of Cavan-Monaghan Official Plan and potential habitat for Species at Risk. There are no provincially significant wetlands or ANSI's found on Site or within 120 m adjacent lands.

The latest site plans (Biglieri Group, June 2025) and Functional Servicing Report and Preliminary grading plan, (Valdor Engineering, June 2025) were also reviewed. As well as the Geotechnical and Hydrogeological Investigation report (GHD, June 12, 2025). A more thorough impact assessment will be included in the EIS report of the impacts of grading, servicing and infrastructure on the natural heritage features.

3. Existing Conditions - To Date

To date, four (4) site visits have been completed: two terrestrial visits that focused on Marsh Monitoring Protocol (MMP) and Ecological Land Classification (ELC), one breeding bird survey and one aquatic visit that focused on fish habitat assessments and surface water quality. The terrestrial site visits took place on April 28, April 30 (aquatic visit), May 20 and June 18, 2025. Together, these visits included walking the extent of the property, the length of watercourses crossing through the centre of the property, all wetland and woodland communities, as well as the agricultural field and road edge. From the date of this letter, two more site visits need to be completed.

The purpose of the site visits was to identify the natural heritage features of the property, including the presence of fish habitat, extent of vegetation communities, presence of Species at Risk (SAR) and their habitat. During the site visit, GHD biologists also searched for regionally rare and/or uncommon plant species, unique

habitat types, and Significant Wildlife Habitat (SWH), as defined by the Significant Wildlife Habitat Technical Guide (MNRF 2014). Survey locations to date and constraints have been illustrated in **Attachment 1**.

It should be noted that additional field surveys are scheduled for the summer of 2025 to complete the remaining field work. That scope of works includes our second breeding bird survey (BBS) and remaining Ecological Land Classification (ELC) ongoing, Species at Risk habitat assessments, confirming Significant Wildlife Habitat, ongoing wetland and woodland boundary delineation and wildlife corridors and conducting fish community sampling (can occur after July 16th as stated on the DFO licence) within the watercourse. The field program will also include searches for bat cavity trees, red-headed woodpecker and pileated woodpecker nests and butternut and black ash trees.

3.1 Vegetation and Communities

To date, six vegetation communities have been identified. Those communities include:

– Agricultural fields
– Meadow marsh
– Deciduous forest
– Coniferous forest
– Cultural meadows
– Shallow marsh

The ELC community boundaries will be confirmed during our site visits and details on vegetation, ecological functions and for wetlands, soil sampling will be conducted. The preliminary community polygons are shown of Figure 1 (attachment 1).

None of the ELC found to date are according to the community type criteria which follows that of MNR's Ecological Land Classification for Southern Ontario program (Lee et al., 1998).

A full plant species and sensitive or rare plant list will be provided with the EIS submission.

3.2 Birds, Herpetozoa and other Wildlife

To date, one breeding bird survey has been completed, with the second, occurring in a few days. Birds observed have been typical rural, fencerow and agricultural field species.

Two Marsh Monitoring Program surveys have been completed with no significant frog species presence on the property within the four stations completed on the property. All species (spring peepers) heard to date, have been located off property to the east.

A full list of birds, amphibians and wildlife will be provided in the EIS submission along with any statements regarding any identified significant species such as species at risk or area sensitive species. Analysis and discussion will be included in the EIS along with policy compliance guidelines and permitting requirements.

Once surveys are completed this summer, a comparison to the latest Species at Risk lists will be conducted and detailed discussion on habitat, impacts and possible ESA compliance included in the EIS report.

3.3 Fish and Fish Habitat

Review of ARA mapping identified three watercourses present on site, one watercourse is a tributary to Cavan Creek and the remaining two function as tributaries to the Cavan Creek tributary. Field assessments confirmed the presence of the three watercourses on the site with the Cavan Creek tributary being confirmed as a permanently flowing watercourse and the two tributaries assessed as Headwater Drainage Features (HDF).

The Cavan Creek tributary originates west of the site and flows in an easterly direction crossing the site in the northern portion of the site. Based on the ARA mapping, HDF1 originates within the site, and HDF2 originates south of the site, and generally flow in an easterly direction, eventually discharging into the Cavan Creek tributary east of the property boundaries. The Cavan Creek tributary has been illustrated as Habitat Zone 1 and the HDFs have been illustrated as HDF 1 and HDF 2 in **Attachment 1**. Assessments were conducted following standardized provincial aquatic protocols, specifically, the Ontario Ministry of Transportation (MTO) Environmental Guide for Fish and Fish Habitat Protocol Section 4.0 0 (MTO, 2009) and applicable sections of the Ontario Stream Assessment modules Rapid Assessment Methodology for Channel Structure (S4:M1) and the Ontario Stream Assessment Protocol, Section 4, Module 11 (Stanfield, 2017).

The tributary of Cavan Creek was located in the north portion of the Site and flows east off Site. The tributary is classified as a coldwater watercourse (ARA, 2024) and was located in the north portion of the Site. The watercourse was confirmed to be a permanently flowing watercourse with well-defined channel, with a hydraulic head of 8 mm, low instream and overhead cover observed during the assessments on April 30, 2025. Based upon conditions observed at the time of field investigations, the tributary provides direct fish habitat. Fish community sampling was not completed during the April 2025 assessments due to timing restrictions outlined in the conditions of the Ministry of Natural Resources (MNR) Licence to Collect Fish for Scientific Purposes (Permit: PEBA-2025_FWCA-00262). The conditions stipulate that sampling can only occur between July 16 and September 30, 2025. GHD will conduct fish community sampling within the watercourse within the approved timing window. Surface water quality was collected within the watercourse and details will be included in the EIS report.

The two HDFs (HDF1 and HDF2) within the Site were classified as swale features providing seasonal indirect fish habitat downstream to the Cavan Creek tributary. Specially they may provide nutrients, and food supply downstream to the watercourse. During the time of field assessments both features had minimal to no flow and no sorted substrates. These features were located in the middle of the Site and flow east off Site, based on aerial imagery it appears these features have the potential to directly connect to the watercourse east off Site. Assessments were not conducted outside of the Site property limits however during the spring freshet and large storm events these features have the potential to directly connect to the watercourse off Site.

It should be noted that HDF1 is mapped as a permanent watercourse (ARA, 2024), however during GHDs site visit fish habitat was not observed within this feature based on a lack of flow, dense vegetation within the channel and a lack of sorted substrates., Direct fish habitat may be present downstream east of the Site where flows may be present for longer periods. The two HDFs will be revisited during when GHD conducts the fish community surveys within the Cavan Creek tributary to confirm if water is present and is sufficient to conduct fish community sampling. This will be used to confirm the function of the HDFs for the EIS.

4. Recommendations

Recommendations will be included in the EIS report, once the field surveys are completed and we have confirmed the boundaries of any natural heritage features and their ecological functions. Recommendations regarding buffers and mitigation measures will be included in the EIS report.

The Cavan Creek tributary (Habitat Zone 1) functions as direct fish habitat. Specifically, it provides cover, feeding, rearing, potential overwintering, and potential spawning habitat for the watercourse and downstream Cavan Creek fish community. These attributes are important for the sustainability of the coldwater fish community that inhabits the tributary and main Cavan Creek channel. It is recommended that the form and function of the tributary within the Site be protected with a 30 m setback from the high-water mark (attached figure), no development, including any proposed stormwater outlet channels shall occur within this setback. If any near or in-water works are proposed it is recommended that the design be reviewed by a qualified biologist

to determine potential impacts and identify any required permits. Permitting may be required from the Conservation Authority and the Department of Fisheries and Oceans (DFO) for any in or near water works.

The HDFs within the Site (HDF 1 and HDF 2) are unlikely to provide direct fish habitat, therefore a buffer has not been applied to these features. If these features are proposed to be altered to facilitate the development, it is recommended that flows from these features are maintained downstream to Cavan Creek tributary through LID lot level conveyance to ensure the project is in compliance with the Fisheries Act.

Woodland significance, woodland dripline and buffer recommendations will be included in the EIS in the second submission.

5. Conclusion

We trust that this constraints letter will help support the design process of the subdivision layout and the other supporting documentation. GHD will work with the study team by identifying potential impacts to natural features and discussing mitigation measures and buffers. The EIS report will review the latest development plan along with proposed infrastructure and grading and the potential impact the natural features and their ecological functions.

The EIS will be completed once the remaining field work has been completed. The EIS will include our detailed methodologies, survey results, discussion, impact assessment and recommendations and mitigation measures. Should you wish to discuss any aspect of this letter, please do not hesitate to contact the undersigned.

Regards,

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Attachments

Attachment 1

Constraints Figure

ELC Types - 1st Approximation

Ecological Land Classification for Southern Ontario: First Approximation and Its Application. 1998.

ELC Code	Ecosite-Vegetation Type Description
CUM1-1	Dry-Moist Old Field Meadow
CUW1	Mineral Cultural Woodland
FOC2-2	Dry-Fresh White Cedar Coniferous Forest
FOD	Deciduous Forest
MAM2-2	Reed-canary Grass Mineral Meadow Marsh
MAM2-9	Jewelweed Mineral Meadow Marsh
MAM2-10	Forb Mineral Meadow Marsh
MAS2-9	Forb Mineral Shallow Marsh



7 FENCEROW
LARMER LINE
MMP4
Hydro Line
Hydro Line
Ag
7 FENCEROW
7 FENCEROW
7 FENCEROW
Ag
EXISTING RESIDENTIAL
12 FOD
HZ-01
9 CUM1-1
9 CUM1-1
10 MAS2-9
MMP3
SFQ001
11 FOC2-2
Seep
Trib. of Cavan Creek
9 CUM1-1
COUNTY ROAD 10
Ag
8 MAM2-10 (to be removed)
MMP2
HDF 1
Ag (SOYA)
7 FENCEROW
Culvert
Ag
6 CUM1-1
HDF 2
MMP1
7 FENCEROW
Ag
5 MAM2-2 (to be removed)
2 MAM2-2
7 FENCEROW
13 HAY FIELD
13 HAY FIELD
1 CUM1-1
EXISTING RESIDENTIAL 316 m²
3 CUM1-1 10,036 m²
4 CUW1 2621 m²
CUM1-1 433 m²

Legend

- Culvert Location
- Seep (GHD)
- MMP - Amphibian Survey Stations
- SFQ - Surface Water Quality Location
- Utility Line
- Watercourse, OHN
- 30 m Setback from Significant Woodland
- 30 M Setback from Aquatic Habitat Zone 1
- Assessment Parcel
- Vegetation Communities
- Significant Woodland
- Forest Communities
- Wetland Communities
- Headwater Drainage Feature (HDF) Line

Aquatic Habitat Zones

- HZ-01

Data Disclaimer

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1:4,200
0 30 60 90 120
Meters

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N
Paper Size ANSI B

Charter Properties
Larmer Line & County Road 10, Fraserville, ON
Township of Cavan Monaghan
Environmental Impact Study

Preliminary Communities, Survey Points and Constraints

Project No. 12662580
Revision No.
Date Jul 8, 2025

Figure 1

Q:\GIS\PROJECTS\12662000s\12662580\GIS\Maps\Deliverables\EIS\12662580_202506_EIS\12662580_202506_EIS.aprx
Print date: 08 Jul 2025 - 14:27

Data source: Image @ County of Peterborough, 2018.

APPENDIX 6

ARCHAEOLOGICAL ASSESSMENT, ASI



Stage 1 Archaeological Assessment Cavan-Monaghan Water and Wastewater Master Servicing Study (Part of Lots 10-13, Concession 5, Former Township of Cavan, County of Durham) Township of Cavan Monaghan, County of Peterborough, Ontario

Draft Report

Prepared for:

R.V. Anderson Associates Limited

2001 Sheppard Avenue East Suite 300, Toronto ON M2J 4Z8

Archaeological Licence: P1066 (Lytle)

PIF P1066-0185-2021

Archaeological Services Inc. File: 20EA-138

18 October 2023



Executive Summary

Archaeological Services Inc. (ASI) was contracted by R.V. Anderson Associates Limited to conduct a Stage 1 Archaeological Assessment (Background Research) as part of the Water and Wastewater Master Servicing Study in the Township of Cavan Monaghan, County of Peterborough. This project involves the water and wastewater infrastructure needs proposed to accommodate additional growth in the Millbrook Urban Settlement Area, with a focus on currently undeveloped areas "Existing Urban Employment Area" and "Special Development Area", as well as a 50-hectare parcel of land outside the Millbrook boundary "Suggested Additional Residential Area". The Stage 1 Study Area includes all three proposed development areas.

The Stage 1 background study determined that 20 sites are within one kilometre of the Study Area and 11 sites are within the Existing Urban Employment Area and the Suggested Additional Residential Area. The Gardiner's United Church Cemetery is within the Existing Urban Employment Area. The entirety of the Special Development Area has been previously assessed and cleared of archaeological concern. Both the Existing Urban Employment Area and the Suggested Additional Residential Area require further archaeological assessment. Sites BaGo-44, BaGo-45, BaGo-46, and BaGo-47 are within the Suggested Additional Residential Area and are considered to have further CHVI requiring Stage 3 assessment.

The following is a summary of our recommendations:

1 Parts of the Existing Urban Employment Area and the Suggested Additional Residential Area exhibit archaeological potential. These lands require Stage 2 archaeological assessment by test pit survey or pedestrian survey at five metre intervals, prior to any proposed construction activities.

2 BaGo-44, BaGo-45, BaGo-46, and BaGo-47 are within the Suggested Additional Residential Area and are considered to retain further cultural heritage value or interest. The sites must be specific to Stage 3 Site-Specific

Assessment prior to any proposed impacts to the area, as per the recommendations made by YNAS 2017 (P156-0254-2016) presented below:

3 Gardiner United Church Cemetery is within the Existing Urban Employment Area. All Cemetery lands should be avoided by project designs. A Stage 3 Cemetery investigation is not required for the well defined northern, eastern, and southern limits. The County Road 10 right-of-way lands adjacent Gardiner United Church Cemetery have potential for unmarked or shifted burials. However, a ditch has been created in these lands and there is buried utility infrastructure which preclude ASI from safely conducting mechanical topsoil removal. ASI recommends that any project impacts adjacent Gardiner United Church Cemetery be subject to Cemetery Investigation by archaeological construction monitoring.

4 The road right-of-ways in the Existing Urban Employment Area and the Suggested Additional Residential Area exhibit low archaeological potential and have likely been subjected to deep soil disturbance events due to typical road construction. However since no property inspection was conducted, these lands beyond the paved road bed must be subject to visual inspection to confirm the extent of disturbance during future Stage 2 survey.

5 The entirety of the Special Development Area does not retain archaeological potential due to being previously assessed and being cleared of further archaeological concern. These lands do not require further archaeological assessment.

6 During any further archaeological assessments, meaningful engagement with Indigenous communities should be conducted, as outlined in Section 3.5 of the S & G and *Engaging Aboriginal Communities in Archaeology Technical Bulletin*.

Project Personnel

- **Senior Project Manager**: Lisa Merritt, MSc. (P094) Partner, Director, Environmental Assessment Division
- **Division Coordinator**: Katrina Thach, BA Hons. (R1225), Associate Archaeologist, Assistant Manager, Environmental Assessment Division
- **Project Administrator**: Catherine Kitchen, BA (R1364), Archaeologist, Project Administrator, Environmental Assessment Division
- **Project Director**: Jessica Lytle, MSc (P1066), Lead Archaeologist, Technical Writer and Fieldwork Coordinator, Environmental Assessment Division
- **Project Manager**: Eliza Brandy, MA (R1109), Associate Archaeologist, Project Manager, Environmental Assessment Division
- **Report Preparation**: Eliza Brandy; Danielle Bella, Hon. BA, Archaeologist, Technical Writer, Environmental Assessment Division
- **Graphics**: Andrew Clish, BES (P046), Senior Archaeologist, Senior Field Director, Laboratory and Fieldwork Services, Operations Division; Carolyn Nettleton, BA, Archaeologist, GIS Technician, Operations Division
- **Report Reviewer**: Lisa Merritt

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1.0 Project Context

Archaeological Services Inc. (ASI) was contracted by R.V. Anderson Associates Limited to conduct a Stage 1 Archaeological Assessment (Background Research) as part of the Water and Wastewater Master Servicing Study in the Township of Cavan Monaghan, County of Peterborough. This project involves the water and wastewater infrastructure needs proposed to accommodate additional growth in the Millbrook Urban Settlement Area, with a focus on currently undeveloped areas "Existing Urban Employment Area" and "Special Development Area", as well as a 50-hectare parcel of land outside the Millbrook boundary "Suggested Additional Residential Area" (Figure 1). The types of infrastructure required for the servicing may include a new municipal well, watermain extensions, a new water tower, sanitary collection system extensions and/or wastewater treatment plant expansion. The Stage 1 Study Area includes all three proposed development areas.

All activities carried out during this assessment were completed in accordance with the *Ontario Heritage Act* (1990, as amended in 2023) and the 2011 *Standards and Guidelines for Consultant Archaeologists* (S & G), administered by the Ministry of Citizenship and Multiculturalism (MCM 2011).

1.1 Development Context

All work has been undertaken as required by the *Environmental Assessment Act, RSO* (Environmental Assessment Act, R.S.O. c. E.18, 1990 as amended 2022) and regulations made under the Act, and are therefore subject to all associated legislation. This project is being conducted in accordance with the *Municipal Class Environmental Assessment* process (Municipal Engineers Association, 2023).

Authorization to carry out the activities necessary for the completion of the Stage 1 Archaeological Assessment was granted by R.V. Anderson & Associates Limited on November 30, 2020.

1.2.2 Treaties and Traditional Territories

The Study Area is within Treaty 20 the Rice Lake Purchase of 1818, and on the traditional territory of the Michi Saagiig and Chippewa Nations, collectively known as the Williams Treaties First Nations, including the Mississaugas of Alderville First Nation, Curve Lake First Nation, Hiawatha First Nation, Scugog Island First Nation and the Chippewas of Beausoleil First Nation, Georgina Island First Nation and the Rama First Nation (Williams Treaties First Nations, 2017). The Study Area is also within the area of interest of the Huron-Wendat Nation.

A large portion of land east and south of Lake Simcoe was negotiated on November 5, 1818 in the interests of encouraging British settlement north of Lake Ontario and included all of Peterborough and Victoria Counties, two small parts of Northumberland, the north half of Durham, the northern tip of Ontario County, and those parts of Muskoka and Haliburton lying south of the 45th parallel. The land in question encompassed some 1.95 million acres (789,500 ha) of land and was negotiated with Mississauga nations in the Rice Lake area, although the treaty describes them as “Chippewa” (Crown-Indigenous Relations and Northern Affairs, 2016). In payment for these lands, the Crown agreed to pay the value of £749.00 currency in goods annually to the nations.

This treaty was subsequently included as part of the Williams Treaties in October and November of 1923. The purpose of the treaties was to address lands that had not been surrendered through previous treaties and no negotiations preceded the signing of the Williams Treaties in 1923, with a commission established by the Federal and Provincial governments led by Treaty Commissioner A. S. Williams.

Through the Williams Treaties, the Crown received three tracts of land occupying approximately 52,000 square kilometres of land. The territory covered by the Williams Treaties stretched from the northern shore of Lake Ontario between Trent River and the Don River to Lake Simcoe and the eastern shore of Georgian Bay to the French River and Lake Nipissing and was bounded to the north and east by the Ottawa River. Specifically, the Williams Treaties includes lands originally covered by the John Collins Purchase (1785), the Johnson-Butler Purchase (1787), the Rice Lake Purchase (Treaty #20 – 1818), and the Robinson-

Huron Treaty (Treaty #61 – 1850). In exchange, the signing nations received a one-time payment of $25 for each band member as well as $233,425.00 to be divided amongst the four Mississauga nations and $233,375.00 to be divided amongst the three Chippewa nations.

However, the seven signatory nations claimed that the original terms of the treaty were not honoured when it was written by the Crown, which included the right to fish and hunt within the treaty lands and did not include the islands along the Trent River (Surtees 1986; Williams Treaties First Nations 2017). In 1992, the seven Williams Treaties First Nations filed a lawsuit against the federal government — Alderville Indian Band et al v. Her Majesty the Queen et al — seeking compensation for the 1923 land surrenders and harvesting rights. This case went to trial in 2012 and in September 2018 the Federal and Provincial governments announced that they had successfully reached a settlement with the seven member nations. The settlement includes financial compensation of $1.11 billion to be divided amongst the nations as well as an entitlement for each First Nation to add up to 11,000 acres to their reserve lands and the recognition by the Crown of the First Nation's Treaty rights to harvest on Crown lands within the treaty territories.

1.2 Historical Context

The purpose of this section, according to the S & G, Section 7.5.7, Standard 1, is to describe the past and present land use and the settlement history and any other relevant historical information pertaining to the Study Area. A summary is first presented of the current understanding of the Indigenous land use of the Study Area. This is then followed by a review of the historical Euro-Canadian settlement history.

1.2.1 Indigenous Land Use and Settlement

Southern Ontario has been occupied by human populations since the retreat of the Laurentide glacier approximately 13,000 years before present (B.P.) (Ferris, 2013). Populations at this time would have been highly mobile, inhabiting a boreal-parkland similar to the modern sub-arctic. By approximately 10,000 B.P.,

the environment had progressively warmed (Edwards & Fritz, 1988) and populations now occupied less extensive territories (Ellis & Deller, 1990).

Between approximately 10,000-5,500 B.P., the Great Lakes basins experienced low-water levels, and many sites which would have been located on those former shorelines are now submerged. This period produces the earliest evidence of heavy wood working tools, an indication of greater investment of labour in felling trees for fuel, to build shelter, and watercraft production. These activities suggest prolonged seasonal residency at occupation sites. Polished stone and native copper implements were being produced by approximately 8,000 B.P.; the latter was acquired from the north shore of Lake Superior, evidence of extensive exchange networks throughout the Great Lakes region. The earliest evidence for cemeteries dates to approximately 4,500-3,000 B.P. and is indicative of increased social organization, investment of labour into social infrastructure, and the establishment of socially prescribed territories (Brown, 1995, p. 13; Ellis et al., 1990, 2009).

Between 3,000-2,500 B.P., populations continued to practice residential mobility and to harvest seasonally available resources, including spawning fish. The Woodland period begins around 2,500 B.P. and exchange and interaction networks broaden at this time (Spence et al., 1990, pp. 136, 138) and by approximately 2,000 B.P., evidence exists for small community camps, focusing on the seasonal harvesting of resources (Spence et al., 1990, pp. 155, 164). By 1,500 B.P. there is macro botanical evidence for maize in southern Ontario, and it is thought that maize only supplemented people's diet. There is earlier phytolithic evidence for maize in central New York State by 2,300 B.P. – it is likely that once similar analyses are conducted on Ontario ceramic vessels of the same period, the same evidence will be found (Birch & Williamson, 2013, pp. 13–15). As is evident in detailed Anishinaabek ethnographies, winter was a period during which some families would depart from the larger group as it was easier to sustain smaller populations (Rogers, 1962). It is generally understood that these populations were Algonquian-speakers during these millennia of settlement and land use.

From the beginning of the Late Woodland period at approximately 1,000 B.P., lifeways became more similar to that described in early historical documents. Between approximately 1000-1300 Common Era (C.E.), the communal site is replaced by the village focused on horticulture. Seasonal disintegration of the community for the exploitation of a wider territory and more varied resource

base was still practised (Williamson, 1990, p. 317). By 1300-1450 C.E., this episodic community disintegration was no longer practised and populations now communally occupied sites throughout the year (Dodd et al., 1990, p. 343). By the mid-sixteenth century these small villages had coalesced into larger communities (Birch et al., 2021). Through this process, the socio-political organization of the First Nations, as described historically by the French and English explorers who first visited southern Ontario, was developed.

By 1600 C.E., the communities within Simcoe County had formed the Confederation of Nations encountered by the first European explorers and missionaries. In the 1640s, devastating epidemics and the traditional enmity between the Haudenosaunee and the Huron-Wendat (and their Algonquian allies such as the Nippissing and Odawa) led to the dispersal of the Huron-Wendat from southern Ontario. Shortly afterwards, the Haudenosaunee established a series of settlements at strategic locations along the trade routes inland from the north shore of Lake Ontario. By the 1690s however, the Anishinaabeg were the only communities with a permanent presence in southern Ontario. From the beginning of the eighteenth century to the assertion of British sovereignty in 1763, there was no interruption to Anishinaabeg control and use of southern Ontario.

1.2.3 Post-Contact Settlement

Historically, the Study Area is located in the Former Township of Cavan, County of Durham in Lots 10-13 & Concession 5.

The S & G stipulates that areas of early Euro-Canadian settlement (pioneer homesteads, isolated cabins, farmstead complexes), early wharf or dock complexes, pioneer churches, and early cemeteries are considered to have archaeological potential. Early historical transportation routes (trails, passes, roads, railways, portage routes), properties listed on a municipal register or designated under the Ontario Heritage Act or a federal, provincial, or municipal historic landmark or site are also considered to have archaeological potential

For the Euro-Canadian period, the majority of early nineteenth century farmsteads (i.e., those that are arguably the most potentially significant resources and whose locations are rarely recorded on nineteenth century maps) are likely to be located in proximity to water. The development of the network of concession

roads and railroads through the course of the nineteenth century frequently influenced the siting of farmsteads and businesses. Accordingly, undisturbed lands within 100 metres of an early settlement road are also considered to have potential for the presence of Euro-Canadian archaeological sites.

The first Europeans to arrive in the area were transient merchants and traders from France and England, who followed Indigenous pathways and set up trading posts at strategic locations along the well-traveled river routes. All of these occupations occurred at sites that afforded both natural landfalls and convenient access, by means of the various waterways and overland trails, into the hinterlands. Early transportation routes followed existing Indigenous trails, both along the lakeshore and adjacent to various creeks and rivers (ASI 2006).

Cavan Township

The Township of Cavan was surveyed in 1816-1817 and John Deyell assisted surveyor Samuel Wilmot in the task. The first Euro-Canadian to settle in the township was John Deyell in 1816. Deyell had come from County Monaghan in Ireland, and he acquired land opposite of the present-day hamlet of South Monaghan. At that location, he constructed the township's first tavern. Deyell also built the township's first grist and sawmill at present-day Millbrook. This was later replaced with another mill, Needler's flour mill, which was destroyed by fire. A subsequent mill was in operation at the location until 1966 (Mika & Mika, 1977).

By 1830, the township had four mills, five stores, and two distilleries. The first church was a log structure, St. John's Anglican, in the hamlet of Ida. The land for the first schoolhouse was donated by settler, John Deyell. The main industry of the township was agriculture, and an Agricultural Society was organized as early as 1859. It continues to be a mainstay for those living within the township. The township had been part of the United Counties of Northumberland and Durham until 1974 (Mika & Mika, 1977). The Township of Cavan amalgamated with the Township of North Monaghan and the Village of Millbrook in 1997 (*Municipal Restructuring Activity Summary Table*, 2018).

Millbrook

In 1816, John Deyell came to the area from Ireland and constructed a grist mill by a brook, giving Millbrook its name. Another early Euro-Canadian settler was John Thorn, who made bricks and burned limestone for lime to construct his house. Thorn also built the first mill to run by hand to grind corn (Mika & Mika, 1981).

Millbrook grew into a prosperous village with many stores and other businesses including Needler's three-storey flour mill, McIvor's mill for oatmeal, a cooper shop, and a pump factory. The New Connexion Church was the first church in the village, followed by the Anglican Parish of Cavan organizing in 1819. In 1881, the cornerstone of the Methodist Church was laid (Mika & Mika, 1981).

The village's Town Hall was constructed in 1877 and the present building was built in 1880, replacing the first which was destroyed by fire. For a time, the old Town Hall was used as the schoolhouse, until a red brick school was built on Union Street. This building burned down in 1887 and a white brick school was opened in 1890. In 1880, Millbrook was incorporated as a village. The population of the community was 1,500 at the time. The library was organized by David Hampton in 1894 with the assistance of the Mechanics' Institute. The following year it became a free Public Library (Mika & Mika, 1981).

The Village of Millbrook amalgamated with the Township of Cavan and the Township of North Monaghan in 1997 (*Municipal Restructuring Activity Summary Table*, 2018).

Gardiner's United Church Cemetery

The Gardiner's United Church Cemetery is an active cemetery located at 1097 County Road 10 on Lot 13, Concession 6 in the Township of Cavan. The church appears on the property of J. & R. Gardner on the 1861 *Tremaine's Map of Durham County*, however it is not until the 1878 *Illustrated Historical Atlas of Durham County* that the cemetery is depicted south of the church on the property of Ralph Gardiner (Tremaine, 1861; Belden, 1878). Copies of the Gardiner's Cemetery plan and burial layout from 1920 were provided by the Bereavement Authority of Ontario (see Appendix A). The Gardiners Cemetery burial layout plan

shows the north fence line, the west fence line and gate, the east fence line, and the line between older and newer cemetery grounds to the south. A tool house is indicated against the eastern fence line within the cemetery, and grave markers are illustrated right up to the fence line on all sides.

Midland Railway

This railroad began in 1846 as the Peterborough and Port Hope Railway Company and was to run from Port Hope to Peterborough around Rice Lake. Initially growth of the rail line was slow due to financial issues and a new charter was issued in 1854 for the Port Hope, Lindsay, and Beaverton Railway Company. Four years later the company constructed a branch line from Millbrook to Peterborough. The railway changed its name to the Midland Railway of Canada in 1869 when it planned for expansion to Beaverton and beyond. During the 1880s, following a decade of growth the company was in financial difficulties as were other rail lines and in 1882, a merger of six rail road companies under the Midland Railway of Canada saw its total mileage swell from 144 miles to 465 miles (Toronto Railway Historical Association, 2020).

The abandonment of the original mainline between Omemee and Millbrook Junction occurred in 1882 when the company decided to build a direct line between Peterborough and Omemee. The company was later taken over by the Grand Trunk Railroad in 1893 and subsequently the Canadian National Railway in 1923 (Andreae, 1997; Toronto Railway Historical Association, 2020).

1.2.4 Historical Map Review

The 1861 *Tremaine's Map of Durham County* (Tremaine, 1861) and the 1878 *Illustrated Historical Atlas of Durham County* (Belden, 1878) were examined to determine the presence of historic features within the Study Area during the nineteenth century (Figures 2-3).

It should be noted, however, that not all features of interest were mapped systematically in the Ontario series of historical atlases, given that they were financed by subscription, and subscribers were given preference with regard to

the level of detail provided on the maps. Moreover, not every feature of interest would have been within the scope of the atlases.

Nineteenth-century mapping shows the Existing Urban Employment Area, Suggested Additional Residential Area, and Special Development Area are within a rural agricultural context. County Road 10, Larmer Lane, King Street, and Fallis Line are shown as historical road allowances. Millbrook is labelled to the southeast. A watercourse is shown intersecting the Existing Urban Employment Area and County Road 10 south of a Wesleyan Methodist church. A schoolhouse is depicted northwest of the intersection of County Road 10 and Larmer Line. The Midland Railroad is illustrated curving from the south to the northwest through the Suggested Additional Residential Area. A structure is shown adjacent the northern limits of the Suggested Additional Residential Area on the property of Patrick Maguire, and adjacent the western limits on the property of James Hunter. Dark shading on the mapping depicts a small development at Queen Street and Hunter Street in the Special Development Area.

The 1878 map shows growth of Millbrook and within the south end of the Special Development Area. Six structures are shown within the Existing Urban Employment Area, and a cemetery is depicted south of the church. A structure is shown adjacent the Existing Urban Employment Area at the northwest corner of County Road 10 and Fallis Lane. Four structures are shown within the Suggested Additional Residential Area and one adjacent to the west.

The 1932 Department of Militia and Defence (DMD) Bolton Sheet topographic mapping and 1985 National Topographic System (NTS) Rice Lake Sheets (Department of National Defence, 1932; Department of Energy, Mines and Resources, 1985) were examined to determine the extent and nature of development and land uses within the Study Area (Figures 4-5).

The twentieth-century mapping continues to depict the Existing Urban Employment Area, Suggested Additional Residential Area, and Special Development Area in a rural agricultural context outside of the village of Millbrook.

The 1932 topographic map illustrates County Road 21 and County Road 10 as improved roads under 20 feet wide. The other roads are depicted as dirt roads. The Midland Railway is labelled as an abandoned line. The areas are shown as being treed. The Gardiner's United Church Cemetery is bordered to the north by a house and its associated barn. Opposite the cemetery across the road, as well as to the south past the bridge over the creek are another two sets of a house and barn. A lane extends north from Fallis Lane into the Suggested Additional Residential Area where there is a house and barn, and two lanes extend south with a house and barn each. A long laneway extends north from King Street, which enters the southern portion of the Suggested Additional Residential Area to the west of the abandoned line. A house and barn are at its end just past a bridge over a watercourse. Five structures are within/adjacent the Special Development Area along Queen Street and Hunter Street.

The 1985 map depicts a hydro corridor intersecting the northern portion of the Existing Urban Employment Area. The limits of Millbrook are outlined, the Special Development Area partially within its limits. The former penitentiary is illustrated within the Special Development Area. Some additional buildings have been constructed east of County Road 10 and north of the tributary of Baxter Creek, as well as an additional building south of Fallis Line.

1.2.5 Aerial and Orthoimagery Review

The 1954 aerial photography (Hunting Survey Corporation Limited, 1954) shows the agricultural context of the Existing Urban Employment Area, Suggested Additional Residential Area, and Special Development Area (Figure6). A patchwork of agricultural fields and tree lines are clearly visible.

Available Google satellite imagery from 2009 to 2020 was reviewed. Within the Special Development Area, demolition of the penitentiary occurs in 2015, with the entirety of the building removed by 2016. The review indicates the Existing Urban Employment Area and the Suggested Additional Residential Area have remained relatively unchanged.

1.3 Archaeological Context

This section provides current land use and field conditions, its environmental characteristics (including drainage, soils or surficial geology and topography, etc.), and background research pertaining to previous archaeological fieldwork conducted within and in the vicinity of the Study Area. Three sources of information were consulted to provide information about previous archaeological research: the site record forms for registered sites available online from the MCM through "Ontario's Past Portal"; published and unpublished documentary sources; and the files of ASI.

1.3.1 Current Land Use and Field Conditions

The Study Area focuses on two areas within the Millbrook boundary that are not currently developed, as well as a third area including 50 hectares of land that are outside the Millbrook boundary that are of interest to the Township. These areas have been identified as "Existing Urban Employment Area", "Special Development Area", and "Suggested Additional Residential Area".

The Existing Urban Employment Area consists largely of agricultural fields west and east of the north-south oriented County Road 10. The road is a two-lane roadway with wide gravel shoulders. It lacks curbs and sidewalks and has drainage ditches within the right-of-ways. Houses, barns and outbuildings, as well as the. Gardiner's United Church Cemetery are within the Existing Urban Employment Area.

The Special Development Area consists of open grassed land. Trees border the footprint of the previously existing penitentiary.

The Suggested Additional Residential Area consists of agricultural fields north and south of Fallis Lane, with a few homes and outbuildings. Fallis Lane is an unmarked two-lane roadway which follows an east-west orientation, with grassed ditched right-of-ways for drainage. It lacks curbs and sidewalks.

1.3.2 Geography

In addition to the known archaeological sites, the state of the natural environment is a helpful indicator of archaeological potential. Accordingly, a description of the physiography and soils are briefly discussed for the Study Area.

The S & G stipulates that primary water sources (lakes, rivers, streams, creeks, etc.), secondary water sources (intermittent streams and creeks, springs, marshes, swamps, etc.), ancient water sources (glacial lake shorelines indicated by the presence of raised sand or gravel beach ridges, relic river or stream channels indicated by clear dip or swale in the topography, shorelines of drained lakes or marshes, cobble beaches, etc.), as well as accessible or inaccessible shorelines (high bluffs, swamp or marsh fields by the edge of a lake, sandbars stretching into marsh, etc.) are characteristics that indicate archaeological potential.

Water has been identified as the major determinant of site selection and the presence of potable water is the single most important resource necessary for any extended human occupation or settlement. Since water sources have remained relatively stable in Ontario since 5,000 BP (Karrow & Warner, 1990, p. Figure 2.16), proximity to water can be regarded as a useful index for the evaluation of archaeological site potential. Indeed, distance from water has been one of the most commonly used variables for predictive modeling of site location.

Other geographic characteristics that can indicate archaeological potential include elevated topography (eskers, drumlins, large knolls, and plateaux), pockets of well-drained sandy soil, especially near areas of heavy soil or rocky ground, distinctive land formations that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases. There may be physical indicators of their use, such as burials, structures, offerings, rock paintings or carvings. Resource areas, including; food or medicinal plants (migratory routes, spawning areas) are also considered characteristics that indicate archaeological potential (S & G, Section 1.3.1).

The Existing Urban Employment Area, the Suggested Additional Residential Area, and the Special Development Area are located within the sand plains of the

Peterborough Drumlin Field physiographic region of southern Ontario (Chapman & Putnam, 1984). The Special Development Area is also within the drumlinized till plains. The Peterborough Drumlin Field extends from Simcoe County east to Hastings County and is generally characterized by rolling till plains overlying limestone bedrock. The region is approximately 4,532 km^2 and contains over 3000 drumlins in addition to many other drumlinoid hills and surface flutings (Chapman and Putnam 1984:169). The drumlins are composed of highly calcareous till but there are local differences in composition. The till plains of the regions were formed during the retreat of the Lake Ontario ice lobe of the Laurentide glacier, and they indicate directionality of glacial advance and retreat. Till is produced from the advance of continental glacial ice. Soil and rock is carried forward by the ice, mixed and milled, producing a heterogeneous soil which is characteristic of glaciations (Chapman and Putnam 1984:10 and 16).

Figure 7 depicts surficial geology for the Existing Urban Employment Area, Suggested Additional Residential Area, and Special Development Area. The surficial geology mapping demonstrates that the Existing Urban Employment Area is underlain by stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain, fine-textured glaciolacustrine deposits of silt and clay, minor sand and gravel, massive to well laminated, by coarse-textured glaciolacustrine deposits of sand, gravel, minor silt and clay, foreshore and basinal deposits, and modern alluvial deposits of clay, silt, sand, gravel, and may contain organic remains. The Suggested Additional Residential Area is underlain by stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain and fine-textured glaciolacustrine deposits of silt and clay, minor sand and gravel, massive to well laminated. The Special Development Area is underlain by modern alluvial deposits of clay, silt, sand, gravel, which may contain organic remains, coarse-textured glaciolacustrine deposits of sand, gravel, minor silt and clay, foreshore and basinal deposits, and older alluvial deposits of clay, silt, sand, gravel and may contain organic remains. A fluvial terrace is within the northwest portion of the Special Development Area (Ontario Geological Survey, 2010).

Soils in the Existing Urban Employment Area, Suggested Additional Residential Area, and Special Development Area are depicted in Figure8. Soils in the Existing Urban Employment Area consist of Otonabee loam and Brighton gravelly sand

with good drainage, Schomberg clay loam with fair to good drainage and Bottom Land with variable drainage that is usually poor. Soils in the Suggested Additional Residential Area consist of Otonabee loam with good drainage and Lyons loam with poor drainage. Soils in the Special Development Area consist of Brighton sand with good drainage, Bottom Land with variable drainage that is usually poor and Otonabee loam steep phase with excessive drainage.

Tributaries of Baxter Creek enter the Existing Urban Employment Area and Suggested Additional Residential Area, and within 90 metres north and 50 metres south of the Special Development Area. The Existing Urban Employment Area, Suggested Additional Residential Area, and Special Development Area are within the Baxter Creek subwatershed of the Otonabee Region Watershed. The Otonabee Region Watershed supports 107,000+ residents, approximately 71% of which live within the City of Peterborough. The watershed has an area of 207 kilometres squared wetland cover, or 11%. About 15% of the watershed is forested, with the Baxter Creek subwatershed receiving the grade “B” for good cover (Otonabee Conservation, 2013, 2018).

1.3.2 Previous Archaeological Research

In Ontario, information concerning archaeological sites is stored in the Ontario Archaeological Sites Database (OASD) maintained by the MCM. This database contains archaeological sites registered within the Borden system. Under the Borden system, Canada has been divided into grid blocks based on latitude and longitude. A Borden block is approximately 13 kilometres east to west, and approximately 18.5 kilometres north to south. Each Borden block is referenced by a four-letter designator, and sites within a block are numbered sequentially as they are found. The Study Area under review is located in Borden blocks *BaGo* and *BbGo*.

According to the OASD, 20 previously registered archaeological sites are located within one kilometre of the Study Area (MCM 2023). Sites BbGo-2, BbGo-31, BbGo-34, BaGo-16, BaGo-44, BaGo-45, BaGo-46, BaGo-47, BaGo-55, BaGo-56, BaGo-57 are within the Study Area (Table 1 sites in bold). One site, BaGo-49, is within 50 metres of the Study Area (Table 1 sites in italics). Whether or not sites

within the Study Area or within 50 metres exhibit CHVI will be indicated in Table 1 or shown as not applicable (N/A) for sites beyond 50 metres from the Study Area.

Table 1: Registered Sites within the Subject Property

Borden number	Site Name	Temporal/ Cultural Affiliation	Site type	Researcher	CHVI
BaGo-16	**Clarke**	**Pre-Contact Indigenous**	**Findspot**	**Roberts 1977**	**Y**
BaGo-19	Draper	Pre-Contact Indigenous	Findspot	Roberts 1977	N/A
BaGo-41	Cluster 2	Woodland, Late	Campsite	Fischer Archaeological Consulting 2010 and 2014	N/A
BaGo-42	Millbrook H1	Euro-Canadian	Homestead	Archeoworks Inc 2014	N/A
BaGo-44	**n/a**	**Euro-Canadian**	**Farmstead; homestead**	**York North Archaeological Services 2016**	**Y**
BaGo-45	**n/a**	**Woodland**	**Camp / campsite**	**York North Archaeological Services 2016**	**Y**
BaGo-46	**n/a**	**Euro-Canadian**	**Cabin**	**York North Archaeological Services 2016**	**Y**
BaGo-47	**n/a**	**Euro-Canadian**	**Cabin**	**York North Archaeological Services 2016**	**Y**
BaGo-49	*Maguire's Castle*	*Euro-Canadian*	*Farmstead*	*AMICK 2017, Irving Heritage Inc 2019*	*N*

Borden number	Site Name	Temporal/ Cultural Affiliation	Site type	Researcher	CHVI
BaGo-50	Patrick Maguire	Euro-Canadian	Other	AMICK 2017	N/A
BaGo-53	Grace	Euro-Canadian	Unknown	Golder Associates Ltd 2018	N/A
BaGo-54	John Ball	Euro-Canadian	Burial	Golder Associates Ltd 2018	N/A
BaGo-55	**Tenant**	**Other**	**Unknown**	**Irving Heritage Inc 2020**	**N**
BaGo-56	**Tenant Knoll**	**Other**	**Unknown**	**Irving Heritage Inc 2020**	**N**
BaGo-57	**Tenant Pond**	**Other**	**Unknown**	**Irving Heritage Inc 2020**	**N**
BbGo-1	Bert Morton	Woodland	Unknown	Roberts 1977	N/A
BbGo-2	**Cheshire**	**Pre-Contact Indigenous**	**Unknown**	**Roberts 1977**	**Y**
BbGo-30	Tenant Field	Other	Unknown	Irving Heritage Inc 2020	N/A
BbGo-31	**Tenant Scatter**	**Other**	**Unknown**	**Irving Heritage Inc 2020**	**N**
BbGo-34	**McNish**	**Other**	**Unknown**	**Irving Heritage Inc 2020, 2022**	**N**

See *Supplementary Documentation* for detailed location information.

Sites BaGo-16, BaGo-19, BbGo-1, and BbGo-2 were identified through background research by Arthur Roberts in 1976 and 1977, and ASI notes that Cultural Heritage Value or Interest (CHVI) has not been demonstrated by Stage 2 survey or by a cultural heritage resource assessment. These sites should be treated as site leads going forward until Stage 2 survey is conducted.

1.3.3 Previous Archaeological Assessments

ASI reviewed previous archaeological assessments that detail fieldwork within 50 metres of the Study Area. Only those specific archaeological assessments of direct relevance to the present undertaking will be included here:

(AMICK Consultants Ltd., 2019a) Stage 1-2 Archaeological Property Assessment Millbrook North Part of Lots 11 and 12, Concession 6 and Part of Lot 12 Concession 5 (Geographic Township of Cavan, County of Durham), Township of Cavan-Millbrook-North Monaghan, County of Peterborough [P058-1580-2017, formerly P1024-0246-2017]

This project was overlapping the current Suggested Additional Residential Area and Existing Urban Employment Area. Test pit and pedestrian surveys were conducted at five metre intervals. The historic domestic occupation scatter of the Patrick MaGuire's Castle Site (BaGo-49) was encountered within the area of farm complex lawn area and surrounding ploughed lands of Lot 12 Concession 6. The assemblage of 1245 artifacts covered an area of 125 metres northwest-southeast by 220 metres northeast to southwest. The Patrick MaGuire's Castle Site (BaGo-49) was determined to date from 1854 to 1956 when the brick house burnt down. A Stage 3 Site-Specific Assessment was recommended.

The remainder of the project area was cleared of archaeological concern.

(AMICK Consultants Ltd., 2019b) Stage 3 Site-Specific Assessment Patrick MaGuire's Castle Site (BaGo-49) Part of Lots 11 and 12, Concession 6, Part of Lot 12 Concession 5 (Geographic Township of Cavan, County of Durham), Township of Cavan-Millbrook-North Monaghan, County of Peterborough [P038-0926-2017]

A total of 4,500 artifacts were recovered during the Stage 3 assessment, with highest artifact yields clustered to the north and northwest of the twentieth-century house located on the property. This was likely built on a portion of the Patrick MaGuire "Castle" built in 1854 and destroyed in a fire in 1956. Regrading in this area was resulted in disturbed layering on top of structures and features. Features included one ash pit, one rubbish pit, an ash or rubbish pit, one unknown, and four structural features. It was determined that the artifacts mostly date to the mid to late nineteenth century into the twentieth century with a small pre-1830s component not associated with a particular layer. Stage 4 Mitigation was recommended.

(Fisher Archaeological Consulting, 2010) Project D-00596 – Former Millbrook Correctional Centre Peterborough County Archaeological Stage 2: Assessment [P042-206-2010]

This project was overlapping the entire Special Development Area. Test pit survey was conducted at five metre intervals and increased to ten metre intervals when met with disturbance. Much of the property had been disturbed by stripping of topsoil, depositing fill and shifting of topography for drainage and building construction. The Stage 2 Archaeological Assessment did result in the identification of two artifact clusters. Cluster 1 was located west of the main entrance and consists of mid-nineteenth-century artifacts. Cluster 2 was situated on the northern property boundary. It was determined that this was a Late Woodland period Indigenous site which had been impacted to some degree through sand bank excavation and erosion. Cluster 1 and Cluster 2 were recommended for Stage 3 Archaeological Assessments before any further work while the balance of the property has been full assessed with no further archaeological concern.

(Fisher Archaeological Consulting, 2014) Project D-00596 – Former Millbrook Correctional Centre Part of Lot 10, Concession 5, (Geographic Township of Cavan), Municipality of Cavan Monaghan Millbrook, Peterborough County Archaeological Stage 3: Site-specific Assessment. [P042-251-2011]

The Stage 3 Site Specific Archaeological Assessment of Cluster 1 and Cluster 2 was conducted in 2011. The Stage 2 work had identified Cluster 1 as requiring further investigation due to the presence of nineteenth century potential artifacts within a buried topsoil below as much as 80 centimetres of fill. A total of 19 test units were excavated during the Stage 3 work, and it was ultimately determined that this buried topsoil is indeed fill, and that the area would have been wet and marshy in the nineteenth century. A section of the corduroy road from the original alignment of County Road 21 was discovered in one of the test units beneath the buried topsoil, confirming the level of fill and disturbance to the area. It was determined that Cluster 1 has been sufficiently documented and no further archaeological work is recommended in this area.

Cluster 2 (BaGo-41) is located on the ravine edge at the northern property limits. It is an Indigenous site from the Late Woodland period. The site may be substantial, but the testing of this site was restricted by modern boundaries (i.e. the property fence line), so its extent to the east was not determined. It may continue on the property to the east. It is unknown whether it is a small camp or a village. The presence of pipes, pottery, wood working tools, and scrapers indicates that this is not a specialized site, but a habitation site with a full complement of people (men, women and children). Stage 4 Mitigation through excavation or avoidance and preservation is recommended. At the time of this report the proponent put the sale of the property on hold. Therefore, the exact nature of the Stage 4 mitigative measures were not determined. Options for Excavation and Avoidance and Long Term Protection were provided.

(Irving Heritage Inc., 2020) Stage 4 Archaeological Excavation of the Patrick MaGuire's Castle Site (BaGo-49) [P379-0259-2019]

The Stage 4 Archaeological Assessment resulted in the complete excavation of the site which was found to have two distinct settlement patterns relating to the 1822-1854 occupation of the site and the 1854 to 1900 occupation of the site. The excavation yielded a total of 4,065 artifacts and the identification of 39 cultural features. The site is primarily attributed to the initial occupation and settlement of the property by Patrick MaGuire. Given the results and conclusions of the completed Stage 4 archaeological assessment, the following recommendations were that the MaGuire's Castle Site (BaGo-49) has been fully mitigated via Stage 4 excavation and retains no further CHVI.

(Irvin Heritage Inc., 2020) Stage 1 & 2 Archaeological Assessment & Stage 3 Archaeological Assessment of the Tenant (BaGo-55), Tenant Knoll (BaGo-56), Tenant Pond (BaGo-57) and McNish (BbGo-34) Sites. [P379-0300-2020, P379-0301-2020, P379-0327-2020, P379-0325-2020, P379-0311-2020, P379-0340-2020]

A total of five Euro-Canadian archaeological sites were identified during the pedestrian survey and no archaeological resources were identified during test pitting. Of these five sites, three sites produced sufficient quantities of artifacts to require further investigation via Stage 3 excavation.

BbGo-30, BbGo-31, BaGo-55, BaGo-56, and BaGo-57 were Post-Contact dumps, and all have been sufficiently documented within the completed Stage 3 archaeological excavation. The sites retain no further CHVI. No further archaeological investigation is required.

The McNish Site (BbGo-34), a Post-Contact homestead, retains CHVI, and Stage 4 Mitigation was recommended.

The Stage 2 Survey has not been completed for a portion of the project area and is required of these lands which overlap the current Study Area.

(York North Archaeological Services Inc., 2017) A Stage 1-2 Archaeological Assessment of the Proposed Bromont Homes Subdivision, Located in Part Lot 11E, Concession 5, Cavan Township, (Former County of Durham), Now in the County of Peterborough, Ontario [P156-0254-2016]

This project was overlapping the southeastern portion of the Suggested Additional Residential Area. Stage 2 pedestrian survey and test pit survey identified four archaeological sites. Site BaGo-44 had an assemblage of 140 historic artifacts determined to date to the mid nineteenth century to the early twentieth century. Site BaGo-45 had 16 pre-contact Indigenous artifacts including three ceramic rim sherds, decorated body sherds, two groundstone fragments, three pieces of debitage and one flake; and a fragment of purple container glass showed retouching on two edges for use as a scraper. Site BaGo-46 was a historic site with 403 artifacts dating from the second half of the nineteenth century to the late nineteenth century. Site BaGo-47 was a historic site with 112 artifacts and was determined to date from the early to late nineteenth century. Sites BaGo-44, BaGo-45, BaGo-46, and BaGo-47 were recommended for Stage 3 site-specific archaeological assessment. A partial clearance was recommended with a 20 metre protective buffer zone and 50 metre monitoring zone for each site.

(Irving Heritage Inc., 2022) Stage 4 Archaeological Excavation of the McNish Site BbGo-34 Part of Lot 12, Concession 6 Township of Cavan-Millbrook-North Monaghan County of Peterborough Historic Durham County [P379-0408-2021]

While this report was not available for review, the OASD notes that the Stage 4 resulted in the complete excavation of the McNish Site BbGo-34, and the site may be considered clear of archaeological concern.

2.0 Analysis and Conclusions

The historical and archaeological contexts have been analyzed to help determine the archaeological potential of the Study Area. Results of the analysis of the Study Area background research are presented in Section 2.1.

2.1 Analysis of Archaeological Potential

The S & G, Section 1.3.1, lists criteria that are indicative of archaeological potential. The Study Area meets the following criteria indicative of archaeological potential:

- Previously identified archaeological sites within one kilometre (see Table 1);
- Water sources within 300 metres: primary, secondary, or past water source (Baxter Creek);
- Early historic transportation routes within 100 metres (Grey Road 19, Scenic Caves Road, Osler Bluff Road);
- Early settlements within 100 metres (Millbrook, Gardiner's Cemetery); and
- Well-drained soils (Otonabee loam, Brighton gravelly sand, Schomberg clay loam, Brighton sand)

According to the S & G, Section 1.4 Standard 1e, no areas within a property containing locations listed or designated by a municipality can be recommended for exemption from further assessment unless the area can be documented as disturbed. The Municipal Heritage Register was consulted and no properties within the Study Area are Listed or Designated under the Ontario Heritage Act.

The background research determined that parts of the Existing Urban Employment Area and the Suggested Additional Residential Area exhibit archaeological potential and will require Stage 2 archaeological assessment prior to any construction activities. According to the S & G Section 2.1.1, pedestrian survey is required in actively or recently cultivated fields (Figures 11-13: areas highlighted in orange). According to the S & G Section 2.1.2, test pit survey is required on terrain where ploughing is not viable, such as wooded areas, properties where existing landscaping or infrastructure would be damaged, overgrown farmland with heavy brush or rocky pasture, and narrow linear corridors up to 10 metres wide (Figures 11-12: areas highlighted in green).

Sites BaGo-44, BaGo-45, BaGo-46, and BaGo-47 are within the Suggested Additional Residential Area and are considered to have further CHVI (Figures 12-

13: area highlighted in red with black hatching). Stage 3 Site-Specific Assessment must be conducted prior to any construction activities (in accordance with the recommendations made in P156-0254-2016).

Part of the Existing Urban Employment Area has been previously assessed and cleared of archaeological concern by Irvin Heritage Inc. under PIFs P379-0300-2020, P379-0301-2020, P379-0327-2020, P379-0325-2020, P379-0311-2020, P379-0340-2020, and P379-0408-2021 (Figure 11: area highlighted in red). The entirety of the Special Development Area has been previously assessed by Fisher Archaeological Consulting in 2010 under PIF P042-206-2010 and cleared of archaeological concern (Figure 13: area highlighted in red).

The road right-of-ways in the Existing Urban Employment Area and the Suggested Additional Residential Area exhibit low archaeological potential and have likely been subjected to deep soil disturbance events due to typical road construction (Figures 11-12: areas highlighted in grey and black hatching). However since no property inspection was conducted, these lands beyond the paved road bed must be subject to visual inspection to confirm the extent of disturbance in the right-of-way during future Stage 2 survey.

2.1.1 Cemetery Assessment

The Gardiner's United Church Cemetery is within the Existing Urban Employment Area at 1097 County Road 10 and should be avoided by project designs (Figure 11: areas outlined in purple). The Gardiner's United Church Cemetery burial layout, as provided by the Bereavement Authority of Ontario (see Supplementary Documentation for a record of communications), from 1920 indicates the cemetery was once fenced in on its northern, western, and eastern limits (See Appendix A).

Along County Road 10, grave markers can be seen in Google Streetview along the western fence line. Some of the names on the grave markers visible include Ferguson, Raper, Gray, Peel, and Burnham (Images 1, 2, 3, and 6). The fence line, as drawn in the 1920 plan, has since been removed from the west side of the property and there is a visible impression where the burial layout plan indicates the former gate was (Image 5). A deep ditch carrying utilities is part of the County

Road 10 right-of-way (Images 2, 4 and 5). Crumbling cement supports can be seen underneath some of the grave markers at the top of the ditch, such as Gray's plot, while other grave markers are slumped, laid against other more stable grave markers, or placed east of their platforms (Images 1, 2, and 3). Utility boxes are seen from Google Streetview within the side of the ditch closest to the cemetery (Image 2).

The northern limit of the Gardiner's United Church Cemetery is seen from Google Streetview as being fenced (Image 7), bordering a farm at 1097 County Road 10 with a two-storey house, barns, and outbuildings. This property is in the general location of the Wesleyan Methodist church as illustrated on the 1861 map. The 1932 and 1985 topographic maps depict a house that borders the northern limits of the cemetery and its associated barn to the east, in the location of the extant house and one of the barns (Department of National Defence, 1932; Department of Energy, Mines and Resources, 1985).

The older portion of the cemetery begins at the north end of the property and ends in the south at Burnham's grave marker. A red stake can be seen on Google Streetview (Image 6) between Burnham's grave marker and the newer cemetery plots to the south. These burials were placed after 1920. The grave markers in the northwest portion of the cemetery are non-uniformly placed, while the southern and eastern portions of the cemetery have linear rows. In addition, the quantity of grave markers shown in the burial layout plan from western limit to eastern limit indicates that the cemetery has expanded eastwards.

A gate is indicated along the western limit which is parallel County Road 10. A review of Google Earth Streetview shows the fence no longer exists around the western and northern limits. The names Ferguson, Gray, and Peel are legible from Streetview and match the plan which places them as the first row against the western fence line (Images 1-3). The grave markers are shown at the top of a slope which leads into the ditched road right-of-way (Image 4). A decorative stone marker reads "Gardiners Cemetery" where the burial layout shows a gap in plots in the entrance east of the gate (Image 5). A cement support has been built into the slope around Gray's grave marker, and utilities are shown within the right-of-way (Image 2). Due to the potential of unmarked or shifted burials combined with

buried utility infrastructure within the ditched right-of-way, any project impacts along the western limits of the Gardiner's United Church Cemetery should be subject to archaeological construction monitoring (Figure 11: areas highlighted in yellow with black hatching).

The northern limit of the Gardiner's United Church Cemetery is fenced. It now borders a two-storey house and associated barn at 1097 County Road 10, as shown in twentieth century mapping, previously bordered to the north by the Wesleyan Methodist church on the 1861 *Tremaine's Map of Durham County* and the 1878 *Illustrated Historical Atlas of Durham County* (Tremaine, 1861; Belden, 1878).

The burial layout shows Burnham's grave marker is closest to the road at the southern limits in 1920. The cemetery expanded south after 1920, as marked by a red stake at the western limits (Image 6). Orthoimagery and review of the burial plan indicates that the cemetery has also expanded eastwards after 1920, based on the increased number of grave markers east of those shown on the burial layout plan as well as the juxtaposition of the older portion of the cemetery having non-uniformly placed grave markers in comparison to the linear rows of the grave markers to the south and east.

The post-1920 expansion of the cemetery to the south and east limits as well as the fenced northern limit have well defined limits and do not require Stage 3 cemetery investigation (Figure 9). A licensed archaeologist should be present on site for the duration of any impacts to monitor for the presence of unmarked burials and shall have the authority to direct construction to subsoil to identify any grave shafts that may be present (as per S & G Section 3.3.3 Standard 2) until it is confirmed that no burials are located within the Study Area, or the area is observed to be extensively and intensively disturbed. If any grave shafts are identified that are associated with this cemetery, all work must cease in the Study Area and the MCM and the Bereavement Authority of Ontario should be contacted for further direction.

2.2 Conclusions

The Stage 1 background study determined that 20 sites are within one kilometre of the Study Area and 11 sites are within the Existing Urban Employment Area and the Suggested Additional Residential Area. The Gardiner's United Church Cemetery is within the Existing Urban Employment Area. The entirety of the Special Development Area has been previously assessed and cleared of archaeological concern. Both the Existing Urban Employment Area and the Suggested Additional Residential Area require further archaeological assessment (Figures 11-13). Sites BaGo-44, BaGo-45, BaGo-46, and BaGo-47 are within the Suggested Additional Residential Area and are considered to have further CHVI requiring Stage 3 assessment.

3.0 Recommendations

The following recommendations are made:

7 Parts of the Existing Urban Employment Area and the Suggested Additional Residential Area exhibit archaeological potential. These lands require Stage 2 archaeological assessment by test pit survey (Figure 11: areas highlighted in green) or pedestrian survey (Figures 11-13: areas highlighted in orange) at five metre intervals, prior to any proposed construction activities.

8 BaGo-44, BaGo-45, BaGo-46, and BaGo-47 are within the Suggested Additional Residential Area and are considered to retain further cultural heritage value or interest. The sites must be specific to Stage 3 Site-Specific Assessment prior to any proposed impacts to the area (Figures 12-13: hatched red areas), as per the recommendations made by YNAS 2017 (P156-0254-2016) presented below:

a) For historic Euro-Canadian sites BaGo-44, BaGo-46, and BaGo-47, Stage 3 should be conducted in accordance with S & G Section 2.2, Standard 1, Subsection c, and Table 3.1: Small pre-contact or post-contact sites where it is not yet evident that the level of CHVI will result in a recommendation to proceed to Stage 4. One metre square test units

should be excavated in a five-metre grid across the site. Additional test units should be excavated amounting to 20 % of the grid unit total (e.g. if the grid total has 40 units, an additional 8 units), focusing on areas of interest within the site extent (such as distinct areas of higher concentrations within a broader artifact concentration or adjacent to high yield units).

b) For the Indigenous Pre-Contact site (BaGo-45), Stage 3 should be done to determine the density and extent of the site and define the date range of occupation. The Stage 3 should be based on S & G Table 3.1 of Section 3.2.3, excavations will follow for small sites where it is clearly evident that the level of CHVI will result in a recommendation to proceed to Stage 4. Stage 3 in this case should take the form of a ten-metre grid laid in over the extent of the Stage 2 surface finds, with one-metre-square units excavated five centimetres into subsoil or to evidence of features are encountered. An additional 40% of the total number of units should be added in areas of interest within the site extent. The fill must be screened through six-millimetre hardware mesh. Partial features should be mapped in plan view when found, their floors covered by geo-cloth and back filled until a complete Stage 4 can be conducted.

c) The proponent must erect a site buffer (fence) twenty metres out from the furthest most positive surface find as a no-go zone. A fifty-metre monitoring buffer is required to be monitored by a License archaeologist during any soil disturbance. The Licensed archaeologist may cease any soil disturbance in the monitoring buffer if archaeological resources will suffer from any development impact until such times as will allow for the excavation of the archaeological resources. These buffers must remain in place during construction or until the Stage 3 is completed at which time the twenty-metre buffer can be reduced to ten metres provided it is not a village site. The fifty-metre monitoring buffer can be removed on completion of the Stage 3.

9 Gardiner United Church Cemetery is within the Existing Urban Employment Area. All Cemetery lands should be avoided by project designs (Figure 11: area outlined in purple). A Stage 3 Cemetery investigation is not required for the well defined northern, eastern, and southern limits. The County Road 10 right-of-way lands adjacent Gardiner United Church Cemetery have potential for unmarked or shifted burials. However, a ditch has been created in these lands and there is buried utility infrastructure which preclude ASI from safely conducting mechanical topsoil removal. ASI recommends that any project impacts adjacent Gardiner United Church Cemetery be subject to Cemetery Investigation by archaeological construction monitoring (Figure 11: hatched yellow areas).

a) A licensed archaeologist should be present on site for the duration of any impacts to monitor for the presence of unmarked burials and shall have the authority to direct construction to subsoil to identify any grave shafts that may be present (as per S & G Section 3.3.3 Standard 2) until it is confirmed that no burials are located within the Study Area, or the area is observed to be extensively and intensively disturbed. If any grave shafts are identified that are associated with this cemetery, all work must cease in the Study Area and the MCM and the Bereavement Authority of Ontario should be contacted for further direction.

10 The road right-of-ways in the Existing Urban Employment Area and the Suggested Additional Residential Area exhibit low archaeological potential and have likely been subjected to deep soil disturbance events due to typical road construction. However since no property inspection was conducted, these lands beyond the paved road bed must be subject to visual inspection to confirm the extent of disturbance during future Stage 2 survey.

11 The entirety of the Special Development Area does not retain archaeological potential due to being previously assessed and being cleared of further archaeological concern. These lands do not require further archaeological assessment.

12 During any further archaeological assessments, meaningful engagement with Indigenous communities should be conducted, as outlined in Section 3.5 of the S & G and *Engaging Aboriginal Communities in Archaeology Technical Bulletin*.

13 Should the proposed work extend beyond the current Study Area, further Stage 1 archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

NOTWITHSTANDING the results and recommendations presented in this study, ASI notes that no archaeological assessment, no matter how thorough or carefully completed, can necessarily predict, account for, or identify every form of isolated or deeply buried archaeological deposit. In the event that archaeological remains are found during subsequent construction activities, the consultant archaeologist, approval authority, and the Cultural Programs Unit of the MCM should be immediately notified.

The above recommendations are subject to MCM approval, and it is an offence to alter any archaeological site without MCM concurrence. No grading or other activities that may result in the destruction or disturbance of any archaeological sites are permitted until notice of MCM approval has been received.

4.0 Legislation Compliance Advice

ASI advises compliance with the following legislation:

- This report is submitted to the MCM as a condition of licensing in accordance with Part VI of the Ontario Heritage Act, RSO 2005, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological field work and report recommendations ensure the conservation, preservation and protection of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the MCM, a letter will be issued by the Ministry stating that there are no further concerns with regards to alterations to archaeological sites by the proposed development.

- It is an offence under Sections 48 and 69 of the Ontario Heritage Act for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological field work on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the Ontario Heritage Act.

- Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the Ontario Heritage Act. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with sec. 48 (1) of the Ontario Heritage Act.

- The Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33, requires that any person discovering or having knowledge of a burial site shall immediately notify the police or coroner. It is recommended that the Registrar of Cemeteries at the Ministry of Consumer Services is also immediately notified.

- Archaeological sites recommended for further archaeological field work or protection remain subject to Section 48(1) of the Ontario Heritage Act and may not be altered, nor may artifacts be removed from them, except by a person holding an archaeological license.

5.0 Bibliography and Sources

AMICK Consultants Ltd. (2019a). Stage 1-2 Archaeological Property Assessment Millbrook North Part of Lots 11 and 12, Concession 6 and Part of Lot 12 Concession 5 (Geographic Township of Cavan, County of Durham), Township of Cavan-Millbrook-North Monaghan, County of Peterborough.

AMICK Consultants Ltd. (2019b). Stage 3 Site-Specific Assessment Patrick MaGuire's Castle Site (BaGo-49) Part of Lots 11 and 12, Concession 6, Part of Lot

12 Concession 5(Geographic Township of Cavan, County of Durham), Township of Cavan-Millbrook-North Monaghan, County of Peterborough.

Andreae, C. (1997). Lines of Country: An Atlas of Railway and Waterway History in Canada. Boston Mills Press.

Archaeological Services Inc. (2006). Historical Overview and Assessment of Archaeological Potential Don River Watershed, City of Toronto. Report on file with the Ontario Ministry of Tourism, Culture and Sport.

Belden, H. (1878). Illustrated Historical Atlas of the Counties of Northumberland and Durham, Ont. [Map].

Birch, J., Manning, S. W., Sanft, S., & Conger, M. A. (2021). Refined Radiocarbon Chronologies for Northern Iroquoian Site Sequences: Implications for Coalescence, Conflict, and the Reception of European Goods. American Antiquity, 86(1), 61–89.

Birch, J., & Williamson, R. F. (2013). The Mantle Site: An Archaeological History of an Ancestral Wendat Community. Rowman & Littlefield Publishers, Inc.

Brown, J. (1995). On Mortuary Analysis – with Special Reference to the Saxe-Binford Research Program. In L. A. Beck (Ed.), Regional Approaches to Mortuary Analysis (pp. 3–23). Plenum Press.

Chapman, L. J., & Putnam, F. (1984). The Physiography of Southern Ontario (3rd ed., Vol. 2). Ontario Ministry of Natural Resources.

Crown-Indigenous Relations and Northern Affairs. (2016). Rice Lake Treaty, No. 20. Treaty Texts – Upper Canada Land Surrenders. https://www.rcaanc-cirnac.gc.ca/eng/1370372152585/1370372222012#ucls18

Department of Energy, Mines and Resources. (1985). Rice Lake Sheet 31D/1 [Map].

Department of National Defence. (1932). Rice Lake Sheet 31D/1 [Map].

Dodd, C. F., Poulton, D. R., Lennox, P. A., Smith, D. G., & Warrick, G. A. (1990). The Middle Ontario Iroquoian Stage. In C. J. Ellis & N. Ferris (Eds.), The Archaeology of Southern Ontario to A.D. 1650 (pp. 321–360). Ontario Archaeological Society Inc.

Edwards, T. W. D., & Fritz, P. (1988). Stable-Isotope Paleoclimate Records from Southern Ontario, Canada: Comparison of Results from Marl and Wood. Canadian Journal of Earth Sciences, 25, 1397–1406.

Ellis, C. J., & Deller, D. B. (1990). Paleo-Indians. In C. J. Ellis & N. Ferris (Eds.), The Archaeology of Southern Ontario to A.D. 1650 (pp. 37–64). Ontario Archaeological Society Inc.

Ellis, C. J., Kenyon, I. T., & Spence, M. W. (1990). The Archaic. In C. J. Ellis & N. Ferris (Eds.), The Archaeology of Southern Ontario to A.D. 1650 (pp. 65–124). Ontario Archaeological Society Inc.

Ellis, C. J., Timmins, P. A., & Martelle, H. (2009). At the Crossroads and Periphery: The Archaic Archaeological Record of Southern Ontario. In T. D. Emerson, D. L. McElrath, & A. C. Fortier (Eds.), Archaic Societies: Diversity and Complexity across the Midcontinent. (pp. 787–837). State University of New York Press.

Ferris, N. (2013). Place, Space, and Dwelling in the Late Woodland. In M. K. Munson & S. M. Jamieson (Eds.), Before Ontario: The Archaeology of a Province (pp. 99–111). McGill-Queen's University Press. http://www.jstor.org/stable/j.ctt32b7n5.15

Fisher Archaeological Consulting. (2010). Project D-00596 – Former Millbrook Correctional Centre Peterborough County Archaeological Stage 2: Assessment.

Fisher Archaeological Consulting. (2014). Project D-00596 – Former Millbrook Correctional Centre Part of Lot 10, Concession 5, (Geographic Township of Cavan), Municipality of Cavan Monaghan Millbrook, Peterborough County Archaeological Stage 3: Site-specific Assessment. P042-251-2011.

Google Maps. (2018). Google Maps [Map].

Hunting Survey Corporation Limited. (1954). Digital Aerial Photographs [Map]. https://mdl.library.utoronto.ca/collections/air-photos/1954-air-photos-southern-ontario/index

Irvin Heritage Inc. (2020). Stage 1 & 2 Archaeological Assessment & Stage 3 Archaeological Assessment of the Tenant (BaGo-55), Tenant Knoll (BaGo-56), Tenant Pond (BaGo-57) and McNish (BbGo-34) Sites. [P379-0300-2020, P379-0301-2020, P379-0327-2020, P379-0325-2020, P379-0311-2020, P379-0340-2020].

Irving Heritage Inc. (2020). Stage 4 Archaeological Excavation of the MaGuire's Castle Site BaGo-49 Part of Lot 12, Concession 6 Township of Cavan-Millbrook-North Monaghan County of Peterborough Historic Durham County [P379-0259-2019].

Irving Heritage Inc. (2022). Stage 4 Archaeological Excavation of the McNish Site BbGo-34 Part of Lot 12, Concession 6 Township of Cavan-Millbrook-North Monaghan County of Peterborough Historic Durham County [P379-0408-2021].

Karrow, P. F., & Warner, B. G. (1990). The Geological and Biological Environment for Human Occupation in Southern Ontario. In The Archaeology of Ontario to A.D. 1650 (pp. 5–36). London Chapter, Ontario Archaeological Society.

Mika, N., & Mika, H. (1977). Places In Ontario: Their Name Origins and History, Part I, A-E: Vol. I (https://archive.org/details/placesinontariot0001mika). Mika Publishing Company; Internet Archive.

Mika, N., & Mika, H. (1981). Places In Ontario: Their Name Origins and History, Part II, F-M (https://archive.org/details/placesinontariot0002mika; Vol. 2). Mika Publishing Company; Internet Archive.

Ministry of Citizenship and Multiculturalism. (1990). Ontario Heritage Act, R.S.O. c. O.18.

Ministry of Citizenship and Multiculturalism. (2023). Ontario's Past Portal. PastPortal. https://www.pastport.mtc.gov.on.ca

Environmental Assessment Act, R.S.O. c. E.18, (1990).

MTC, (Ministry of Tourism and Culture). (2011). Standards and Guidelines for Consultant Archaeologists. Archaeology Programs Branch, Ontario Ministry of Tourism and Culture.

Municipal Engineers Association. (2023). Municipal Class Environmental Assessment.

Municipal Restructuring Activity Summary Table. (2018). http://www.mah.gov.on.ca/AssetFactory.aspx?did=19769

Ontario Geological Survey. (2010). Surficial geology of Southern Ontario. Miscellaneous Release—Data 128 – Revised. [Map]. http://www.geologyontario.mndm.gov.on.ca/mndmaccess/mndm_dir.asp?type=pub&id=MRD128-REV

Otonabee Conservation. (2013). Otonabee Region Watershed Report Card 2013. https://issuu.com/forsefield/docs/otonabee?e=1403707/1803012

Otonabee Conservation. (2018). Otonabee Region Watershed Report Card 2018. https://www.otonabeeconservation.com/wp-content/uploads/2018/03/2018-Watershed-Report-Card-FOR-WEB.pdf

Rogers, E. S. (1962). The Round Lake Ojibwa. Royal Ontario Museum.

Spence, M. W., Pihl, R. H., & Murphy, C. (1990). Cultural Complexes of the Early and Middle Woodland Periods. In C. J. Ellis & N. Ferris (Eds.), The Archaeology of Southern Ontario to A.D. 1650. Ontario Archaeological Society Inc.

Toronto Railway Historical Association. (2020). Midland Railway of Canada. https://www.trha.ca/trha/history/railways/midland-railway-of-canada/

Tremaine, G. C. (1861). Tremaine's Map of the County of Durham, Upper Canada [Map]. George C. Tremaine.

Williams Treaties First Nations. (2017). About Williams Treaties First Nations. http://www.williamstreatiesfirstnations.ca/about/

Williamson, R. F. (1990). The Early Iroquoian Period of Southern Ontario. In C. J. Ellis & N. Ferris (Eds.), The Archaeology of Southern Ontario to A.D. 1650 (pp. 291–320). Ontario Archaeological Society Inc.

York North Archaeological Services Inc. (2017). A Stage 1 -2 Archaeological Assessment of the Proposed Bromont Homes Subdivision, Located in Part Lot 11e, Concession 5, Cavan Township, (Former County of Durham), Now in the County of Peterborough, Ontario.

6.0 Images



Image 1: View of Ferguson grave marker (Google Maps, 2018).

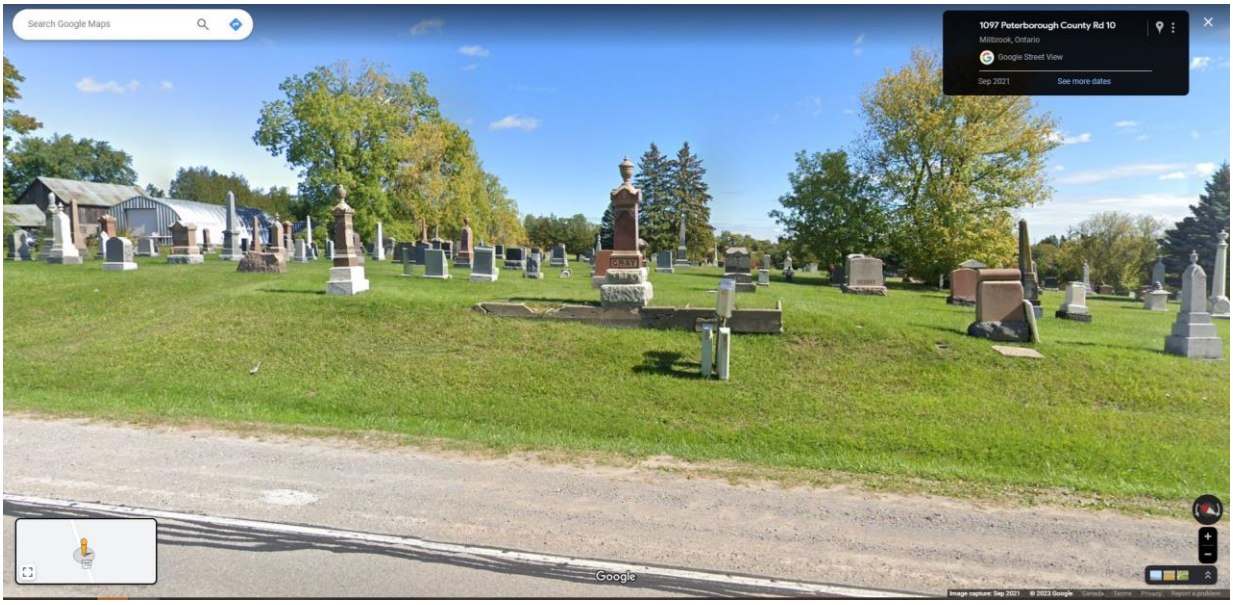


Image 2: View of Gray grave marker and cement support with utility boxes in ditched right-of-way (Google Maps, 2018).

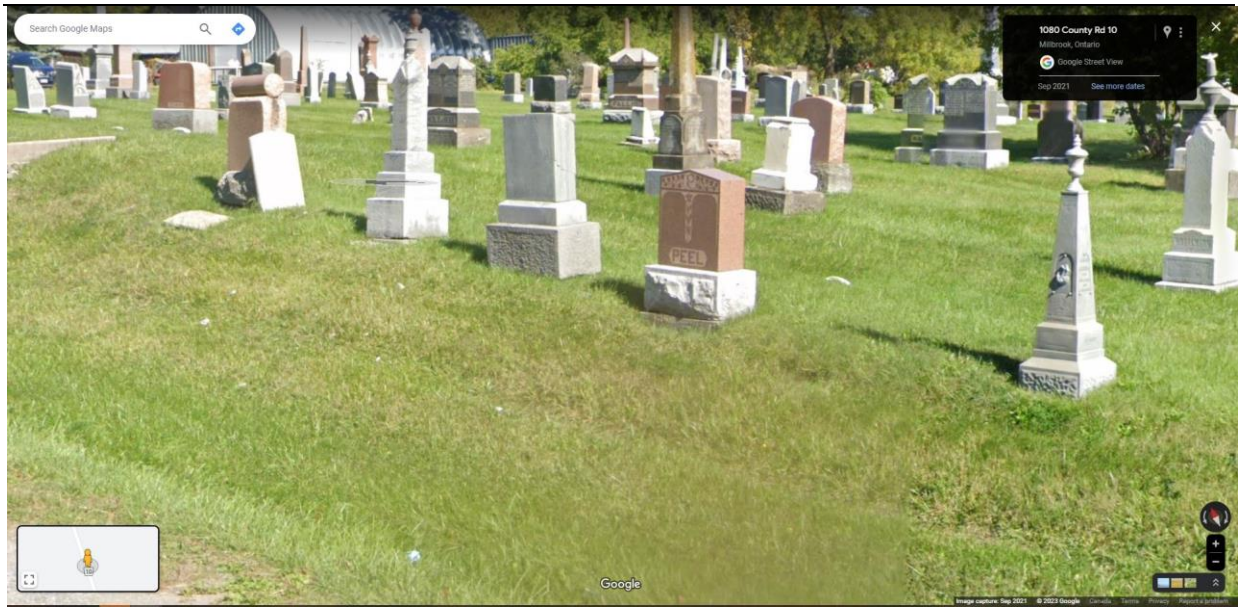


Image 3: View of Peel grave marker (Google Maps, 2018).

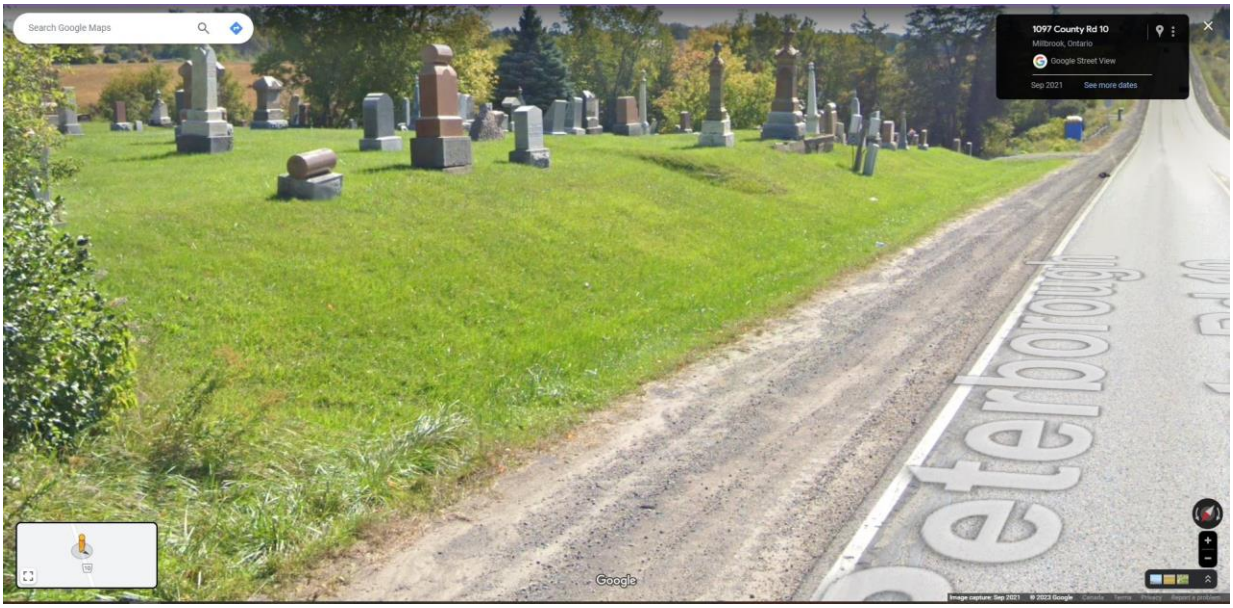


Image 4: View of grave makers along western boundary along ditched right-of-way (Google Maps, 2018).

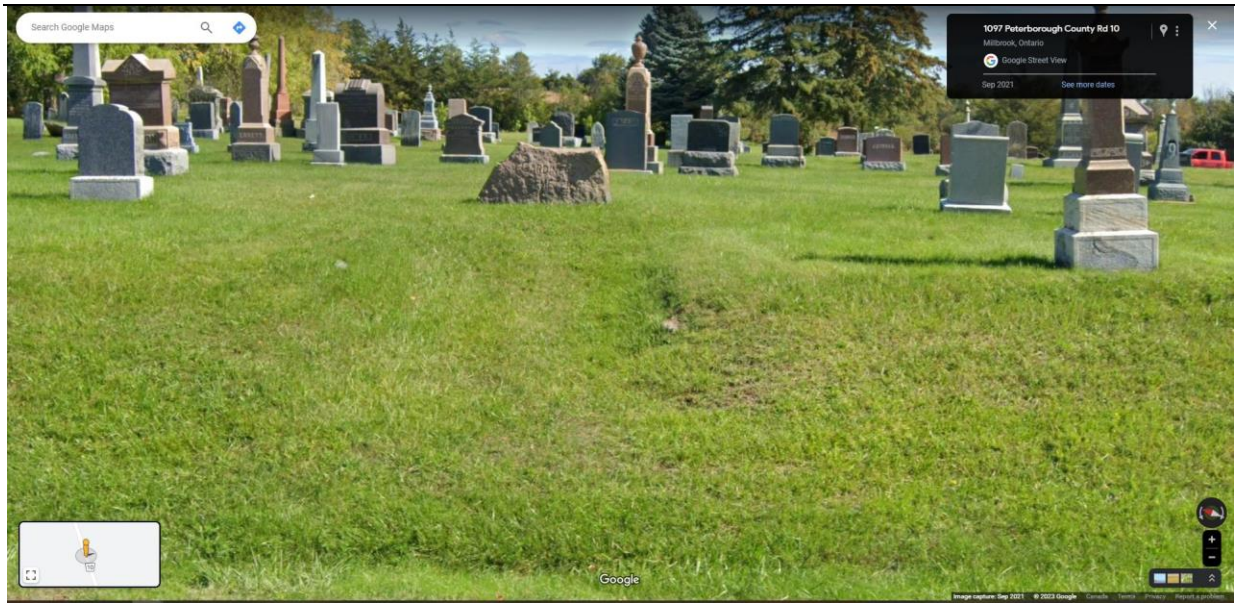


Image 5: View of grave markers and Gardiner's Cemetery decorative marker around previous gate location (Google Maps, 2018).

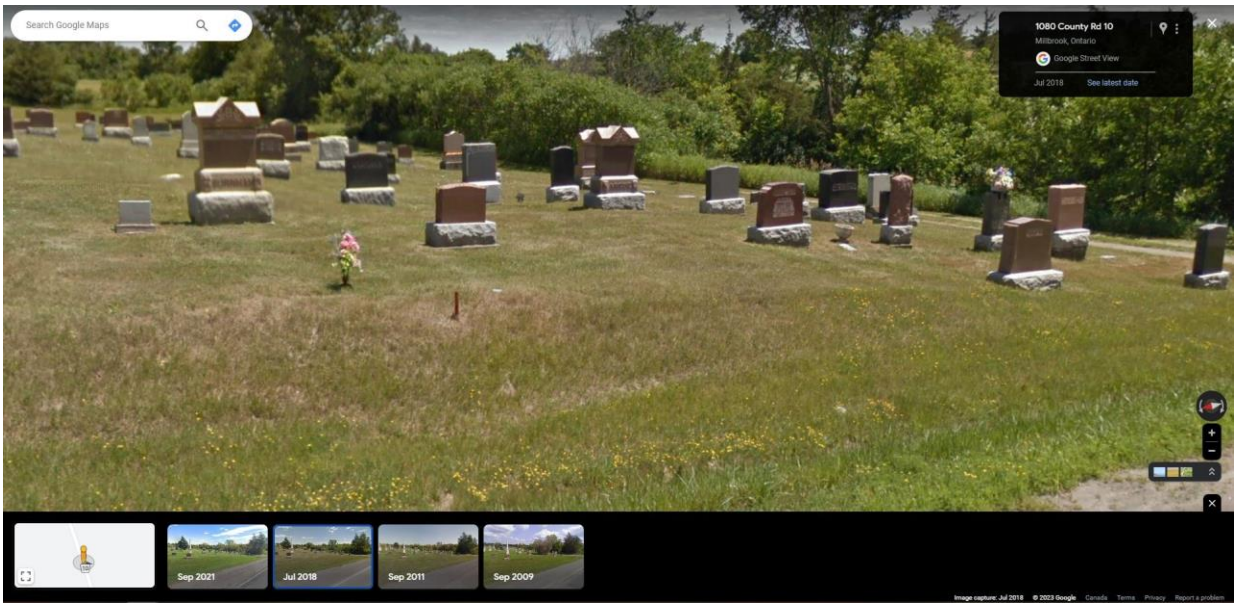


Image 6: View of Burnham grave marker and red stake marker for line between old and new cemetery grounds (Google Maps, 2018).



Image 7: View of Gardiner's Cemetery northern limit (Google Maps, 2018).

7.0 Maps

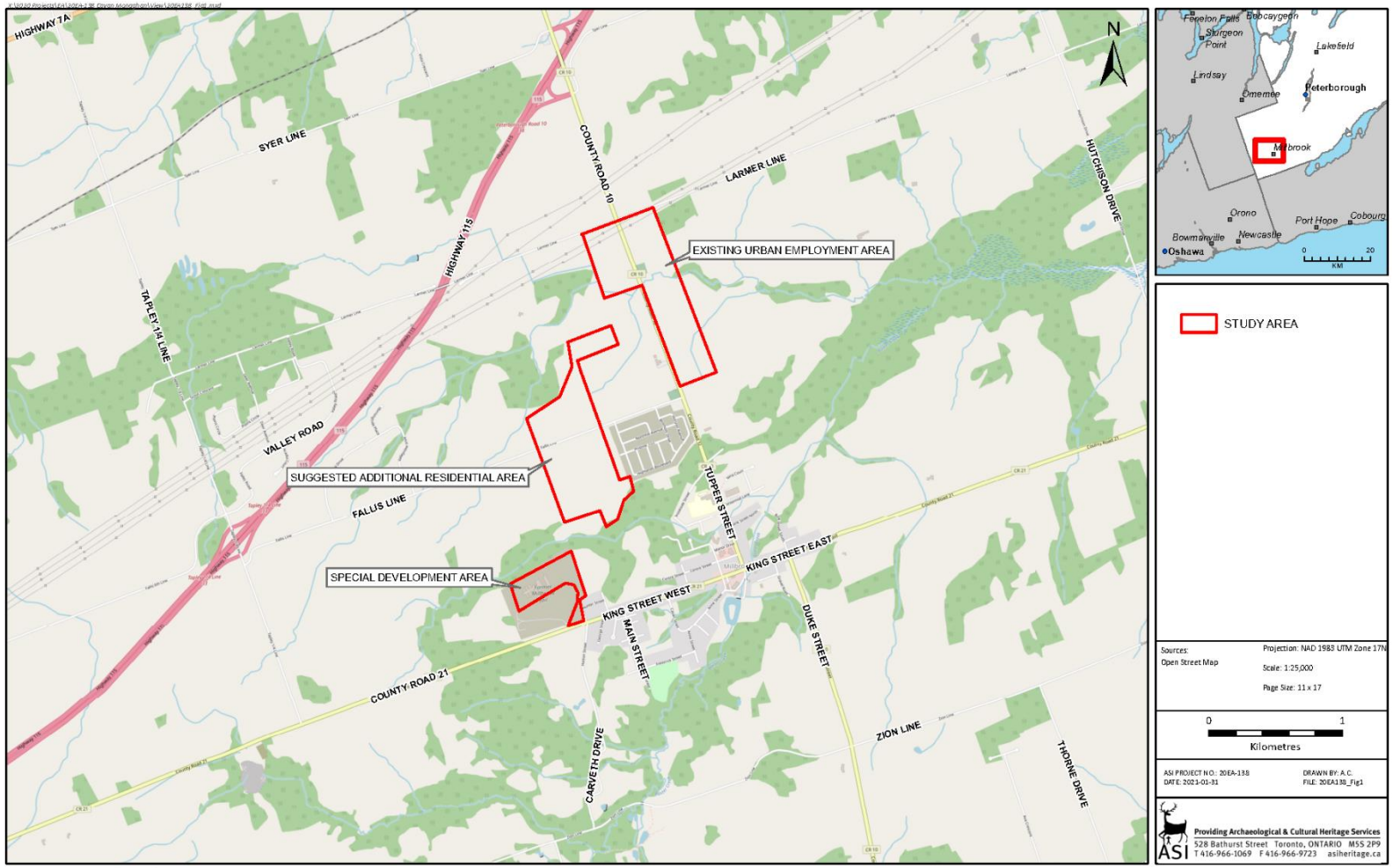


Figure 1: Study Area Location

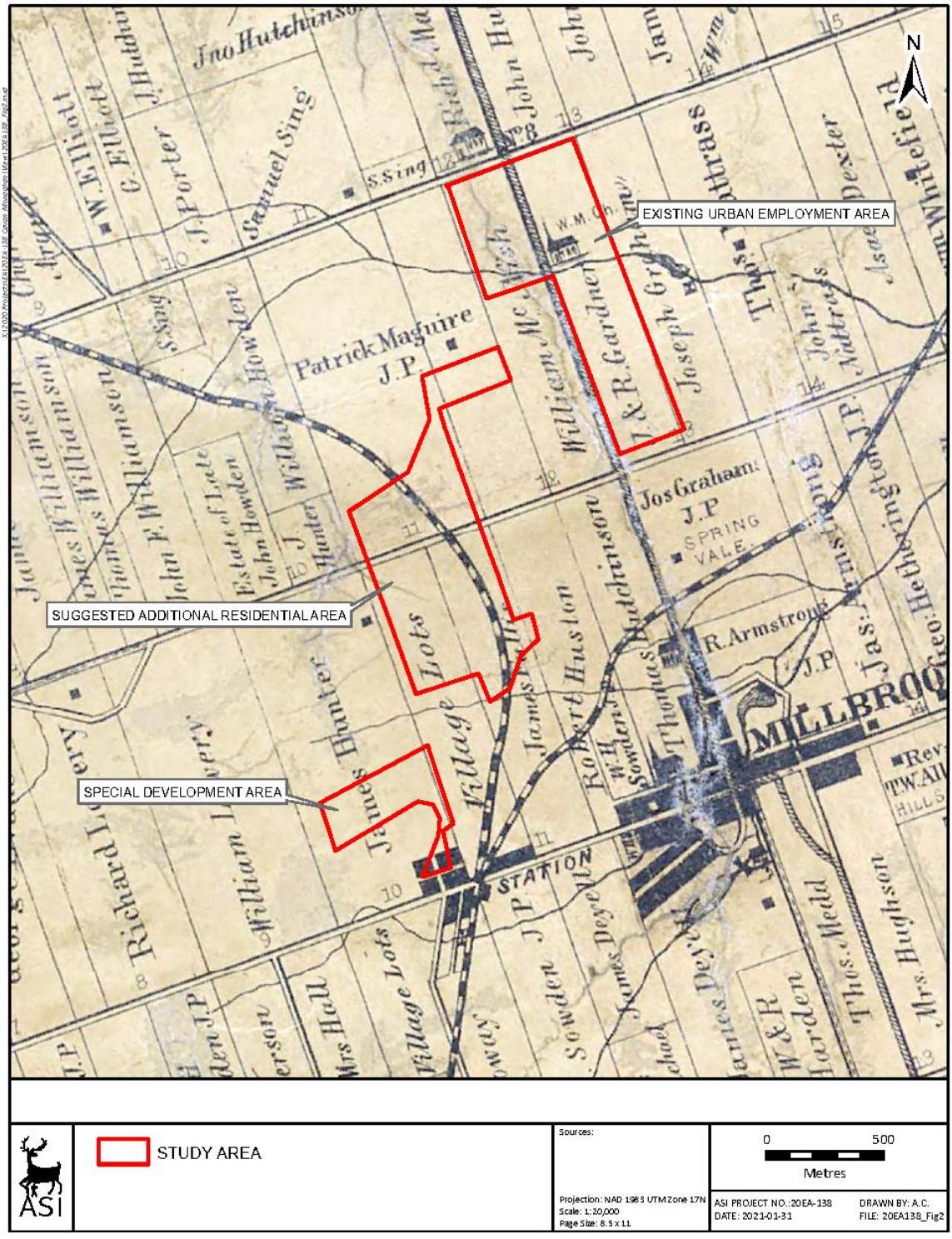


Figure 2: Study Area (Approximate Location) Overlaid on the 1861 Tremaine's Map of Durham County.

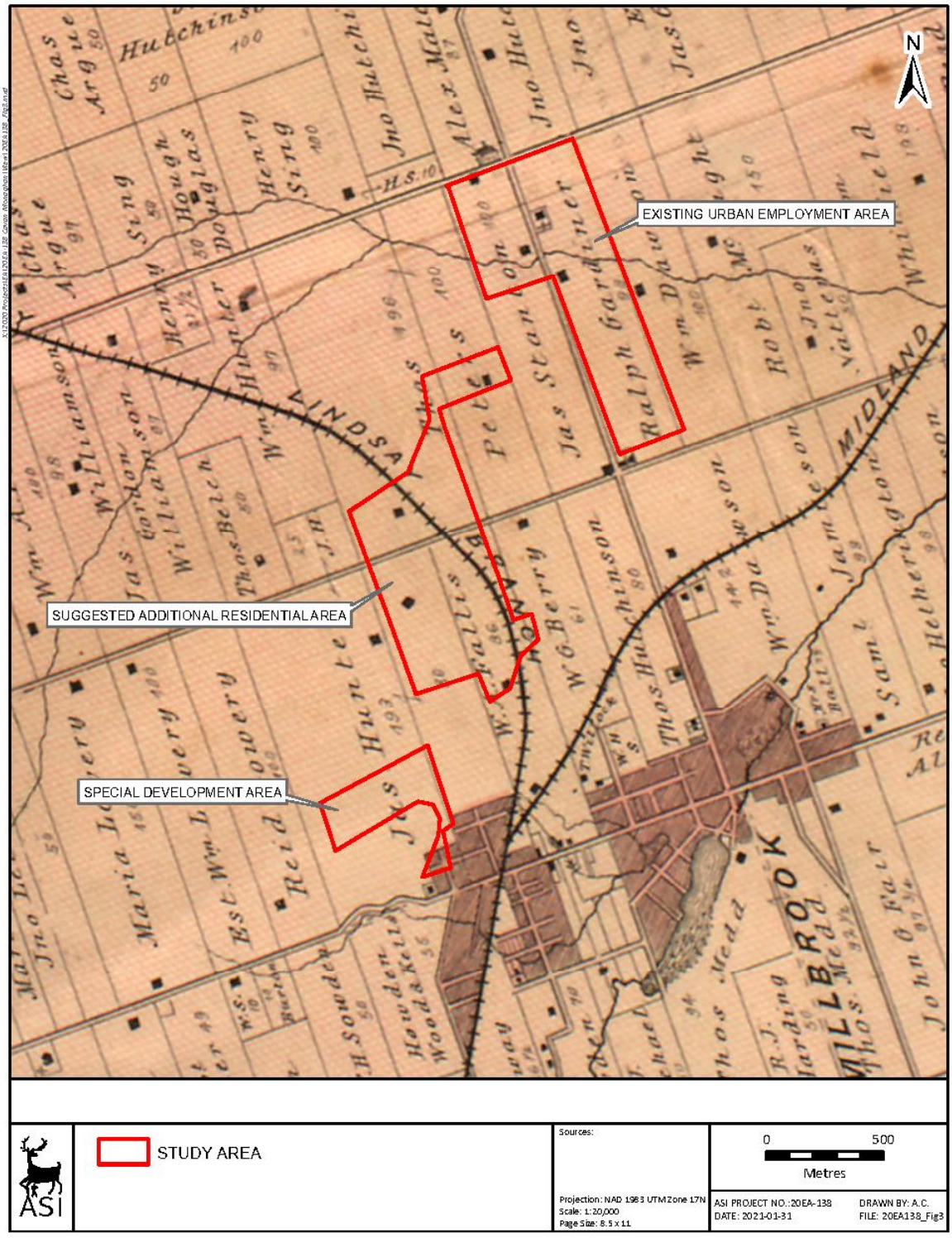


Figure 3: Study Area (Approximate Location) Overlaid on the 1878 Illustrated Historical Atlas of Durham County.

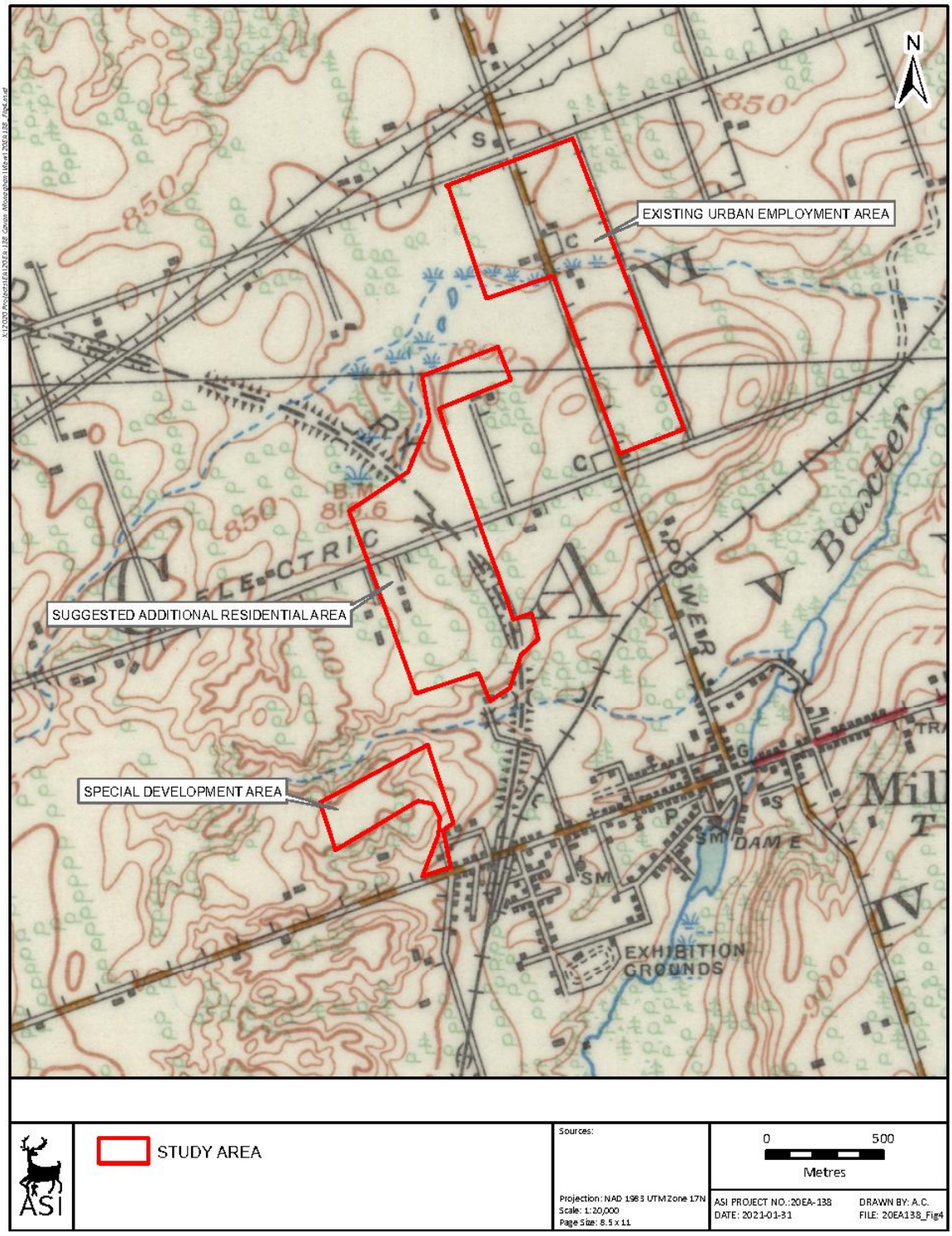


Figure 4: Study Area (Approximate Location) Overlaid on the 1932 DMD Topographic Mapping Rice Lake Sheet.

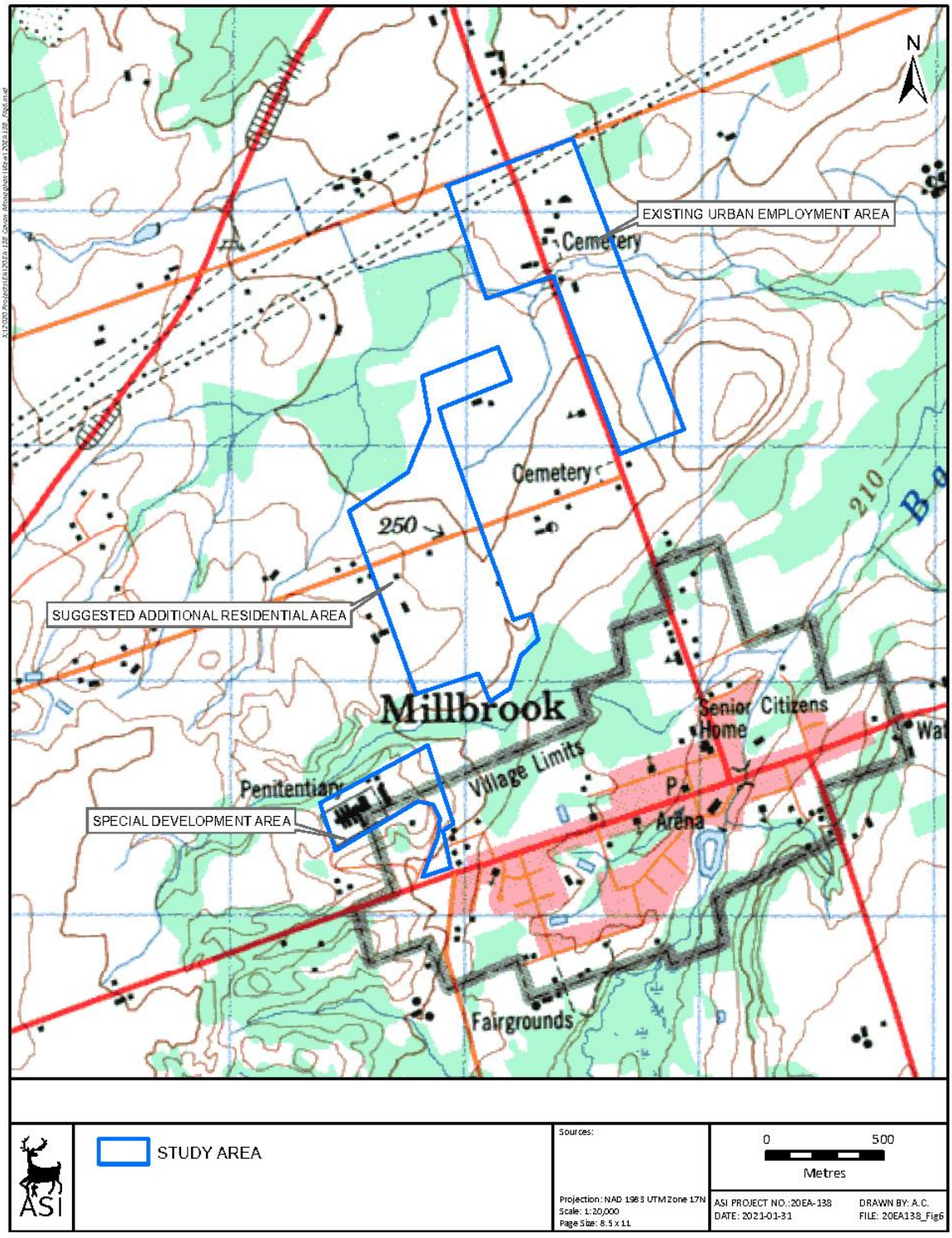


Figure 5: Study Area (Approximate Location) Overlaid on the 1985 NTS Rice Lake Sheet.

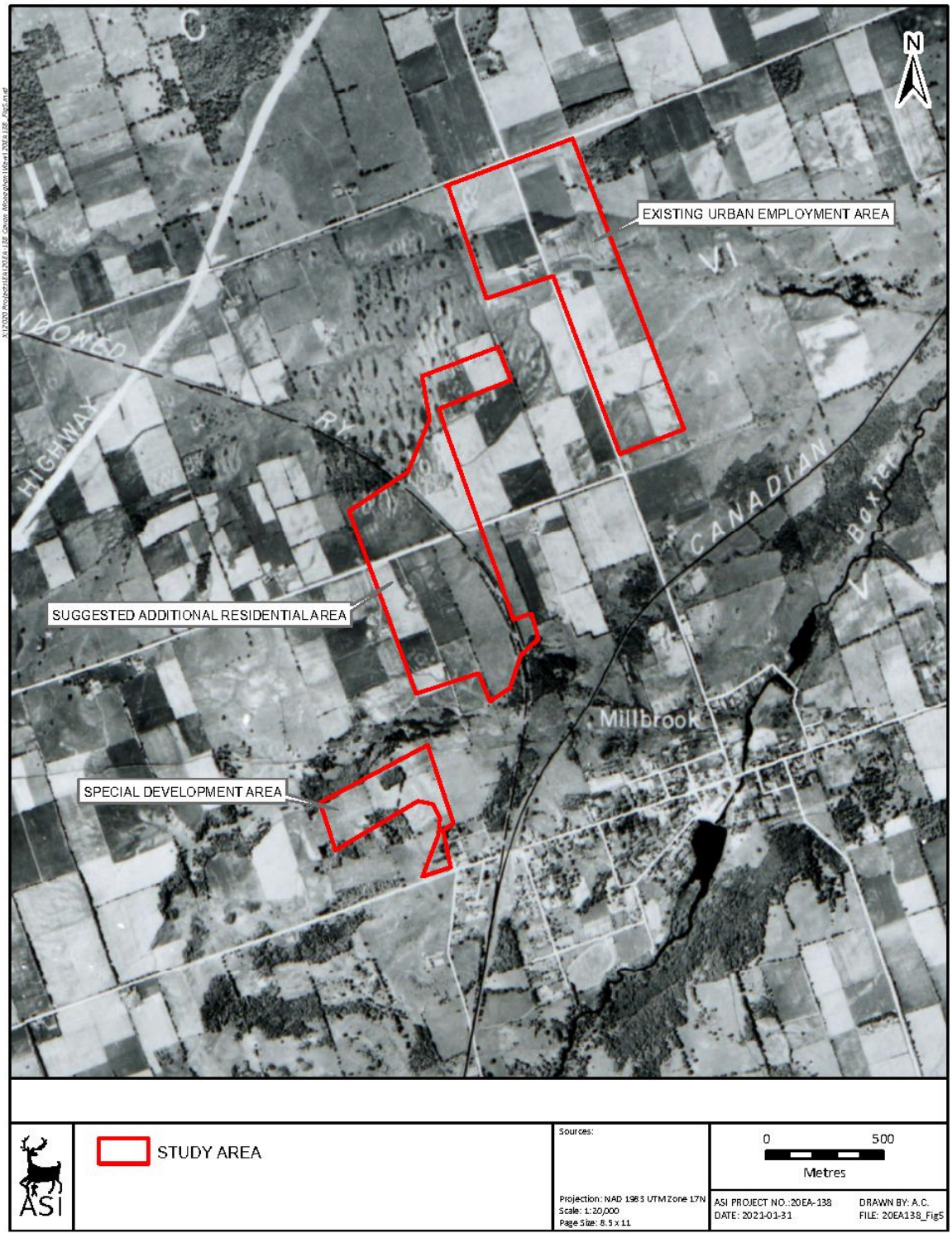


Figure 6: Study Area (Approximate Location) Overlaid on the 1954 Aerial Photography.

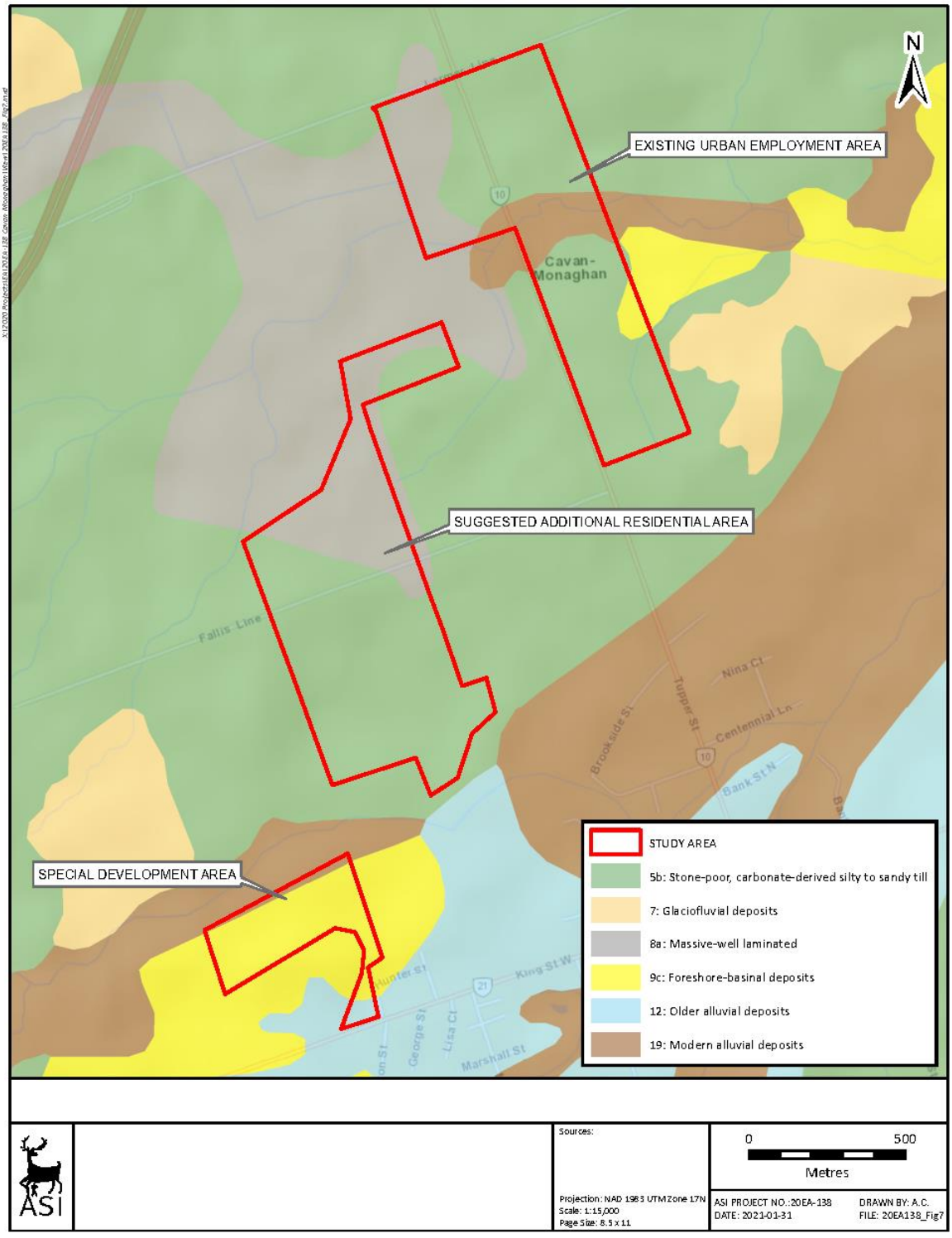


Figure 7: Study Area - Surficial Geology.

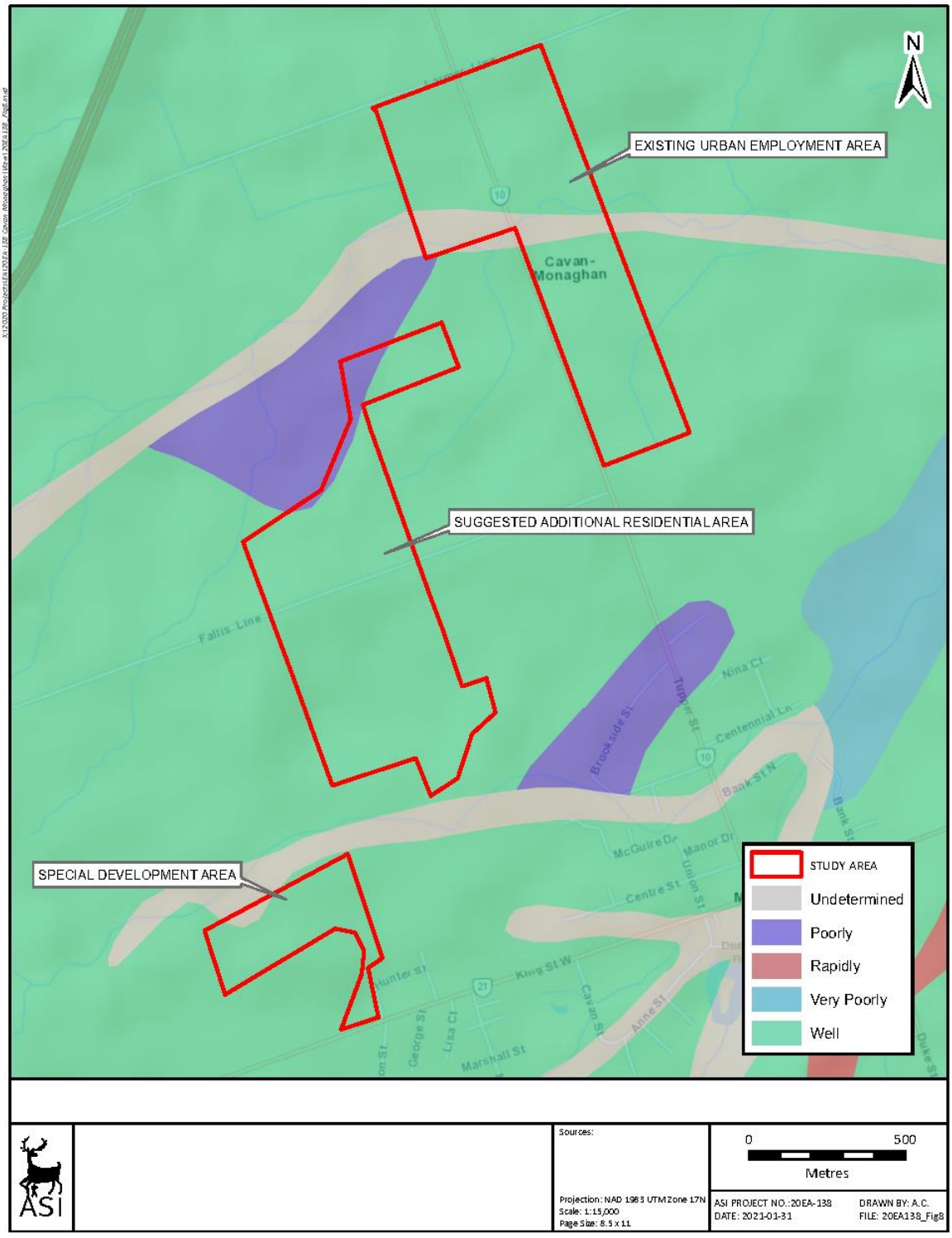


Figure 8: Study Area - Soil Drainage.



Figure 9: Gardiner's Cemetery (2018 Google Imagery).

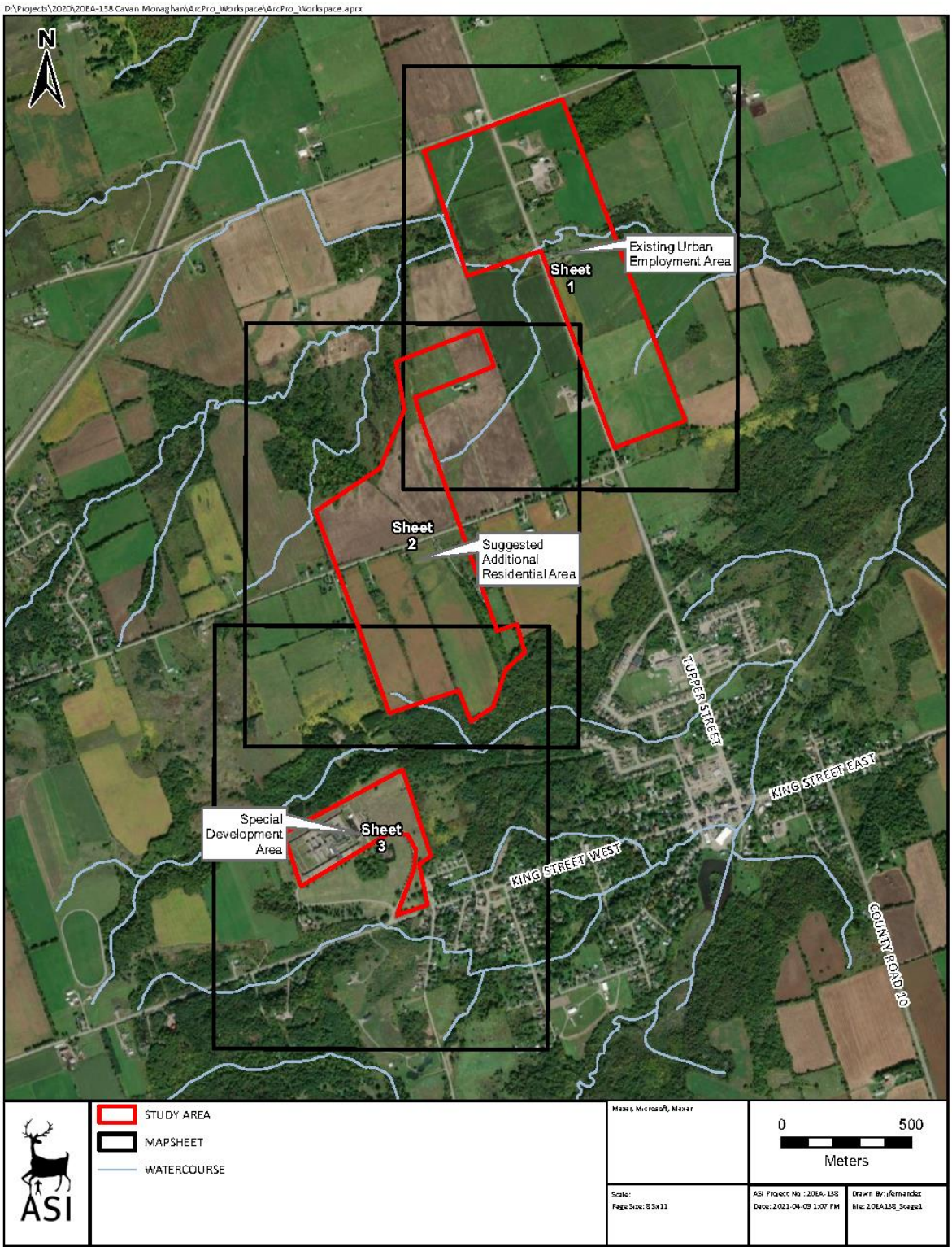


Figure 10: Study Area – Results of Stage 1 (Key Map).



Figure 11: Existing Urban Employment Area – Results of Stage 1 (Sheet 1).

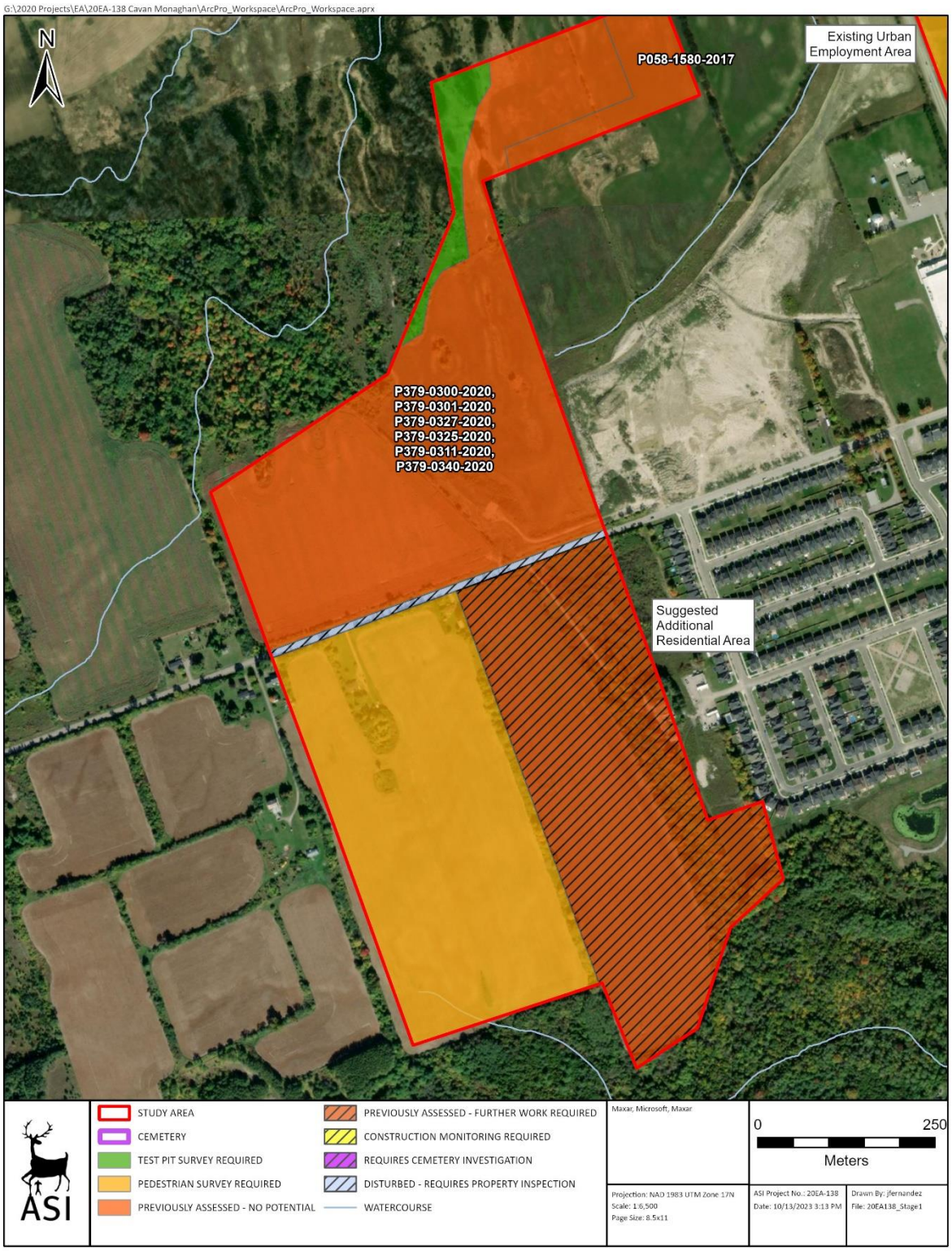


Figure 12: Suggested Additional Residential Area – Results of Stage 1 (Sheet 2).

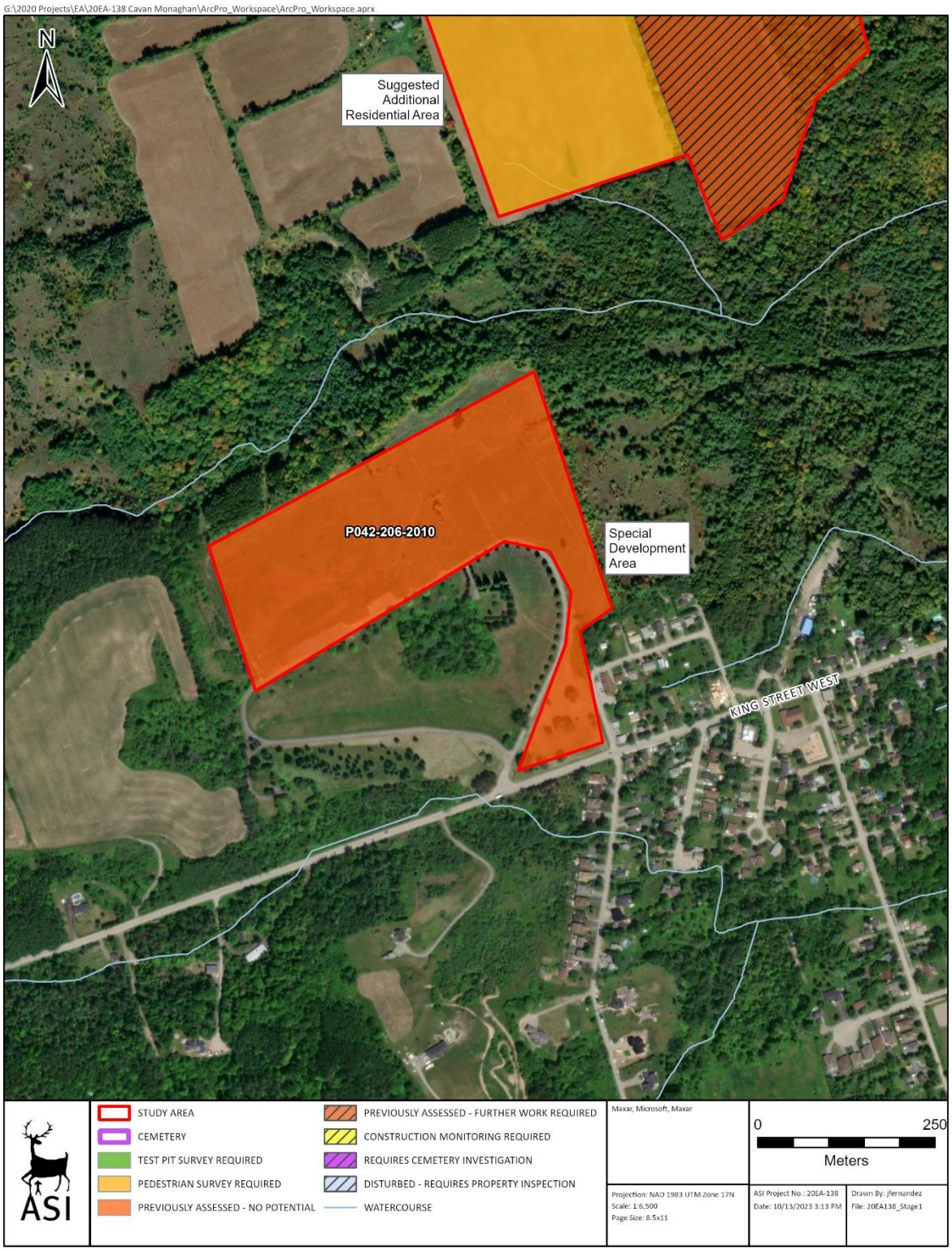


Figure 13: Special Development Area – Results of Stage 1 (Sheet 3).

8.0 Appendix A: Cemetery Plans



Figure 14: Gardiner's Cemetery Burial Plots and Boundaries.

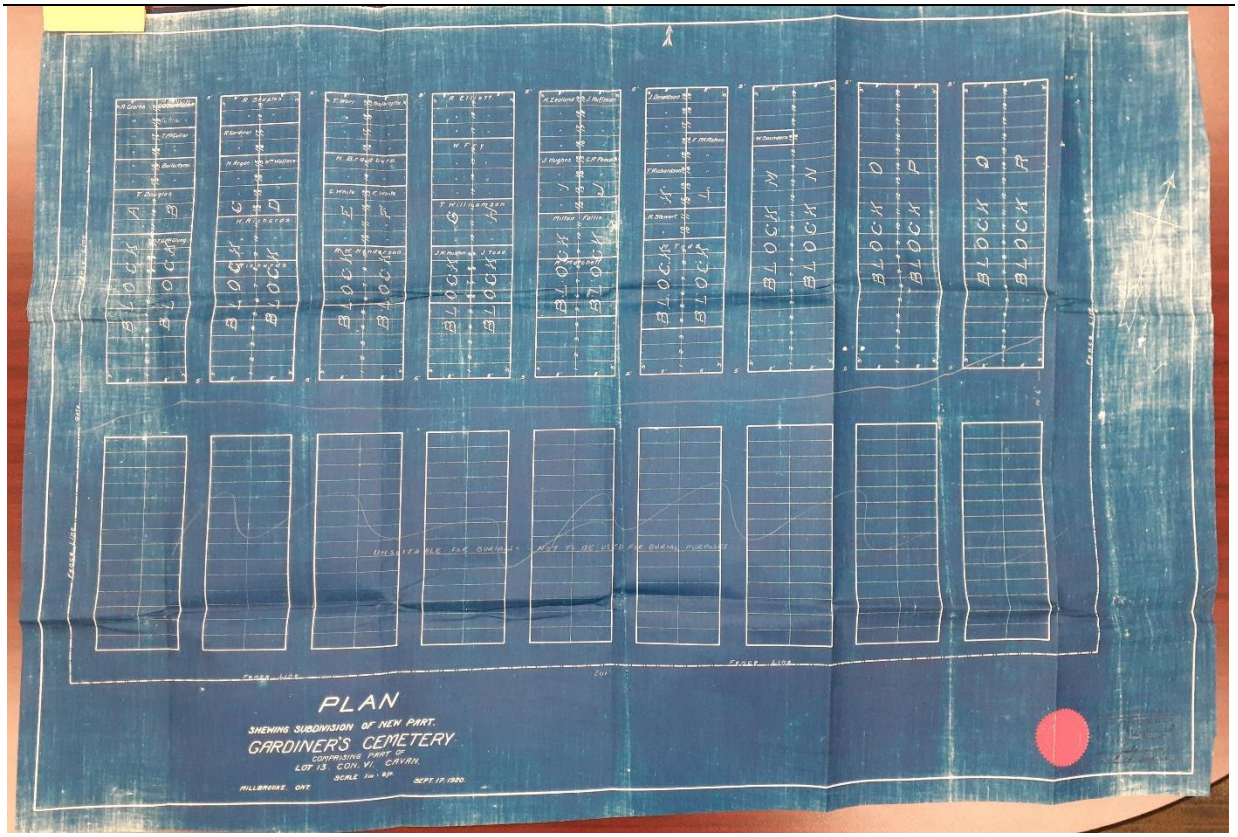


Figure 15: Gardiner's Cemetery Burial Plots and Boundaries.

APPENDIX 7

CULTURAL HERITAGE REPORTING



Cultural Heritage Report: Desktop Collection Results

Cavan Monaghan Water and Wastewater Master Servicing Study

Township of Cavan Monaghan, Ontario

Final Report

Prepared for:

R. V. Anderson Associates Ltd.
2001 Sheppard Avenue East, Suite 300
Toronto, ON M2J 4Z8

ASI File: 22CH-111

January 2021 (Revised July and October 2023)



Executive Summary

Archaeological Services Inc. was contracted by R.V. Anderson Associates Ltd., on behalf of the Township of Cavan Monaghan, to conduct a Cultural Heritage Report: Desktop Collection Results (Cultural Heritage Report) as part of the Cavan Monaghan Water and Wastewater Master Servicing Study. The Cavan Monaghan Water and Wastewater Master Servicing Study involves the evaluation of water and wastewater servicing infrastructure needs to accommodate additional growth in the Millbrook Urban Settlement Area. The project study area focuses on two areas within the Millbrook boundary, that are not currently developed, as well as a third area including 50 hectares of land that are outside the Millbrook boundary that are of interest to the Township.

The results of background historical research and a review of secondary source material, including historical mapping, indicate a study area with a rural land use history dating back to the early nineteenth century. A review of federal, provincial, and municipal registers, inventories, and databases revealed that there are eight potential cultural heritage landscapes within the Cavan Monaghan Water and Wastewater Master Servicing Study project study area.

The results presented in this desktop report are of the previously identified built heritage resources and cultural heritage landscapes within the study area. As the scope of work for this assessment does not include a field review, there is the potential for additional built heritage resources and cultural heritage landscapes to be located within the study area. Given the high-level nature of the Master Servicing Study, specific locations of the future infrastructure had not been determined at the time of report finalization (July 2023). When the future infrastructure locations are being considered through subsequent studies, they will be assessed against information contained in this report and additional cultural heritage reporting will be undertaken as required.

Report Accessibility Features

This report has been formatted to meet the Information and Communications Standards under the *Accessibility for Ontarians with Disabilities Act*, 2005 (A.O.D.A.). Features of this report which enhance accessibility include: headings, font size and colour, alternative text provided for images, and the use of periods within acronyms. Given this is a technical report, there may be instances where additional accommodation is required in order for readers to access the report's information. If additional accommodation is required, please contact Annie Veilleux, Manager of the Cultural Heritage Division at Archaeological Services Inc., by email at aveilleux@asiheritage.ca or by phone 416-966-1069 ext. 255.

Project Personnel

- **Senior Project Manager**: Annie Veilleux, M. A., CAHP, Senior Cultural Heritage Specialist, Manager - Cultural Heritage Division
- **Project Coordinator:** Katrina Thatch, Hon. B. A., Archaeologist, Project Coordinator - Environmental Assessment Division
- **Project Manager**: Johanna Kelly, M. Sc., Cultural Heritage Analyst, Project Manager - Cultural Heritage Division
- **Report Production**: Kirstyn Allam, B. A. (Hon), Advanced Diploma in Applied Museum Studies, Cultural Heritage Technician, Technical Writer and Researcher - Cultural Heritage Division
- **Graphics Production**: Andrew Clish, B. E. S., Senior Archaeologist - Planning Assessment Division; Peter Bikoulis, Archaeologist, GIS Technician – Operations Division
- **Report Reviewer(s)**: Johanna Kelly and Annie Veilleux

Qualified Persons Involved in the Project

Annie Veilleux, M. A., C.A.H.P.
Senior Cultural Heritage Specialist, Manager - Cultural Heritage Division

The Senior Project Manager for this Cultural Heritage Report is **Annie Veilleux** (M.A., C.A.H.P.), who is a Senior Cultural Heritage Specialist and Manager of the Cultural Heritage Division with ASI. She was responsible for: overall project scoping and approach; development and confirmation of technical findings and study recommendations; application of relevant standards, guidelines and regulations; and implementation of quality control procedures. Annie is academically trained in the fields of cultural landscape theory, history, archaeology, and collections management and has over 15 years of experience in the field of cultural heritage resource management. This work has focused on the identification and evaluation of cultural heritage resources, both above and below ground. Annie has managed and conducted numerous built heritage and cultural heritage landscape assessments, heritage recordings and evaluations, and heritage impact assessments as required for Environmental Assessments and Planning projects throughout the Province of Ontario. Annie has extensive experience leading and conducting research for large-scale heritage planning studies, heritage interpretation programs, and projects requiring comprehensive public and Indigenous engagement programs. She is fully bilingual in English and French and has served as a French language liaison on behalf of ASI. Annie is a member of the Ontario Archaeological Society, the National Trust for Canada, the Ontario Association for Impact Assessment, and the Association for Critical Heritage Studies. She is also a professional member in good standing of the Canadian Association of Heritage Professionals.

Johanna Kelly, M.S.c.,
Cultural Heritage Analyst, Project Manager - Cultural Heritage Division

The Project Manager for this Cultural Heritage Report is **Johanna Kelly** (M.S.c.), who is a Cultural Heritage Analyst and Project Manager within the Cultural Heritage Division with ASI. She was responsible for the day-to-day management

activities, including scoping of research activities and drafting of study findings and recommendations. With over ten years of experience in the field, Johanna has focused on the identification and evaluation of cultural heritage resources both above and below ground. With a background in archaeology, her current focus is the assessment, evaluation, and protection of above ground cultural heritage resources. Johanna has been involved in numerous large scale and high profile projects in various capacities, including built heritage and cultural heritage landscape assessments under the *Ontario Environmental Assessment Act* for Class Environmental Assessments and Individual Environmental Assessments, and as required for various planning studies throughout the Province of Ontario.

Kirstyn Allam, B.A. (Hon), Advanced Dipl. in Applied Museum Studies
Cultural Heritage Technician, Technical Writer and Researcher - Cultural Heritage Division

The Cultural Heritage Technician for this project is **Kirstyn Allam** (B.A. (Hon.), Advanced Diploma in Applied Museum Studies), who is a Cultural Heritage Technician and Technical Writer and Researcher within the Cultural Heritage Division with ASI. She was responsible for preparing and contributing to research and technical reporting. Kirstyn's education and experience in cultural heritage, historical research, archaeology, and collections management has provided her with a deep knowledge and strong understanding of the issues facing the cultural heritage industry and best practices in the field. Kirstyn has experience in heritage conservation principles and practices in cultural resource management. Kirstyn also has experience being involved with Stage 1-4 archaeological excavations in the Province of Ontario.

Glossary

Built Heritage Resource (B.H.R.)
Definition: "…a building, structure, monument, installation or any manufactured remnant that contributes to a property's cultural heritage value or interest as identified by a community, including an Indigenous community. built heritage resources are located on property that may be designated under Parts IV or V of the *Ontario Heritage Act*, or that may be included on local, provincial, federal and/or international registers" (Ministry of Municipal Affairs and Housing, 2020, p. 41).

Cultural Heritage Landscape (C.H.L.)
Definition: "…a defined geographical area that may have been modified by human activity and is identified as having cultural heritage value or interest by a community, including an Indigenous community. The area may include features such as buildings, structures, spaces, views, archaeological sites or natural elements that are valued together for their interrelationship, meaning or association. Cultural heritage landscapes may be properties that have been determined to have cultural heritage value or interest under the *Ontario Heritage Act*, or have been included on federal and/or international registers, and/or protected through official plan, zoning by-law, or other land use planning mechanisms" (Ministry of Municipal Affairs and Housing, 2020, p. 42).

Known Built Heritage Resource or Cultural Heritage Landscape
Definition: A known built heritage resource or cultural heritage landscape is a property that has recognized cultural heritage value or interest. This can include a property listed on a Municipal Heritage Register, designated under Part IV or V of the *Ontario Heritage Act*, or protected by a heritage agreement, covenant or easement, protected by the *Heritage Railway Stations Protection Act or the Heritage Lighthouse Protection Act*, identified as a Federal Heritage Building, or located within a U.N.E.S.C.O. World Heritage Site (Ministry of Tourism, Culture and Sport, 2016).

Impact

Definition: Includes negative and positive, direct and indirect effects to an identified built heritage resource and cultural heritage landscape. Direct impacts include destruction of any, or part of any, significant heritage attributes or features and/or unsympathetic or incompatible alterations to an identified resource. Indirect impacts include, but are not limited to, creation of shadows, isolation of heritage attributes, direct or indirect obstruction of significant views, change in land use, land disturbances (Ministry of Tourism Culture and Sport, 2006b). Indirect impacts also include potential vibration impacts.

Potential Built Heritage Resource or Cultural Heritage Landscape

Definition: A potential built heritage resource or cultural heritage landscape is a property that has the potential for cultural heritage value or interest. This can include properties/project area that contain a parcel of land that is the subject of a commemorative or interpretive plaque, is adjacent to a known burial site and/or cemetery, is in a Canadian Heritage River Watershed, or contains buildings or structures that are 40 or more years old (Ministry of Tourism, Culture and Sport, 2016).

Significant

Definition: With regard to cultural heritage and archaeology resources, significant means “resources that have been determined to have cultural heritage value or interest. Processes and criteria for determining cultural heritage value or interest are established by the Province under the authority of the *Ontario Heritage Act.* While some significant resources may already be identified and inventoried by official sources, the significance of others can only be determined after evaluation” (Ministry of Municipal Affairs and Housing, 2020, p. 51).

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1.0 Introduction

Archaeological Services Inc. was contracted by R.V. Anderson Associates Ltd., on behalf of the Township of Cavan Monaghan, to conduct a Cultural Heritage Report: Desktop Collection Results (Cultural Heritage Report) as part of the Cavan Monaghan Water and Wastewater Master Servicing Study. The purpose of this report is to present an inventory of known and potential built heritage resources (B.H.R.s) and cultural heritage landscapes (C.H.L.s) to assist with the evaluation of potential water and wastewater servicing alternatives. This submission includes the Desktop Collections Results component of the assessment. Given the high-level nature of the Master Servicing Study, specific locations of the future infrastructure had not been determined at the time of report finalization (July 2023). When the future infrastructure locations are being considered through subsequent studies, they will be assessed against information contained in this report and additional cultural heritage reporting will be undertaken as required.

1.1 Project Overview

The Cavan Monaghan Water and Wastewater Master Servicing Study involves the evaluation of water and wastewater servicing infrastructure needs to accommodate additional growth in the Millbrook Urban Settlement Area. The types of infrastructure required for the servicing may include a new municipal well, watermain extensions, a new water tower, sanitary collection system extensions, and/or wastewater treatment plant expansion. The project study area focuses on three undeveloped areas to the north and west of the community of Millbrook in the Township of Cavan Monaghan.

1.2 Description of Study Area

The project study area focuses on two areas within the Millbrook boundary that are not currently developed, as well as a third area including 50 hectares of land that are outside the Millbrook boundary that are of interest to the Township. For this Cultural Heritage Report, the three study areas are used with a buffer of 50

metres (Figure 1). This project study area has been defined as inclusive of those lands that may contain B.H.R.s or C.H.L.s that may be subject to direct or indirect impacts as a result of the proposed undertaking.

These areas have been identified as “Existing Urban Employment Area”, “Special Development Area”, and “Suggested Additional Residential Area”. The Existing Urban Employment Area and Special Development Area are defined in the Official Plan for Township of Cavan Monaghan (Township of Cavan Monaghan, 2015 [amended in 2021]). Properties within the study area are located in the Township of Cavan Monaghan.

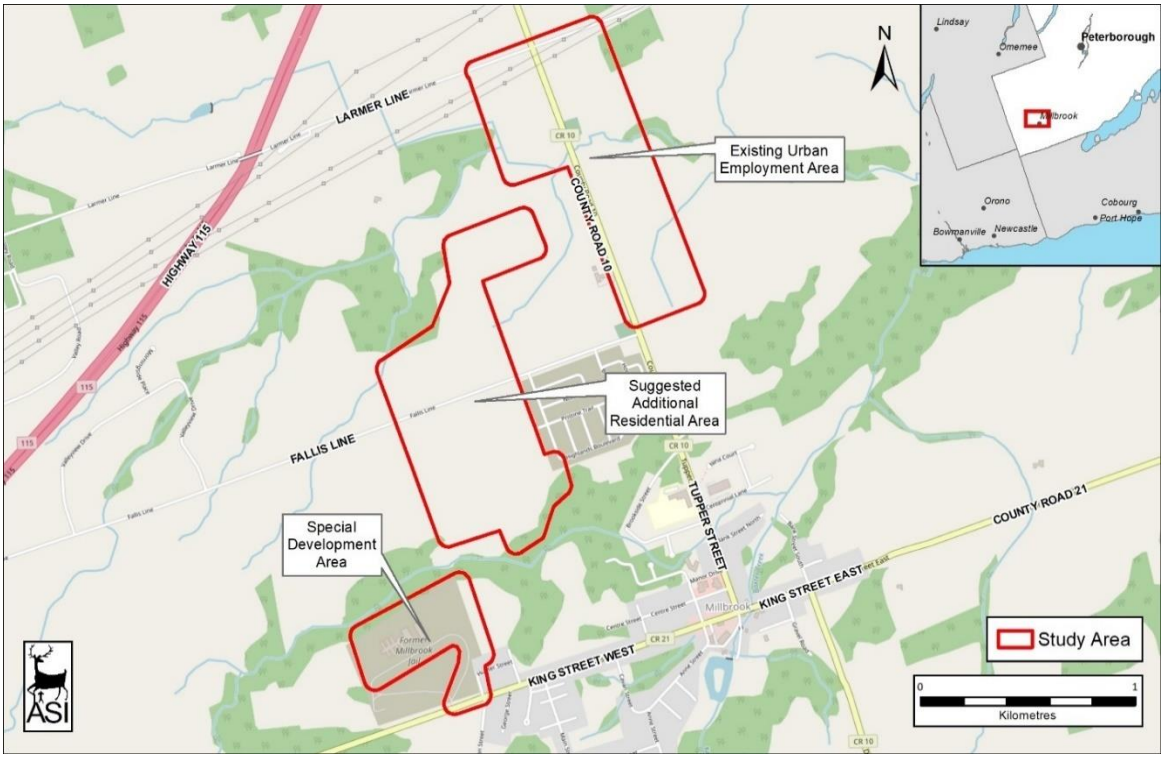


Figure 1: Location of the study area. Base Map: ©OpenStreetMap and contributors, Creative Commons-Share Alike License (C.C.-By-S.A.)

2.0 Methodology

The following sections provide a summary of regulatory requirements and municipal and regional heritage policies that guide this cultural heritage assessment. In addition, an overview of the process undertaken to identify known and potential built heritage resources (B.H.R.s) and cultural heritage landscapes (C.H.L.s) is provided, along with a description of how the preliminary impact assessment will be undertaken.

2.1 Regulatory Requirements

The *Ontario Heritage Act* (O.H.A.) (Ontario Heritage Act, R.S.O. c. O.18, 1990 [as Amended in 2021], 1990) is the primary piece of legislation that determines policies, priorities and programs for the conservation of Ontario's heritage. There are many other provincial acts, regulations and policies governing land use planning and resource development that support heritage conservation, including:

- The *Planning Act* (Planning Act, R.S.O. 1990, c. P.13, 1990), which states that "conservation of features of significant architectural, cultural, historical, archaeological or scientific interest" is a "matter of provincial interest". The *Provincial Policy Statement* (Ministry of Municipal Affairs and Housing, 2020), issued under the *Planning Act*, links heritage conservation to long-term economic prosperity and requires municipalities and the Crown to conserve significant B.H.R.s and C.H.L.s.
- The *Environmental Assessment Act* (Environmental Assessment Act, R.S.O. c. E.18, 1990), which defines "environment" to include cultural conditions that influence the life of humans or a community. Cultural heritage resources, which includes archaeological resources, B.H.R.s and C.H.L.s, are important components of those cultural conditions.

The Ministry of Citizenship and Multiculturalism (hereafter "The Ministry") is charged under Section 2.0 of the O.H.A. with the responsibility to determine policies, priorities, and programs for the conservation, protection, and

preservation of the heritage of Ontario. The *Standards and Guidelines for Conservation of Provincial Heritage Properties* (Ministry of Tourism Culture and Sport, 2010) (hereinafter "*Standards and Guidelines")* apply to properties the Government of Ontario owns or controls that have "cultural heritage value or interest" (C.H.V.I.). The *Standards and Guidelines* provide a series of guidelines that apply to provincial heritage properties in the areas of identification and evaluation; protection; maintenance; use; and disposal. For the purpose of this report, the *Standards and Guidelines* provide points of reference to aid in determining potential heritage significance in the identification of B.H.R.s and C.H.L.s. While not directly applicable for use in properties not under provincial ownership, the *Standards and Guidelines* are regarded as best practice for guiding heritage assessments and ensure that additional identification and mitigation measures are considered.

Similarly, the *Ontario Heritage Tool Kit* (Ministry of Culture, 2006) provides a guide to evaluate heritage properties. To conserve a B.H.R. or C.H.L., the *Ontario Heritage Tool Kit* states that a municipality or approval authority may require a heritage impact assessment and/or a conservation plan to guide the approval, modification, or denial of a proposed development.

2.2 Municipal/Regional Heritage Policies

The study area is located within the Township of Cavan Monaghan, in the County of Peterborough. Policies relating to B.H.R.s and C.H.L.s were reviewed from the following sources:

- *Official Plan for Township of Cavan Monaghan* (Township of Cavan Monaghan, 2015 [amended in 2021])
- *County of Peterborough Official Plan* (County of Peterborough, 1994)
- *Oak Ridges Moraine Conservation Plan* (Ministry of Municipal Affairs and Housing, 2017)

2.3 Identification of Built Heritage Resources and Cultural Heritage Landscapes

This Cultural Heritage Report follows guidelines presented in the *Ontario Heritage Tool Kit* (Ministry of Culture, 2006) and *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes* (Ministry of Tourism, Culture and Sport, 2016). The objective of this report is to present an inventory of known and potential B.H.R.s and C.H.L.s, and to provide a preliminary understanding of known and potential B.H.R.s and C.H.L.s located within areas anticipated to be directly or indirectly impacted by the proposed project.

In the course of the cultural heritage assessment process, all potentially affected B.H.R.s and C.H.L.s are subject to identification and inventory. Generally, when conducting an identification of B.H.R.s and C.H.L.s within a study area, three stages of research and data collection are undertaken to appropriately establish the potential for and existence of B.H.R.s and C.H.L.s in a geographic area: background research and desktop data collection; field review; and identification.

Background historical research, which includes consultation of primary and secondary source research and historical mapping, is undertaken to identify early settlement patterns and broad agents or themes of change in a study area. This stage in the data collection process enables the researcher to determine the presence of sensitive heritage areas that correspond to nineteenth- and twentieth-century settlement and development patterns. To augment data collected during this stage of the research process, federal, provincial, and municipal databases and/or agencies are consulted to obtain information about specific properties that have been previously identified and/or designated as having cultural heritage value. Typically, resources identified during these stages of the research process are reflective of particular architectural styles or construction methods, associated with an important person, place, or event, and contribute to the contextual facets of a particular place, neighbourhood, or intersection.

While the subject Cultural Heritage Report provides desktop collection results only, a field review is typically undertaken to confirm the location and condition of previously identified B.H.R.s and C.H.L.s. The field review is also used to identify potential B.H.R.s or C.H.L.s that have not been previously identified on federal, provincial, or municipal databases or through other appropriate agency data sources.

During the cultural heritage assessment process, a property is identified as a potential B.H.R. or C.H.L. based on research, the Ministry screening tool, and professional expertise. In addition, use of a 40-year-old benchmark is a guiding principle when conducting a preliminary identification of B.H.R.s and C.H.L.s. While identification of a resource that is 40 years old or older does not confer outright heritage significance, this benchmark provides a means to collect information about resources that may retain heritage value. Similarly, if a resource is slightly younger than 40 years old, this does not preclude the resource from having cultural heritage value or interest.

The scope of work for this assessment does not include a field review, which may yield additional potential B.H.R.s or C.H.L.s. As such, there is the potential for additional B.H.R.s and C.H.L.s to be located within the study area.

2.4 Background Information Review

To make an identification of previously identified known or potential B.H.R.s and C.H.L.s within the study area, the following sections present the resources that were consulted as part of this Cultural Heritage Report.

2.4.1 Review of Existing Heritage Inventories

A number of resources were consulted in order to identify previously identified B.H.R.s and C.H.L.s within the study area. These resources, reviewed on 8 January 2021, include:

- Cavan Monaghan Cultural Resources available online through Peterborough County Public GIS (Peterborough County, n.d.);

- Historical maps (including historical atlases, topographic maps, and aerial photography);
- The *Ontario Heritage Act Register* (Ontario Heritage Trust, n.d.b);
- The *Places of Worship Inventory* (Ontario Heritage Trust, n.d.c);
- The inventory of Ontario Heritage Trust easements (Ontario Heritage Trust, n.d.a);
- The Ontario Heritage Trust's *An Inventory of Provincial Plaques Across Ontario*: a PDF of Ontario Heritage Trust Plaques and their locations (Ontario Heritage Trust, 2018);
- Inventory of known cemeteries/burial sites in the Ontario Genealogical Society's online databases (Ontario Genealogical Society, n.d.);
- Canada's Historic Places website: available online, the searchable register provides information on historic places recognized for their heritage value at the local, provincial, territorial, and national levels (Parks Canada, n.d.a);
- Directory of Federal Heritage Designations: a searchable on-line database that identifies National Historic Sites, National Historic Events, National Historic People, Heritage Railway Stations, Federal Heritage Buildings, and Heritage Lighthouses (Parks Canada, n.d.b);
- Canadian Heritage River System: a national river conservation program that promotes, protects and enhances the best examples of Canada's river heritage (Canadian Heritage Rivers Board and Technical Planning Committee, n.d.); and,
- United Nations Educational, Scientific and Cultural Organization (U.N.E.S.C.O.) World Heritage Sites (U.N.E.S.C.O. World Heritage Centre, n.d.).

2.4.2 Review of Previous Heritage Reporting

Additional cultural heritage studies undertaken within parts of the study area were also reviewed. These include:

- The Cultural Resource Mapping Project (Township of Cavan Monaghan & EcoVue Consulting Services Inc., 2011)

2.4.3 Community Information Gathering

The following individuals, groups, and/or organizations were contacted to gather information on known and potential B.H.R.s and C.H.L.s, active and inactive cemeteries, and areas of identified Indigenous interest within the study area:

- Karen Ellis, Director of Planning, Township of Cavan Monaghan (email communication 20 and 22 January 2021). Email correspondence confirmed that the Township of Cavan Monaghan does not maintain a Heritage Register. Karen Ellis also confirmed that the properties identified on the Cavan Monaghan Cultural Resources on the Peterborough County – Public GIS website (Peterborough County, n.d.) and the Cultural Resource Mapping Project (Township of Cavan Monaghan & EcoVue Consulting Services Inc., 2011) have not been evaluated, listed, or designated by the Township.
- The Ministry of Citizenship and Multiculturalism (email communication 20 and 26 January 2021)[1]. Email correspondence confirmed that there are no additional previously identified heritage resources or concerns regarding the study area.
- The Ontario Heritage Trust (email communications 20 January 2021). A response indicated that there are no conservation easements or Trust-owned properties within the study area.

3.0 Summary of Historical Development Within the Study Area

This section provides a brief summary of historical research. A review of available primary and secondary source material was undertaken to produce a contextual overview of the study area, including a general description of physiography, Indigenous land use, and Euro-Canadian settlement.

[1] Contacted at registrar@ontario.ca.

3.1 Physiography

The study area is located within the Peterborough Drumlin Field which extends from Simcoe County east to Hastings County and is generally characterized by rolling till plains overlying limestone bedrock. The region is approximately 4,532 kilometres squared and contains over 3,000 drumlins in addition to many other drumlinoid hills and surface flutings (Chapman & Putnam, 1984). The drumlins are composed of highly calcareous till but there are local differences in composition. The till plains of the regions were formed during the retreat of the Lake Ontario ice lobe of the Laurentide glacier and they indicate directionality of glacial advance and retreat. Till is produced from the advance of continental glacial ice. Soil and rock is carried forward by the ice, mixed and milled, producing a heterogeneous soil which is characteristic of glaciations (Chapman & Putnam, 1984).

Those looking to make use of the lands within the Peterborough drumlin field were faced with the challenges of stoniness, steep slopes, and wet swampy areas. Euro-Canadian settlers to the area also had another set of difficulties when trying to farm the area because of the way in which the land survey was completed. When the land was surveyed into townships with concession and lots, the base lines were created parallel to the shores of the Great Lakes. In the Peterborough drumlin field this led to roads and farms that were on angles with the drumlin. This created a large number of triangular and diamond-shaped fields and many areas that were not utilized as it was too small or too awkward to be worked successfully (Chapman & Putnam, 1984).

Road corner hamlets developed within the Peterborough drumlin fields. In some instances, the location of rural hamlets and rural residences were influenced by the physiography, the sites overlooking a drumlin landscape would have a visual appeal to those who chose to settle there. The odd corners on many of the sloping farms have more value as building lots than they have as agricultural lots leading to development along the rural-urban boundaries (Chapman & Putnam, 1984).

3.2 Indigenous Land Use and Settlement

Southern Ontario has been occupied by human populations since the retreat of the Laurentide glacier approximately 13,000 years ago, or 11,000 Before the Common Era (B.C.E.) (Ferris, 2013)[2]. During the Paleo period (c. 11,000 B.C.E. to 9,000 B.C.E.), groups tended to be small, nomadic, and non-stratified. The population relied on hunting, fishing, and gathering for sustenance, though their lives went far beyond subsistence strategies to include cultural practices including but not limited to art and astronomy. Fluted points, beaked scrapers, and gravers are among the most important artifacts to have been found at various sites throughout southern Ontario, and particularly along the shorelines of former glacial lakes. Given the low regional population levels at this time, evidence concerning Paleo period groups is very limited (C. J. Ellis & Deller, 1990).

Moving into the Archaic period (c. 9,000 B.C.E. to 1,000 B.C.E.), many of the same roles and responsibilities continued as they had for millennia, with groups generally remaining small, nomadic, and non-hierarchical. The seasons dictated the size of groups (with a general tendency to congregate in the spring/summer and disperse in the fall/winter), as well as their various sustenance activities, including fishing, foraging, trapping, and food storage and preparation. There were extensive trade networks which involved the exchange of both raw materials and finished objects such as polished or ground stone tools, beads, and notched or stemmed projectile points. Furthermore, mortuary ceremonialism was evident, meaning that there were burial practices and traditions associated with a group member's death (C. J. Ellis et al., 2009; C. J. Ellis & Deller, 1990).

The Woodland period (c. 1,000 B.C.E. to 1600 C.E.) saw several trends and aspects of life remain consistent with previous generations. Among the more notable

[2] While many types of information can inform the precontact settlement of Ontario, such as oral traditions and histories, this summary provides information drawn from archaeological research conducted in southern Ontario over the last century.

changes, however, was the introduction of pottery, the establishment of larger occupations and territorial settlements, incipient horticulture, more stratified societies, and more elaborate burials. Later in this period, settlement patterns, foods, and the socio-political system continued to change. A major shift to agriculture occurred in some regions, and the ability to grow vegetables and legumes such as corn, beans, and squash ensured long-term settlement occupation and less dependence upon hunting and fishing. This development contributed to population growth as well as the emergence of permanent villages and special purpose sites supporting those villages. Furthermore, the socio-political system shifted from one which was strongly kinship based to one that involved tribal differentiation as well as political alliances across and between regions (Birch et al., 2021; Dodd et al., 1990; C. J. Ellis & Deller, 1990; Williamson, 1990).

The arrival of European trade goods in the sixteenth century, Europeans themselves in the seventeenth century, and increasing settlement efforts in the eighteenth century all significantly impacted traditional ways of life in Southern Ontario. Over time, war and disease contributed to death, dispersion, and displacement of many Indigenous peoples across the region. The Euro-Canadian population grew in both numbers and power through the eighteenth and nineteenth centuries and treaties between colonial administrators and First Nations representatives began to be negotiated.

The study area is within Treaty 20 the Rice Lake Purchase of 1818 and the Williams Treaties of 1923, on the traditional territory of the Michi Saagiig and Chippewa Nations, collectively known as the Williams Treaties First Nations, including the Mississaugas of Alderville First Nation, Curve Lake First Nation, Hiawatha First Nation, Scugog Island First Nation and the Chippewas of Beausoleil First Nation, Georgina Island First Nation and the Rama First Nation (Williams Treaties First Nations, 2017). In October and November of 1923, the governments of Canada and Ontario, chaired by A.S. Williams, signed treaties with the Chippewa and Mississauga for three large tracts of land in central Ontario and the northern shore of Lake Ontario which had never been included in previous

treaties (Crown-Indigenous Relations and Northern Affairs, 2013). Part of the Williams Treaties area includes lands originally negotiated under the Rice Lake Treaty, Treaty Number 20, signed on November 5, 1818 between the Mississaugas in the Rice Lake area and the Crown, which opened up colonization for settlers (Crown-Indigenous Relations and Northern Affairs, 2016).

In 2018 the Government of Canada reached a settlement with the Williams Treaties First Nations reaffirming the recognized Treaty harvesting rights in the Williams Treaties territories of each of the seven nations.

3.3 Historical Euro-Canadian Township Survey and Settlement

The first Europeans to arrive in the area were transient merchants and traders from France and England, who followed Indigenous pathways and set up trading posts at strategic locations along the well-travelled river routes. All of these occupations occurred at sites that afforded both natural landfalls and convenient access, by means of the various waterways and overland trails, into the hinterlands. Early transportation routes continued the use of existing Indigenous trails that typically followed the highlands adjacent to various creeks and rivers (Archaeological Services Inc., 2006). Early European settlements occupied similar locations as Indigenous settlements as they were generally accessible by trail or water routes and would have been in locations with good soil and suitable topography to ensure adequate drainage.

Historically, the study area is located in the Former Township of Cavan, County of Durham in Lot 10, Concession V; Lot 11, Concession V – VI; and Lots 12-13, Concession VI.

3.3.1 Township of Cavan

The study area is located in the former Township of Cavan. The Township of Cavan was surveyed in 1816-1817 and John Deyell assisted surveyor Samuel Wilmot in the task. The first Euro-Canadian to settle in the township was John

Deyell in 1816. Deyell had come from County Monaghan in Ireland and he acquired land opposite of the present-day hamlet of South Monaghan. At that location, he constructed the township's first tavern. Deyell also built the township's first grist and sawmill at present-day Millbrook. This was later replaced with another mill, Needler's flour mill, which was destroyed by fire. A subsequent mill was in operation at the location until 1966 (Mika & Mika, 1977).

By 1830, the township had four mills, five stores, and two distilleries. The first church was a log structure, St. John's Anglican, in the hamlet of Ida. The land for the first schoolhouse was donated by settler, John Deyell. The main industry of the township was agriculture and an Agricultural Society was organized as early as 1859. It continues to be a mainstay for those living within the township. The township had been part of the United Counties of Northumberland and Durham until 1974 (Mika & Mika, 1977). The Township of Cavan amalgamated with the Township of North Monaghan and the Village of Millbrook in 1997 (*Municipal Restructuring Activity Summary Table*, 2018).

3.3.2 Millbrook

The study area is located north and west of the historical community of Millbrook. In 1816, John Deyell came to the area from Ireland and constructed a grist mill by a brook, giving Millbrook its name. Another early Euro-Canadian settler was John Thorn, who made bricks and burned limestone for lime in order to construct his house. Thorn also built the first mill to run by hand to grind corn (Mika & Mika, 1981).

Millbrook grew into a prosperous village with many stores and other businesses including: Needler's three-storey flour mill, McIvor's mill for oatmeal, a cooper shop, and a pump factory. The New Connexion Church was the first church in the village, followed by the Anglican Parish of Cavan organizing in 1819. In 1881, the cornerstone of the Methodist Church was laid (Mika & Mika, 1981).

The village's Town Hall was constructed in 1877 and the present building was built in 1880, replacing the first which was destroyed by fire. For a time, the old Town

Hall was used as the schoolhouse, until a red brick school was built on Union Street. This building burned down in 1887 and a white brick school was opened in 1890. In 1880, Millbrook was incorporated as a village. The population of the community was 1,500 at the time. The library was organized by David Hampton in 1894 with the assistance of the Mechanics' Institute. The following year it became a free Public Library (Mika & Mika, 1981).

The Village of Millbrook amalgamated with the Township of Cavan and the Township of North Monaghan in 1997 (*Municipal Restructuring Activity Summary Table*, 2018).

3.3.3 Midland Railway

Through the northern portion of the study area is the former alignment of the Midland Railway. In 1846, the Peterborough and Port Hope Railway Company was planned to run from Port Hope to Peterborough around Rice Lake. Initially growth of the rail line was slow due to financial issues and a new charter was issued in 1854 for the Port Hope, Lindsay, and Beaverton Railway Company. Four years later the company constructed a branch line from Millbrook to Peterborough. The railway changed its name to the Midland Railway of Canada in 1869 when it planned for expansion to Beaverton and beyond. During the 1880s, following a decade of growth the company was in financial strain, as were other rail lines, and in 1882, a merger of six rail road companies under the Midland Railway of Canada saw its total mileage swell from 144 miles to 465 miles (Toronto Railway Historical Association, 2020).

The abandonment of the original mainline between Omemee and Millbrook Junction occurred in 1882 when the company decided to build a direct line between Peterborough and Omemee. The company was later taken over by the Grand Trunk Railroad in 1893 and subsequently the Canadian National Railway in 1923 (Andreae, 1997; Toronto Railway Historical Association, 2020).

3.4 Review of Historical Mapping

The 1861 *Map of the County of Durham, Upper Canada* (Tremaine, 1861) and the 1878 *Illustrated Historical Atlas of the Counties of Northumberland and Durham, Ont.* (Belden, 1878), were examined to determine the presence of historical features within the study area during the nineteenth century (Figure 2 and Figure 3).

It should be noted, however, that not all features of interest were mapped systematically in the Ontario series of historical atlases. For instance, they were often financed by subscription limiting the level of detail provided on the maps. Moreover, not every feature of interest would have been within the scope of the atlases. The use of historical map sources to reconstruct or predict the location of former features within the modern landscape generally begins by using common reference points between the various sources. The historical maps are geo-referenced to provide the most accurate determination of the location of any property on a modern map. The results of this exercise can often be imprecise or even contradictory, as there are numerous potential sources of error inherent in such a process, including differences of scale and resolution, and distortions introduced by reproduction of the sources.

Nineteenth-century mapping shows that the study area was located within a rural agricultural context to the west and north of the village of Millbrook (Figure 2 and Figure 3). The mapping illustrates that Queen Street, Hunter Street, County Road 21, County Road 10, Fallis Line, and Larmer Line were all historically surveyed roads following their present alignment. The 1861 mapping depicted a small development at Queen Street and Hunter Street is indicated by the dark shading on the mapping. A Wesleyan Methodist church is illustrated north of the tributary of Baxter Creek, east of County Road 10 and a schoolhouse is depicted northwest of the intersection of County Road 10 and Larmer Line. The Midland Railroad is illustrated curving from the south to the northwest through the study area. The 1878 mapping depicts the study area within a similar context. The development around Queen Street and Hunter Street has grown easterly. Seven residences are

now illustrated within the study area. A cemetery is now depicted adjacent to the location of the earlier church.

In addition to nineteenth-century mapping, historical topographic mapping and aerial photographs from the twentieth century were examined. This report presents maps and aerial photographs from 1932, 1954, 1972, and 1985 (Figure 4 to Figure 7).

The twentieth-century mapping continues to depict the study area in a rural agricultural context outside of the village of Millbrook. The 1932 topographic map (Figure 4

Figure 5: The study area overlaid on the 1954 aerial photograph of Millbrook, Plate 442.782 (Hunting Survey Corporation Limited, 1954)

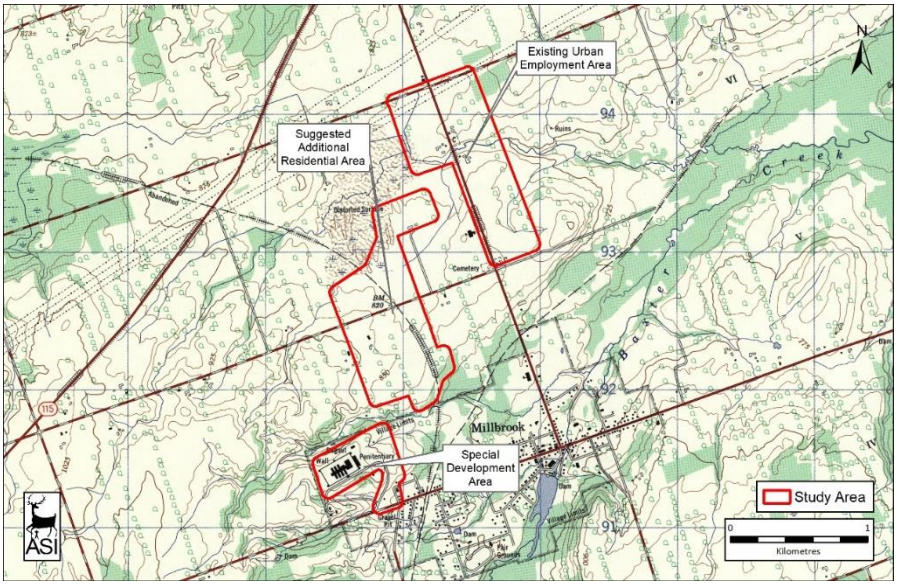


Figure 6: The study area overlaid on the 1972 topographic map of Millbrook, Millbrook Sheet 31D/1e (Department of Energy, Mines and Resources, 1972)

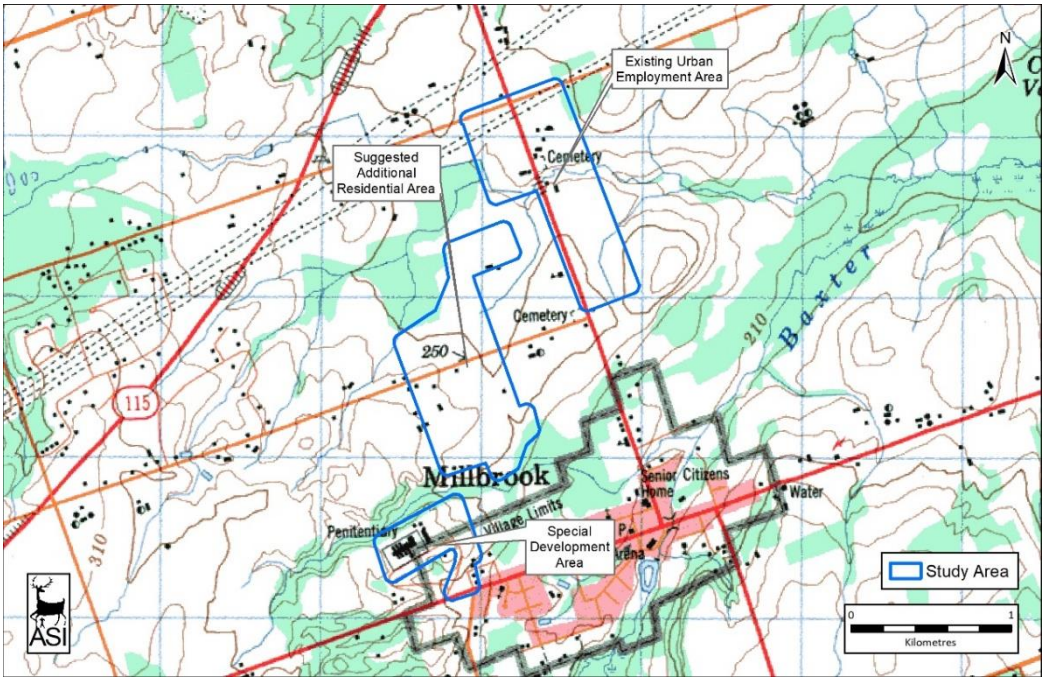


Figure 7: The study area overlaid on the 1985 topographic map of Rice Lake, Rice Lake Sheet 31D/1 (Department of Energy, Mines and Resources, 1985)

) illustrates County Road 21 and County Road 10 as improved roads under 20 feet wide. The other roads are depicted as dirt roads. The Midland Railway is now labelled as an abandoned line. The 1954 aerial photograph (Figure 5) shows the agricultural context of the study area, a patchwork of agricultural fields and tree lines are clearly visible. The 1972 topographic map (Figure 6) depicts the southern study area within the village of Millbrook limits with a penitentiary now constructed within it. County Road 10 is illustrated as a hard surface, all weather road; the other roadways are all depicted as looser stabilized surface, all weather roads. The 1985 topographic map (Figure 7) illustrates the study area in a similar context to earlier mapping. The village limits have moved to the south. Some additional buildings have been constructed east of County Road 10 and north of the tributary of Baxter Creek, as well as an additional building south of Fallis Line.

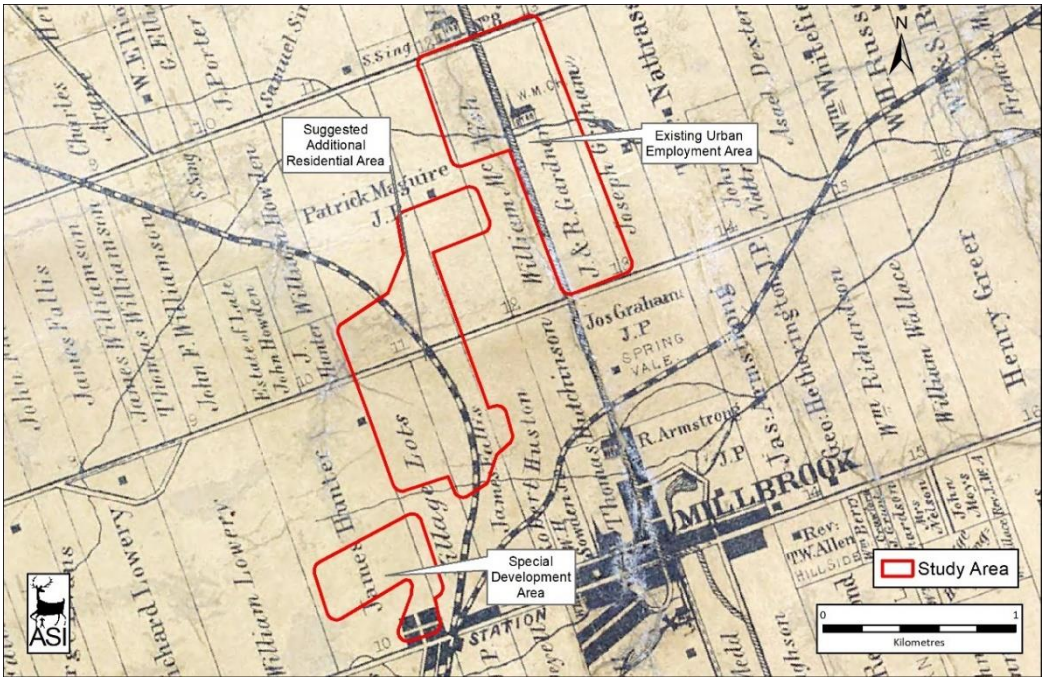


Figure 2: The study area overlaid on the 1861 *Map of the County of Durham, Upper Canada* (Tremaine, 1861)

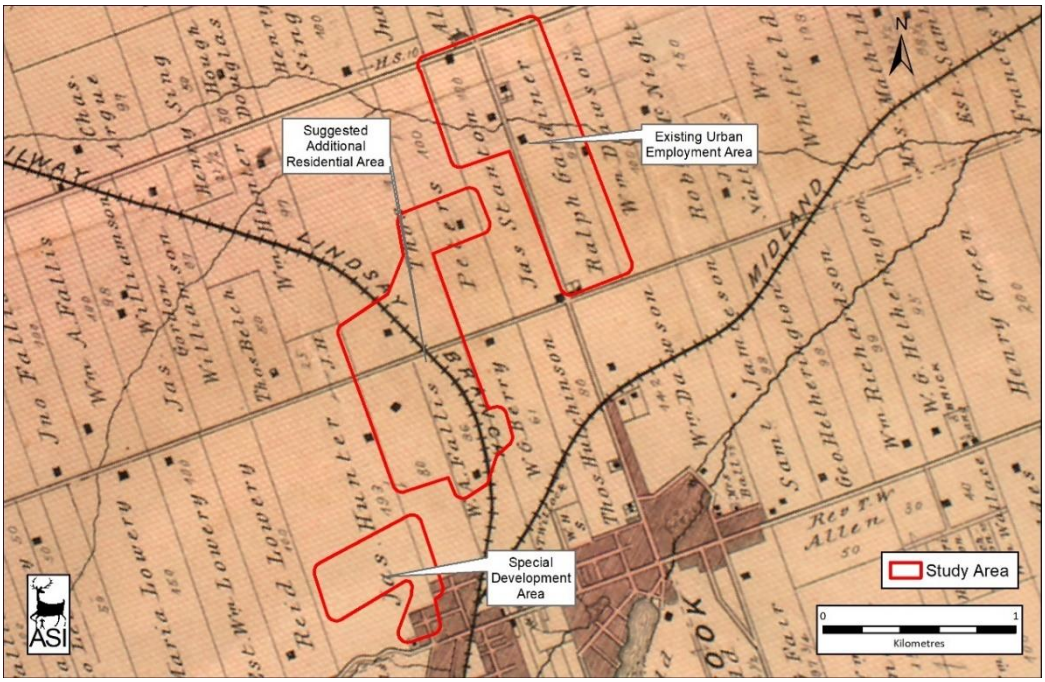


Figure 3: The study area overlaid on the 1878 *Illustrated Historical Atlas of the Counties of Northumberland and Durham, Ont.* (Belden, 1878)

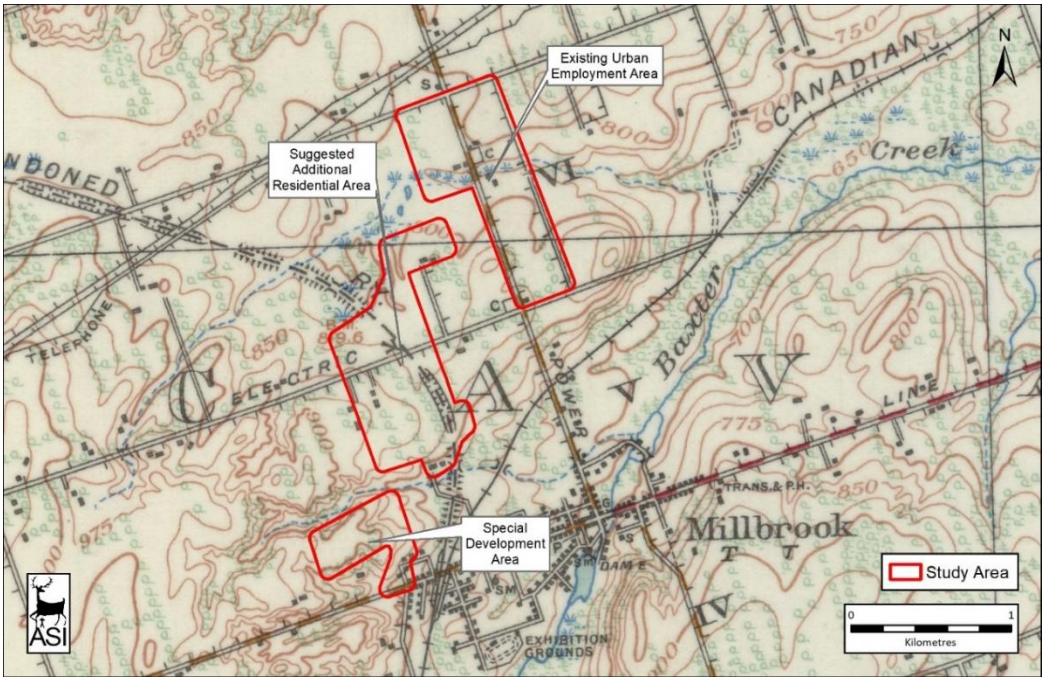


Figure 4: The study area overlaid on the 1932 topographic map of Rice Lake, Rice Lake Sheet 31D/1 (Department of National Defence, 1932)

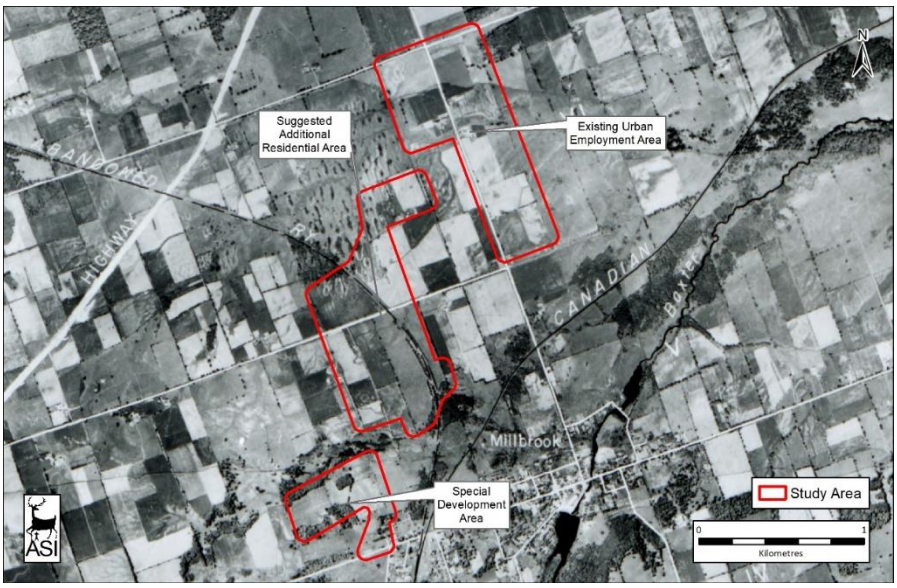


Figure 5: The study area overlaid on the 1954 aerial photograph of Millbrook, Plate 442.782 (Hunting Survey Corporation Limited, 1954)

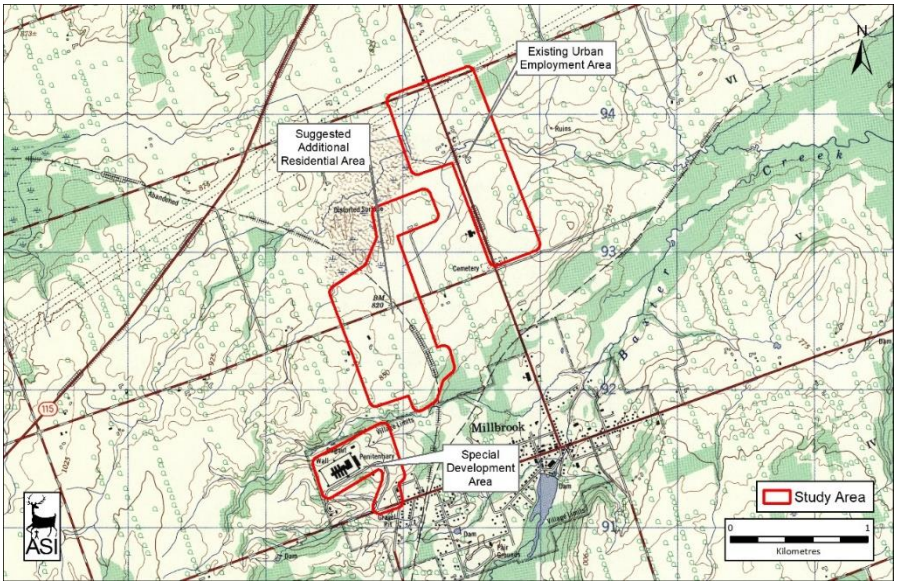


Figure 6: The study area overlaid on the 1972 topographic map of Millbrook, Millbrook Sheet 31D/1e (Department of Energy, Mines and Resources, 1972)

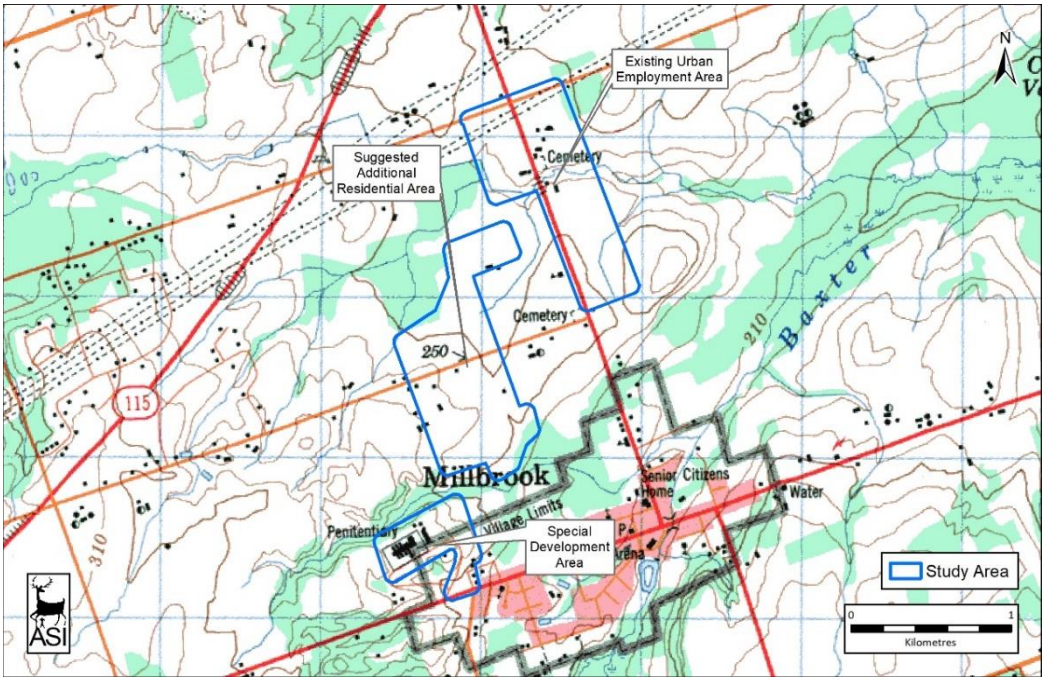


Figure 7: The study area overlaid on the 1985 topographic map of Rice Lake, Rice Lake Sheet 31D/1 (Department of Energy, Mines and Resources, 1985)

4.0 Desktop Review

4.1 Identification of Known and Potential Built Heritage Resources and Cultural Heritage Landscapes

Based on the results of the background research, eight potential cultural heritage landscapes (C.H.L.s) were identified within the study area. All eight properties are identified on the Cavan Monaghan Cultural Resources on the Peterborough County – Public GIS website (Peterborough County, n.d.) and the Cultural Resource Mapping Project (Township of Cavan Monaghan & EcoVue Consulting Services Inc., 2011). A detailed inventory of potential C.H.L.s within the study area is presented in Table 1. See Figure 8 for mapping showing the location of identified C.H.L.s.

Table 1: Inventory of Known and Potential Cultural Heritage Landscapes within the Study Areas

Feature ID	Study Areas	Type of Property	Address or Location	Heritage Status and Recognition	Description of Property and Known or Potential CHVI
C.H.L. 1	Existing Urban Employment Area	Farmscape	1069 County Road 10 and Roll - 150901003005700	Potential C.H.L. – Identified in the Cavan Monaghan Cultural Resources	The C.H.L. encapsulates two property parcels that were once a singular parcel that has since been severed. The farmscape is located east of County Road 10, south of Larmer Line. The potential heritage attributes include a one-and-a-half storey red brick Ontario cottage farmhouse, long driveways leading to the barns and outbuildings, and surrounding agricultural fields. The farmhouse property has been severed from the property containing the outbuildings and fields. The 1878 Illustrated Historical Atlas (Figure 3) illustrates a residence in this general location and indicates that the property owner was Ralph Gardiner.
C.H.L. 2	Existing Urban Employment Area	Farmscape	1080 County Road 10	Potential C.H.L. – Identified in the Cavan Monaghan Cultural Resources	The farmscape is located west of County Road 10, south of Larmer Line. The potential heritage attributes include a two-storey red brick farmhouse, a tree-lined driveway, barns and outbuildings, and surrounding agricultural fields. The 1878 Illustrated Historical Atlas (Figure 3) illustrates a residence in this general location and indicates that the property owner was Jas. Stanton.
C.H.L. 3	Existing Urban Employment Area	Farmscape	1097 County Road 10	Potential C.H.L. – Identified in the Cavan Monaghan Cultural Resources	The farmscape is located east of County Road 10, south of Larmer Line. The potential heritage attributes include a two-storey house, barns, outbuildings, and tree-lined property parcel. The 1861 map (Figure 2) illustrates a Wesleyan Methodist church in this general location and indicates that the property owner was J. & R. Gardiner.
C.H.L. 4	Existing Urban Employment Area	Cemetery	Roll - 150901003005600	Potential C.H.L. – Identified in the Cavan Monaghan Cultural Resources	The Gardiner Cemetery is located east of County Road 10, south of Larmer Line. The potential heritage attributes include the gravestones which remain in situ in rows parallel the County Road 10 and mature trees. The 1878 Illustrated Historical Atlas (Figure 3) illustrates a cemetery in this general location and indicates that the property owner was Ralph Gardiner.

Feature ID	Study Areas	Type of Property	Address or Location	Heritage Status and Recognition	Description of Property and Known or Potential CHVI
C.H.L. 5	Existing Urban Employment Area	Farmscape	1187 County Road 10	Potential C.H.L. – Identified in the Cavan Monaghan Cultural Resources	The farmscape is located at the northeast corner of the County Road 10 and Larmer Line intersection. The potential heritage attributes include a red brick farmhouse, long driveway, barn, outbuildings, and surrounding agricultural fields. The 1878 Illustrated Historical Atlas illustrates a residence in this general location and indicates that the property owner was Jno. Hutchinson Jr.
C.H.L. 6	Existing Urban Employment Area	Cemetery	Roll - 150901003006100	Potential C.H.L. – Identified in the Cavan Monaghan Cultural Resources	The Grace Presbyterian Cemetery is located at the northwest corner of County Road 10 and Fallis Line intersection. The potential heritage attributes include the gravestones which remain in situ in rows parallel the County Road 10 and mature trees. The 1932 topographic map (Figure 4) illustrates a cemetery in this location.
C.H.L. 7	Existing Urban Employment Area	Farmscape	987 Syer Line	Potential C.H.L.– Identified in the Cavan Monaghan Cultural Resources	The farmscape is located south of Syer Line, east of Highway 115. The potential heritage attributes include a one-and-a-half storey frame house, barn, driveway, and surrounding agricultural fields. The 1878 Illustrated Historical Atlas (Figure 3) illustrates a residence in this general location and indicates that the property owner was Jno. Sutton.
C.H.L. 8	Special Development Area	Former Penitentiary	706 County Road 21	Potential C.H.L. – Identified in the Cavan Monaghan Cultural Resources	The C.H.L. contains the property parcel of the former Millbrook Correction Centre, also known as the Old Millbrook Jail. No structures are currently on the property. The circulation route begins in the adjacent parcel and loops around to 706 County Road 21. The northern portion of the property includes naturalized areas as part of the Oak Ridges Moraines and contains scenic views. Trees have been planted along the inner side of the loop. The 1972 topographic map (Figure 6) illustrates the penitentiary in the location of the former jail. According to Google Earth aerial imagery, the structures on the property were demolished in 2014-2015.

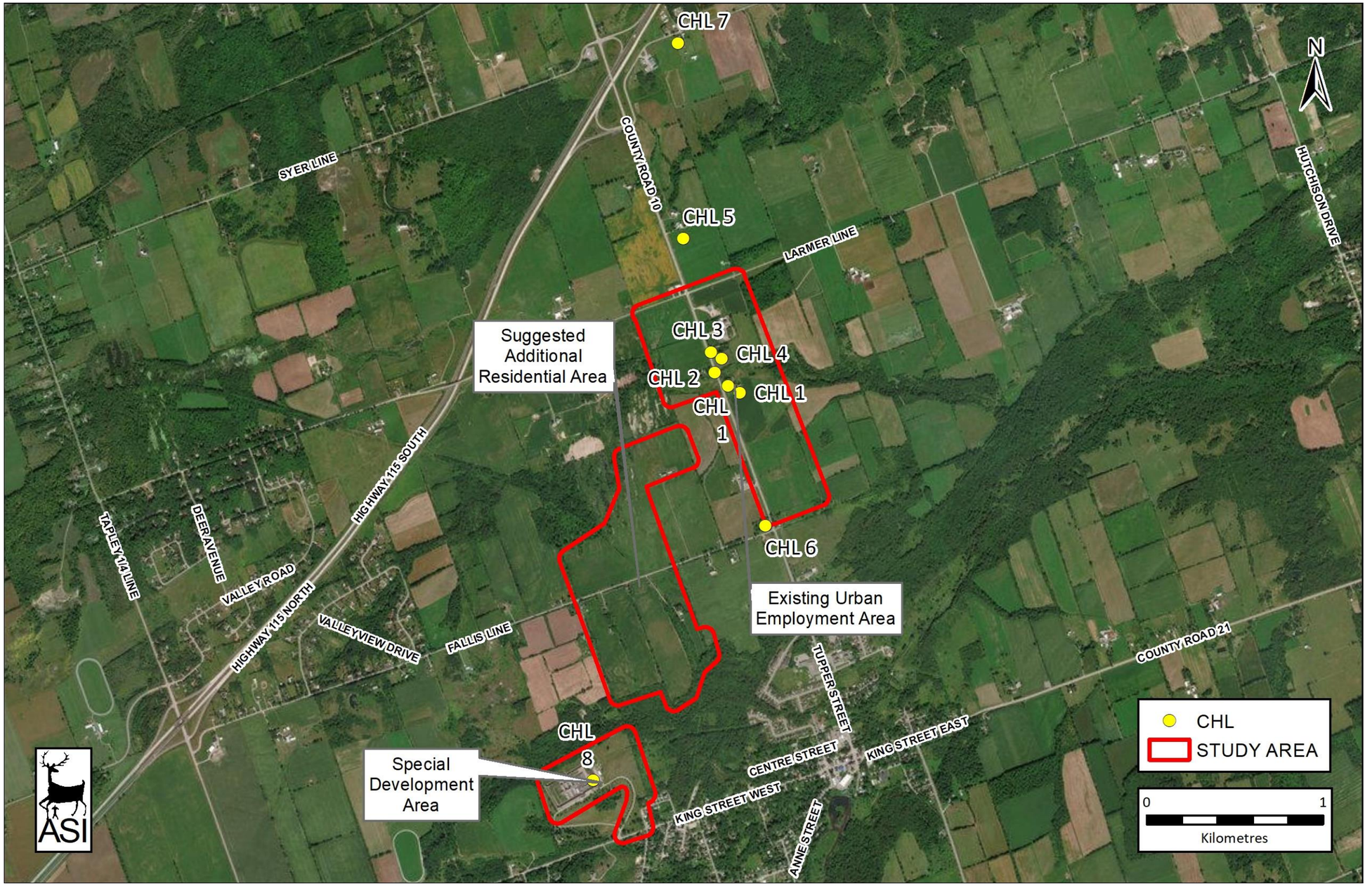


Figure 8: Location of the Identified Cultural Heritage Landscape (C.H.L.) in the Study Area

5.0 Results and Future Work

The results of background historical research and a review of secondary source material, including historical mapping, indicate a study area with a rural land use history dating back to the early nineteenth century. A review of federal, provincial, and municipal registers, inventories, and databases revealed that there are eight potential cultural heritage landscapes (C.H.L.s) within the Cavan Monaghan Water and Wastewater Master Servicing Study project study area.

5.1 Key Findings

A total of eight C.H.L.s were identified within the study area:

- Seven C.H.L.s (C.H.L. 1 – 7) were identified within the Existing Urban Employment Area study area; and
- One C.H.L. (C.H.L. 8) was identified within the Special Development Area study area.
- The eight C.H.L.s are all identified in the Cavan Monaghan Cultural Resources on the Peterborough County – Public GIS website (Peterborough County, n.d.) and the Cultural Resource Mapping Project (Township of Cavan Monaghan & EcoVue Consulting Services Inc., 2011).
- The identified C.H.L.s are historically, architecturally, and contextually associated with land use patterns in the Township of Cavan Monaghan.

5.2 Future Work

The results presented in this desktop report are of the previously identified C.H.L.s within the study area. As the scope of work for this assessment does not include a field review, there is the potential for additional built heritage resources and C.H.L.s to be identified within the study area. Given the high-level nature of the Master Servicing Study, specific locations of the future infrastructure had not been determined at the time of report finalization (July 2023). When the future infrastructure locations are being considered through

subsequent studies, they will be assessed against information contained in this report and additional cultural heritage reporting will be undertaken as required.

6.0 References

Andreae, C. (1997). *Lines of Country: An Atlas of Railway and Waterway History in Canada*. Boston Mills Press.

Archaeological Services Inc. (2006). *Historical Overview and Assessment of Archaeological Potential Don River Watershed, City of Toronto*. Report on file with the Ontario Ministry of Tourism, Culture and Sport.

Belden, H. (1878). *Illustrated Historical Atlas of the Counties of Northumberland and Durham, Ont.* [Map].

Birch, J., Manning, S. W., Sanft, S., & Conger, M. A. (2021). Refined Radiocarbon Chronologies for Northern Iroquoian Site Sequences: Implications for Coalescence, Conflict, and the Reception of European Goods. *American Antiquity*, *86*(1), 61–89.

Canadian Heritage Rivers Board and Technical Planning Committee. (n.d.). *The Rivers – Canadian Heritage Rivers System Canada's National River Conservation Program*. Canadian Heritage Rivers System. http://chrs.ca/en/rivers/

Carman, R. A., Buehler, D., Mikesell, S., & Searls, C. L. (2012). *Current Practices to Address Construction Vibration and Potential Effects to Historic Buildings Adjacent to Transportation Projects*. Wilson, Ihrig and Associates, ICF International, and Simpson, Gumpertz and Heger, Incorporated for the American Association of State Highway and Transportation Officials (AASHTO).

Chapman, L. J., & Putnam, F. (1984). *The Physiography of Southern Ontario* (3rd ed., Vol. 2). Ontario Ministry of Natural Resources.

County of Peterborough. (1994). *County of Peterborough Official Plan, consolidated March 2020*.

Crispino, M., & D'Apuzzo, M. (2001). Measurement and Prediction of Traffic-induced Vibrations in a Heritage Building. *Journal of Sound and Vibration*, *246*(2), 319–335.

Crown-Indigenous Relations and Northern Affairs. (2013). *Upper Canada Land Surrenders and the Williams Treaties (1781-1862/1923)*. https://www.rcaanc-cirnac.gc.ca/eng/1360941656761/1360941689121

Crown-Indigenous Relations and Northern Affairs. (2016). *Rice Lake Treaty, No. 20*. Treaty Texts – Upper Canada Land Surrenders. https://www.rcaanc-cirnac.gc.ca/eng/1370372152585/1370372222012#ucls18

Department of Energy, Mines and Resources. (1972). *Millbrook Sheet 31D/1e* [Map].

Department of Energy, Mines and Resources. (1985). *Rice Lake Sheet 31D/1* [Map].

Department of National Defence. (1932). *Rice Lake Sheet 31D/1* [Map].

Dodd, C. F., Poulton, D. R., Lennox, P. A., Smith, D. G., & Warrick, G. A. (1990). The Middle Ontario Iroquoian Stage. In C. J. Ellis & N. Ferris (Eds.), *The Archaeology of Southern Ontario to A.D. 1650* (pp. 321–360). Ontario Archaeological Society Inc.

Ellis, C. J., & Deller, D. B. (1990). Paleo-Indians. In C. J. Ellis & N. Ferris (Eds.), *The Archaeology of Southern Ontario to A.D. 1650* (pp. 37–64). Ontario Archaeological Society Inc.

Ellis, C. J., Timmins, P. A., & Martelle, H. (2009). At the Crossroads and Periphery: The Archaic Archaeological Record of Southern Ontario. In T. D. Emerson, D. L. McElrath, & A. C. Fortier (Eds.), *Archaic Societies: Diversity and Complexity across the Midcontinent.* (pp. 787–837). State University of New York Press.

Ellis, P. (1987). Effects of Traffic Vibration on Historic Buildings. *The Science of the Total Environment*, *59*, 37–45.

Ferris, N. (2013). Place, Space, and Dwelling in the Late Woodland. In M. K. Munson & S. M. Jamieson (Eds.), *Before Ontario: The Archaeology of a Province* (pp. 99–111). McGill-Queen's University Press. http://www.jstor.org/stable/j.ctt32b7n5.15

Hunting Survey Corporation Limited. (1954). *1954 Air Photos of Southern Ontario*. https://mdl.library.utoronto.ca/collections/air-photos/1954-air-photos-southern-ontario/index

Mika, N., & Mika, H. (1977). *Places In Ontario: Their Name Origins and History, Part I, A-E: Vol. I* (https://archive.org/details/placesinontariot0001mika). Mika Publishing Company; Internet Archive.

Mika, N., & Mika, H. (1981). *Places In Ontario: Their Name Origins and History, Part II, F-M* (https://archive.org/details/placesinontariot0002mika; Vol. 2). Mika Publishing Company; Internet Archive.

Ontario Heritage Act, R.S.O. c. O.18, 1990 [as amended in 2021], (1990).

Ministry of Culture. (2006). *Ontario Heritage Tool Kit*.

Ministry of Culture and Communications, & Ministry of the Environment. (1992). *Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments*.

Planning Act, R.S.O. 1990, c. P.13, (1990).

Ministry of Municipal Affairs and Housing. (2017). *Oak Ridges Moraine Conservation Plan*. https://files.ontario.ca/oak-ridges-moraine-conservation-plan-2017.pdf

Ministry of Municipal Affairs and Housing. (2020). *Provincial Policy Statement, 2020, Under the Planning Act*. Queen's Printer for Ontario.

Environmental Assessment Act, R.S.O. c. E.18, (1990).

Ministry of Tourism, Culture and Sport. (2016). *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes, A Checklist for the Non-Specialist*. http://www.mtc.gov.on.ca/en/heritage/tools.shtml

Ministry of Tourism Culture and Sport, M. T. C. S. (2006a). *Heritage Resources in the Land Use Planning Process: Info Sheet #5, Heritage Impact Assessments and Conservation Plans*. http://www.mtc.gov.on.ca/en/publications/Heritage_Tool_Kit_Heritage_PPS_infoSheet.pdf

Ministry of Tourism Culture and Sport, M. T. C. S. (2006b). *InfoSheet #5: Heritage Impact Assessments and Conservation Plans*.

Ministry of Tourism Culture and Sport, M. T. C. S. (2010). *Standards and Guidelines for Conservation of Provincial Heritage Properties: Standards & Guidelines*.

Municipal Restructuring Activity Summary Table. (2018). http://www.mah.gov.on.ca/AssetFactory.aspx?did=19769

Ontario Genealogical Society. (n.d.). *OGS Cemeteries*. Digitals Collections & Library Catalogue. http://vitacollections.ca/ogscollections/2818487/data

Ontario Heritage Trust. (2018). *An Inventory of Provincial Plaques Across Ontario*. https://www.heritagetrust.on.ca/user_assets/documents/Inventory-of-provincial-plaques-ENG.pdf

Ontario Heritage Trust. (n.d.a). *Easement Properties*. Ontario Heritage Trust. https://www.heritagetrust.on.ca/en/property-types/easement-properties

Ontario Heritage Trust. (n.d.b). *Ontario Heritage Act Register*. https://www.heritagetrust.on.ca/en/pages/tools/ontario-heritage-act-register

Ontario Heritage Trust. (n.d.c). *Places of Worship Inventory*. Ontario Heritage Trust. https://www.heritagetrust.on.ca/en/places-of-worship/places-of-worship-database

Parks Canada. (n.d.a). *Canada's Historic Places*. www.historicplaces.ca

Parks Canada. (n.d.b). *Directory of Federal Heritage Designations*. https://www.pc.gc.ca/apps/dfhd/search-recherche_eng.aspx

Peterborough County. (n.d.). *Peterborough County—Public GIS*. https://ptbocounty.geocortex.com/Html5Viewer/Index.html?viewer=PeterboroughPublic

Rainer, J. H. (1982). Effect of Vibrations on Historic Buildings. *The Association for Preservation Technology Bulletin*, *XIV*(1), 2–10.

Randl, C. (2001). *Preservation Tech Notes: Protecting a Historic Structure during Adjacent Construction*. U.S. Department of the Interior National Park Service. https://www.nps.gov/tps/how-to-preserve/tech-notes/Tech-Notes-Protection03.pdf

Toronto Railway Historical Association. (2020). *Midland Railway of Canada*. https://www.trha.ca/trha/history/railways/midland-railway-of-canada/

Township of Cavan Monaghan. (2015). *Official Plan for Township of Cavan Monaghan*.

Township of Cavan Monaghan, & EcoVue Consulting Services Inc. (2011). *The Cultural Resource Mapping Project*.

Tremaine, G. C. (1861). *Tremaine's Map of the County of Durham, Upper Canada* [Map]. George C. Tremaine.

U.N.E.S.C.O. World Heritage Centre. (n.d.). *World Heritage List*. U.N.E.S.C.O. World Heritage Centre. http://whc.unesco.org/en/list/

Williams Treaties First Nations. (2017). *About Williams Treaties First Nations*. http://www.williamstreatiesfirstnations.ca/about/

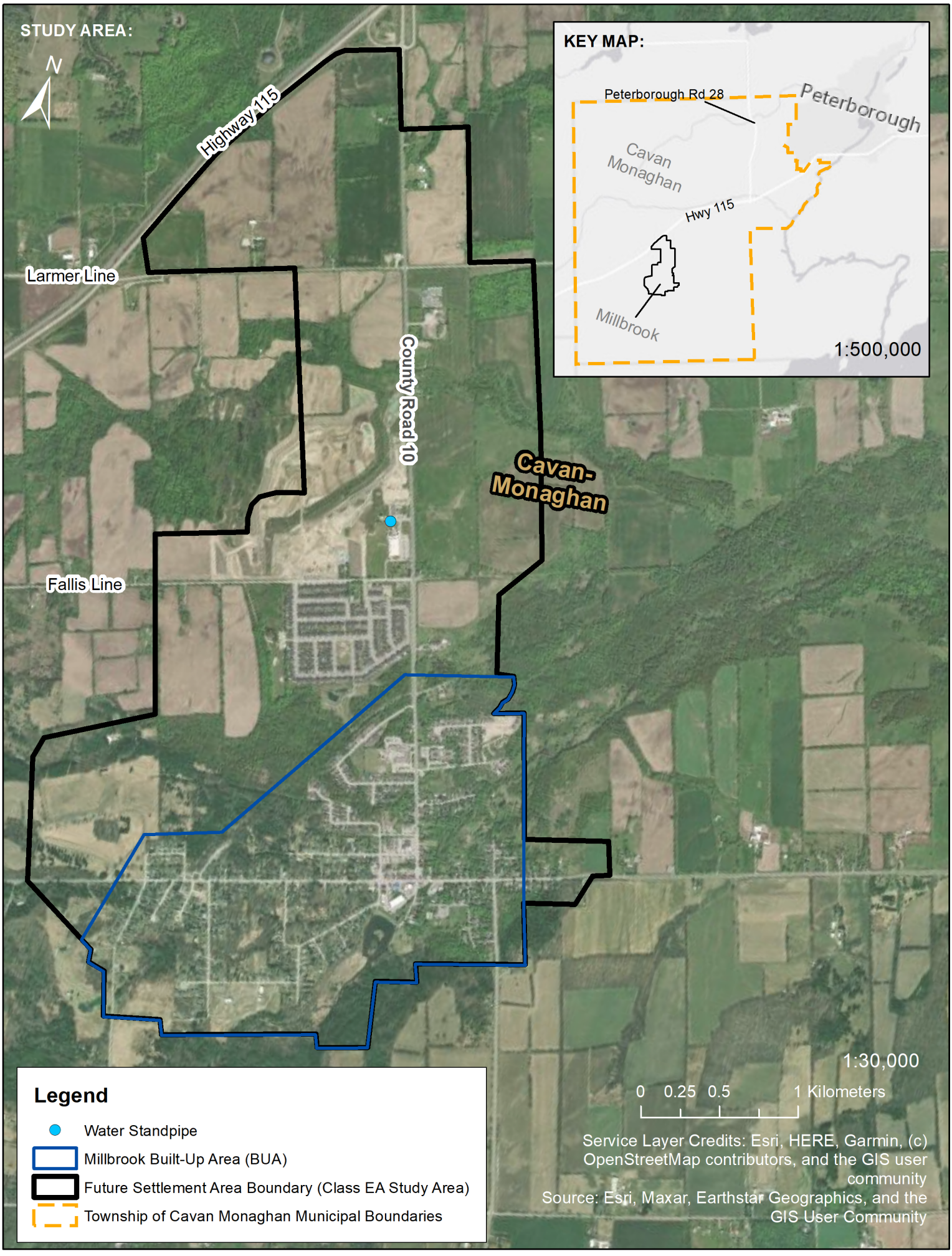
Williamson, R. F. (1990). The Early Iroquoian Period of Southern Ontario. In C. J. Ellis & N. Ferris (Eds.), *The Archaeology of Southern Ontario to A.D. 1650* (pp. 291–320). Ontario Archaeological Society Inc.

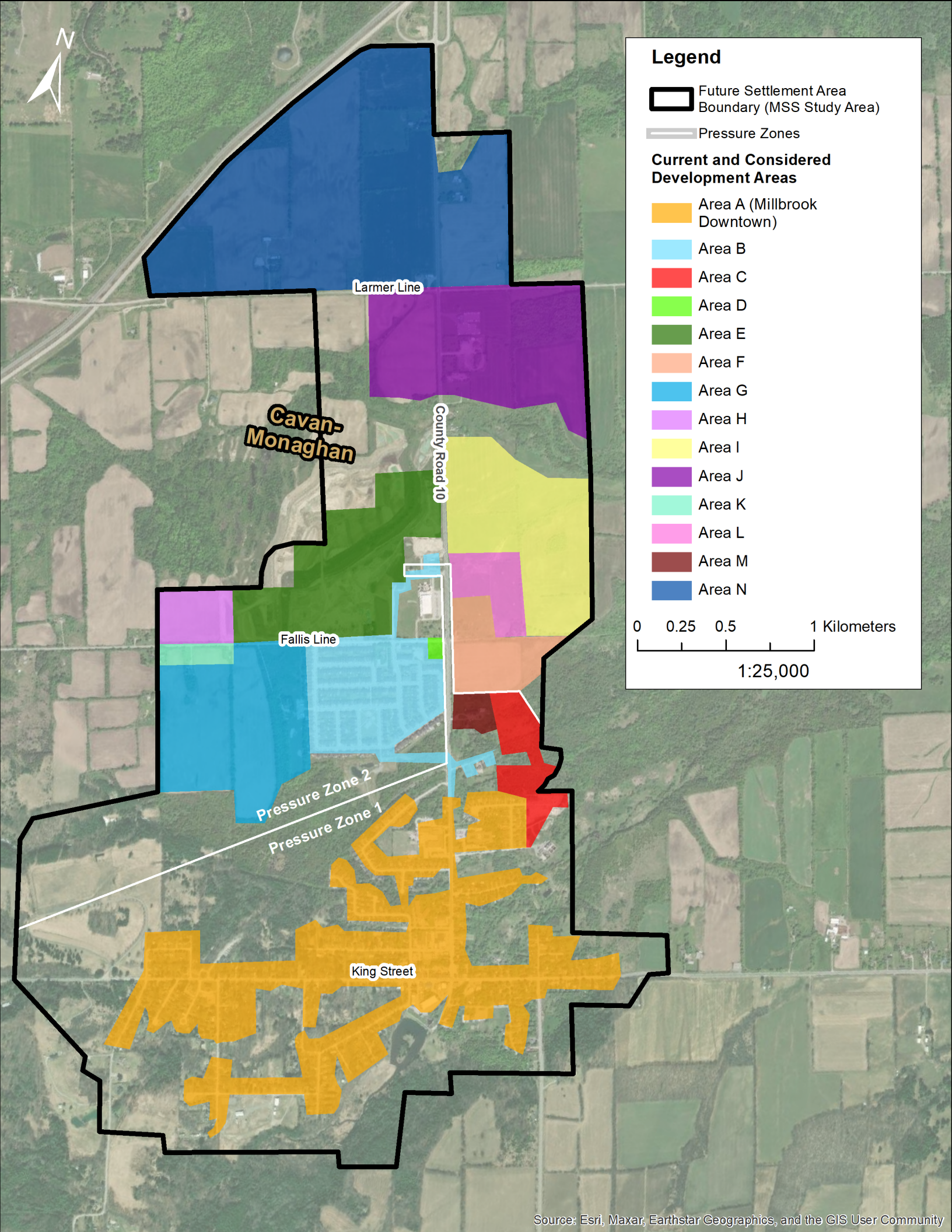
Wiss, J. F. (1981). Construction Vibrations; State-of-the-Art. *Journal of Geotechnical Engineering*, *107*, 167–181.

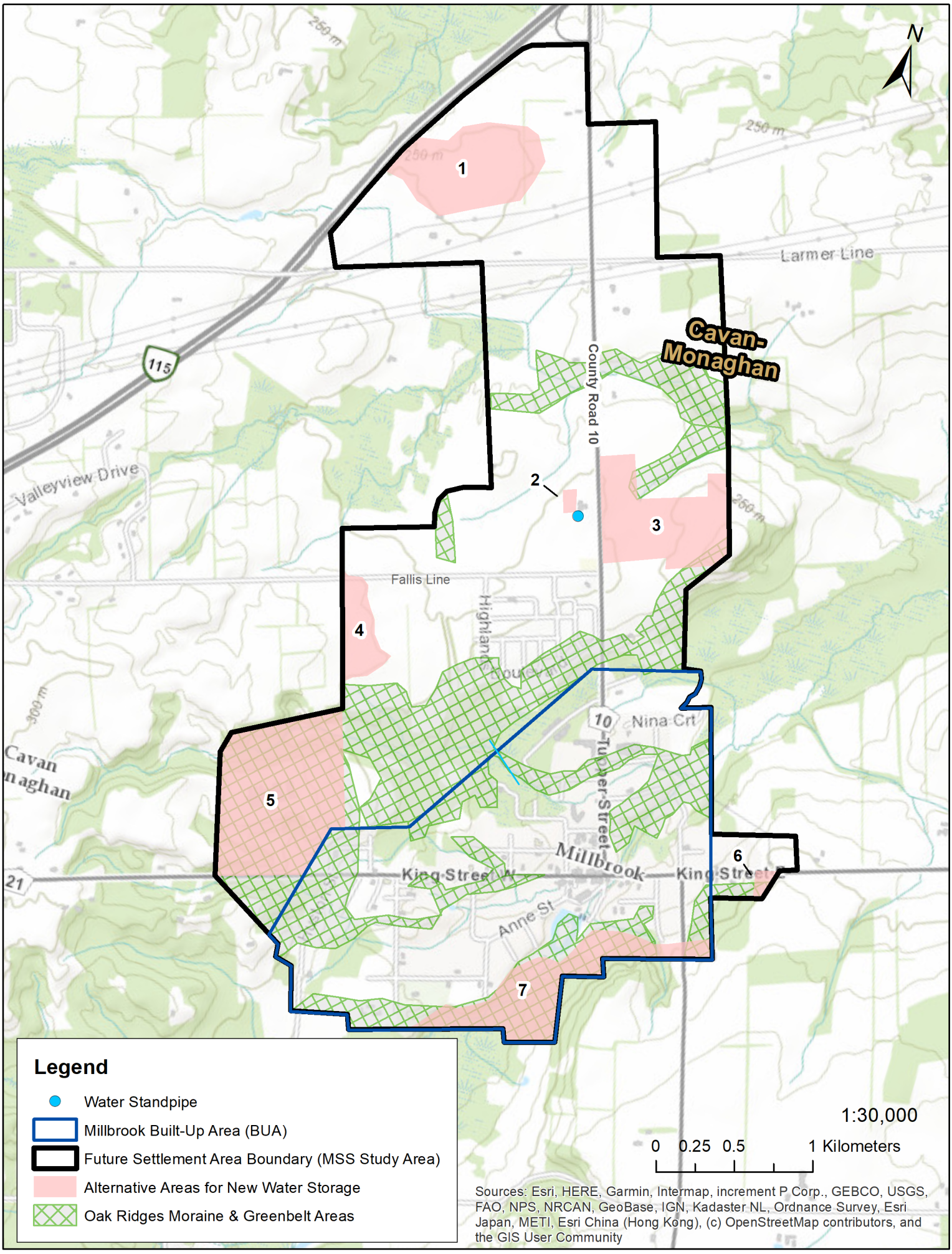
APPENDIX 8

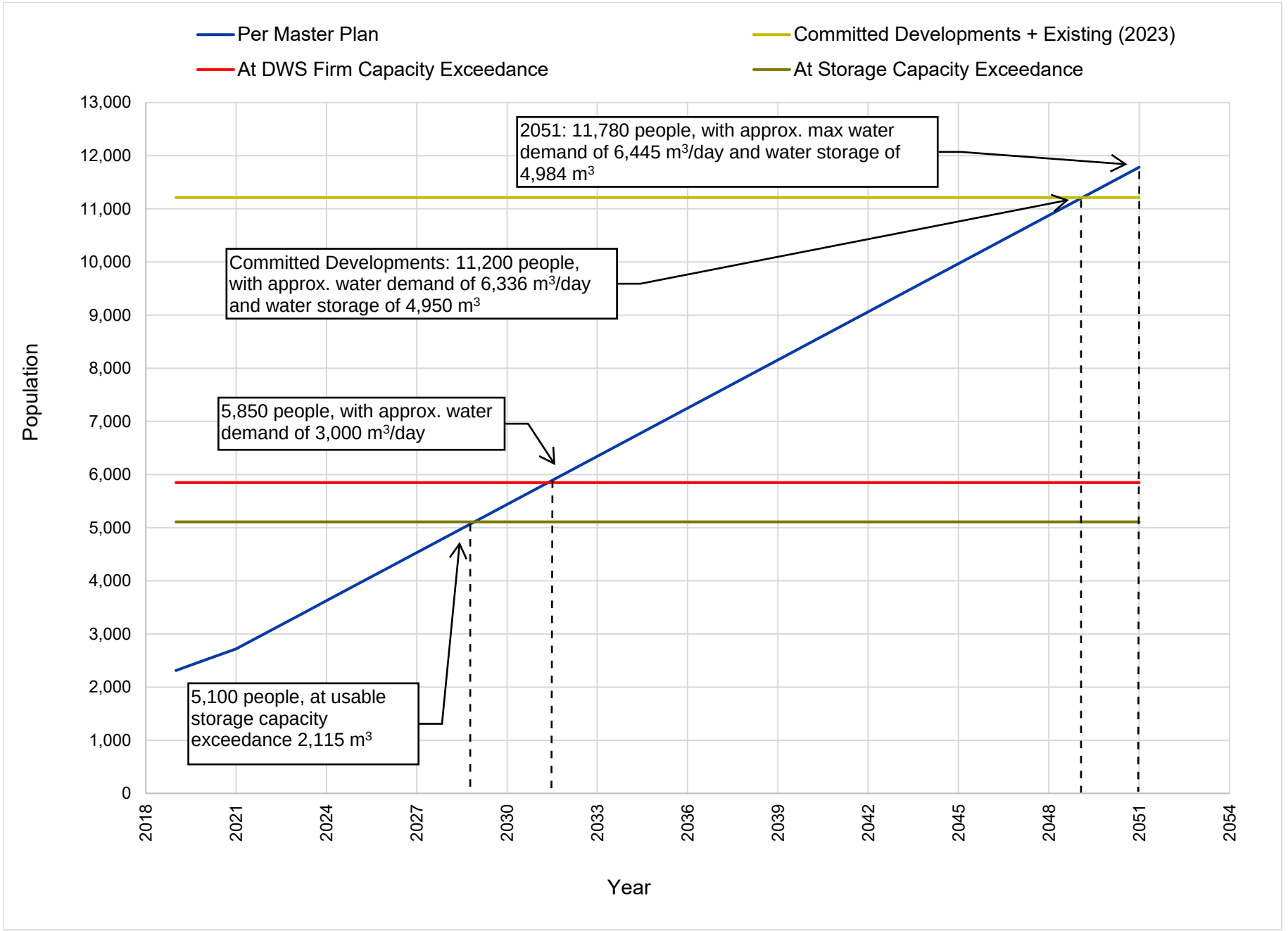
FULL SIZED MAPS & GRAPHS




STUDY AREA:
N
Highway 115
Larmer Line
County Road 10
Cavan-
Monaghan
Fallis Line
KEY MAP:
Peterborough Rd 28
Peterborough
Cavan
Monaghan
Hwy 115
Millbrook
1:500,000
1:30,000
0 0.25 0.5 1 Kilometers
Legend
Water Standpipe
Millbrook Built-Up Area (BUA)
Future Settlement Area Boundary (Class EA Study Area)
Township of Cavan Monaghan Municipal Boundaries
Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community


N
Legend
Future Settlement Area Boundary (MSS Study Area)
Pressure Zones
Current and Considered Development Areas
Area A (Millbrook Downtown)
Area B
Area C
Area D
Area E
Area F
Area G
Area H
Area I
Area J
Area K
Area L
Area M
Area N
0 0.25 0.5 1 Kilometers
1:25,000
Larmer Line
Cavan-Monaghan
County Road 10
Fallis Line
Pressure Zone 2
Pressure Zone 1
King Street
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community


N
1
2
3
4
5
6
7
Larmer Line
Cavan-
Monaghan
County Road 10
115
Valleyview Drive
Fallis Line
Highland
Nina Crt
10
Tupper Street
Millbrook
King Street W
King Street E
21
Anne St
Cavan
naghan
250 m
300 m
Legend
Water Standpipe
Millbrook Built-Up Area (BUA)
Future Settlement Area Boundary (MSS Study Area)
Alternative Areas for New Water Storage
Oak Ridges Moraine & Greenbelt Areas
1:30,000
0 0.25 0.5 1 Kilometers
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community


Per Master Plan
Committed Developments + Existing (2023)
At DWS Firm Capacity Exceedance
At Storage Capacity Exceedance
2051: 11,780 people, with approx. max water demand of 6,445 m³/day and water storage of 4,984 m³
Committed Developments: 11,200 people, with approx. water demand of 6,336 m³/day and water storage of 4,950 m³
5,850 people, with approx. water demand of 3,000 m³/day
5,100 people, at usable storage capacity exceedance 2,115 m³
Population
Year
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
11,000
12,000
13,000
2018
2021
2024
2027
2030
2033
2036
2039
2042
2045
2048
2051
2054

APPENDIX 9

COMMUNICATION RECORDS AND CONSULTATION



APPENDIX 9

COMMUNICATION RECORDS AND CONSULTATION



Date Modified	Company / Organization	Job Title	First Name	Last Name	Address	City	Prov	Post Code	Phone	Email
	Federal Agencies									
Original list	Crown-Indigenous Relations and Northern Affairs Canada and Indigenous Services Canada	Class Environmental Coordinator							1-800-567-9604	aadnc.infopubs.aandc@canada.ca
2024-07-04	Indigenous Services Canada	Senior Environmental Advisor	René	Damecour	320 ST-JOSEPH ST EAST, ROOM 400	Quebec	QC	G1K 9J2	418-906-6978	rene.damecour2@sac-isc.gc.ca
2024-07-04	Indigenous Services Canada	Regional Manager - Lands	Shannon	Doyle	655 BAY ST	Toronto	ON	M5G 2K4	416-949-1793	shannon.doyle@sac-isc.gc.ca
2024-07-04	Indigenous Services Canada	Senior Advisor	John	Schmied	655 BAY ST	Toronto	ON	M5G 2K4	416-565-2212	john.schmied@sac-isc.gc.ca
2024-07-04	Indigenous Services Canada	Chief Information Officer	Tim	Eryou	10 WELLINGTON ST	Gatineau	QC	K1A 0H4	613-302-6953	tim.eryou@sac-isc.gc.ca
2024-07-04	Indigenous Services Canada	Senior Land Negotiations Officer	Pauline	Haarmeyer	655 Bay Street, Suite 700, 8th Floor	Toronto	ON	M5G 2K4	416-973-3990	pauline.haarmeyer@sac-isc.gc.ca
Original list	Environment Canada	General Contact			200 Sacré-Coeur Blvd	Gatineau	QC	K1A 0H3	819-938-3860	ec.enviroinfo.ec@canada.ca
~~2024-07-04~~	~~Environment and Climate Change Canada~~	~~Manager~~	~~Jack~~	~~Hughes~~	~~335 River Road~~	~~Ottawa~~	~~ON~~	~~K1V 1C7~~	~~613-990-8400~~	~~jack.hughes@ec.gc.ca~~
2024-07-04	Environment and Climate Change Canada	Manager, Environmental assessment	Louis	Breton	801-1550 avenue D'Estimauville	Québec	QC	G1J 0C3	418-446-5639	louis.breton@ec.gc.ca
2024-07-04	Federal Economic Development Agency for Southern Ontario	Operations and Stakeholder Relations Manager	Bita	Pejam	222 Queen St	Ottawa	ON	K1A 0H5	N/A	Bita.Pejam@FedDevOntario.gc.ca
Original list	Transport Canada	Class Environmental Assessment Contact			4900 Yonge St	Toronto	ON	M2N 6A5	416-952-0514	EnviroOnt@tc.gc.ca
	Provincial Agencies									
2024-06-24	Infrastructure Ontario	Vice President, Real Estate Transactions	Adam	Carr	1 Dundas Street West, Suite 2000	Toronto	ON	M5G 1Z3	647-952-3657	Adam.Carr@infrastructureontario.ca
2024-06-24	Infrastructure Ontario	Project Manager, Sales, Easements & Acquisitions	William	Plexman	1 Dundas Street West, Suite 2000	Toronto	ON	M5G 1Z3	647-264-3911	
2025-04-24	Infrastructure Ontario	Environmental Specialist	Erica	Anderson	1 Dundas Street West, Suite 2000	Toronto	ON	M5G 1Z3	613-530-4512	erica.anderson@infrastructureontario.ca
2025-04-24	Infrastructure Ontario	Environmental Specialist	Nick	Cole	1 Dundas Street West, Suite 2000	Toronto	ON	M5G 1Z3	647-264-3331	nick.cole@infrastructureontario.ca
2025-04-24	Infrastructure Ontario	Manager, Environmental Projects	Katherine	Hotrum	1 Dundas Street West, Suite 2000	Toronto	ON	M5G 1Z3	647-264-3331	katherine.hotrum@infrastructureontario.ca
2023-06-20	Ministry of Agriculture, Food & Rural Affairs	General Contact								omafra.eanotices@ontario.ca
2023-06-20	Ministry of Citizenship and Multiculturalism	Heritage - Team Lead. Citizenship, Inclusion and Heritage Division	Karla	Barboza	5th Flr, 400 University Ave	Toronto	ON	M7A 2R9	416-660-1027	Karla.Barboza@ontario.ca
2023-06-20	Ministry of Citizenship and Multiculturalism	Heritage Planner, Citizenship, Inclusion and Heritage Division	Dan	Minkin	5th Flr, 400 University Ave	Toronto	ON	M7A 2R9	416-786-7553	Dan.Minkin@ontario.ca
2024-06-04	Ministry of Municipal Affairs & Housing	Regional Director	Laurie	Miller	College Park, 16th Flr, 777 Bay St	Toronto	ON	M7A 2J3	416-585-7264	laurie.miller@ontario.ca
2024-06-04	Ministry of Municipal Affairs & Housing	Manager, Community Planning and Development	Erick	Boyd	659 Exeter Road, 2nd Floor	London	ON	N6E 1L3	226-688-9058	erick.boyd@ontario.ca
2024-06-04	Ministry of Natural Resources and Forestry	Conservation Programs Advisor (Acting)	Catherine	Warren	1st Flr S, 300 Water St	Peterborough	ON	K9J 3C7	705-772-9012	catherine.warren@ontario.ca
2023-06-20	Ministry of Natural Resources and Forestry	Lands & Water Technical Specialist	Tamara	Dolan	1st Flr S, 300 Water St	Peterborough	ON	K9J 3C7	705-313-9746	tamara.dolan@ontario.ca
2023-06-20	Ministry of Natural Resources and Forestry	District Manager (Acting)	Hal	Leadlay	1st Flr S, 300 Water St	Peterborough	ON	K9J 3C7	705-761-7395	hal.leadlay@ontario.ca
Original list	Ministry of Natural Resources and Forestry	Management Biologist	Margaret	Bérubé	1st Flr S, 300 Water St	Peterborough	ON	K9J 3C7	705-772-9824	margaret.berube@ontario.ca
Original list	Ministry of the Environment, Conservation and Parks		Class Environmental Assessment Contact							eanotification.eregion@ontario.ca
Original list	Ministry of the Environment, Conservation and Parks	MEA Notices								MEANoticesEAAB@ontario.ca
2023-06-20	Ministry of the Environment, Conservation and Parks	Environmental Resource Planner & EA Coordinator	Jon	Orpana	7th Flr, 135 St Clair Ave W	Toronto	ON	M4V 1P5	613-561-8250	jon.orpana@ontario.ca
2023-06-20	Ministry of Transportation	General Contact								Website: https://www.ontario.ca/feedback/contact-us?id=26938&nid=97174
	Local Agencies									
Original list	Township of Cavan Monaghan	Director of Public Works	Wayne	Hancock	988 COUNTY ROAD 10	Millbrook	ON	L0A 1G0	705-932-9327	whancock@cavanmonaghan.net
Original list	Township of Cavan Monaghan	Fire Chief	Bill	Balfour	988 COUNTY ROAD 10	Millbrook	ON	L0A 1G0	705-932-9342	bbalbour@cavanmonaghan.net
2024-07-08	Township of Cavan Monaghan	Administrator Fire Services	Cassidy	Als	988 COUNTY ROAD 10	Millbrook	ON	L0A 1G0	705-932-9337	
2024-07-08	Township of Cavan Monaghan	Councillor	Nelson	Edgerton	988 COUNTY ROAD 10	Millbrook	ON	L0A 1G0	705-931-2301	nedgerton@cavanmonaghan.net
2024-07-08	Township of Cavan Monaghan	Councillor	Gerry	Byrne	988 COUNTY ROAD 10	Millbrook	ON	L0A 1G0	705-927-5360	cmoore@cavanmonaghan.net
2024-07-08	Township of Cavan Monaghan	Councillor	Lance	Nachoff	988 COUNTY ROAD 10	Millbrook	ON	L0A 1G0	705-930-1879	lnachoff@cavanmonaghan.net
2024-07-08	Township of Cavan Monaghan	Director of Planning	Karen	Ellis	988 COUNTY ROAD 10	Millbrook	ON	L0A 1G0	705-932-9334	kellis@cavanmonaghan.net
2024-07-08	Township of Cavan Monaghan	Deputy Mayor	Ryan	Huntley	988 COUNTY ROAD 10	Millbrook	ON	L0A 1G0	705-760-1476	rhuntley@cavanmonaghan.net

Date Modified	Company / Organization	Job Title	First Name	Last Name	Address	City	Prov	Post Code	Phone	Email
2024-07-08	Township of Cavan Monaghan	Mayor	Matthew	Graham	988 COUNTY ROAD 10	Millbrook	ON	L0A 1G0	705-418-1615	mgraham@cavanmonaghan.net
2024-07-08	Township of Cavan Monaghan	Water & Wastewater Technician	Jessica	Fradley	988 COUNTY ROAD 10	Millbrook	ON	L0A 1G0	705-932-9348	
Original list	Township of Cavan Monaghan	Chief Administrative Officer	Yvette	Hurley	988 COUNTY ROAD 10	Millbrook	ON	L0A 1G0	705-932-9328	yhurley@cavanmonaghan.net
Original list	Township of Cavan Monaghan	Chief Building Official	Kyle	Phillips	988 COUNTY ROAD 10	Millbrook	ON	L0A 1G0	705-932-9319	kphillips@cavanmonaghan.net
Original list	Township of Cavan Monaghan	Community Policing	General Contact		1 Dufferin Street P.O. Box 8	Millbrook	ON	L0A 1G0	705-761-6899	cmcpolice1@gmail.com
Original list	Township of Cavan Monaghan	Community Policing	Chairman		1 Dufferin Street P.O. Box 8	Millbrook	ON	L0A 1G0	705-761-6899	cmcpolice@nexicom.net
2023-06-20	Baxter Creek Watershed Alliance		Graham	Whitelaw						graham.whitelaw@gmail.com
2023-06-20	Baxter Creek Watershed Alliance		Craig	Onafrychuk						conafrychuk@hotmail.com
2023-11-01	Baxter Creek Watershed Alliance	Chair	Chris	Grayson					226-558-1519	cgrayson@nexicom.net
Original list	Kawartha Pine Ridge District School Board	Director of Education	Jennifer	Leclerc	1994 Fisher Drive	Peterborough	ON	K9J 6X6	705-742-9773 x 2005	Director_Education@kprdsb.ca
Original list	Kawartha Pine Ridge District School Board	Executive Liason to the Trustees	Linda	Burton	1994 Fisher Drive	Peterborough	ON	K9J 6X6	705-742-9773 x 2006	Linda_Burton@kprdsb.ca
Original list	Kawartha Pine Ridge District School Board	Executive Assistant	Stacey	Foss	1994 Fisher Drive	Peterborough	ON	K9J 6X6	705-742-9773 x 2024	stacey_foss@kprdsb.ca
Original list	Kawartha Pine Ridge District School Board	Manager, Construction and Engineering Services	Joe	Newbery	1994 Fisher Dr	Peterborough	ON	K9J 7A1	705-933-9736	joseph_newbery@kprdsb.ca
Original list	Kawartha Pine Ridge District School Board	Capital Projects Supervisor, Construction and Engineering Services	Sophia	Wouters	1994 Fisher Dr	Peterborough	ON	K9J 7A1	705-740-5149	sophia_wouters@kprdsb.ca
Original list	Millbrook & District Chamber of Commerce	Secretary	Kim	Bos					705-868-1720	bosb001@nexicom.net
Original list	Millbrook BIA	Chair, Business Improvement Area (BIA)	Christine	McCullough						chair@millbrookbia.com
Original list	Millbrook South Cavan Public School	Principal	Jeffery	White	47 Tupper Street	Millbrook	ON	L0A 1G0	7059322789	jeffery_white@kprdsb.ca
2023-06-20	Millbrook South Cavan Public School	Vice Principal	Jayne	Patterson						jayne_patterson@kprdsb.ca
Original list	Centennial Place	Centennial Place AON Long Term Care			2 Centennial Lane N.	Millbrook	ON	L0A 1G0	7059324464	cpadm@aoninc.com
Original list	Member of Provincial Parliament (MPP)	MPP Haliburton-Kawartha Lakes-Brock	Laurie	Scott	14 Lindsay Street North	Lindsay	ON	K9V 1T4	705-324-6654	laurie.scottco@pc.ola.org
Original list	Otonabee Conservation	Manager, Watershed Management	Meredith	Carter	250 Milroy Drive	Peterborough	ON	K9H 7M9	705-745-5791x - 223	mcarter@otonabeeconservation.com
Original list	Otonabee Conservation	Water Resource Technologist	Gordon	Earle	250 Milroy Drive	Peterborough	ON	K9H 7M9	705-745-5791x- 214	gearle@otonabeeconservation.com
Original list	Otonabee Conservation	Planning & Development Officer	Don	Allin	250 Milroy Drive	Peterborough	ON	K9H 7M9	705-745-5791x- 225	dallin@otonabeeconservation.com
2023-06-20	Otonabee Conservation	General Contact								otonabeeca@otonabeeconservation.com
	Private Agencies									
Original list	Enbridge									webmaster-corp@enbridge.com
Original list	Hydro One Networks Inc.		Class Environmental Coordinator		P.O. Box 5700	Markham	ON	L3R 1C8		CustomerRelations@HydroOne.com
Original list	Hydro One Networks Inc.		Secondary Land Use		483 Bay Street	Toronto	ON			SecondaryLandUse@HydroOne.com
Original list	Nexicom Inc	Plant/Facility Manager	Greg	Conlin		Millbrook	ON		705-932-4142	gconlin@nexicomgroup.net
2023-06-20	Veltri Group		Hayley	Middleton	68 King St East	Bowmanville	ON	L1C 3X2		construction@veltrigroup.com
2023-06-20	Veltri Group		Frank	Veltri	68 King St East	Bowmanville	ON	L1C 3X2		rentals@veltrigroup.com
	Public Stakeholders									
[redacted]										

APPENDIX 9

COMMUNICATION RECORDS AND CONSULTATION



April 15th, 2025.

NOTICE OF CLASS ENVIRONMENTAL ASSESSMENT

Millbrook Water Storage Class Environmental Assessment

The Township of Cavan Monaghan is undertaking a Class Environmental Assessment (Class EA) for a new water storage system in Millbrook.

The Township of Cavan Monaghan recently completed a Water and Wastewater Master Servicing Study (MSS), under the Municipal Class Environmental Assessment (Class EA) framework. As part of this study, a preferred alternative for the water storage aspect was to increase the water storage volume and accommodate Millbrook's forecasted growth. The preferred alternative was to have additional water storage at a new location and retain the existing standpipe by the Municipal Office. The purpose of the study is to confirm the location, capacity, and storage type for the new storage solution. The study will follow the Schedule 'B' Municipal Class EA process as set out by the Municipal Engineers Association (October 2000 amended in 2007, 2011, 2015, 2023 and 2024).

The Township of Cavan Moghan will be considering and evaluating suitable sites for the construction of a new water storage tank within Millbrook's Settlement Area Boundary (see figure). The Township will look at the existing water system to identify any necessary improvements and impacts that the construction of the tank may have on the potential sites.

Public consultation is critical to the success of the study. We welcome your comments and will provide opportunities for your input throughout the study. There will be a Public Information Centre (PIC) scheduled, providing an opportunity to share information, obtain your input and respond to questions. Further details on the upcoming PIC will be provided as the project progresses. The EA is planned to be completed in 2025.

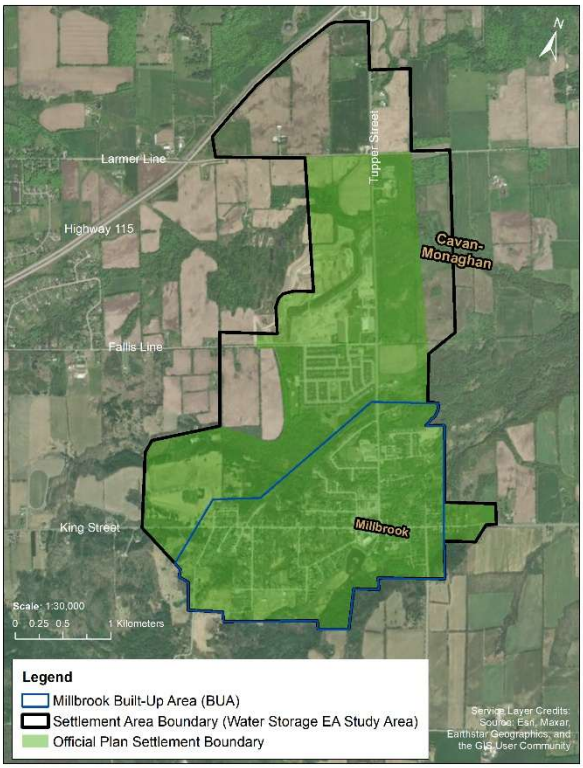


Figure 1. Map Showing **Study Area**

Should you have any questions or concerns, please contact one of the following project team members:

R.V. Anderson Associates Limited
Nikash Persaud
Class Environmental Assessment Coordinator
2001 Sheppard Avenue East
Suite 300
Toronto, ON, M2J 4Z8
Tel: (416) 497-8600 ext. 1337
npersaud@rvanderson.com

Township of Cavan Monaghan
Public Works
Wayne Hancock, P.Eng.
Director of Public Works
988 County Road 10
Millbrook, Ontario, L0A 1G0
Tel: (705) 932-9327
Fax: (705) 932-3458
whancock@cavanmonaghan.net

This notice was first issued on April 15th, 2025.

Millbrook Water Storage Class Environmental Assessment

Notice of Public Information Centre Class Environmental Assessment

The Township of Cavan Monaghan is undertaking a Class Environmental Assessment (Class EA) for a new water storage tank in Millbrook.

The Township of Cavan Monaghan recently completed a Water and Wastewater Master Servicing Study (MSS), under the Municipal Class Environmental Assessment (Class EA) framework. This study concluded that an increase in water storage volume would be required to accommodate Millbrook's forecasted growth. The preferred alternative will have additional water storage built at a new location while retaining the existing standpipe by the Municipal Office.

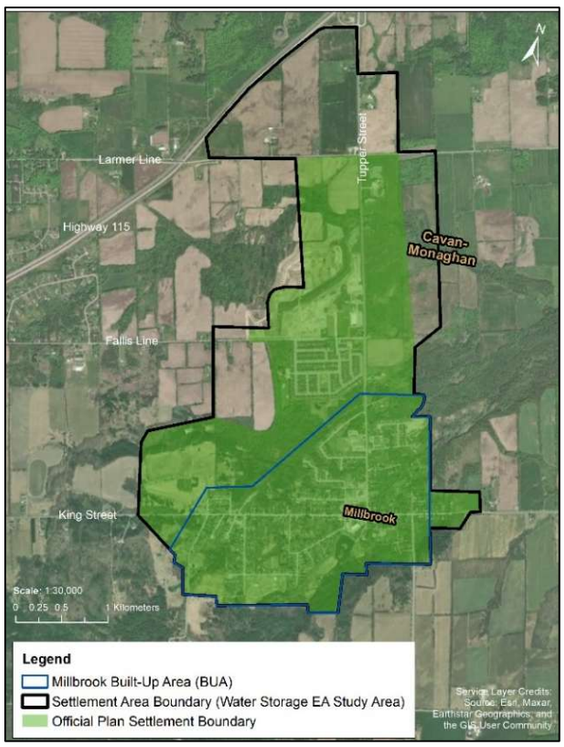


Figure 1. Map Showing Study Area

Through a Schedule 'B' Municipal Class EA process, The Township of Cavan Monaghan will be considering and evaluating suitable sites for the construction of a new water storage tank within Millbrook's Settlement Area Boundary (see figure 1). The Township will look at the existing water system to identify any necessary improvements as well as impacts that construction may have on the potential sites.

The Township of Cavan Monaghan encourages the public to actively participate in this planning process and invites interested parties to attend an in-person Public Information Centre (PIC):

Date: Wednesday, September 24, 2025
Time: 4:00 p.m. to 6:00 p.m.
Location: Municipal Office 988 County Rd 10, Millbrook ON L0A 1G0

Information about the project, including PIC display materials, will also be made available on the Township website after September 24, 2025:
www.cavanmonaghan.net

The PIC will provide an overview of the study, including the problem and opportunity statement, existing conditions, alternative solutions and evaluation to select the location in support of the forecasted growth to 2051.

If you have any questions or comments, please contact the Project Team:

Township of Cavan Monaghan
Public Works
Wayne Hancock, P.Eng.
Director of Public Works
988 County Road 10
Millbrook, Ontario, L0A 1G0
Tel: (705) 932-9327
Fax: (705) 932-3458
whancock@cavanmonaghan.net

R.V. Anderson Associates Limited
Nikash Persaud
Class Environmental Assessment Coordinator
2001 Sheppard Avenue East
Suite 300
Toronto, ON, M2J 4Z8
Tel: (416) 497-8600 ext. 1337
npersaud@rvanderson.com

This notice was first issued on September 11, 2025

APPENDIX 9-3

PIC MATERIALS

Prepared for the Community of Millbrook in the Township of Cavan Monaghan

Public Information Center

Water Storage Municipal Class Environmental Assessment



September 24th, 2025

WELCOME

The Township of Cavan Monaghan welcomes you to this Public Information Centre (PIC) so that we can share study objectives, findings to date, alternative solutions and next steps for the Water Storage Class Environmental Assessment (EA) Project.

Please review the material and provide us with any comments you may have. Your input is important to the Class Environmental Assessment process. Staff and Project Team are available to answer your questions and receive your comments. Comment sheets are also available for you to fill out.

Thank you for attending this Public Information Centre

Please sign in

PURPOSE OF THIS PUBLIC INFORMATION CENTRE

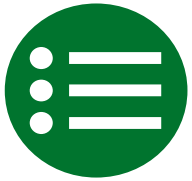


To inform the public, stakeholders and Indigenous communities about the need for additional water storage in the Millbrook Urban Settlement Area.



To provide an overview of the:

- Class Environmental Assessment (Class EA) Process
- Findings of the Class EA for Water Storage
- Evaluation and tentatively preferred alternative for new Water Storage in Millbrook



To present project information and gather your feedback on:

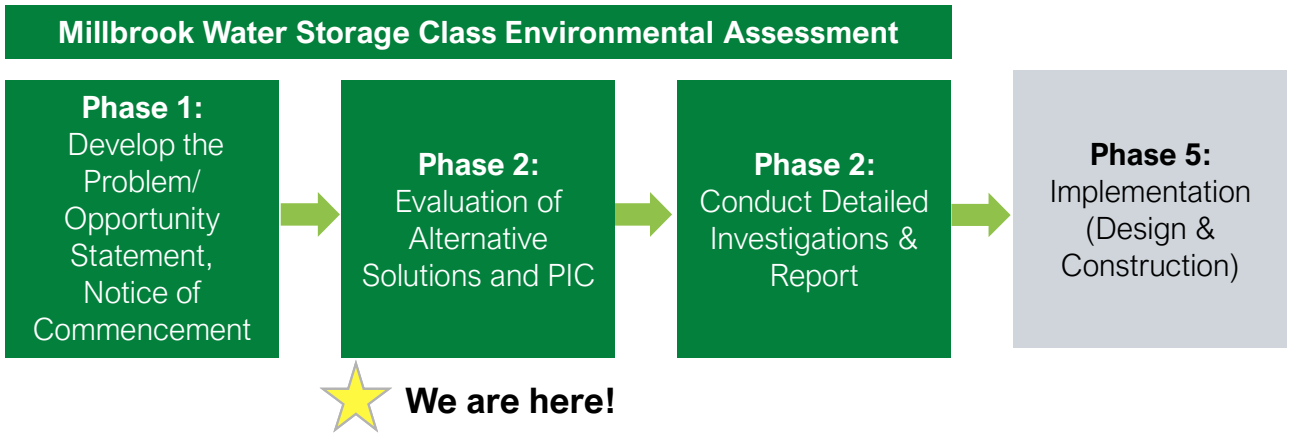
- Problem and opportunity statement
- List of alternatives
- Evaluation of alternatives
- Next steps in the process

SCHEDULE


August 2024
• Project Initiation
• Background Studies and Investigations
March 2025
• Township of Cavan Monaghan Council Meeting Presentation
April 2025
• Issue Notice of Commencement
• Identification and Evaluation of Alternative Water Storage Expansion Strategies
September 2025
• Public Information Center
We are here!
December 2025
• Final Project Report Submission
• Notice of Completion

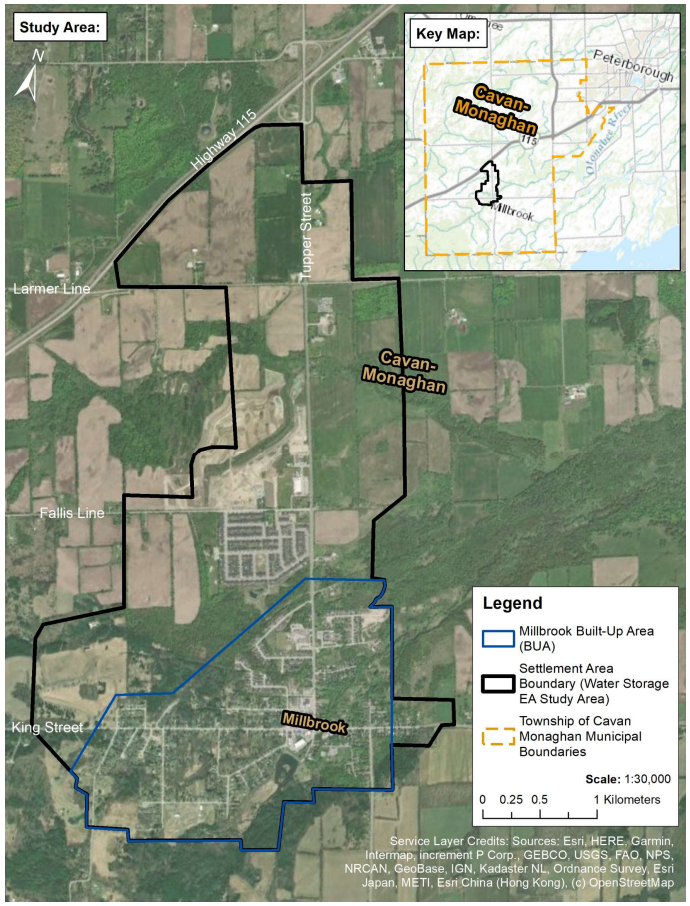
CLASS ENVIRONMENTAL ASSESSMENT PROCESS

This Schedule B Class EA project will complete **Phase 1** and **Phase 2** of the environmental assessment process and then proceed directly to **Phase 5** as per the Schedule B requirements.



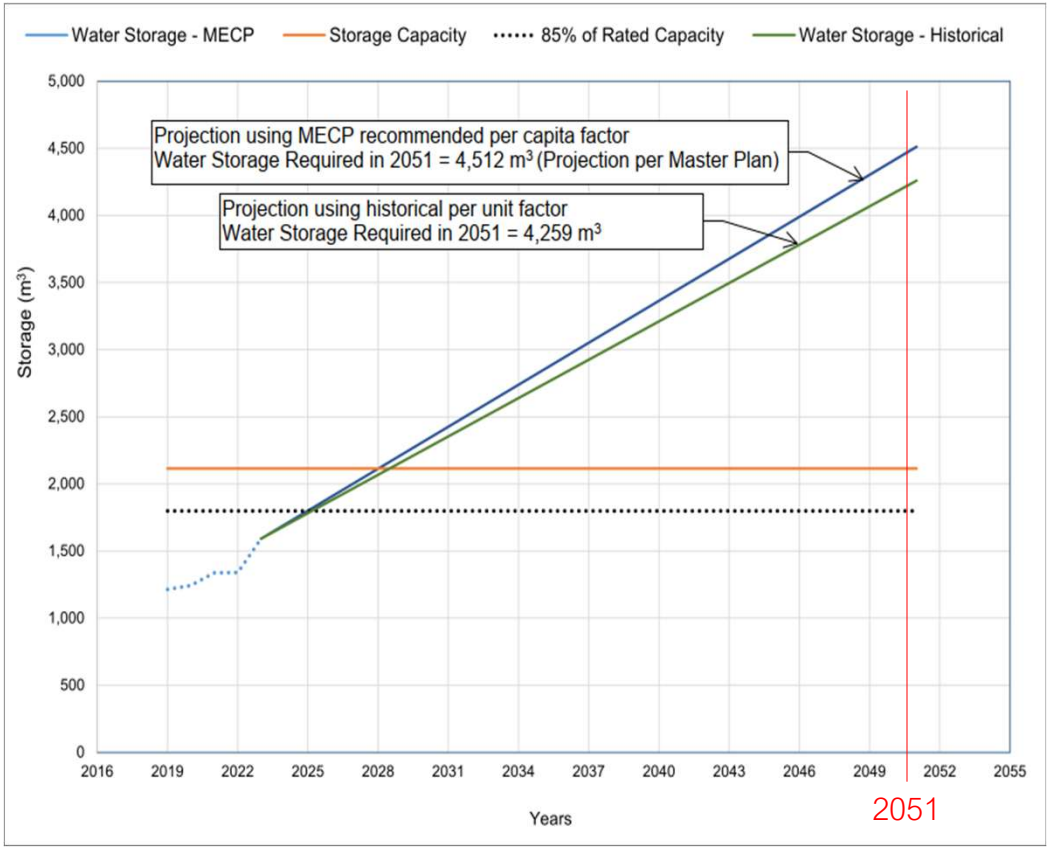
The purpose of the study is to take the next step after the Master Servicing Study (MSS) with a Class Environmental Assessment to confirm the location, capacity, and storage type for the new water storage solution (i.e. standpipe, elevated tank or in-ground reservoir) which will service the anticipated growth in the Millbrook Settlement Area as identified in the previously completed Growth Management Study and Master Servicing Study (MSS).

PROBLEM & OPPORTUNITY STATEMENT



- Building upon the findings of the completed Growth Management Study (GMS) and the Water and Wastewater Master Servicing Study (MSS), this Class EA will confirm the location, capacity and storage type for a new water storage solution in the Millbrook Urban Settlement Area.
- The preferred water storage solution will:
  - Comply with applicable regulations to provide adequate water servicing.
  - Comply with the Official Plan (2021) while accommodating future vision of servicing beyond the settlement boundary.
  - Comply with the recommendations from the 2024 MSS.
  - Consider stakeholder and rights-holder comments and concerns.
  - Be technically feasible and operationally sustainable.
  - Be financially viable while also socially and environmentally responsible.

FORCASTED POPULATION & STORAGE REQUIREMENTS TO 2051



* Actual timelines for water supply requirements will depend on rate of growth and demand

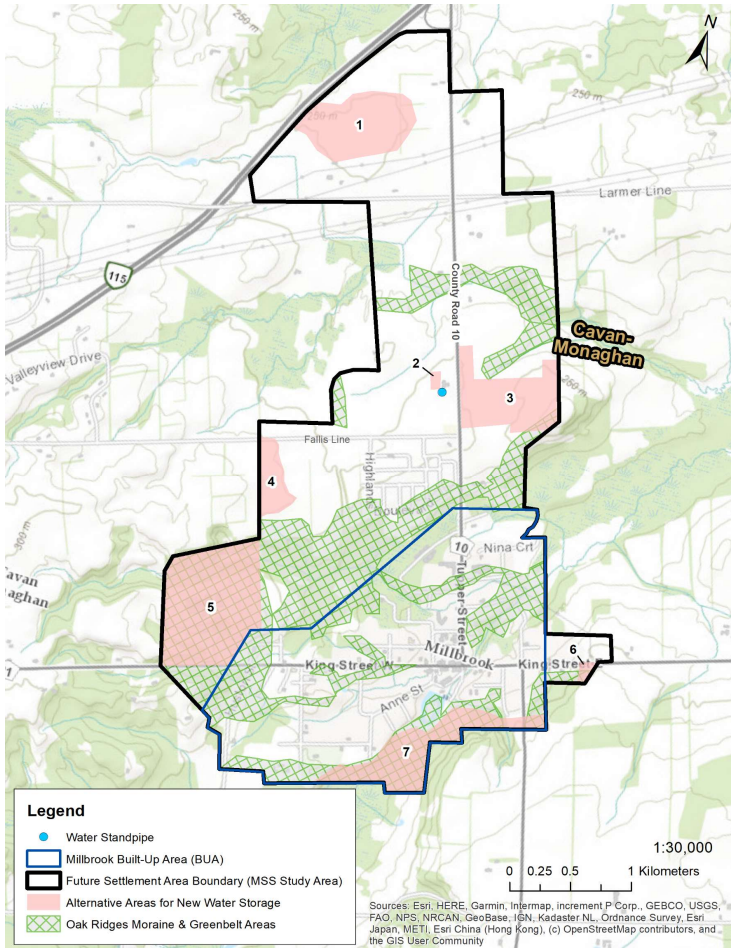
Millbrook Total Long-Term Population and Employment Estimates

Year	Total Residential Population	Total Employees
2021	2,558	970
2051	10,455	3,983

- The current Millbrook Standpipe has 2,115 m^3.
- Based on future population and employment projections, the Millbrook water supply is anticipated to reach 80–85% of its capacity by approximately 2025. As per industry standards, this threshold typically signals the need to begin planning for infrastructure expansion.
- By 2028, the existing storage capacity would be insufficient
- By 2051, a total volume of approximately 4,820 m^3 will be required to meet long-term demand.

Therefore, increasing water storage capacity would be required to service growth beyond 2028.

LOCATIONS FOR PROPOSED STORAGE FACILITY



As part of the Water Storage Class Environmental Assessment, seven potential locations were identified within the Millbrook Settlement Area based on elevation, proximity to existing infrastructure and alignment with future development areas.

Each location was evaluated using criteria from the MECP Design Guidelines and the Township's Official Plan including:

- Hydraulic performance and elevation
- Environmental, archaeological and cultural heritage constraints
- Land ownership and acquisition feasibility
- Proximity to committed and future developments
- Opportunities for proposed and future water storage

Following this screening process:

- **Location 1** and **Location 3** were shortlisted for further evaluation and hydraulic modeling.

- Locations 2, 4, 5, 6 and 7 were screened out due to constraints such as limited space, environmental sensitivity or operational risks and complications. Next slide provides the preliminary screening evaluation.

EVALUATION APPROACH AND CRITERIA

After screening the long list of location alternatives, the shortlisted location alternatives for the proposed water storage solution were evaluated using the criteria and rating scale below.

Criteria	Example Considerations
Social	• Ability to allow for future growth forecast under Township's GMS • Sensory impacts, such as noise, dust, etc. both during and after construction • Effects on neighboring properties • Effects on the municipality, local businesses, etc. • Effects on Indigenous communities
Technical	• Compatibility with existing systems • Ease of implementation • Effects on operations and maintenance • Technical Complexity • Complies with regulatory/approval requirements
Cultural	• Effects on archaeological sites or structures • Effects on cultural sites or structures
Environmental	• Effects on wildlife and vegetation, habitat • Effects on water, soil and air quality • Climate Change
Cost	• Approximate magnitude of life cycle costs (capital cost, operation & maintenance cost) • Sustainability and affordability • Financial risks

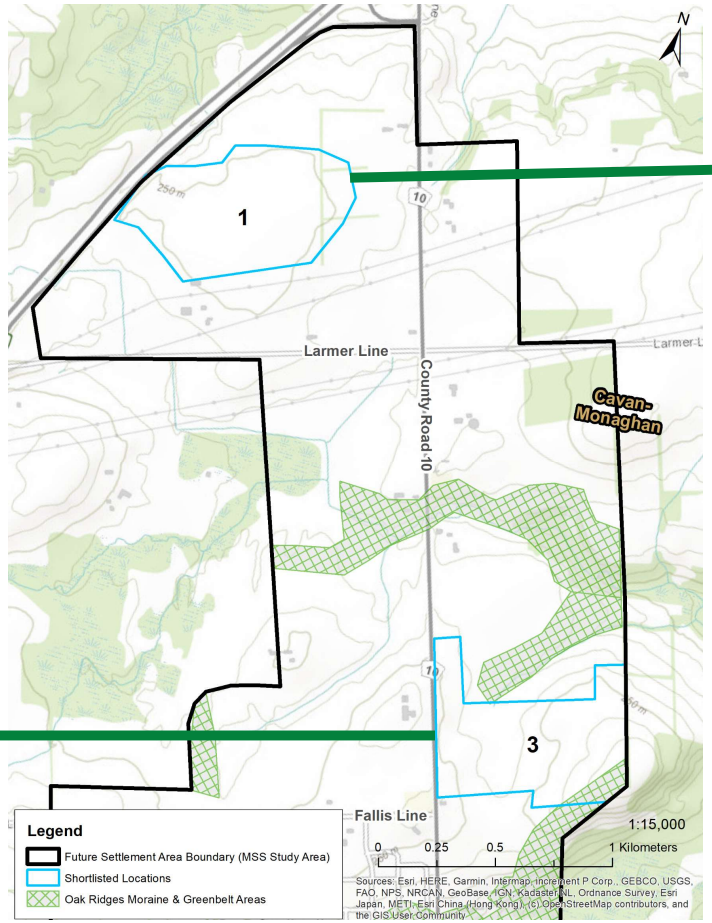
Evaluation Ranking:

Symbol	Ranking
	Most Positive / Least Negative
	More Positive Than Negative
	Moderate
	More Negative Than Positive
	Least Positive / Most Negatives

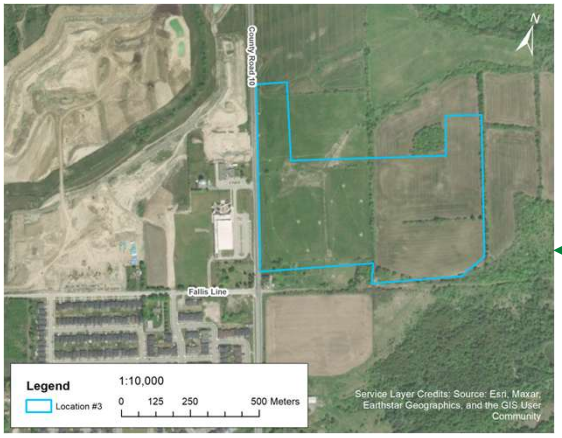
LONG LIST OF LOCATION ALTERNATIVES & SCREENING

Location	Does the alternative address the Problem & Opportunity Statement?	Is the alternative technical and economically feasible?	Can the alternative be implemented without significant impacts?	Summary
Location 1	✓	✓	✓	Carried over to detailed evaluation
Location 2	✓	✗	✗	Existing storage tank at location, and remaining area is already zoned for institutional. Location reserved by Township for other endeavours. Risk to redundancy from grouping storage facilities in the same location.
Location 3	✓	✓	✓	Carried over to detailed evaluation
Location 4	✗	✗	✓	Not centralized to the future anticipated areas of need. May not have enough space for water storage facility. Property acquisition required.
Location 5	✓	✗	✗	Millbrook's Natural Heritage System will be impacted by construction. Environmental investigations and property acquisition required.
Location 6	✓	✗	✓	Not centralized to the future anticipated areas of need, as well as operational issues with supplying water to pressure zone 2 from this location. Space constraints and property acquisition required to support storage of an adequate size.
Location 7	✗	✗	✗	Cannot provide the high ground elevation needed for a gravity-based system. Millbrook's Natural Heritage System will be impacted by construction.

SHORTLISTED LOCATION ALTERNATIVES





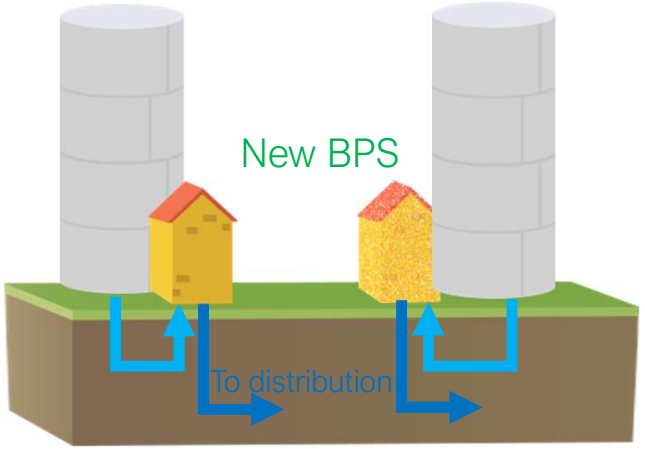


EVALUATION OF SHORTLISTED LOCATION ALTERNATIVES

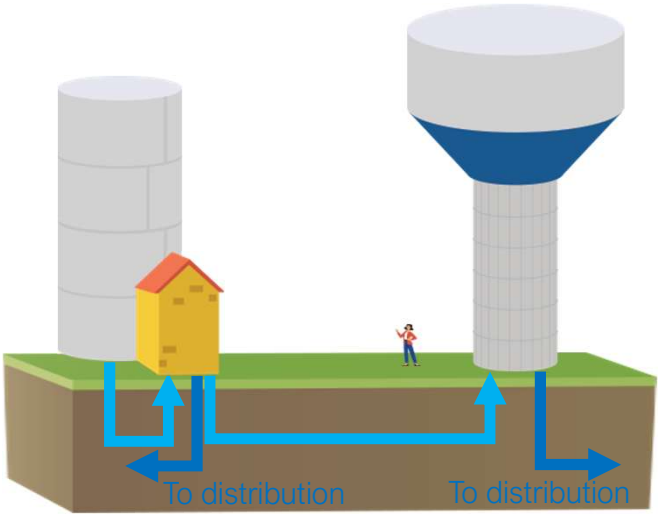
Criteria	Location #1	Evaluation	Location #3	Evaluation
Social	• Aesthetic advantage, as a water tower showing the Township's name will be visible from the highway. • Near future employment area rather than residential area		• Near the immediate future development areas but may be less centralized for future northern settlement expansion areas beyond 2051. • Near future commercial and residential area	
Technical	• Further from existing standpipe so there is better storage redundancy coverage in case of a key watermain break. • Will require a new longer watermain to reach Location #1		• Less storage redundancy coverage compared to Location #1 • Near existing watermain and closer to existing BPS to optimize use of existing infrastructure to reduce cost. • Expansion of ex. Upgrades to existing BPS.	
Cultural	• Cultural Heritage and Archaeological potential not currently evaluated, would require additional studies.		• Existing Stage 1-2 Archaeological Assessment and Cultural Heritage study screened out potential/found no items of interest	
Environmental	• Natural environmental studies required to determine impacts Current agricultural land will be impacted for imminent building of new storage tank even though area will not see development until a long time later		• Environmental conditions previously evaluated in support of planned development in the area • Existing natural environment studies cleared area for construction. Some space constraints due to existing creek	
Cost	• Township will have to front end the cost for long watermain extension from existing distribution network to this location before development occurs here.		• Lower watermain costs due to closer proximity to existing available infrastructure • Upgrades to existing BPS will be relatively low cost	

Least Positive / Most Negatives	More Negative Than Positive	Moderate	More Positive Than Negative	Most Positive / Least Negative
				

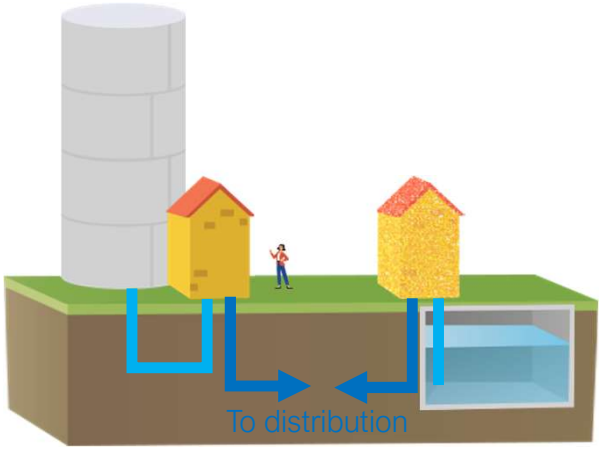
TYPES OF STORAGE TANKS



Existing New



Existing New



Existing New

Standpipe	Elevated Tank	In-Ground Reservoir with BPS
A water storage tank at ground level, usually placed at higher elevation. Has more 'unusable' volume and stagnant water unless accompanied with booster pumping station (BPS) to reduce 'unusable' volume and achieve required pressure.	A water storage tank is raised above ground level to the desired elevation. This will require BPS upstream since well pumps cannot reach desired elevation. Utilizes gravity to push water to distribution system. Does not need BPS downstream of tank.	A water storage tank under ground level supported by a booster pumping station (BPS) at ground level to provide adequate pressure to distribution system.

ADVANTAGES AND DISADVANTAGES OF DIFFERENT TANK STYLES AT LOCATION 3

Criteria	New Standpipe + New BPS at Location #3	New Elevated Tank at Location #3 + BPS Upgrades at Municipal Office	New In Ground Reservoir + New BPS at Location #3
Advantages	• Maximizes use of the existing infrastructure and supports future proofing • Another possible location for mounting communication antenna etc. (source of revenue for Township) • Lower number of different facilities needed to be operated and maintained compared to the new in-ground reservoir and new BPS option • Allows for some operational redundancy for existing standpipe if either storage tank needed to be taken out of service and maintained • Lowest construction cost compared to all other tank options	• Provides 'floating storage' to upper Pressure Zone 2 area (instead of pumped storage via existing BPS and Standpipe). This better manages the pressure fluctuations in the pressure zone and is not contingent on a pump being on or off • Another possible location for mounting communication antenna etc. (source of revenue for Township)	• Minimal aesthetic impacts to surrounding properties. Only the new BPS will be visible as the tank will be buried. New BPS exterior can be designed to suit the neighboring development to blend in with other nearby buildings • Allows for some operational redundancy for existing standpipe if it needs to be taken out of service and maintained • No shadow impacts to upcoming development area
Disadvantages	• Moderate aesthetic impacts to surrounding properties • Could have shadow impacts to upcoming development area, even though the shadow is transitory throughout the day and season • No 'floating storage' available for Pressure Zone 2 area. The pressure in the system will fluctuate with the operation of the pumps at the existing BPS • Further geotechnical and Phase 1 & 2 Environmental Site Assessment (ESA) investigations needed to confirm suitability of Standpipe at Location 3	• Greatest aesthetic impacts to surrounding properties (will be taller than existing standpipe) • More technical and operational complications due to different storage tank heights • Does not allow for operational redundancy to the existing standpipe because that is still needed for the existing BPS in order to feed pressurized water to the new Elevated Tank • Could have shadow impacts to upcoming development area, even though the shadow is transitory throughout the day and season • Higher construction cost compared to Standpipe option • Further geotechnical and Phase 1 & 2 Environmental Site Assessment (ESA) investigations needed to confirm suitability of Elevated Tank at Location 3	• No 'floating storage' available for Pressure Zone 2 area. The pressure in the system will fluctuate with the operation of the pumps at the new and existing BPSs • Highest construction cost compared to Standpipe and Elevated tank option • More (and different) facilities needed to be operated and maintained compared to new standpipe and upgrade to existing BPS • Further geotechnical and Phase 1 & 2 Environmental Site Assessment (ESA) investigations needed to confirm suitability of inground tank at Location 3 • More technical and operational complications to work with existing Standpipe and BPS.

PREFERRED SOLUTION



Preferred alternative solution:

- **New Storage Tank and New Booster Pumping Station (BPS) at Location #3**

- Additional tank to provide additional storage volume, in support of the population growth projected by the previously completed Growth Management Study (GMS) and Master Servicing Study (MSS).
- New storage tank to be constructed within Location #3, at County Road 10, north of Fallis Line

Next Steps:

- Preparation of a Technical Memorandum (TM) outlining tank style options for submission to the Council.
- Confirmation of exact storage tank location within Location #3 to prepare for land acquisition
- Conclusion and finalization of Schedule B Class EA with Project File Report
- Project proceeds to detailed design and then construction.

NEXT STEPS

Following this Public Information Centre (PIC), the Project Team will receive and consider comments from interested parties to help with finalizing the recommended solution for water storage and will be documented through the Project File Report. Complete a comment sheet this evening or submit comments to a member of the project team.

More information including copies of project notices and PIC materials can be found at: www.CavanMonaghan.net

Please provide your comments by **October 24th, 2025**

The next opportunities for public notification and input will include:

Opportunity	Anticipated Date
Notice of Study Completion Published & Start of 30-Day Public Review Period	December 2025

Project Team Contact Information	
Wayne Hancock, P.Eng. Director of Public Works Township of Cavan Monaghan 988 County Road 10 Millbrook, ON, L0A 1G0 (705) 932 9327 WHancock@CavanMonaghan.net	**Nikash Persaud** Coordinator, Environmental Assessments R.V. Anderson Associates Limited 2001 Sheppard Ave. East, Suite 300 Toronto, ON, M2J 4Z8 (416) 497-8600 ext. 1337 NPersaud@rvanderson.com

APPENDIX 9-4

COMMENTS AND CORRESPONDENCE

Emails and Correspondence

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Agencies

Subject: 205371 - Notice of Commencement for the Township of Cavan Monaghan Water Storage Environmental Assessment
Sent: 2025-04-15, 9:12:39 AM
From: Nikash Persaud<npersaud@rvanderson.com>
Bcc: aadnc.infopubs.aandc@canada.ca; rene.damecour2@sac-isc.gc.ca; shannon.doyle@sac-isc.gc.ca; john.schmied@sac-isc.gc.ca; tim.eryou@sac-isc.gc.ca; pauline.haarmeyer@sac-isc.gc.ca; ec.enviroinfo.ec@canada.ca; jack.hughes@ec.gc.ca; louis.breton@ec.gc.ca; Bita.Pejam@FedDevOntario.gc.ca; EnviroOnt@tc.gc.ca; Adam.Carr@infrastructureontario.ca; joanna.brown@infrastructureontario.ca; cory.ostrowka@infrastructureontario.ca; omafra.eanotices@ontario.ca; Karla.Barboza@ontario.ca; Dan.Minkin@ontario.ca; laura.e.hatcher@ontario.ca; anna.david@ontario.ca; laurie.miller@ontario.ca; erick.boyd@ontario.ca; catherine.warren@ontario.ca; tamara.dolan@ontario.ca; hal.leadlay@ontario.ca; margaret.berube@ontario.ca; gillian.hartman@ontario.ca; Linda_Burton@kprdsb.ca; stacey_foss@kprdsb.ca; joseph_newbery@kprdsb.ca; sophia_wouters@kprdsb.ca; bosb001@nexicom.net; chair@millbrookbia.com; webmaster-corp@enbridge.com; CustomerRelations@HydroOne.com; SecondaryLandUse@HydroOne.com; gconlin@nexicomgroup.net; jeffery_white@kprdsb.ca; jayne_patterson@kprdsb.ca; cpadm@aoninc.com; laurie.scottco@pc.ola.org
Attachments: Cavan Monaghan Water Storage EA - Notice of Commencement - AODA.pdf

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Categories: Filed by Newforma

Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment.

This notice is sent to your attention as it was deemed that you may be an interested stakeholder.

Should you wish to stop receiving notices pertaining to this project or would like to direct them to an alternate recipient, please advise the undersigned.

Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
LinkedIn | Facebook | Website

PROUDLY 100% CANADIAN

Subject: Township of Cavan Monaghan, Environmental Assessment for Water Storage
Sent: 2025-04-15, 9:34:46 AM
From: Nikash Persaud<npersaud@rvanderson.com>
To: EA Notices to ERegion (MECP); MEANoticesEAAB@ontario.ca; Orpana, Jon (MECP)
Cc: Wayne Hancock; Jessica Fradley; Rika Law; Darika Sharma; Maia Mandel
Attachments: Project Initiation Form (PIF).xlsx
Cavan Monaghan Water Storage EA - Notice of Commencement - AODA.pdf

---

Categories: Filed by Newforma

Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment, as well as the associated Project Information Form (PIF).

Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
LinkedIn | Facebook | Website

PROUDLY 100% CANADIAN

Subject: RE: Millbrook Water Storage Class Environmental Assessment
Sent: 2025-04-23, 9:16:43 AM
From: Nikash Persaud<npersaud@rvanderson.com>
To: Orpana, Jon (MECP); Wayne Hancock
Cc: Jackson, Brad (He/Him) (MECP); Darika Sharma; Rika Law; Maia Mandel

---

Hi Jon,

Thank you, this has been received by our team. We will review and work accordingly.

Hope you are well.

Regards,
Nikash

From: Orpana, Jon (MECP) <Jon.Orpana@ontario.ca>
Sent: April 22, 2025 2:35 PM
To: Wayne Hancock <whancock@cavanmonaghan.net>
Cc: Nikash Persaud <npersaud@rvanderson.com>; Jackson, Brad (He/Him) (MECP) <Brad.Jackson@ontario.ca>
Subject: Millbrook Water Storage Class Environmental Assessment

[CAUTION EXTERNAL EMAIL] Make Sure that it is legitimate **before** Replying or Clicking on any links

Hello Folks,

Please find attached MECP's preliminary comments on the above-mentioned file.

Included are a list of recommended indigenous communities that you consult with during your study process under the Class EA.

I have also included resources, hyperlinks and references you can refer to during the course of your study (ies).

Regards,

Jon

Jon K. Orpana
Regional Environmental Planner
Environmental Assessment Branch
Ministry of the Environment, Conservation and Parks
Kingston Regional Office
PO Box 22032, 1259 Gardiners Road
Kingston, Ontario
K7M 8S5

Phone: (613) 561 8250
Email: jon.orpana@ontario.ca

Ministry of the Environment, Conservation and Parks

Environmental Assessment Branch

7th Floor
135 St. Clair Avenue W
Toronto ON M4V 1P5
Tel.: 416 314-8001
Fax.: 416 314-8452

Ministère de l'Environnement, de la Protection de la nature et des Parcs

Direction des évaluations environnementales

7ème étage
135, avenue St. Clair Ouest
Toronto ON M4V 1P5
Tél. : 416 314-8001
Téléc. : 416 314-8452

April 22, 2025

Wayne Hancock, P.Eng.
Director of Public Works
The Township of Cavan Monaghan
whancock@cavanmonaghan.net

BY EMAIL ONLY

Re: **Millbrook Water Storage Class Environmental Assessment**
Municipal Class Environmental Assessment, Schedule B
MECP Acknowledgement of Notice of Commencement

Dear Wayne Hancock,

This letter is in response to the Notice of Commencement for the above noted project first issued April 15th. The Ministry of the Environment, Conservation and Parks (MECP) acknowledges that the Township of Cavan Monaghan (proponent) has indicated that the study is following the approved environmental planning process for a Schedule B project under the Municipal Class Environmental Assessment (Class EA) (February 2024)

The Township of Cavan Monaghan is undertaking a Class Environmental Assessment (Class EA) for a new water storage system in Millbrook.

The Township of Cavan Monaghan recently completed a Water and Wastewater Master Servicing Study (MSS), under the Municipal Class Environmental Assessment (Class EA) framework. As part of this study, a preferred alternative for the water storage aspect was to increase the water storage volume and accommodate Millbrook's forecasted growth. The preferred alternative was to have additional water storage at a new location and retain the existing standpipe by the Municipal Office. The purpose of the study is to confirm the location, capacity, and storage type for the new storage solution. The study will follow the Schedule 'B'

Municipal Class EA process as set out by the Municipal Engineers Association (October 2000 amended in 2007, 2011, 2015, 2023 and 2024).

The Township of Cavan Monaghan will be considering and evaluating suitable sites for the construction of a new water storage tank within Millbrook's Settlement Area Boundary (see figure). The Township will look at the existing water system to identify any necessary improvements and impacts that the construction of the tank may have on the potential sites.

The updated attached "Areas of Interest" document provides guidance regarding the ministry's interests with respect to the Class EA process. Please address all areas of interest in the EA documentation at an appropriate level for the EA study. Proponents who address all the applicable areas of interest can minimize potential delays to the project schedule. Information is provided at the end of the Areas of Interest document relating to the Notice of Completion**.**

The Crown has a legal duty to consult Aboriginal communities when it has knowledge, real or constructive, of the existence or potential existence of an Aboriginal or treaty right and contemplates conduct that may adversely impact that right. Before authorizing this project, the Crown must ensure that its duty to consult has been fulfilled, where such a duty is triggered. Although the duty to consult with Aboriginal peoples is a duty of the Crown, the Crown may delegate procedural aspects of this duty to project proponents while retaining oversight of the consultation process.

The proposed project may have the potential to affect Aboriginal or treaty rights protected under Section 35 of Canada's *Constitution Act* 1982. Where the Crown's duty to consult is triggered in relation to the proposed project**, the MECP is delegating the procedural aspects of rights-based consultation to the proponent through this letter.** The Crown intends to rely on the delegated consultation process in discharging its duty to consult and maintains the right to participate in the consultation process as it sees fit.

Based on information provided to date and the Crown`s preliminary assessment the proponent is recommended to consult with the following communities who have been identified as potentially affected by the proposed project:

Steps that the proponent may need to take in relation to Aboriginal consultation for the proposed project are outlined in the "Code of Practice for Consultation in Ontario's Environmental Assessment Process". Additional information related to Ontario's Environmental Assessment Act is available online at: www.ontario.ca/environmentalassessments.

Please also refer to the attached document "A Proponent's Introduction to the Delegation of Procedural Aspects of consultation with Aboriginal Communities" for further information, including the MECP's expectations for EA report documentation related to consultation with communities.

- **Williams Treaties First Nations**
    - **Chippewas of Rama First Nation**
    - **Chippewas of Georgina Island**
    - **Beausoleil First Nation**
    - **Alderville First Nation**
    - **Curve Lake First Nation**
    - **Hiawatha First Nation**
    - **Mississaugas of Scugog Island First Nation**

For the above Williams Treaties communities, please cc Karry Sandy McKenzie, William Treaties First Nations Process Co-ordinator, inquiries@williamstreatiesfirstnations.ca

- **Kawartha Nishnawbe**

If the proponent has undertaken archeological studies and are required to undertake any work related to archeological resources, they should also include:

- **Huron-Wendat**

The proponent must contact the Director of Environmental Assessment Branch (EABDirector@ontario.ca) under the following circumstances after initial discussions with the communities identified by the MECP:

- Aboriginal or treaty rights impacts are identified to you by the communities;
- You have reason to believe that your proposed project may adversely affect an Aboriginal or treaty right;
- Consultation with Indigenous communities or other stakeholders has reached an impasse; or
- A Section 16 Order request is expected based on impacts to Aboriginal or treaty rights

The MECP will then assess the extent of any Crown duty to consult for the circumstances and will consider whether additional steps should be taken, including what role you will be asked to play should additional steps and activities be required.

Please ensure the Notice of Completion and final report are sent to the ministry's Eastern Region EA notification email account (eanotification.eregion@ontario.ca).

Should you or any members of your project team have any questions regarding the material above, please contact me at jon.orpana@ontario.ca.

Sincerely,



Jon Orpana
Regional Environmental Planner – Eastern Region
Project Review Unit, Environmental Assessment Branch

Cc: Brad Jackson, (A) Water Compliance Supervisor, Peterborough District Office, MECP

Nikash Persaud, Class Environmental Assessment Coordinator,
R.V. Anderson Associates Limited

Enclosed: Areas of Interest

Attached: Client's Guide to Preliminary Screening for Species at Risk

A Proponent's Introduction to the Delegation of Procedural Aspects of Consultation with Aboriginal Communities

AREAS OF INTEREST

It is suggested that you check off each section after you have considered / addressed it.

Planning and Policy

- Applicable plans and policies should be identified in the report, and the proponent should describe how the proposed project adheres to the relevant policies in these plans.
    - The **Provincial Planning Statement (PPS) (2024)** contains policies that protect Ontario's natural heritage and water resources. Applicable policies in the PPS 2024 should be referenced in the report, and the proponent should describe how the proposed project is consistent with these policies. **The PPS 2024 replaces the Provincial Policy Statement (PPS) (2020) and A Place to Grow: Growth Plan for the Greater Golden Horseshoe (APTG) (2019)**.
    - Projects located in MECP Central or Eastern Region may be subject to the **Oak Ridges Moraine Conservation Plan (2017)** or the **Lake Simcoe Protection Plan (2014)**.
    - Projects located in MECP Central, Southwest or West Central Region may be subject to the **Niagara Escarpment Plan (2017)**.
    - Projects located in MECP Central, Eastern, Southwest or West Central Region may be subject to the **Greenbelt Plan (2017)**. Due to Amendment 4 to the Greenbelt Plan, areas within the Greenbelt are still subject to applicable policies in the PPS **(2020)** and APTG **(2019)**.
    - Projects located in MECP Northern Region may be subject to the **Growth Plan for Northern Ontario (2011)**.

- In addition to the provincial planning and policy level, the report should also discuss the planning context at the municipal and federal levels, as appropriate.

Source Water Protection

The *Clean Water Act*, 2006 (CWA) aims to protect existing and future sources of drinking water. To achieve this, several types of vulnerable areas have been delineated around surface water intakes and wellheads for every municipal residential drinking water system that is located in a source protection area. These vulnerable areas are known as a Wellhead Protection Areas (WHPAs) and surface water Intake Protection Zones (IPZs). Other vulnerable areas that have been delineated under the CWA include Highly Vulnerable Aquifers (HVAs), Significant Groundwater Recharge Areas (SGRAs), Event-based modelling areas (EBAs), and Issues Contributing Areas (ICAs). Source protection plans have been developed that include policies to address existing and future risks to sources of municipal drinking water within these vulnerable areas.

Projects that are subject to the Environmental Assessment Act that fall under a Class EA, or one of the Regulations, have the potential to impact sources of drinking water if they occur in

designated vulnerable areas or in the vicinity of other at-risk drinking water systems (i.e. systems that are not municipal residential systems). MEA Class EA projects may include activities that, if located in a vulnerable area, could be a threat to sources of drinking water (i.e. have the potential to adversely affect the quality or quantity of drinking water sources) and the activity could therefore be subject to policies in a source protection plan. Where an activity poses a risk to drinking water, policies in the local source protection plan may impact how or where that activity is undertaken. Policies may prohibit certain activities, or they may require risk management measures for these activities. Municipal Official Plans, planning decisions, Class EA projects (where the project includes an activity that is a threat to drinking water) and prescribed instruments must conform with policies that address significant risks to drinking water and must have regard for policies that address moderate or low risks.

- In October 2015, the MEA Parent Class EA document was amended to include reference to the Clean Water Act (Section A.2.10.6) and indicates that proponents undertaking a Municipal Class EA project must identify early in their process whether a project is or could potentially be occurring with a vulnerable area. **Given this requirement, please include a section in the report on source water protection.**

    - The proponent should identify the source protection area and should clearly document how the proximity of the project to sources of drinking water (municipal or other) and any delineated vulnerable areas was considered and assessed. Specifically, the report should discuss whether or not the project is located in a vulnerable area and provide applicable details about the area.

    - If located in a vulnerable area, proponents should document whether any project activities are prescribed drinking water threats and thus pose a risk to drinking water (this should be consulted on with the appropriate Source Protection Authority). Where an activity poses a risk to drinking water, the proponent must document and discuss in the report how the project adheres to or has regard to applicable policies in the local source protection plan. This section should then be used to inform and be reflected in other sections of the report, such as the identification of net positive/negative effects of alternatives, mitigation measures, evaluation of alternatives etc.

- While most source protection plans focused on including policies for significant drinking water threats in the WHPAs and IPZs it should be noted that even though source protection plan policies may not apply in HVAs, these are areas where aquifers are sensitive and at risk to impacts and within these areas, activities may impact the quality of sources of drinking water for systems other than municipal residential systems.

- In order to determine if this project is occurring within a vulnerable area, proponents can use Source Protection Information Atlas, which is an online mapping tool available to the public. Note that various layers (including WHPAs, WHPA-Q1 and WHPA-Q2, IPZs, HVAs, SGRAs, EBAs, ICAs) can be turned on through the “Map Legend” bar on the left. The

mapping tool will also provide a link to the appropriate source protection plan in order to identify what policies may be applicable in the vulnerable area.

- For further information on the maps or source protection plan policies which may relate to their project, proponents must contact the appropriate source protection authority. **Please consult with the local source protection authority to discuss potential impacts on drinking water. Please document the results of that consultation within the report and include all communication documents/correspondence.**

More Information

For more information on the *Clean Water Act*, source protection areas and plans, including specific information on the vulnerable areas and drinking water threats, please refer to Conservation Ontario's website where you will also find links to the local source protection plan/assessment report.

A list of the prescribed drinking water threats can be found in section 1.1 of Ontario Regulation 287/07 made under the *Clean Water Act*. In addition to prescribed drinking water threats, some source protection plans may include policies to address additional "local" threat activities, as approved by the MECP.

Climate Change

The document "Considering Climate Change in the Environmental Assessment Process" (Guide) is part of the Environmental Assessment program's Guides and Codes of Practice. The Guide sets out the MECP's expectation for considering climate change in the preparation, execution and documentation of environmental assessment studies and processes. The guide provides examples, approaches, resources, and references to assist proponents with consideration of climate change in EA. Proponents should review this Guide in detail.

- **The MECP expects proponents of Class EA projects to:**

1. Consider during the assessment of alternative solutions and alternative designs, the following:
    a. the project's expected production of greenhouse gas emissions and impacts on carbon sinks (climate change mitigation); and
    b. resilience or vulnerability of the undertaking to changing climatic conditions (climate change adaptation).
2. Include a discrete section in the report detailing how climate change was considered in the EA.

How climate change is considered can be qualitative or quantitative in nature and should be scaled to the project's level of environmental effect. In all instances, both a project's impacts on climate change (mitigation) and impacts of climate change on a project (adaptation) should be considered.

- The MECP has also prepared another guide to support provincial land use planning direction related to the completion of energy and emission plans. The "Community Emissions Reduction Planning: A Guide for Municipalities" document is designed to educate stakeholders on the municipal opportunities to reduce energy and greenhouse gas emissions, and to provide guidance on methods and techniques to incorporate consideration of energy and greenhouse gas emissions into municipal activities of all types. We encourage you to review the Guide for information.

Air Quality, Dust and Noise

- If there are sensitive receptors in the surrounding area of this project, a quantitative air quality/odour impact assessment will be useful to evaluate alternatives, determine impacts and identify appropriate mitigation measures. The scope of the assessment can be determined based on the potential effects of the proposed alternatives, and typically includes source and receptor characterization and a quantification of local air quality impacts on the sensitive receptors and the environment in the study area. The assessment will compare to all applicable standards or guidelines for all contaminants of concern. **Please contact this office for further consultation on the level of Air Quality Impact Assessment required for this project if not already advised.**

- If a quantitative Air Quality Impact Assessment is not required for the project, the MECP expects that the report contain a qualitative assessment which includes:

    - A discussion of local air quality including existing activities/sources that significantly impact local air quality and how the project may impact existing conditions;
    - A discussion of the nearby sensitive receptors and the project's potential air quality impacts on present and future sensitive receptors;
    - A discussion of local air quality impacts that could arise from this project during both construction and operation; and
    - A discussion of potential mitigation measures.

- As a common practice, "air quality" should be used an evaluation criterion for all road projects.

- Dust and noise control measures should be addressed and included in the construction plans to ensure that nearby residential and other sensitive land uses within the study area are not adversely affected during construction activities.

- The MECP recommends that non-chloride dust-suppressants be applied. For a comprehensive list of fugitive dust prevention and control measures that could be applied, refer to *Cheminfo Services Inc. Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities* report prepared for Environment Canada. March 2005.

- The report should consider the potential impacts of increased noise levels during the operation of the completed project. The proponent should explore all potential measures to mitigate significant noise impacts during the assessment of alternatives.

Ecosystem Protection and Restoration

- Any impacts to ecosystem form and function must be avoided where possible. The report should describe any proposed mitigation measures and how project planning will protect and enhance the local ecosystem.

- Natural heritage and hydrologic features should be identified and described in detail to assess potential impacts and to develop appropriate mitigation measures. The following sensitive environmental features may be located within or adjacent to the study area:
    - Key Natural Heritage Features: Habitat of endangered species and threatened species, fish habitat, wetlands, areas of natural and scientific interest (ANSIs), significant valleylands, significant woodlands; significant wildlife habitat (including habitat of special concern species); sand barrens, savannahs, and tallgrass prairies; and alvars.
    - Key Hydrologic Features: Permanent streams, intermittent streams, inland lakes and their littoral zones, seepage areas and springs, and wetlands.
    - Other natural heritage features and areas such as: vegetation communities, rare species of flora or fauna, Environmentally Sensitive Areas, Environmentally Sensitive Policy Areas, federal and provincial parks and conservation reserves, Greenland systems etc.

We recommend consulting with the Ministry of Natural Resources and Forestry (MNRF), Fisheries and Oceans Canada (DFO) and your local conservation authority to determine if special measures or additional studies will be necessary to preserve and protect these sensitive features. In addition, for projects located in Central Region you may consider the provisions of the Rouge Park Management Plan if applicable.

Species at Risk

- The Ministry of the Environment, Conservation and Parks has now assumed responsibility of Ontario's Species at Risk program. Information, standards, guidelines, reference materials and technical resources to assist you are found at https://www.ontario.ca/page/species-risk.

- The Client's Guide to Preliminary Screening for Species at Risk (Draft May 2019) has been attached to the covering email for your reference and use. Please review this document for next steps.

- For any questions related to subsequent permit requirements and SAR consideration proponents should contact SAROntario@ontario.ca.

Surface Water

- The report must include enough information to demonstrate that there will be no negative impacts on the natural features or ecological functions of any watercourses within the study area. Measures should be included in the planning and design process to ensure that any impacts to watercourses from construction or operational activities (e.g. spills, erosion, pollution) are mitigated as part of the proposed undertaking.

- Additional stormwater runoff from new pavement can impact receiving watercourses and flood conditions. Quality and quantity control measures to treat stormwater runoff should be considered for all new impervious areas and, where possible, existing surfaces. The ministry's Stormwater Management Planning and Design Manual (2003) should be referenced in the report and utilized when designing stormwater control methods. **A Stormwater Management Plan should be prepared as part of the Class EA process** that includes:

    - Strategies to address potential water quantity and erosion impacts related to stormwater draining into streams or other sensitive environmental features, and to ensure that adequate (enhanced) water quality is maintained
    - Watershed information, drainage conditions, and other relevant background information
    - Future drainage conditions, stormwater management options, information on erosion and sediment control during construction, and other details of the proposed works
    - Information on maintenance and monitoring commitments.

- Ontario Regulation 60/08 under the *Ontario Water Resources Act* (OWRA) applies to the Lake Simcoe Basin, which encompasses Lake Simcoe and the lands from which surface water drains into Lake Simcoe. If a proposed sewage treatment plant is listed in Table 1 of the regulation, the report should describe how the proposed project and its mitigation measures are consistent with the requirements of this regulation and the OWRA.

- Any potential approval requirements for surface water taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, except for certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16*. These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information. Additionally, an Environmental Compliance Approval under the OWRA is required for municipal stormwater management works.

Groundwater

- The status of, and potential impacts to any well water supplies should be addressed. If the project involves groundwater takings or changes to drainage patterns, the quantity and quality of groundwater may be affected due to drawdown effects or the redirection of existing contamination flows. In addition, project activities may infringe on existing wells such that they must be reconstructed or sealed and abandoned. Appropriate information to define existing groundwater conditions should be included in the report.

- If the potential construction or decommissioning of water wells is identified as an issue, the report should refer to Ontario Regulation 903, Wells, under the OWRA.

- Potential impacts to groundwater-dependent natural features should be addressed. Any changes to groundwater flow or quality from groundwater taking may interfere with the ecological processes of streams, wetlands or other surficial features. In addition, discharging contaminated or high volumes of groundwater to these features may have direct impacts on their function. Any potential effects should be identified, and appropriate mitigation measures should be recommended. The level of detail required will be dependent on the significance of the potential impacts.

- Any potential approval requirements for groundwater taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, with the exception of certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16*. These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information.

- Consultation with the railroad authorities is necessary wherever there is a plan to use construction dewatering in the vicinity of railroad lines or where the zone of influence of the construction dewatering potentially intercepts railroad lines.

Excess Materials Management

- In December 2019, MECP released a new regulation under the Environmental Protection Act, titled "On-Site and Excess Soil Management" (O. Reg. 406/19) to support improved management of excess construction soil. This regulation is a key step to support proper management of excess soils, ensuring valuable resources don't go to waste and to provide clear rules on managing and reusing excess soil. New risk-based standards referenced by this regulation help to facilitate local beneficial reuse which in turn will reduce greenhouse gas emissions from soil transportation, while ensuring strong protection of human health and the environment. The new regulation is being phased in over time, with the first phase

in effect on January 1, 2021. For more information, please visit https://www.ontario.ca/page/handling-excess-soil.

- The report should reference that activities involving the management of excess soil should be completed in accordance with O. Reg. 406/19 and the MECP's current guidance document titled "Management of Excess Soil – A Guide for Best Management Practices" (2014).

- All waste generated during construction must be disposed of in accordance with ministry requirements.

Contaminated Sites

- Any current or historical waste disposal sites should be identified in the report. The status of these sites should be determined to confirm whether approval pursuant to Section 46 of the EPA may be required for land uses on former disposal sites. We recommend referring to the MECP's D-4 guideline for land use considerations near landfills and dumps.
    - Resources available may include regional/local municipal official plans and data; provincial data on large landfill sites and small landfill sites; Environmental Compliance Approval information for waste disposal sites on Access Environment.

- Other known contaminated sites (local, provincial, federal) in the study area should also be identified in the report (Note – information on federal contaminated sites is found on the Government of Canada's website).

- The location of any underground storage tanks should be investigated in the report. Measures should be identified to ensure the integrity of these tanks and to ensure an appropriate response in the event of a spill. The ministry's Spills Action Centre must be contacted in such an event.

- Since the removal or movement of soils may be required, appropriate tests to determine contaminant levels from previous land uses or dumping should be undertaken. If the soils are contaminated, you must determine how and where they are to be disposed of, consistent with *Part XV.1 of the Environmental Protection Act* (EPA) and Ontario Regulation 153/04, Records of Site Condition, which details the new requirements related to site assessment and clean up. Please contact the appropriate MECP District Office for further consultation if contaminated sites are present.

Servicing, Utilities and Facilities

- The report should identify any above or underground utilities in the study area such as transmission lines, telephone/internet, oil/gas etc. The owners should be consulted to discuss impacts to this infrastructure, including potential spills.

- The report should identify any servicing infrastructure in the study area such as wastewater, water, stormwater that may potentially be impacted by the project.

- Any facility that releases emissions to the atmosphere, discharges contaminants to ground or surface water, provides potable water supplies, or stores, transports or disposes of waste must have an Environmental Compliance Approval (ECA) before it can operate lawfully. Please consult with MECP's Environmental Permissions Branch to determine whether a new or amended ECA will be required for any proposed infrastructure.

- We recommend referring to the ministry's environmental land use planning guides to ensure that any potential land use conflicts are considered when planning for any infrastructure or facilities related to wastewater, pipelines, landfills or industrial uses.

Mitigation and Monitoring

- Contractors must be made aware of all environmental considerations so that all environmental standards and commitments for both construction and operation are met. Mitigation measures should be clearly referenced in the report and regularly monitored during the construction stage of the project. In addition, we encourage proponents to conduct post-construction monitoring to ensure all mitigation measures have been effective and are functioning properly.

- Design and construction reports and plans should be based on a best management approach that centres on the prevention of impacts, protection of the existing environment, and opportunities for rehabilitation and enhancement of any impacted areas.

- The proponent's construction and post-construction monitoring plans must be documented in the report, as outlined in Section A.2.5 and A.4.1 of the MEA Class EA parent document.

Consultation

- The report must demonstrate how the consultation provisions of the Class EA have been fulfilled, including documentation of all stakeholder consultation efforts undertaken during the planning process. This includes a discussion in the report that identifies concerns that were raised and **describes how they have been addressed by the proponent** throughout

the planning process. The report should also include copies of comments submitted on the project by interested stakeholders, and the proponent's responses to these comments (as directed by the Class EA to include full documentation).

- Please include the full stakeholder distribution/consultation list in the documentation.

Class EA Process

- If this project is a Master Plan: there are several different approaches that can be used to conduct a Master Plan, examples of which are outlined in Appendix 4 of the Class EA. **The Master Plan should clearly indicate the selected approach for conducting the plan**, by identifying whether the levels of assessment, consultation and documentation are sufficient to fulfill the requirements for Schedule B or C projects. Please note that any Schedule B or C projects identified in the plan would be subject to Section 16 Order Requests under the Environmental Assessment Act, although the plan itself would not be. **Please include a description of the approach being undertaken (use Appendix 4 as a reference).**

- If this project is a Master Plan: Any identified projects should also include information on the MCEA schedule associated with the project.

- The report should provide clear and complete documentation of the planning process in order to allow for transparency in decision-making.

- The Class EA requires the consideration of the effects of each alternative on all aspects of the environment (including planning, natural, social, cultural, economic, technical). The report should include a level of detail (e.g. hydrogeological investigations, terrestrial and aquatic assessments, cultural heritage assessments) such that all potential impacts can be identified, and appropriate mitigation measures can be developed. Any supporting studies conducted during the Class EA process should be referenced and included as part of the report.

- Please include in the report a list of all subsequent permits or approvals that may be required for the implementation of the preferred alternative, including but not limited to, MECP's PTTW, EASR Registrations and ECAs, conservation authority permits, species at risk permits, MTO permits and approvals under the *Impact Assessment Act*, 2019.

- Ministry guidelines and other information related to the issues above are available at http://www.ontario.ca/environment-and-energy/environment-and-energy. We encourage you to review all the available guides and to reference any relevant information in the report.

Notice of Completion

Once the EA Report is finalized, the proponent must issue a Notice of Completion providing a minimum 30-day period during which documentation may be reviewed and comment and input can be submitted to the proponent. The Notice of Completion must be sent to the appropriate MECP Regional Office email address.

The public can request a higher level of assessment on a project if they are concerned about potential adverse impacts to constitutionally protected Aboriginal and treaty rights. In addition, the Minister may issue an order on his or her own initiative within a specified time period. The Director (of the Environmental Assessment Branch) will issue a Notice of Proposed Order to the proponent if the Minister is considering an order for the project within 30 days after the conclusion of the comment period on the Notice of Completion. At this time, the Director may request additional information from the proponent. Once the requested information has been received, the Minister will have 30 days within which to make a decision or impose conditions on your project.

Therefore, the proponent cannot proceed with the project until at least 30 days after the end of the comment period provided for in the Notice of Completion. Further, the proponent may not proceed after this time if:

- a Section 16 Order request has been submitted to the ministry regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, or
- the Director has issued a Notice of Proposed order regarding the project.

Please ensure that the Notice of Completion advises that outstanding concerns are to be directed to the proponent for a response, and that in the event there are outstanding concerns regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, Section 16 Order requests on those matters should be addressed in writing to:

Minister of the Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto ON M7A 2J3
minister.mecp@ontario.ca

and

Director, Environmental Assessment Branch
Ministry of the Environment, Conservation and Parks
135 St. Clair Ave. W, 1st Floor
Toronto ON, M4V 1P5
EABDirector@ontario.ca

Client's Guide to Preliminary Screening for Species at Risk

Ministry of the Environment, Conservation and Parks

Species at Risk Branch, Permissions and Compliance

DRAFT - May 2019

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1.0 Purpose, Scope, Background and Context

1.1 Purpose of this Guide

This guide has been created to:

- help clients better understand their obligation to gather information and complete a preliminary screening for species at risk before contacting the ministry,
- outline guidance and advice clients can expect to receive from the ministry at the preliminary screening stage,
- help clients understand how they can gather information about species at risk by accessing publicly available information housed by the Government of Ontario, and
- provide a list of other potential sources of species at risk information that exist outside the Government of Ontario.

It remains the client's responsibility to:

- carry out a preliminary screening for their projects,
- obtain best available information from all applicable information sources,
- conduct any necessary field studies or inventories to identify and confirm the presence or absence of species at risk or their habitat,
- consider any potential impacts to species at risk that a proposed activity might cause, and
- comply with the *Endangered Species Act* (ESA).

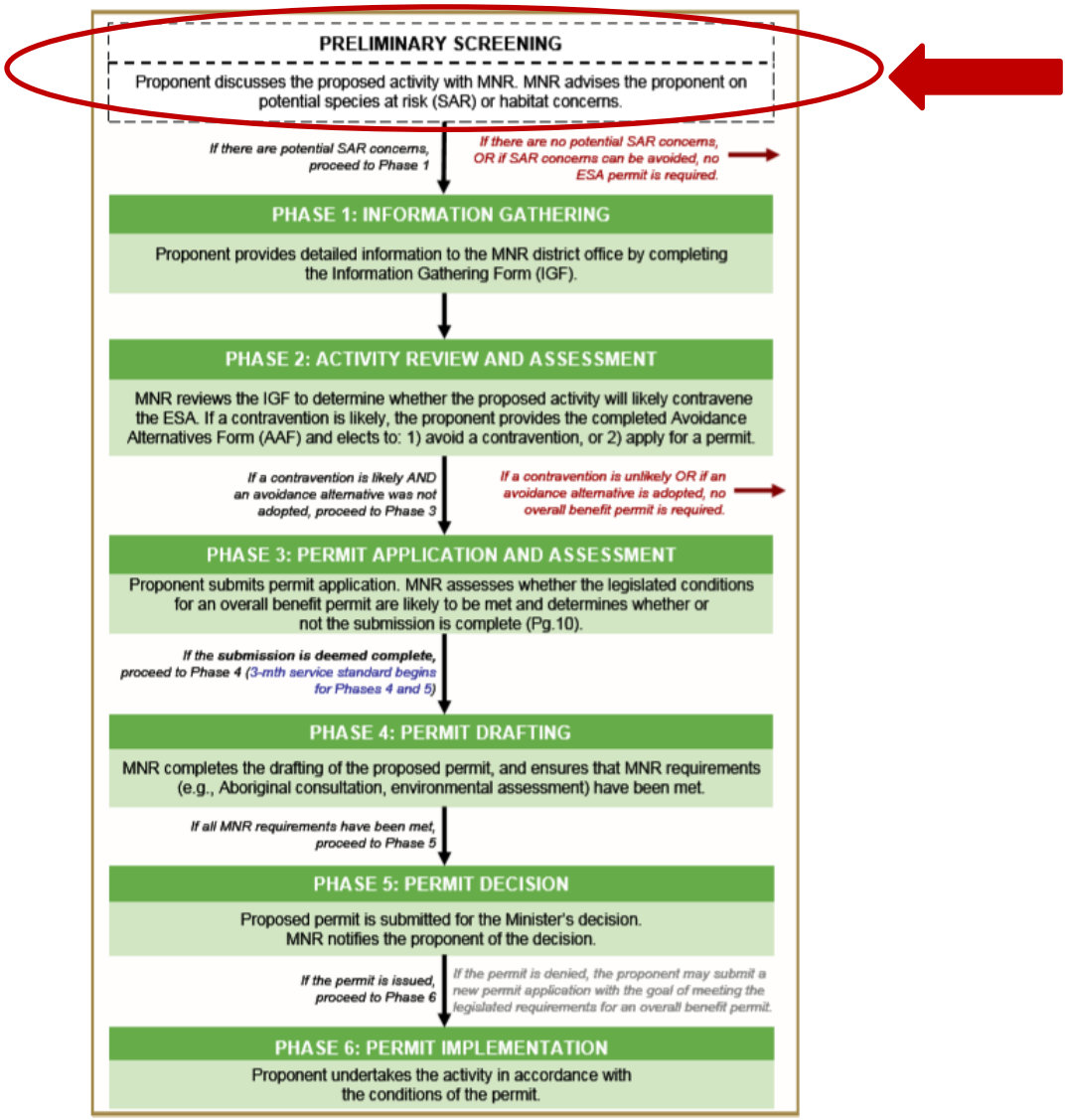
To provide the most efficient service, clients should initiate species at risk screenings and seek information from all applicable information sources identified in this guide, at a minimum, prior to contacting Government of Ontario ministry offices for further information or advice.

1.2 Scope

This guide is a resource for clients seeking to understand if their activity is likely to impact species at risk or if they are likely to trigger the need for an authorization under the ESA. It is not intended to circumvent any detailed site surveys that may be necessary to document species at risk or their habitat nor to circumvent the need to assess the impacts of a proposed activity on species at risk or their habitat. This guide is not an exhaustive list of available information sources for any given area as the availability of information on species at risk and their habitat varies across the province. This guide is intended to support projects and activities carried out on Crown and private land, by private landowners, businesses, other provincial ministries and agencies, or municipal government.

1.3 Background and Context

To receive advice on their proposed activity, clients must first determine whether any species at risk or their habitat exist or are likely to exist at or near their proposed activity, and whether their proposed activity is likely to contravene the ESA. Once this step is complete, clients may contact the ministry at SAROntario@ontario.ca to discuss the main purpose, general methods, timing and location of their proposed activity as well as information obtained about species at risk and their habitat at, or near, the site. At this stage, the ministry can provide advice and guidance to the client about potential species at risk or habitat concerns, measures that the client is considering to avoid adverse effects on species at risk or their habitat and whether additional field surveys are advisable. This is referred to as the "Preliminary Screening" stage. For more information on additional phases in the diagram below, please refer to the *Endangered Species Act Submission Standards for Activity Review and 17(2)(c) Overall Benefit Permits* policy available online at https://www.ontario.ca/page/species-risk-overall-benefit-permits



2.0 Roles and Responsibilities

To provide the most efficient service, clients should initiate species at risk screenings and seek information from all applicable information sources identified in this guide prior to contacting Government of Ontario ministry offices for further information or advice.

Step 1: Client seeks information regarding species at risk or their habitat that exist, or are likely to exist, at or near their proposed activity by referring to all applicable information sources identified in this guide.

Step 2: Client reviews and consider guidance on whether their proposed activity is likely to contravene the ESA (see section 3.4 of this guide for guidance on what to consider).

Step 3: Client gathers information identified in the checklist in section 4 of this guide.

Step 4: Client contacts the ministry at SAROntario@ontario.ca to discuss their preliminary screening. Ministry staff will ask the client questions about the main purpose, general methods, timing and location of their proposed activity as well as information obtained about species at risk and their habitat at, or near, the site. Ministry staff will also ask the client for their interpretation of the impacts of their activity on species at risk or their habitat as well as measures the client has considered to avoid any adverse impacts.

Step 5: Ministry staff will provide advice on next steps.

Option A: Ministry staff may advise the client they can proceed with their activity without an authorization under the ESA where the ministry is confident that:

- no protected species at risk or habitats are likely to be present at or near the proposed location of the activity; or
- protected species at risk or habitats are known to be present but the activity is not likely to contravene the ESA; or
- through the adoption of avoidance measures, the modified activity is not likely to contravene the ESA.

Option B: Ministry staff may advise the client to proceed to Phase 1 of the overall benefit permitting process (i.e. Information Gathering in the previous diagram), where:

- there is uncertainty as to whether any protected species at risk or habitats are present at or near the proposed location of the activity; or
- the potential impacts of the proposed activity are uncertain; or
- ministry staff anticipate the proposed activity is likely to contravene the ESA.

3.0 Information Sources

Land Information Ontario (LIO) and the Natural Heritage Information Centre (NHIC) maintain and provide information about species at risk, as well as related information about fisheries, wildlife, crown lands, protected lands and more. This information is made available to organizations, private individuals, consultants, and developers through online sources and is often considered under various pieces of legislation or as part of regulatory approvals and planning processes.

The information available from LIO or NHIC and the sources listed in this guide should not be considered as a substitute for site visits and appropriate field surveys. Generally, this information can be regarded as a starting point from which to conduct further field surveys, if needed. While this data represents best available current information, it is important to note that a lack of information for a site does not mean that species at risk or their habitat are not present. There are many areas where the Government of Ontario does not currently have information, especially in more remote parts of the province. The absence of species at risk location data at or near your site does not necessarily mean no species at risk are present at that location. On-site assessments can better verify site conditions, identify and confirm presence of species at risk and/or their habitats.

Information on the location (i.e. observations and occurrences) of species at risk is considered sensitive and therefore publicly available only on a 1km square grid as opposed to as a detailed point on a map. This generalized information can help you understand which species at risk are in the general vicinity of your proposed activity and can help inform field level studies you may want to undertake to confirm the presence, or absence of species at risk at or near your site.

Should you require specific and detailed information pertaining to species at risk observations and occurrences at or near your site on a finer geographic scale; you will be required to demonstrate your need to access this information, to complete data sensitivity training and to obtain a Sensitive Data Use License from the NHIC. Information on how to obtain a license can be found online at https://www.ontario.ca/page/get-natural-heritage-information.

Many organizations (e.g. other Ontario ministries, municipalities, conservation authorities) have ongoing licensing to access this data so be sure to check if your organization has this access and consult this data as part of your preliminary screening if your organization already has a license.

3.1 Make a Map: Natural Heritage Areas

The Make a Natural Heritage Area Map (available online at http://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US provides public access to natural heritage information, including species at risk, without the user needing to have Geographic Information System (GIS) capability. It allows users to view and identify generalized species at risk information, mark areas of interest, and create and print a custom map directly from the web application. The tool also shows topographic information such as roads, rivers, contours and municipal boundaries.

Users are advised that sensitive information has been removed from the natural areas dataset and the occurrences of species at risk has been generalized to a 1-kilometre grid to mitigate the risks to the species (e.g. illegal harvest, habitat disturbance, poaching).

The web-based mapping tool displays natural heritage data, including:

- Generalized Species at risk occurrence data (based on a 1-km square grid),
- Natural Heritage Information Centre data.

Data cannot be downloaded directly from this web map; however, information included in this application is available digitally through Land Information Ontario (LIO) at https://www.ontario.ca/page/land-information-ontario.

3.2 Land Information Ontario (LIO)

Most natural heritage data is publicly available. This data is managed in a large provincial corporate database called the LIO Warehouse and can be accessed online through the LIO Metadata Management Tool at https://www.javacoeapp.lrc.gov.on.ca/geonetwork/srv/en/main.home. This tool provides descriptive information about the characteristics, quality and context of the data. Publicly available geospatial data can be downloaded directly from this site.

While most data are publicly available, some data may be considered highly sensitive (i.e. nursery areas for fish, species at risk observations) and as such, access to some data maybe restricted.

3.3 Additional Species at Risk Information Sources

- The Breeding Bird Atlas can be accessed online at http://www.birdsontario.org/atlas/index.jsp?lang=en
- eBird can be accessed online at https://ebird.org/home
- iNaturalist can be accessed online at https://www.inaturalist.org/
- The Ontario Reptile and Amphibian Atlas can be accessed online at https://ontarionature.org/programs/citizen-science/reptile-amphibian-atlas
- Your local Conservation Authority. Information to help you find your local Conservation Authority can be accessed online at https://conservationontario.ca/conservation-authorities/find-a-conservation-authority/

  Local naturalist groups or other similar community-based organizations
- Local Indigenous communities
- Local land trusts or other similar Environmental Non-Government Organizations
- Field level studies to identify if species at risk, or their habitat, are likely present or absent at or near the site.
- When an activity is proposed within one of the continuous caribou ranges, please be sure to consider the caribou Range Management Policy. This policy includes figures and maps of the continuous caribou range, can be found online at https://www.ontario.ca/page/range-management-policy-support-woodland-caribou-conservation-and-recovery

3.4 Information Sources to Support Impact Assessments

- Guidance to help you understand if your activity is likely to adversely impact species at risk or their habitat can be found online at https://www.ontario.ca/page/policy-guidance-harm-and-harass-under-endangered-species-act and https://www.ontario.ca/page/categorizing-and-protecting-habitat-under-endangered-species-act
- A list of species at risk in Ontario is available online at https://www.ontario.ca/page/species-risk-ontario. On this webpage, you can find out more about each species, including where is lives, what threatens it and any specific habitat protections that apply to it by clicking on the photo of the species.

4.0 Check-List

Please feel free to use the check list below to help you confirm you have explored all applicable information sources and to support your discussion with Ministry staff at the preliminary screening stage.

- ✓ Land Information Ontario (LIO)
- ✓ Natural Heritage Information Centre (NHIC)
- ✓ The Breeding Bird Atlas
- ✓ eBird
- ✓ iNaturalist
- ✓ Ontario Reptile and Amphibian Atlas
- ✓ List Conservation Authorities you contacted:_____

  _____
- ✓ List local naturalist groups you contacted:_____

  _____
- ✓ List local Indigenous communities you contacted:_____

  _____
- ✓ List any other local land trusts or Environmental Non-Government Organizations you contacted:_____

  _____
- ✓ List and field studies that were conducted to identify species at risk, or their habitat, likely to be present or absent at or near the site: _____

  _____
- ✓ List what you think the likely impacts of your activity are on species at risk and their habitat (e.g. damage or destruction of habitat, killing, harming or harassing species at risk):_____

  _____

Ontario

A PROPONENT'S INTRODUCTION TO THE DELEGATION OF PROCEDURAL ASPECTS OF CONSULTATION WITH ABORIGINAL COMMUNITIES

DEFINITIONS

The following definitions are specific to this document and may not apply in other contexts:

Aboriginal communities – the First Nation or Métis communities identified by the Crown for the purpose of consultation.

Consultation – the Crown's legal obligation to consult when the Crown has knowledge of an established or asserted Aboriginal or treaty right and contemplates conduct that might adversely impact that right. This is the type of consultation required pursuant to s. 35 of the *Constitution Act, 1982*. Note that this definition does not include consultation with Aboriginal communities for other reasons, such as regulatory requirements.

Crown – the Ontario Crown, acting through a particular ministry or ministries.

Procedural aspects of consultation – those portions of consultation related to the process of consultation, such as notifying an Aboriginal community about a project, providing information about the potential impacts of a project, responding to concerns raised by an Aboriginal community and proposing changes to the project to avoid negative impacts.

Proponent – the person or entity that wants to undertake a project and requires an Ontario Crown decision or approval for the project.

I. PURPOSE

The Crown has a legal duty to consult Aboriginal communities when it has knowledge of an existing or asserted Aboriginal or treaty right and contemplates conduct that may adversely impact that right. In outlining a framework for the duty to consult, the Supreme Court of Canada has stated that the Crown may delegate procedural aspects of consultation to third parties. This document provides general information about the Ontario Crown's approach to delegation of the procedural aspects of consultation to proponents.

This document is not intended to instruct a proponent about an individual project, and it does not constitute legal advice.

II. WHY IS IT NECESSARY TO CONSULT WITH ABORIGINAL COMMUNITIES?

The objective of the modern law of Aboriginal and treaty rights is the *reconciliation* of Aboriginal peoples and non-Aboriginal peoples and their respective rights, claims and interests. Consultation is an important component of the reconciliation process.

The Crown has a legal duty to consult Aboriginal communities when it has knowledge of an existing or asserted Aboriginal or treaty right and contemplates conduct that might adversely impact that right. For example, the Crown's duty to consult is triggered when it considers

issuing a permit, authorization or approval for a project which has the potential to adversely impact an Aboriginal right, such as the right to hunt, fish, or trap in a particular area.

The scope of consultation required in particular circumstances ranges across a spectrum depending on both the nature of the asserted or established right and the seriousness of the potential adverse impacts on that right.

Depending on the particular circumstances, the Crown may also need to take steps to accommodate the potentially impacted Aboriginal or treaty right. For example, the Crown may be required to avoid or minimize the potential adverse impacts of the project.

III. THE CROWN'S ROLE AND RESPONSIBILITIES IN THE DELEGATED CONSULTATION PROCESS

The Crown has the responsibility for ensuring that the duty to consult, and accommodate where appropriate, is met. However, the Crown may delegate the procedural aspects of consultation to a proponent.

There are different ways in which the Crown may delegate the procedural aspects of consultation to a proponent, including through a letter, a memorandum of understanding, legislation, regulation, policy and codes of practice.

If the Crown decides to delegate procedural aspects of consultation, the Crown will generally:

- Ensure that the delegation of procedural aspects of consultation and the responsibilities of the proponent are clearly communicated to the proponent;
- Identify which Aboriginal communities must be consulted;
- Provide contact information for the Aboriginal communities;
- Revise, as necessary, the list of Aboriginal communities to be consulted as new information becomes available and is assessed by the Crown;
- Assess the scope of consultation owed to the Aboriginal communities;
- Maintain appropriate oversight of the actions taken by the proponent in fulfilling the procedural aspects of consultation;
- Assess the adequacy of consultation that is undertaken and any accommodation that may be required;
- Provide a contact within any responsible ministry in case issues arise that require direction from the Crown; and
- Participate in the consultation process as necessary and as determined by the Crown.

IV. THE PROPONENT'S ROLE AND RESPONSIBILITIES IN THE DELEGATED CONSULTATION PROCESS

Where aspects of the consultation process have been delegated to a proponent, the Crown, in meeting its duty to consult, will rely on the proponent's consultation activities and documentation of those activities. The consultation process informs the Crown's decision of whether or not to approve a proposed project or activity.

A proponent's role and responsibilities will vary depending on a variety of factors including the extent of consultation required in the circumstance and the procedural aspects of consultation the Crown has delegated to it. Proponents are often in a better position than the Crown to discuss a project and its potential impacts with Aboriginal communities and to determine ways to avoid or minimize the adverse impacts of a project.

A proponent can raise issues or questions with the Crown at any time during the consultation process. If issues or concerns arise during the consultation that cannot be addressed by the proponent, the proponent should contact the Crown.

a) What might a proponent be required to do in carrying out the procedural aspects of consultation?

Where the Crown delegates procedural aspects of consultation, it is often the proponent's responsibility to provide notice of the proposed project to the identified Aboriginal communities. The notice should indicate that the Crown has delegated the procedural aspects of consultation to the proponent and should include the following information:

- a description of the proposed project or activity;
- mapping;
- proposed timelines;
- details regarding anticipated environmental and other impacts;
- details regarding opportunities to comment; and
- any changes to the proposed project that have been made for seasonal conditions or other factors, where relevant.

Proponents should provide enough information and time to allow Aboriginal communities to provide meaningful feedback regarding the potential impacts of the project. Depending on the nature of consultation required for a project, a proponent also may be required to:

- provide the Crown with copies of any consultation plans prepared and an opportunity to review and comment;
- ensure that any necessary follow-up discussions with Aboriginal communities take place in a timely manner, including to confirm receipt of information, share and update information and to address questions or concerns that may arise;

- as appropriate, discuss with Aboriginal communities potential mitigation measures and/or changes to the project in response to concerns raised by Aboriginal communities;
- use language that is accessible and not overly technical, and translate material into Aboriginal languages where requested or appropriate;
- bear the reasonable costs associated with the consultation process such as, but not limited to, meeting hall rental, meal costs, document translation(s), or to address technical & capacity issues;
- provide the Crown with all the details about potential impacts on established or asserted Aboriginal or treaty rights, how these concerns have been considered and addressed by the proponent and the Aboriginal communities and any steps taken to mitigate the potential impacts;
- provide the Crown with complete and accurate documentation from these meetings and communications; and
- notify the Crown immediately if an Aboriginal community not identified by the Crown approaches the proponent seeking consultation opportunities.

b) What documentation and reporting does the Crown need from the proponent?

Proponents should keep records of all communications with the Aboriginal communities involved in the consultation process and any information provided to these Aboriginal communities.

As the Crown is required to assess the adequacy of consultation, it needs documentation to satisfy itself that the proponent has fulfilled the procedural aspects of consultation delegated to it. The documentation required would typically include:

- the date of meetings, the agendas, any materials distributed, those in attendance and copies of any minutes prepared;
- the description of the proposed project that was shared at the meeting;
- any and all concerns or other feedback provided by the communities;
- any information that was shared by a community in relation to its asserted or established Aboriginal or treaty rights and any potential adverse impacts of the proposed activity, approval or disposition on such rights;
- any proposed project changes or mitigation measures that were discussed, and feedback from Aboriginal communities about the proposed changes and measures;
- any commitments made by the proponent in response to any concerns raised, and feedback from Aboriginal communities on those commitments;
- copies of correspondence to or from Aboriginal communities, and any materials distributed electronically or by mail;

- information regarding any financial assistance provided by the proponent to enable participation by Aboriginal communities in the consultation;
- periodic consultation progress reports or copies of meeting notes if requested by the Crown;
- a summary of how the delegated aspects of consultation were carried out and the results; and
- a summary of issues raised by the Aboriginal communities, how the issues were addressed and any outstanding issues.

In certain circumstances, the Crown may share and discuss the proponent's consultation record with an Aboriginal community to ensure that it is an accurate reflection of the consultation process.

c) Will the Crown require a proponent to provide information about its commercial arrangements with Aboriginal communities?

The Crown may require a proponent to share information about aspects of commercial arrangements between the proponent and Aboriginal communities where the arrangements:

- include elements that are directed at mitigating or otherwise addressing impacts of the project;
- include securing an Aboriginal community's support for the project; or
- may potentially affect the obligations of the Crown to the Aboriginal communities.

The proponent should make every reasonable effort to exempt the Crown from confidentiality provisions in commercial arrangements with Aboriginal communities to the extent necessary to allow this information to be shared with the Crown.

The Crown cannot guarantee that information shared with the Crown will remain confidential. Confidential commercial information should not be provided to the Crown as part of the consultation record if it is not relevant to the duty to consult or otherwise required to be submitted to the Crown as part of the regulatory process.

V. WHAT ARE THE ROLES AND RESPONSIBILITIES OF ABORIGINAL COMMUNITIES' IN THE CONSULTATION PROCESS?

Like the Crown, Aboriginal communities are expected to engage in consultation in good faith. This includes:

- responding to the consultation notice;
- engaging in the proposed consultation process;
- providing relevant documentation;

- clearly articulating the potential impacts of the proposed project on Aboriginal or treaty rights; and
- discussing ways to mitigates any adverse impacts.

Some Aboriginal communities have developed tools, such as consultation protocols, policies or processes that provide guidance on how they would prefer to be consulted. Although not legally binding, proponents are encouraged to respect these community processes where it is reasonable to do so. Please note that there is no obligation for a proponent to pay a fee to an Aboriginal community in order to enter into a consultation process.

To ensure that the Crown is aware of existing community consultation protocols, proponents should contact the relevant Crown ministry when presented with a consultation protocol by an Aboriginal community or anyone purporting to be a representative of an Aboriginal community.

VI. WHAT IF MORE THAN ONE PROVINCIAL CROWN MINISTRY IS INVOLVED IN APPROVING A PROPONENT'S PROJECT?

Depending on the project and the required permits or approvals, one or more ministries may delegate procedural aspects of the Crown's duty to consult to the proponent. The proponent may contact individual ministries for guidance related to the delegation of procedural aspects of consultation for ministry-specific permits/approvals required for the project in question. Proponents are encouraged to seek input from all involved Crown ministries sooner rather than later.

Subject: Automatic reply: 205371 - Notice of Commencement for the Township of Cavan Monaghan Water Storage Environmental Assessment
Sent: 2025-04-15, 9:13:15 AM
From: Enviroinfo (ECCC)<Enviroinfo@ec.gc.ca>
To: Nikash Persaud

You don't often get email from enviroinfo@ec.gc.ca. Learn why this is important

[CAUTION EXTERNAL EMAIL] Make Sure that it is legitimate **before** Replying or Clicking on any links

*** English version will follow ***

Merci d'avoir communiqué avec le Centre de renseignements à la population d'Environnement et Changement climatique Canada.

Nous accusons réception de votre demande et vous répondrons dans les meilleurs délais.

Veuillez noter que les courriels contenant des injures, des grossièretés ou des menaces ne seront pas tolérés et ne recevront aucune réponse.

Pour les demandes de renseignements des médias, veuillez communiquer avec l'équipe des relations avec les médias d'Environnement et Changement climatique Canada par courriel à l'adresse media@ec.gc.ca ou par téléphone au 1-844-836-7799.
Nos bureaux sont ouverts du lundi au vendredi, de 8 h à 17 h 00, heure de l'Est, et sont fermés les jours fériés.

Pour signaler une urgence environnementale, composez le numéro de téléphone disponible 24 heures sur 24 de la province ou du territoire **dans lequel l'événement se produit**. Pour obtenir de plus amples renseignements, visitez le https://www.canada.ca/fr/environnement-changement-climatique/services/programme-urgences-environnementales/signaler-urgence.html

Centre de renseignements à la population
Environnement et Changement climatique Canada
enviroinfo@ec.gc.ca
1-800-668-6767

****

Thank you for contacting Environment and Climate Change Canada's Public Inquiries Centre.

We acknowledge receipt of your email and will get back to you as soon as possible.

Please note that emails containing profanity / foul language or threats will not be tolerated and will not be responded to.

For media enquiries, please contact Environment and Climate Change Canada's Media Relations team by email at media@ec.gc.ca or by phone at 1-844-836-7799.
Our offices are open Monday to Friday from 8:00 a.m. to 5:00 p.m., Eastern Time, and are closed on statutory holidays.

To report an environmental emergency: Call the 24-hour telephone number for the province or territory **where the event is occurring**. For more information, please visit: Report an Environmental Emergency.

Public Inquiries Centre
Environment and Climate Change Canada
enviroinfo@ec.gc.ca
1-800-668-6767

Subject: SPF violationAutomatic reply: 205371 - Notice of Commencement for the Township of Cavan Monaghan Water Storage Environmental Assessment
Sent: 2025-04-15, 9:12:55 AM
From: Webmaster Mailbox<webmaster.mailbox@enbridge.com>
To: Nikash Persaud

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Thanks for reaching out. This account is checked intermittently for messages.

If you believe you are witnessing a **pipeline emergency**, call 911 and then, if applicable, call the emergency number that you see on a pipeline marker.
If you are an **Enbridge Gas customer and you smell gas**, call **1-866-763-5427 (Ontario)** or **1-877-542-2630 (Ohio).**
If you are an Enbridge Gas customer in **Ontario** with account/billing/moving inquiries, please **call 1-877-362-7434 or visit https://www.enbridgegas.com/ontario/contact-us (Ontario)**.
If you are an Enbridge Gas customer in **Ohio** with account/billing/moving inquiries, please **call 1-800-362-7557 or visit https://www.dominionenergy.com/ohio/enbridge-update**
If you are seeking employment, please visit careers.enbridge.com to see a list of available job positions.
If you are looking for our Investor Relations department, please call 1-800-481-2804 or email investor.relations@enbridge.com.
If this is a media inquiry, please call 1-888-992-0997 or email media@enbridge.com.

Thank you,
Enbridge Webmaster

Subject: Automatic reply: Township of Cavan Monaghan, Environmental Assessment for Water Storage
Sent: 2025-04-15, 9:35:27 AM
From: EA Notices to ERegion (MECP)<eanotification.eregion@ontario.ca>
To: Nikash Persaud

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This is to acknowledge your email has been delivered to the Regional email account. A Regional EA Coordinator will contact you if additional information is needed. To speak directly to a Regional EA Coordinator, go to the INFO-GO website and under our ministry, select: 1) Drinking Water and Environmental Compliance Division 2) applicable Regional Office 3) Technical Support Section 4) Air, Pesticides, and Environmental Planning 5) Environmental Resource Planner & EA Coordinator

Subject: RE: 205371 - Notice of Commencement for the Township of Cavan Monaghan Water Storage Environmental Assessment
Sent: 2025-04-15, 11:33:28 AM
From: Bale, Sarah (MNR)<Sarah.Bale@ontario.ca>
To: Nikash Persaud
Attachments: MNR Southern Region Information Package – For External Proponent Environmental Assessments_Ver2.pdf

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[CAUTION EXTERNAL EMAIL] Make Sure that it is legitimate **before** Replying or Clicking on any links

Dear Nikash,

The Ministry of Natural Resources (MNR) received the Notice of Commencement for Millbrook Water Storage Class Environmental Assessment on April 15, 2025. Thank you for circulating this to our office.

MNR has prepared the attached **MNR Southern Region Information Package – For External Proponent Environmental Assessments** (Package) to help project proponents understand MNR's role as a commenting agency and interests related to environmental assessment within the Ministry's mandate. The Package also provides information on the Ministry's regulatory authority to issue authorizations, permits, licenses and/or approvals. The information provided is subject to change from time to time and it is the proponent's responsibility to ensure the information used to support project planning and compliance with *Environmental Assessment Act* requirements is current and accurate. It is the proponent's responsibility to be aware of, and comply with, all relevant federal or provincial legislation, municipal by-laws and/or other agency approvals.

Please note the ministry has not completed a screening of natural heritage or other resource values at this time. If no MNR interests are identified based on the information contained in this Package, there is no need to further circulate MNR as a commenting agency when undertaking consultation and review under the applicable EA process. If you have identified any MNR interests in your project planning and require additional technical information, or if you have questions about the content of this Package, please feel free to contact me, or SR.planning@ontario.ca.

Best Regards,

Sarah Bale
Regional Planner | Land Use Planning and Strategic Issues Section Southern Region
Ministry of Natural Resources | Ontario Public Service
613-504-2254 | sarah.bale@ontario.ca

Ontario

Taking pride in strengthening Ontario, its places and its people

From: Nikash Persaud <npersaud@rvanderson.com>
Sent: Tuesday, April 15, 2025 9:13 AM
Subject: 205371 - Notice of Commencement for the Township of Cavan Monaghan Water Storage Environmental Assessment

CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.

Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment.

This notice is sent to your attention as it was deemed that you may be an interested stakeholder.

Should you wish to stop receiving notices pertaining to this project or would like to direct them to an alternate recipient, please advise the undersigned.

Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
LinkedIn | Facebook | Website



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MNR SOUTHERN REGION INFORMATION PACKAGE – FOR EXTERNAL PROPONENT ENVIRONMENTAL ASSESSMENTS

MNR – SOUTHERN REGION – LUPSI

October 2024

How to Use This Information Package

Environmental Assessment (EA) is a planning and decision-making process used to promote environmentally responsible decision-making. In Ontario, this process is defined and is required pursuant to the *Environmental Assessment Act (EAA)*. The Ministry of Environment, Conservation and Parks (MECP) administers the *EAA*.

The Ministry of Natural Resources (MNR) may be asked by a proponent of a project subject to an EA or Class EA to participate as a commenting agency to ensure provincial interests within MNR's mandate are considered by the proponent in the project planning process.

Use of this Information Package "Package" is intended to help project proponents understand MNR's:

- role as a commenting agency and interests related to environmental assessment within the Ministry's mandate (refer Sections 1 through 8 of this document)
- regulatory authority to issue authorizations, permits, licenses and/or approvals (refer Appendix A – MNR Regulatory Role)

The information provided by MNR and the sources listed in this Package should not be considered exhaustive nor a substitute for consultation with other agencies, site visits and appropriate field studies. The information provided is subject to change from time to time and it is the proponent's responsibility to ensure the information used to support project planning and compliance with *EAA* requirements is current and accurate.

If no MNR interests are identified based on the information contained in this Package there is no need to further circulate MNR as a commenting agency when undertaking consultation and review under the applicable EA process. MNR Southern Region (via sr.planning@ontario.ca) may be contacted if there are any questions about the content of this Package or if specific technical information is required.

This Package is intended for use within MNR's Southern Region (SR) regional boundary only. To view the MNR SR regional boundary please see Ministry of Natural Resources and Forestry work centres | ontario.ca.

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1. MNR Mandate

MNR has a mandate to protect Ontario's biodiversity while promoting economic opportunities in the resource sector and supporting outdoor recreation opportunities by:

- Sustainably managing Ontario's fish and wildlife resources.
- Leading the management of Ontario's public (also referred to as Crown) lands, including the beds of navigable waters, oil, gas, salt and aggregate resources, and access to Crown land for renewable energy projects.
- Ensuring the sustainable management of Ontario's Crown forests.
- Protecting people, property and communities from forest fires, floods, and droughts.
- Developing and applying geographic information to help manage the province's natural resources.

MNR's regulatory role is triggered when a project proponent seeks an approval under legislation administered by the Ministry. Information on the Ministry's regulatory role under applicable legislation can be found in Appendix A.

2. MNR Role as Commenting Agency

MNR's role as a commenting agency on projects subject to *EAA* requirements is to:

- Assist and enable project proponents to access relevant technical and scientific information within the scope of MNR's mandate.
- Provide legislative / regulatory / policy information and direction regarding interests within MNR's mandate.
- Support the identification and consideration of the potential effects of a project on matters within MNR's mandate.
- Identify where the project proponent may need to seek MNR approvals regarding the project.

3. Provincial Planning Policies

Provincial plans together with the *Provincial Policy Statement, 2024* (PPS) issued under section 3(1) of the *Planning Act,* provide policy direction on matters of provincial interest related to land use planning and development in Ontario. The PPS and provincial plans contain policies specific to infrastructure projects.

A summary of matters related to MNR's mandate within specific infrastructure-related provincial planning policies can be found below. Please note, this is not an exhaustive list of provincial policies that may apply to a project and other MNR mandated interests may be applicable. It is the project proponent's responsibility to review the provincial plans and PPS,

which may be amended from time to time, to determine policies applicable to the proposed project.

Provincial Plan Mapping

Mapping of provincial plan boundaries and natural heritage areas as defined in individual provincial plans is available to view or download through Make A Map: Natural Heritage Areas or Ontario GeoHub (GeoHub) - Natural Heritage System Area.

Greenbelt Plan, 2017

Section 4.2.1.2 of the Greenbelt Plan contains policies which are designed to direct infrastructure away from, or where not possible, to minimize the impacts on the Natural Heritage and Water Resource Systems. It requires that new or expanding infrastructure "shall avoid *key natural heritage features, key hydrologic features or key hydrologic areas* unless need has been demonstrated and it has been established that there is no other reasonable alternative."

Niagara Escarpment Plan (NEP), 2017

The NEP is administered by the Niagara Escarpment Commission, the government agency mandated to develop, interpret, and apply NEP policies that maintain and enhance the Niagara Escarpment's unique environmental and landscape features. In addition to Make A Map: Natural Heritage Areas, mapping of NEP Escarpment Natural Areas and Escarpment Protection Areas may be obtained from your local municipality or the Niagara Escarpment Commission.

Oak Ridges Moraine Conservation Plan (ORMCP), 2017

Section 41 of the ORMCP contains policies specific to the development of new or the upgrading/extension of existing infrastructure. This policy direction includes where development shall not be permitted unless specified criteria have been satisfied (including where applicable that there is no other reasonable alternative) and establishes required documentation to support infrastructure projects. Specific conditions apply to proposed infrastructure development within a natural core area and infrastructure crossings of key natural heritage features.

Lake Simcoe Protection Plan (LSPP), 2009

Policy 6.23-DP of the LSPP directs that development or site alteration in relation to infrastructure shall not be permitted within a key natural heritage feature, a key hydrologic feature or within a related vegetation protection zone unless the need for the project has been demonstrated through an Environmental Assessment or other similar environmental approval and it has been demonstrated there is no reasonable alternative. Some exceptions may apply.

4. Fish, Wildlife and Natural Heritage

MNR's natural heritage and natural resources geospatial data layers can be accessed through the ministry's GeoHub and Natural Resources Data Access Requests | Ontario GeoHub. Please note, these Geospatial Ontario (formerly known as Land Information Ontario) GIS data layers available from MNR and the sources listed and linked on this webpage should not be considered as a substitute for site visits and appropriate field surveys. Generally, information available from MNR can be regarded as a starting point from which to conduct further field studies, if needed. While this data represents MNR's best available current information, it is important to note that a lack of information for a site does not mean that additional features and values are not present. There are many areas where MNR does not currently have information. On-site assessments can better verify site conditions, identify natural features and values and confirm presence of species at risk and/or their habitats.

The information below provides an overview of MNR's mandated interests in natural heritage to consider within the project study area. A detailed list of provincial technical guidance material used to identify significant natural heritage features in different landscapes can be found in Appendix B.

Fisheries

All permanent and intermittent watercourses and waterbodies have potential to contain fish habitat or contribute to fisheries resources. MNR is responsible for administering and enforcing the Ontario Fishery Regulations under the *Fisheries Act*.

When agency approvals are required for a proposed project, it is the responsibility of the authorizing regulatory agency to set any in-water work timing windows in their authorizations. These timing windows may be based on the MNR's In-water Work Timing Window Guidelines.

Areas of Natural and Scientific Interest

The study area should be screened for the presence of Areas of Natural and Scientific Interest (ANSI). ANSIs are lands and waters containing features that are important for natural heritage protection, scientific study, and education. ANSIs are identified and confirmed by MNR based on their representation of Ontario's significant geological and natural heritage features and are categorized as either Earth Science or Life Science.

Wetlands

Study areas that contain unevaluated or unmapped wet features should be investigated for the presence of wetlands. Wetlands are lands that are seasonally or permanently covered by shallow water, as well as lands where the water table is close to the surface. Wetlands may

vary in their significance, and the four major types of wetlands are swamps, marshes, bogs, and fens.

As of January 1, 2023, MNR no longer reviews and confirms wetland evaluations. MNR's role with respect to wetland evaluation includes providing the provincial framework under which wetlands in Ontario are evaluated for significance (OWES), and uploading digital wetland boundary mapping and wetland status into the Geospatial Ontario database.

Significant Wildlife Habitat

Study areas which may contain significant wildlife habitat should be investigated for its presence or absence. Significant wildlife habitat may include features such as: seasonal concentration areas for wildlife species (e.g., snake hibernaculum), rare vegetation communities (e.g., tallgrass prairie), specialized habitats of wildlife (e.g., turtle nesting and over-wintering areas), habitats of species of conservation concern (e.g., Special Concern species as identified on the Species at Risk in Ontario list) and animal movement corridors (e.g., amphibian movement corridors). Provincially tracked species data (generalized to Natural Heritage Information Centre 1 km screening grid) can be viewed in Natural Heritage Make a Map. Detailed geospatial data may be obtained through GeoHub via a data sharing agreement.

Please note, relying on online mapping tools only may not accurately reflect the presence or absence of significant wildlife habitat within the project study area. Surveys or additional site level assessment are often required to confirm presence or absence of natural heritage features and values.

Significant Woodlands

Project study areas that contain wooded areas should be investigated for the presence of significant woodlands. Significant woodlands are areas that are ecologically important in terms of features such as species composition, age of trees and stand history; functionally important due to their contribution to the broader landscape; or economically important. Local planning authorities are responsible for identifying significant woodlands in accordance with criteria established by MNR.

Significant Valleylands

Project study areas that occur in a valley or other landform depression that has water for some period of the year should be investigated for the presence of significant valleylands. The identification of valleyland significance is the responsibility of the local planning authority. MNR recommends criteria for determination of valleyland significance.

5. Natural Hazards

In Ontario, development is generally directed away from areas impacted by natural hazards to prevent risks from inappropriate development on and around these lands and to ensure that the risks to public health and safety are minimized. Keeping people and property out of harm's way is a cost-effective, socially responsible, and proactive approach to addressing natural hazards. Various policies and programs direct people and development outside of natural hazard areas.

Responsibility for natural hazard management and implementation of programs and policies for most natural hazards has been delegated to municipalities and Conservation Authorities (CA) where they exist. MNR supports implementation of natural hazard policies by local municipalities and CAs by providing a series of natural hazard technical guidelines (see Appendix B).

Hazardous Lands (flooding, erosion and dynamic beach hazards)

The project location should be reviewed for the presence of hazardous lands. These may include lands subject to flooding and/or erosion and dynamic beaches. These lands become hazardous when people and property locate in these areas. The local municipality and CA should be contacted for further guidance where required.

Special Policy Areas

Some localized areas of the province may be subject to an approved Special Policy Area (SPA), as defined by the PPS. If the study area is located within or adjacent to a SPA, special consideration for any impacts to the flood plain and site-specific SPA policies may be necessary. Any proposed change or modification to the official plan policies, land use designations or boundaries applying to SPA lands, requires joint approval by the Ministers of the Ministry of Municipal Affairs and Housing (MMAH) and MNR.

Local official plans may be reviewed to identify the presence of SPAs within the study area. MNR may have additional information regarding SPAs which can be made available upon request.

Where applicable, information should be identified at the EA stage regarding any expected changes to the floodplain or potential modifications to the SPA subject to provincial approval.

Hazardous Sites (unstable soils and bedrock)

The project location should be reviewed for the presence of hazardous sites. These may include unstable soils (sensitive marine clays [leda], organic soils) or unstable bedrock (karst topography). General information and mapping tools available to assist in identifying the

potential presence of hazardous sites (e.g., karst and organic soils) include, but are not limited to:

- GeologyOntario (gov.on.ca) is maintained by the Ministry of Mines and provides access to all Ontario Geological Survey maps, reports and digital datasets.
- Wetland mapping
- Soil information and mapping maintained by the Ministry of Agriculture, Food and Rural Affairs is available at Soil Survey Complex (GeoON) or AgMaps

Hazardous Forest Types for Wildland Fire

Project study areas containing wooded areas should be screened for the presence of hazardous forest types for wildland fire. Data to identify potential areas that meet this definition can be found in GeoHub - Potential Hazardous Forest Types for Wildland Fire. Note that this data layer is based on forest type data at a coarse scale. Complete assessment of risk and determination of appropriate mitigation measures can only be done with confidence on a site-specific basis.

6. Oil, Gas and Salt Resources

Oil, gas or salt wells are regulated under the *Oil, Gas and Salt Resources Act*, and the supporting regulations and operating standards.

To help determine the presence of petroleum wells within the proposed project area, basic mapping information can be found through the GeoHub portal or the Ontario Oil, Gas and Salt Resources Library (www.ogsrlibrary.com). The 'Definitions and Terminology Guide' listed in the publications section on the library website may provide a better understanding of the well and resource information available.

The Ontario Petroleum Institute (OPI) is an industry association that can assist with retaining the services of a consultant who can provide information about the potential resources located below the property.

If any unanticipated petroleum wells or associated works are encountered during a project, the proponent should cease work immediately and contact MNR's Petroleum Operations Section (POS) to further understand the proponent's obligations under the *Oil, Gas and Salt Resources Act*. The POS may be contacted at POSRecords@ontario.ca or 519-873-4634. In the event of a spill, the project proponent should report it to the Spills Action Centre at 416-325-3000, 1-800-268-6060 (toll free), or 1-855-889-5775 (TTY).

7. Mineral Aggregate Resources

Mineral aggregate resources are usually sand, gravel, clay, earth and bedrock. They are used to make roads, subway tunnels, homes and other structures. Mineral aggregate resources are a non-renewable resource that exist in fixed locations.

MNR has an interest in protecting mineral aggregate resources from incompatible development so they may continue to be available for future extraction. Data to map known deposits of mineral aggregate resources is available from Geology Ontario at GeologyOntario (gov.on.ca).

Project proponents should consider mineral aggregate resources by screening for existing aggregate operations at Find Pits and Quarries | ontario.ca, and consider any potential to preclude or hinder operations and the use of aggregate resource deposits through incompatible development.

8. Crown Lands, Lakes, Rivers and Forests

MNR manages public lands including the beds of most lakes and rivers. Some activities on shore lands (both public and private) are also managed by the MNR.

Public land boundaries (mapping is representative only) and applicable Crown land use policies can be viewed at Crown Land Use Policy Atlas | ontario.ca. Provincial parks and conservation reserves are managed by MECP under the *Provincial Parks and Conservation Reserves Act*.

MNR manages the health of Crown forests so they may continue to provide ecological, economic, and social benefits. Most of Ontario's Crown forests are managed by forest companies under 20-year Sustainable Forest Licences. These companies are responsible for working with government and others to prepare and implement a forest management plan for their licence area, monitoring compliance with the plan and renewing the forest after harvesting trees.

9. Conclusion

The list of interests within MNR's mandate described in this document is not exhaustive. For additional information on legislation and programs the ministry administers see Ministry of Natural Resources | ontario.ca.

If you have identified any MNR interests in your project planning and require additional information, please direct your specific questions to the designated Regional Planner for the project, or to SR.planning@ontario.ca.

Appendix A – MNR Regulatory Role

MNR's regulatory role is triggered when a project proponent seeks an approval under legislation administered by the Ministry. This Appendix provides information about some of the more commonly applicable approvals issued by MNR. Please note, MNR may not be able to confirm the requirement for an approval until a detailed project and site plan have been provided to the Ministry.

A proposal for an MNR approval may engage the ministry's duty to consult Indigenous peoples.

Where MNR is considering an application, the ministry must also ensure its own obligations under the *EAA* are satisfied prior to a final decision. Where an approval would dispose of rights to Crown Resources for a project that has already completed *EAA* requirements under another process, MNR will require written documentation from the applicant setting out how *EAA* requirements for the project have been met prior to MNR issuing any requested approval.

Fish and Wildlife Conservation Act

The *Fish and Wildlife Conservation Act, 1997* regulates the relocation of fish and wildlife. Accordingly, should a project require:

- The relocation of fish outside of the work area, a Licence to Collect Fish for Scientific Purposes will be required.
- The relocation of wildlife outside of the work area (including amphibians, reptiles, and small mammals), will require a Wildlife Collector's Authorization.
- The destruction, taking or possession of any nests or eggs of species not protected by the *Migratory Birds Convention Act (*MBCA*)* or excluded under section 7(2) of the FWCA may also require a Wildlife Collector's Authorization.

To learn more about the management of Fish and Wildlife in Ontario, or to apply for permits or licenses, please visit the Natural Resources Information Portal.

Aggregate Resources Act

The *Aggregate Resources Act* (ARA) is the primary legislative framework for regulating aggregate resource extraction in Ontario. The MNR administers the *ARA* and issues licenses, permits and approves amendments to existing approvals. Information on existing pits and quarries and when an aggregate permit or license may be required can be accessed from MNR's Aggregates Section or GeoHub – Additional Resources

Lakes and Rivers Improvement Act

The *Lakes and Rivers Improvement Act* (LRIA) provides the MNR with regulatory authority over the design, construction, operation, maintenance and safety of dams in Ontario. For

information regarding when a MNR approval may be required and how the LRIA is administered by the Ministry visit Lakes and Rivers Improvement Act administrative guide | ontario.ca

Public Lands Act

The use of public land and shore lands are regulated under the *Public Lands Act*. A work permit must be obtained from MNR to undertake certain activities on public land and shore lands. To occupy public lands in Ontario, you must receive prior approval from MNR unless the use is permitted by regulation. Visit Natural Resources Information Portal for information on when a permit or approval is required and how to submit an application.

Crown Forest Sustainability Act

Any activities that involve a proposal to cut Crown forest resources (e.g., trees on Crown land) may require approval under the *Crown Forest Sustainability Act, 1994.*

Appendix B – Technical Guides

The following technical guides are the province's best available information to support identification of significant natural heritage features in different landscapes:

- Natural Heritage Reference Manual (2010)
- Greenbelt Technical Paper (2005)
- Oak Ridges Moraine Technical Paper 1 (Natural Heritage Features)
- Oak Ridges Moraine Technical Paper 2 (Significant Wildlife Habitat)
- Oak Ridges Moraine Technical Paper 7 (Significant Woodlands)
- Lake Simcoe Protection Plan Technical Paper
- Ontario Wetland Evaluation System (OWES)
- Significant Wildlife Habitat Technical Guide
    - Ecoregion Criterion Schedules for the identification of Significant Wildlife Habitat
        - Ecoregion 5E
        - Ecoregion 6E
        - Ecoregion 7E
    - Significant Wildlife Habitat Mitigation Support Tool (MiST)

Other supporting information may be found at Ontario GeoHub or Natural Resources Data Access Requests | Ontario GeoHub.

The following technical guides are the province's best available information to support implementation of MNR's interest in natural hazards (contact MNR to request pdf copies):

- Understanding Natural Hazards (2001)
- Special Policy Areas Procedures (2009)
- Technical Guide – River & Stream Systems: Flooding Hazard Limit (2002)
- Technical Guide – River & Stream Systems: Erosion Hazard Limit (2002)
- Great Lakes-St. Lawrence River Shorelines: Flooding, Erosion and Dynamic Beaches (2001)
- Technical Guide for Large Inland Lakes Shorelines: Flooding, Erosion and Dynamic Beaches (1996)
- Hazardous Sites Technical Guide (1996)
- Technical Bulletin: Flooding Hazards: Data Survey and Mapping Specifications (2023)
- Wildland Fire Risk Assessment and Mitigation Reference Manual (2017)

The following technical guide is the province's best available information supporting implementation of MNR's mandated interest in mineral aggregate resources (contact MNR to request pdf copy):

- Non-renewable Resources Training Manual (1997)

Subject: RE: [External/Externe]: 205371 - Notice of Commencement for the Township of Cavan Monaghan Water Storage Environmental Assessment
Sent: 2025-04-15, 1:53:54 PM
From: ONT Environment / Environnement ONT<EnviroOnt@tc.gc.ca>
To: Nikash Persaud

You don't often get email from enviroont@tc.gc.ca. Learn why this is important

[CAUTION EXTERNAL EMAIL] Make Sure that it is legitimate **before** Replying or Clicking on any links

Greetings,

Thank you for your correspondence.

Please note Transport Canada does not require receipt of all Individual or Class EA related notifications. We request that project proponents self-assess whether their project:

1. Will interact with a federal property and/or waterway by reviewing the Directory of Federal Real Property, available at at www.tbs-sct.gc.ca/dfrp-rbif/; **and**
2. Will require approval and/or authorization under any Acts administered by Transport Canada* available at http://www.tc.gc.ca/eng/acts-regulations/menu.htm.

Proposed projects that will occur on federal property (including reserve lands or lands owned by federal departments other than Transport Canada) will be subject to an Impact Assessment per Section 82 of the *Impact Assessment Act, 2019* prior to exercising a federal power (including full or partial funding), and/or performing a function or duty (e.g. regulatory approval or issuance of a lease) in relation to that project.

If the criteria above do not apply, Transport Canada's Environmental Assessment program should not be included in any further correspondence, and future notifications will not receive a response. If there is a role under the program, correspondence should be forwarded to: EnviroOnt@tc.gc.ca with a **brief description of Transport Canada's expected role**.

*Below is a summary of the most common Acts that apply to projects in an Environmental Assessment context:

Canadian Navigable Waters Act (CNWA) – the Act applies primarily to works constructed or placed in, on, over, under, through, or across navigable waters set out under the Act. The Navigation Protection Program administers the CNWA through the review and authorization of works affecting navigable waters. Information about the Program, CNWA and approval process is available at: http://www.tc.gc.ca/eng/programs-621.html. Inquiries can be directed to NPPONT-PPNONT@tc.gc.ca or by calling (519) 383-1863.

Railway Safety Act (RSA) – the Act provides the regulatory framework for railway safety, security, and some of the environmental impacts of railway operations in Canada. The Rail Safety Program develops and enforces regulations, rules, standards and procedures governing safe railway operations. Additional information about the Program is available at: https://www.tc.gc.ca/eng/railsafety/menu.htm. Inquiries can be directed to RailSafety@tc.gc.ca or by calling (613) 998-2985.

Transportation of Dangerous Goods Act (TDGA) – the transportation of dangerous goods by air, marine, rail and road is regulated under the TDGA. Transport Canada, based on risks, develops safety standards and regulations, provides oversight and gives expert advice on dangerous goods to promote public safety. Additional information about the transportation of dangerous goods is available at: https://www.tc.gc.ca/eng/tdg/safety-menu.htm. Inquiries can be directed to TDG-TMDOntario@tc.gc.ca or by calling (416) 973-1868.

Aeronautics Act – this Act and the associated Canadian Aviation Regulations (CARs) govern civil aviation in Canada. Transport Canada should be notified of projects involving aerodromes and associated structures, or activities that could affect aviation safety. Elevated structures, such as wind turbines and communication towers, are examples of projects that must be assessed for lighting and marking requirements in accordance with the CARs. Transport Canada also has an interest in projects that have the potential to cause interference between wildlife and aviation activities. One example would be waste facilities, which may attract birds into commercial and recreational flight paths. Additional guidance can be found in the *Land Use In The Vicinity of Aerodromes* publication, available at: https://www.tc.gc.ca/eng/civilaviation/publications/tp1247-menu-1418.htm. Information about Transport Canada's

Civil Aviation program can be found at: https://tc.canada.ca/en/aviation. Inquires can be directed to aviation.ont@tc.gc.ca or by calling 1 (800) 305-2059 / (416) 952-0230.

Please advise if additional information is needed.

Thank you,

Environmental Assessment Program, Ontario Region
Transport Canada / Government of Canada / 4900 Yonge St., Toronto, ON M2N 6A5
EnviroOnt@tc.gc.ca

Programme d'évaluation environnementale, Région de l'Ontario
Transports Canada / Gouvernement du Canada / 4900, rue Yonge, Toronto, ON, M2N 6A5
EnviroOnt@tc.gc.ca

From: Nikash Persaud <npersaud@rvanderson.com>
Sent: Tuesday, April 15, 2025 9:13 AM
Subject: [External/Externe]: 205371 - Notice of Commencement for the Township of Cavan Monaghan Water Storage Environmental Assessment

Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment.

This notice is sent to your attention as it was deemed that you may be an interested stakeholder.

Should you wish to stop receiving notices pertaining to this project or would like to direct them to an alternate recipient, please advise the undersigned.

Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
LinkedIn | **Facebook** | **Website**

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Subject: FW: MCM Response - Cavan Monaghan - Water Storage Environmental Assessment [MCM File 0023442]
Sent: 2025-04-25, 9:34:20 AM
From: Nikash Persaud<npersaud@rvanderson.com>
To: Maia Mandel
Attachments: 2025-04-25_CavanMonaghan_MillbrookWaterStorage_MCM_InitialLetter.pdf
2025-04-15 CavanMonaghan_WaterStorage_NofCommencement.pdf

Review the letter and file. Please and thanks!

From: Kaufman, Jackson (MCM) <Jackson.Kaufman@ontario.ca>
Sent: April 25, 2025 9:33 AM
To: Nikash Persaud <npersaud@rvanderson.com>
Cc: Barboza, Karla (She/Her) (MCM) <Karla.Barboza@ontario.ca>; Minkin, Dan (MHSTCI) <dan.minkin@ontario.ca>; whancock@cavanmonaghan.net
Subject: MCM Response - Cavan Monaghan - Water Storage Environmental Assessment [MCM File 0023442]

You don't often get email from jackson.kaufman@ontario.ca. Learn why this is important

[CAUTION EXTERNAL EMAIL] Make Sure that it is legitimate **before** Replying or Clicking on any links

Good morning, Nikash Persaud,

Thank you for providing the Ministry of Citizenship and Multiculturalism (MCM) with the Notice of Commencement for the above referenced project.

MCM's initial letter on this project is attached. Please do not hesitate to contact us if you have any questions or require additional information.

Kind regards,

Jackson Kaufman
Heritage Planner | Heritage Operations Branch / Citizenship, Inclusion and Heritage Division
Ministry of Citizenship and Multiculturalism | Ontario Public Service
613-242-3743 | jackson.kaufman@ontario.ca

Ontario

Taking pride in strengthening Ontario, its places and its people

---

From: Nikash Persaud <npersaud@rvanderson.com>
Sent: Tuesday, April 15, 2025 9:13 AM
Subject: 205371 - Notice of Commencement for the Township of Cavan Monaghan Water Storage Environmental Assessment

Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment.

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Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

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2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
LinkedIn | **Facebook** | **Website**

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Ministry of Citizenship and Multiculturalism

Heritage Planning Unit
Heritage Operations Branch
Citizenship, Inclusion and Heritage Division
5th Flr, 400 University Ave
Toronto, ON M5G 1S7
Tel.: 416-786-7553

Ministère des Affaires civiques et du Multiculturalisme

Planification relative au patrimoine
Opérations relatives au patrimoine
Division des affaires civiques, de l'inclusion et du patrimoine
5e étage, 400, av. University
Toronto, ON M5G 1S7
Tél.: 416-786-7553

April 25, 2025 EMAIL ONLY

Nikash Persaud
Coordinator, Environmental Assessments
R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
npersaud@rvanderson.com

MCM File	**:**	**0023442**
Proponent	**:**	**Township of Cavan Monaghan**
Subject	**:**	**Municipal Class Environmental Assessment – Schedule B – Notice of Commencement**
Project	**:**	**Millbrook Water Storage**
Location	**:**	**Township of Cavan Monaghan, County of Peterborough**

Dear Nikash Persaud:

Thank you for providing the Ministry of Citizenship and Multiculturalism (MCM) with the Notice of Commencement for the above-referenced project.

MCM's interest in this project relates to its mandate of conserving Ontario's cultural heritage, which includes:

- archaeological resources, including land and marine;
- built heritage resources, including bridges and monuments; and
- cultural heritage landscapes.

Under the EA process, the proponent is required to determine a project's potential impact on known (previously recognized) and potential cultural heritage resources.

Project Summary
The Township of Cavan Monaghan recently completed a Water and Wastewater Master Servicing Study (MSS), under the Municipal Class Environmental Assessment (Class EA) framework. As part of this study, a preferred alternative for the water storage aspect was to increase the water storage volume and accommodate Millbrook's forecasted growth. The preferred alternative was to have additional water storage at a new location and retain the existing standpipe by the Municipal Office. The purpose of the study is to confirm the location, capacity, and storage type

for the new storage solution. The study will follow the Schedule 'B' Municipal Class EA process as set out by the Municipal Engineers Association (October 2000 amended in 2007, 2011, 2015, 2023 and 2024).

The Township of Cavan Monaghan will be considering and evaluating suitable sites for the construction of a new water storage tank within Millbrook's Settlement Area Boundary. The Township will look at the existing water system to identify any necessary improvements and impacts that the construction of the tank may have on the potential sites.

Identifying Cultural Heritage Resources
While some cultural heritage resources may have already been formally identified, others may be identified through screening and evaluation.

Archaeological Resources
This EA project may impact archaeological resources and should be screened using the Ministry's *Criteria for Evaluating Archaeological Potential* and *Criteria for Evaluating Marine Archaeological Potential* (if shoreline or in-water works are proposed) to determine if an archaeological assessment is needed.

If the EA project area exhibits archaeological potential, then an archaeological assessment (AA) shall be undertaken by an archaeologist licenced under the *Ontario Heritage Act (OHA)*, who is responsible for submitting the report directly to MCM for review.

Built Heritage Resources and Cultural Heritage Landscapes
The Ministry's *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes* should be completed to help determine whether this EA project may impact known or potential built heritage resources and/or cultural heritage landscapes.

If there is potential for built heritage resources and/or cultural heritage landscapes within the project area, then a Cultural Heritage Report: Existing Conditions and Preliminary Impact Assessment should be undertaken for the entire study area during the planning phase and will be summarized in the EA Report. This study will:

1. Describe the existing baseline cultural heritage conditions within the study area by identifying all known or potential built heritage resources and cultural heritage landscapes, including a historical summary of the study area. The Ministry has developed a screening checklist that may assist with this exercise: *Criteria for Evaluating for Potential Built Heritage Resources and Cultural Heritage Landscapes*.

2. Identify preliminary potential project-specific impacts on the known and potential built heritage resources and cultural heritage landscapes that have been identified. The report should include a description of the anticipated impact to each known or potential built heritage resource or cultural heritage landscape that has been identified.

3. Recommend measures to avoid or mitigate potential negative impacts to known or potential built heritage resources and cultural heritage landscapes. The proposed mitigation measures are to inform the next steps of project planning and design.

Given that this project covers a large study area, MCM recommends that the Cultural Heritage Report is carried out so that step 1 described above is undertaken early in the planning process. Then, steps 2 and 3 can be undertaken once the preferred alternatives have been selected.

Cultural Heritage Reports will be undertaken by a qualified person who has expertise, recent experience, and knowledge relevant to the type of cultural heritage resources being considered and the nature of the activity being proposed.

Community input should be sought to identify locally recognized and potential cultural heritage resources. Sources include, but are not limited to, municipal heritage committees, historical societies and other local heritage organizations.

Cultural heritage resources are often of critical importance to Indigenous communities. Indigenous communities may have knowledge that can contribute to the identification of cultural heritage resources, and we suggest that any engagement with Indigenous communities includes a discussion about known or potential cultural heritage resources that are of value to them.

Environmental Assessment Reporting
All technical cultural heritage studies and their recommendations are to be addressed and incorporated into EA projects. Please advise MCM whether any technical cultural heritage studies will be completed for this EA project, and provide them to MCM before issuing a Notice of Completion or commencing any work on the site. If screening has identified no known or potential cultural heritage resources, or no impacts to these resources, please include the completed checklists and supporting documentation in the EA report or file.

Please note that the responsibility for administration of the *Ontario Heritage Act* and matters related to cultural heritage have been transferred from the Ministry of Tourism, Culture and Sport (MTCS) to the Ministry of Citizenship and Multiculturalism (MCM). Individual staff roles and contact information remain unchanged. Please continue to send any notices, report and/or documentation **via email only** to both Karla Barboza and Dan Minkin.

- Karla Barboza, Team Lead - Heritage | Heritage Planning Unit (Citizenship and Multiculturalism) | 416-660-1027 | karla.barboza@ontario.ca
- Dan Minkin, Heritage Planner | Heritage Planning Unit (Citizenship and Multiculturalism) | 416-786-7553| dan.minkin@ontario.ca

Thank you for consulting MCM on this project and please continue to do so throughout the EA process. If you have any questions or require clarification, please do not hesitate to contact me.

Sincerely,
Jackson Kaufman
On behalf of

Dan Minkin
Heritage Planner
dan.minkin@ontario.ca

Copied to: Karla Barboza, Team Lead, Heritage Planning Unit, MCM
Wayne Hancock, Director of Public Works, Township of Cavan Monaghan

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out an archaeological assessment, in compliance with Section 48(1) of the *Ontario Heritage Act*.

The *Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33* requires that any person discovering human remains must cease all activities immediately and notify the police or coroner. If the coroner does not suspect foul play in the disposition of the

remains, in accordance with *Ontario Regulation 30/11* the coroner shall notify the Registrar, Ontario Ministry of Public and Business Service Delivery and Procurement, which administers provisions of that Act related to burial sites. In situations where human remains are associated with archaeological resources, the Ministry of Citizenship and Multiculturalism should also be notified (at archaeology@ontario.ca) to ensure that the archaeological site is not subject to unlicensed alterations which would be a contravention of the *Ontario Heritage Act*.

Subject: FW: 205371 - Notice of Commencement for the Township of Cavan Monaghan Water Storage Environmental Assessment
Sent: 2025-05-01, 1:31:06 PM
From: Nikash Persaud<npersaud@rvanderson.com>
To: Maia Mandel

Hi Maia – Please investigate, log and send a new NoC email to a new contact if required.

Thanks,
Nikash

From: Info Pubs <infopubs@sac-isc.gc.ca>
Sent: May 1, 2025 1:29 PM
To: Nikash Persaud <npersaud@rvanderson.com>
Subject: RE: 205371 - Notice of Commencement for the Township of Cavan Monaghan Water Storage Environmental Assessment

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Hello,

Thank you for contacting Indigenous Services Canada (ISC) and Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC).

I recommend that you communicate with the regional office. You can find their contact information online at :
https://www.sac-isc.gc.ca/eng/1100100016936/1534342668402

Sincerely,

Sally

Centre de contacts de demandes de renseignements du public / Direction générale de la gestion de l'information
Relations Couronne-Autochtones et Affaires du Nord Canada (RCAANC) et Services aux Autochtones Canada (SAC) / Gouvernement du Canada
infopubs@sac-isc.gc.ca / Tél. : 1-800-567-9604 / ATS: 1-866-553-0554

Public Enquiries Contact Centre / Information Management Branch
Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) and Indigenous Services Canada (ISC) / Government of Canada
infopubs@sac-isc.gc.ca / Tel. : 1-800-567-9604 / TTY: 1-866-553-0554

From: Nikash Persaud <npersaud@rvanderson.com>
Sent: Tuesday, April 15, 2025 9:13 AM
Subject: 205371 - Notice of Commencement for the Township of Cavan Monaghan Water Storage Environmental Assessment

Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment.

This notice is sent to your attention as it was deemed that you may be an interested stakeholder.

Should you wish to stop receiving notices pertaining to this project or would like to direct them to an alternate recipient, please advise the undersigned.

Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
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Subject: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre
Sent: 2025-09-12, 9:27:20 AM
From: Ayushmaan Juyal<ajuyal@rvanderson.com>
Cc: Nikash Persaud
Bcc: 'matthew.armstrong2@rcaanc-cirnac.gc.ca'; 'rene.damecour2@sac-isc.gc.ca'; 'shannon.doyle@sac-isc.gc.ca'; 'john.schmied@sac-isc.gc.ca'; 'tim.eryou@sac-isc.gc.ca'; 'pauline.haarmeyer@sac-isc.gc.ca'; 'ec.environfo.ec@canada.ca'; 'jack.hughes@ec.gc.ca'; 'louis.breton@ec.gc.ca'; 'Bita.Pejam@FedDevOntario.gc.ca'; 'EnviroOnt@tc.gc.ca'; 'Adam.Carr@infrastructureontario.ca'; 'erica.anderson@infrastructureontario.ca'; 'nick.cole@infrastructureontario.ca'; 'katherine.hotrum@infrastructureontario.ca'; 'omafra.eanotices@ontario.ca'; 'Karla.Barboza@ontario.ca'; 'Dan.Minkin@ontario.ca'; 'anna.david@ontario.ca'; 'laurie.miller@ontario.ca'; 'erick.boyd@ontario.ca'; 'catherine.warren@ontario.ca'; 'tamara.dolan@ontario.ca'; 'hal.leadlay@ontario.ca'; 'margaret.berube@ontario.ca'; 'eanotification.eregion@ontario.ca'; 'MEANoticesEAAB@ontario.ca'; 'jon.orpana@ontario.ca'; 'cmcpolice1@gmail.com'; 'cmcpolice@nexicom.net'; 'Director_Education@kprdsb.ca'; 'Linda_Burton@kprdsb.ca'; 'stacey_foss@kprdsb.ca'; 'joseph_newbery@kprdsb.ca'; 'sophia_wouters@kprdsb.ca'; 'bosb001@nexicom.net'; 'chair@millbrookbia.com'; 'jeffery_white@kprdsb.ca'; 'jayne_patterson@kprdsb.ca'; 'cpadm@aoninc.com'; 'laurie.scottco@pc.ola.org'; 'mcarter@otonabeeconservation.com'; 'gearle@otonabeeconservation.com'; 'dallin@otonabeeconservation.com'; 'otonabeeca@otonabeeconservation.com'; 'webmaster-corp@enbridge.com'; 'CustomerRelations@HydroOne.com'; 'SecondaryLandUse@HydroOne.com'; 'gconlin@nexicomgroup.net'; 'aadnc.infopubs.aandc@canada.ca'
Attachments: 205371-20250911 - Cavan Monaghan Water Storage EA Notice of PIC-AODA.pdf

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Hello,

On behalf of the Township of Cavan Monaghan please see the Notice of Public Information Centre for the Class Environmental Assessment for Water Storage in Millbrook.

You are receiving this email because of your previous interest in the completed Master Servicing Study Class Environmental Assessment project. If you would no longer like to be on the stakeholder list, please respond indicating so and your email will be removed from the list.

Regards,

Ayushmaan Juyal (He/Him)
Student Engineer

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
m 416 497 8600 x1262
LinkedIn | Facebook | Website

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Subject: FW: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre
Sent: 2025-09-15, 10:29:49 AM
From: MNRF PET (MNR)<MNRF.PET@ontario.ca>
To: Southern Region Planning Inbox (MNR)
Cc: Ayushmaan Juyal
Attachments: 205371-20250911 - Cavan Monaghan Water Storage EA Notice of PIC-AODA.pdf

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Good morning!

This notice is for your section.

Kind regards,

Peterborough Work Centre
Peterborough Bancroft District
Ontario Ministry of Natural Resources | Ontario Public Service
Phone: 705-755-2001 | mnrf.pet@ontario.ca

300 Water Street, 1st Floor, South Tower
Peterborough, ON K9J 3C7

Ontario

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Please note: As part of providing accessible customer service, if you have any accommodation needs, require communication supports, or alternate formats please let us know.

From: Dolan, Tamara (MNR) <Tamara.Dolan@ontario.ca>
Sent: September 15, 2025 7:57 AM
To: MNRF PET (MNR) <MNRF.PET@ontario.ca>
Subject: FW: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre

FYI

From: Ayushmaan Juyal <ajuyal@rvanderson.com>
Sent: September 12, 2025 9:27 AM
Cc: Nikash Persaud <npersaud@rvanderson.com>
Subject: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre

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Hello,

On behalf of the Township of Cavan Monaghan please see the Notice of Public Information Centre for the Class Environmental Assessment for Water Storage in Millbrook.

You are receiving this email because of your previous interest in the completed Master Servicing Study Class Environmental Assessment project. If you would no longer like to be on the stakeholder list, please respond indicating so and your email will be removed from the list.

Regards,

Ayushmaan Juyal (He/Him)
Student Engineer

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
m 416 497 8600 x1262
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Subject: Millbrook Water Storage Municipal Class EA - Infrastructure Ontario comments
Sent: 2025-10-02, 10:33:59 AM
From: Kelly, Tate(IO)<Tate.Kelly@infrastructureontario.ca>
To: whancock@cavanmonaghan.net; Nikash Persaud
Attachments: 205371-20250820---Water-Storage-EA-PIC-Slides_v7.pdf

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Categories: Filed by Newforma

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Hello Wayne and Nikash,

Although I was unable to attend the PIC on September 24th, I have reviewed the presentation online and note that Location #5, the provincially owned property northwest of King Street and Queen Street (Teranet PIN 28012-0263), was screened out due to the reasons noted on page 10 of the attached presentation.

As IO is responsible for the strategic management of the provincial realty portfolio on behalf of the Ministry of Infrastructure, with the mandate of protecting and optimizing the value of the portfolio, while ensuring real estate decisions reflect public policy objectives, I would appreciate if the Township and R.V. Anderson Associates Ltd. could please notify me if the review of alternatives changes and Location #5 is further studied, although it seems unlikely from what I gather in the presentation.

Thanks for your time,
Tate

Infrastructure Ontario

Tate Kelly, MCIP RPP
Infrastructure Ontario
Senior Planner, Portfolio Planning & Pre-Construction Services

tate.kelly@infrastructureontario.ca
Mobile: 416.578.8783

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Subject: RE: Millbrook Water Storage Municipal Class EA - Infrastructure Ontario comments
Sent: 2025-10-10, 3:48:47 PM
From: Kelly, Tate(IO)<Tate.Kelly@infrastructureontario.ca>
To: Nikash Persaud
Cc: whancock@cavanmonaghan.net

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Thanks, Nikash.

From: Nikash Persaud <npersaud@rvanderson.com>
Sent: October 10, 2025 3:06 PM
To: Kelly, Tate(IO) <Tate.Kelly@infrastructureontario.ca>
Cc: whancock@cavanmonaghan.net
Subject: RE: Millbrook Water Storage Municipal Class EA - Infrastructure Ontario comments

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Hi Tate,

I can confirm based on our evaluation that Location #5 is screened out as a possible location for Water Storage. It is extremely unlikely that that will change. Regardless, if anything comes up related to Location #5 for the rest of our study, I will keep you in the loop.

Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
LinkedIn | **Facebook** | **Website**

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From: Kelly, Tate(IO) <Tate.Kelly@infrastructureontario.ca>
Sent: October 2, 2025 10:34 AM
To: whancock@cavanmonaghan.net; Nikash Persaud <npersaud@rvanderson.com>
Subject: Millbrook Water Storage Municipal Class EA - Infrastructure Ontario comments

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[CAUTION EXTERNAL EMAIL] Make Sure that it is legitimate **before** Replying or Clicking on any links

Hello Wayne and Nikash,

Although I was unable to attend the PIC on September 24th, I have reviewed the presentation online and note that Location #5, the provincially owned property northwest of King Street and Queen Street (Teranet PIN 28012-0263), was screened out due to the reasons noted on page 10 of the attached presentation.

As IO is responsible for the strategic management of the provincial realty portfolio on behalf of the Ministry of Infrastructure, with the mandate of protecting and optimizing the value of the portfolio, while ensuring real estate decisions reflect public policy objectives, I would appreciate if the Township and R.V. Anderson Associates Ltd. could please notify me if the review of alternatives changes and Location #5 is further studied, although it seems unlikely from what I gather in the presentation.

Thanks for your time,
Tate



Tate Kelly, MCIP RPP
Infrastructure Ontario
Senior Planner, Portfolio Planning & Pre-Construction Services

tate.kelly@infrastructureontario.ca
Mobile: 416.578.8783

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Subject: RE: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre
Sent: 2025-09-12, 10:07:29 AM
From: Hughes,Jack (ECCC)<Jack.Hughes@ec.gc.ca>
To: Ayushmaan Juyal

You don't often get email from jack.hughes@ec.gc.ca. Learn why this is important

[CAUTION EXTERNAL EMAIL] Make Sure that it is legitimate **before** Replying or Clicking on any links

Please remove my email address from the list

Thank you

Jack Hughes

From: Ayushmaan Juyal <ajuyal@rvanderson.com>
Sent: September 12, 2025 9:27 AM
Cc: Nikash Persaud <npersaud@rvanderson.com>
Subject: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre

You don't often get email from ajuyal@rvanderson.com. Learn why this is important

Hello,

On behalf of the Township of Cavan Monaghan please see the Notice of Public Information Centre for the Class Environmental Assessment for Water Storage in Millbrook.

You are receiving this email because of your previous interest in the completed Master Servicing Study Class Environmental Assessment project. If you would no longer like to be on the stakeholder list, please respond indicating so and your email will be removed from the list.

Regards,

Ayushmaan Juyal (He/Him)
Student Engineer

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
m 416 497 8600 x1262
LinkedIn | **Facebook** | **Website**

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Subject: RE: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre
Sent: 2025-09-12, 10:00:56 AM
From: ONT Environment / Environnement ONT<EnviroOnt@tc.gc.ca>
To: Ayushmaan Juyal

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[CAUTION EXTERNAL EMAIL] Make Sure that it is legitimate **before** Replying or Clicking on any links

UNCLASSIFIED / NON CLASSIFIÉ

Hello,

Thank you for your email.

Please note Transport Canada does not require receipt of all Individual or Class EA related notifications. We request that project proponents self-assess whether their project:

1. Will interact with a federal property and/or waterway by reviewing the Directory of Federal Real Property, available at at www.tbs-sct.gc.ca/dfrp-rbif/; **and**
2. Will require approval and/or authorization under any Acts administered by Transport Canada* available at http://www.tc.gc.ca/eng/acts-regulations/menu.htm.

Proposed projects that will occur on federal property (including reserve lands or lands owned by federal departments other than Transport Canada) will be subject to an Impact Assessment per Section 82 of the *Impact Assessment Act, 2019* prior to exercising a federal power (including full or partial funding), and/or performing a function or duty (e.g. regulatory approval or issuance of a lease) in relation to that project.

If the criteria above do not apply, Transport Canada's Environmental Assessment program should not be included in any further correspondence, and future notifications will not receive a response. If there is a role under the program, correspondence should be forwarded to: EnviroOnt@tc.gc.ca with a **brief description of Transport Canada's expected role**.

*Below is a summary of the most common Acts that apply to projects in an Environmental Assessment context:

Canadian Navigable Waters Act (CNWA) – the Act applies primarily to works constructed or placed in, on, over, under, through, or across navigable waters set out under the Act. The Navigation Protection Program administers the CNWA through the review and authorization of works affecting navigable waters. Information about the Program, CNWA and approval process is available at: http://www.tc.gc.ca/eng/programs-621.html. Inquiries can be directed to NPPONT-PPNONT@tc.gc.ca or by calling (519) 383-1863.

Railway Safety Act (RSA) – the Act provides the regulatory framework for railway safety, security, and some of the environmental impacts of railway operations in Canada. The Rail Safety Program develops and enforces regulations, rules, standards and procedures governing safe railway operations. Additional information about the Program is available at: https://www.tc.gc.ca/eng/railsafety/menu.htm. Inquiries can be directed to RailSafety@tc.gc.ca or by calling (613) 998-2985.

Transportation of Dangerous Goods Act (TDGA) – the transportation of dangerous goods by air, marine, rail and road is regulated under the TDGA. Transport Canada, based on risks, develops safety standards and regulations, provides oversight and gives expert advice on dangerous goods to promote public safety. Additional information about the transportation of dangerous goods is available at:

https://www.tc.gc.ca/eng/tdg/safety-menu.htm. Inquiries can be directed to TDG-TMDOntario@tc.gc.ca or by calling (416) 973-1868.

Aeronautics Act – this Act and the associated Canadian Aviation Regulations (CARs) govern civil aviation in Canada. Transport Canada should be notified of projects involving aerodromes and associated structures, or activities that could affect aviation safety. Elevated structures, such as wind turbines and communication towers, are examples of projects that must be assessed for lighting and marking requirements in accordance with the CARs. Transport Canada also has an interest in projects that have the potential to cause interference between wildlife and aviation activities. One example would be waste facilities, which may attract birds into commercial and recreational flight paths. Additional guidance can be found in the *Land Use In The Vicinity of Aerodromes* publication, available at: https://www.tc.gc.ca/eng/civilaviation/publications/tp1247-menu-1418.htm. Information about Transport Canada's Civil Aviation program can be found at: https://tc.canada.ca/en/aviation. Inquires can be directed to aviation.ont@tc.gc.ca or by calling 1 (800) 305-2059 / (416) 952-0230.

Please advise if additional information is needed.

Thank you,

Environmental Assessment Program, Ontario Region
Transport Canada / Government of Canada / 4900 Yonge St., Toronto, ON M2N 6A5
EnviroOnt@tc.gc.ca

Programme d'évaluation environnementale, Région de l'Ontario
Transports Canada / Gouvernement du Canada / 4900, rue Yonge, Toronto, ON, M2N 6A5
EnviroOnt@tc.gc.ca

From: Ayushmaan Juyal <ajuyal@rvanderson.com>
Sent: Friday, September 12, 2025 9:27 AM
Cc: Nikash Persaud <npersaud@rvanderson.com>
Subject: [External/Externe]: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre

You don't often get email from ajuyal@rvanderson.com. Learn why this is important
Hello,

On behalf of the Township of Cavan Monaghan please see the Notice of Public Information Centre for the Class Environmental Assessment for Water Storage in Millbrook.

You are receiving this email because of your previous interest in the completed Master Servicing Study Class Environmental Assessment project. If you would no longer like to be on the stakeholder list, please respond indicating so and your email will be removed from the list.

Regards,

Ayushmaan Juyal (He/Him)
Student Engineer

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
m 416 497 8600 x1262
LinkedIn | **Facebook** | **Website**

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Subject: Automatic reply: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre
Sent: 2025-09-12, 9:28:39 AM
From: Enviroinfo (ECCC)<Enviroinfo@ec.gc.ca>
To: Ayushmaan Juyal

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*** English version will follow ***

Merci d'avoir communiqué avec le Centre de renseignements à la population d'Environnement et Changement climatique Canada.

Nous accusons réception de votre demande et vous répondrons dans les meilleurs délais.

Veuillez noter que les courriels contenant des injures, des grossièretés ou des menaces ne seront pas tolérés et ne recevront aucune réponse.

Pour les demandes de renseignements des médias, veuillez communiquer avec l'équipe des relations avec les médias d'Environnement et Changement climatique Canada par courriel à l'adresse media@ec.gc.ca ou par téléphone au 1-844-836-7799.
Nos bureaux sont ouverts du lundi au vendredi, de 8 h à 17 h 00, heure de l'Est, et sont fermés les jours fériés.

Pour signaler une urgence environnementale, composez le numéro de téléphone disponible 24 heures sur 24 de la province ou du territoire **dans lequel l'événement se produit**. Pour obtenir de plus amples renseignements, visitez le https://www.canada.ca/fr/environnement-changement-climatique/services/programme-urgences-environnementales/signaler-urgence.html

Centre de renseignements à la population
Environnement et Changement climatique Canada
enviroinfo@ec.gc.ca
1-800-668-6767

****
Thank you for contacting Environment and Climate Change Canada's Public Inquiries Centre.

We acknowledge receipt of your email and will get back to you as soon as possible.

Please note that emails containing profanity / foul language or threats will not be tolerated and will not be responded to.

For media enquiries, please contact Environment and Climate Change Canada's Media Relations team by email at media@ec.gc.ca or by phone at 1-844-836-7799.
Our offices are open Monday to Friday from 8:00 a.m. to 5:00 p.m., Eastern Time, and are closed on statutory holidays.

To report an environmental emergency: Call the 24-hour telephone number for the province or territory **where the event is occurring**. For more information, please visit: Report an Environmental Emergency.

Public Inquiries Centre
Environment and Climate Change Canada
enviroinfo@ec.gc.ca
1-800-668-6767

Subject: SPF violationAutomatic reply: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre
Sent: 2025-09-12, 9:30:44 AM
From: Webmaster Mailbox<webmaster.mailbox@enbridge.com>
To: Ayushmaan Juyal

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Thanks for reaching out. This account is checked intermittently for messages.

If you believe you are witnessing a **pipeline emergency**, call 911 and then, if applicable, call the emergency number that you see on a pipeline marker.
If you are an **Enbridge Gas customer and you smell gas**, call **1-866-763-5427 (Ontario)** or **1-877-542-2630 (Ohio).**
If you are an Enbridge Gas customer in **Ontario** with account/billing/moving inquiries, please **call 1-877-362-7434 or visit https://www.enbridgegas.com/ontario/contact-us (Ontario)**.
If you are an Enbridge Gas customer in **Ohio** with account/billing/moving inquiries, please **call 1-800-362-7557 or visit https://www.dominionenergy.com/ohio/enbridge-update**
If you are seeking employment, please visit careers.enbridge.com to see a list of available job positions.
If you are looking for our Investor Relations department, please call 1-800-481-2804 or email investor.relations@enbridge.com.
If this is a media inquiry, please call 1-888-992-0997 or email media@enbridge.com.

Thank you,
Enbridge Webmaster

Subject: Automatic reply: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre
Sent: 2025-09-12, 9:28:11 AM
From: EA Notices to ERegion (MECP)<eanotification.eregion@ontario.ca>
To: Ayushmaan Juyal

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This is to acknowledge your email has been delivered to the Regional email account. A Regional EA Coordinator will contact you if additional information is needed. To speak directly to a Regional EA Coordinator, go to the INFO-GO website and under our ministry, select: 1) Drinking Water and Environmental Compliance Division 2) applicable Regional Office 3) Technical Support Section 4) Air, Pesticides, and Environmental Planning 5) Environmental Resource Planner & EA Coordinator

Emails and Correspondence

~

Indigenous Communities

Subject: 205371 - Notice of Commencement and Notice of Request to Consult for Township of Cavan Monaghan Water Storage EA
Sent: 2025-04-15, 10:24:56 AM
From: Nikash Persaud<npersaud@rvanderson.com>
To: Julie Kapyrka
Cc: tsimpson@alderville.ca; szilinski@alderville.ca; Darika Sharma; Wayne Hancock; Maia Mandel
Attachments: Notice of Request to Consult Alderville First Nation.pdf
Cavan Monaghan Water Storage EA - Notice of Commencement - AODA.pdf

---

Categories: Filed by Newforma

Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment. Additionally attached is a Notice of Request to Consult.

The following link encompasses the available documentation (Master Servicing Study including Archaeological report, etc.) for your review: Water and Wastewater Master Servicing Plan - Township of Cavan Monaghan

Should you wish to stop receiving notices pertaining to this project or would like to direct them to an alternate recipient, please advise the undersigned.

Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
LinkedIn | Facebook | Website

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Subject: 205371 - Notice of Commencement and Notice of Request to Consult for Township of Cavan Monaghan Water Storage EA
Sent: 2025-04-15, 10:26:24 AM
From: Nikash Persaud<npersaud@rvanderson.com>
To: 'jsandy@chimnissing.ca'; 'bfnchief@chimnissing.ca'
Cc: 'msmith@chimnissing.ca'; Darika Sharma; Maia Mandel; Wayne Hancock
Attachments: Notice of Request to Consult Beausoleil First Nation.pdf
Cavan Monaghan Water Storage EA - Notice of Commencement - AODA.pdf

---

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Good morning,

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Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
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Subject: 205371 - Notice of Commencement and Notice of Request to Consult for Township of Cavan Monaghan Water Storage EA
Sent: 2025-04-15, 10:26:14 AM
From: Nikash Persaud<npersaud@rvanderson.com>
To: donna.bigcanoe@georginaisland.com
Cc: alyssa.warren@georginaisland.com; jl.porte@georginaisland.com; Darika Sharma; Maia Mandel; Wayne Hancock
Attachments: Notice of Request to Consult Chippewas of Georgina Island FN.pdf
Cavan Monaghan Water Storage EA - Notice of Commencement - AODA.pdf

---

Categories: Filed by Newforma

Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment. Additionally attached is a Notice of Request to Consult.

The following link encompasses the available documentation (Master Servicing Study including Archaeological report, etc.) for your review: Water and Wastewater Master Servicing Plan - Township of Cavan Monaghan

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Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
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Subject: 205371 - Notice of Commencement and Notice of Request to Consult for Township of Cavan Monaghan Water Storage EA
Sent: 2025-04-15, 10:26:36 AM
From: Nikash Persaud<npersaud@rvanderson.com>
To: 'tedw@ramafirstnation.ca'
Cc: 'consultation@ramafirstnation.ca'; 'benc@ramafirtstnation.ca'; Darika Sharma; Maia Mandel; Wayne Hancock
Attachments: Notice of Request to Consult Chippewas of Rama FN.pdf
Cavan Monaghan Water Storage EA - Notice of Commencement - AODA.pdf

---

Categories: Filed by Newforma

Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment. Additionally attached is a Notice of Request to Consult.

The following link encompasses the available documentation (Master Servicing Study including Archaeological report, etc.) for your review: Water and Wastewater Master Servicing Plan - Township of Cavan Monaghan

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Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
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Subject: 205371 - Notice of Commencement and Notice of Request to Consult for Township of Cavan Monaghan Water Storage EA
Sent: 2025-04-15, 10:25:16 AM
From: Nikash Persaud<npersaud@rvanderson.com>
To: keithk@curvelake.ca
Cc: Darika Sharma; Wayne Hancock; Maia Mandel; paigew@curvelake.ca; francis@francischua.com; kayla@francischua.com; consultationlead@curvelake.ca
Attachments: Notice of Request to Consult Curve Lake First Nation.pdf
Cavan Monaghan Water Storage EA - Notice of Commencement - AODA.pdf

---

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Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment. Additionally attached is a Notice of Request to Consult.

The following link encompasses the available documentation (Master Servicing Study including Archaeological report, etc.) for your review: Water and Wastewater Master Servicing Plan - Township of Cavan Monaghan

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Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
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Subject: 205371 - Notice of Commencement and Notice of Request to Consult for Township of Cavan Monaghan Water Storage EA
Sent: 2025-04-15, 10:26:43 AM
From: Nikash Persaud<npersaud@rvanderson.com>
To: chiefcarr@hiawathafn.ca
Cc: tcowie@hiawathafn.ca; sdavison@hiawathafn.ca; mmcgonigle@hiawathafn.ca; dcdc@hiawathafn.ca; Darika Sharma; Maia Mandel; Wayne Hancock
Attachments: Notice of Request to Consult Hiawatha First Nation.pdf
Cavan Monaghan Water Storage EA - Notice of Commencement - AODA.pdf

---

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Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment. Additionally attached is a Notice of Request to Consult.

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Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
LinkedIn | Facebook | Website

PROUDLY 100% CANADIAN

Subject: 205371 - Notice of Commencement and Notice of Request to Consult for Township of Cavan Monaghan Water Storage EA
Sent: 2025-04-15, 10:26:32 AM
From: Nikash Persaud<npersaud@rvanderson.com>
To: nodin.webb@hotmail.com
Cc: Darika Sharma; Maia Mandel; Wayne Hancock
Attachments: Cavan Monaghan Water Storage EA - Notice of Commencement - AODA.pdf
Notice of Request to Consult Kawartha Nishnawbe FN.pdf

Categories: Filed by Newforma

Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment. Additionally attached is a Notice of Request to Consult.

The following link encompasses the available documentation (Master Servicing Study including Archaeological report, etc.) for your review: Water and Wastewater Master Servicing Plan - Township of Cavan Monaghan

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Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
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Subject: 205371 - Notice of Commencement and Notice of Request to Consult for Township of Cavan Monaghan Water Storage EA
Sent: 2025-04-15, 10:25:42 AM
From: Nikash Persaud<npersaud@rvanderson.com>
To: 'klarocca@scugogfirstnation.com'
Cc: 'drichardson@scugogfirstnation.ca'; 'consultation@scugogfirstnation.com'; Darika Sharma; Maia Mandel; Wayne Hancock
Attachments: Cavan Monaghan Water Storage EA - Notice of Commencement - AODA.pdf
Notice of Request to Consult Mississaugas of Scugog Island FN.pdf

---

Categories: Filed by Newforma

Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment. Additionally attached is a Notice of Request to Consult.

The following link encompasses the available documentation (Master Servicing Study including Archaeological report, etc.) for your review: Water and Wastewater Master Servicing Plan - Township of Cavan Monaghan

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Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
LinkedIn | Facebook | Website

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Subject: RE: 205371 - Notice of Commencement and Notice of Request to Consult for Township of Cavan Monaghan Water Storage EA
Sent: 2025-04-16, 3:27:38 PM
From: Nikash Persaud<npersaud@rvanderson.com>
To: Tom Cowie; Chief Laurie Carr
Cc: Sean Davison; Mandy McGonigle; Mike Howard; Darika Sharma; Maia Mandel; Wayne Hancock

---

Good afternoon, Tom,

Thank you for your prompt response. Feel free to reach out if you or your team does have any questions. We will be in touch with further notices as they become available.

Have a great rest of your week,
Nikash

From: Tom Cowie <tcowie@hiawathafn.ca>
Sent: April 15, 2025 12:34 PM
To: Nikash Persaud <npersaud@rvanderson.com>; Chief Laurie Carr <chiefcarr@hiawathafn.ca>
Cc: Sean Davison <sdavison@hiawathafn.ca>; Mandy McGonigle <mmcgonigle@hiawathafn.ca>; Mike Howard <dcdc@hiawathafn.ca>; Darika Sharma <DSharma@rvanderson.com>; Maia Mandel <mmandel@rvanderson.com>; Wayne Hancock <whancock@cavanmonaghan.net>
Subject: RE: 205371 - Notice of Commencement and Notice of Request to Consult for Township of Cavan Monaghan Water Storage EA

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Aaniin Nikash,

Chi miigwech for the updates on this project. At this moment we have no questions or concerns. If any should arise we will contact your office after reviewing this information more thoroughly. Have a great week.

Gichi manaadendamowin

Tom Cowie

Tom Cowie
Consultation Indigenous Knowledge Lead
Hiawatha First Nation
431 Hiawatha Line,
Hiawatha, On
K9J 0E6
705 295-4421 Ext. 216
Email tcowie@hiawathafn.ca

We, the Michi Saagiig of Hiawatha First Nation, are a vibrant, proud, independent and healthy people balanced in the richness of our culture and traditional way of life

---

From: Nikash Persaud <npersaud@rvanderson.com>
Sent: Tuesday, April 15, 2025 10:27 AM

To: Chief Laurie Carr <chiefcarr@hiawathafn.ca>
Cc: Tom Cowie <tcowie@hiawathafn.ca>; Sean Davison <sdavison@hiawathafn.ca>; Mandy McGonigle <mmcgonigle@hiawathafn.ca>; Mike Howard <dcdc@hiawathafn.ca>; Darika Sharma <DSharma@rvanderson.com>; Maia Mandel <mmandel@rvanderson.com>; Wayne Hancock <whancock@cavanmonaghan.net>
Subject: 205371 - Notice of Commencement and Notice of Request to Consult for Township of Cavan Monaghan Water Storage EA

ALERT: This message originated outside of HFN's network. **BE CAUTIOUS** before clicking any link or attachment.

Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment. Additionally attached is a Notice of Request to Consult.

The following link encompasses the available documentation (Master Servicing Study including Archaeological report, etc.) for your review: Water and Wastewater Master Servicing Plan - Township of Cavan Monaghan

Should you wish to stop receiving notices pertaining to this project or would like to direct them to an alternate recipient, please advise the undersigned.

Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
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Subject: 205371 - Notice of Commencement and Notice of Request to Consult for Township of Cavan Monaghan Water Storage EA
Sent: 2025-04-16, 3:25:51 PM
From: Nikash Persaud<npersaud@rvanderson.com>
To: contactus@metisnation.org; CarynM@metisnation.org
Cc: Wayne Hancock; Darika Sharma; Maia Mandel
Attachments: Cavan Monaghan Water Storage EA - Notice of Commencement - AODA.pdf
Notice of Request to Consult Metis Nation of Ontario.pdf

Categories: Filed by Newforma

Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment. Additionally attached is a Notice of Request to Consult.

The following link encompasses the available documentation (Master Servicing Study including Archaeological report, etc.) for your review: Water and Wastewater Master Servicing Plan - Township of Cavan Monaghan

Should you wish to stop receiving notices pertaining to this project or would like to direct them to an alternate recipient, please advise the undersigned.

Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
LinkedIn | Facebook | Website

PROUDLY 100% CANADIAN

Subject: RE: 205371 - Notice of Commencement and Notice of Request to Consult for Township of Cavan Monaghan Water Storage EA
Sent: 2025-04-15, 12:33:56 PM
From: Tom Cowie<tcowie@hiawathafn.ca>
To: Nikash Persaud; Chief Laurie Carr
Cc: Sean Davison; Mandy McGonigle; Mike Howard; Darika Sharma; Maia Mandel; Wayne Hancock

---

Categories: Filed by Newforma

[CAUTION EXTERNAL EMAIL] Make Sure that it is legitimate **before** Replying or Clicking on any links

Aaniin Nikash,

Chi miigwech for the updates on this project. At this moment we have no questions or concerns. If any should arise we will contact your office after reviewing this information more thoroughly. Have a great week.

Gichi manaadendamowin

Tom Cowie
Tom Cowie
Consultation Indigenous Knowledge Lead
Hiawatha First Nation
431 Hiawatha Line,
Hiawatha, On
K9J 0E6
705 295-4421 Ext. 216
Email tcowie@hiawathafn.ca

We, the Michi Saagiig of Hiawatha First Nation, are a vibrant, proud, independent and healthy people balanced in the richness of our culture and traditional way of life

---

From: Nikash Persaud <npersaud@rvanderson.com>
Sent: Tuesday, April 15, 2025 10:27 AM
To: Chief Laurie Carr <chiefcarr@hiawathafn.ca>
Cc: Tom Cowie <tcowie@hiawathafn.ca>; Sean Davison <sdavison@hiawathafn.ca>; Mandy McGonigle <mmcgonigle@hiawathafn.ca>; Mike Howard <dcdc@hiawathafn.ca>; Darika Sharma <DSharma@rvanderson.com>; Maia Mandel <mmandel@rvanderson.com>; Wayne Hancock <whancock@cavanmonaghan.net>
Subject: 205371 - Notice of Commencement and Notice of Request to Consult for Township of Cavan Monaghan Water Storage EA

ALERT: This message originated outside of HFN's network. **BE CAUTIOUS** before clicking any link or attachment.

Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment. Additionally attached is a Notice of Request to Consult.

The following link encompasses the available documentation (Master Servicing Study including Archaeological report, etc.) for your review: Water and Wastewater Master Servicing Plan - Township of Cavan Monaghan

Should you wish to stop receiving notices pertaining to this project or would like to direct them to an alternate recipient, please advise the undersigned.

Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
LinkedIn | **Facebook** | **Website**



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Subject: RE: 205371 - Notice of Commencement and Notice of Request to Consult for Township of Cavan Monaghan Water Storage EA
Sent: 2025-04-17, 8:46:30 AM
From: Jaimi O'hara<jaimi@francischua.com>
To: whancock@cavanmonaghan.net; Nikash Persaud; Darika Sharma; Maia Mandel
Cc: Mindy Knott; Paige Williams; David Rewniak; consultationlead@curvelake.ca; Francis M. Chua; Kayla Wright
Attachments: 2025-04-17 CLFN Level 2 Letter - Millbrook Water Storage Class EA - Township of Cavan Monaghan.pdf

---

You don't often get email from jaimi@francischua.com. Learn why this is important

[CAUTION EXTERNAL EMAIL] Make Sure that it is legitimate **before** Replying or Clicking on any links

Good morning.

On behalf of Curve Lake First Nation, please see attached a response to your correspondence dated April 15, 2025, regarding the Millbrook Water Storage Class Environmental Assessment.

Please do not hesitate to reach out should you have any questions or concerns. Curve Lake First Nation appreciates the efforts of the Township of Cavan Monaghan to initiate the consultation process.

Thank you,
Jaimi O'Hara

Support to Curve Lake First Nation
Project Manager
Consultant to Francis Chua Consulting Services Inc.

From: Nikash Persaud <npersaud@rvanderson.com>
Sent: Tuesday, April 15, 2025 10:25 AM
To: keithk@curvelake.ca <keithk@curvelake.ca>
Cc: Darika Sharma <DSharma@rvanderson.com>; Wayne Hancock <whancock@cavanmonaghan.net>; Maia Mandel <mmandel@rvanderson.com>; Paige Williams <paigew@curvelake.ca>; Francis M. Chua <francis@francischua.com>; Kayla Wright <kayla@francischua.com>; consultationlead@curvelake.ca <consultationlead@curvelake.ca>
Subject: 205371 - Notice of Commencement and Notice of Request to Consult for Township of Cavan Monaghan Water Storage EA

Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment. Additionally attached is a Notice of Request to Consult.

The following link encompasses the available documentation (Master Servicing Study including Archaeological report, etc.) for your review: Water and Wastewater Master Servicing Plan - Township of Cavan Monaghan

Should you wish to stop receiving notices pertaining to this project or would like to direct them to an alternate recipient, please advise the undersigned.

Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300

Toronto ON M2J 4Z8
t 416 497 8600 x1337
LinkedIn | **Facebook** | **Website**



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Subject: RE: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre
Sent: 2025-09-12, 10:25:02 AM
From: Tom Cowie<tcowie@hiawathafn.ca>
To: Ayushmaan Juyal
Cc: Nikash Persaud; Sean Davison; Mandy McGonigle; Mike Howard

---

[CAUTION EXTERNAL EMAIL] Make Sure that it is legitimate **before** Replying or Clicking on any links

Aaniin Ayushmaan,

Chi miigwech for the information regarding this project. If we have any questions we will contact your office. Have a great weekend.

Gichi manaadendamowin

Tom Cowie

Tom Cowie
Consultation Indigenous Knowledge Lead
Hiawatha First Nation
431 Hiawatha Line,
Hiawatha, On
K9J 0E6
705 295-4421 Ext. 216
Email tcowie@hiawathafn.ca

We, the Michi Saagiig of Hiawatha First Nation, are a vibrant, proud, independent and healthy people balanced in the richness of our culture and traditional way of life

---

From: Ayushmaan Juyal <ajuyal@rvanderson.com>
Sent: Friday, September 12, 2025 9:28 AM
To: Tom Cowie <tcowie@hiawathafn.ca>
Cc: Nikash Persaud <npersaud@rvanderson.com>; Sean Davison <sdavison@hiawathafn.ca>; Mandy McGonigle <mmcgonigle@hiawathafn.ca>; Mike Howard <dcdc@hiawathafn.ca>
Subject: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre

ALERT: This message originated outside of HFN's network. **BE CAUTIOUS** before clicking any link or attachment.

Hello,

On behalf of the Township of Cavan Monaghan please see the Notice of Public Information Centre for the Class Environmental Assessment for Water Storage in Millbrook.
We would be glad to provide any information for this project via a meeting with your community where we can engage in answering your questions and knowledge sharing. Otherwise, the information will be posted on the Township website after the Public Information Centre.

Should you wish to stop receiving notices pertaining to this project or would like to direct them to an alternate recipient, please advise the undersigned.

Regards,

Ayushmaan Juyal (He/Him)
Student Engineer

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
m 416 497 8600 x1262
LinkedIn | Facebook | Website

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Subject: Re: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre
Sent: 2025-09-12, 9:42:49 AM
From: nodin webb<nodin.webb@hotmail.com>
To: Ayushmaan Juyal

[CAUTION EXTERNAL EMAIL] Make Sure that it is legitimate **before** Replying or Clicking on any links

Boozhoo,
KNFN appreciates you contacting us and we are interested to consult with you on this matter. We are available for virtual consultation bookings 2 weeks from now between Mon-Friday 1-4pm. KNFN is a non-funded First Nation and our council works voluntarily. We must schedule ahead and plan to take time from our full time jobs for consultations and require the funding to adequately engage. KNFN will provide an invoice for $1000.00 for funding for a virtual meeting. Please respond with a date(s) that works for you.
Miigwech,
Nodin Webb - Council Member of KNFN, a treaty 20 Mississauga First Nation

Kawartha Nishnawbe First Nation
Mississauga's of Burliegh Falls
71 Ojibway Dr S, Trent Lakes
Ontario, K0L 1JO

Sent from my iPhone

On Sep 12, 2025, at 9:29 AM, Ayushmaan Juyal <ajuyal@rvanderson.com> wrote:

Hello,

On behalf of the Township of Cavan Monaghan please see the Notice of Public Information Centre for the Class Environmental Assessment for Water Storage in Millbrook.
We would be glad to provide any information for this project via a meeting with your community where we can engage in answering your questions and knowledge sharing. Otherwise, the information will be posted on the Township website after the Public Information Centre.

Should you wish to stop receiving notices pertaining to this project or would like to direct them to an alternate recipient, please advise the undersigned.

Regards,

Ayushmaan Juyal (He/Him)
Student Engineer

<image001.png>
R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
m 416 497 8600 x1262
LinkedIn | **Facebook** | **Website** <image002.png>

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<205371-20250911 - Cavan Monaghan Water Storage EA Notice of PIC-AODA.pdf>

Subject: RE: Millbrook Water Storage Class Environmental Assessment
Sent: 2025-11-25, 10:06:32 AM
From: Nikash Persaud<npersaud@rvanderson.com>
To: Julie Kapyrka
Cc: 'Wayne Hancock'; Taynar Simpson
Attachments: 2023-260 REVISED Stage 1-2 Report Apr25.pdf
2024-641 Original Stage 1-2 Report (11 Feb 2025) (2).pdf
205371.00-20251125 - NoticeOfRequestToConsult-Alderville.pdf

Categories: Filed by Newforma

Good morning Dr. Kapyrka,

We appreciate Alderville First Nation's interest in the Township of Cavan Monaghan Class EA for Water Storage project and your patience in receiving a response from the Township.

Please see attached for our Notice of Request to Consult for the Class Environmental Assessment for Water Storage in Millbrook, as well as the most recent Archaeological assessment for your reference.

As detailed in the Notice of Request to Consult, please advise if you would like a meeting to discuss the project and I will provide dates our team is available to meet.

A cheque with the $300.00 file fee has been drafted and has been sent in the mail with a physical copy of the Notice of Request to Consult document.

Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
LinkedIn | Facebook | Website

PROUDLY 100% CANADIAN

From: Julie Kapyrka <jkapyrka@alderville.ca>
Sent: Wednesday, October 15, 2025 5:56 PM
To: Wayne Hancock <whancock@cavanmonaghan.net>
Cc: Taynar Simpson <tsimpson@alderville.ca>
Subject: Millbrook Water Storage Class Environmental Assessment

You don't often get email from jkapyrka@alderville.ca. Learn why this is important

Aaniin Wayne,

Please see attached.

Miigwech,

Dr. Julie Kapyrka
Consultation Manager



11696 Second Line Rd.
Roseneath, ON K0K 2X0
905-352-2662
jkapyrka@alderville.ca

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8 Canada
T 416 497 8600 **F** 855 833 4022
rvanderson.com

RVA 205371

November 25, 2025

Alderville First Nation
11696 Second Line Road
Roseneath, ON
K0K 2X0

Attention: Dr. Julie Kapyrka
Consultation Coordinator

Dear Dr. Julie Kapyrka,

Re: Millbrook Water Storage Class Environmental Assessment
Notice of Request to Consult

Proponent

The Township of Cavan Monaghan (The Township) is the proponent undertaking the Millbrook Water Storage Class Environmental Assessment (Class EA). The Township is supported by R.V. Anderson Associates Limited (RVA) as the engineering consultant for this project.

The purpose of this letter is to:

1. Provide notification of the commencement of the Class EA process.
2. Invite you to participate in the Class EA process. Possible avenues to participate may include attending meetings, participating in field investigations, receiving and reviewing reports and/or providing comments.

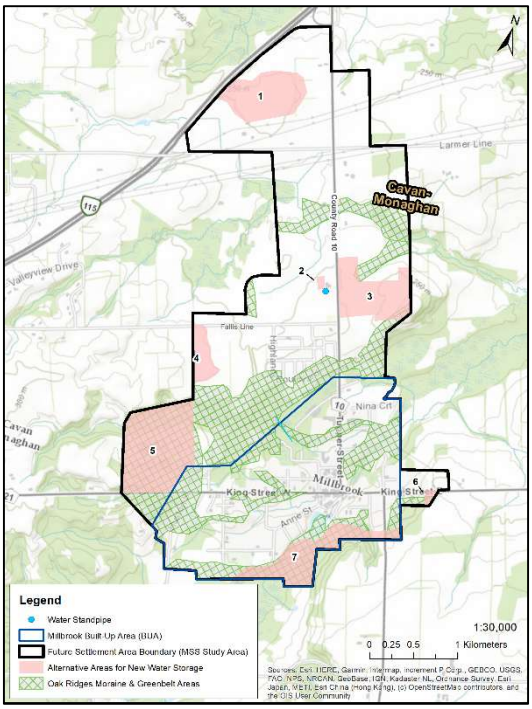


Figure 1: Class EA Study Area

Class Environmental Assessment (EA) Process

The purpose of this Class EA process is to determine the preferred location for a new water storage facility in the Township of Cavan Monaghan to service projected population increases in the Township up to 2051.

This Class EA project is informed by the previously completed Master Servicing Study (MSS) which identified new water storage being needed to support anticipated population growth by 2027.

BEST MANAGED COMPANIES Platinum member

Scope and Location

The scope of the study is to take the next step after the MSS with a Class EA to confirm the location, capacity, and storage type for the new water storage solution (i.e. standpipe, elevated tank or in-ground storage reservoir) which will service the anticipated growth in the Millbrook Settlement Area as identified in the previously completed Growth Management Study and MSS. The potential locations of the new storage facility are outlined in Figure 1. A full-sized version of Figure 1 has been attached to this document.

Effects on Williams Treaty First Nations & Traditional Territories

The study area is in the treaty territories of the Williams Treaty of 1923. Additional studies and investigations are required for major works and analysis, as described below (Studies). The Township intends to consult with all Williams Treaty First Nations during these investigations.

Proposed Consultation Process

- Provide Project Notices (Notice of Commencement, Notice of Public Information Centre, Notice of Completion)
- Provide project updates at key project milestones coinciding with the above project notices. Arrange meetings as required to review any concerns or details.
- Provide copies of available environmental, archaeological and cultural heritage studies
- Provide reasonable advanced notice and invitation to communities in the Williams Treaty staff to attend field investigations (archaeological, cultural heritage and environmental), and coordinate scheduling, where possible.
- Two-way knowledge sharing and, at Williams Treaty Nations's discretion, sharing of oral histories for archaeological and cultural heritage studies
- Receive input from Williams Treaty First Nations pertaining to major points of the project as they occur for consideration into project.
- Continue to consult with the Williams Treaty Nations during the design and construction phases of the project, as required. The Township aims to complete the Storage Class EA by end of 2025/early 2026.

Studies

This Class EA will use the Archaeological and Cultural Heritage studies completed as part of the previously completed MSS and/or other completed studies. Additional studies, including a Stage 1-2 Archaeological Assessment have been completed for the preferred location for Water Storage determined through the Class EA process.

Documents for Review Available

The previously completed MSS can be found on the Township's website (https://www.cavanmonaghan.net/en/live-here/water-and-wastewater-master-servicing-plan.aspx). The appendices of the MSS include the previously completed Archaeological, Cultural Heritage and Natural Heritage studies – that have already been filled with the Ministry of Citizenship and Multiculturalism (MCM) – which inform this Class EA project for future Water Storage.

Our Public Information Centre (PIC) presenting the alternatives for new storage in the Township of Cavan Monaghan occurred on September 24th, 2025. You can view the slides which were presented on the Township's website (https://www.cavanmonaghan.net/en/news/water-storage-municipal-class-environmental-assessment.aspx). Attached to this correspondence are the previously completed Stage 1-2 Archaeological Assessments completed by the developer of the preferred alternative site for Water Storage.

Approvals

Approvals associated with the current Class EA process, include filing the final Project File Report with the Ministry of Environment, Conservation and Parks (MECP).

Other approvals such as a Drinking Water Works Permit (DWWP) amendment from the MECP, site plan approval and building permit from the Township will be required in the future design project.

Invitation to Participate and Important Dates

We are committed to establishing a mutually beneficial relationship, rooted in respect, open communication and a shared commitment to environmental stewardship.

We would be pleased to discuss the project in further detail and welcome the opportunity for Alderville First Nation representatives to educate the Township and consult team members about the important historical, political and geographical context, as well as Alderville First Nation's interests as it relates to this project.

We are happy to arrange a meeting at a time and in a format that suits you. We look forward to engaging with your community, and we thank you for your time and consideration.

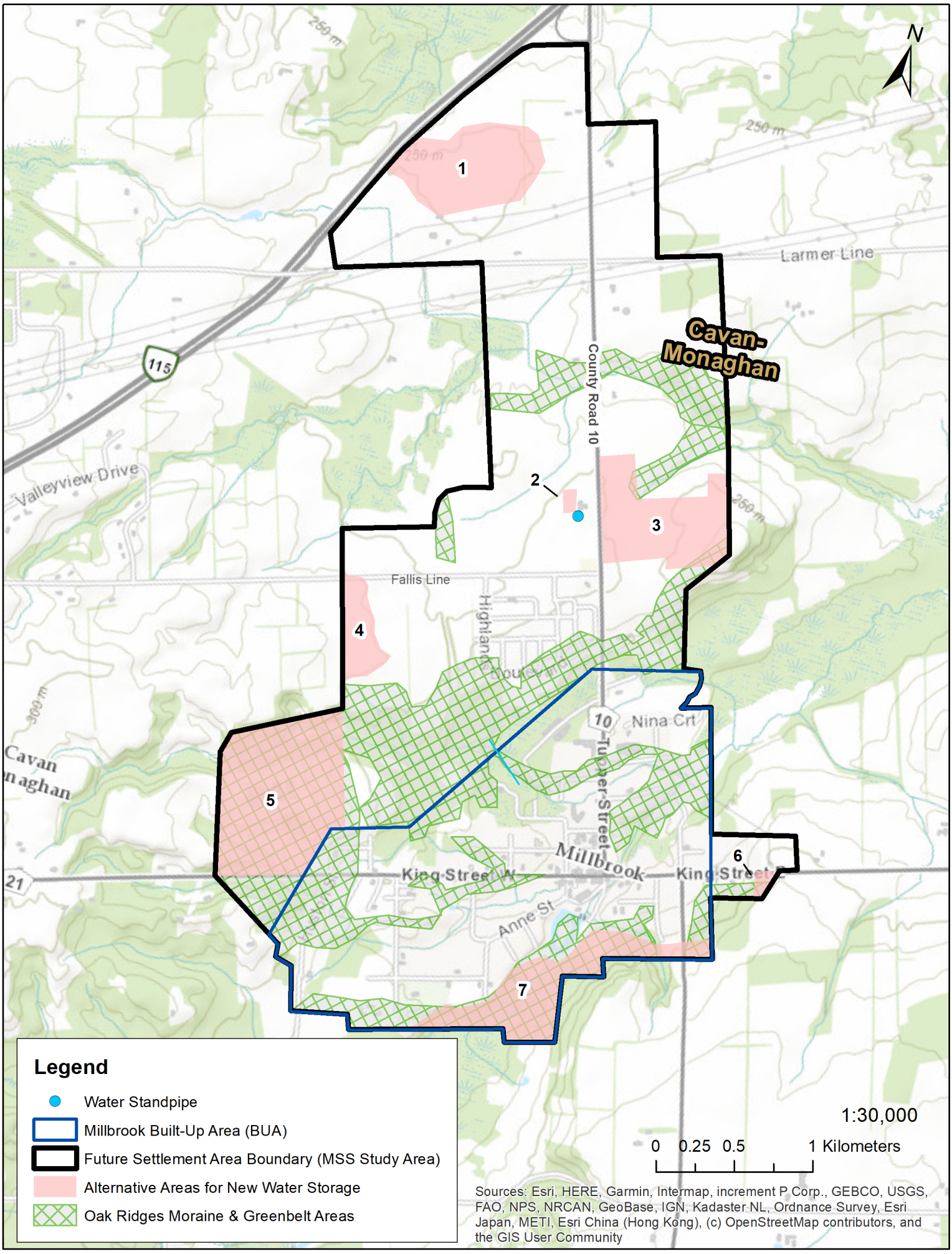
Please feel free to call me if you would like to discuss this further. My contact information is below, and the project team's contact information is attached.

Yours very truly,

Wayne Hancock, P.Eng.
Director of Public Works
Township of Cavan Monaghan

Contacts (Key Contacts Bolded)

Township of Cavan Monoghan (The Proponent)	R.V. Anderson Associates Limited (The Consultant)
Wayne Hancock, P.Eng. Director of Public Works Tel: 705-932-9327 Fax: 705-932-3458 whancock@cavanmonaghan.net	Nikash Persaud **[Key Contact]** R.V. Anderson Associates Limited Coordinator, Environmental Assessments Tel: 416-497-8600 ext. 1337 npersaud@rvanderson.com
Clinton Hiltz Water/Wastewater/Compliance Coordinator Tel: 705-932-9348 Fax: 705-932-3458 chiltz@cavanmonaghan.net	Rika Law R.V. Anderson Associates Limited Project Manager Tel: 416-497-8600 ext. 1209 rlaw@rvanderson.com


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King Street W
King Street E
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Anne St
Cavan
naghan
250 m
300 m
Legend
Water Standpipe
Millbrook Built-Up Area (BUA)
Future Settlement Area Boundary (MSS Study Area)
Alternative Areas for New Water Storage
Oak Ridges Moraine & Greenbelt Areas
1:30,000
0 0.25 0.5 1 Kilometers
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Subject: Re: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre
Sent: 2025-12-10, 5:08:03 PM
From: nodin webb<nodin.webb@hotmail.com>
To: Nikash Persaud
Cc: Jessica Frost-Cruise; Diane Blunt; Jack Hogarth

[CAUTION EXTERNAL EMAIL] Make Sure that it is legitimate **before** Replying or Clicking on any links

Aaniin,
Yes, this time works.
Miigwech,
Nodin Webb
Sent from my iPhone

On Dec 10, 2025, at 9:28 AM, Nikash Persaud <npersaud@rvanderson.com> wrote:

Good morning Nodin,

I have confirmed with the Township a date. Does December 18th from 10:30am to 11:30am work for you and your team?

Regards,
Nikash

From: nodin webb <nodin.webb@hotmail.com>
Sent: December 3, 2025 10:52 AM
To: Nikash Persaud <npersaud@rvanderson.com>
Cc: Jessica Frost-Cruise <Jessica-BFCC@outlook.com>; Diane Blunt (KNFN) <dianeblunt1@gmail.com>; Jack Hogarth <giiwednang@hotmail.com>
Subject: Re: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre

[CAUTION EXTERNAL EMAIL] Make Sure that it is legitimate **before** Replying or Clicking on any links

Aaniin,
Below is the invoice for the upcoming consultation:
<image002.jpg>
Cheques can be mailed to 71 Ojibway Dr S, Trent Lakes, ON K0L1J0.
Miigwech,
Nodin Webb
<image003.jpg>

Sent from my iPhone

On Dec 3, 2025, at 8:39 AM, Nikash Persaud <npersaud@rvanderson.com> wrote:

Hi Nodin,

I am confirming times with the Township, I will have those to you shortly.

As for the invoice, it would be to:

To the attention of: Wayne Hancock, P.Eng., Director of Public Works
Township of Cavan Monaghan
988 County Road 10, Millbrook ON, L0A 1G0

Regards,
Nikash

From: nodin webb <nodin.webb@hotmail.com>
Sent: December 2, 2025 9:29 AM
To: Nikash Persaud <npersaud@rvanderson.com>
Subject: Re: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre

[CAUTION EXTERNAL EMAIL] Make Sure that it is legitimate **before** Replying or Clicking on any links

Aaniin,
Our schedule is fairly open for mid December. Are there any days that work for you as well as tentative times? Would we invoice to: R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8? As well as Attn the person mentioned.
If you'd like a review of the stage 1-2 report we could invoice you for $3,000.00 for that as well as that is what we require for capacity funding to complete it.
Miigwech,
Nodin Webb
<image003.jpg>

Sent from my iPhone

> On Nov 25, 2025, at 9:58 AM, Nikash Persaud <npersaud@rvanderson.com> wrote:
>
> R.V. Anderson Associates Limited
> 2001 Sheppard Avenue East, Suite 300
> Toronto ON M2J 4Z8

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Emails and Correspondence

~

Public Members

Subject: 205371 - Notice of Commencement for the Township of Cavan Monaghan Water Storage Environmental Assessment
Sent: 2025-04-15, 9:19:10 AM
From: Nikash Persaud<npersaud@rvanderson.com>
Bcc: [redacted]
Attachments: Cavan Monaghan Water Storage EA - Notice of Commencement - AODA.pdf

---

Categories: Filed by Newforma

Good morning,

On behalf of the Township of Cavan Monaghan, please see the attached Notice of Commencement for the Millbrook Water Storage Class Environmental Assessment.

This notice is sent to your attention as it was deemed that you may be an interested stakeholder.

Should you wish to stop receiving notices pertaining to this project or would like to direct them to an alternate recipient, please advise the undersigned.

Thank you,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
t 416 497 8600 x1337
LinkedIn | Facebook | Website

PROUDLY 100% CANADIAN

Subject: Millbrook Water Storage Class Environmental Assessment - Notice of Public Information Centre
Sent: 2025-09-12, 9:27:29 AM
From: Ayushmaan Juyal<ajuyal@rvanderson.com>
Cc: Nikash Persaud
Bcc: [redacted]
Attachments: 205371-20250911 - Cavan Monaghan Water Storage EA Notice of PIC-AODA.pdf

---

Hello,

On behalf of the Township of Cavan Monaghan please see the Notice of Public Information Centre for the Class Environmental Assessment for Water Storage in Millbrook.

You are receiving this email because of your previous interest in the completed Master Servicing Study Class Environmental Assessment project. If you would no longer like to be on the stakeholder list, please respond indicating so and your email will be removed from the list.

Regards,

Ayushmaan Juyal (He/Him)
Student Engineer

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8
m 416 497 8600 x1262
LinkedIn | Facebook | Website

PROUDLY 100% CANADIAN

Subject: FW: Millbrook Water Storage Class EA Comments - September 2025
Sent: 2025-09-22, 1:35:29 PM
From: Nikash Persaud<npersaud@rvanderson.com>
To: Rika Law; Ayushmaan Juyal

Follow Up Flag: Follow up

Flag Status: Flagged

From: [redacted]
Sent: September 22, 2025 8:11 AM
To: Nikash Persaud <npersaud@rvanderson.com>; 'Wayne Hancock' <whancock@cavanmonaghan.net>
Cc: 'Graham, Matthew' <mgraham@cavanmonaghan.net>; 'Ryan Huntley' <rhuntley@cavanmonaghan.net>; 'Nelson Edgerton' <nedgerton@cavanmonaghan.net>; 'Gerry Byrne' <gbyrne@cavanmonaghan.net>; 'Lance Nachoff' <lnachoff@cavanmonaghan.net>
Subject: Millbrook Water Storage Class EA Comments - September 2025

You don't often get email from [redacted] Learn why this is important

[CAUTION EXTERNAL EMAIL] Make Sure that it is legitimate **before** Replying or Clicking on any links

Re: Millbrook Water Storage Class Environmental Assessment Comments

Water Safety and Security:

Neither the Growth Management Strategy nor the Master Servicing Study provide any assurances that there is a safe, secure and sustainable water supply. Millbrook is solely reliant on an Oak Ridges Moraine sourced aquifer.

The first water tower constructed in 2016, had a capacity of 2115m3 – the proposed new water tower at Site # 1 will have a capacity of 4,512m3 – more than double.

In 2014 during the Class EA for the first water tower, it was stated by this same consultant, that water safety and security is not their responsibility, but that of the municipality.

"The mandate of this project is not about the ability of the water supply aquifer to support the proposed new development, rather the amount of water storage needed to support it. The public concern is specifically related to the planning processes associated with the Township's new OP. The request for a full hydrogeological study to review the impact of the new development on the ground water aquifer is not a water storage issue and, therefore, is not within the mandate of this project." (page 35) November 8, 2014 Class EA Water Storage

The MSS is solely focused on "infrastructure planning process that focused on municipal water and wastewater infrastructure services required to support growth to 2051. This study revolves around providing infrastructure to support desktop consultant reports and government policies which direct a population growth target increase in Millbrook from 2,558 to 10,455 (13,468 with employment) by the year 2051. (June 2023 MSS)

The MSS is not based on a comprehensive investigation of the complex interconnected Oak Ridges Moraine hydrogeological system first to determine if a safe and secure long term sustainable water supply is possible and guaranteed. It does address concerns about the long-term environmental sustainability of Baxter Creek.

To date, the municipality of Cavan Monaghan has failed to provide concrete scientific evidence that this dramatic increase in water taking, which will require an increase in the PTTW from 3000 m3/day to 6214m3/day, will be safe and secure and sustainable.

The 2014 CLASS EA water tower and wastewater expansion Final Phase 2 Report for the Millbrook Water Storage and Servicing Expansion noted:

"Council will need to be mindful of water demands in approving any development applications."

The last examination of the Millbrook municipal water supply source was in 2009. There was a desktop review in 2016. The 2016 review suggested that given the expected increase in groundwater withdrawals in the coming years, more study should be undertaken to establish a baseline level, as ultimately removals of groundwater from municipal wells must be balanced out by a reduction in the flow of local streams, with the most significant impact occurring in Baxter Creek. A monitoring program begun sooner than later would provide useful information to allow better assessment of the impact of increased withdrawal rates in the future.

The 2016 review was issued before construction of the 354 unit Highland subdivision. The 2023 Growth Management Strategy & Master Servicing Study states an expectation of 3,338 residential units by 2051 as well as commercial, industrial and institutional units (approved new school for example) .

The 2009 Golder report indicated for the then anticipated construction of 1037 residential units, the expected drawdown in the three municipal wells using an extrapolation of the pumping test rate at the conclusion of a continuous water taking for 20 years, to be between 7.5 m and 9.2 m compared to the available drawdown of 27.4 to 28.1 m…. an almost 30% decrease. Currently the number of residential units has more than doubled. The Golder report also did not account for the changing climate and the drier conditions.

"Several dry summers have occurred in Ontario since 1990, with the late 1990s and early 2000s experiencing notable drought conditions. Specifically, the period from mid-1997 through 1999 saw heightened concerns about water resources in many Ontario municipalities due to drought. Additionally, the early 2000s continued to be drier than normal. More recently, the 2020s have seen some dry stretches, including a very dry October in 2024"– Environment Canada

Currently the region is in a Level 2 Drought. Environment Canada predicts that drought patterns will continue on in the future. Before there is any commitment to this new larger water tower, a safe and secure water supply for the foreseeable future must be guaranteed first.

(There is speculation the recent watermain breaks may have been caused by lower levels and pressure in the aquifer caused by the drought, coupled with over-use, resulting in some subsidence, then followed by a sudden recharge after that one heavy rainfall increasing the hydraulic pressure in the aquifer high enough to push water out of the fractured pipes and onto the surface. Land subsidence can cause aquifer contamination by disrupting infrastructure, facilitating intrusion, and altering the natural geology to release contaminants – perhaps like those found on the former Millbrook jail lands.)

What is the current drawdown level of the Millbrook wells, and what is the anticipated drawdown after construction of the second water tower and extensive pipeline and/or the possible proposed reservoir?

PPS…

2.2 Water

2.2.1 Planning authorities shall protect, improve or restore the *quality and quantity of water* by:

a**) using the *watershed* as the ecologically meaningful scale for integrated and long-term planning, which can be a foundation for considering cumulative impacts of development;**

b) **minimizing potential *negative impacts*, including cross-jurisdictional and cross-*watershed* impacts**;

c) **identifying water resource systems consisting of *ground water features*, *hydrologic functions*, *natural heritage features and areas*, and *surface water features* including shoreline areas, which are necessary for the ecological and hydrological integrity of the *watershed***;

d) **maintaining linkages and related functions among *ground water features*, *hydrologic functions*, *natural heritage features and areas*, and *surface water features* including shoreline areas; e) implementing necessary restrictions on *development* and *site alteration* to:**

1. **protect all municipal drinking water supplies and *designated vulnerable areas*; and**

2. **protect, improve or restore *vulnerable* surface and ground water, *sensitive surface water features* and *sensitive ground water features*, and their *hydrologic functions*;**

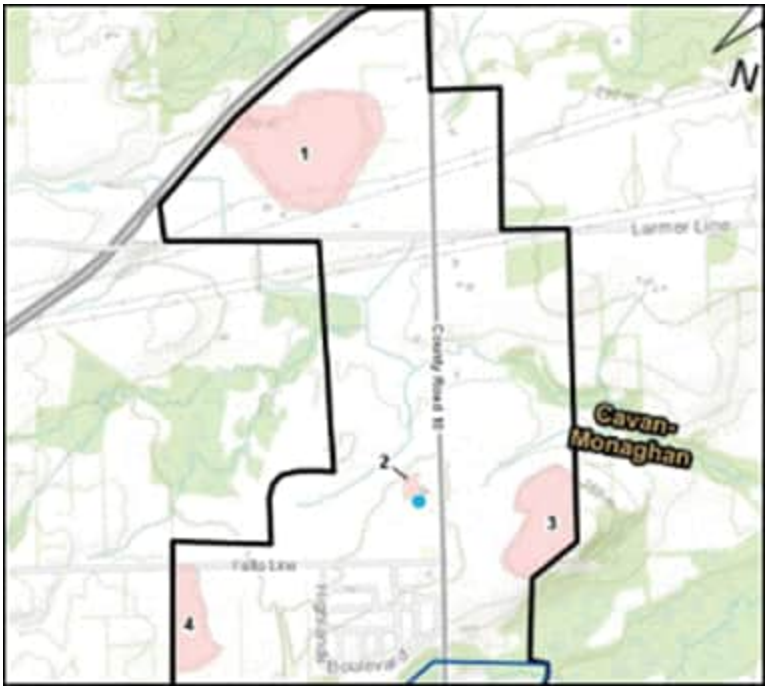
f) **planning for efficient and sustainable use of water resources, through practices for water conservation and sustaining water quality;**

g) ensuring consideration of environmental lake capacity, where applicable; and

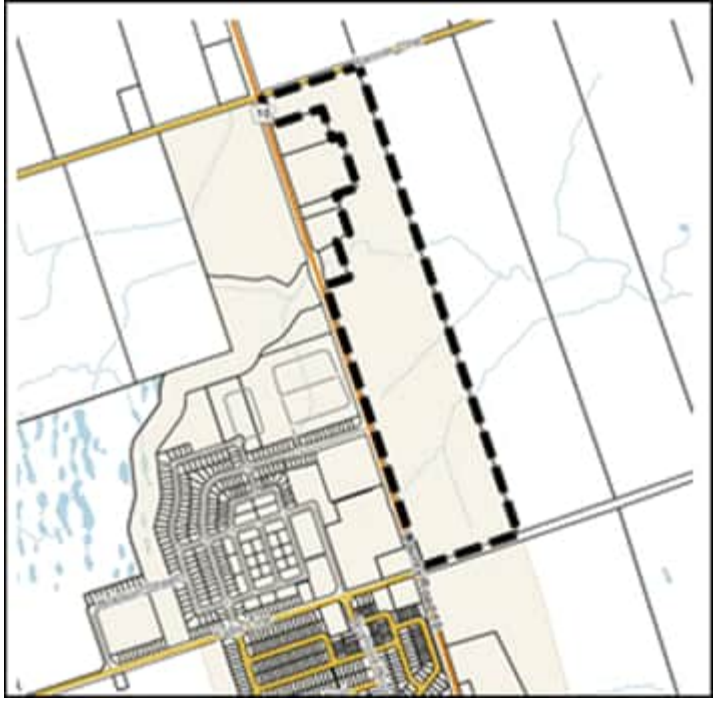
h**) ensuring stormwater management practices minimize stormwater volumes and contaminant loads, and maintain or increase the extent of vegetative and pervious surfaces**

Site Location:

The March 17, 2025 Anderson presentation to Council lists two optimal sites = # 1 near Hwy 115 and # 3 – across from the municipal office and Highlands subdivision in a “non-residential area”.



However, it has just been announced that this “non-residential” area known as Site 3 will now be re-zoned residential. The site plan in the application currently before the county indicates Site 3 will be filled with residential lots.



The purpose of the subdivision application is to create one-hundred-and-fifty-nine (159) new lots intended for residential dwelling units, twenty-eight (28) townhouse blocks, and two (2) multi- residential blocks, for a total of four-hundred-and-eighty-three (483) residential units. The subject lands maintain frontage along County Road 10, as well as Fallis Line to the south (unopened) and Larmer Line to the north.

The subject lands are currently designated as Urban Employment, Community Commercial, Natural Linkage Area, and Natural Core Area in the Township Official Plan.

Notice of Complete Application for Approval of a Plan of Subdivision - File #15T-25004 | County of Peterborough

So, it appears only Site # 1, the most expensive option, will be the only option.

Financial Considerations:

The March 17, 2025 report to Council indicates that it is expected that development charges will cover most of the costs. The March 17, 2025 presentation to Council, also notes in reference to Site # 1:

Township will have to front end the cost for extending distribution network to this location before development occurs here.

While it was recently announced the Ontario Government is investing $12,911,875 in water infrastructure for Cavan Monaghan, the estimated cost of Site 1 is $17,850,000 – a difference of almost 5 million dollars.

Residents are still paying for the cost of the first water tower over the Build Canada Fund allotment. The Clean Water Act (CWA) requires users to pay for the costs of clean water initiatives and infrastructure - it appears any new costs will be recovered in an increase in resident water bills. What is the anticipated increased cost?

In summation – the water storage tower will go ahead. However, the continual reluctance to conform with the PPS, and to scientifically know what the limits of the Millbrook aquifer currently and in the future especially in light of our changing climate is dangerous and incomprehensible. It seems the old adage "*there's lots of water in Millbrook"* is the only measure being used to ensure water safety and security for residents.

[redacted]

Subject: RE: Millbrook Water Storage Class EA Comments - September 2025
Sent: 2025-10-28, 4:02:21 PM
From: Nikash Persaud<npersaud@rvanderson.com>
To: [redacted]

Dear [redacted]

Thank you for your detailed and thoughtful comments regarding the Millbrook Water Storage Class Environmental Assessment (EA). We appreciate your engagement and patience in receiving our response.

The ultimate purpose of the Class EA for Water Storage in Millbrook is to evaluate a preferred location and type of water storage for a new 2,400 m^3 tank which would suit Millbrook's needs based on population and growth projections as described in both the previously completed Growth Management Study (GMS) and Master Servicing Study (MSS). The current water tower by the Municipal Office and this new tank will work together to provide a combined capacity of approximately 4,500 m^3.

Regarding your interest in the preferred storage tank location, Location 3 (east side of County Road 10, across from the Township office) was evaluated through the Class EA process to be the preferred location. You are correct that there is a draft plan for a subdevelopment in the area. It has been zoned as residential-commercial, and the Township is presently in talks with the developer to place a water storage solution somewhere on that site. The exact location will be subject to negotiations between the Township and the developer and, will be refined after the Class EA project concludes.

For further information on this evaluation, our Public Information Centre (PIC) presenting information about the evaluation and the evaluation process occurred on September 24th and the materials are now available online for you to access at your convenience. It is the intention of the Township to complete the Water Storage Project File Report in December 2025 and conduct the public 30-day review period early 2026. The full report and appendices, with more detailed descriptions of the evaluation will also be available for you at that time.

To answer your other questions, a recommendation was provided in the previously completed MSS report to evaluate and seek out additional water supply sources to support both expansion of infrastructure and anticipated population growth in the Township. It is anticipated that sometime after the conclusion of the Class EA for Water Storage, the Township will undertake a separate Class EA for Water Supply, with a comprehensive list of environmental studies and hydrogeological study. The Township recognize the importance of considering aquifer sustainability and redundancy for the water supply. The Township also recognizes that aging infrastructure, which caused the recent watermain break, need to be replaced and have expedited their watermain replacement program to install new watermains made of currently superior material compared to the previous pipes.

Thank you again for your comments and engagement with the Class EA for Water Storage in Millbrook.

Regards,

Nikash Persaud (They/Them)
Coordinator, Environmental Assessments

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t 416 497 8600 x1337
LinkedIn | Facebook | Website

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TOWNSHIP OF CAVAN MONAGHAN
Have it all. Right here.

SIGN-IN SHEET

Township of Cavan Monaghan
Class Environmental Assessment for Water Storage
Public Information Centre (PIC)
Wednesday, September 24th, 2025

Note: Personal information provided will be used only for providing updates on the status of the project, if requested. It will not become part of the public record.

Please Print Clearly				
NAME	**ADDRESS (INCLUDE POSTAL CODE)**	**TELEPHONE**	**E-MAIL**	**ADD TO STUDY MAILING LIST?**
[redacted]		[redacted]		
[redacted]	[redacted]	[redacted]	[redacted]	✓
[redacted]	[redacted]	[redacted]	[redacted]	✓
[redacted]	[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]	
[redacted]	"	"	"	

TOWNSHIP OF CAVAN MONAGHAN
Have it all. Right here.

Class Environmental Assessment for Water Storage
Public Information Centre

Comment Sheet

Name / Organization: [redacted]

Address: [redacted]

Phone Number: [redacted]

Comments: Our concerns about this process is that there are many parts including sewage handling/filtration capacity in conjunction w/ growth, steps required for growth in area to use the water storage and at what point would the build actually be necessary and where is the water coming from for this growth and storage. All the separate pieces need to be brought together for us all to see the explained end point.

Thank you for your participation!

If you have additional comments or questions, please contact a member of the project team below:

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Nikash Persaud
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2001 Sheppard Avenue East, Suite 300
Toronto, Ontario, M2J 4Z8
Tel: (416) 497 – 8600 ext. 1337
npersaud@rvanderson.com

Subject: 205371.00 - Response to Comment at Public Information Centre for Class EA for Water Storage in Millbrook
Sent: 2025-11-11, 1:35:18 PM
From: Nikash Persaud<npersaud@rvanderson.com>
To: [redacted]
Cc: Wayne Hancock

Categories: Filed by Newforma

Dear [redacted]

Thank you for your thoughtful comment which you provided to our team at the Public Information Centre for the Class Environmental Assessment (Class EA) for Water Storage in Millbrook as well as your patience in receiving a response.

Regarding your question about the processes which need to all occur to support growth in the Township, we agree that water storage, water supply, water distribution system, wastewater treatment and sanitary sewer systems are all important components to be considered. These various aspects were reviewed and recommendations of when these need to be upgraded/expanded were presented in the recently completed Master Servicing Study (MSS). The Class EA for the Water Storage is only one of the Class EA's outlined in the MSS. Although the Township's current project is the Class EA for new water storage, the intention is to undertake a separate Class EA for water supply and wastewater treatment, when required.

The purpose of the Class EA process is to evaluate viable solutions for infrastructure against environmental, social, cultural, technical and economic criteria and to choose preferred solutions which provide the least impact to those criteria. As Class EAs are completed and accepted by the Ministry of Environment, Conservation and Parks (MECP), the preferred solution(s) can proceed to detailed design and implementation. The accepted preferred solution remains valid for 10 years, so even if the Township determines that implementation of the preferred solution is not needed presently, they are still getting ahead by understanding the infrastructure needs of Millbrook and determining what upgrades, replacements or new infrastructure may be needed in the near future.

The MSS report concluded that based on the anticipated population growth outlined in the previously completed Growth Management Study (GMS), additional water storage would be needed in the Township by 2028. The Township is regularly reviewing the actual population growth and resulting needs of the water system and will continue to consult with the Township of Cavan Monaghan Council and local residents on implementation of upgrades/new infrastructure for the benefit of the community.

Thank you again for your comments and interest in the Class EA for Water Storage in Millbrook. Feel free to reach out to the team if you have any additional questions.

Yours very truly,

Township of Cavan Monaghan, Public Works
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