The Regional Municipality of Peel

New Supplementary Water Supply Source for the Palgrave – Caledon East Drinking Water System

FINAL Environmental Study Report

Monday, May 27, 2024

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FINAL Environmental Study Report

Class Environmental Assessment for a New Supplementary Water Supply Source for the Palgrave – Caledon East Drinking Water System

Project no T001448A

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Executive Summary

I. Introduction and Background

The Region of Peel (Region) is responsible for several municipal drinking water systems within its municipal boundaries, which includes the City of Mississauga, City of Brampton, and the Town of Caledon. Within the Town of Caledon, the Region owns and operates four (4) independent groundwater systems; namely, Alton/Caledon Village, Palgrave/Caledon East, Cheltenham, and Inglewood, all of which service ten (10) villages, hamlets, and rural service centres across the Town of Caledon.

The Palgrave/Caledon East Drinking Water System (DWS) supplies drinking water to the communities of Caledon East, Palgrave, Palgrave Estates, Mono Road, Albion, Centreville, and Cedar Mills, drawing from six (6) municipal groundwater sources located across the Palgrave and Caledon East areas.

In 2019, the Region completed a comprehensive review of its municipal water systems in the Town of Caledon to understand the unique needs of each community, assess the capacity to service future population based on the projected and planned growth in these areas, and confirm infrastructure needs to accommodate existing and future demands. The review also included a risk assessment of system reliability, current ongoing planning review, development pressures and available system capacity. The findings of the 2019 review identified limited system redundancy as a potential risk in some areas, including the Palgrave and Caledon East communities, serviced by the Palgrave/Caledon East DWS, and concluded that additional capital works were necessary to mitigate risks and enhance system redundancy.

Specific to the Palgrave/Caledon East DWS, the Region identified the need for additional water supply and initiated an action plan to explore new supply opportunities in both Caledon East and Palgrave areas. An exploration program for an additional water supply in Caledon East was initiated in early spring 2019. Favorable aquifer conditions were encountered at one (1) test well site, leading to the recommendation for the construction of a new production well in the vicinity of the test well. Construction of a new municipal production well, herein referred to as Caledon East Well 6 (CE6), was completed in early 2020. A long-term aquifer performance test confirmed that the new municipal production well CE6 can sustainably produce 50 L/s (4,320 m^3/day) without interference with existing domestic wells or surface water features in the area. As such, planning for the connection of the new supplementary water supply source, CE6, to the existing Palgrave/Caledon East DWS is necessary.

CIMA+, on behalf of the Region, completed a Schedule C Municipal Class EA study to evaluate water supply servicing solutions for the Palgrave/Caledon East DWS and determine the preferred long-term solution. This Environmental Study Report (ESR) outlines the planning and decision-making process followed in the Class EA study and the recommendations.

II. Municipal Class Environmental Assessment Process

All municipal infrastructure projects in Ontario are subject to the Municipal Class EA process (Municipal Engineers Association, March 2023) to meet the requirements of the Environmental Assessment Act (EA Act).

The Municipal Class EA process is an approved decision-making and planning process that covers all aspects of the environment that should be considered during the planning and construction phases of a project. The Municipal Class EA process includes various phases that are completed subsequently to ensure that the best approach is identified to address a specific problem, requiring the evaluation of possible solutions/design concepts, and recommending the best solution based on a comprehensive evaluation of environmental effects and identification of mitigation measures.

The new supplementary water supply source for the Palgrave/Caledon East System project has been ultimately completed as a Schedule C undertaking under the Municipal Class EA Process. Completion of this report, referred to as the Environmental Study Report (ESR), fulfills the requirements of the Schedule C Class EA study process. The ESR will be placed on the public record for at least 30 calendar days for public review. Notification to the public and review agencies will be through the issuance of a Notice of Study Completion.

Interested persons may provide written comments to the project team within the review period and all comments and concerns should be sent directly to the Region. In addition, if there are outstanding concerns that the project may have a potential adverse impact on constitutionally protected Indigenous and treaty rights and that an Order may prevent, mitigate, or remedy this impact, Section 16 Order requests on those matters should be addressed in writing to the Minister of Environment, Conservation and Parks (MECP), the Director of Environmental Assessment Branch and the Region.

If no significant issues arise during the review period which cannot be resolved in consultation with the Region, and no Section 16 Order requests are received, the project will be considered approved and may proceed directly to implementation, as outlined in this report.

III. Problem/Opportunity Statement

The problem/opportunity statement for the New Supplementary Water Supply Source for the Palgrave – Caledon East Drinking Water System has been defined as follows:

Infrastructure improvements to the water supply system in the Palgrave/Caledon East Drinking Water System are required to:

- *Increase supply capacity and enhance the security of water supply.*
- *Minimize potential risks associated with declined well efficiency.*
- *Provide an appropriate level of service while meeting the long-term water needs of the serviced area.*

IV. Identification and Preliminary Screening of Alternative Solutions

A broad range of alternative solutions was developed during the early stages – Phase 2 of the Class EA Study. Preliminary screening of these alternative solutions was completed based on defined screening criteria, which included supply capacity and contribution to redundancy in security of water supply, compliance with applicable local plans and land use policies, technical feasibility, and financial viability relative to the other alternative solutions being evaluated.

The preliminary screening step resulted in the identification of the feasible alternative solution - "**Obtain Additional Supply Capacity from Another Source**", which includes two (2) potential sub-alternatives:

- Option 1 – Obtain Additional Supply Capacity though a connection between New Well CE6 and Existing Caledon East Water Treatment Plant #1 (WTP1). Raw water to be treated at WTP1. This option would involve construction of a raw water supply line connecting the new CE6 well to the existing Caledon East WTP1, to convey raw water for treatment prior to distribution.
- Option 2 – Obtain Additional Supply Capacity through a connection between New Well CE6 and Existing Distribution System. Raw water to be treated at a new treatment plant, to be built in the vicinity of CE6. This option would involve the construction of a 1 km long feedermain pipe, connecting the new treatment facility to the existing distribution system on Airport Road.

V. Development and Evaluation of Feasible Alternative Solutions

The feasible sub-alternative solutions were further conceptualized to capture key infrastructure requirements and key considerations in terms of main advantages and disadvantages as follows:

- Option 1 – Obtain Additional Supply Capacity though a connection between New Well CE6 and Existing Caledon East Water Treatment Plant #1 (WTP1). Major infrastructure requirements included a raw water pipeline connecting the new CE6 well to WTP1 and treatment capacity upgrades at WTP1 to accommodate future additional flows from CE6. Seven (7) different routes were identified reflecting potential raw water pipeline alignments, as shown in **Figure (i)**:
    - Route 1 A (3.7 km) – along Castlederg Road, Airport Road and Caledon Trailway Path
    - Route 1 B (4.1 km) – along Castlederg Road, Airport Road and Old Church Road
    - Route 1 C (3.8 km) – along Castlederg Road, Airport, Mouncrest and Old Church Road
    - Route 2 A (3.8 km) – along Castlederg Road, Innis Lake Road and Caledon Trailway Path
    - Route 2 B (5.5 km) – along Castlederg Road, Innis Lake Road and Old Church Road
    - Route 3 A (6.3 km) – along Castlederg Road, Mountainview Road and Caledon Trailway Path
    - Route 3 B (7.4 km) – along Castlederg Road, Boston Mills Road, Torbram Road, Mountainview Road, Walker Road, Airport Road and Old Church Road.

  All seven (7) pipeline routes would require crossing of the Caledon East Meltwater Aquifer situated in the northern part of the study area, with routes 2A, 2B, 3A and 3B having the longest distances through this area. Construction within the aquifer would entail significant dewatering requirements and groundwater control, requiring extensive technical and field investigations, as well as permits from relevant approval agencies.

  Specific considerations and challenges for each route were identified including terrain characteristics, dewatering and groundwater control requirements, potential conflicts with existing underground utilities, potential environmental and social impacts, source water protection concerns, traffic disruptions, and regulatory requirements. The assessment revealed several disadvantages associated in general with the concept for Option 1, including major environmental and technical implications arising from crossing the aquifer complex, significant dewatering requirements, potential conflicts with existing underground utilities and risk of traffic disruption, especially for the pipeline routing options along Airport Road.

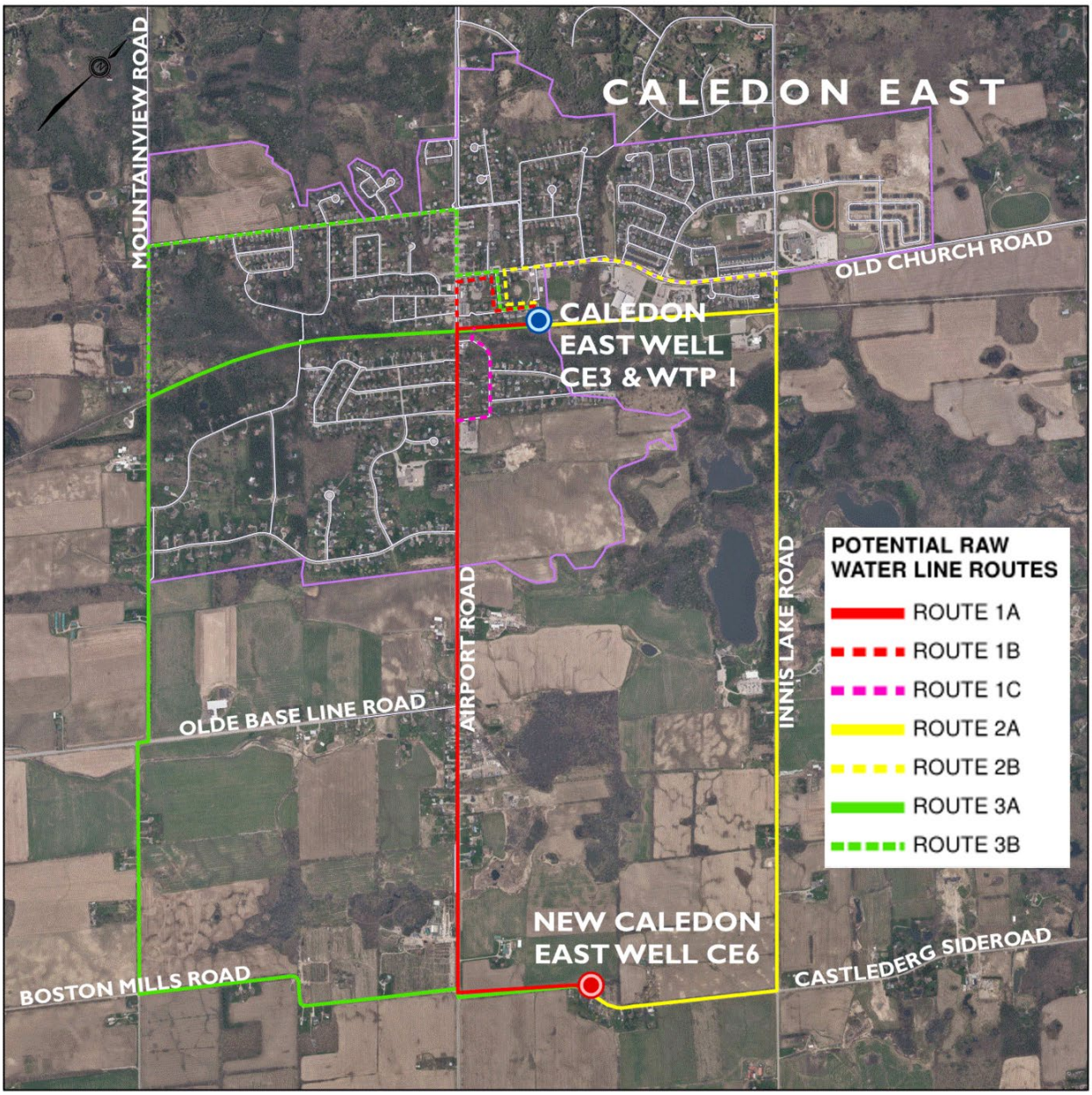

Figure (i): Option 1 – Obtain Additional Supply Capacity though a connection between New Well CE6 and Existing Caledon East Water Treatment Plant #1 (WTP1)

- Option 2 – Obtain Additional Supply Capacity through a Connection between New Well CE6 and Existing Distribution System. Raw water to be treated at a new treatment plant, to be built in the vicinity of CE6. Key components of Option 2, include:
    - New production well CE6, with a supply capacity of 50 L/s, located in Town of Caledon property.

- New treatment plant for treatment of CE6 groundwater in the vicinity of CE6.
- Approximately 1 km feedermain between the new treatment plant and the existing distribution system on Airport Road. The feedermain would extend westbound on Castlederg Sideroad (approximately 580m long) and then northbound on Airport Road (approximately 430m long).

General location of Option 2 and its key infrastructure components is shown in **Figure (ii)**.

A key consideration for Option 2 included the need for property acquisition to sit the required new water treatment plant. Preliminary consultation with the property owner, the Town of Caledon, was initiated during the early stages of the Class EA Study to gauge their willingness to sell and seek their feedback. Consultation and discussions with the Town were maintained as the Class EA progressed to keep them appraised of the results of key activities in the study and to continue gathering their feedback and input.

The presence of TRCA regulated floodplain areas in the vicinity of the CE6 well site and adjacent lands was also identified early in the Class EA study. TRCA was engaged early in the project to review the potential implications of regulated areas on the project and ensure their needs and requirements were addressed through the different activities and recommendations of the Class EA study.

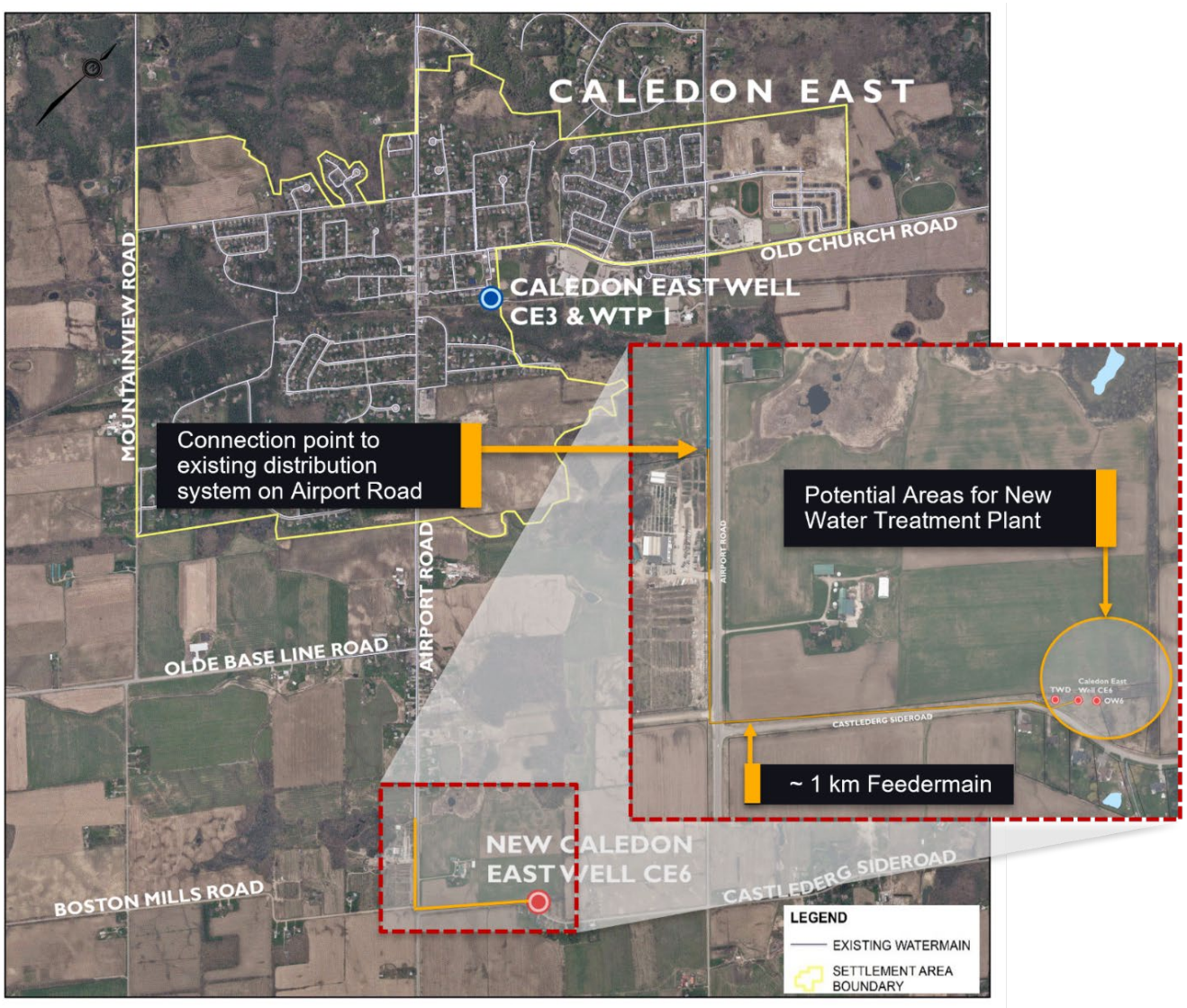

Figure (ii): Option 2 – Obtain Additional Supply Capacity through a Connection between New Well CE6 and Existing Distribution System

A significant differentiation between Option 1 and Option 2 comprised the elimination for crossing the Caledon East Meltwater Channel Aquifer with Option 2 and the associated prevention for significant dewatering challenges with Option 1. The relative short length of the connecting 1-km feedermain in Option 2, relative to the range in pipeline length for Option 1 (3.8 km to 7.4 km) would also result in less constructability complexity and minimize environmental and social impacts due to construction. In addition, Option 2 provided a significant opportunity to enhance system redundancy by adding a new independent groundwater source with its own treatment facility.

Desktop studies/investigations were completed to characterize existing conditions and identify potential constraints for the preliminary assessment of the feasible alternative solutions and their sub-options. Additionally, delineation of draft Wellhead Protection Areas (WHPAs) for new well CE6 and source water protection updates were carried out as a separate assignment to the Class EA study. Desktop studies/investigations included:

- Baseline Natural Features Assessment
- Background Hydrogeologic Assessment
- Desktop Geotechnical Study
- Traffic Assessment
- Contamination Overview Study
- Stage 1 Archaeological Assessment
- Cultural Heritage Resources Review

All options and sub-options were assessed against four (4) main criteria categories: natural environmental, technical, socio-cultural, and economic. Findings and recommendations from the desktop studies were used to support the assessment of the options. The results of the comparative evaluation provided the basis for the selection of the Preferred Alternative Solution:

Option 2: Obtain Additional Supply Capacity through a Connection between New Well CE6 and Existing Distribution System. Raw water to be treated at a new treatment plant, to be built in the vicinity of CE6.

Key advantages of Option 2 include:

- An additional treatment plant with the proposed new treatment facility improves security / redundancy of the Palgrave – Caledon East DWS.

- Major dewatering challenges and technical/construction costs associated with crossing of Meltwater Aquifer are eliminated.
- Pipeline crossing of key natural and hydrologic features are avoided, eliminating associated construction challenges, and greatly reducing impacts to sensitive environmental features and water resources.
- The short feedermain length (~1 km) reduces project cost and potential conflicts with underground infrastructure.
- Traffic impacts are minimized by avoiding construction for a long distance in a major arterial road (Airport Road). Minor traffic impacts are expected from feedermain installation on Castlederg Sideroad and south section of Airport Road (outside Caledon Village core area).

The list of potential alternative solutions and the results of the preliminary screening and comparative evaluation of feasible alternative solutions were presented to the public and agencies for feedback via an online Public Information Centre (PIC). The PIC was held on the Region's website on May 23, 2022, for approximately three (3) weeks, until June 10, 2022, concluding Phase 2 of the Class EA study process.

VI. Identification and Evaluation of Alternative Design Concepts

As part of Phase 3 of the Class EA study, the Preferred Alternative Solution – **Option 2: Obtain Additional Supply Capacity through a Connection between New Well CE6 and Existing Distribution System. Raw water to be treated at a new treatment plant, to be built in the vicinity of CE6 –** was further developed into alternative design concepts.

Major infrastructure components were categorized into vertical infrastructure which comprises the new water treatment plant, and linear infrastructure which comprises the 1.0 km feedermain connection. Alternative design concepts were developed separately for both components.

For vertical infrastructure, two (2) alternative design concepts for treatment trains to be implemented at the new water treatment plant were developed:

- Option WTP1: Disinfection through chlorination only
- Option WTP2: Disinfection through a combination of chlorination and UV irradiation

For linear infrastructure, three (3) alternative design concepts were developed to reflect feasible pipe installation methods for the new 300mm diameter interconnecting feedermain, as follows:

- Option F1: Pipe installation predominantly by open-cut method with no trenchless sections
- Option F2: Pipe installation predominantly by trenchless methods with minimum open cut sections
- Option F3: Pipe installation by a combination of open cut and trenchless methods

To support the evaluation of alternative design concepts outlined above, field investigations were conducted to identify potential impacts and mitigation measures specific to each option. A thorough comparative evaluation of the alternative design concepts was conducted considering various evaluation criteria such as natural/environmental, socio-cultural, technical/operational, and financial/economics aspects. Opinion of probable capital costs were developed for each design concept, for both vertical and linear infrastructure, to support the financial evaluation of the options. Additionally, operating and maintenance costs, as well as lifecycle costs were developed for vertical infrastructure to provide further insights for the financial assessment.

Each design concept was assessed and given a score based on its potential net impact. The alternative design concepts, results of the selection process for the preliminary preferred design concept and the potential impacts and mitigation measures were presented to the public and agencies for feedback via a second Public Information Centre (PIC 2) held in-person at Caledon East Community Complex on October 4, 2023, from 4:00 pm to 7:00 pm.

VII. Preferred Recommended Alternative Design Concept

The preferred design concept identified in the Class EA study is:

To Obtain Additional Supply Capacity through a Connection between New Well CE6 and Existing Distribution System. Vertical infrastructure comprises a new water treatment plant in the vicinity of the existing New Well CE6. Linear infrastructure comprises a 1 km feedermain interconnection between the new water treatment plant and the connection point to the existing distribution system on Airport Road. Feedermain pipeline installation to be predominantly by trenchless methods with minimum open cut sections.

Key considerations for the preferred recommended alternative design concept include:

- A new water treatment plant providing treatment for disinfection through chlorination alone, built in the immediate vicinity of the new well CE6. The new building will have

sufficient footprint to allow for future installation of greensand filters, if considered necessary. A building footprint of approximately 18m x 23m has been established.

- A 1 km long, 300mm diameter connecting feedermain between the new CE6 water treatment plant and the existing Caledon East distribution system on Airport Road. The feedermain will extend westbound on Castlederg Sideroad (approximately 580m long) and then northbound on Airport Road (approximately 430m long) to the connection point to the distribution system. The feedermain will be installed primarily through trenchless methods along Castlederg Road and Airport Road.
- The new treatment building will be designed to accommodate the future process wastewater management system associated with a future provision of a greensand filtration system. This system is proposed to be installed during building construction to avoid any future construction challenges under existing buildings.
- Treatment building to include a separate generator room to house the emergency standby power equipment. Consideration to availability of natural gas source in the area, associated costs, and potential implications to source water protection to be reviewed and evaluated during the design phase of the project.
- Site works will also include a new driveway for site access, chemical delivery, and future sludge disposal trucking, as well as landscaping for aesthetics.
- Property acquisition with the Town of Caledon to be continued to secure the site for the new water treatment plant. Future 26 m Right of Way of Castlederg Side Road to be maintained, as requested by the Town of Caledon.
- Utility locates confirmed that other than underground telecommunication services (i.e., Bell), there are no municipal water, sewage, or stormwater services along the subject section of Castlederg Road. Municipal sewage services exist on the east side of the road section investigated on Airport Road.

A preliminary site plan illustrating a conceptual site layout for the new water treatment plant at the CE6 well site is shown in **Figure (iii).** All proposed new infrastructure will be located respecting the minimum 10m setback from the TRCA regulated floodplain areas and a minimum setback from existing onsite wells. The most appropriate building size for the new water treatment facility, orientation, and location within the CE6 well site, as well as feedermain alignment along Castlederg Side Road and Airport Road, will be refined during the design phase.

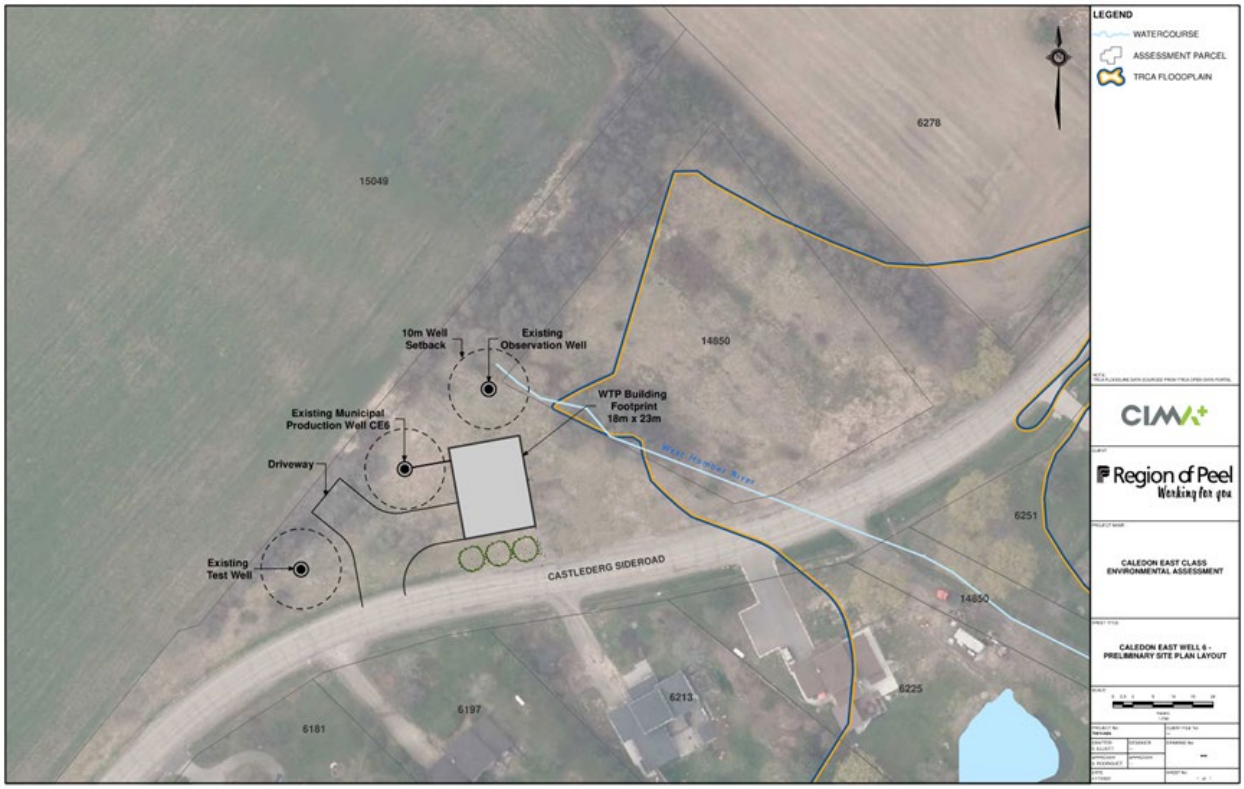

Figure (iii): Conceptual Site Plan – New Water Treatment Plant on CE6 well site

The schematic of the preferred design concept for vertical infrastructure is presented in **Figure (iv)**. The key advantages of providing disinfection through chlorination alone are reduced complexity of the treatment process, decreased operational and maintenance needs, lower energy requirements, and relatively lower costs.

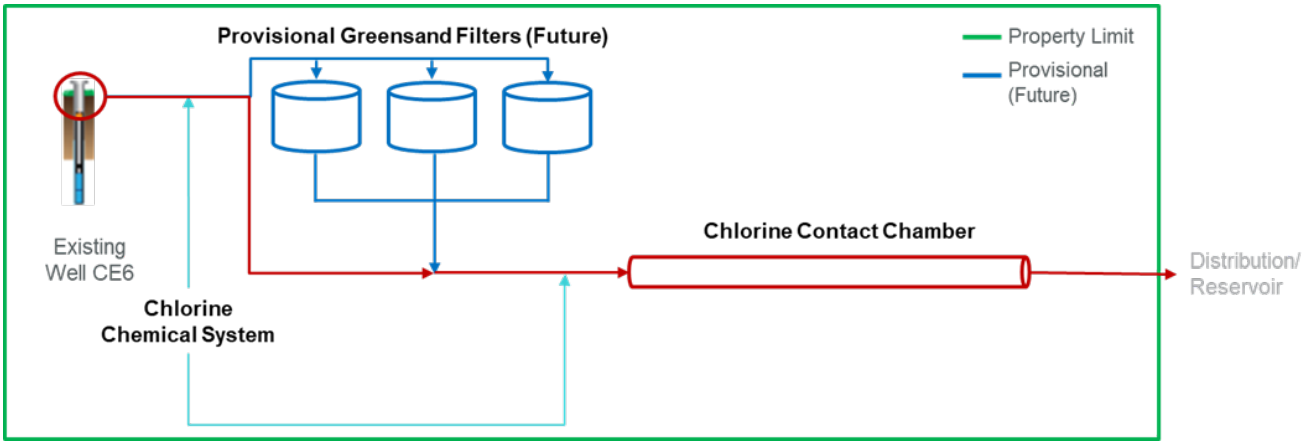

Figure (iv): Preferred Water Treatment Design Concept – Option WTP1 Disinfection through Chlorination Only

A general schematic of the preferred design concept for linear infrastructure is presented in **Figure (v)**. The key advantages of predominantly employing trenchless methods for pipe installation are minimal recurring disruptions along Castlederg Sideroad, reduced inconvenience for residents and road users, and minimum impacts on streetscape and traffic during construction.

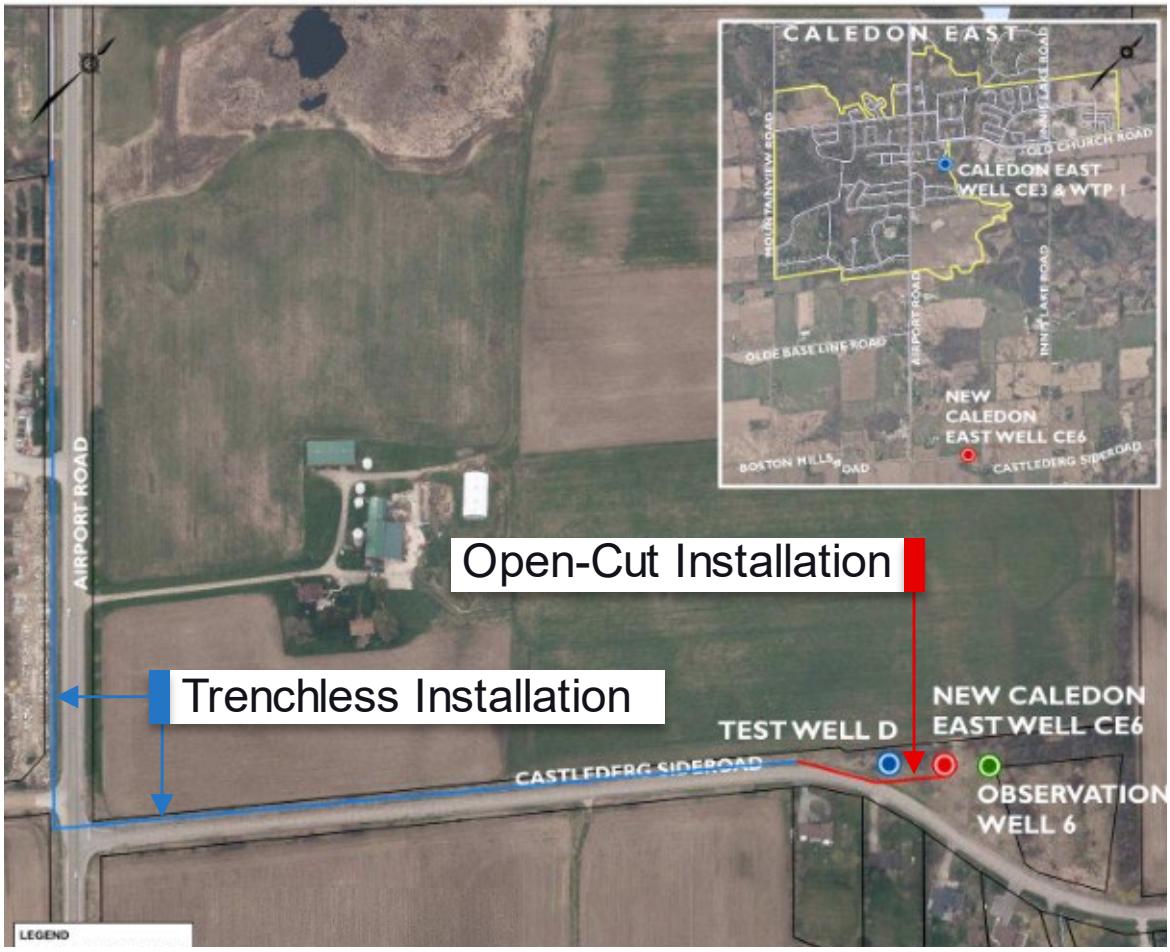

Figure (v): Preferred Feedermain Design Concept - Option F2 Pipe installation predominantly by trenchless methods with minimum open cut sections

VIII. Anticipated Potential Impacts and Mitigation Measures

Potential impacts associated with the implementation of the preferred alternative design concept were identified as well as available mitigation measures. As with any other construction project, some inevitable short-term construction effects in terms of noise, vibration, dust, and truck traffic will be experienced around the construction areas; however, no residual negative impacts are expected with the implementation of mitigation measures outlined in this report. Specific mitigation measures, as

summarized below, are recommended for implementation to reduce anticipated potential impacts.

Socio-Cultural Environment

Specific mitigation measures are recommended for implementation to reduce anticipated short-term impacts associated with the duration of construction.

Public health and safety are a priority to the Region and as such, all design and construction activities related to the project will adhere to strict safety guidelines and all applicable codes and standards. All construction work must be carried out in accordance with the Occupational Health and Safety Act (OHSA) and other local regulations.

Construction activities associated with the construction of the new treatment facility and feedermain could affect the surrounding socio-cultural environment. The private residences in the vicinity are anticipated to have a low impact from potential disturbances from operations and maintenance activities.

The selected route for the feedermain follows low traffic volume sections on Castlederg Road and Airport Road, minimizing disruptions as it will be primarily installed using trenchless methods. The increased construction activities may lead to an increase in traffic volume and congestion in the project area during the duration of construction from the delivery of construction equipment, construction materials and potential removal of excavated material from the site. This could potentially disrupt regular traffic patterns and impact the overall safety and convenience for road users. The proposed mitigation measures include:

- Appropriate hours of work to be specified in the contract and in accordance with local by-laws.
- Completion of lane closures in accordance with best practices to protect the safety of the workers and public.
- Informing residents of any road closures and anticipated timing as well as the overall schedule of construction.
- Employment of all standard best practices for vehicle and pedestrian safety throughout all construction areas in adherence with strict safety guidelines.

Construction traffic and activities could create additional dust and mud. There are no anticipated concerns regarding dust and mud during normal facility operation. The proposed mitigation measures include dust control measures such as the application of

water to be implemented as required. The Region will ensure that the contractor maintain public roadways clean and free of mud on a consistent basis.

Temporary noise and vibration effects are anticipated in connection with construction traffic and construction equipment. Noise during operation of the well and treatment facility is not expected to be significant. Standard proposed mitigation measures include regular monitoring, ensuring all vehicles and construction equipment are equipped with effective muffling devices and are operated in a fashion to minimize noise in the project area, and ensure the contractors undertake measures to reduce noise disturbances as much as possible and adhere to local noise by-laws.

Archaeological Resources

Findings of the Stage 1 and Stage 2 Archaeological Assessments carried out as part of the study concluded that the project area is free from archaeological concerns. Consequently, the construction disturbance activities related to the Project within the project area are not expected to cause any archaeological impacts.

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, 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.

Built Heritage Resources and Cultural Heritage Landscapes

Golder (now a part of WSP) was retained as a sub-consultant to conduct an assessment of the built heritage resources and cultural heritage landscapes in support of the Class EA Study. WSP’s findings and recommendations are documented in the

"Cultural Heritage Report: Existing Conditions and Preliminary Impact Assessment" (dated February 2023) and is attached in Appendix S.

The study identified five (5) built heritage resources (BHRs) and one (1) cultural heritage landscape (CHL) with known or potential cultural heritage value or interest (CHVI) within the Study Area. However, the preliminary impact assessment determined that there would be no adverse impacts on the BHRs or CHL.

The Cultural Heritage Report includes the following mitigation recommendations:

- Staging and construction activities should be carefully located and planned to prevent any negative impacts on the identified BHRs and CHL.
- In case of future work that involves the expansion of the New Supplementary Water Supply Source for the Palgrave/Caledon East Drinking Water System Class EA Study Area, it is advisable to engage a qualified heritage consultant to assess the impacts of the proposed work on known or potential BHRs and CHLs.

Natural Environment

The Natural Environment Report by WSP Canada (January 2023, Appendix G) provides a detailed assessment of potential impacts and mitigation measures to the natural environmental features including Candidate and Confirmed Significant Wildlife Habitat (SWH) areas such as the ROW Cultural Meadow (Vegetation Unit 1) and the Caledon East 6 Municipal Supply Well property (Vegetation Unit 4). Several species, including Monarch and Yellow-banded Bumblebees, Barn Swallows, Red-headed Woodpeckers, and Short-eared Owls, may experience minor and temporary disruptions to their foraging habitats due to the project's construction, with subsequent restoration post-construction.

Other species like Eastern Ribbonsnake and Snapping Turtle, although lacking on-site habitat, may be susceptible to construction activities while moving between wetland habitats.

Standard best management practices and recommended mitigation measures include:

- Re-stabilizing and re-vegetating exposed surfaces, appropriate vegetation clearing methods, proper disposal of cut and grubbed material, equipment cleaning to prevent invasive species spread, and the use of standard practices like sediment and erosion controls.

- Avoiding vegetation removal during nesting season unless preceded by a nesting survey, installing buffers around active nests, and refraining from disturbing active nests.
- Daily inspection of construction areas to ensure no SAR turtles or snakes have entered the construction zone. Nests of turtles should not be disturbed, and if necessary, they should be protected and relocated. Mesh or netting materials that might entangle wildlife should be avoided.
- Re-vegetation of disturbed areas with a native seed mix to enhance Monarch and Yellow-banded Bumblebee habitat. All disturbed areas should be restored to pre-construction conditions.

Geotechnical and Hydrogeological

The hydrogeological assessment conducted by Geo Kamp Limited (July 2021) and the geotechnical study conducted by Golder Associates Limited (August 2021) reported favorable conditions, with no significant concerns for the new well CE6 and pipeline construction, indicating no expected interference with existing wells or surface water. The construction avoids sensitive areas like the Melt Water Aquifer Complex and floodplain areas and both assessments indicate positive conditions and minimal geotechnical and hydrogeological concerns in the study area.

Source Water Protection

Impacts on Existing Groundwater Users and Surface Water Features

The construction and testing of CE6 as part of the Well Construction Program in 2020 included an assessment of cumulative impacts on existing groundwater users and surface water features from water takings at CE6. The assessment involved a 3-day constant rate pumping test and included the following key activities:

- A total of twenty-three (23) groundwater and surface water stations were monitored during the well testing including the pumped well (CE6), two (2) dedicated observation wells, six (6) surface water locations and fourteen (14) local domestic wells to address potential shallow groundwater and surface water concerns.
- Identification of potential groundwater receptors including domestic or permitted water supplies in the area that could reasonably be impacted by water takings of CE6. A total of 67 water well records were obtained from MECP database in the vicinity of CE6. A door to door well survey was undertaken to confirm the location and completion details of all private domestic wells within a 500m radius or anticipated zone of influence of CE6. 14 domestic drilled or dug wells, shown in **Figure (vi),** were monitored before, during and after the test pumping of CE6.

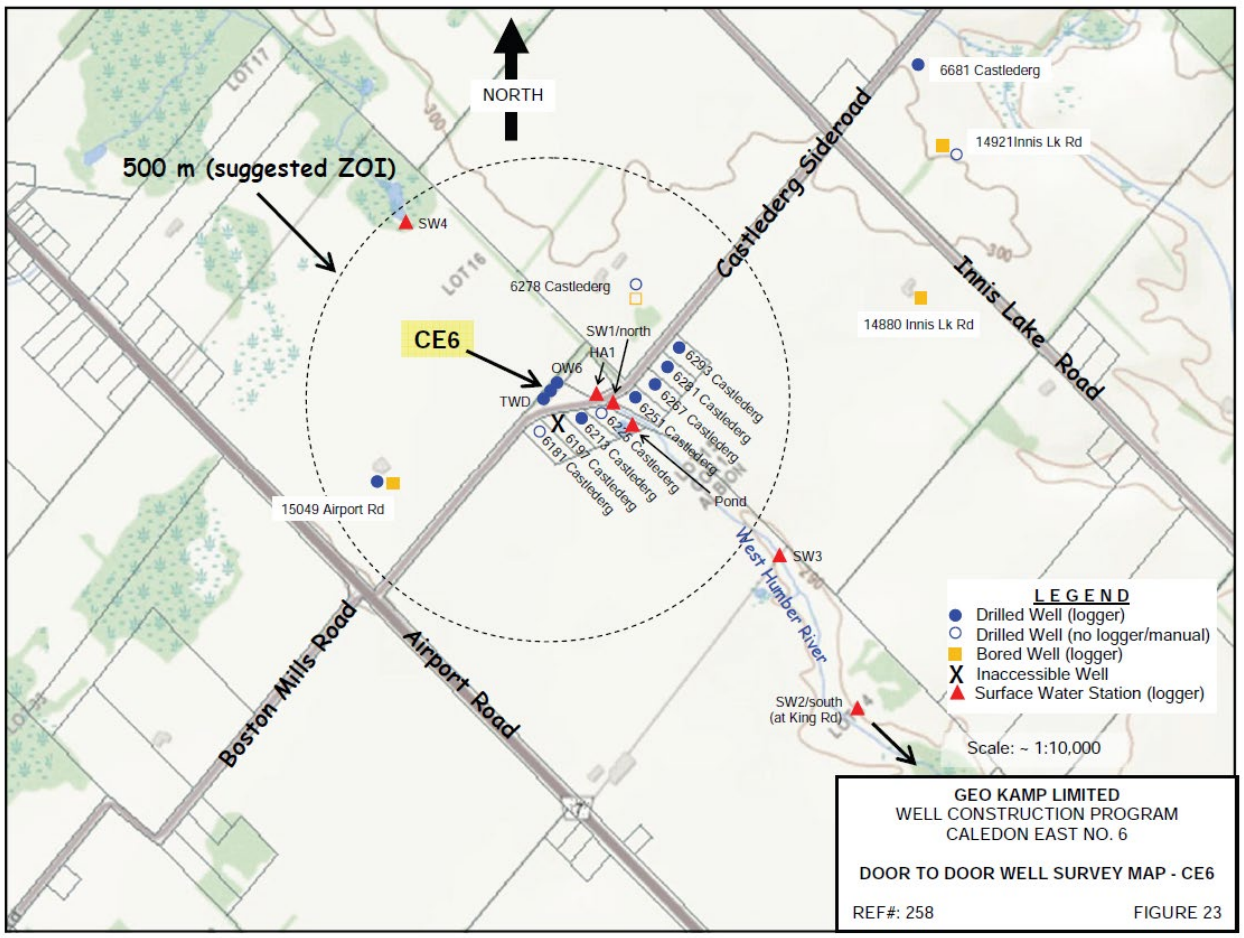

Figure (vi): Existing Domestic Wells and Monitoring Locations – CE6 Well Construction Program 2020

Key findings of the impact assessment included:

- Most of the monitored wells within the vicinity of CE6 were identified to be screened at a depth less than 30 m (Shallow), while two (2) wells were identified to be screened at a depth of 30 – 100 m (Intermediate depth water bearing zone). Along with CE6 and test well TWD, one (1) well was identified to be deeper than 100 m (within the Buried Bedrock Valley).
- No drawdown was observed in shallow and intermediate depth wells.
- No significant interference will occur with existing domestic wells or surface water features as a result of the long-term operation of the new well CE6.
- The estimated cone of influence measured during the 3-day aquifer performance test was approximately 6,000 m.

- As noted above, it was concluded that the operation of CE6 is unlikely to significantly interfere with existing domestic wells or surface water features. However, if an unacceptable impact is reported and believed to be caused directly from municipal water takings, a contingency plan, including the following key actions are recommended:
- Temporarily stall water takings at the well until it is proven that the unacceptable impact is unrelated to the operation of the well.
- Prepare a detailed report on the unacceptable impact, including information on the reporter, location and damages incurred.
- Validate the claims against the operation of the well using historical pumping test evaluations to assess the likelihood of the impact being a direct result of the well.
- If the impact is confirmed as a direct result of the well operation and affects groundwater quantity or quality in a private well, implement a plan to mitigate damages and prevent future occurrences.
- If the impact is confirmed and affects the natural functions of the surrounding ecosystem, establish a plan to mitigate further impacts to the ecosystem.
- If the impact is determined to be unrelated to the well's operation, reinstate the well, and resume pumping. Maintain a record of the impact report for three (3) years.

Additionally, based on the findings of the hydrogeological assessment conducted by Geo Kamp Limited in 2021, the construction of 1 km feedermain along Castlederg Sideroad and Airport Road is not expected to have impacts on surface water features since the feedermain avoids crossing any watercourses. The feedermain will be installed primarily through trenchless methods along Castlederg Road and Airport Road, and excavations during construction could be up to 5m in depth. Dewatering challenges are not expected, and the route is expected to be relatively dry since it avoids the Caledon East Meltwater Channel.

It is recommended that private groundwater wells situated within 200 meters of the proposed infrastructure be inventoried and monitored both before and after construction to ensure the protection of local water resources.

In summary, the Project is not expected to affect the quantity or quality of groundwater or surface water features in the area and any conditions from WHPA policies will be included in the amended Municipal Drinking Water License.

Delineation of Wellhead Protection Areas (WHPAs) and Groundwater Vulnerability Assessment

A new municipal supply well results in new Wellhead Protection Areas (WHPAs). The delineation of these new WHPAs was carried out as a separate assignment in parallel to this Class EA project. The draft limits of the new WHPAs were shared with the public during the first PIC 1. The final boundaries of the WHPAs were subsequently confirmed and presented during PIC 2, as shown in **Figure (vii)**.

Along with WHPA delineation, groundwater vulnerability, issues evaluation and threats assessment were completed by Aqua Insight in December 2022. Key findings include:

- The unsaturated travel time within the CE6 WHPAs exceeds 50 years, due to deeper water tables and low recharge rates.
- Particles from WHPA-D take over 100 years to reach the well due to the deep and confined production aquifer.
- Surface to Well Advective Travel Time (SWAT) in WHPAs exceeds 25 years, indicating low vulnerability.
- Vulnerability scores were assigned to WHPA polygons, with WHPA-C and -D at score 2 (low vulnerability), WHPA-B at score 6, and WHPA-A at score 10.
- WHPA-A has 40-80% managed land due to residential presence, while WHPA-B has over 80% managed land and varying livestock density.
- Road salt application within CE6 WHPAs presents low threats to drinking water according to established technical guidelines.

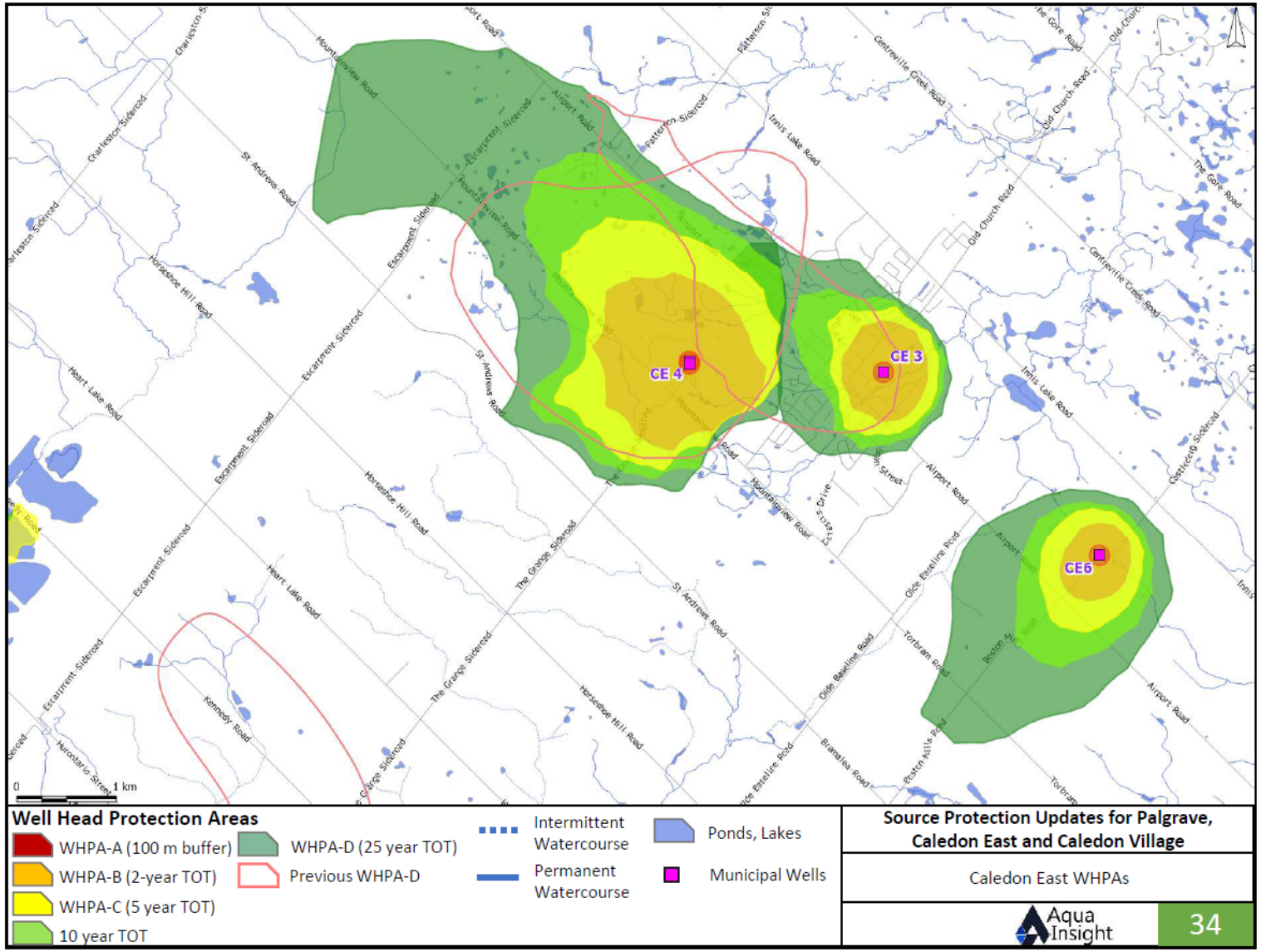

Figure (vii) : Delineation of WHPAs for Caledon East Wells 3, 4/4A, and 6

Drinking Water Vulnerability Analysis and Threats Evaluation

As per the Clean Water Act, 2006, a drinking water threat is defined as an activity or condition that adversely affects or has the potential to adversely affect the quality or quantity of any water that is or may be used as a source of drinking water.

Ontario Regulation O. Reg. 287/07 under the 2006 Clean Water Act, has prescribed 22 threats for which policies must be written in areas where these threats could be significant. The following threats were identified to be associated with CE6:

- *Threat #2. The establishment, operation or maintenance of a system that collects, stores, transmits, treats, or disposes of sewage.*

  The sources for this threat are associated with existing residential land uses in the vicinity of the CE6 area. Specific actions related to septic systems governed under the Building Code Act and the Ontario Building Code, are to be implemented by the local Municipality. The responsible authority for policy implementation in this specific case is the Town, which addressed septic systems through the Town's Septic Re-inspection Program for on-site sewage disposal systems that discharge 10,000 litres and less.

- *Threat #3. The application of agricultural source material to land.*
- *Threat #4. The storage of agricultural source material.*
- *Threat #5. The management of agricultural source material.*
- *Threat #8. The application of commercial fertilizer to land.*
- *Threat #9. The handling and storage of commercial fertilizer.*
- *Threat #21. The use of land as livestock grazing or pasturing land, an outdoor confinement area or a farm-animal yard.*

The Source Protection Updates for the Communities of Palgrave, Caledon East, and Caledon Village, completed by Aqua Insight, December 2022, included a review of all agricultural and non-agricultural Managed Land parcels within the WHPAs for CE6.

The assessment targeted areas with a vulnerability score of 6 or higher, as defined in the 2021 Director's Technical Rules (MECP), indicating Moderate or Significant drinking water threats. For CE6, within WHPA-A (vulnerability score of 10) and WHPA-B (vulnerability score of 6), the analysis revealed that WHPA-A had 40% to 80% Managed Lands due to the presence of residential land uses, while WHPA-B had more than 80% Managed Lands. The land use type was predominantly classified as Agricultural Managed Lands, indicating the potential for these lands to receive agricultural source material (ASM) or fertilizer. Residential areas were conservatively interpreted to have

80% pervious surface where fertilizer could be applied, in consistency with the Town of Caledon Official Plan.

In addition, Aqua Insight's assessment included mapping livestock density to understand water quality impacts related to the storage, generation, and application of agricultural source material. Livestock-related threats were evaluated based on nutrient units generated per acre. The analysis determined that WHPA-A had a livestock density less than 0.5 nutrient units per acre, which can be categorized as low potential threats as defined by the thresholds in the Technical Rules (MECP, 2021). Conversely, WHPA-B had a density ranging from 0.5 to 1.0 nutrient units per acre, categorizing it as a moderate potential threat.

Consequently, the Threats # 3, 4, 5, 8, 9 and 21 were identified to be potential threats associated with CE6.

- *Threat #10. The application of pesticide to land.*
- *Threat #11. The handling and storage of pesticide.*

  Before the initiation of the Region’s 2019 Groundwater Exploration program, a comprehensive screening of the test drilling site for CE6 took place in 2014 to assess potential environmental risks. An Ecolog ERIS Ltd. search was conducted within a 600-meter radius of the proposed test drilling targets. The search identified three mappable records in the Pesticide Register related to the CE6 area (Site D). The reported presence of pesticides in proximity to CE6 was likely associated with the Glen Echo Nursery.

  Although the nursery itself does not fall within the WHPA-A and WHPA-B designations for CE6, Threats #10 and #11 were recognized for CE6 based on this information.

- *Threat #12. The application of road salt.*
- *Threat #13. The handling and storage of road salt.*

  The Source Protection Updates for the Communities of Palgrave, Caledon East, and Caledon Village, completed by Aqua Insight, December 2022, included an assessment of the potential threats related to winter road salt application. Consideration to the percentage of impervious surface area (e.g., roads, parking lots) was part of the impervious cover assessment exercise. Within the Caledon East area, road salt application on all roads within the WHPAs were classified as Low Drinking Water Threats, using the Circumstance Tables in the Technical Rules (MECP, 2021).

Recent feedback received from the MECP revealed that storage of road salt could become a significant threat based on how it is stored and regardless of the percentage of impervious surface area. The following policies in the CTC Source Protection Plan apply to Low/Moderate drinking water threats related to the application, handling, and storage of road salt:

- SAL-12: Encourages municipalities to mandate a salt management plan for unassumed roads and private parking lots exceeding 200 square meters in specified Wellhead Protection Areas (WHPAs) and Highly Vulnerable Areas (HVA), where road salt application poses a moderate or low drinking water threat. The plan should focus on minimizing salt usage through alternative measures while ensuring public safety, and it should involve the requirement for trained individuals in road salt application, potentially including technicians, technologists, winter maintenance supervisors, patrollers, equipment operators, mechanics, and contract employees.
- SAL-13: Encourages municipalities to annually report sodium and chloride monitoring results to the Source Protection Authority in areas where the application, handling, and storage of road salt pose a moderate or low drinking water threat. The Source Protection Authority shall assess the information for trends and advise the Source Protection Committee on the need for development of new source protection plan policies to prevent potential drinking water issues.

The Region is implementing a winter maintenance pilot project with best management practices (BMPs) to minimize salt usage and its impact on municipal wells. BMPs include adhering to Site Plans for snow pile locations and salt instructions, removing snow before applying de-icing products, having Smart About Salt certified contractors, sweeping and removing excess salt or de-icing products, considering temperature and conditions before application, and requiring monthly tracking of salt usage at each well facility by contractors.

- *Threat #15. The handling and storage of fuel*

  The handling and storage of fuel poses a potential threat for CE6, contingent upon the system configuration. The preferred recommended design concept, identified in this Class EA study and outlined in this report, proposes the construction of a new water treatment plant in the immediate vicinity of CE6. If an emergency standby diesel generator is considered for the new treatment plant, it would necessitate a fuel tank, making this threat relevant. Additionally, due to the presence of agricultural

lands, heavy machinery and agricultural equipment powered by fuels like diesel pose a risk of fuel spills through accidental leaks or improper handling.

- *Threat #16. The handling and storage of a dense non-aqueous phase liquid (DNAPL)*

  This threat has not been identified as a significant threat resulting from the operation of the CE6 system, following the proposed recommendations of the Class EA study. However, construction activities associated with the project may introduce potential temporary risks related to fuel and DNAPL. Heavy machinery and construction equipment, powered by fuels like diesel, pose a risk of fuel spills through accidental leaks or improper handling. Additionally, the use of DNAPLs, such as degreasers and industrial chemicals during construction, can contribute to soil and water contamination. Stormwater runoff from construction sites may carry pollutants, including residues of fuel and DNAPL, into nearby water bodies.

  To mitigate potential risks during construction, proposed measures include implementing erosion and sediment control techniques, conducting regular site inspections to address fuel spills and DNAPL contamination, instituting monitoring programs for soil and water quality, practicing proper storage and handling of fuels and chemicals, obtaining required permits, developing spill response plans, and ensuring personnel are trained in emergency procedures and hazard awareness.

Climate Change

Construction/operation of a new well and treatment plant may result in higher energy requirements and additional greenhouse gas emissions due to heating, lighting, electrical requirements as well as chemical delivery needs. In addition, the existing landscape of the area would need to be altered to accommodate new infrastructure.

Implementation of the following climate mitigation measures should be considered to reduce the long-term generation of carbon emissions arising mainly from operation of the new treatment facility and to enhance carbon storage due to proposed changes in the landscape:

- Construction equipment should be appropriately maintained to ensure that exhaust emissions meet industry standards.
- Use of energy efficiency features within the treatment facility such as LED lighting features and insulation to reduce the energy needs. Moreover, using energy-efficient pumps and equipment and optimizing system design would also contribute to the mitigation of climate change impacts.

- Chemical delivery is expected to be minimal; however, delivery could be scheduled on a monthly/bi-monthly basis to reduce the number of delivery trucks to/from the new reservoirs and new facilities.
- Implementation of an adequate landscape plan, comprising planting of new trees and local non-invasive vegetation species within the new site

IX. Public and Review Agency Consultation

Schedule C undertakings under the Municipal Class EA planning process require that members of the public, interest groups, review agencies and Indigenous Communities are given opportunities to provide input and comments from the early stages of the Class EA Study. The project team met this requirement by issuing and providing a Notice of Study Commencement advising of the start of the project and public notices advising of two (2) Public Information Centres (PIC). The public notices were placed for two (2) consecutive publications in a local newspaper, Caledon Citizen and also posted on the Region's webpage.

Through the consultation process, no major public concerns or issues were raised associated with the preferred recommended design concept. Comments and feedback were received after the Notice of Commencement and first virtual PIC in relation to the New Supplementary Water Supply Source for the Palgrave/ Caledon East Drinking Water System Class EA Study. The major comments received include inquiries about private well impacts. The project team provided transparent communication and thorough information sharing to successfully address all concerns.

Communication and consultation with Indigenous Communities was also undertaken and accommodated throughout the Class EA study. Communication and consultation with MECP, TRCA, CVC and MHSTC were undertaken at various key stages of the Class EA process. Consultation will continue, as required, with public and agency stakeholders during the design and construction stages of the project.

Property acquisition is a critical aspect of accommodating the new treatment plant and is a key consideration in this study. The Region engaged its internal real estate group to explore property acquisition opportunities in the early stages of the project. Consultations between the Town of Caledon and the Region were carried out throughout the study to assess the feasibility of acquiring the existing site where the new well CE6 is located. The Town has expressed willingness to sell the property and has also requested the use of trenchless methods for the feedermain installation along Castlederg sideroad. The preliminary preferred design concept and conceptual site plan layouts were reviewed with the Town of Caledon to support the ongoing land acquisition

process. The Town confirmed their support for the proposed preliminary preferred solution and the project in general, subject to addressing the provided comments. The Region will continue the property acquisition process in direct consultation with the Town of Caledon to secure the new municipal site.

A Notice of Study Completion will be published in the local newspapers and distributed to all in the project contact list. The notice will notify the public and agencies that this report has been placed on the public record for review. The Notice will advise available methods to review the report, the time period to provide comments, and the opportunity to provide further comments.

The Region will continue to inform the public during the project design and construction phases. Project updates will be issued, as necessary, and notices will include a dedicated contact person from the Region to respond to issues or concerns that may arise.

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1 Introduction

1.1 Background

The Region of Peel (Region) encompasses the City of Mississauga, the City of Brampton, and the Town of Caledon. The Region is responsible for the planning, design, construction, operation, and maintenance of the water systems within its municipal boundaries. In some rural areas of the Town of Caledon (Town), drinking water is provided through well-based drinking water systems where groundwater is drawn from municipal wells and treated at small scale water treatment plants.

The Region owns and operates four (4) groundwater-based drinking water systems in the Town, namely, Alton/Caledon Village, Palgrave/Caledon East, Cheltenham, and Inglewood. Ten (10) villages, hamlets and rural service centres are currently serviced by the four (4) municipal groundwater systems. The Palgrave/Caledon East Drinking Water System (DWS) supplies drinking water to the communities of Caledon East, Palgrave, Palgrave Estates, Mono Road, Albion, Centreville, and Cedar Mills in the Town. The system is currently supplied by six (6) active municipal groundwater sources; three (3) located in Palgrave and three (3) in Caledon East.

In 2019, the Region completed a comprehensive review of its municipal groundwater-based and wastewater systems in the Town to understand the unique needs of each community, assess the capacity to service future population based on the projected and planned growth in these areas, and confirm infrastructure needs to accommodate existing and future demands. The review also included a risk assessment of system reliability, current ongoing planning review, development pressures and available system capacity. Findings revealed that while current and projected growth can be supported by the existing municipal drinking water systems, limited system redundancy poses a potential risk in some areas, particularly the Palgrave and Caledon East communities serviced by the Palgrave/Caledon East Drinking Water System. The review also concluded that additional capital works are necessary to mitigate risks and enhance system redundancy.

Specific to the Palgrave/Caledon East Drinking Water System, the Region identified the need for additional water supply and initiated an action plan to explore new supply opportunities in both Caledon East and Palgrave areas. An exploration program for an additional water supply in Caledon East was initiated in early spring 2019. Favorable aquifer conditions were encountered at one (1) test well site, leading to the recommendation for the construction of a new production well in the vicinity of the test well. Construction of a new municipal production well, herein referred to as Caledon

East Well 6 (CE6), was completed in early 2020. A long-term aquifer performance test confirmed that the new well CE6 can sustainably produce 50 L/s (4,320 m^3/day) without interference with existing domestic wells or surface water features in the area.

Preliminary testing results revealed that, based on water quality and quantity data, CE6 could serve as an additional municipal production well to the Palgrave/Caledon East Drinking Water System, with the requirement for raw water treatment before distribution. Considering the geographical location of the new well CE6 relative to other drinking water supply and treatment infrastructure in the Caledon East area, it was anticipated that treatment for CE6 raw water could be provided at the existing Caledon East Water Treatment Plant 1 (WTP1).

Accordingly, the Region originally commenced this study as a Schedule B Municipal Class Environmental Assessment (Class EA) for the Connection of the New Caledon East Well #6 (CE6). As the project progressed, and various alternative solutions were identified and developed, it became evident that elevating the project schedule to a Schedule C Class EA study was necessary. Consequently, the project name was revised to reflect the larger and more complex scope of the study. The project scope was expanded to include additional activities necessary to fulfill Schedule C requirements under the Municipal Class EA process, covering Phases 1 through 4.

CIMA+, on behalf of the Region, completed a Schedule C Municipal Class EA study to evaluate water supply servicing solutions for the Palgrave/Caledon East Drinking Water System and determine the preferred long-term solution. This Environmental Study Report (ESR) outlines the planning and decision-making process followed in the Class EA study and the recommendations.

1.2 Study Context

1.2.1 Groundwater Development Program, 2019

Following the 2019 comprehensive review of its groundwater-based systems, the Region initiated a hydrogeological investigation to explore alternatives of providing additional water supply for the Village of Caledon East. The investigation, carried out by Geo Kamp Limited, included a test drilling program to establish potential groundwater supply locations. Ten (10) potential test drilling target sites (location shown in **Figure 1**). were identified with consideration to locations of high-capacity sand and gravel aquifers. Target drilling sites were then prioritized and screened based on a review of possible environmental risks and limiting environmental features. Key findings for each of the sites and the priority rankings is summarized in **Table 1.**

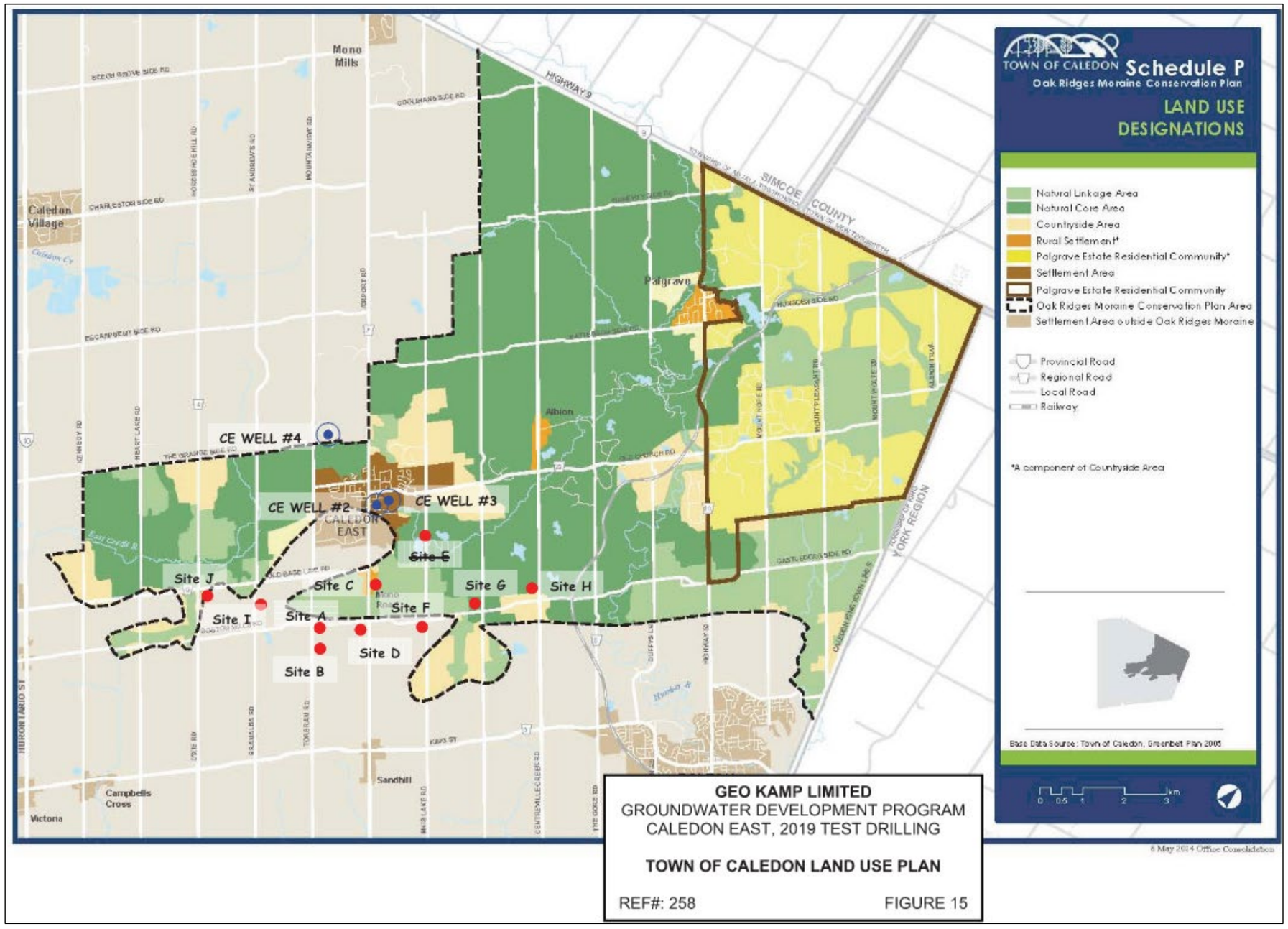

Figure 1: Test Drilling Site Locations (Source: GeoKamp Groundwater Development Program, 2020)

Table 1: Test Drilling Sites – Key Considerations and Ranking

Site ID	Site Description	Key Considerations / Differentiators	Rank
A	Torbram Road next to Existing Test Well	• Low interference with local wells expected • Four water bearing zones suggested within the area Materials sufficiently course and thick enough to warrant groundwater exploration. • Unlikely surface water impacts	1
D	Airport Road, Site 2	• Site along the axis of the Buried Bedrock Valley Aquifer Complex • Suitable access for test drilling equipment and activities • Low interference with local wells expected • Unlikely surface water impacts	2
J	Olde Baseline Road and Dixie Road	• Deepest bedrock location • Suitable access for test drilling equipment and activities • Piece of land is municipally owned • A few local wells in proximity would need inspection, monitoring and assessment	3
F	Innis Lake Road (S Valley)	• Location with greatest opportunity to encounter sand and gravel deposits • Possible interference with surface water features or local wells but not likely major	4
B	Torbram Road South of Boston Mills	• Location suggested a main river channel with potential for washing and depositing of course material • Local well interference and surface water impacts expected to be low • Two (2) large dairy farms could raise wellhead protection and possibly well interference concerns	5
C	Airport Road, Site 1	• Deepest portion of the Buried Bedrock Valley • Potential sources of contamination nearby (e.g., auto repair facility, car wrecker and gas station). • Access improvements required for test drilling	6
G	Centreville Creek Road	• A few local wells in proximity would need inspection, monitoring and assessment • Nearby surface water features could generate concerns from conservation authority	7

Site ID	Site Description	Key Considerations / Differentiators	Rank
		• Accessibility challenges for test drilling	
H	The Gore Road	• Number of nearby wells suggested deep sand and gravel deposits • High number of local wells in proximity would need inspection, monitoring and assessment • Concerns with well interference anticipated • Expected impacts on three (3) nearby surface water features	8
I	Bramalea Road	• Acceptable site accessibility for test drilling • A few local wells in proximity would need inspection, monitoring and assessment • Low interference with local wells expected • Large farms nearby could raise wellhead protection and possibly well interference concerns • Expected impacts on nearby surface water features	9
E	Innis Lake Road	• Eliminated as it had already been explored and a new production well CE4A was constructed on the site.	10

Test holes were drilled at the top three (3) ranked sites; Sites A, D and J, between January and March 2019, providing the following conclusions:

- Site A: relatively low yield (7.5 L/s) encountered during well development and unlikelihood of potential yield improvement. No further work on Site A.
- Site D: favorable aquifer conditions encountered at the test hole drilled on Site D (Test Well Site D, TWD). A test well was advanced approximately 200m east of Airport Road within the northside of the Castlederg Sideroad allowance.
- Site J: no formations encountered. Test hole was abandoned.

An aquifer performance test at TWD (200m east of Airport Road within the northside of the Castlederg Sideroad allowance) was undertaken in September 2019to obtain factual aquifer performance information, assess potential interference with surface and groundwater resources and identify treatment requirements.

A new production well, Caledon East Well #6 (CE6), was constructed in March 2020 in the vicinity of TWD, within the Castlederg Road allowance, as shown in **Figure 2**. Complete details of the 2019 test drilling program, methodology and results are

documented in the Groundwater Development Program, Village of Caledon East, 2019 Test Drilling Report (Geo Kamp Limited, 2020), included in **Appendix A**.

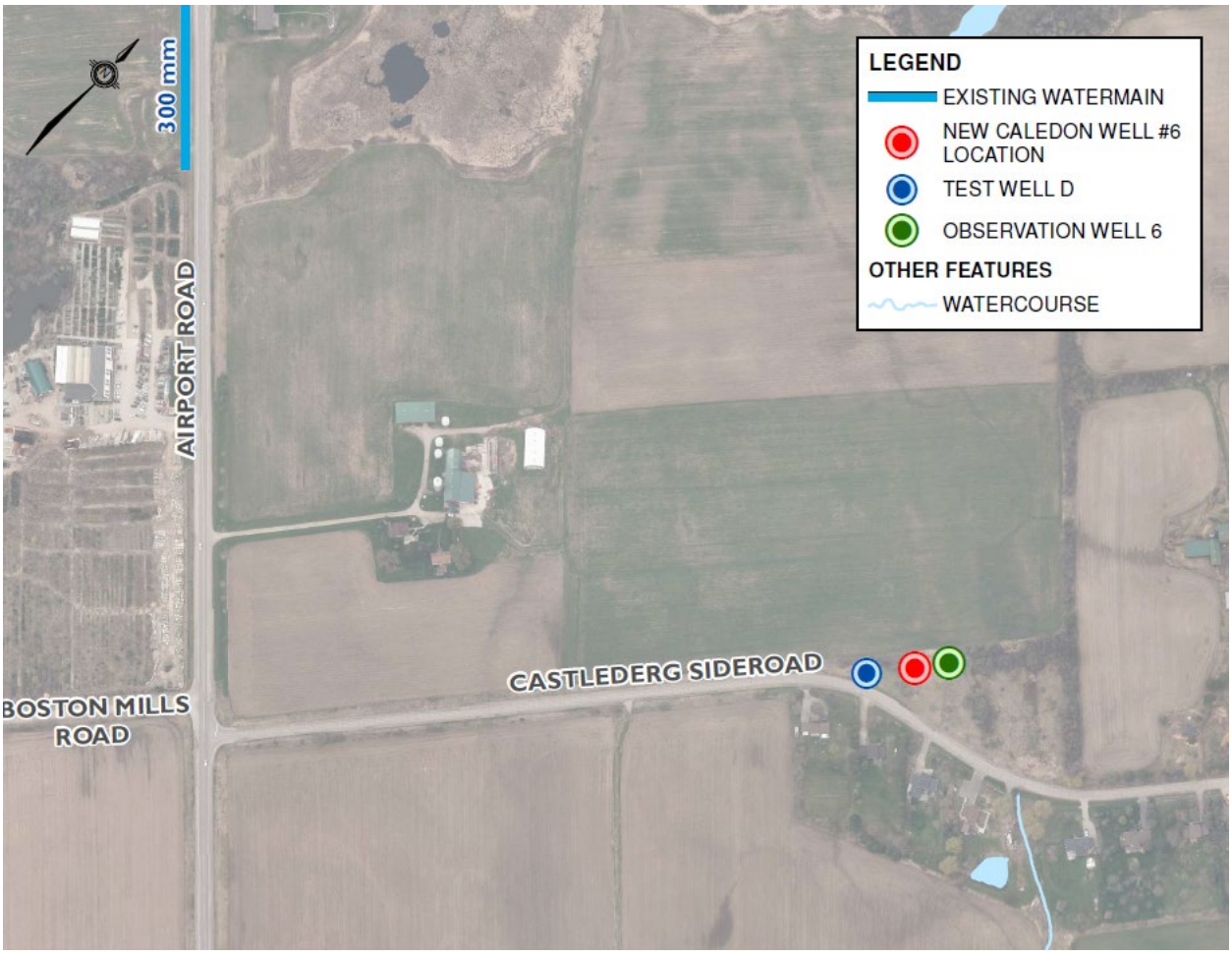

Figure 2: Location of New Caledon East Well 6 (CE6) and other Wells in the Vicinity

1.2.2 New Caledon East Well No. 6 (CE6)

Construction and testing of CE6 was carried out in 2020 by Geo Kamp Limited. The new CE6 is a 10-inch diameter stainless steel casing natural pack municipal production well located on the north side of Castlederg Road, approximately 600m east of Airport Road.

A long-term aquifer performance test was completed on CE6. Cumulative impacts to groundwater and surface water resources from water takings at CE6 were reviewed as part of the investigation. The assessment included the following key activities:

- A total of twenty-three (23) groundwater and surface water stations were monitored during the well testing including the pumped well (CE6), two (2) dedicated

observation wells, six (6) surface water locations and fourteen (14) local domestic wells to address potential shallow groundwater and surface water concerns.

- Identification of potential groundwater receptors including domestic or permitted water supplies in the area that could reasonably be impacted by water takings of CE6. A total of 67 water well records were obtained from MECP database in the vicinity of CE6. A door to door well survey was undertaken to confirm the location and completion details of all private domestic wells within a 500m radius or anticipated zone of influence of CE6. 14 domestic drilled or dug wells, shown in **Figure 3,** were monitored before, during and after the test pumping of CE6.
- Samples were collected for water quality analyses to support the determination for minimum treatment requirements.

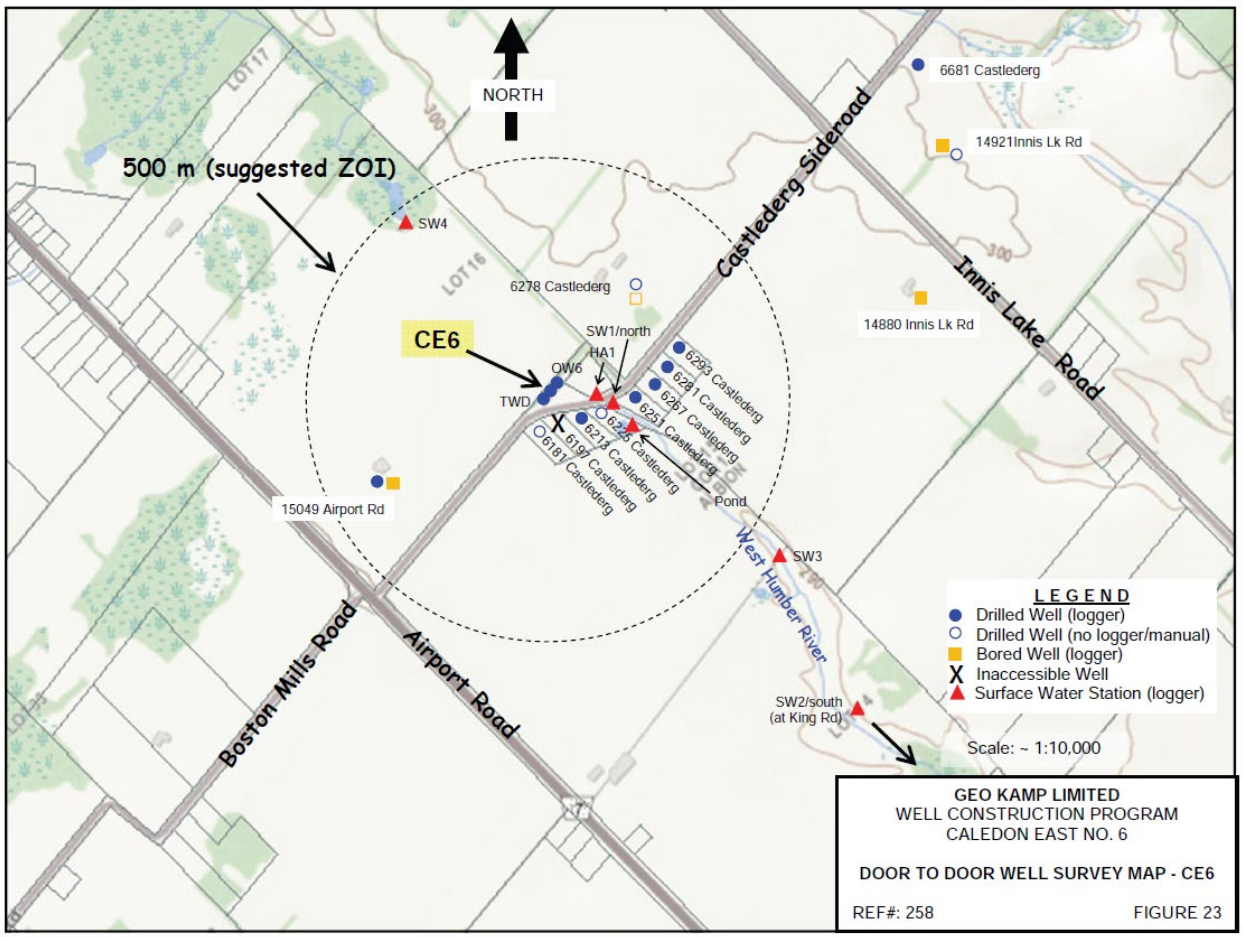

Figure 3: Existing Domestic Wells and Monitoring Locations – CE6 Well Construction Program 2020

Key findings from the aquifer performance test and impact assessment included:

- The new well, CE6, can produce up to 50 L/s (4,320 m^3/day) on a sustainable basis.

- Most of the monitored wells within the vicinity of CE6 were identified to be screened at a depth less than 30 m (Shallow), while two (2) wells were identified to be screened at a depth of 30 – 100 m (Intermediate depth water bearing zone). Along with CE6 and test well TWD, one (1) well was identified to be deeper than 100 m (within the Buried Bedrock Valley).
- No drawdown was observed in shallow and intermediate depth wells.
- No significant interference will occur with existing domestic wells or surface water features as a result of the long-term operation of the new well CE6.
- The estimated cone of influence measured during the 3-day aquifer performance test was approximately 6,000 m.
- All raw water quality parameters for which analysis were completed were found to be within the Ontario Drinking Water Quality Standards, Objectives and Guidelines (ODWQS), except for hardness. The hardness concentration of 130 mg/L slightly exceeded the ODWQS operational guideline range of 80 to 100 mg/L; however, elevated hardness is not uncommon in groundwater supplies and is generally not considered an issue unless the levels exceed 500 mg/L.
- Treatment requirements include provision for disinfection only.
- CE6 was classified as a true groundwater source and not Groundwater Under the Direct Influence of Surface Water (non-GUDI), for the following reasons:
    - There was no response in shallow monitoring domestic wells. As such, no impacts on the fisheries resources at the monitored locations and no cumulative impacts related to base flow reductions are anticipated.
    - There is a significant clay aquitard confining the deep buried bedrock valley aquifer complex
    - The groundwater temperature remained unchanged over the data collecting period of time
    - The turbidity data indicates the water quality is acceptable despite fluctuations in pumping rate, water level, water temperature, air temperature and precipitation
    - Ultraviolet (UV) transmittance did not change with pumping and was above the guideline of 80%
    - There was no detection of bacteriological, Cryptosporidium, Giardia or Photosynthetic pigment-bearing algae and diatoms (PBADs) – indicators of recent protozoa contamination, in the samples collected.

Long-term testing and water quality results obtained for the new CE6 confirmed that from a water quantity and quality perspective, the new well CE6 can be considered a new supply source in the Palgrave/Caledon East Drinking Water System. Complete details of the 2020 Well Construction and testing are documented in Well Construction Program, Village of Caledon East, Caledon East Well No. 6 Report (Geo Kamp Limited, 2020), included in **Appendix B**.

1.2.3 Delineation of CE6 Wellhead Protection Areas

The delineation of Wellhead Protection Areas (WHPAs) for the new production well CE6 was conducted independently from this Class EA study. Aqua Insight Inc. was retained by the Region to undertake source protection updates for all the municipal wells in the Palgrave, Caledon East, and Caledon Village water systems, including the new well CE6 (not yet connected to the system). The study included a groundwater vulnerability assessment, along with an analysis of potential issues and threats. Further details can be found in Section 12.1.8 of this report.

The WHPAs delineation exercise was complemented through a separate public consultation with property owners within the newly delineated WHPAs. This involved site visits to residents within WHPA-A boundaries and addressing a few raised concerns. Further details can be found in Section 3.4 of this report.

1.3 Objectives of the Class EA Study

The main goal of this Class EA Study is:

To objectively evaluate water servicing alternatives and identify the necessary improvements to the Palgrave/Caledon East DWS required to enhance the security of water supply through addition of a new supplementary water supply source, referred to as Well CE6. The preferred water servicing solution should be sustainable, technically, and environmentally sound and economically mindful in terms of capital and operating costs.

Other Class EA objectives include:

- To provide appropriate consultation with all potentially affected and interested parties, including participation of a broad range of stakeholders and Indigenous Communities to allow for the sharing of ideas, education, feedback; and
- To document the study process in compliance with all phases of the Municipal Class EA planning process.

This Environmental Study Report (ESR) completes the Schedule C Municipal Class EA requirements and provides a description of the planning and decision-making process as well as the recommendations for the preferred water servicing solution for the Palgrave/Caledon East area related to the integration of the new municipal production well, CE6 into the system.

1.4 Objectives of the Environmental Study Report

This ESR describes the planning and decision-making process followed during the Class EA Study for the provision of infrastructure improvements required for the addition of the new supplementary water supply source, CE6. The ESR describes:

- Key components of the existing Palgrave/Caledon East Drinking Water System
- Design criteria, including existing and future (beyond 2031) service population and system demands
- Problem/Opportunity Statement
- Evaluation methodology and evaluation criteria used to assess the different servicing alternatives
- Various alternative solutions and design concepts evaluated in the study
- Anticipated potential impacts and mitigation measures associated with implementation of the alternative solutions/design concepts, and
- Rationale for the selection of the preferred water servicing solution and preferred recommended alternative design concept
- Public and agency consultation process.

The Municipal Class EA process provides an opportunity for members of the public, interest groups and review agencies to review the ESR during a 30-day review period. The 30-day review period gives individuals additional opportunities to raise additional concerns regarding the project with the Region. Any outstanding concerns are to be addressed directly to the Region.

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 Indigenous and treaty rights. The request, also known as a Section 16 Order, must be

submitted in writing to the Minister of the Environment, Conservation and Parks, and should be submitted to the Director of the Environmental Assessment Branch and the Region.

Provided that no additional concerns or Section 16 Order requests are received within the 30-day review period, the project will proceed through the detailed design and construction phases as outlined in this ESR.

1.5 Report Outline

This report has been prepared to meet the requirements of the Ontario Municipal Engineer's Association (MEA) Municipal Class EA Planning Process (March 2023). This report combines all phases of the planning process under one (1) cover and includes steps that are considered essential for meeting the requirements of the Environmental Assessment Act (EAA). The report includes the following sections:

Section 1: Introduction – Provides background information leading to the initiation of this study and context such as groundwater exploration and the establishment of new well CE6. Outlines the objectives of the Class EA study and the ESR, and an overview of the report format.

Section 2: Municipal Class Environmental Assessment Process – Provides a summary description of the framework and activities to be completed to meet the Municipal Class EA process requirements.

Section 3: Public and Agency Consultation Process – Describes the consultation program with the public and agencies, and public engagement activities.

Section 4: Planning Policy Context - Describes background information relevant to growth and development in the study area, including provincial, regional, and municipal planning policy documents.

Section 5: Existing Conditions – Presents an overview of current conditions in the Drinking Water System that currently provides municipal drinking water servicing to Palgrave/Caledon East.

Section 6: Design Criteria – Presents the design criteria for drinking water servicing in Palgrave/Caledon area.

Section 7: Class EA Phase 1 – Problem / Opportunity Statement – Presents the problem/opportunity statement for this Class EA Study.

Section 8: Project Study Area – Presents an overview of the study area.

Section 9: Evaluation Framework – Presents the evaluation methodology used to ultimately select the preferred recommended water servicing alternative.

Section 10: Class EA Phase 2 – Identification of Alternative Water Supply Solutions – Describes the water servicing strategies explored in the Class EA study by providing information on a long-list of alternatives and identifies a short-list of feasible alternatives based on a set of must-meet criteria.

Section 11: Development of Feasible Alternative Solutions – Presents the key considerations for development of feasible alternative solutions and the respective sub-options.

Section 12: Comparative Evaluation of Feasible Alternatives – Presents an overview of the desktop studies and the results of the comparative evaluation of the feasible alternative solutions to identify the recommended alternative solution, which concludes Phase 2 of the Class EA study process.

Section 13: Treatment Technologies Review – Presents an assessment of the treatment requirements and technologies used to develop potential implementation strategies for the short-listed alternative.

Section 14: Class EA Phase 3 – Identification of Alternative Design Concepts – Describes the key considerations used to develop potential implementation strategies for the short-listed alternative.

Section 15: Field Wok Investigation and Studies – Presents the key findings and recommendations from the field studies to support the evaluation of alternative design concepts.

Section 16: Class EA Phase 3 – Evaluation of Alternative Design Concepts – Summarizes the results of the detailed comparative evaluation carried out for the short-listed water supply alternatives described, with relevant findings and recommendations from desktop/field studies and technical considerations and economic factors.

Section 17: Preferred Recommended Alternative Design Concept – Presents the key components of the preferred recommended water servicing solution.

Section 18: Anticipated Potential Impacts and Mitigation Measures – Describes potential impacts from implementation of the preferred water servicing solution and the proposed mitigation measures.

Section 19: Class EA Phase 4 – Conclusions and Recommendations – Presents the conclusions and recommendations of the Environmental Study Report.

2 Municipal Class EA Process

This section provides an overview of the Municipal Class EA process and the steps involved in bringing a municipal infrastructure project to the design and construction phases.

2.1 Municipal Class Environmental Assessment

The New Supplementary Water Supply Source for the Palgrave/Caledon East System Class EA Study has been undertaken in accordance with the requirements of the Municipal Class Environmental Assessment document (amended in 2023). The Municipal Class EA process is an approved decision-making and planning process that proponents of municipal infrastructure projects must follow to meet the requirements of the Environmental Assessment Act (EA Act).

All municipal infrastructure projects in Ontario, including water and wastewater project, are subject to the Municipal Class EA process. The Municipal Class EA was created to ensure that all aspects of the environment are considered during the planning and construction phases of a project. The Class EA process outlines the steps that must be followed to satisfy the EA requirements for water, wastewater, and road projects.

The Municipal Class EA process includes five (5) phases to be followed to ensure that the best approach is identified to address a specific problem, requiring the evaluation of possible solutions, design concepts, and recommends the best approach based on a comprehensive evaluation of environmental effects and how to minimize them. As shown in **Figure 4**, the five (5) phases include:

- Phase 1: Identification of the problem or opportunity.
- Phase 2: Identification of alternative solutions to the problem or opportunity and their respective impacts to the environment. Evaluation of alternative solutions and selection of a preferred solution considering public and review agency input.
- Phase 3: Identification and evaluation of alternative design approaches for the preferred solution. Selection of the preferred design concept based upon public and review agency input.
- Phase 4: Documentation of the planning, rationale, design and consultation process in a final Environmental Study Report (ESR). The ESR must be available to the public and review agencies.
- Phase 5: Implementation of the preferred alternative design concept and monitoring for environmental provisions and mitigation measures.

Public and agency consultation is an important part of the Class EA planning process. Gaining input from individuals and groups can help identify project concerns early, and to find ways to address concerns wherever possible. Public consultation is carried out at key stages of the Class EA process to allow time to review and provide input related to the project.

Projects subject to the Class EA process are classified into three (3) possible "schedules" (or categories), depending on the degree of expected impacts:

- Schedule A projects represent minor operational and maintenance activities and are approved without the need of further assessment.
- Schedule A+ projects also represent minor activities and are pre-approved but require public notification prior to project implementation.
- Schedule B projects require screening of alternative solutions based on their environmental impacts. Phases 1 and 2 must be completed and are typically presented in a report with a Notice of Completion from the project proponent, followed by a 30-day public review period. If no significant impacts are identified and there are no requests for a Section 16 Order by the Minister for an Individual EA, then the Schedule B projects are approved and may proceed to Phase 5.
- Schedule C projects typically have greater potential to impact the environment and must complete all five phases of the Class EA planning process. In addition to Phases 1 and 2, Phase 3 involves the assessment of alternative solutions followed by a public consultation of the preferred design concept. Phase 4 typically entails the preparation of an Environmental Study Report to be filed for public review. If no significant impacts are identified and no Section 16 Order is received from the Minister, then Schedule C projects are approved and proceed to Phase 5.

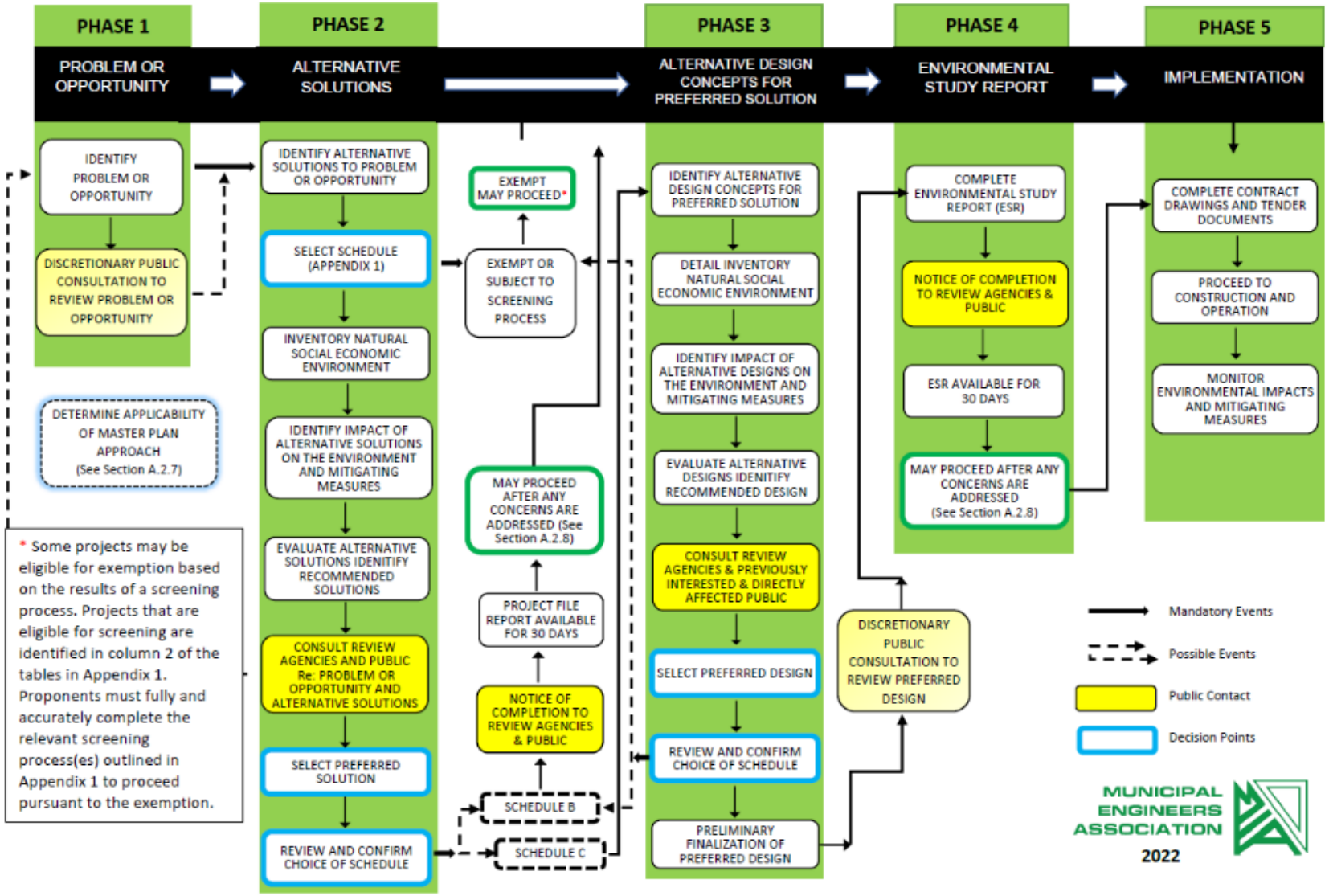

Figure 4: Municipal Class EA Planning and Design Process (Source: Municipal Engineers Association, 2023)

2.2 New Supplementary Water Supply Source for the Palgrave – Caledon East System Class Environmental Assessment Process

The planning and development of a New Supplementary Water Supply Source for the Palgrave/Caledon East System has been conducted as a Schedule C undertaking under the Municipal Class EA process.

The project was originally commenced as a Schedule B Class EA Study for the Connection of the New Caledon East Well #6, CE6. However, as the project advanced and various alternative solutions were identified and developed, it became evident that elevating the project schedule to Schedule C Class EA study was necessary. The project name was then respectively revised to reflect the larger and more complex scope of the study. The project scope was broadened to include the pertinent additional activities needed to fulfill the requirements for Schedule C activities under the Municipal Class EA process satisfying Phases 1 through 4.

Phase 1 (Identification of the Problem/Opportunity), Phase 2 (Identification of Alternative Solutions), Phase 3 (Identification and Evaluation of Alternative Design Concepts for Preferred Solution) and Phase 4 (Preparation of the Environmental Study Report) have been carried out accordingly for this Class EA Study. Review agencies, stakeholders, indigenous communities, and the general public were consulted at several points in the project to solicit input and comments.

This document, referred to herein as the Environmental Study Report (ESR), summarizes Phases 1, 2 and 3 of the Class EA process and fulfills the requirements for the Municipal Class EA process for Schedule C undertakings. The ESR will be placed on the public record for at least 30 calendar days for review by the public. Notification to the public and review agencies will be through the issuance of a Notice of Study Completion.

The Notice of Completion will advise that interested persons may provide written comments to the project team within the review period and all comments and concerns should be sent directly to the Proponent. In addition, if there are outstanding concerns regarding potential adverse impacts to constitutionally protected Indigenous and treaty rights, Section 16 Order requests on those matters should be addressed in writing to the Minister of Environment, Conservation and Parks (MECP), the Director of Environmental Assessment Branch and the Region.

If no significant issues arise during the review period which cannot be resolved in consultation with the Region, and no Section 16 Order requests are received, the project will be considered approved and may proceed directly to implementation.

2.3 Information on Section 16 Order Requests

Under the Class EA planning process, there is an opportunity for the Minister or delegate to review the status of a project. A request may be made to the 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 Indigenous and treaty rights. Requests on other grounds will not be considered. Requests should include the requester contact information and full name for the ministry.

Requests should specify what kind of order is being requested (request for additional conditions or a request for an individual/comprehensive environmental assessment), how an order may prevent, mitigate, or remedy those potential adverse impacts, and any information in support of the statements in the request. This will ensure that the ministry is able to efficiently begin reviewing the request. The requests should also be sent to the Proponent by mail or email.

The request should be sent in writing or by email to:

Minister of the Environment, Conservation and Parks
Ministry of Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto ON M7A 2J3
minister.mecp@ontario.ca

and,

Director, Environmental Assessment Branch
Ministry of Environment, Conservation and Parks
135 St. Clair Ave. W, 1st Floor
Toronto ON, M4V 1P5
EABDirector@ontario.ca:

Other comments and concerns about the proposed works related to the preferred recommended water servicing alternative or the Class EA study should be dealt directly with the Region. Interested persons may provide written comments to the project team, within the established review period.

3 Public and Agency Consultation Process

Public consultation is an integral component of the Class EA study process. Successful public consultation programs build and maintain community trust and credibility, improve project decision-making, and identify community issues far enough in advance so that they can be effectively addressed.

This section provides a summary of public and agency consultation activities undertaken at key stages of the New Supplementary Water Supply Source for the Palgrave/Caledon East System. Comments, feedback, and relevant information received throughout the course of the Class EA study from review agencies and the public are described in the following sections. Detailed information regarding public and agency consultation can be found further in the appendices referenced in the following sections.

3.1 Public Consultation and Communication Program

A Communication and Consultation Program was implemented to manage public relations between the community and the Project Team and to establish opportunities to gather feedback from the public. Key objectives of this program were to:

- Inform the public, stakeholders, and Indigenous Communities of the project
- Facilitate and communicate opportunities for public input
- Obtain input on project components at key decision-making points
- Involve stakeholders and Indigenous Communities by identifying appropriate mitigation measures and to assure them that these measures will be implemented

3.2 Stakeholders and Indigenous Communities

Various groups of stakeholders and Indigenous Communities which were considered to have an interest in the New Supplementary Water Supply Source for the Palgrave/Caledon East System Class EA were identified, as outlined below.

- Residents: local residents within the immediate vicinity and in the greater community were included in the project contact list and contacted throughout the project through direct mailing of all project notices.
- Local and Regional Ward Councillors and Councils

- Review agencies: Provincial ministries and agencies, Federal Government departments and agencies, local area municipalities, district and planning boards, emergency services (fire, police, ambulance), school boards, transit authorities and utilities (natural gas, cable, telephone, etc.)
- Environmental stakeholders and conservation authorities: Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation Authority (CVC).
- Indigenous Communities: Chiefs of Ontario and First Nations including Mississaugas of the Credit First Nation, Metis Nation of Ontario, Fort William First Nation, Haudenosaunee Development Institute (HDI), Six Nations of the Grand River, Huron-Wendat Nation. Project notices were mailed out emails were sent to all Indigenous Communities listed in the Project Contact List. Follow up phone calls were conducted to confirm receipt of notices and need for further involvement. Representatives from indigenous communities within the study area were also invited to participate in field work related to the Stage 2 Archaeological Assessment.
- Local businesses, mostly along Airport Road within the limits of the project study area.

3.3 Public Consultation, Communication Strategies and Tactics

The following outlines the specific consultation activities undertaken to support the New Supplementary Water Supply Source for the Palgrave/Caledon East DWS Class EA Study:

- **Project Mailing List**: A master project contact list, including residents within the study area, members of community groups, local businesses and developers, Indigenous Communities, and several technical review agencies and organizations was developed. Interested members of the public were added to the project mailing list if requested and kept informed of project developments. All individuals on the project list were contacted at the appropriate stages of the study to inform them of meetings and events. A copy of the Project Mailing List is included in **Appendix C** for further reference.
- **Notice of Study Commencement:** The first “Notice of Study Commencement”, advising of the start of the Class EA study as a Schedule B project, was placed in Caledon Citizen news on two (2) consecutive publications on March 25 and April 1, 2021. Copies of the notice were mailed and/or emailed to those on the project mailing list. A copy of the notice was also posted on the Region’s webpage, on

March 25, 2021: https://www.peelregion.ca/public-works/environmental-assessments/caledon/caledon-ea-well6.asp. Subsequently, the project's status was elevated to a Schedule C Class EA Study. The Revised project name and schedule was communicated to the public, agencies and stakeholders through issuance of a revised notice titled 'Study Commencement Update – Revised Project Name and Schedule', dated August 5, 2021. A copy of the original and revised Notice of Commencement is provided in **Appendix D**

- **Online Public Information Centre No. 1 (PIC 1):** Due to the COVID restrictions at the time of the first PIC, the format of PIC 1 was virtual with PIC related information posted on the Region's website on May 23, 2022, for approximately three (3) weeks, until June 10, 2022. Everyone on the Project Contact List, including review agencies, indigenous communities, and members of the general public were notified by mail and/or email of the virtual PIC. Hard copies of the Notice of PIC were mailed out to all in the Project Contact List including a few residents that had requested to be included in the list. Digital copies of the notice were also emailed to all in the list with an available email address.

  The purpose of PIC 1 was to introduce the project, present the decision-making process proposed for the study and the preliminary options under consideration, and to actively seek public input and feedback on the information presented. The presentation boards for the online PIC were posted on the Region's webpage: https://www.peelregion.ca/public-works/environmental-assessments/caledon/revised-project-name.asp. Contact information was provided for both the Region's and the consultant's project managers if stakeholders wanted to further discuss any content presented. An online comment form was also made available online on the project's webpage. Comments received after the PIC are summarized in the Section 3.4 of this report. A copy of the notice of the PIC is provided in **Appendix D**. The information presented at the virtual PIC is included in **Appendix E.**

- **In-person Public Information Centre No. 2 (PIC 2):** A second PIC was held in-person at the Caledon East Community Complex on October 4, 2023, from 4:00 pm to 7:00 pm. Everyone on the Project Contact List, including review agencies, indigenous communities and members of the public were notified by mail and/or email of the PIC. Hard copies of the Notice of PIC were mailed out to all in the Project Contact List including a few residents that had requested to be included in the list. Digital copies of the notice were also emailed to all in the list with an available email address.

The PIC 2 was held in-person as an open forum where attendees were encouraged to review information displayed on poster boards and have one-on-one conversations with staff from the Region and its consultant team, CIMA+. The purpose of PIC 2 was to present the study recommendations and the results of the selection process for the preliminary preferred design concept to the public, and to identify the next steps in the study and gather public feedback on the information presented. The PIC also identified potential impacts and mitigation measures resulting from the preliminary preferred design concept being recommended.

The PIC 2 meeting materials available included:

- Display panels, including information about the project using both text and visuals
- Comments Sheets, which the attendees were encouraged to fill out as an opportunity to provide comments, make suggestions or ask questions about the project and/or the Class EA Study process

The information for PIC 2 was also posted on the Region's webpage: https://www.peelregion.ca/public-works/environmental-assessments/caledon/revised-project-name.asp. The comments received after PIC 2 are summarized in Section 3.4 of this report. A copy of the notice of the PIC is provided in **Appendix D**. The information presented for the PIC 2 is included in **Appendix E.**

- **Notice of Study Completion:** A "Notice of Study Completion" notifying the public and stakeholders that the ESR will be placed on the public record for review will be issued. The Notice will advise available methods to review the ESR, as well as their ability to address outstanding issues and concerns with the Region or a request for a Section 16 Order, provided that the concern(s) raised deals with constitutionally protected Indigenous or treaty rights. The Notice of Study Completion will be advertised in the local newspapers as well as posted on the Region's project website and mailed out/emailed to all in the Project Contact List. The appropriate follow up phone calls with Indigenous Groups and Communities will take place prior to issuing the Notice of Completion to ensure any additional consultation is accommodated before the report is filed on the public record.

3.4 Summary of Public Issues, Comments and Concerns

Comments were received from a few residents and local businesses in response to the Notice of Study Commencement and PICs. Comments were received by the Project Team mostly through email. All correspondence shared with the public, including comments collected, throughout the Class EA study are included in **Appendix E.**

The following summarizes the action items and outcomes of activities carried out to address concerns raised by the public:

- A resident within the Project Study Area expressed concerns about potential water quality issues with their well on Castlederg Sideroad due to the new CE6 well. The Region provided an official response explaining that the private well is not within the new well CE6's zone of influence, therefore no adverse impacts were expected to their well in association with the new CE6 well or the study.
- Another resident expressed concern, via the online webform, regarding the possibility of their private well running dry or becoming contaminated. The project team responded by explaining the results of a pumping test for the new well CE6 conducted in 2020, which showed no anticipated impact on water sources feeding private wells within the new well's Zone of Influence. The resident was also added to the contact list for project updates.
- As part of delineation of WHPAs and source water protection updates for new Well CE6, the Region's Source Water Protection team carried out a separate public consultation process that involved direct communication and consultation with property owners within the newly delineated WHPAs. In July 2023, the Region's Source Water Protection team visited the four (4) residential properties along Castlederg Sideroad within the limits of the WHPA-A area for CE6 to discuss source water protection policy implications related to septic systems with the property owners. Some residents expressed concerns about potential interference with their private wells due to the new municipal supply well, CE6, and its future connection implications. They also mentioned a lack of feedback regarding monitoring conducted during the CE6 pumping test. The general preference indicated by those approached was to retain their private wells rather than a municipal connection.

  The Project Team prepared individual responses to each resident in the form of letters, which were emailed in September 2023. The letters included information regarding the new well CE6 and the comprehensive investigations carried out during the 2020 pumping tests to support the conclusions that the new source of water would not adversely impact local private wells within the Zone of Influence.
- Several local businesses requested to be added to the contact list. One of them inquired about the possibility of the Class EA study considering the connection of the existing Palgrave/Caledon East DWS to the Region's lake-based system. Another engaged in a phone discussion with the Project Team and discussed intentions to meet with the Councillor to explore the possibility of connecting residences along Innis Lake Road if it proves to be the optimal route.

3.5 Agency Consultation

In conformance with the consultation program established for the Class EA Study, the Project Team ensured that similarly to the public, appropriate review agencies were informed and given opportunities to contribute during the study.

Opportunities for review agencies to participate in the project were provided through the distribution of the Notice of Study Commencement and Notice of PICs via direct letter mailing and/or through email, if specified. The complete list of all agencies contacted is included in **Appendix C**. Detailed agency consultation information is included in **Appendix F.**

This section describes major considerations and key input and feedback sought/received from review agencies during the study. Standards letters and exchange of information was carried out as part of the communication and consultation component, which can be found in **Appendix F.**

3.5.1 Ministry of Environment, Conservation and Parks

A response to the Notice of Study Commencement was received from MECP via email on April 28, 2021. The letter provided a list of Aboriginal communities potentially affected by the project and to be consulted as part of this EA including Mississaugas of the Credit First Nation, Six Nations of the Grand River, Haudenosaunee Confederacy Chiefs Council, and the Huron-Wendat Nation (if there is potential for the project to impact archeological resources). The letter also advised of circumstances under which the Director of Environmental Assessment Branch should be contacted after initial discussions with the communities identified by MECP.

Moreover, the letter included a standard list of “Areas of Interest” for the proponent to identify and address, as applicable, on a project basis. The following summarizes how applicable areas of interests were addressed and incorporated into the planning and decision-making process for this Class EA study.

- **Species at Risk:** In July 2021, Golder Associates Ltd. (now WSP) completed a desktop assessment of the existing natural features and their associated habitats within the study area to inventory existing conditions and identify potential natural environmental constraints for the preliminary assessment of alternative solutions. Sensitive natural features were identified, including provincially designated natural features, Species at Risk (SAR), wildlife and significant wildlife habitat, fish habitat and TRCA/CVC regulated areas, as identified in relevant acts and policy documents. The study identified a potential for the occurrence of SAR within the study area, and recommended field investigations to verify occurrence and potential impacts from

proposed infrastructure. Field investigations were subsequently conducted in 2022 as part of the Natural Environment Study. The scope of the field work was limited to the areas that could potentially be impacted from construction of new proposed infrastructure. The study found low potential for impacts on natural heritage, including vegetation, aquatic habitats, and wildlife within the construction areas. No SAR or their habitats were identified. Specific recommendations were provided to minimize disturbance to wildlife such as standard practices like sediment and erosion control, avoiding vegetation removal during the migratory bird nesting season, revegetation, and restoration of all disturbed areas. A detailed description of the applicable expected impacts and recommended mitigation measures are provided in Section 18.2 of the ESR. The standalone Baseline Natural Features Assessment and Natural Environment Reports can be found in **Appendix G**.

- **Planning and Policy:** Provincial, regional, and municipal planning policy documents relevant to the growth and development at Palgrave and Caledon East, as well as current and planned works projects, are considered as part of this Class EA study and are described in Section 4: Planning Policy Context.
- **Source Water Protection and Groundwater:** A desktop hydrogeologic assessment was undertaken by Geo Kamp Limited in July 2021 to help characterize the study area and identify potential constraints for assessing alternative solutions. Groundwater resources and hydrogeological conditions of the study area, specific to the site and roadway corridors under consideration, were identified and assessed. A Stand-alone report documenting the findings of the hydrogeological review is included in **Appendix H**.

  In addition, and as noted in Section 12.1.8 of the ESR, the Region also completed separately, the Source Water Protection Update to assess the groundwater vulnerability and delineate new WHPAs for all municipal wells located in Caledon East, including the new production well CE6. Evaluation of the aquifer vulnerability, and calculation and identification of non-point source threats within the newly delineated WHPAs for all wells were carried out as part of the study. The complete Source Protection Update report (Aqua Insight, December 2022) has been attached as **Appendix I.**

  The findings from the hydrogeologic review and the source protection updates were used to assess feasible alternative solutions against the evaluation criteria set out, as described in Section 9.1.2 of the ESR. Details of the evaluation matrix and the comparative assessment for the identification of the preferred alternative solution have been discussed in Section 12 of the report.

- **Climate Change:** The feasible alternative solutions and design concepts considered in the study were evaluated against a set of categories that include natural environmental considerations such as 'climate change' criteria, as described in Section 8. In addition, potential impacts to climate change anticipated from implementation of the preferred recommended alternative solutions, along with available mitigation measures proposed to minimize or avoid such impacts, are described in Section 17.2 of this report.
- **Air Quality, Dust and Noise:** The feasible alternative solutions and alternative design concepts considered in the study were evaluated against a set of categories that include socio-cultural considerations, such as aesthetics and operational impacts of new infrastructure, described in Section 9. Potential impacts to air quality, dust and noise anticipated from implementation of the preferred recommended design concept, along with available mitigation measures proposed to minimize or avoid such impacts, are described in Section 17.2.
- **Ecosystem Protection and Restoration:** The feasible alternative solutions and design concepts considered in the study were evaluated against a set of categories that include natural environment considerations, described in Section 8. A Baseline Natural Features Assessment and a Natural Environment Study including a combination of desktop assessment and field investigations was undertaken by Golder Associates Ltd. (now WSP) to determine the sensitivity of the study area, identify the existing features and natural heritage constraints, and to identify potential impacts and mitigation measures. The findings and recommendations of these studies were used in the selection of the preferred alternative solution and preferred recommended design concept. In addition, potential impacts due to the implementation of the preferred recommended design concept are identified and mitigation measures proposed to minimize or avoid such impacts, described in Section 17.2.

3.5.2 Toronto and Region Conservation Authority

Consultation with the Toronto and Region Conservation Authority (TRCA) was carried out throughout the study and has been summarized in **Table 2** below.

Table 2: Summary of consultation with TRCA

Date	Comment/Issue Description	Resolution Description
August 13, 2021	In response to the Revised Notice of Commencement, TRCA sent a	CIMA sent a pre-consultation request to TRCA in an email dated November

Date	Comment/Issue Description	Resolution Description
	letter with details regarding areas of interest. They also provided the recommended contact points when TRCA should be engaged through the various stages of the Class EA process, and submission requirements for TRCA review.	29, 2021, to confirm the limits of floodplain areas and implications related to the proposed works, including land acquisition for a new treatment facility near CE6.
January 19, 2022	TRCA responded to CIMA's queries of November 2021 with the following comments: • The proposed sites are within TRCA's estimated Regulatory Floodplain, and the outdated HEC-RAS model requires revision to determine the extent of developable area. • Natural features including wetlands to be confirmed through site visits and 10m buffer to be included. • Confirmation of proposed infrastructure details, clarification on the status of wells, and evaluation of potential impacts of CE6 on hydrological features is required. • Proposed development to be located outside of all natural features and hazards setbacks. • Need for a meeting with Region's team to discuss HEC-RAS model revision.	• CIMA+ responded to the queries and sent a copy of the CE6 well construction report to TRCA on February 22, 2022. • A virtual meeting was held with TRCA on March 11, 2022, to discuss modeling requirements regarding the floodplain in the area. • CIMA+ undertook the review and revision of the floodplain model.

Date	Comment/Issue Description	Resolution Description
June 22, 2022	TRCA provided the following additional comments in response to PIC 1: • The wetland boundary should be determined through on-site staking exercise with TRCA staff and licensed land surveyors. • Reiterated the requirements for setbacks. • During the detailed design stage, the following information will be required: Grading Plan, Erosion and Sediment Control Plans, and Planting Plan.	A memo summarizing the methodology and results of modelling was shared with TRCA on July 5, 2022, and the digital file for HECRAS model was shared on August 18, 2022.
November 13, 2022 – September 6 2023	Several comments were received on the memo and updated HEC-RAS model during ongoing correspondence with TRCA via email.	• Comments were addressed by the Project team and an updated version of the model was shared on February 28, 2023. • A virtual meeting was held on July 4, 2023, to discuss further revisions. Further elevation dataset for the project area was shared by TRCA. The final version of the updated model was shared with TRCA on September 6, 2023.
November 23, 2023	TRCA staff completed their review of PIC 2 materials and confirmed no additional comments or feedback via email.	A copy of the Draft ESR was shared with TRCA on March 15, 2024 for comment and feedback. TRCA confirmed their review, with no further comments, in a letter dated April 24, 2024, and requested for a copy of the Final ESR and appendices.

3.5.3 Credit Valley Conservation

Consultation with the Credit Valley Conservation (CVC) was carried out throughout the study. In response to the Notice of Commencement, CVC advised on potential permit requirements in scenarios involving grading or construction in regulated areas, alterations to watercourses, construction within the storm floodplain related to East Credit River tributaries, and potential development near wetlands.

CVC's initial recommendations included consulting with relevant authorities such as the Township for Natural Heritage Systems, the local municipality for the Oak Ridges Moraine Conservation Plan, the Department of Fisheries and Oceans Canada for permits, and the TRCA for their watershed. They emphasized documenting natural features and site constraints, seeking CVC's guidance on aquatic habitat, valleylands, hydraulics, and geomorphology analysis, and restoring disturbed areas with native species. As requested by the project team, CVC provided GIS data for key natural features.

In response to PIC 1, CVC requested field surveys, technical studies/assessments, and evaluation criteria/matrix related to the preferred alternative completed at that stage. CIMA's Technical Memorandum 2B: Comparative Evaluation of Feasible Alternatives was shared by the project team, which CVC staff reviewed and expressed support for the preferred alternative, "Obtain additional supply capacity from another source: New supply well, Caledon East 6 (CE6), and provide treatment at a new well site." It was confirmed by CVC that the new water treatment plant shown in the figure provided was outside their regulated area, and thus, a CVC permit was not further required.

3.5.4 Ministry of Citizenship and Multiculturalism

The Ministry of Citizenship and Multiculturalism (MCM), formerly referred to as Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI), offered comprehensive guidance and recommendations for the Class Environmental Assessment (EA) project, in a letter dated April 19, 2021, in response to the Notice of Commencement. They underscored the necessity for the project proponent to assess potential impacts on cultural heritage resources within the Class EA. In addition, MCM encouraged meaningful engagement with Indigenous communities, emphasizing discussions concerning known or potential cultural heritage resources significant to these communities. Furthermore, they highlighted that Municipal Heritage Committees, historical societies, and local heritage organizations might possess valuable knowledge contributing to the identification of cultural heritage resources.

MCM recommended project screening using the Ministry's criteria and submitting all checklists and supporting documentation pertaining to archaeological assessment (AA) and cultural heritage review with the final EA report.

The Draft Stage 1 Archaeological Assessment report (attached in **Appendix J**) dated July 15, 2021, was submitted to the MCM. The Draft Stage 1 and 2 Archaeological Assessment Report (attached in **Appendix K**) was submitted to MCM in February, 2023 by WSP. MCM requested that technical cultural heritage studies and recommendations be addressed and incorporated into the Class EA study and asked that Cultural Heritage Assessment and any other technical cultural heritage studies be provided to the Ministry before issuing the Notice of Completion.

3.5.5 Town of Caledon

Following the advancement of the project schedule to a Schedule C Class EA Study and the issuance of the revised Notice of Commencement, the project team began exploring potential sites for a new water treatment plant, including the new CE6 well site, owned by the Town of Caledon. Consultation activities with the Town regarding the Class EA and property acquisition is summarized below.

Table 3: Summary of Consultation with Town of Caledon

Date	Description
September 16, 2021	The Region's real estate group initiated contact with the Town of Caledon via email. The email detailed the Region's prior successful drilling of a Test Well on the Town's Castlederg Side Road property, subsequently completed as a Production Well. The Region sought assistance from the Town in identifying relevant staff for discussions. The Town confirmed via email on May 5, 2022 that the property request had been internally circulated as a rush request.

Date	Description
June 3, 2022	A meeting was held with the Town of Caledon staff to discuss the feasibility and preliminary requirements for land transfer. • The project team outlined the project background and identified vacant lands along Castlederg Sideroad for a new water treatment plant at the Caledon East Well #6 site. • The Town raised concerns about coordinating with road reconstruction and the necessity of retaining road widening space. Additionally, they requested the land request to encompass the entire Town-owned property to prevent fragmentation. • The Town shared plans for the reconstruction of Castlederg Sideroad in 2022, necessitating future watermain works to utilize trenchless installation methods. The Region committed to evaluate trenchless installation for the proposed feedermain component with the objective of minimizing further disturbance to residents and local road users during construction. • Next steps included the project team completing the EA followed by detailed design, drafting a reference plan, and finalizing the real estate agreement.
September 21, 2023	A virtual meeting was held on September 21, 2023, to discuss the preliminary preferred design concept being recommended in the Class EA study. The meeting was held prior to PIC 2 in an effort to capture the Town's feedback on the proposed recommendations before making an official presentation to the public. Draft PIC 2 boards and a conceptual site plan layout were reviewed. • Key comments from the Town included the preference for only one access driveway from Castlederg Sideroad to the CE6 well site, a commitment to architectural control for the building's aesthetics, and the need for the proposed property line to reflect the planned right-of-way width. The project team proceeded to revise the PIC 2 panels to address the Town's feedback and requests. • The land acquisition process is currently underway between the Region's real estate group and the Town.

Date	Description
March 15, 2024	A copy of the Draft ESR was shared with the Town for review and feedback. A meeting was held on March 25, 2024, following which the Town confirmed via email that they had no objections to the transfer of land ownership, provided that: • The proposed watermain is constructed via tunneling. • The proposed works are situated outside of the future Castlederg Sideroad right of way (ROW) of 26m. • There will be only one driveway access point to the site. • Safety and sightline impacts of the proposed driveway will be considered in the detailed design, with consultation from Town Engineering prior to finalizing the driveway location. All necessary mitigation measures, including signage on Castlederg Road, will be addressed.

3.6 Others

Hydro One Networks confirmed the absence of Hydro One Transmission assets in the project area and requested updates on any changes to the project's scope. The updated contact email was added to the contact list.

3.7 Indigenous Communities

To coordinate the engagement of Indigenous Community members, a list of Indigenous Communities was developed, including communities with existing or asserted rights or claims within the study area based on similar projects in the area and the list provided by MECP after the Notice of Commencement was released. The identified Indigenous Communities were notified about the Class EA as well as the consultation activities (e.g., PIC) proposed as part of the project. Additional project information was provided by the Project Team, as requested by each group, and follow up phone calls were made by CIMA+ to ensure that they have received the Project Notices and to solicit their feedback on the project.

Consultation and correspondence regarding archaeological fieldwork was carried out by Golder Associates Ltd. (now WSP) prior to Stage 2 Archaeological Assessment in September 2022. A Notice of upcoming fieldwork was shared via email and agreements between the Region and relevant groups were signed. The field assessment was carried out in October 2022, with representatives from the relevant groups.

A separate consultation log was maintained for Indigenous Communities, included in **Appendix L**. The following sections summarize the key action items and outcomes of consultation activities carried out to address concerns specific to each Indigenous Community.

3.7.1 Mississaugas of the Credit First Nation

Consultation with the Mississaugas of the Credit First Nation (MCFN), Department of Consultation and Accommodation (DOCA) was carried out throughout the study. Major comments received from the MCFN and a description of how these comments were incorporated or addressed throughout completion of different activities or investigations are summarized in **Table 4** below.

Table 4: MCFN – Summary of Key Comments

Date	Comment/Issue Description	Resolution Description
May 3, 2021	DOCA was notified of the submission of project information file to MCM for Stage 1 AA desktop study by Golder Associates Ltd. In a response letter addressed to Golder, DOCA advised of their expectation to participate in fieldwork and requested additional project information.	WSP conveyed the following details in their email response: • An overview of the study, along with a link for additional project details • Golder's involvement in the Stage 1 AA, including ongoing desktop studies and a scheduled property inspection completion in May 2021
June 1 – June 9, 2021	MCFN provided the following key comments to the Region on June 1, 2021, in a response letter to the Notice of Study Commencement: • Requested confirmation on the Project contacts and clarification on how the project may affect MCFN.	Further engagement with MCFN was carried out by Golder prior to Stage 1&2 Archaeological Assessment in 2022, which MCFN participated in.

Date	Comment/Issue Description	Resolution Description
	• Requested additional information pertaining to project deadlines and required approvals, and relevant documentation for their review. The following was conveyed in subsequent email and letters addressed to the Region on June 9, 2021: • Agreements, including the Archaeological Review Agreement and Field Liaison Representatives (FLR) Participation Agreement, were provided. • Missing project information was requested.	
May 26, 2022	In response to Notice of PIC #1, MCFN requested via email to provide documents on completion of EA study and keep MCFN DOCA updated regarding any future archaeological work.	CIMA/Golder shared Notice of upcoming fieldwork via email prior to Stage 1&2 AA in September 2022. Agreements between the Region and MCFN were signed. The field assessment was carried out in October 2022, with MCFN representatives.

3.7.2 Huron-Wendat Nation

The Huron-Wendat Nation (HWN) engaged with the EA study through several interactions. In a letter to CIMA+ on May 5, 2021, HWN requested information about the need for archaeological studies or fieldwork in the Class EA study. The Project Team responded by informing HWN that Stage 1 AA would commence in May 2021, with Golder (WSP) leading the related work.

WSP subsequently contacted HWN, planning to undertake the Stage 1 property inspection on May 7, and offered HWN the opportunity to be involved in the works. HWN expressed their inability to participate and interest in receiving a copy of the report

for review. On August 17, 2021, HWN in an email to CIMA+, acknowledged receipt of the Revised Notice of Study Commencement and reaffirmed their interest in participating in all archaeological fieldwork for the project. They also expressed the desire to receive copies of draft reports for review and comments.

3.7.3 Haudenosaunee Development Institute

In response to the Notice of Commencement, the Haudenosaunee Development Institute (HDI) formally requested through email on May 5, 2021, the appointment of a field monitor and need for an agreement. A follow-up call was placed to CIMA+ on May 14, 2021. The project team acknowledged the receipt of the email and took note of HDI's expressed interest in staying informed about the project's progress. A formal agreement was entered into between the Region and HDI. HDI representatives actively participated during the archaeological field assessment work on October 12/13, 2022.

3.7.4 Six Nations of the Grand River First Nation

Golder (now WSP) notified Six Nations of the Grand River First Nation (SNFN) of upcoming fieldwork via email prior to Stage 1&2 AA in September 2022. Pertinent details were provided, leading to the signing of the Six Nations of the Grand River Elected Council – Archaeological Monitoring Agreement with the Region, confirming their involvement in the fieldwork. SNFN representatives actively participated during the archaeological field assessment work on October 12/13, 2022.

4 Planning Policy Context

Palgrave and Caledon East are part of a two-tier municipality system, with the Regional Municipality of Peel serving as the upper tier municipality and the Town of Caledon serving as the lower tier municipality. This section provides a description of background information relevant to the growth and development in Palgrave and Caledon East, including provincial, regional, and municipal planning policy documents.

4.1 Provincial, Regional and Municipal Planning Policies

4.1.1 Provincial Policy Statement, 2020

The Provincial Policy Statement (PPS), authorized by Section 3 of the Planning Act (MMAH 2020a), is geared towards safeguarding natural heritage. Its primary objective is to ensure the lasting preservation of natural features and their ecological functions, while also promoting the enhancement of connections between these natural features, surface water elements, and groundwater features. Within this framework:

- Significant wetlands and significant coastal wetlands are protected against development and site alteration.
- Development and site alteration are strictly prohibited in areas that serve as fish habitat or are habitats for endangered or threatened species, unless they adhere to both provincial and federal requirements.
- In certain cases, development may be allowed within or adjacent to various other natural features, provided that it is demonstrated that such development will not have any adverse impacts on these features or their ecological functions. These features include significant wetlands (north of Ecoregions 5E, 6E, and 7E), significant woodlands, significant valleylands, SWH, significant areas of natural and scientific interest (ANSI), and other coastal wetlands.

4.1.2 Region of Peel Official Plan, 2022

The Region has established a comprehensive natural heritage system known as the Regional Greenlands System, comprising Core Areas, Natural Areas and Corridors, and Potential Natural Areas and Corridors. Core Areas encompass critical natural heritage features, such as Provincially Significant Wetlands (PSWs), significant coastal wetlands, core woodlands, environmentally sensitive or significant areas, provincially significant life science Areas of Natural and Scientific Interest (ANSIs), habitats of endangered or threatened species, and core valley and stream corridors. Core Areas were visually mapped within the Study Area and appear to be closely associated with the Mono Road

Wetland Complex, situated east of Airport Road. However, this Core Area does not overlap with the project site.

Within Core Areas, development and site alteration are generally prohibited, although exceptions exist for essential infrastructure projects that are authorized under the EA process. Furthermore, within PSWs, significant coastal wetlands, and habitats of endangered or threatened species, exceptions are only permitted in accordance with relevant provincial and federal legislation, such as the Provincial Policy Statement (PPS) and the Endangered Species Act (ESA).

Natural Areas and Corridors encompass various natural heritage features, including evaluated non-significant wetlands, woodlands, significant wildlife habitat (SWH), fish habitat, regionally significant life science ANSIs, provincially significant earth science ANSIs, other valley and stream corridors that are not classified as Core Areas, headwater source and discharge areas, and any other natural features identified as part of this area by municipalities.

Potential Natural Areas and Corridors encompass a wide range of natural heritage features, including unevaluated wetlands, cultural woodlands, or cultural savannahs within Urban System and Rural Service Centres, other woodlands larger than 0.5 hectares, regionally significant earth science ANSIs, sensitive groundwater recharge areas, open space portions of the Parkway Belt West Plan Area, potential environmentally sensitive or significant areas identified by conservation authorities, and any other natural features designated as part of this area by municipalities.

4.1.3 Town of Caledon Official Plan, 2018

A significant portion of the study area falls within zones designated for agricultural or residential land use, as outlined in the Town of Caledon's Official Plan (OP). A visual representation in Schedule A – Town of Caledon Land Use Plan reveals the presence of Environmental Policy Areas, in the eastern and southern segments of the study area, as well as within the Caledon East settlement area. The settlement area, as delineated in Schedule D – Caledon East Land Use Plan of the Town's Official Plan, predominantly designates the land use as low-density residential dwellings, interspersed with a few pockets of institutional areas.

The Town's Environmental Policy Areas encompass Natural Core Areas and Natural Corridors. Natural Core Areas comprise various essential natural heritage features such as woodland core areas, wetland core areas, life science Areas of Natural and Scientific Interest (ANSIs), environmentally significant areas, habitat hosting endangered or threatened species, Significant Wildlife Habitat (SWH), as well as all Greenbelt and Oak

Ridges Moraine Conservation Plan (ORMCP) defined Key Natural Heritage Features (KNHFs) and Key Hydrologic Features (KHFs), along with their associated Vegetation Protection Zones (VPZs). Natural Corridors encompass core fishery resource areas, valley and stream corridors, and all Greenbelt and ORMCP defined KNHFs and KHFs, and related VPZs.

Generally, new development is prohibited in Environmental Policy Areas, except for essential infrastructure projects that require an Environmental Impact Study (EIS) to demonstrate compliance with the Town's environmental policies. The study must demonstrate that an evaluation of alternatives has been thoroughly considered and that the project aligns, to the greatest extent possible, with the environmental policies outlined in the Town's regulations.

Supportive Natural Systems and Natural Linkages, which enhance Natural Core Areas and Natural Corridors, also fall within the Town's Environmental Policy Areas. They involve features like woodlands, wetlands, erosion-prone soils, and natural slopes exceeding 15%. Development in these areas may require an EIS.

Furthermore, areas not initially designated as Environmental Policy Areas may be protected based on comprehensive environmental studies, potentially leading to Environmental Policy Area designations and adherence to specific policies for those areas. When the Town's policies conflict with those of other planning documents, the stricter policies will prevail.

4.1.4 Places to Grow – Growth Plan for the Greater Golden Horseshoe, 2020

The Growth Plan for the Greater Golden Horseshoe, established under The Places to Grow Act (MMAH 2020b), is a key influencer in land use planning in the Region. It collaborates with other provincial plans to create a unique framework focusing on developing complete communities, a strong economy, a sustainable environment, and social equity. Notably, policies in the Oak Ridges Moraine Conservation Plan usually take precedence over the Growth Plan, with stricter policies prevailing in conflicts.

The Growth Plan includes a Natural Heritage System (NHS) mapped in 2018, aimed at conserving natural heritage and biodiversity. The Study Area along Castlederg Sideroad falls within the Growth Plan NHS, encompassing Key Natural Heritage Features (KNHFs) like endangered habitats, wetlands, significant woodlands, and more. Key Hydrologic Features (KHFs) can also exist in various land use designations in the Growth Plan area, such as streams, lakes, wetlands, and springs.

Development and alterations are generally prohibited in KNHFs within the Growth Plan NHS or KHFs outside designated settlement areas, except for specific exceptions like infrastructure projects authorized through the EA process. In such cases, proposed development must demonstrate how it will minimize adverse impacts on KNHFs and KHFs, implementing mitigation efforts. For developments within 120 meters of a KNHF or KHF, a natural heritage evaluation is required. Natural heritage feature protection outside the Growth Plan NHS must adhere to the policies of the Provincial Policy Statement.

4.1.5 Greenbelt Plan, 2017

The Greenbelt Plan serves multiple purposes, directing population growth to designated areas, supporting agriculture in Protected Countryside zones, and safeguarding natural features in the Natural Heritage System (NHS). The province aims to align Greenbelt Plan land use designations with the Oak Ridges Moraine Conservation Plan, with stricter regulations prevailing in policy conflicts.

In the Study Area along Airport Road, a section falls within the Greenbelt Plan's Protected Countryside, but none of it is within the Greenbelt Plan NHS. Infrastructure can be approved within the Protected Countryside through the Environmental Assessment (EA) process, with a requirement to avoid Key Natural Heritage Features (KNHFs) and Key Hydrologic Features (KHFs) unless there's a clear necessity and no reasonable alternatives. When development impacts KNHFs or KHFs, efforts must minimize disturbances.

KNHFs in the Greenbelt Plan include habitats of endangered species, wetlands, significant woodlands, and more. KHFs consist of streams, lakes, and wetlands. Outside the Greenbelt NHS, KNHFs are subject to Provincial Policy Statement (PPS) policies.

Greenbelt KNHFs and KHFs are also part of the Town's Environmental Policy Area. Typically, development is prohibited, but exceptions exist for essential infrastructure. Development within 120 meters of a KNHF within the Greenbelt NHS or within 120 meters of a KHF within the Protected Countryside may be permitted according to municipal land use designations.

4.1.6 Oak Ridges Moraine Conservation Plan, 2017

The Oak Ridges Moraine Conservation Plan (ORMCP), established by Ontario Regulation 140/02 under the Oak Ridges Moraine Conservation Act, 2001, serves as a policy framework for land use decisions within the Moraine, providing guidance for

protecting its ecological and hydrological features and functions. The ORMCP classifies the Moraine into four land use designations: ‘Natural Core Areas,’ ‘Natural Linkage Areas,’ ‘Countryside Areas,’ and ‘Settlement Areas.

Most of the study area falls within the Oak Ridges Moraine Conservation Plan (ORMCP) area. The northern portion of the study area is designated as a Settlement Area, while the southern section is designated as a Natural Linkage Area. The eastern part, corresponding to the Widgett-Innis Lakes Provincially Significant Wetland (PSW), is characterized as a Natural Core Area. Additionally, there are smaller regions defined as Countryside Areas situated in the central part of the study area.

Within Natural Core Areas and Natural Linkage Areas, development is generally prohibited, except for essential infrastructure. In cases where exceptions are granted, the design and construction of the project must minimize disturbance within these areas.

Key Natural Heritage Features (KNHFs) within the ORMCP area encompass habitats of endangered or threatened species, fish habitats, wetlands, life science Areas of Natural and Scientific Interest (ANSIs), significant valleylands, significant woodlands, Significant Wildlife Habitat (SWH), and rare plant communities. Key Hydrologic Features (KHFs) include permanent or intermittent streams, kettle lakes, seepage areas and springs, and wetlands.

Development is generally prohibited within KNHFs or KHFs and their associated Vegetation Protection Zones (VPZs), with exceptions for essential infrastructure. In cases where exceptions are allowed, the project must demonstrate the necessity of the infrastructure and establish the absence of reasonable alternatives. Additionally, project design and construction must minimize disturbance within these areas and strive to maintain, improve, or restore key ecological and recreational linkages.

ORMCP-designated KNHFs and KHFs, along with associated VPZs, are also designated as part of the Town's Environmental Policy Area. Generally, development is prohibited within these areas, with exceptions made for essential infrastructure. Development within the minimum area of influence of a KNHF or KHF may be permitted in accordance with the underlying municipal land use designation.

5 Existing Palgrave/Caledon East Drinking Water System

The following sections summarize the overall Palgrave/Caledon East Drinking Water System including supply, treatment, and distribution.

5.1 Overview of Palgrave/Caledon East Drinking Water System

The Palgrave/Caledon East Drinking Water System is an interconnected groundwater-based supply system, servicing the communities of Caledon East, Mono Road, Albion, Centreville, Cedar Mills, Palgrave and Palgrave Estates. The system is comprised of the Caledon East and the Palgrave Drinking Water Systems and includes seven (7) installed municipal wells, four (4) Water Treatment Plants (WTPs), two (2) storage facilities and 108 km of watermains. Presently, six (6) of the installed municipal wells are operational while the new well, Caledon East Well 6 (CE6), installed in 2020 is not yet connected to the system. The connection of CE6 to the current system is pending results from this Class EA study.

Each of the drinking water systems, Caledon East and Palgrave, comprises a total of three (3) operational production wells and two (2) WTPs, geographically distributed in each community.

The Palgrave/Caledon East system is an integrated drinking water system interconnected via a watermain along Old Church Road. Both water systems can serve as a back up water supply to each other, to meet water demands, as required. Under normal operating conditions, treated water generally moves from Palgrave to Caledon East.

A map showing the overall location of the existing municipal water infrastructure within the Palgrave/Caledon East drinking water systems is shown in **Figure 5.**

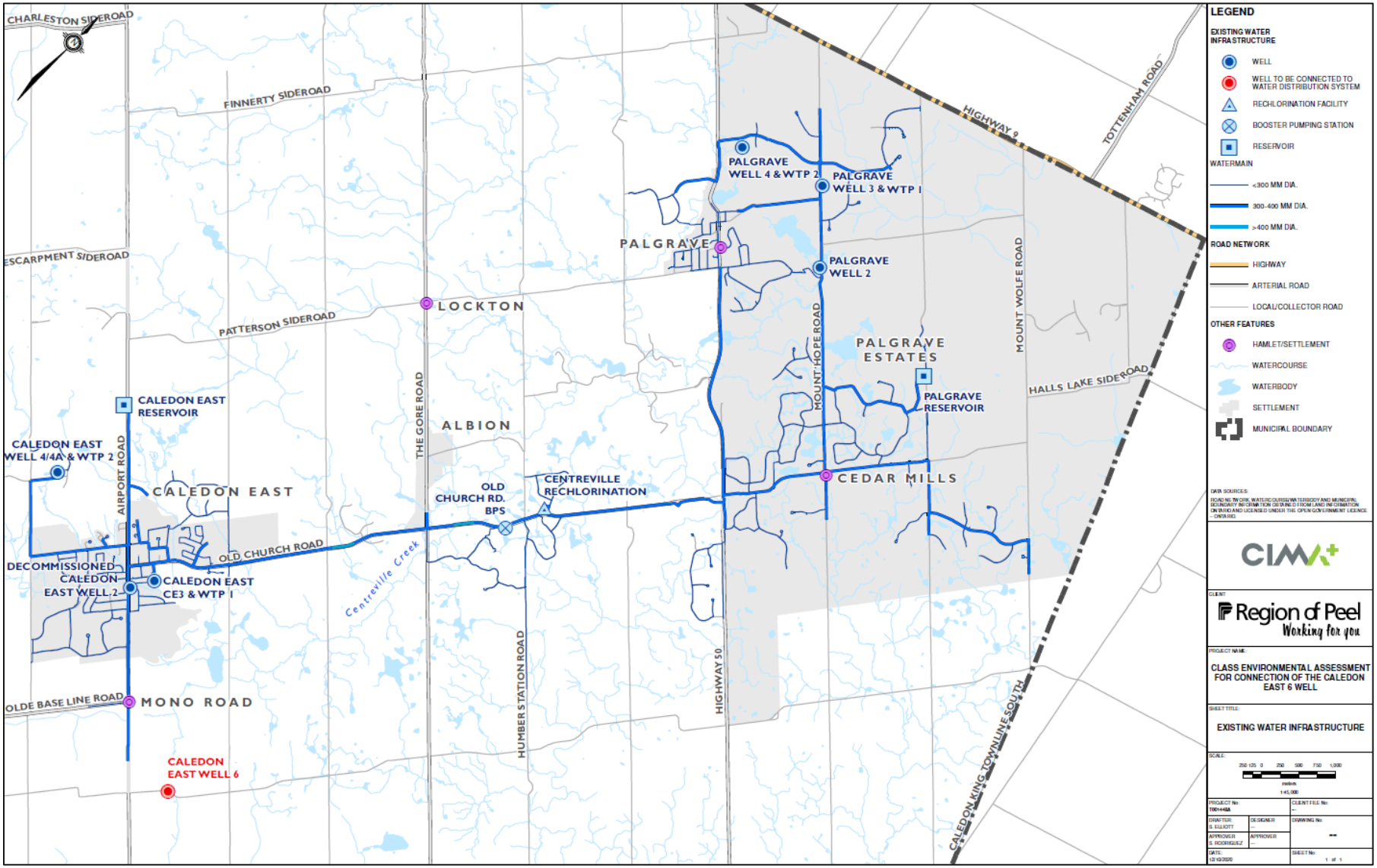

Figure 5: Location of Existing Palgrave/ Caledon East Drinking Water System

5.1.1 Water Supply

The Palgrave/Caledon East water supply system is owned and operated by the Region. The system currently obtains its raw water from six (6) operational groundwater wells, three (3) wells in Palgrave and the other three (3) in Caledon East. A new well, CE6, was installed in 2020 and is planned to be connected to the system. The main components of the water supply system include:

- Palgrave well No.2 (PAL2): 305 mm diameter and 47.2 m deep drilled well equipped with a submersible well pump rated at 30.3 L/s at 120 m Total Dynamic Head (TDH)
- Palgrave well No.3 (PAL3): 254 mm diameter and 82.5 m deep drilled well equipped with a submersible well pump rated at 68.2 L/s at 126.5m TDH
- Palgrave well No.4 (PAL 4): 610 mm diameter and 91.4 m deep drilled well equipped with a submersible well pump rated at 30.3 L/s at 93 m of TDH
- Caledon East Well No. 3 (CE3): 300 mm diameter and 48 m deep drilled well equipped with a submersible well pump rated at 30.3 L/s at 100.6 m TDH
- Caledon East Well No. 4 (CE4): 254 mm diameter and 57 m deep drilled well equipped with a submersible pump rated at 36 L/s at 59 m TDH
- Caledon East Well No. 4A (CE4A): 254 mm diameter and 57 m deep drilled well with a Pitless adapter assembly. It includes a submersible pump rated at 37 L/s at 55 m TDH.

All production wells in the Palgrave/Caledon East Drinking Water System are classified as true groundwater (not Groundwater Under the Influence of Surface Water, GUDI), as per existing Drinking Water Works Permit (DWWP) No. 009-205 Issue Number 8, dated October 6th, 2020. Permitted rated capacity of the supply wells in the Palgrave/Caledon East Drinking Water System, including new well CE6, and the corresponding permit/license number, are summarized in **Table 5.**

Table 5: Permitted Water Taking Rated Capacity of Palgrave/Caledon East Water System Wells

Supply Source	Rated Capacity m^3/day (L/s)	Permit to Take Water Number	Effective Date	Renewal Date
PAL2	2,619 m^3/day (30 L/s)	PTTW P-300-2034379854 Version 1.0	May 10, 2019	May 9, 2024
PAL3	5,892 m^3/day (68 L/s)	PTTW P-300-2034379854 Version 1.0	May 10, 2019	May 9, 2024
PAL4	2,619 m^3/day (30 L/s)	PTTW P-300-2034379854 Version 1.0	May 10, 2019	May 9, 2024

Supply Source	Rated Capacity m^3/day (L/s)	Permit to Take Water Number	Effective Date	Renewal Date
CE3	2,557 m^3/day (30 L/s)	PTTW P-300-2095321129 Version: 1.0	December 30, 2020	December 26, 2025
CE4	3,629 m^3/day (42 L/s)	PTTW P-300-2095321129 Version: 1.0	December 30, 2020	December 26, 2025
CE4A	6,480 m^3/day (75 L/s)	PTTW P-300-2095321129 Version: 1.0	December 30, 2020	December 26, 2025
CE6 (new well not yet connected)	4,320 m^3/day (50 L/s)	PTTW P-300-2095321129 Version: 1.0	December 30, 2020	December 26, 2025

The current Palgrave PTTW limits the combined production from the three (3) Palgrave wells to 128.8 L/s (11,129 m^3/day). The PTTW for the Caledon East wells, issued on December 30, 2020, reflects all four (4) Caledon East wells, including the new CE6 well (yet to be connected). The new Caledon East PTTW limits the combined production from the four (4) Caledon East wells to 125.0 L/s (10,800 m^3/day). The combined pumping rate for Caledon East reflects an existing limitation in the aquifer which prevents wells CE4 and CE4A (drilled in the same aquifer) from pumping together at rates greater than 75 L/s (6,480 m^3/day). The maximum combined PTTW capacity for all production wells in the Palgrave/Caledon East Drinking Water System is 21,929 m^3/day (253.8 L/s).

5.1.1.1 Available Supply Capacity

In groundwater-based systems, supply capacity is influenced by several factors beyond the permitted water taking capacity of the production well(s); such as maximum well/pumping capacity, aquifer sustainability, or restrictions imposed by the MECP in the PTTW related to potential effects on nearby surface or groundwater features, operational limitations, or water quality issues. Routine assessment of well performance and rehabilitation needs is part of the Region's regular operation and maintenance activities.

The efficiency of the Caledon East wells CE4 and CE4A has been declining over the last seven (7) years due to changes in the aquifer pressure. CE4 has been historically experiencing plugging issues since 2014 and is currently not capable of pumping its current PTTW rate without more rehabilitation. In addition, a decline in specific capacity of approximately 50% has been reported based on a comparison from post well

construction testing in 1975 and the latest step test records from 2009 (CIMA+, Well Asset Management Report Card, 2020).

As a general practice, a 15% buffer or reserve capacity is accounted for in water and wastewater systems to establish the need for additional capacity expansions. As such, planning for future capacity expansions and/or the need for new infrastructure is generally initiated when 85% of existing capacity is reached. The combined well rated capacity and the available supply capacity in the Palgrave/Caledon East system is summarized in **Table 6.**

Table 6: Combined Permitted and Available Supply Capacity

Supply Wells	Combined Rated Capacity	Available Supply Capacity[1]
Connected supply wells only: PAL2, PAL3, PAL4, CE3, CE4, CE4A	17,609 m^3/day (204 L/s)	14,968 m^3/day (173 L/s)
Connected supply wells + new unconnected well (CE6): PAL2, PAL3, PAL4, CE3, CE4, CE4A, CE6	21,929 m^3/day (254 L/s)	18,640 m^3/day (216 L/s)

Notes:

1. Available supply capacity assumes a 15% reserve capacity.

5.1.2 Water Treatment

Water treatment is facilitated through four (4) WTPs, two (2) of which are in Palgrave and two (2) in Caledon East.

Raw water from PAL2 is pumped to the PAL3 treatment plant (Palgrave WTP1), where it is combined with the raw water from PAL3 for treatment. PAL4 has its own treatment facility, Palgrave WTP2. Palgrave WTP1 and WTP2 both provide, separately, primary and secondary disinfection treatment via liquid sodium hypochlorite; as well as iron removal via a combination of oxidation with chlorine followed by greensand filtration. In the Palgrave system, treated water is pumped from WTP1 and WTP2 to the Palgrave Reservoir which provides storage and sufficient system pressure to maintain the water supply demands. Each WTP in Palgrave includes the following major treatment equipment:

- Sodium hypochlorite feed pumps for primary and secondary disinfection, and iron oxidation
- Sodium hypochlorite storage tank
- Chlorine contact tank

- Greensand filter system including process residue holding tank, supernatant pumps, sludge transfer pumps, piping, valves, controls and backwash supply from the water distribution.

Raw water from CE3 is pumped to the Caledon East WTP1 for treatment, consisting of primary and secondary disinfection treatment via sodium hypochlorite, no other treatment is provided in Caledon East WTP1. Major treatment equipment in the Caledon WTP1 includes:

- Sodium hypochlorite feed pumps for primary and secondary disinfection
- Sodium hypochlorite storage tank
- Chlorine contact tank

Raw water from CE4 and CE4A is treated at the Caledon East WTP2 for primary and secondary disinfection via sodium hypochlorite. Iron is removed by oxidation followed by greensand filtration. Major treatment equipment in the Caledon WTP2 includes:

- Sodium hypochlorite feed pumps for primary and secondary disinfection, and iron oxidation
- Sodium hypochlorite storage tank
- Chlorine contact tank
- Greensand filter system including process residue holding tank, supernatant pumps, sludge transfer pumps, piping, valves, controls and backwash supply from the water distribution.

In the Caledon East water system, treated water is pumped from WTP1 and WTP2 to the Caledon East Storage Reservoir which provides sufficient pressure to meet the supply demands. A booster pumping station at WTP2, (Granite Stones Booster Pumping System) is equipped with booster pumps and pressure regulating tanks to service the Granite Stones subdivision, located at a higher elevation. Permitted rated capacity of the treatment equipment and plants, as well as the corresponding permit/license number, are summarized in **Table 7.**

Table 7 Permitted Treatment Rated Capacity in Palgrave/Caledon East Water System

Water Facility	Rated Capacity m^3/day (L/s)	Permit/License Number	Renewal Date
Palgrave WTP1	8,493 m^3/day (98 L/s)	MWDL 009-105 Issue No.: 8	May 7, 2024
Palgrave WTP2	2,618 m^3/day (30 L/s)	MWDL 009-105 Issue No.: 8	May 7, 2024
Caledon East WTP1	2,618 m^3/day (30 L/s)	MWDL 009-105 Issue No.: 8	May 7, 2024
Caledon East WTP2	5,530 m^3/day (64 L/s)	MWDL 009-105 Issue No.: 8	May 7, 2024

5.1.3 Water Distribution

The Palgrave/Caledon East Drinking Water Systems are interconnected via a 400 mm diameter watermain on Old Church Road. The Old Church Booster Pumping Station connects the two (2) systems and allows both water systems to serve as a back up water supply to each other, to meet the demands in either system.

As per the 2019 Water Quality Report for the Palgrave/Caledon East Drinking Water System, the distribution system comprises approximately 108 km of watermains and feedermains, about 3,000 service connections.

5.2 Water Quality

The Palgrave/Caledon East supply system uses “true” groundwater sources (non-GUDI) in all production wells. Raw water is of high-quality necessitating in some cases, only disinfection or a combination of disinfection and iron/manganese removal/control. Raw and treated water quality data for the Palgrave/Caledon East Drinking Water System has been extracted from the 2019 Water Quality Report. Relevant physical and chemical parameters have been reviewed with observations summarized in the following sections.

5.2.1 Raw Water Quality

Raw water quality data for selected physical and chemical parameters are summarized in **Table 8**. The limits set out in the Ontario Drinking Water Quality Standards (ODWQS), Objectives and Guidelines are also included in the tables. These standards, objectives and guidelines apply only to treated/distribution water and do not apply directly to raw water; however, they provide an indication of treatment requirements at the plants and have been included in the tables for comparative purposes only.

Table 8: Raw Water Quality of the Palgrave/Caledon East Water System[1]

Parameter	Parameter Description	Units	Palgrave System (Min-Max)	Caledon East System (Min-Max)	ODWQS limits	AO/OG/ Health-based Standard[2]
Turbidity	Suspended particles of organic/ inorganic matter	NTU	0.05 – 0.45	0.08 – 0.51	5 (at point of consumption) 1 (adverse water quality level)	AO
Chloride	Non-toxic material	mg/L	9.2 – 14	22 – 150	250	AO

Parameter	Parameter Description	Units	Palgrave System (Min-Max)	Caledon East System (Min-Max)	ODWQS limits	AO/OG/ Health-based Standard[2]
	naturally present in drinking water					
Hardness (as $CaCO_3$)	Naturally occurring; related mainly to calcium and magnesium	mg/L	230 – 260	260 – 360	80 – 100	OG
Iron	Naturally occurring in mineral deposits and from sediment decay	mg/L	0.66 – 0.88	0.1 – 0.63	0.3	AO
Organic Nitrogen[3]	Natural decay of organic material	mg/L	<0.05 – 0.23	<0.05 – 0.14	0.15	OG
pH	Water acidity	-	7.24 – 7.90	7.15 – 7.91	6.5 – 8.5	OG
Sulphate	Naturally occurring	mg/L	29 – 36	32 - 37	500	AO
Temperature	Varies seasonally	^{0}C	8.10 – 9.7	6.9 – 12.1	15	AO

Notes:

1. Water quality data as per Region of Peel, 2019 Water Quality report, Palgrave Caledon, Centerville and Cedar Mills, Palgrave – Caledon Drinking Water System, 2019
2. From O. Reg. 169/03 and Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (June 2003). AO is the Aesthetic Objective; OG is the Operational Guideline.
3. Organic nitrogen calculated from the available data on Total Kjeldahl Nitrogen (TKN) and Total Ammonia Nitrogen. Total Organic Nitrogen = TKN – Total Ammonia Nitrogen.

In comparing the reported raw water data with the treated water quality objectives outlined in the ODWQS Guideline only hardness and iron are outside the recommended range for both systems. Iron removal treatment is provided in Palgrave WTP1 and 2, as well as in Caledon East WTP 2.

The levels for hardness slightly exceed the operational guideline. This specific parameter is not substantially affected by conventional treatment. Hardness in the range of 80-100 mg/L are considered to provide an acceptable balance between corrosion and

incrustation. Hardness level of around 200 mg/L is considered tolerable, while levels above 500 mg/L is considered unacceptable for domestic use. Organic nitrogen concentrations higher than the operational guideline of 0.15 mg/L may affect taste and odour of the water. The maximum organic nitrogen in the Palgrave system slightly exceeds the operational guideline, however it is not expected to have an adverse effect on human health.

All other physical and chemical water quality parameters are well below the ODWS limits; therefore, besides iron removal, only disinfection treatment is required.

5.2.2 Treated Water Quality

Treated water quality data for selected physical and chemical parameters are summarized in **Table 9**.

Table 9: Treated Water Quality of the Palgrave/Caledon East Water System[1]

Parameter	Parameter Description	Units	Palgrave System (Min-Max)	Caledon East System (Min-Max)	ODWQS limits	AO/OG/ Health-based Standard[2]
Alkalinity	Water resistance to effects of acids added to water	mg/L	200	220 – 270	30 – 500	OG[3]
Lead	Resulting from corrosion of process fitting containing lead	mg/L	<0.0005	<0.0005	0.01	MAC[4]
Total Dissolved Solids	Mainly inorganic substances dissolved in water	mg/L	280	310 – 610	500	AO5
Hardness (as $CaCO_3$)	Naturally occurring; mainly calcium and magnesium	mg/L	230 – 240	260 – 360	80 – 100	OG
Iron	Naturally occurring in mineral deposits and from sediment decay	mg/L	<0.1	<0.1	0.3	AO

Parameter	Parameter Description	Units	Palgrave System (Min-Max)	Caledon East System (Min-Max)	ODWQS limits	AO/OG/ Health-based Standard[2]
Manganese	In groundwater as a result of mineral deposits	mg/L	<0.002	<0.002 – 0.011	0.05	AO
Nitrate	Present in groundwater as a result of plant or animal material decay	mg/L	<0.10	<0.10 – 4.12	10	MAC
Nitrite	Present in groundwater and is oxidized to nitrate when chlorinated	mg/L as N	<0.01	<0.01	1.0	MAC
pH	Water acidity	-	6.98 – 7.92	7.10 – 7.91	6.5 – 8.5	OG
Sulphate	Naturally occurring	mg/L	36	30 – 37	500	AO
Sodium	Naturally occurring or due to water softening	mg/L	7.0 – 9.4	7.8 – 99	200[3]	AO

Notes:

1. Water quality data as per Region of Peel, 2019 Water Quality report, Palgrave Caledon, Centerville and Cedar Mills, Palgrave – Caledon Drinking Water System, 2019
2. From O. Reg. 169/03 and Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (June 2003). OG is the Operational Guideline, MAC is the Maximum Allowable Concentration, AO is the Aesthetic Objective.
3. The aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.

In comparing the ODWQS limits with the treated water quality, the treated water quality for both Palgrave and Caledon East water systems meets the ODWQS, except for total dissolved solids and hardness. Although total dissolved solids concentrations are outside of the recommended range, they are only expected to potentially affect the palatability of the water and have no adverse impacts on human health. As noted before, hardness levels of around 200 mg/L are considered tolerable and not related to public health.

The ODWQS states that the presence of any total coliform bacteria or Escherichia coli (*E. coli*) in water leaving a treatment plant or in any treated water immediately post treatment signifies inadequate treatment and is unacceptable. A summary of the treated water microbiological test results in the Palgrave/Caledon East, as extracted from the 2019 Water Quality Report is shown in **Table 10**. All treated water sample results analysed from the Palgrave/Caledon East system were in compliance with the ODWQS.

Table 10: Treated Water Microbiological Test Results for Palgrave/Caledon East Water System[1]

Sample Location	No. of samples	E. *coli* (CFU/100 mL) (Min – Max)	Total Coliform (CFU/100 mL) (Min – Max)	Criteria (ODWQS)	Health Based Standard[2]
Palgrave WTP1 (PAL2 and PAL3)	52	0 – 0	0 – 0	Not Detectable	MAC
Palgrave WTP2 (PAL4)	47	0 – 0	0 – 0	Not Detectable	MAC
Palgrave Distribution	210	0 – 0	0 – 0	Not Detectable	MAC
Caledon East WTP1 (CE3)	52	0 – 0	0 – 0	Not Detectable	MAC
Caledon East WTP2 (CE4 and CE4A)	52	0 – 0	0 – 0	Not Detectable	MAC
Caledon East Distribution	211	0 – 0	0 – 0	Not Detectable	MAC

Notes:

1. Data as per Region of Peel, 2019 Water Quality report, Palgrave Caledon, Centerville and Cedar Mills, Palgrave – Caledon Drinking Water System, 2019
2. From O. Reg. 169/03 and Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (June 2003). MAC is the Maximum Allowable Concentration

6 Design Criteria

6.1 Service Population and System Demands

In June 2020, the Region completed a study to establish servicing requirements and confirm population projection and servicing approaches in the Town of Caledon. The study included a detail analysis of each individual municipal groundwater system to confirm capacity and servicing needs of the existing systems to accommodate projected growth in accordance with Official Plan Amendments. Future growth in the subject areas was projected based on the Town of Caledon's growth projections up to 2031, as well as development applications/inquires for the villages with the Town of Caledon that could add further growth beyond 2031.

The Region's study concluded that projected equivalent serviced population in the Palgrave/Caledon East Drinking Water System is anticipated to increase from an existing 12,187 people to 14,184 people, beyond 2031, as shown in **Table 11.** Correspondingly, maximum water demands are expected to increase from approximately 9,041 m^3/day to 13,263 m^3/day, representing an increase in system demands of almost 50%.

Table 11: Existing and Projected Population and Demand for Palgrave/Caledon East Water System[1]

System	Existing Equivalent Service Population (2020)	Existing Max. Day Demands (m^3/day)	Potential Projected Population[2] (2031+)	Potential Projected Max Day Demands (m^3/day)
Palgrave/Caledon East	12,187	9,041	14,184	13,263

Note:

1. Population and system demands excerpted from Servicing Update of Groundwater-Based Drinking Water Systems, Region of Peel, 2020.
2. As per Region's report, potential projected population includes current development applications approved but not yet serviced, as well as future potential growth.

As shown previously in **Table 6**, the currently available supply capacity in the Palgrave/Caledon East Drinking Water System, excluding the new well CE6 is approximately 14,968 m^3/day. Based on the projected maximum day demands for the Palgrave/Caledon East Drinking Water System for 2031 and beyond, of 13,263 m^3/day (shown in **Table 11**), the existing municipal supply wells have enough combined capacity, from a supply perspective, to accommodate the projected demands.

The life cycle of a production well is generally influenced by a few factors or processes that are external to well construction or well operation. This include material or performance deterioration resulting from physical, chemical and/or biological processes occurring in the aquifer where the well has been built. In the case of the Palgrave/Caledon East system, the efficiency of Caledon wells CE4 and CE4A has been declining over the last seven (7) years due to changes in the aquifer pressure.

Furthermore, under the current system configuration, the Palgrave wells alone, or the Caledon East wells alone, would not be able to satisfy the projected combined system demands, should anything happen with the wells, their aquifers, or the interconnecting watermain between the two (2) systems. To this effect, the Region recognized an opportunity to explore options to enhance the redundancy of supply in the system and mitigate the associated risks.

7 Class EA Phase 1 – Problem / Opportunity Statement

Phase 1 of the Municipal Class EA planning process requires the proponent of an undertaking to first document factors leading to the conclusion that the opportunity is required, and to develop a clear statement of the problem/opportunity to be investigated.

7.1 Needs Assessment and Justification

A review of the existing Palgrave/Caledon East Drinking Water System identified limited system redundancy with the security of supply, coupled with a historical decline in well efficiency in a few of the system's production wells. To this effect, the Region recognized an opportunity to explore alternatives to enhance the security of water supply in the Palgrave/Caledon East Drinking Water System and reduce the associated risks. A groundwater exploration and a long-term testing program, undertaken prior to the Class EA study, identified and led to the construction of a new municipal supply well, CE6 in the Caledon East area. Testing results confirmed that the new well, CE6, has good water quality and sufficient capacity, capable of sustainably producing 50 L/s of water, making it an excellent alternative for additional supply capacity in the system. Consequently, a connection of the new well CE6 to the existing Palgrave/Caledon East Drinking Water System would be necessary, requiring the completion of a Class EA study.

Initially, the works associated with the connection of the new well CE6 to the existing Palgrave/Caledon Drinking Water System were considered Schedule B undertakings under the Municipal Class Environmental Assessment document (October 2000, as amended in 2007, 2011 & 2015). However, as per Table B, Appendix 1 of the Municipal Class Environmental Assessment document (2023) activities *10a: Construct a new water system including a new well* and *15c: Construct new water treatment plant or expand existing water treatment plant beyond existing rated capacity* are classified as Schedule C undertakings. Thus, as the project advanced and the scope was expanded to include the construction of a new water treatment plant the project schedule was elevated to a Schedule C Class EA study.

7.2 Problem / Opportunity Statement

The problem/opportunity statement for the New Supplementary Water Supply Source for the Palgrave – Caledon East Drinking Water System has been defined as follows:

Infrastructure improvements to the water supply system in the Palgrave/Caledon East Drinking Water System are required to:

- *Increase supply capacity and enhance the security of water supply.*
- *Minimize potential risks associated with declined well efficiency.*
- *Provide an appropriate level of service while meeting the long-term water needs of the serviced area.*

The preferred water servicing solution to meet the above Problem / Opportunity Statement was identified and developed in this Class EA study in a way that is reliable, sustainable, and environmentally and financially responsible.

8 Project Study Area

The Project Study Area was delineated to encompass areas where the project was expected to occur. A potential connection of the new well, CE6, to the existing drinking water system was originally used as the basis for establishing study area limits. Considering the geographical proximity of the new well CE6 to other municipal water infrastructure in the Caledon East area, along with the potential for treating CE6 raw water at the Caledon East Water Treatment Plant 1 (WTP1), the study area was initially delineated to include potential routes for connecting CE6 to WTP1. The study area, as shown in **Figure 6**, is generally bounded by Old Church Road and Walker Road West to the north, Innis Lake Road to the east, Castlederg Sideroad and Boston Mills Road to the south, and Torbram Road and Mountainview Road to the west.

Figure 6: Project Study Area

9 Evaluation Framework

9.1 Overview

The evaluation process for this Class EA study consisted of the following sequential steps:

1. Identification and Evaluation of Alternative Solutions – This first step allows the project team to identify a long list of available potential water supply solutions and select only those that are considered feasible and eliminate the alternatives that are not. Alternative solutions are subjected to a preliminary screening step and assessed against a set of must-meet criteria that include key aspects for supply capacity, compliance with applicable planning policies, and technical and financial feasibility. This first step leads to the preliminary identification (screening) of short-listed feasible alternatives and avoids the need to carry unrealistic alternatives through the next steps.
2. Comparative Evaluation of Feasible Alternative Solutions – Shortlisted feasible alternative solutions identified in the preliminary screening step are further conceptualized into options and sub-options. Options are then compared relative to one another to assess their viability for implementation and the merits for a more detailed evaluation. The comparative analysis is based on a relative assessment against natural environmental, technical, socio-cultural and economic considerations. The economic assessment was based on the relative scale of construction costs for each option, including the need for supportive investigations, dewatering contingencies, traffic management, and securing permits, resulting in higher construction duration and financial expenditures. Preliminary findings from desktop studies are accounted for and reflected in the comparative analysis of the options and sub-options. This second steps results in the identification of the preferred alternative solution. Activities and results from Steps 1 and 2 are presented to the public during a first Public Information Centre (PIC) for feedback and consensus.
3. Identification and Detailed Evaluation of Alternative Design Concepts – Alternative methods for implementing the preferred alternative solution, referred as alternative design concepts are developed to capture major infrastructure components. Alternative design concepts are further refined and evaluated against a comprehensive set of detailed evaluation criteria that include, but is not limited to, technical, natural environment, socio-cultural and economic considerations. Opinion of probable costs are developed for each design concept and accounted for in the economic evaluation. Findings and recommendations from field work studies and

investigations are also captured in the detailed evaluation of the alternative design concepts.

4. Selection and Recommendation of the Preferred Solution – The outcome of the detailed evaluation is the selection of the preliminary preferred design concept. The preliminary preferred design concept is presented to the public during a second PIC for feedback and consensus.

A general schematic of the evaluation methodology is outlined in **Figure 7** and described in more detail in subsequent sections. Specific activities undertaken as part of each step described above, as well as the results of such activities, are described in detail in the following sections.

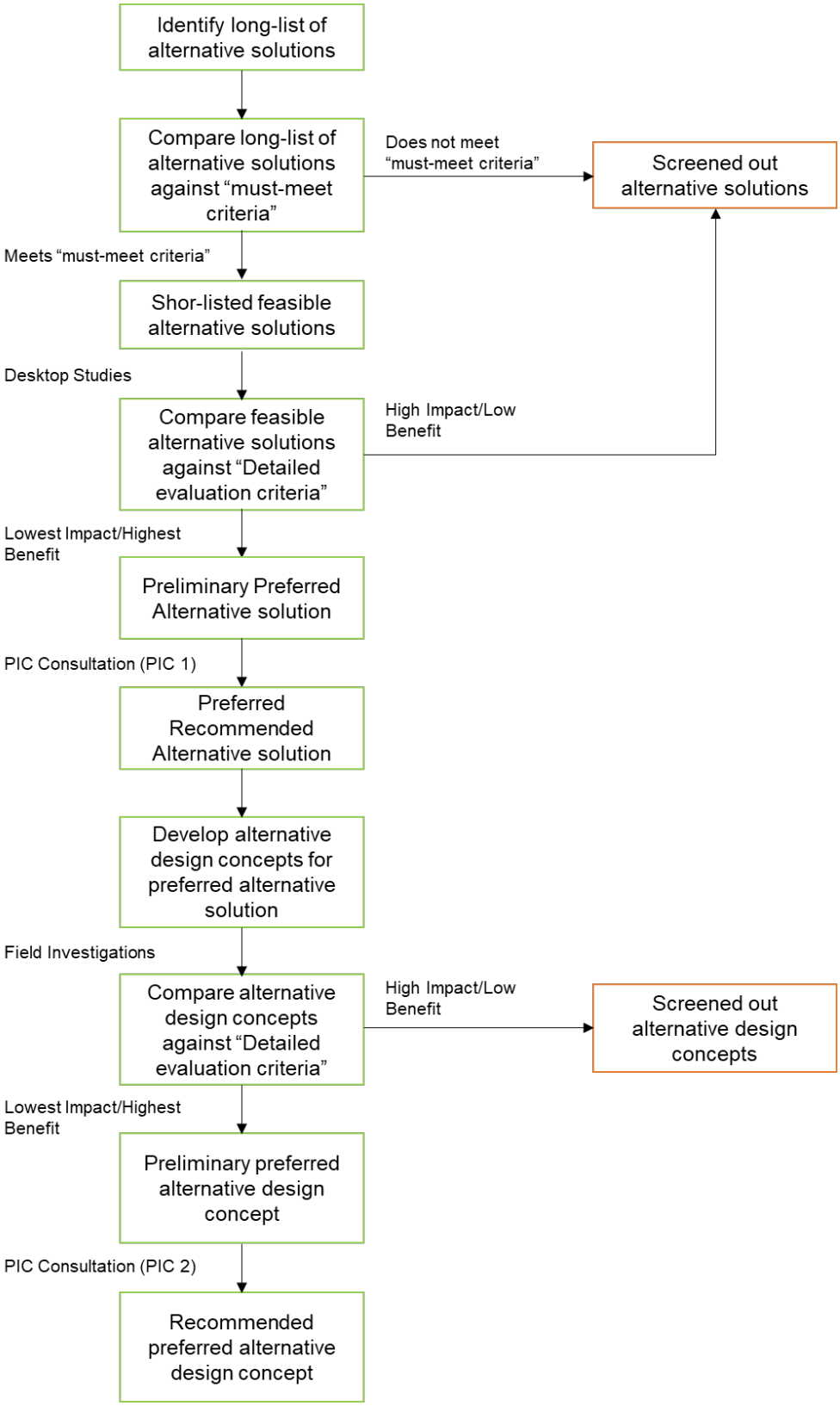

Figure 7: Overview of Evaluation Approach

9.1.1 Preliminary Screening of Available Alternative Solutions

A list of available alternative water supply solutions was initially developed to include potential water supply scenarios, including the Status Quo, to reflect the current condition of the Palgrave/Caledon East Drinking Water System.

Each water supply alternative solution was assessed against a set of preliminary screening criteria with the purpose of narrowing down the list to only those that are considered “feasible” and eliminating alternatives that are unrealistic from further analysis and consideration. The preliminary screening step helps to avoid the need to carry unrealistic water supply alternatives through the next steps of the evaluation process.

Preliminary screening was accomplished by applying the “must-meet” criteria shown in **Table 12**. Must-meet criteria were established to capture key objectives established for this project. The “must-meet” criteria are considered as a “yes/no” or “pass/fail” basis. Alternative water supply solutions must pass all “must-meet” criteria to be short-listed or carried forward through the next step in the evaluation process.

Table 12: Preliminary “Must-Meet” Screening Criteria

Must-Meet Criteria	Description
Supply Capacity	• Does the alternative solution contribute to an increase in system redundancy with the security of water supply in the Palgrave – Caledon East Drinking Water System, consistent with the Problem/Opportunity Statement defined for the Class EA study?
Compliance	• Is the alternative solution in general agreement with the requirements, policies and permitted land uses of the applicable local plans and policies contained in the Niagara Escarpment Plan, 2017, Oak Ridges Moraine Conservation Plan, 2017, Greenbelt Plan, 2017, Growth Plan for the Greater Golden Horseshoe, The Growth Plan 2020, the Region’s Official Plan and Town of Caledon Official Plan?
Technical Feasibility	• Does the alternative solution maximize the use the existing municipal assets and infrastructure in the serviced area? • Is the alternative solution compatible with existing treatment processes and operational practices, such that its implementation will not significantly impact the existing operations?

Must-Meet Criteria	Description
Financial Feasibility	• Is the alternative solution economically mindful in terms of capital and operating costs, relative to the alternative solutions being considered in the study?

9.1.2 Comparative Evaluation of Feasible Alternative Solutions

A comparative evaluation of options and sub-options conceptualized for the short-listed (feasible)) alternative solutions is then undertaken. Consideration to the results of the desktop studies/investigations is accounted for in the comparative evaluation. Options are assessed against four (4) main criteria categories: natural environmental, technical, socio-cultural and economic. All criteria categories are considered equally important in the evaluation scheme, so they are weighted equally. Specific considerations under each criterion category included:

- Natural Environment
    - Impact to existing natural heritage features (e.g., terrestrial aquatic features and habitats, sensitive species, watercourses, ANSI, ESAs, SARA, wetlands, woodland, etc.)
    - Impact to water resources and source water protection areas
    - Compatibility and conformity with existing and future land uses
    - Potential impacts on climatic conditions and project vulnerability to climate change
- Technical
    - Constructability, complexity of construction
    - Need for permits and approvals
    - Legal/Jurisdictional Requirements, need for land acquisition, easements
- Socio-cultural
    - Potential impact to archaeological and cultural heritage features
    - Potential short- and long-term disruption to local users and existing uses
- Economic
    - Relative assessment of potential scale of construction costs.

All options are assessed, relative to each other, and assigned a score based on the scoring approach shown in **Table 13**. The score assigned represents the potential net impact, which intends to reflect the impact that remains, or is predicted to remain, after

mitigation measures are in place. The option that achieves the highest overall score is selected as the preferred alternative solution and is recommended for further analysis in the study.

Table 13: Overall Scoring Approach

Score	Description
●	Potential impacts are negligible, no mitigation is required.
◕	Potential impacts are minor and can be easily mitigated through implementation of standard mitigation measures.
◑	Potential impacts are moderate and implementation of a number of mitigation measures are required to reduce/eliminate the risks.
◔	Potential impacts are major, and implementation of extensive mitigation measures are required to reduce/eliminate the risks.
○	Potential impacts are significant, and implementation of substantial mitigation measures are required to reduce the risks; however, risk cannot be completed eliminated.

9.1.3 Detailed Evaluation of Alternative Design Concepts

Alternative design concepts are then developed for the preferred alternative solution. Specific infrastructure needs are established to reflect possible ways of implementing the preferred alternative in more detail. Major infrastructure components of the preferred alternative solution are categorized into two: vertical infrastructure and linear infrastructure. Alternative design concepts were developed separately for both components.

Alternative design concepts for both vertical and linear infrastructure are then subjected to a detailed evaluation using the same multi-criteria evaluation methodology used in the comparison of the feasible alternative solutions. Separate evaluation matrices are developed for linear and vertical infrastructure. Economic considerations for vertical infrastructure were assessed according to the relative scale of life cycle costs for each option, while for linear infrastructure, the evaluation focused solely on capital costs. Consideration to the findings and recommendations from the field work investigations as well as the opinion of probable cost for each option is accounted for in the detailed evaluation.

Alternative design concepts are scored comparatively using the scoring rationale presented in **Table 13**. For each alterative design concept, detailed information is gathered and used to provide a relative score that accounts for the following:

- Risk and/or potential impacts for each criterion
- Available approaches to mitigate risks and/or impacts
- Scoring rationale, based on degree of risk and/or mitigation required

The detailed evaluation of the alternative design concepts was carried out by comparing differences in impacts and establishing a clear rationale for the selection of the design concept that provides the most overall benefits to this project. The alternative design concept that achieves the highest overall score is selected as the preferred design concept and recommended for implementation.

9.1.3.1 Evaluation Criteria, Rationale, and Indicators

The evaluation criteria categories were considered equally important across the overall evaluation scheme. As such, a weighting factor of 25% or 25 points was assigned to each of the four (4) criteria categories for a total of 100% or 100 points. Secondary criteria or sub-criteria were identified within each main criterion, as shown in **Table 14** to represent specific aspects and considerations of the category being evaluated, and most relevant to this project.

Table 14: Evaluation Criteria and Indicators

Criteria	Description	Indicators
Natural Environmental		

Natural Environmental Features	Potential impacts to existing natural environment	• Impacts during construction on environmental significant features:
		  • Terrestrial and aquatic features and habitats and sensitive species
		  • Number of watercourse crossings including coldwater streams, warmwater and intermittent streams
		  • Areas of Natural and Scientific Interests (ANSI),

Criteria	Description	Indicators
		Environmentally Sensitive Area (ESA) • Significant vegetation such as wetlands, woodlands, woodlots, greenlands, valley systems • Regulated and protected areas • Floodplain areas • Meander belts • Endangered species and species at risk • Tree removal requirement and tree compensation • Displacement or disruption of topographical features • Opportunities for enhancement or restoration of habitat
Water Resources and Source Water Protection	Potential temporary and permanent effects on surface water and groundwater quantity/quality due to construction	• Proximity and potential impact on: • Existing groundwater wells and wellhead protection areas (WHPAs) • Areas of groundwater recharge and discharge • Highly vulnerable aquifers • Dewatering requirements during construction • Conformity with policies and requirements of existing source water protection program
Land Uses	Potential impacts on existing and future land uses	• Conformity with land use planning policies contained in: • Niagara Escarpment Plan • Greenbelt Plan

Criteria	Description	Indicators
		• Oak Ridges Moraine Conservation Plan • Provincial Policy Statement • Official plans/zoning bylaws
Climate Change	Potential impact on climatic conditions during construction and project vulnerability to changing climatic conditions.	• Resilience and flexibility of construction materials and installation methodology
Technical		
Constructability	Complexity of Construction	• Compatibility with existing systems, process complexity • Operation and maintenance requirements • System robustness and redundancy • Flexibility for expansion • Soil conditions • Groundwater table and requirements for groundwater control • Creek crossings/trailway crossing methods • Construction means and methods • Construction duration • Conflicts with existing utilities and impact on existing infrastructure • Maintenance access • Traffic management and control during construction • Road restoration requirements

Criteria	Description	Indicators
Approval Requirements	Number of permits/approvals required	• Permits from Conservation Authorities for construction within floodplain areas, regulated areas, etc. • Permits from Department of Fisheries and Oceans • Town of Caledon and Regional permitting for construction on regional/local roads • Potential schedule impacts due to permitting requirements
Legal / Jurisdictional	Land acquisition requirements and availability of property	• Potential land requirements, including temporary and permanent easements, within public and private lands • Risk to schedule
Socio-Cultural		
Archaeological and Built Cultural Heritage Features	Potential impact to cultural heritage features.	• Potential impacts to archaeological and built heritage (historical) features
Nuisance Impacts	Potential short-term disruption during construction (i.e., noise, dust, vibration, visual, access to property, street parking, traffic management, detours)	• Number of private residences and businesses to be impacted during construction • Number of sensitive receptors such as schools, daycares, and long-term facilities. • Disruption to existing recreational/agricultural activities • Disruption to existing private/flowing wells
Economic		

Criteria	Description	Indicators
Construction Costs	Relative scale of Life Cycle Cost for vertical infrastructure and, Relative scale of construction costs for linear infrastructure	• Vertical Infrastructure: Life Cycle Cost including capital and operations and maintenance costs • Linear Infrastructure: Construction costs

9.1.4 Selection of Preferred Alternative Design Concept

Individual scores assigned to each implementation option were totaled, with consideration to the relative weighting factor of each primary criteria category. The implementation option with the highest final score is considered to provide the most overall benefits to this project and was thus selected as the preliminary preferred water supply solution for recommendation.

In order to determine a preliminary preferred water servicing solution, scores were assigned for each option against each criterion. Any option that has empty circles was considered not preferred as this indicates that there are significant impacts and mitigation will not result in the elimination of the impacts. The preliminary preferred long-term water servicing solution is that with the least overall impact and provides the most benefits to the Region, for this specific project.

10 Class EA Phase 2 – Identification of Alternative Water Supply Solutions

This section describes the long-list of alternative water supply solutions explored in Phase 2 of the Class EA study, the methodology used to screen these alternatives and the short-listed feasible water supply alternatives that were established when subjected against a set of must-meet criteria. Consultation with the public and review agencies, in the form of a first Public Information Centre (PIC 1), was carried out to confirm the preliminary recommendations for further consideration in the next phases of the Class EA study.

10.1 Identification of Alternative Solutions

In accordance with Phase 2 of the Municipal Class EA process, a long list of available potential alternative solutions to address the Problem/Opportunity Statement for the New Caledon East 6 Well (CE6) Class EA study, was developed, as listed below.

- Alternative 1 – Do Nothing
- Alternative 2 – Limit Community Growth
- Alternative 3 – Reduce Water Demands
- Alternative 4 – Improve Operation and Maintenance of Existing Supply Wells
- Alternative 5 – Obtain Additional Supply Capacity from Existing Source
- Alternative 6 – Obtain Additional Supply Capacity from Another Source

Description of each available alternative solution is provided in the following sections.

10.1.1 Alternative 1 – Do Nothing

The “Do Nothing” alternative represents the existing conditions where the current Palgrave – Caledon East Drinking Water System will be maintained as is. No improvements or changes would be made to address the identified problem (system limitations) or opportunity.

The “Do Nothing” alternative does not address the current limitations identified with the security of supply in the Palgrave – Caledon East Drinking Water System.

10.1.2 Alternative 2 – Limit Community Growth

The “Limit Community Growth” alternative represents a scenario where future growth in the areas serviced by the Palgrave – Caledon East Drinking Water System is limited to the extent that the existing facilities and infrastructure are sufficient.

One of the key objectives of the comprehensive review of the municipal water and wastewater systems in the Town of Caledon, completed by the Region in 2020, comprised a capacity assessment of each municipal system to service future population based on the projected and planned growth in the serviced areas. The study concluded that current and projected water demands in the Palgrave – Caledon East Drinking Water System can be provided through the existing system; however, limited system redundancy in the security of supply was identified as a potential risk in the system.

The “Limit Community Growth” alternative does not address the limitations identified with the redundancy of supply in the Palgrave – Caledon East Drinking Water System.

10.1.3 Alternative 3 – Reduce Water Demands

The “Reduce Water Demands” through implementation of water conservation and water efficiency measures represents a scenario where improvements in water conservation and water efficiency would reduce water consumption to the extent that the existing facilities and infrastructure are sufficient.

With a population growth rate of approximately 35,000 persons per year, water demands within the Region are expected to increase. These growing demands are expected to be met through both infrastructure expansion and implementation of various water efficiency initiatives and education and outreach programs identified in the 2013 Water Efficiency Strategy (WES), which has been built upon the success of the Region’s 2004 Water Efficiency Plan (WEP).

Key factors that have significantly influenced water demands in the Region comprise the implementation of the Region’s WEP, combined with changes in the water efficiency marketplace and increased public environmental awareness. Although annual average day demands are declining in the Region, peak day water demands are not. Peak day demands often drive the need for infrastructure expansion because many infrastructure elements are designed and sized to meet peak day demands. According to the Region’s 2012 WES Update, the Region’s peak day demand is highly variable, dependant on short- and long-term weather patterns and is essentially following the projected growth rate. Although indoor demands are declining in the Region, outdoor water demands are not and thus, the Region plans to implement water efficiency measures that specifically target irrigation demands reductions to keep the peak day ratio as low as possible. The Region has reduced its future demand forecast in response to lower than projected demands. However, further reductions in water demands through implementation of conservation measures will not address the current limitations identified with the security of supply in the Palgrave/Caledon East Drinking Water System.

10.1.4 Alternative 4 – Improve Operation and Maintenance of Existing Supply Wells

The “Improve Operation and Maintenance of Existing Supply Wells” represents a scenario where improvements and modifications to the current operational and maintenance practices associated with the municipal supply wells in the Palgrave/Caledon East Drinking Water System are undertaken.

The Region currently has a Production Well Management Program in place which reviews the efficiency and sustainability of the municipal supply wells, on a continuous basis. A key component of the program includes the assessment of the performance of the municipal supply wells through well testing. Other key well-related monitoring and maintenance activities are also defined in the program, to maximize the working life of the well equipment, reduce the frequency of equipment breakdown and achieve a cost-efficient operation of the well equipment. In addition, the Region is currently developing a Well Asset Management Program to provide specific strategies for each municipal supply well in relation to maintenance, rehabilitation, replacement, and disposal over the life cycle of each well.

The “Improve Operation and Maintenance of Existing Supply Wells” alternative helps to alleviate some of the limitations identified with the redundancy of supply in the Palgrave/Caledon East Drinking Water System through the standard and continuous maintenance, inspection, servicing and testing of the municipal supply wells. However, the alternative on its own cannot fully address, in the long-term, the limitations identified with the redundancy of supply in the Palgrave/Caledon East Drinking Water System.

The Region intends to continue with the implementation of the Production Well Management Program and adopt the recommendations of the Well Asset Management Program. The “Improve Operation and Maintenance of Existing Supply Wells” alternative is not recommended as a stand-alone solution but should be considered in combination with the preferred alternative solution.

10.1.5 Alternative 5 – Obtain Additional Supply Capacity from Existing Source

The “Obtain Additional Supply Capacity from Existing Source” alternative represents a scenario where the water taking capacity in any of the existing production wells within the Palgrave/Caledon East Drinking Water System is increased. The Region is exploring options to increase the water taking capacity of Palgrave Well #4 (PAL4), which is one of the six (6) municipal groundwater sources currently supplying the Palgrave/Caledon East Drinking Water System.

The potential capacity increase of PAL4 is being undertaken as a separate Class EA study; however, the planning and decision-making process will be integrated, as practical as possible, with the development and recommendations of this Class EA study to ensure that any new infrastructure proposed within the Palgrave/Caledon East Drinking Water System addresses the identified needs and/or opportunities of the integrated drinking water system.

10.1.6 Alternative 6 – Obtain Additional Supply Capacity from Another Source

The “Obtain Additional Supply Capacity from Another Source” alternative, includes two (2) potential sub-alternatives:

10.1.6.1 6A – Additional Supply from the Region’s South Peel Lake-based System

This alternative would involve a connection to the Region’s South Peel lake-based drinking water system through extension of watermains into the area serviced by the Palgrave/Caledon East Drinking Water System. In principle, the rural communities in the Town of Caledon are outside of the Region’s lake-based service area limits and are intended to be supplied separately by one of the Region’s municipal groundwater-based systems.

The closest connection point to the South Peel lake-based distribution system would be an existing watermain on Mayfield Road/Airport Road intersection, approximately 11 km away from the project study area. The interconnection would require the creation of a new Pressure Zone 8 for the South Peel system, due to the higher topography of the serviced areas in Palgrave/Caledon East. Based on the 2020 Water & Wastewater Master Plan for the Lake-Based System, there are currently seven (7) Lake-based water system pressure zones that service an elevation of up to 289.6 m. The Caledon East area has a serviceable elevation of higher that 295 m. In addition, extensions to the transmission/distribution network, new facilities and/or treatment upgrades will most likely be required to overcome any capacity constraints of the existing lake-based infrastructure to allow water conveyance to north areas outside the lake-based system boundaries. From a financial perspective alone, this option would result financially prohibited to the Region, especially when compared to other alternative solutions under consideration.

10.1.6.2 6B – Additional Supply from a New Municipal Production Well

This alternative would involve construction of a brand-new municipal production well within either an existing municipal site or a new site to provide for additional supply capacity to the Palgrave/Caledon East Drinking Water System.

To support the potential establishment of a new supply well, the Region concluded a Groundwater Exploration Program in 2019 by drilling test wells within and around the aquifer complex in the vicinity of the Village of Caledon East, also known as the Buried Bedrock Valley Aquifer Complex. As discussed in Section 1.2, a long list of ten (10) potential test drilling target sites was initially developed and screened based on environmental risks and presence of environmental features that could hydrogeologically influence the development of groundwater resources. Test holes were drilled at the top three (3) ranked sites; Sites A, D and J. Favorable aquifer conditions were encountered at Site D and a test well was advanced. An aquifer performance test at Test Well D (TWD) was undertaken in September 2019 to obtain factual aquifer performance information, assess potential interference with surface and groundwater resources and identify treatment requirements.

Based on the findings of the 2019 groundwater exploration and test drilling program, a new production well, Caledon East Well #6 (CE6), was constructed in March 2020 in the vicinity of TWD, within the Castlederg Road allowance.

A 3-day aquifer performance test was completed in July 2020 by Geo Kamp Limited, confirming a sustainable production capacity of 50 L/s (4,320 m^3/day) and no significant interference with existing domestic wells or surface water features. CE6 was classified as a true groundwater source (non-GUDI).

Long-term testing and water quality results obtained for the new CE6 have confirmed that from a water quantity and quality perspective, the new well CE6 can be considered a new supply source in the Palgrave/Caledon East Drinking Water System. It is anticipated that treatment for only disinfection will be required for the new municipal well CE6.

Considering the new municipal supply source, CE6, developed in the Caledon East area, two (2) different sub-options of the primary alternative solution 6B “Additional Supply from a New Production Well”, were identified to provide a potential connection of the new supply well, CE6, to the existing Palgrave/Caledon East Drinking Water System, which include:

- Provision for treatment at an existing well site
- Provision for treatment at a new well site

Each sub-alternative is further described in the following sections.

Alternative 6B, Option 1 – Additional Supply Capacity through a connection between new Well CE6 and existing Caledon East Water Treatment Plant #1 (WTP #1). Raw water to be treated at WTP #1.

This option represents a scenario where treatment for raw water from the new well CE6 will be provided at an existing municipal site within the Palgrave/Caledon East Drinking Water System, in the area nearby to the new well CE6. Depending on the existing treatment facility to be used, this alternative would potentially involve expansions/modifications and/or upgrades to the existing treatment building and treatment processes, as well as a connection from the new well CE6 to the existing facility with a raw water line.

Based on the geographical location of the new well CE6 and the existing municipal treatment facilities in the Caledon East area, as shown in **Figure 8**, there are two (2) possible options available for treatment:

- Treatment provided at the existing Caledon East Water Treatment Plant #1 (WTP1) located at 20 Robert Carson Drive. This plant is located approximately 4km away from the new CE6 well site and provides treatment to Caledon East Well #3 (CE3) prior to distribution; or,
- Treatment provided at the existing Caledon East Water Treatment Plant #2 (WTP2) located at 5612 The Grange Side Road. This plant is located approximately 6.5km away from the new CE6 well site and provides treatment to CE4 and CE4A prior to distribution.

The existing treatment process at the Caledon East WTP1, which consists of disinfection only, is fully compatible with the anticipated treatment requirements for the raw water from the new CE6. The Caledon East WTP1 currently has a treatment rated capacity of 30.3 L/s (2,618 m^3/day). While CE3 has a permitted water taking capacity of 29.6 L/s (2,557 m^3/day), the average water taking for CE3 in 2020 was approximately 6 L/s (522 m^3/day) [1]. This accounts for about 20% of the existing treatment capacity at WTP1, which indicates that there is available treatment capacity at the Caledon East WTP1 to treat additional flows in the short-term. In the long term, the capacity of WTP1, will need to be increased to treat the combined flows from CE6 and CE3. The Caledon East WTP1 was originally designed with provision for installation of additional equipment to accommodate higher flows, should it be required in the future, so

[1] 2020 Summary Report Drinking Water in Peel, Region of Peel

treatment upgrades can be accommodated at the existing facility to treat future higher combined flows from CE3 and CE6.

The existing treatment processes at the Caledon East WTP2 include disinfection and iron removal through a combination of oxidation and greensand filtration, to provide slightly higher treatment requirements for the source water from CE4 and CE4A. In a scenario where raw water from the new CE6 were to be conveyed to Caledon East WTP2 for treatment, operational modifications would be required at the plant to ensure efficiency of the treatment processes according to the source water requirements. The existing treatment/operational practices would need to be modified/retrofitted so that raw water from the new CE6 bypasses the existing iron removal process. Alternatively, raw water from all or a combination of production wells supplying Caledon East WTP2 could be blended prior to entering the treatment facility. This would require operational modifications to the existing treatment system to deal with the new blended water quality.

The Caledon East WTP2 currently has a treatment rated capacity of 64 L/s (5,530 m^3/day). While CE4 and CE4A have a permitted water taking capacity of 42 L/s (3,629 m^3/day) and 75 L/s (6,480 m3/day), respectively, there are pumping limitations for both wells, as they are drilled in the same aquifer. The average combined water taking for CE4 and CE4A in 2020 was approximately 20 L/s (1,700 m^3/day) [2], which accounts for about 31% of the existing treatment capacity at WTP2. This indicates that there is available treatment capacity at the Caledon East WTP2 for increased flows in the short term. However, treatment upgrades/modifications would be required in the future to accommodate treatment of combined flow from all three (3) wells (CE4, CE4A and CE6).

The Caledon East WTP2 is located within the Greenbelt and the Niagara Escarpment Plan Area, so any new development, including the raw water supply line connection from the new CE6 to the treatment facility may be subjected to a development permit process and demonstrate conformance with existing land use designations and development criteria of the Niagara Escarpment Plan.

Considering the proximity of existing municipal infrastructure to the new well CE6, compatibility with existing processes, current land use designations, and the associated capital expenditures resulting from these considerations, provision of treatment for the water source from the new CE6 at the existing Caledon East WTP1 offers benefits relative to provision of treatment at the Caledon East WTP2. For the purpose of establishing available alternative solutions in the Class EA study, it is assumed that

[2] 2020 Summary Report Drinking Water in Peel, Region of Peel

Alternative 6B, Option 1 will comprise – Additional Supply Capacity through a connection between new Well CE6 and existing Caledon East Water Treatment Plant #1 (WTP #1). Raw water to be treated at WTP #1.

Depending on the selected route for the raw water line connecting the new well to the Caledon East WTP1, crossing of the Caledon East Meltwater Channel Aquifer would be required. Some technical and dewatering concerns associated with excavation around the channel area would be important considerations for this option, in addition to potential constructability and environmental impacts related to the pipeline installation in the areas surrounding the new well CE6 and the existing Caledon East WTP1.

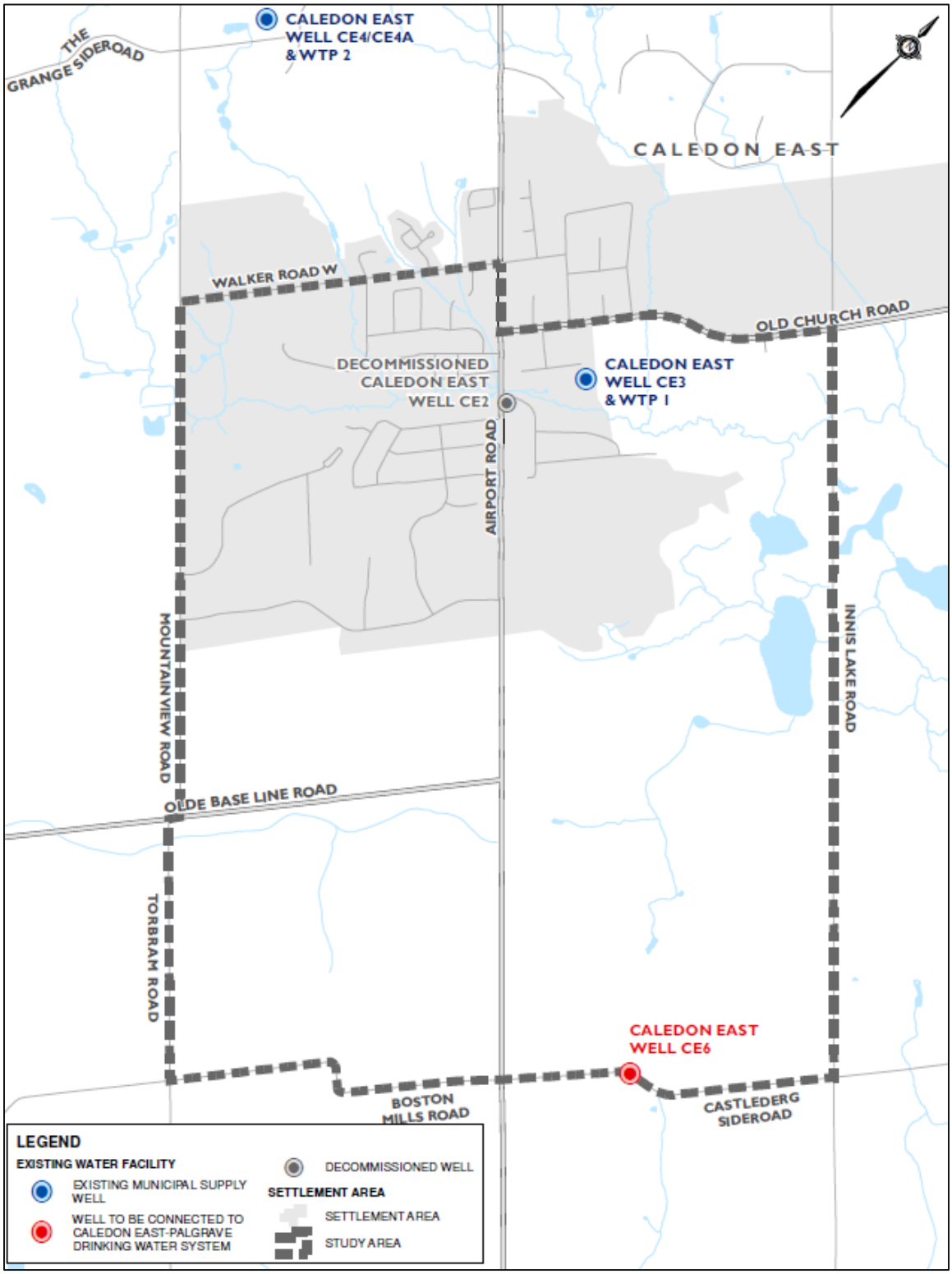

Figure 8: Existing Municipal Treatment Facilities in The Caledon East Area

Alternative 6B, Option 2 – Additional Supply Capacity through a connection between new Well CE6 and existing distribution system. Raw water to be treated at a new treatment plant, to be built in the vicinity of CE6.

This option represents a scenario where treatment for raw water from the new well CE6 will be provided at a new well site, in a location adjacent or in the vicinity of the new well CE6. This option would require construction of a new treatment facility at a new site to house the required treatment processes, as well as a connection to the existing Palgrave/Caledon East Drinking Water Distribution System on Airport Road, with a new feedermain. The new feedermain will extend approximately 1 km, from the location of the new CE6 water treatment facility to the connection point on Airport Road.

Since the new well CE6 is currently located within the Town of Caledon right-of-way, construction of additional infrastructure in proximity to CE6 will require property acquisition, whether the new facility is at the new CE6 site or in the vicinity. A direct connection to the distribution system on Airport Road would eliminate the need for crossing the Caledon East Meltwater Channel Aquifer, which runs east to west through the centre of the Caledon East Centreville Creek area, as well as anticipated dewatering challenges associated with excavation around the channel area.

Other key considerations for this option include:

- Proximity to Road – The new well CE6 has been developed in close proximity to Castlederg Sideroad which would allow for easy access and a feedermain connection.
- Size – the size of land needed is dependent on the footprint and configuration of the new water treatment facility. The results of water quality sampling undertaken during the development of CE6 in 2020 indicate that only disinfection would be required for treatment for this source. As such, equipment and treatment processes at this facility are expected to be simple and compact in terms of footprint requirements. The new water treatment facility could be constructed by either traditional construction methods or by installation of a prefabricated facility. The latter would be a consideration should there be limitations in terms of the available land size. Based on typical facilities, a site of approximately 0.2 hectares would be required to allow construction by traditional methods. Consultation with the Town of Caledon was considered necessary to gauge the feasibility of acquiring land immediately adjacent to CE6. There are other vacant lands, privately owned, to the east of the CE6 site and north of Castlederg Side Road. These vacant land options were also considered as alternative sites for the new treatment facility in this Class EA study. The Region's

internal capital acquisition real estate group assisted this project with property acquisition matters.

- Land use – municipal infrastructure, including water treatment facilities, must be compatible with existing and future land uses in the area and comply with applicable regulatory requirements. As per the Town of Caledon Official Plan, the land area where new well CE6 is located is outside of the Oak Ridges Moraine Conservation Plan (ORMCP) or the Green Belt Planning Areas. Current zoning designation for the CE6 well site is agricultural/rural area.

10.2 Preliminary Screening of Alternative Solutions

A preliminary screening of the water supply alternative solutions described in Section 10.1 was carried out in accordance with the screening methodology described in Section 9.1.1. Available alternative solutions that did not meet any of the “must-meet criteria” in the preliminary screening, were not considered a feasible solution for the Class EA study and thus, were recommended to be eliminated from further consideration in the study.

Alternative solutions that meet all “must-meet criteria” were short-listed and recommended to move forward for a more detailed examination in the Class EA study. The results of the preliminary screening are described in **Table 15**.

Table 15: Preliminary Screening Results

Alternative Solutions	Preliminary Screening Criteria Key Observations	Recommended to Carry Forward
1. Do Nothing	• **Supply Capacity**: Option does not address the limitations identified with the redundancy of supply in the Palgrave – Caledon East Drinking Water System. • **Compliance:** Option is in agreement with the requirements, policies and permitted land uses of the applicable local plans and policies since it is the status quo, and no new infrastructure is proposed. • **Technical Feasibility**: Option maximizes the use of existing assets and is compatible with existing processes since no new infrastructure is proposed. • **Financial Feasibility**: Option is financially feasible since no new infrastructure is proposed.	No. Eliminated from further consideration
2. Limit Community Growth	• **Supply Capacity**: Option does not address the limitations identified with the redundancy of supply in the Palgrave – Caledon East Drinking Water System. • **Compliance:** Inconsistent with the planning principles that guide the Region's and Town's Official Plans. • **Technical Feasibility**: Option maximizes the use of existing assets and is compatible with existing processes since no new infrastructure is proposed. • **Financial Feasibility**: Option is financially feasible since no new infrastructure is proposed.	No. Eliminated from further consideration
3. Reduce Water Demands	• **Supply Capacity**: Option does not address the limitations identified with the redundancy of supply in the Palgrave – Caledon East Drinking Water System. • **Compliance:** Inconsistent with the log-term sustainability vision of the Region's and Town's Official Plans. • **Technical Feasibility**: Option maximizes the use of existing assets and is compatible with existing processes since no new infrastructure is proposed. • **Financial Feasibility**: Option is considered financially feasible since no new infrastructure is proposed.	No. Eliminated from further consideration

Alternative Solutions	Preliminary Screening Criteria Key Observations	Recommended to Carry Forward
4. Improve Operation and Maintenance of Existing Supply Wells	• **Supply Capacity**: Option helps to address the limitations identified with the redundancy of supply in the Palgrave – Caledon East Drinking Water System through continuous implementation of the Region's Production Well Management Program. However, the option cannot fully address the long-term limitations identified with the redundancy of supply on its own. • **Compliance:** Option is in agreement with the requirements, policies and permitted land uses of the applicable local plans and policies since no new infrastructure is proposed. • **Technical Feasibility**: Option maximizes the use of existing assets and is compatible with existing processes. • **Financial Feasibility**: Option is financially feasible as the Region's Production Well Management Program helps to maintain the performance and condition of the existing assets through proper monitoring, maintenance and service, and thus avoiding major capital expenditures associated with construction of new wells.	Not recommended as a stand-alone solution. Recommended to carry forward in combination with preferred solution.
5. Obtain Additional Supply Capacity from Existing Source	• **Supply Capacity**: Option helps to address the limitations identified with the redundancy of supply in the Palgrave – Caledon East Drinking Water System through continuous implementation of the Region's Production Well Management Program. However, the option cannot fully address the long-term limitations identified with the redundancy of supply on its own. • **Compliance:** Option is in agreement with the requirements, policies and permitted land uses of the applicable local plans and policies since it is the status quo, and no new infrastructure is proposed. • **Technical Feasibility**: Option maximizes the use of existing assets and is compatible with existing processes. • **Financial Feasibility**: Option is financially feasible as it focused on preservation and optimization of existing assets.	Not recommended as a stand-alone solution. Recommended to carry forward in combination with preferred solution.

Alternative Solutions	Preliminary Screening Criteria Key Observations	Recommended to Carry Forward
6A. Obtain Additional Supply Capacity from Another Source: Region South Peel Lake-based System	• **Supply Capacity**: Option addresses the limitations identified with the redundancy of supply in the Palgrave – Caledon East Drinking Water System. • **Compliance:** Option would require a long transmission line connecting the South Lake-based system to the Palgrave/Caledon East service area. This is not consistent with the nodal approach established in the Town's Official Plan which aims to minimize interference with agricultural activity and concentrate new demands for services in locations where the demands can be most readily met. • **Technical Feasibility**: Option would require construction of major new infrastructure and potentially major upgrades/modifications to the existing water treatment, pumping, storage facilities and distribution network. • **Financial Feasibility**: Option is financially prohibitive in comparison to other available options due to potential capital costs.	No. Eliminated from further consideration
6B – Option 1. Obtain Additional Supply Capacity from Another Source: New Supply Well and Provide Treatment at a New Well Site	• **Supply Capacity**: Option addresses the limitations identified with the redundancy of supply in the Palgrave – Caledon East Drinking Water System. • **Compliance:** Option is consistent with the general requirements, policies and permitted land uses of the applicable local plans and policies. • **Technical Feasibility**: Option would require construction of a new treatment facility and a new feedermain connection to the existing distribution system. Construction of a new treatment facility at or nearby well CE6, significantly reduces the section of pipeline required for connection to the existing system and eliminates dewatering concerns and constructability challenges associated with the crossing of the Caledon East Meltwater Channel Aquifer. • **Financial Feasibility**: Capital costs associated with construction of a new treatment building and property acquisition are expected to be offset by eliminating the need to use capital intensive mitigation measures to avoid constructability issues, environmental impacts and dewatering concerns related to the raw water line installation.	Yes. Recommended for further consideration.

Alternative Solutions	Preliminary Screening Criteria Key Observations	Recommended to Carry Forward
6B – Option 2. Obtain Additional Supply Capacity from Another Source: New Supply Well and Provide Treatment at an Existing Municipal Site	• **Supply Capacity**: Option addresses the limitations identified with the redundancy of supply in the Palgrave – Caledon East Drinking Water System. • **Compliance:** Option is consistent with the general requirements, policies and permitted land uses of the applicable local plans and policies. • **Technical Feasibility**: Although there are dewatering concerns and constructability challenges associated with the crossing of the Caledon East Meltwater Channel Aquifer with the connecting raw water line, this option provides benefits with using existing assets, maximizing spare capacity and compatibility with existing processes at the Caledon East WTP1. • **Financial Feasibility:** Option may require the use of trenchless technology for installation of the raw water line and implementation of other mitigation measures to reduce potential technical and environmental impacts, which can be capital intensive. However, this option is economically mindful in terms of operating costs as an existing treatment facility (Caledon East WTP1) would continue to operate as a common facility for two (2) separate groundwater sources	Yes. Recommended for further consideration.

10.2.1 Preliminary Screening Results – Preferred Alternative Solutions

Generally, at the end of the preliminary screening stage, a preferred alternative solution is identified; so that all attention is focused on a single alternative solution. Based on results of preliminary screening, summarized in **Table 15**, a few alternative solutions were found to meet the preliminary screening criteria and thus considered feasible solutions for this Class EA study. They are:

- Alternative 6B – Option 1. Additional Supply Capacity through a connection between new Well CE6 and existing Caledon East Water Treatment Plant #1 (WTP #1). Raw water to be treated at WTP #1. This option involves construction of a raw water supply line connecting the new CE6 well, to the existing Caledon East WTP1, to convey raw water for treatment, prior to distribution. Potential implementation options to provide for the connection of the new well CE6 to the existing Caledon East WTP1 will be developed and explored in the next steps of the Class EA study.
- Alternative 6B – Option 2. Additional Supply Capacity through a connection between new Well CE6 and existing distribution system. Raw water to be treated at a new treatment plant, to be built in the vicinity of CE6. A new treatment facility would be built at or in the vicinity of the CE6 well. A 1 km long feedermain pipe, connecting the new treatment facility to the existing distribution system on Airport Road is also required.

Both alternative solutions meet the project's primary objectives with respect to additional supply capacity, compliance with the general requirements, policies and permitted land uses of the applicable local plans and policies; and are technically and financially feasible regarding existing and new infrastructure and operational requirements.

In addition, the following alternatives were recommended for further analysis and implementation, in combination with the preferred alternative design concept, to be identified in the next phases of the Class EA study:

- Alternative 4 – Improve Operation and Maintenance of Existing Supply Wells. The Region will continue implementing the well monitoring, testing, inspection and servicing activities in accordance with the Region's Production Well Management Program and the recommendations of the Well Asset Management Program to maximize the working life of the well equipment, reduce the frequency of equipment breakdown and achieve a cost-efficient operation of the well equipment.
- Alternative 5 – Obtain Additional Supply Capacity from an Existing Source. As noted earlier, the Region has been exploring options to increase the water taking capacity of the existing municipal supply well, Palgrave Well #4 (PAL4), which is one of the

six (6) municipal groundwater sources currently supplying the Palgrave/Caledon East Drinking Water System. A water taking capacity increase of the existing well PAL4 has been recently evaluated in detailed in a separate Municipal Schedule C Class EA study. The Supply Capacity Increase for Palgrave Well #4 Class EA study, recently completed in January 2024, has confirmed the water taking increase of PAL4 and the necessary infrastructure upgrades of the respective water treatment facility in Palgrave. The Region will proceed to implementation of the necessary infrastructure upgrades in the Palgrave Well#4 water system, as recommended in the Palgrave Well #4 Class EA study. The Palgrave Well #4 upgrades will be completed as a separate project from the recommendations of this Class EA study.

11 Development of Feasible Alternative Solutions

The feasible alternative solutions recommended for further exploration in the Class EA study, as identified in the Preliminary Screening, were further developed into sub-options. This section describes infrastructure requirements, and key considerations in terms of main advantages and disadvantages for each alternative and the respective sub-options.

11.1 Alternative 6B – Option 1. Additional Supply Capacity through a connection between new Well CE6 and existing Caledon East Water Treatment Plant #1 (WTP #1). Raw water to be treated at WTP #1.

This option involves a connection from the new well CE6 to the existing Caledon East Water Treatment Plant #1 (WTP1), located at 20 Robert Carson Drive, and approximately 4km away from the new CE6 well site. Treatment for disinfection will be provided at the Caledon East WTP1 prior to distribution.

Major infrastructure requirements for this option include:

- A 300 mm diameter raw water supply pipeline connecting the new CE6 well to the Caledon East WTP1.
- Treatment capacity upgrades/expansion at the Caledon East WTP1 to accommodate future additional flows from CE6.

In order to pre-select alternative raw water supply line routes in an unbiased manner, consideration was given to the following key guidelines:

- Mandatory pipeline connection points must be maintained at CE6 well site and Caledon East WTP1.
- Routes on public lands (road allowances, utility easements, parks) are preferred to those on private lands to reduce/eliminate the need for property acquisition.
- Routes should consider simplicity in design, with minimized: length, changes in topography, depth of cover, lengths of tunnels, creek crossings, etc.
- Sufficient room should be provided to allow for construction using conventional methods.
- Routes should consider or take advantage of other construction work occurring in the same area.

Based on the location of the two (2) required connecting points, new CE6 well and Caledon East WTP1, seven (7) alternative routes for the raw water line have been established:

- Route 1 A – Castlederg Road, Airport Road and Caledon Trailway Path
- Route 1 B – Castlederg Road, Airport Road and Old Church Road
- Route 1 C – Castlederg Road, Airport, Mouncrest and Old Church Road
- Route 2 A – Castlederg Road, Innis Lake Road and Caledon Trailway Path
- Route 2 B – Castlederg Road, Innis Lake Road and Old Church Road
- Route 3 A – Castlederg Road, Mountainview Road and Caledon Trailway Path
- Route 3 B – Castlederg Road, Boston Mills Road, Torbram Road, Mountainview Road, Walker Road, Airport Road and Old Church Road.

The alternative routes are conceptually shown in **Figure 9.** A brief description of the pipeline routes and key considerations is provided in **Table 16**.

Key considerations common to all routing options (Routes 1A, 1B, 1C, 2A, 2B, 3A and 3B) include:

- A permanent easement from the Town of Caledon will be required to provide continuous Regional access to new Well C6 site.
- All routes will require crossing of the Caledon East Meltwater Aquifer, resulting in significant dewatering requirements and groundwater control during construction. Extensive field investigations would need to be completed to support detailed design and construction and securing permits from approval agencies.
- There are environmentally sensitive areas in the vicinity of the raw water pipeline routes, some more sensitive and significant than others. Potential impacts to existing features may result in need for site specific investigations and permits from review agencies/conservation authorities.
- Significant capital costs associated with extensive technical and field investigations needed to support crossing of the Caledon East Meltwater Aquifer pre-, during and post-construction, as well as increased technical complexity in the crossing of the aquifer.
- Installation of a pipeline in areas not currently municipally serviced may prompt local area residents to request a service connection to the municipal system, resulting in potential project delays and added construction costs due to a new distribution pipe alongside the raw water pipeline.

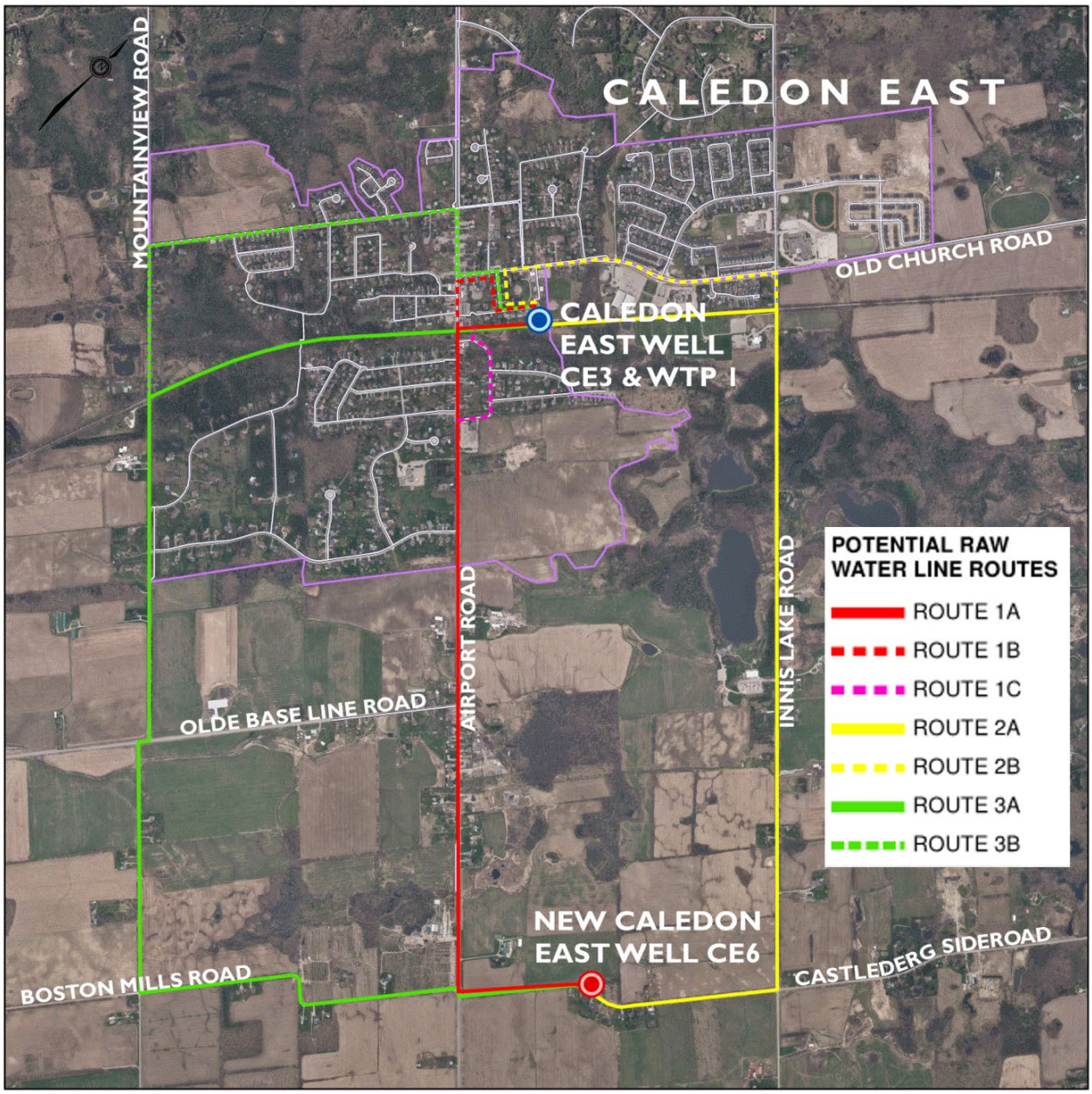

Figure 9: 6B Option 1 – Connect CE6 to existing Caledon East WTP#1 - Alternative Raw Water Supply Line Routes

Table 16: Alternative Raw Water Supply Line Routes, Description and Key Considerations

Route	Description	Key Considerations

1A	Starts at CE6 site, proceeds westward along Castlederg Sideroad and then north on Airport Road up to the Caledon Trailway Path. The route then proceeds eastward on the Caledon Trailway Path and connects to the back of the existing Caledon East WTP1.	• Raw water pipeline length approximately 3.7km.
		• Airport Road is generally characterized by a hilly profile. High water table expected at low points, with substantial trench dewatering for open cut installation.
		• Existing underground infrastructure along the route:
		  • A 450mm – 600 mm sanitary sewer along the east side of Airport Road and beyond the gravel shoulder, from Mountcrest Road
		  • A 300mm watermain on the west side of Airport Road in the roadside ditch, starting just south of Mono Road in a northbound direction
		  • Other underground services including storm sewers, forcemain, sanitary sewers and utilities approaching the area of the creek on Airport Road and the rail trail
		• One (1) creek crossing with trenchless methods consistent with existing installations. Potential challenges at creek crossing due to an existing box culvert at the crossing with services (300mm watermain and 375mm sanitary sewer) tunneled under the culvert.
		• Due to the presence and location of existing major services, pipeline installation may impact several mature trees along the route.
		• Potential constructability concerns around the core of the Caledon East Village given the available limited space in the roadway and at the creek crossing.
		• Potential disturbance to a well-established trail, including partial closure of the trail and some tree removal.
		• Gas station, old railway stops and automotive dealership along route.
		• Potentially high impact to traffic during pipeline installation around the Village core areas
		• Crossing of wellhead protection areas, highly vulnerable recharge areas and groundwater recharge areas
		• TRCA and CVC regulated areas

Route	Description	Key Considerations

1B	Starts at CE6 site, proceeds westward along Castlederg Sideroad and then north on Airport Road up to the Old Church Road. The route then proceeds eastward on Old Church Road, south on John Street South and eastward on Robert Carson Drive up to the front of the Caledon East WTP1.	• Pipeline length approximately 4.1km.
		• Airport Road is generally characterized by a hilly profile. High water table expected at low points, with substantial trench dewatering for open cut installation.
		• Existing underground infrastructure along the route:
		  • A 450mm – 600 mm sanitary sewer along the east side of Airport Road and beyond the gravel shoulder, from Mountcrest Road
		  • A 300mm watermain on the west side of Airport Road in the roadside ditch, starting just south of Mono Road in a northbound direction
		  • Other underground services including storm sewers, forcemain, sanitary sewers and utilities approaching the area of the creek on Airport Road and the rail trail
		• One (1) creek crossing with trenchless methods consistent with existing installations. Potential challenges at creek crossing due to an existing box culvert at the crossing with services (300mm watermain and 375mm sanitary sewer) tunneled under the culvert.
		• Due to the presence and location of existing major services, pipeline installation may impact several mature trees along the route.
		• Potential constructability concerns around the core of the Caledon East Village given the available limited space in the roadway and at the creek crossing.
		• Temporary construction impacts to the residential neighborhood in the vicinity of the Caledon East WTP1
		• Gas station, old railway stops and automotive dealership along route.
		• Potentially high impact to traffic during pipeline installation around the Village core areas
		• Crossing of wellhead protection areas, highly vulnerable recharge areas and groundwater recharge areas
		• TRCA and CVC regulated areas

1C	Starts at CE6 site, proceeds westward	• Raw water pipeline length approximately 3.8km.

Route	Description	Key Considerations

	along Castlederg Sideroad and then north on Airport Road up to Mountcrest Road. The route follows Mountcrest Road and connects with Caledon Trailway Path at an angle in a north-east direction. The route then proceeds eastward on the Caledon Trailway Path and connects to the back of the existing Caledon East WTP1.	• Airport Road is generally characterized by a hilly profile. High water table expected at low points, with substantial trench dewatering for open cut installation.
		• Existing underground infrastructure along the route:
		  • A 450mm – 600 mm sanitary sewer along the east side of Airport Road and beyond the gravel shoulder, from Mountcrest Road
		  • A 300mm watermain on the west side of Airport Road in the roadside ditch, starting just south of Mono Road in a northbound direction
		  • Other underground services including storm sewers, forcemain, sanitary sewers and utilities approaching the area of the creek on Airport Road and the rail trail
		• One (1) creek crossing with trenchless methods consistent with existing installations.
		• Due to the presence and location of existing major services, pipeline installation may impact several mature trees along the route.
		• Potential constructability concerns around the core of the Caledon East Village given the available limited space in the roadway and at the creek crossing.
		• Potential disturbance to a well-established trail, including partial closure of the trail and some tree removal.
		• Gas station, old railway stops and automotive dealership along route.
		• Potentially high impact to traffic during pipeline installation around the Village core areas
		• Crossing of wellhead protection areas, highly vulnerable recharge areas and groundwater recharge areas
		• TRCA and CVC regulated areas

2A	Starts at CE6 site, proceeds eastward along Castlederg Sideroad up to Innis Lake Road. The route then proceeds north on	• Raw water pipeline length approximately 3.8km. • No existing underground services on Innis Lake Road (based on information available to date). • Negligible interference with underground services along the trailway path between Innis Lake Road to the end point, as there are no underground services present (based on information available to date).

Route	Description	Key Considerations
	Innis Lake Road and turns west on the Caledon Trailway Path and connects to the back of the existing Caledon East WTP1.	• The southern segment of Innis Lake Road features gravel shoulders and ditches on both sides, facilitating raw pipeline installation by open cut methods and minor impact to traffic. • The northern segment of Innis Lake Road presents significant and denser vegetation on both sides, suggesting potential for vegetation and tree removal to enable pipeline installation. • Innis Lake Road has segments of hilly profile. High water table expected at low points (in the area of Innis Lake) with substantial trench dewatering anticipated for open cut installation. • Environmentally sensitive areas and significant wetlands along a segment of the route, representing potential significant environmental impacts, trenchless pipe installation methods. • Crossing of significant groundwater recharge areas along the Castlederg Sideroad, the trailway path and most of the route along Innis Lake Road. • Crossing of wellhead protection areas and highly vulnerable recharge areas. • TRCA regulated areas. • Two (2) creek crossings along Innis Lake Road and the trailway path.
2B	Starts at CE6 site, proceeds westerly along Castlederg Sideroad up to Innis Lake Road. The route then proceeds north on Innis Lake Road, westward on Old Church Road, south on John Street South and	• Raw water pipeline approximately 5.5km. • No existing underground services on Innis Lake Road (based on information available to date). • The southern segment of Innis Lake Road features gravel shoulders and ditches on both sides, facilitating raw pipeline installation by open cut methods and minor impact to traffic. • The northern segment of Innis Lake Road presents significant and denser vegetation on both sides, suggesting potential for vegetation and tree removal to enable pipeline installation. • Innis Lake Road has segments of hilly profile. High water table expected at low points (in the area of Innis Lake) with substantial trench dewatering anticipated for open cut installation.

Route	Description	Key Considerations
	eastward on Robert Carson Drive up to the front of the Caledon East WTP1.	• Environmentally sensitive areas and significant wetlands along a segment of the route, representing potential significant environmental impacts, trenchless pipe installation methods. • Crossing of significant groundwater recharge areas along the Castlederg Sideroad and most of the route along Innis Lake Road • Crossing of wellhead protection areas and highly vulnerable recharge areas • TRCA regulated areas • Two (2) creek crossings along Innis Lake Road and Old Church Road.
3A	Starts at CE6 site, proceeds westward along Castlederg Sideroad and Boston Mills Road up to Torbram Road. The route then proceeds north on Torbram road/Mountainview Road and then eastward on Caledon Trailway Path and connects to the back of the existing Caledon East WTP1.	• Raw water pipeline approximately 6.3km. • No existing underground services on Mountainview Road (based on information available to date). • Negligible interference with underground services along the trailway path between Mountainview to Airport Road. • Gravel shoulders and ditches on either side of Torbram Road and the southern portion of Mountainview Road would allow pipeline installation by open cut with minor impact to traffic. • Potential disturbance to a well-established trail, including partial closure of the trail and some tree removal. • The trailway path is surrounded by dense vegetation and does not appear to be easily accessible by vehicles. Pipe installation and accessibility for installation may result in additional environmental impact. Additional access for pipeline maintenance or conversion of temporary access to permanent may be required which could result in further vegetation removal and environmental impact. • Adjacent areas mostly agricultural. • Multiple creek crossings along Torbram Road and the Trailway Path • Crossing of wellhead protection areas, highly vulnerable recharge areas and groundwater recharge areas. • TRCA and CVC regulated areas.

Route	Description	Key Considerations
		• Five (5) creek crossings along Mountainview Road and the trailway path.
3B	Starts at CE6 site, proceeds westward along Castlederg Sideroad and Boston Mills Road, north on Torbram Road/Mountainview Road, east on Walker Road West and south on Airport Road up to Old Church Road. The route then proceeds eastward on Old Church Road, south on John Street South and eastward on Robert Carson Drive up to the front of the Caledon East WTP1.	• Raw water pipeline approximately 7.4km. • No existing underground services on Mountainview Road (based on information available to date). • Gravel shoulders and ditches on either side of Torbram Road and the southern portion of Mountainview Road would allow pipeline installation by open cut with minor impact to traffic. • Vegetation and tree removals may be required to enable the pipeline installation by open cut on Mountainview Road, past the trailway path. • Significant dewatering requirements may be required particularly in the area north of the trailway path up to Walker Road West due to crossing of the Meltwater Channel Aquifer. • Multiple creek crossings along the entire route • Temporary construction impacts to the residential neighborhood in the vicinity of the Caledon East WTP1 • Crossing of wellhead protection areas, highly vulnerable recharge areas and groundwater recharge areas • TRCA and CVC regulated areas • Five (5) creek crossings along Mountainview Road and Walker Road West.

11.2 Alternative 6B – Option 2. Additional Supply Capacity through a connection between new Well CE6 and existing distribution system. Raw water to be treated at a new treatment plant, to be built in the vicinity of CE6

Implementation of this option will require construction of a new treatment facility at or in the vicinity of the CE6 well to accommodate the required pumping and treatment equipment. The new treatment facility will have sufficient capacity to treat the maximum permitted water taking for the CE6 well of 50 L/s. Treated water will then be conveyed from the new on-site water treatment facility directly into the existing distribution system via a new feedermain. The connection into the existing distribution system will be provided at the end of the existing watermain on Airport Road, approximately 600 m north of Castlederg Sideroad. A simplified schematic for this option is shown in **Figure 10.**

Major infrastructure requirements for this option include:

- A new treatment facility with provision for disinfection. Treatment capacity to match the maximum permitted water taking for the new CE6 well of 50 L/s. Land acquisition will be required to accommodate the new treatment facility. Potential focus areas for the new water treatment plant were preliminarily delineated as shown in **Figure 11**.
- A 300mm diameter feedermain line to connect to the existing distribution system on Airport Road. Based on the focus area delineated for the new treatment facility and the configuration of existing distribution system, a feedermain of approximately 1 km long would be required along Castlederg Sideroad (560 m) and Airport Road (440 m).

Key considerations for this option include:

- The new CE6 well is located on the Town of Caledon road allowance, on a vacant piece of land. The existing CE6 well site is also in the immediate vicinity of vacant lands, which are privately owned. Ideally, the new treatment facility will be either at the well site or near it.
- Willingness to sell from a property owner will need to be explored to allow construction of the new water treatment facility. Properties in the immediate vicinity of the new well CE6 site are preferable; however, other neighbouring focus areas may also need to be explored, as necessary. The Region engaged their internal

capital acquisition real estate group to investigate opportunities for property acquisition.

- As per the Town of Caledon Official Plan, the land area where new well CE6 is located is outside of the Oak Ridges Moraine Conservation Plan (ORMCP) or the Green Belt Planning Areas. Current zoning designation for the CE6 well site and adjacent lot to the west of the well site is agricultural/rural area.
- Focus area for the new water treatment plant is outside of the Greenbelt area boundary.
- Potential areas for the new water treatment plant and feedermain route fall within highly vulnerable aquifer and groundwater recharge areas.
- The feedermain avoids crossing of the Caledon East Meltwater Channel and eliminates the anticipated hydrogeological challenges from major dewatering and groundwater control during construction.
- The relative short length of the feedermain (1.0 km) eliminates crossing of watercourses and key natural heritage features.
- Feedermain installation is anticipated to be completed by open cut methods, within the existing road rights-of-way, possibly reducing construction duration and complexity.
- There is a sewer on Airport Road along the route of the new feedermain. Installation of the feedermain under the sidewalk or via trenchless methodologies may be required in this location. A detailed Subsurface Utility Engineering (SUE) Investigation study will be conducted before any final construction methodology is recommended.
- TRCA and CVC regulated areas. TRCA regulated floodplain areas in the vicinity of the CE6 well site and adjacent lands as shown in **Figure 12**. TRCA was engaged early in the project to review the limits of the regulated floodplain areas and the implications on the project. A summary of the discussions with TRCA can be found in Section 3.5 of the ESR.
- Short- and long-term construction impacts are limited to a few residential houses in the immediate vicinity of the new water treatment plant.
- Opportunity to add redundancy and flexibility to the Palgrave/Caledon East Drinking Water System by the addition of a completely independent new groundwater source

and treatment system. Reliance of a single water treatment plant for two (2) separate groundwater sources is eliminated.

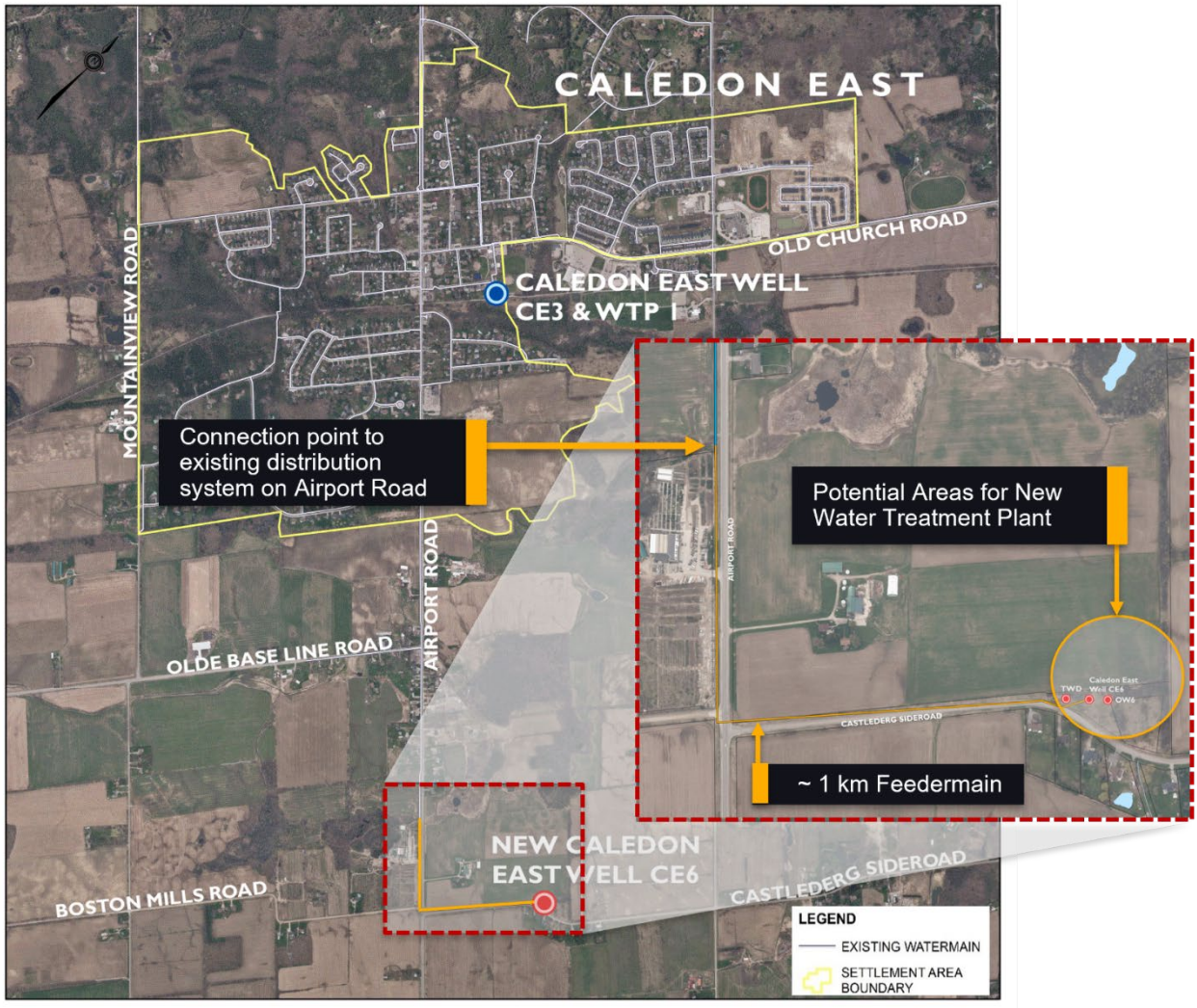

Figure 10: Schematic Alternative 6B – Option 2. New Supply Well, Caledon East 6 (CE6) and Provide Treatment at a New Well Site

Figure 11: Potential Location for New Water Treatment Plant

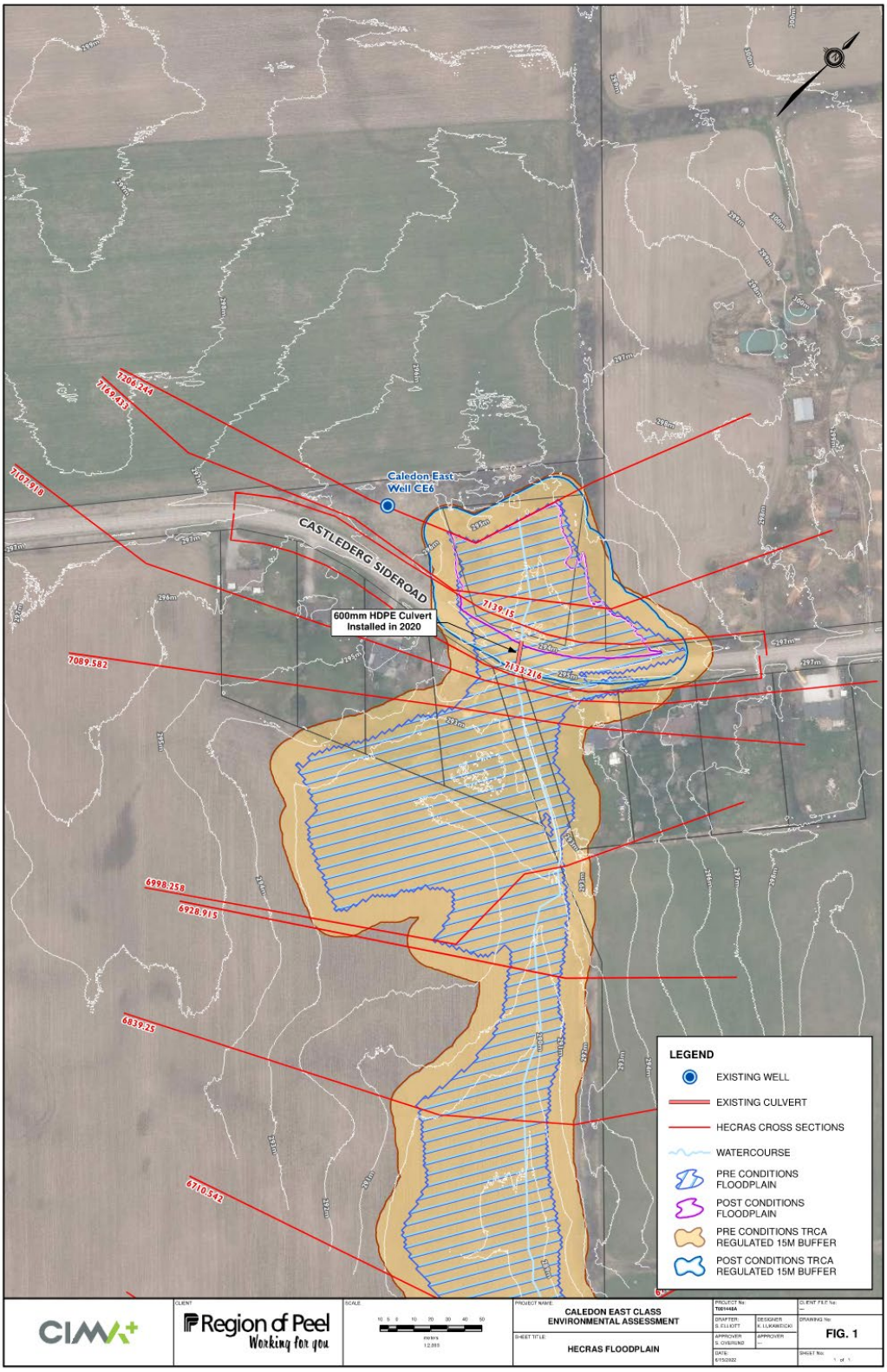

Figure 12: TRCA Regulated Flood Plain Areas (Re-delineated by CIMA+)

12 Comparative Evaluation of Feasible Alternatives

A comparative evaluation of options and sub-options conceptualized for the short-listed (feasible) alternative solutions was conducted. Desktop studies/investigations were completed, and the preliminary findings were used to support the comparative assessment. Each option was assessed against four (4) equally weighted criteria categories: natural environmental, technical, socio-cultural, and economic, as detailed in Section 9.1.2.

This section is structured into two parts: Section 12.1 provides a summary of desktop studies, characterizing existing conditions and identifying potential constraints for the preliminary assessment of feasible alternative solutions. Stand-alone reports, detailing the scope, methodology, and findings of each study, are included in the appendices for reference and briefly summarized in Section 12.1.

In Section 12.2, the results of the comparative evaluation are presented, culminating in the identification of the preferred alternative solution. Consultation with the public and review agencies, in the form of a first Public Information Centre (PIC 1), was carried out to confirm the preferred recommended alternative solution, which concludes Phase 2 of the Class EA study process.

12.1 Summary of Desktop Studies

12.1.1 Baseline Natural Features Assessment

In July 2021, Golder Associates Ltd. (now WSP) completed an assessment of the existing natural features and their associated habitats within the study area to identify potential natural environmental constraints. Sensitive natural features considered in the assessment included provincially designated natural features, Species at Risk (SAR), wildlife and significant wildlife habitat, fish habitat and TRCA/CVC regulated areas, as identified in relevant acts and policy documents. The location and extent of the natural features identified in the study area is shown in **Figure 13.** Major natural heritage features include:

- Core fishery resource areas, associated fish habitats and valleylands, including:
  - Centreville Creek and its tributaries (TRCA) and Innis Lake (TRCA) covering a large part of the northern portion of the study area. Potentially affecting all raw water pipeline routes (routes 1A, 1B, 1C, 2A, 3A and 3B) on the north.
  - Little Credit River (CVC) in the southern portion of the study area. Potentially affecting raw water pipeline routes 3A and 3B, south of Old Baseline Road, and,

  - West Humber River (TRCA) overlapping the eastern portion of the study area at Castlederg Side Road, east of Airport Road. This feature is designated as a warmwater feature. Potentially affecting construction of new water treatment plant for Option 2, as well as raw water pipeline routes 2A and 2B east on Castlederg Road.

- Significant woodlands such as the Caledon East Swamp in the northwest corner (affecting routes 3A and 3B), woodlands associated with the Widgett-Innis Lakes Wetland Complex in the easter portion of the study area (affecting routes 2A and 2B), woodlands associated with the Mono Road Wetland Complex in the southern and southeastern portion of the study area (affecting routes 1A, 1B, 1C, 2A and 2B) and woodlands in the western portion of the study area.
- Endangered or threatened species under the Species at Risk Act (SARA), with moderate or high potential to occur in the study area. With exceptions for essential infrastructure, new development within habitat of threatened or endangered species is generally prohibited. Field surveys were required to be completed to verify occurrence and potential impacts to Species at Risk (SAR) from proposed infrastructure.
- Two (2) Environmentally Significant Areas (ESAs) in the northern portion of the study area: Centreville Creek and the Caledon East Swamps (potentially affecting routes 1A, 1B, 2A, 3A and 3B).

Any development proposed within regulated areas may require a permit from the TRCA or CVC. In addition, new development within core fishery resource areas, habitat of threatened or endangered species, or key natural heritage features is generally prohibited, except for essential infrastructure. Proposed development within 30m of a core fishery resource area, or within 120 m of a significant woodland, valleyland or a significant wildlife habitat, would require an impact assessment to demonstrate no adverse effects to the features or the ecological functions. If fish or fish habitat will be impacted, permitting under the Fisheries Act may be required. Specific details of the baseline natural features assessment can be found in the stand-alone report included in **Appendix G.**

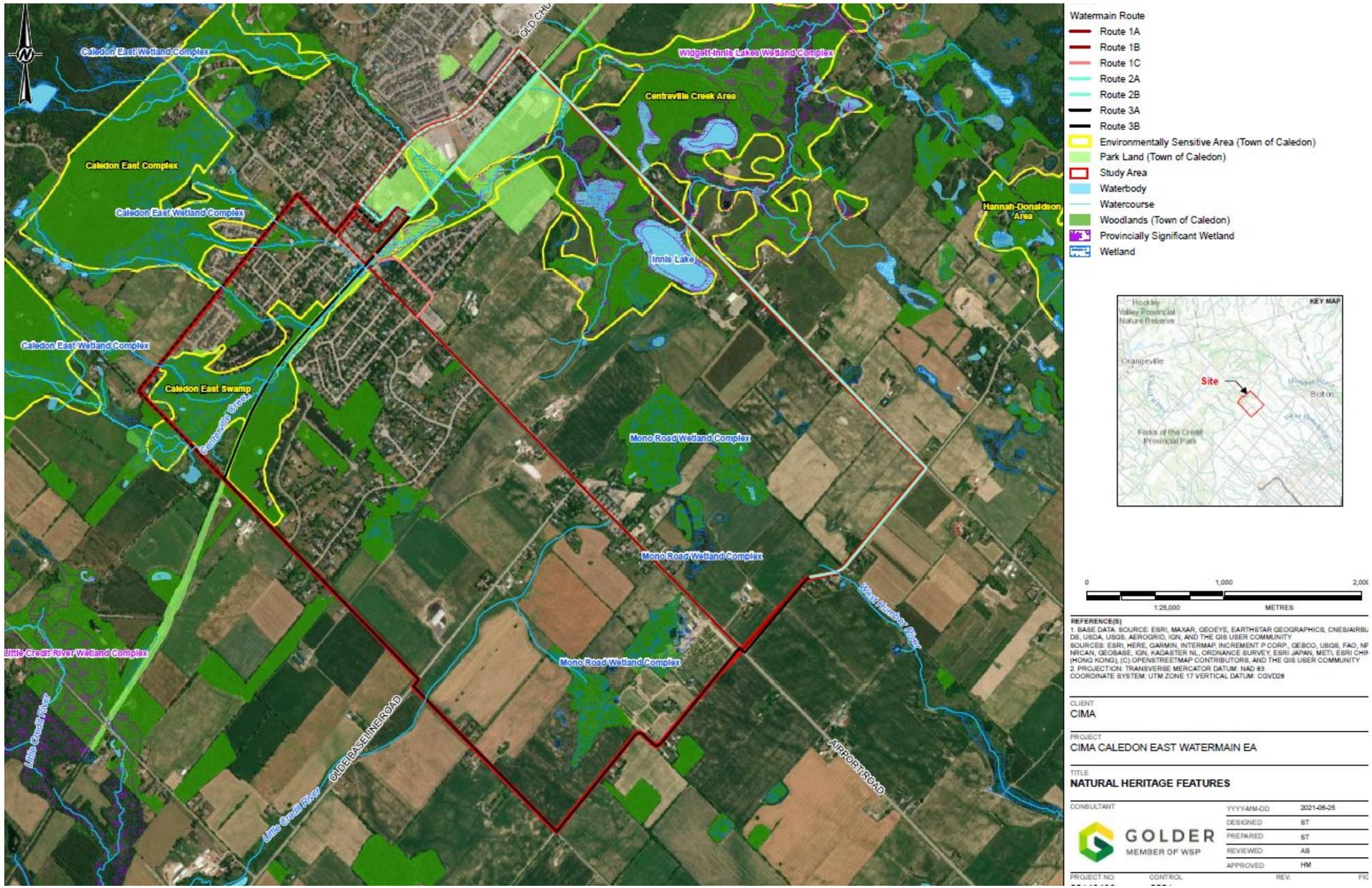

Figure 13: Baseline Natural Heritage Features

12.1.2 Background Hydrogeologic Assessment

In July 2021, Geo Kamp Ltd completed a background hydrogeological assessment of the project study area. The scope included an examination of the area covering the roadway corridors under consideration, plus approximately 50m from the outside sides of the road allowance. The assessment identifies important environmental features in the study area that could hydrogeologically influence groundwater resources. The following sections summarize the key findings of the Background Hydrogeologic Assessment. The complete report is included in **Appendix H.**

- There are three (3) sand gravel overburden aquifers in the vicinity of Caledon East. An estimation of the aquifers' location is shown on **Figure 14.**
    - Granite Stones Aquifer Complex: generally located to the northwestern limits of the study area. It is presumed to be relatively localized where it pinches out and east and west of Airport Road and Mountainview Road. Municipal wells CE4 and CE4A are completed within this aquifer complex. The aquifer, known to have strong flowing conditions, terminates approximately 400m south of CE4/CE4A and does not underlie the Village of Caledon East. This aquifer is not within the limits of the options being considered in the study.
    - Buried Bedrock Valley Aquifer Complex: the aquifer trends west to east, approximately 2.5km south of the Village of Caledon East. Municipal wells Inglewood #3&4 and Bolton #5 are completed within this aquifer complex. The new well CE6 is also completed within this aquifer. The depth of the aquifer is possibly up to 150m deep in the Village of Caledon East area and up to 2km wide. Although this aquifer would be crossed at some point, by all options considered in the study, the formation is too deep to be of concern.
    - Caledon East Meltwater Channel Aquifer: generally located in the northern limits of the study area, within the Caledon East area. Municipal wells CE2 (now abandoned) and CE3 (feeding Caledon East WTP1) are completed in this formation. Well depths are expected to be relatively shallow (40m). Dewatering through this formation could be challenging, especially where water levels are less than 5m. Most shallow ground constraints (<5m) are expected in the vicinity of Innis Lake and Centreville Creek. Most of the pipeline routes are likely to be relatively dry, with the exception of Innis Lake Road at Centreville Creek (affecting routes 2A and 2B), until pipelines encounter the Caledon East Meltwater Channel, which is coincidently in the vicinity of the Caledon Trailway Path (especially affecting the routes with the longest distances through this area, routes 2A, 2B, 3A and 3B.

- The roadway corridors under consideration pass through rural areas that are currently serviced by individual private wells. Numerous properties obtain groundwater from private wells within 200m of the roadway corridors. It is important to inventory existing well users to ensure that drawdown or construction activities do not impact existing users. Airport Road, around the community of Mono Mills, has the greatest number of private wells (affecting routes 1A, 1B and 1C) while Innis Lake Road exhibits the lowest number of private wells (routes 2A and 2B). A higher number of existing private wells results in additional monitoring expenses.
- There are Well Head Protection, Significant Groundwater Recharge and Highly Vulnerable Aquifer Areas present within the study area. None of the options being considered avoid interference with these areas. The options with the least infrastructure requirements (e.g., shorter pipeline lengths) would have lower impacts to these areas.
- All roadway corridors pass through Natural Linkage, Natural Core, Countryside, Rural Settlement and Settlement Areas. It is assumed that the Countryside, Rural Settlement and Settlement Areas have no associated hydrogeological constraints (except for existing well users); therefore, options in the vicinity of these areas would be expected to have less impact (Option 1, and routes 1A, 1B and 1C).

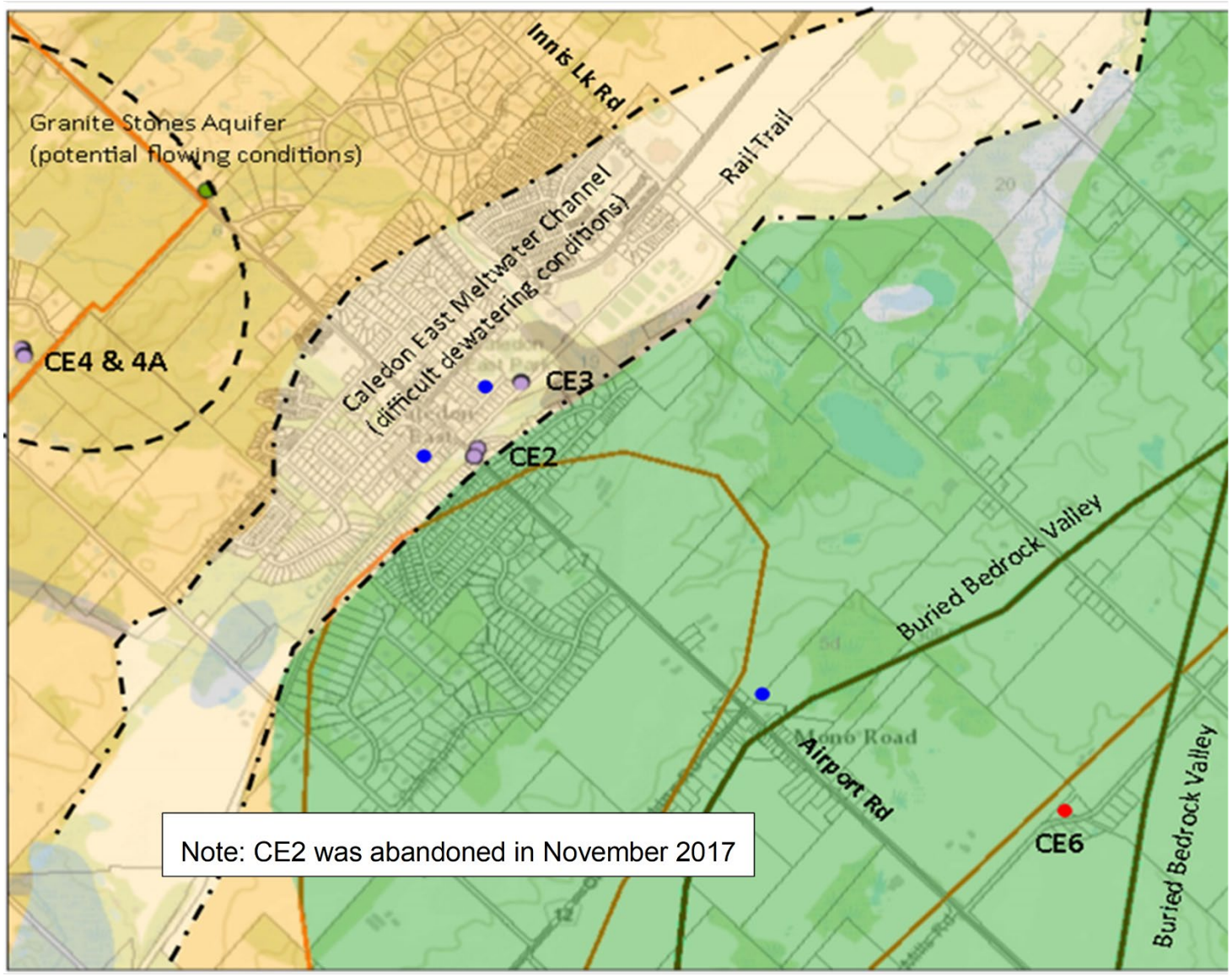

Figure 14: Approximate Location of Existing Aquifers within Study Area

12.1.3 Desktop Geotechnical Study

In August 2021, Golder Associates Ltd. (WSP) completed a desktop geotechnical study to identify potential geotechnical engineering concerns along the roadway corridors under consideration. The study evaluated key subsurface geologic conditions including surficial geology, physiographic mapping, and existing borehole and groundwater information. The complete report is included in **Appendix M.**

Key findings of the Desktop Geotechnical Study are:

- No major roadblocks were encountered for any of the options from a geotechnical perspective. The near surface soil conditions are generally suitable for conventional construction.
- Groundwater is typically found at depths greater than 2m below the ground surface. However, groundwater levels are expected to be influenced in areas in the vicinity of Innis Lake and Centerville Creek (potentially affecting all raw water pipeline routes). Proactive dewatering may be required for excavation in the granular deposits below the groundwater table. Dewatering activities around these areas would have to include an evaluation of the impacts on the lakes or watercourses. Consideration of trenchless crossings of these features is recommended.
- The study area is located within areas of glacially derived till soil containing cobbles and boulders which could be a challenge during construction. All the options in consideration are affected by these soil conditions. Overburden soils can be excavated using conventional hydraulic equipment; however, excavation into very dense tills may require removal of cobbles and boulders.
- Shallow foundations, if required around the new well CE6 site, are likely to be feasible. Site specific investigations will be required to determine the capacity of the overburden to support foundations. Loose sand/silty sand conditions were encountered in some of the boreholes drilled as part of records from previous geotechnical investigations.

12.1.4 Traffic Assessment

In May 2021, CIMA+ completed a traffic assessment of the major roadway corridors within the study area. The desktop review was supplemented by a site visit to confirm existing conditions based on the criteria listed below:

- Right-of-way (ROW) width
- Posted speed
- Frequency of driveways per 100m

- Vertical curves with potential to obstruct sightlines during construction
- Presence of structures such as bridges, on-street parking, utilities near roadway
- Number of signalized and stop controlled intersections
- Obstructions near the roadways
- Animal crossings marked by warning signs
- Pedestrian and school crossings; and
- Observed vehicle traffic volumes

The complete report is included in **Appendix N.** Key findings of the Traffic Assessment are:

- Airport Road has the highest traffic volume and presence of buried utilities amongst all the roadway corridors evaluated, requiring extensive traffic control measures (affecting routes 1A, 1B, 1C and a small portion of the feedermain for Option 1). It also has the largest number of residential and commercial driveways that would be impacted during construction, especially the areas around Caledon East village with on-street parking (mostly affecting route 1B).
- The Caledon Trailway Path (primarily associated with options 1A, 1C, 2A and 3A) has a narrow ROW for both construction and pedestrian detour; closure of the trailway path would most likely be necessary to ensure the highest level of safety
- Mountainview Road, Torbram Road and Castlederg Sideroad offer key advantages such as exceedingly low traffic volumes, few driveways and utilities, no on-street parking, no structures or obstructions, posted speeds of 60 km/h or less (associated with routes 3A and 3B).
- From a traffic perspective alone, Option 1 with the shortest feedermain route along low traffic volume sections on Castlederg Road and Airport Road would offer the most advantages. Pipeline route 3A is considered superior over 3B as it avoids the narrow ROW on Mountainview Road north of the Caledon Trailway Path, as well as driveways, on-street parking, overhead utilities and increased traffic volumes along Walker Road West to Old Church Road.

12.1.5 Contamination Overview Study

In April 2021, Golder Associates Ltd. (WSP) completed a Contamination Overview Study for the three (3) main corridors and adjacent lands within 250m, to assess from a broad level, potential sources of contamination. A drive-by for visual site reconnaissance was also carried out. The study reviewed historic records and database information from Ecolog ERIS report, city directories, physiographic, geologic and hydrogeologic maps and reports and aerial photographs.

Areas of Potential Environmental Concern (APEC) were identified with rankings assigned to reflect low or moderate potential for subsurface impacts. The complete report is included in **Appendix O.** Key findings of the Contamination Overview Study are:

- Twenty (20) APEC were identified within the study area as shown in **Figure 15.**
- Two (2) gas stations were found on Airport Road. Multiple environmental spills including diesel fuel, petroleum and gasoline were listed at the reported service stations, adjacent to the Airport Road RO, with listed environmental impacts. (affecting routes 1A, 1B and 1C and 3B).
- One (1) dry cleaner, two (2) automobile salvage facilities and a commercial truck and trailer repair company were identified on Airport Road in the vicinity of routes 1A, 1B and 1C.
- Former railway tracks, identified as having potential to impact soil conditions, crossed the study area at Airport Road and Olde Baseline Road affecting Routes1A, 1B and 1C; as well as on Castlederg Sideroad, in the vicinity of CE6 affecting all route options as well as the new WTP in Option 1. The Caledon Trailway Path from Mountainview road to Innis Lake Road also had railway tracks but is now being used as a walking trail. Routes 1A, 1C, 2A and 3A are all impacted by this activity.
- Underground fuel oil storage tanks were located at 5671 Boston Mills Road affecting routes 3A and 3B; and at 14999 Innis Lake Road affecting routes 2A and 2B.
- Six (6) historical orchards were found within the study area, as shown in **Figure 15** which may present soils contaminated by pesticides (potentially impacting all pipeline routing options, except for Option 1).
- Application of de-icing salt affects all options considered within the study area and has the potential to impact soil and groundwater conditions.

Completion of a Phase 1 Environmental Site Assessment was recommended for lands that are in the vicinity of APECs, especially those with moderate risk.

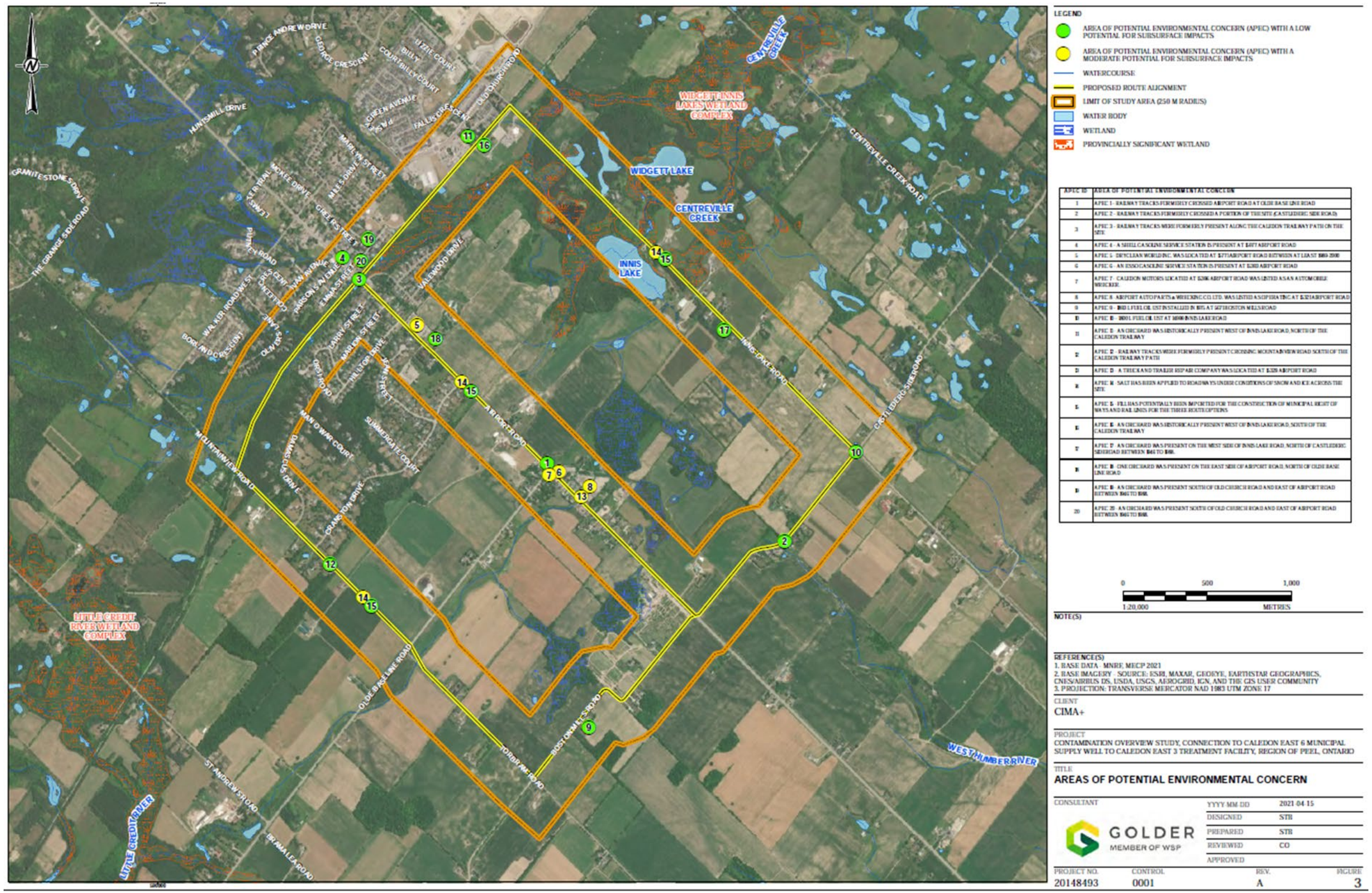

Figure 15: Areas of Potential Environmental Concern

12.1.6 Stage 1 Archaeological Assessment

A Stage 1 Archaeological Assessment (AA) (under Project Information Form number (PIF) P399-0003-2022) was undertaken in July 2021 by Golder Associates Ltd. (now WSP) for the study area. A Stage 1 AA consists of a review of geographic, land use and historical information for the property and the relevant surrounding area, and contacting MCM to find out whether, or not, there are any known archaeological sites on or near the property. Its purpose is to identify areas of archaeological potential and further archaeological assessment (e.g., Stage 2-4) as necessary. The Stage 1 AA report is included in **Appendix J**. Key findings of the Stage 1 Archaeological Assessment are:

- The major roadway corridors have been, for the most part, previously disturbed and are free of archaeological potential and no further studies are required, as shown in **Figure 16**. Some road sections within the study area that have been found to retain archaeological potential, are recommended to be subjected to a Stage 2 archaeological assessment, as shown in **Figure 16**.
- The Caledon Trailway path presents archeological potential requiring completion of Stage 2 test pit survey assessment (primarily affecting Routes 1A, 1C, 2A and 3A).
- The CE6 well site also recommended to be subject to a Stage 2 test pit survey assessment.
- Any recommended archaeological assessment within 20m of the St. James Anglican Cemetery, a known burial ground, located southeast of the intersection of Innis Lake Road and Old Church Road, will require a Cemetery Investigation Authorization application to the Bereavement Authority of Ontario (BAO), in consultation with the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI). Primarily affecting Route 2B.

12.1.7 Cultural Heritage Resources Review

In June 2021, Golder Associates Ltd. (now WSP) completed a cultural heritage review of the project study area to identify areas listed or designated as having cultural heritage value. Cultural heritage resources include both cultural heritage landscapes and built heritage resources. Key findings include:

- Several designated, listed, and potential heritage properties were found within the study area, as shown in **Figure 17.** Potential heritage properties are properties with buildings or structures 40 or more years old. A Cultural Heritage Field Investigation and Impact Assessment was recommended for any option located in or directly adjacent to properties identified as having cultural heritage value.

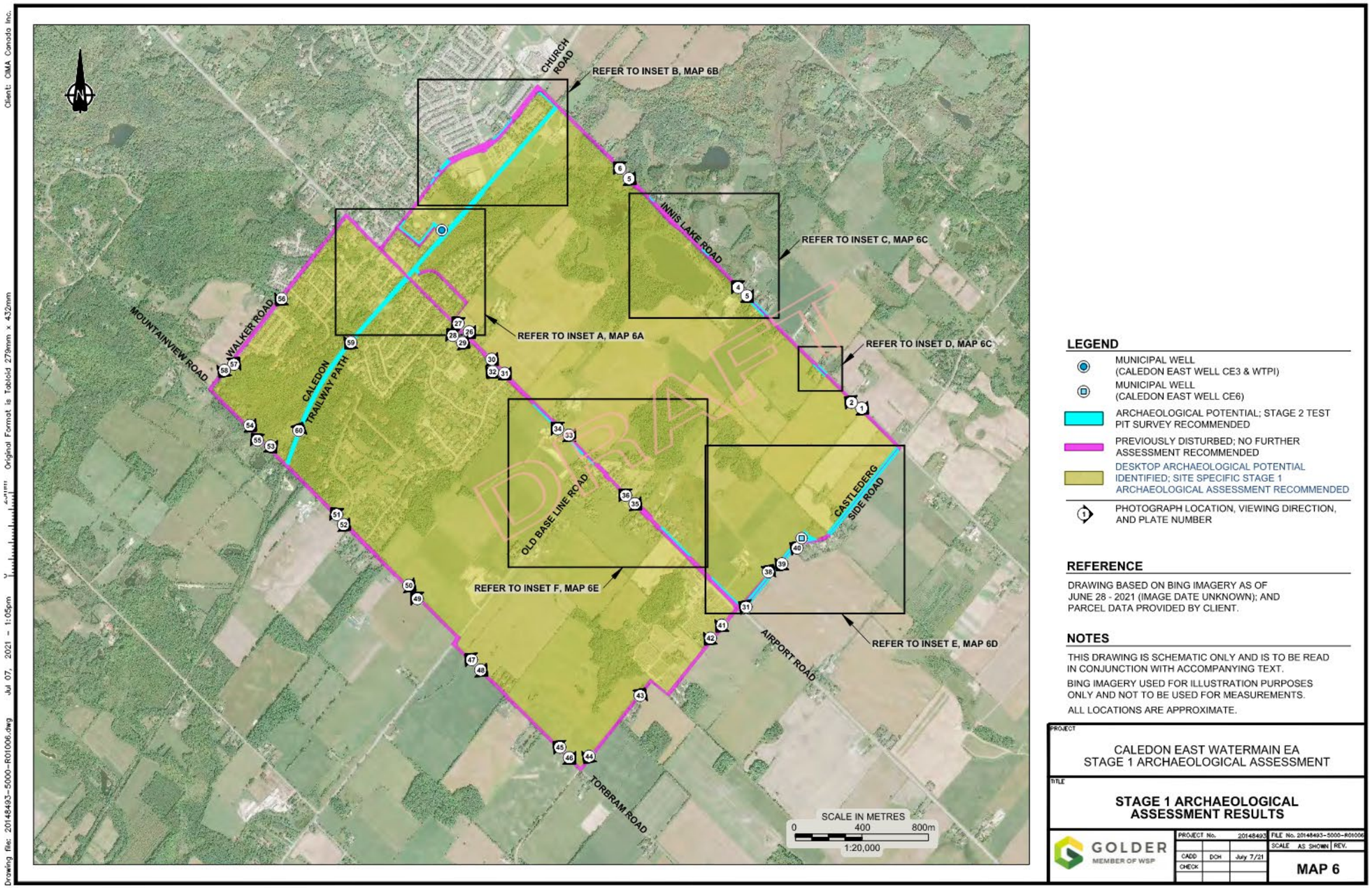

Figure 16: Stage 1 Archaeological Assessment Results

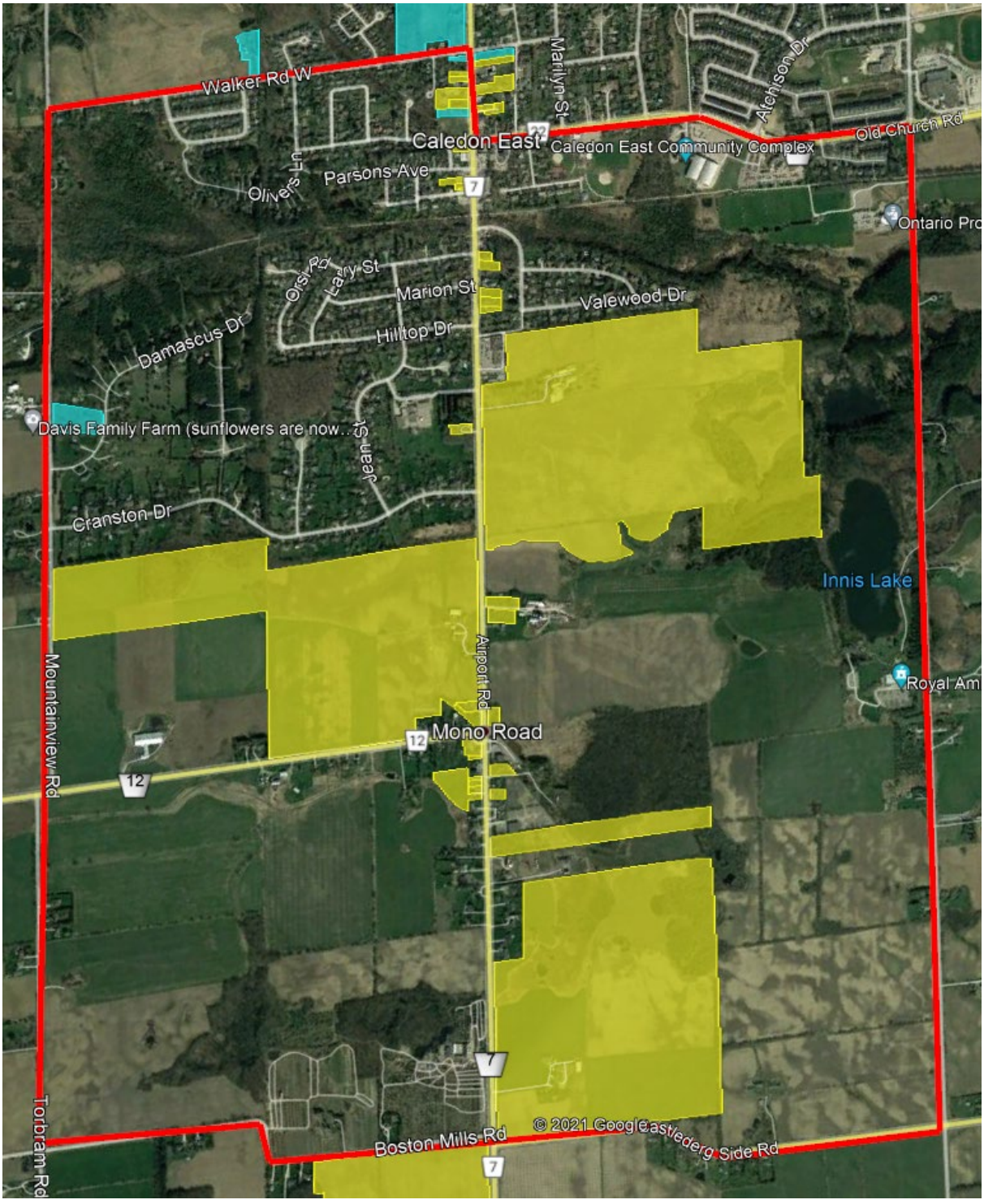

Figure 17: Location of Listed (yellow) and Designated (blue) Cultural Heritage Properties in the Study Area

12.1.8 Source Water Protection

Source water protection areas play a fundamental role in the ability to supply water to the Regional municipal systems. Protection of these areas is key for preventing municipal drinking water from becoming contaminated or impacted. According to available maps for source water protection areas, most of the study area falls under significant groundwater recharge areas and highly vulnerable aquifers as shown in **Figure 18**.

There are also WHPAs designated near the existing wells in the study area. A WHPA is the area around the well that contributes source water to the drinking water system. A WHPA shows where groundwater is coming from to supply the municipal well, and how fast it is travelling through the ground toward the well. The new production well CE6, results in its own new WHPAs.

As noted earlier, delineation of the WHPAs for the new production well CE6 was carried out as a separate assignment to this Class EA study. Key findings of the study are discussed in the next sections and have been considered in the assessment of feasible alternative solutions. The Source Protection Updates for the Communities of Palgrave, Caledon East, and Caledon Village Report (December 2022) by Aqua Insight can be found in **Appendix I**.

Groundwater-related features such as significant groundwater recharge areas, highly vulnerable aquifers and WHPAs were considered in the evaluation of feasible alternative solutions, under the ‘Water Resources and Source Water Protection’ criteria, as described in Section 9. In general, options resulting in the avoidance or reduction of potential impacts to source water protection areas, dewatering requirements, extensive mitigation measures and permitting requirements were scored higher.

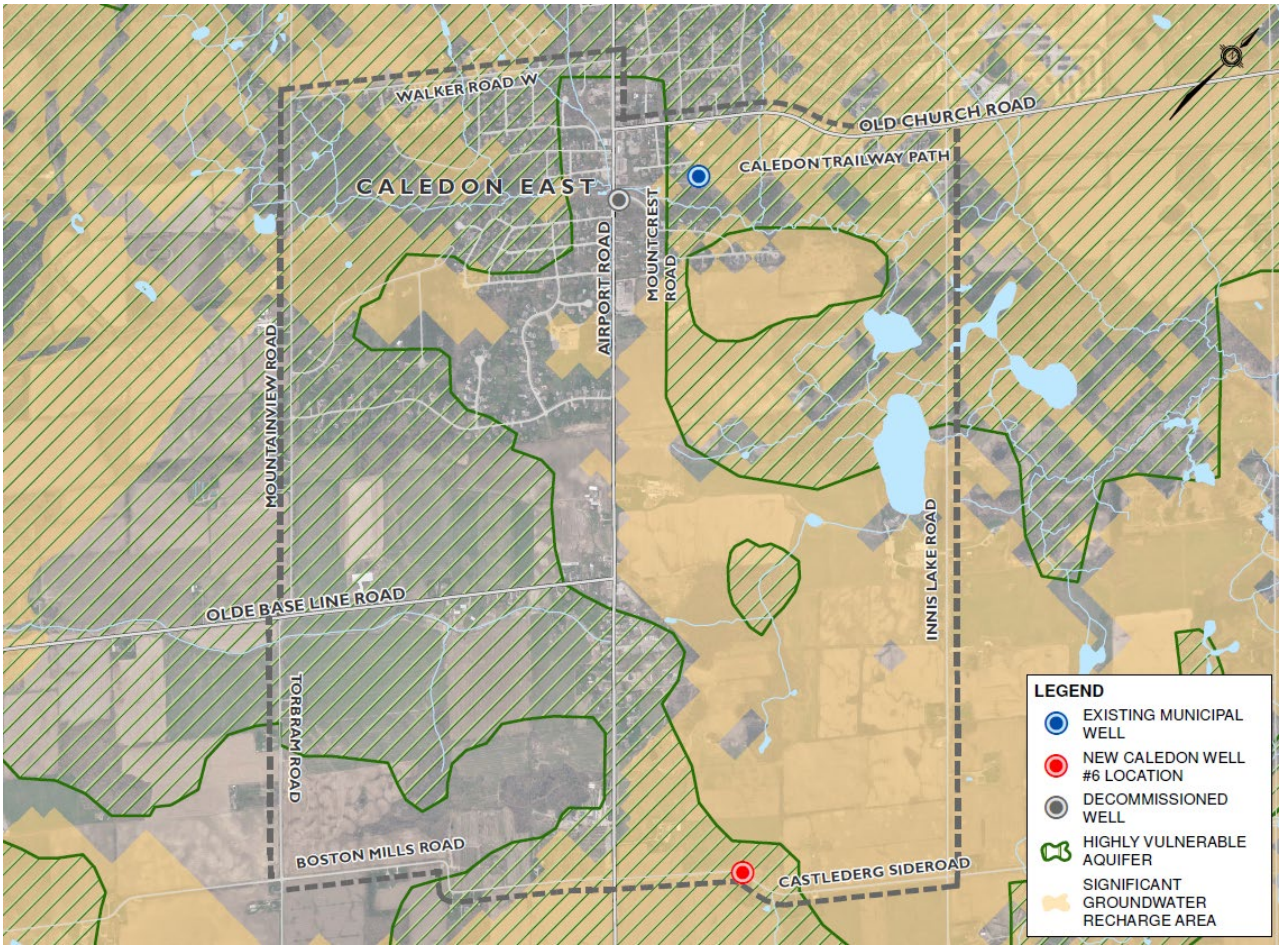

Figure 18: Significant Groundwater Recharge Areas and Highly Vulnerable Aquifers in the Study Area

12.1.8.1 Delineation of Wellhead Protection Areas (WHPAs) and Groundwater Vulnerability Assessment

The limits of the new WHPAs delineated for Caledon East Wells 3, 4/4A, and 6 are illustrated on **Figure 19**. The WHPA-As are illustrated as 100 m buffers surrounding each of the wells. The WHPA-B and -C zones extend broadly in a near radial direction away from each of the municipal wells. New supply well, CE6, is screened in a deep confined buried bedrock valley that is interpreted to underlie the East Credit River and run from southwest of Caledon East in a north-easterly direction to an area north of Bolton. The WHPA-D for CE6 trends southwest within the aquifer lying at the base of the interpreted buried bedrock valley.

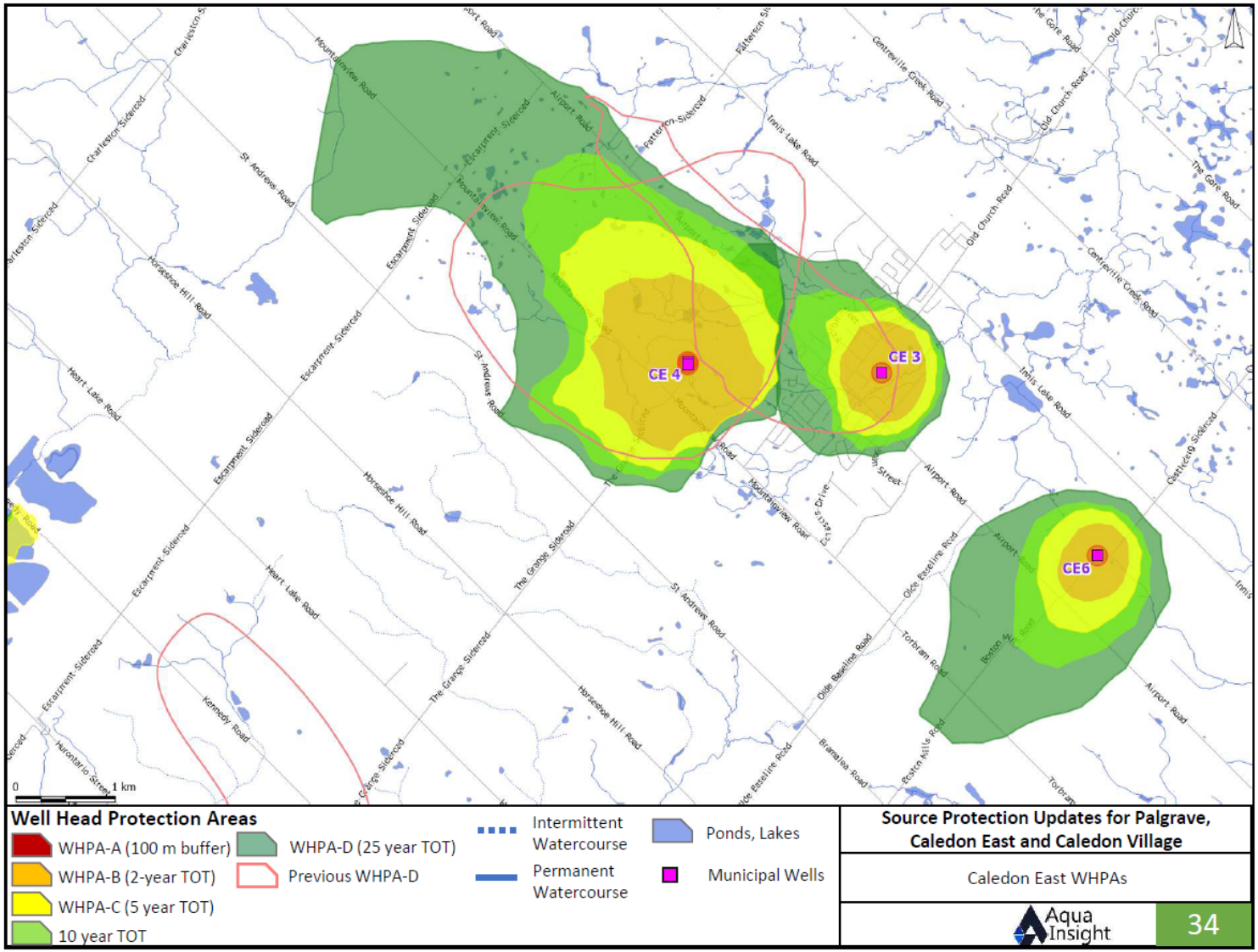

Figure 19: Delineation of WHPAs for Caledon East Wells 3, 4/4A, and 6

The draft limits of the new WHPAs were shared with the public during the first PIC 1. The final boundaries of the WHPAs were subsequently confirmed and presented during PIC 2. In addition to the delineation of the new WHPAs, a groundwater vulnerability, issues and threats assessment was completed by Aqua Insight. The study provided the following findings:

- The unsaturated travel time within the CE6 WHPAs exceeds 50 years. The WHPAs are characterized by deeper water tables and lower groundwater recharge rates.
- No particles were simulated to travel from the water table to CE6 in less than 25 years as the production aquifer is deep and confined. The particles released on the water table within the WHPA-D for CE6 reach the well in over 100 years, and the ultimate source of water for CE6 is much broader than the WHPA-D polygon illustrated in **Figure 19**.
- The Surface to Well Advective Travel Time (SWAT) within the WHPAs for CE6 was rated as having a low vulnerability category, exceeding 25 years.
- A set of vulnerability scores were assigned to the WHPA polygons using the updated vulnerability rating categories that consider transport pathways. The WHPA-C and -D areas have a score of 2, due to the low vulnerability category rating, and the WHPA-B is primarily assigned a score of 6. Scores of 10 are limited to the WHPA-A.
- The WHPA-A for CE 6 has a Managed Land percentage of 40% to 80% due to the presence of the residential land uses, and the WHPA-B has a percentage of Managed Lands greater than 80%.
- Based on the areas of the barns and the interpreted livestock contained within the barns, the WHPA-A was estimated to have a livestock density value less than 0.5 nutrient units per acre, and the WHPA-B was calculated to have 0.5 to 1.0 nutrient unit per acre.
- Road salt application on all roads within the CE6 WHPAs were classified using the Circumstance Tables in the Technical Rules (MECP, 2021) as Low Drinking Water Threats.

12.2 Summary of Comparative Evaluation

Consistent with the evaluation framework described in Section 9.1.2, all options were assessed relative to each other and assigned a score. The detailed comparative evaluation matrix, describing the rationale and preliminary scoring assigned to each

option is included in **Appendix P**. Overall results from the comparative evaluation are summarized in **Table 17** and described as follows.

Table 17: Comparative Evaluation of Alternative Solutions – Results

Option ID	Description	Total Score
1.	Connect CE6 to existing Caledon East Water Treatment Plant, WTP#1	
Route 1A	Airport Road and Caledon Trailway Path	
Route 1B	Airport and Old Church Road	
Route 1C	Airport, Mountcrest and Old Church Road	
Route 2A	Innis Lake Road and Caledon Trailway Path	
Route 2B	Innis Lake Road and Old Church Road	
Route 3A	Mountainview Road and Caledon Trailway Path	
Route 3B	Mountainview, Walker and Old Church Road	
2.	Connect CE6 to existing Distribution System after on-site treatment	

The results of the comparative evaluation indicate that "**Option 2: Additional Supply Capacity through a connection between new Well CE6 and existing distribution system. Raw water to be treated at a new treatment plant, to be built in the vicinity of CE6**" achieved the highest overall score and was therefore recommended as the preferred alternative solution to be explored further in the Class EA study.

Major advantages and key considerations of Option 2 include:

- Construction of a new water treatment plant and a 1km feedermain line would be required. The pipeline length for Option 2 is significantly shorter than all other sub-options considered under Option 1. This results in elimination and/or reduction to a great extent, of potential impacts to sensitive environmental features, water resources, and source water protection areas present within the major corridors of the study area and affecting all other options. Particularly relevant, is the elimination of the crossing of the Caledon East Meltwater Aquifer which eliminates significant dewatering concerns and groundwater monitoring and control, as well as technical and permitting requirements expected pre- during and after- construction.

- It substantially reduces the overall complexity of construction with the shortest length and route for the feedermain, along roads with low volumes of traffic and few residences in the vicinity. These characteristics provide an opportunity for pipeline installation through traditional open cut methods, subject to confirmation from detailed investigations. The shortest pipeline also represents reduced road restoration requirements, overall impacts, conflict with underground utilities and construction duration.
- Construction of a new water treatment plant in the Palgrave/Caledon East Drinking Water system would increase security, redundancy and robustness of the overall system by adding a secondary independent groundwater source and treatment facility to the system. In addition, flexibility for expansion in the future as spare treatment capacity at the existing Caledon East WTP1 would remain available.
- Property acquisition of the existing site, where the new well CE6 is located, is necessary to accommodate the new treatment plant. Preliminary discussions between the Town of Caledon and the Region were initiated to review the viability of acquiring the property. In principle, the Town confirmed the viability of selling the parcel of land to the Region for the intended purposes. Furthermore, the Town indicated that full reconstruction of Castlederg Sideroad, east of Airport Road, is scheduled for the 2022 construction season (Summer/Fall 2022). As such, The Town requested that preference be given to installation of the feedermain section on Castlederg Sideroad with trenchless methods to eliminate rework on the road and disturbance to road users and residents.
- TRCA floodplain regulated areas, re-delineated as part of this project, were found to encroach into the site as shown previously in **Figure 12**. As requested by TRCA, no development is to occur within TRCA regulated areas. Proposed infrastructure will be conceptualized to maintain the required clearances from regulated areas.
- The new production well results in new Wellhead Protection Areas (WHPAs). As discussed in Section 12.1.8, delineation of the new WHPAs was completed in parallel to this Class EA study to support the study recommendations as well as the identification of necessary mitigation measures. Source water protection policies will apply to the new WHPAs and will also be considered in the design, construction, and long-term operation of the proposed works.
- Non-residential uses on lands currently designated as agricultural are permitted but may be subject to an area municipal official plan amendment and in accordance with the provisions set out in the Official Plan. In addition, an Agricultural Impact Assessment will be required for any infrastructure proposed on prime agricultural lands adjacent to CE6 well site.

- On a high-level, construction cost for a new treatment facility (assuming traditional construction) are considered comparable to construction of a single connecting pipeline (with lengths assumed for the sub-options under Option 1). However, by eliminating the crossing of the Caledon East Meltwater Aquifer, the extensive technical studies, field investigation, extensive mitigation measures, plans and dewatering contingencies involved with the crossing of aquifer, are eliminated with this option, therefore making Option 2 more financially attractive.

13 Treatment Technologies Review

A key component of the Preferred Alternative Solution – Option 2, includes the construction of a New Water Treatment Plant in the vicinity of the new well CE6. To assist activities in Phase 3 of the Class EA Study, a review of treatment technologies for the new water treatment plant was completed. Alternative design concepts were subsequently developed to reflect potential treatment processes and layout configurations for the new water treatment plant (recommended as part of the preferred solution identified in Phase 2).

This section provides an overview of the key characteristics of the new well CE6, along with an assessment of the treatment requirements for the New Water Treatment Plant, including treatment technologies that were incorporated into potential treatment trains for the facility.

13.1 Key Characteristics of New Well CE6

This section summarizes key characteristics of the New Well CE6 and an assessment of the quality of raw water sourced from CE6. Treatment requirements were identified subsequently based on this assessment which was later used to select applicable treatment technologies.

13.1.1 CE6 Well Construction Details

As per the existing PTTW detailed in Section 5.1.1, CE6 has a rated capacity of 4,320 m^3/day (50 L/s). Key construction details of the new well, CE6, are listed in **Table 18**. The well construction log can be found in Figure 26 of Well Construction Program report, included in **Appendix B**.

Table 18: Well CE6 – Construction Details[1]

Component	Description
Well	Well Record Number: A285973 Well Record Date: 2022-03-10 UTM Easting Coordinates: 593573 UTM Northing Coordinates: 4856335 Well Depth: 159.39 m Type of Construction: Rotary (Conventional) Normal Static Level: 19 m

Component	Description
Annular Seal	Type of Sealant: Cement Depth: 150 m Thickness: 78 mm
Well Casing	Material: 304 stainless steel Diameter: 254 mm (10 in) Top of Casing: 0.74m above ground level Depth: 150.8 m below top of casing
Well Screen	Material: stainless steel Length: 9.3 m

Notes:

1. Well construction details as per Well Construction Program Report, Village of Caledon East, Caledon East Well No.6, Geo Kamp Limited, October 21, 2020.
2. Well depth measured on September 24, 2020, as indicated in Geo Kamp's October 2020 Well Construction Program Report.

13.1.2 Raw Water Quality

During the test pumping of CE6 in 2020, discussed in detail in Section 1.2.2, water samples were collected every 24 hours for 3 consecutive days. A comprehensive water quality analysis was completed for the water sample collected at the end of the testing (72 hours) in accordance with Tables 1, 2, 3 and 4 of the Technical Support Document for Ontario Drinking Water Quality Standards, Objectives and Guidelines (ODWQS, June 2003, Revised June 2006) except for chloramines, dioxins, furans and metribuzin. Water quality field observations were also collected. The complete list of sampled parameters and the results are included in Geo Kamp Limited, Well Construction Program Report, 2020 (**Appendix B**).

For the purpose of the Class EA study, selected physical and chemical parameters, and microbiological parameters, as shown in **Table 19** and **Table 20**, were reviewed in more detail. It is noted that the limits set out in the ODWQS, apply only to treated/distribution water and do not apply directly to raw water; however, they provide an indication of treatment requirements at the plant and have been included in the tables for comparative purposes only.

Table 19: Well CE6 – Raw Water Quality, Physical and Chemical Parameters

Parameter	Unit	ODWQS Limit	Standard Type AO/OG/Health-based Standard[1]	72-hr Sample Result[2]
Alkalinity (as $CaCO_3$)	mg/L	30-500	OG	150
Arsenic	mg/L	0.01	Health-based	0.0026
Chloride	mg/L	250	AO	12
Colour[3]	TCU	5	AO	0
Dissolved Organic Carbon (DOC)	mg/L	5	AO	0.66
Hardness	**mg/L**	**80-100**	**OG**	**130**
Iron	mg/L	0.3	AO	0.16
Manganese	**mg/L** **mg/L** **mg/L**	**0.05** **0.02[3]** **0.12[4]**	**AO** **AO[3]** **MAC[4]**	**0.028**
Methane	L/m^3	3	AO	0.36
Organic Nitrogen	mg/L	0.15	OG	<0.10
pH	-	6.5-8.5	OG	8.07
Sodium	mg/L	200 / 20[5]	AO	21
Sulphide	mg/L	0.05	AO	<0.020
Taste & Odour[6]	-	Inoffensive	AO	Not inoffensive
Temperature[6]	°C	15	AO	11.3
Total Nitrate	mg/L	10	Health based	<0.1
Turbidity	NTU	5[7]	-	0.15

Notes:

1. From O. Reg. 169/03 and Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (June 2003). AO/OG Aesthetic Objective or Operational Guideline (not heath-based).
2. Raw water quality data results obtained for 72-hour sample, as per Well Construction Program Report, Village of Caledon East, Caledon East Well No.6, Geo Kamp Limited, October 21, 2020.
3. Aesthetic Objective (AO) for total manganese in drinking water is 0.02 mg/L, as per the Guidelines for Canadian Drinking Water Quality, Guideline Technical Document Manganese, May 2019. AO based on minimizing the occurrence of discoloured water, consumer complaints and staining laundry.
4. Maximum Acceptable Concentration (MAC) for total manganese in drinking water is 0.12 mg/L, as per the Guidelines for Canadian Drinking Water Quality, Guideline Technical Document Manganese, May 2019. MAC based on effects on neurological development and behaviour,

attention, and motor skills. Formula-fed infants (where water containing manganese levels above the MAC is used to prepare formula) may be especially at risk.

5. The Aesthetic Objective (AO) for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.
6. Field measurement obtained for 72-hour sample, as per Well Construction Program Report, Village of Caledon East, Caledon East Well No.6, Geo Kamp Limited, October 21, 2020.
7. Applicable for all waters at the point of consumption.

Table 20: Well CE6 – Raw Water Quality, Microbiological Parameters

Parameter	Units	ODWQS Limit[1] MAC[2]	72-hr Sample Result[3]
Total Coliform	CFU/100 mL	Not detectable	0
Escherichia coli (*E.coli*)	CFU/100 mL	Not detectable	0

Notes:

1. From O. Reg. 169/03 and Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (June 2003). AO/OG Aesthetic Objective or Operational Guideline (not heath-based).
2. MAC is the Maximum Acceptable Concentration established for parameters which when present above certain concentration, have known or suspected adverse health effects. The length of time the MAC can be exceeded without health effects will depend on the nature and concentration of the parameter.
3. Raw water quality data results obtained for 72-hour sample, as per Well Construction Program Report, Village of Caledon East, Caledon East Well No.6, Geo Kamp Limited, October 21, 2020.

In comparing the reported raw water data obtained against the treated water quality objectives outlined in the ODWQS, only hardness was found outside the recommended operational guideline.

A summary of observations pertaining to key water quality parameters is provided below:

Hardness

Hardness is not substantially affected by conventional treatment in surface or GUDI waters. Hardness in the range of 80-100 mg/L (ODWQS operational guideline) is considered to provide an acceptable balance between corrosion and incrustation. A hardness level of around 200 mg/L is considered tolerable, while levels above 500 mg/L are considered unacceptable for domestic use. The reported hardness concentrations (130 mg/L) are relatively near the ODWQS operational guideline and are not considered

to potentially cause operational challenges from a treatment perspective or cause issues in the distribution system.

Manganese

Manganese is present in some groundwaters because of chemically reducing underground conditions coupled with presence of manganese mineral deposits. Manganese is objectionable like iron in water supplies because it stains laundry and fixtures black, and at excessive concentrations causes undesirable tastes in beverages (ODWQS).

Manganese in drinking water is responsible for the discoloration of water in the distribution system and at the tap. Low levels of manganese in treated water may accumulate in the distribution system and periodically lead to high levels of manganese at the tap.

Manganese concentration following the 72-hour pump test was 0.028 mg/L, which is below the ODWQS aesthetic objective for manganese of 0.05 mg/L, set to limit discoloured water in the distribution system. The Guidelines for Canadian Drinking Water Quality (2019) designate a maximum acceptable concentration (MAC) for total manganese in drinking water of 0.12 mg/L, and an aesthetic objective (AO) at 0.02 mg/L. The AO has been set to minimize the occurrence of discoloured water complaints based on the presence of manganese oxides, and to improve consumer confidence in drinking water quality (Health Canada, 2019). Ontario Drinking Water Quality Guidelines generally follow new Canadian Drinking Water Quality Guidelines, which are based on latest research by Health Canada.

While the manganese levels found at the new well CE6 (0.028 mg/L) are below the ODWQS, it exceeds the AO set out in the 2019 Canadian Guidelines of 0.02 mg/L. It is suggested to consider planning for the adoption of the Canadian manganese guideline of 0.02 mg/L for the new facility. This would also help to minimize the accumulation of manganese in the distribution system as even low levels in the treated water can lead to high levels of manganese at the tap.

It is suggested that the new treatment facility be constructed with additional footprint to house a manganese removal system. The manganese removal system could be installed during or after construction of the plant (in 2-3 years), depending on when the new ODWQG would be adopted. CIMA+ will await the Region’s advice regarding their preference for planning of potential future manganese removal at the facility.

Iron

Iron may be present in groundwater because of mineral deposits and chemically reducing underground conditions. The AO for iron, set by OQWQS by appearance effects, in drinking water is 0.3 mg/L. Excessive levels of iron in drinking water supplies may impart a brownish colour to laundered goods, plumbing fixtures and the water itself (ODWQS).

Raw water quality data obtained from the 72-hour pump test indicate an iron concentration of 0.16 mg/L, which is below the current ODWQS AO of 0.3 mg/L. Consideration for the provision of some treatment for the removal of iron, is suggested, as water quality could potentially deteriorate in the future and/or regulations become more stringent.

Typically, in manganese removal processes, such as oxidation/greensand filtration (like the one currently employed at Palgrave Well 4), the chemical reactions causing precipitation of manganese and iron ions typically occur in parallel, and as such treatment for the removal of manganese would also result in some iron removal.

Other Parameters

Other physical and chemical parameters that help characterize the groundwater quality for drinking water purposes such as arsenic, chloride, dissolved organic carbon, iron, manganese, nitrates, temperature, and turbidity are all well within the limits of the maximum acceptable concentrations, aesthetic objectives and operational guidelines, as shown in **Table 19**.

As per **Table 20**, the raw water quality data from the sample collected at the end of the pumping test (72 hours) met the microbiological parameters in accordance with the limits set out in the ODWQ Standards, Objectives and Guidelines.

Based on the raw water quality, it is confirmed that treatment for disinfection will be required for the new groundwater source at CE6. Treatment for manganese removal/control (with provision for iron removal) can also be provided, should the Region decide to adopt the lower AO for total manganese of 0.02 mg/L set out in the Canadian Drinking Water Guidelines.

Should the Region decide to continue to abide by the existing ODWQS AO of 0.05 mg/L for total manganese, it is suggested that the new treatment facility be constructed with additional footprint to house an iron and manganese removal system, if needed in the future. Typically, the system would require additional sodium hypochlorite for oxidation and potentially slightly larger filters (if removal of both iron and manganese is required). CIMA+ will await the Region’s advice regarding their preference for planning of potential need for control/removal of iron and manganese at the new treatment facility.

GUDI Characterization

Currently, Ontario Regulation 170/03 under the Safe Drinking Water Act sets out the criteria for determining if a well supply should be managed, from a treatment perspective, as either “true” groundwater or “Groundwater Under the Direct Influence of Surface Water” (GUDI).

As detailed in Section 1.2.2, pumping tests of the new well CE6 were conducted in accordance with the methodology and requirements established in the new DRAFT GUDI ToR dated January 22, 2019 – which had not been finalized as of the date of well testing/construction. Based on the July 2020 aquifer testing for CE6, it was inferred that CE6 is not GUDI.

As per the existing DWWP, all production wells in the Palgrave/Caledon East Drinking Water System, including the new production well CE6, are classified as true groundwater (not GUDI).

Chlorine Demand

A chlorine demand test completed at the end of the well pumping test suggests that a chlorine dosage requirement of 3.3 mg/L to 4.5 mg/L is necessary to obtain an operating objective of 1.5 mg/L free chlorine residual after 60 minutes at an approximate temperature of 13^{o}C and a pH of 8.27.

13.1.3 Key Considerations for Treatment Requirements

As summarized in the previous section, the physical, chemical and microbiological water quality parameters for CE6 are well below the ODWQS limits with the exception of hardness, which is slightly above the operational guideline.

From a disinfection perspective and based on the DRAFT GUDI ToR, January 22, 2019, it is anticipated that the new production well CE6 will require treatment in accordance with Category 1 of the new TOR, requiring a 4-log virus inactivation.

Groundwater quality is vulnerable to contaminants from natural and human activities. Among many contaminants, iron (Fe) and manganese (Mn), are present in chemicals derived from both natural sources, such as soil and rock, and human activities. Iron and manganese are two (2) common elements, often found together in groundwater and wells, in different concentrations. Water quality analysis carried out during testing of CE6 has shown that manganese, although below the ODWQS, is above the Canadian Drinking Water Guideline of 0.02 mg/L.

As discussed previously, it is suggested that provisional treatment for the removal of manganese and iron is included, should CE6 may experience a possible deterioration of water quality in the future. As a result, the overall treatment process for the new water source at CE6 well could ultimately consists of iron/manganese removal followed by disinfection. With consideration to current provincial requirements for treated water quality, the treatment process at the new treatment facility would initially include disinfection only. Additional footprint will be allocated in the new building for a future installation of iron/manganese removal equipment.

Footprint will also be provided for future process wastewater/sludge handling if the iron and manganese removal equipment is installed. Allocating additional footprint within the new proposed treatment building to accommodate future equipment will avoid the need for a future building expansion.

Table 21 summarizes the treatment requirements for the new supply well CE6.

Table 21: New Supply Well CE6 Treatment Requirements

Description	Design Criteria	Units
Caledon East Well 6 Capacity	50	L/s
Treated Water Iron Concentration	0.3[1]	mg/L
Treated Water Manganese Concentration	0.02[2]	mg/L
Virus Inactivation Required	4[3]	log
Minimum Free Chlorine Residual	0.2[4]	mg/L

Notes:

1. Aesthetic objective as per O. Reg 169/03 and Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines (ODWQS), June 2003.
2. Aesthetic objective as per the Guidelines for Canadian Drinking Water Quality, Guideline Technical Document Manganese, May 2019.
3. Anticipated minimum required virus inactivation, as per the DRAFT GUDI ToR, January 2019.
4. Recommended minimum free chlorine residual in water distribution system.

13.2 Review of Treatment Technologies

A few alternative process technologies are available to provide the level of treatment required for disinfection and manganese & iron removal (provisional). A brief description of each technology is provided in this section. Manganese and iron removal technologies are also included, should the Region decide to pursue the future installation of a manganese and iron removal system.

13.2.1 Disinfection (Pathogen Inactivation) Alternatives

Disinfection is usually the most critical step in a multi-barrier approach for a water treatment plant, as this entails the removal or inactivation of disease-causing organisms from the raw water, rendering it safe to drink. Since these organisms have a finite size, processes known to achieve particulate removal generally also achieve a degree of pathogen removal.

The combination of several processes in series, each of which provides some pathogen removal or inactivation represents the “multi-barrier” approach so desirable in water treatment plant design. Typically, the last process in the multiple-barrier approach to the protection against pathogens is the disinfection process. In the case of non-GUDI water, disinfection alone can provide the required pathogen removal or inactivation.

Disinfection involves the exposure of the groundwater or filtered water to one or more chemicals or agents able to inactivate or kill residual pathogens. The disinfection process includes:

- Primary disinfection – intended to inactivate human pathogens such as viruses, bacteria and protozoa (protozoa is present in surface and GUDI waters) potentially present in the water before the water is delivered to the first costumer. The existing Caledon East WTP #1 currently provides primary disinfection through chlorination (sodium hypochlorite).
- Secondary disinfection – intended to maintain a disinfectant residual in the distribution system to prevent or mitigate bacterial growth in the distribution system. The existing Caledon East WTP currently provides secondary disinfection through chlorination (sodium hypochlorite).

In general, alternatives available for disinfection include:

- Chlorination (free chlorine contact usually as chlorine gas or sodium hypochlorite form)
- Ultraviolet (UV) Irradiation
- Ozonation

13.2.1.1 Chlorination

Chlorine has been used as an effective disinfectant in drinking water for many years. It is by far the most common disinfectant, by virtue of its low cost, ease of use, and relative effectiveness. Chlorine is a powerful oxidant that works quickly on bacteria, viruses, although it is not particularly effective against *Giardia* and it is almost completely ineffective against *Cryptosporidium*. Chlorine is injected to the water in some

form, usually either as gaseous chlorine or in the liquid hypochlorite form. Typically, the chlorinated water passes through chlorine contact chambers where the water is in contact with chlorine for a certain contact time, required to achieve pathogen inactivation.

13.2.1.2 Ultraviolet (UV) Irradiation

UV is a physical process that uses ultraviolet irradiation to prevent the cellular replication of organisms so that they cannot reproduce and are thus inactivated. UV light is emitted through a series of lamps located in enclosed contactors.

UV is the most common type of non-chemical inactivation. UV irradiation has rapidly gained an important position in the industry due to its effectiveness against *Giardia* and *Cryptosporidium*; however, it is not effective for all viruses, typically requiring a short chemical disinfectant contact time (typically by chlorine) for virus inactivation.

UV disinfection is only effective while the water is actually being irradiated, and it is therefore only useful as a primary disinfection strategy, as it provides no residual. A secondary disinfectant such as chlorine or chloramines must be applied downstream of UV disinfection for protection of the distribution system.

13.2.1.3 Ozonation

Ozonation involves the application of ozone to the water. Ozonated water is directed to ozone contactors where the water is in contact with ozone for the required contact time to achieve pathogen inactivation

Ozone is an unstable derivative of oxygen, which is formed on-site and immediately applied to the water. An ozonation system typically consists of oxygen storage, ozone generators, ozone contactors to provide the required contact time, a quenching chemical system and ozone off-gas destructing system to remove excess ozone from the water and air respectively.

Ozone is a very strong oxidant and disinfectant, but one which decays very rapidly, and is therefore only suitable as a primary disinfectant. Generally, ozone achieves a much higher degree of disinfection with relatively less concentration and contact time compared to other chemical disinfectants. Ozone degrades rapidly overtime, therefore, a secondary disinfectant such as chlorine or chloramines must be applied downstream of ozonation for protection of the distribution system.

Compared to chlorination and UV, ozonation has significantly higher capital and operating costs for a disinfection application only, in addition to health hazards associated with oxygen storage and ozone generation, and control measures. This

would render ozonation financially and operationally challenging for this project and the least viable option.

13.2.2 Iron and Manganese Removal

As noted, concerns regarding the presence of manganese in drinking water are often related to consumer complaints regarding discoloured water. Water containing excessive amounts of iron and manganese can result in stained clothes, discoloring of plumbing fixtures, and sometimes add a “rusty” taste and look to the water.

Iron and manganese removal processes typically provide removal of both manganese and iron by precipitation followed by filtration or by sequestration. Various technologies are available for iron and manganese control; however, a few are not considered effective or suitable for the new Well CE06.

The **sequestration** process consists in chemical addition, typically phosphate solutions, to maintain iron and manganese in solution (as soluble complexes) in the distribution system. This method does not solve the problem at the source (iron and manganese are not removed) and does not have a good track record in Ontario.

The **lime softening process** consists in the addition of hydrated lime or quicklime to raise pH and precipitate calcium, iron and manganese; it is more suitable when hardness removal is required (not required for CE06). The process is more complex, typically includes solids contact clarifiers followed by recarbonation (to raise pH) and filtration and requires the storage and handling of lime silo and carbon dioxide.

Ion exchange may also remove iron and manganese and is typically used in home softening. The process typically consists in hardness, iron and manganese ions being exchanged with sodium ions. Hardness, iron and manganese ions are disposed of, and the resin must be regenerated by a regenerant solution. The process is complex and expensive, it requires softening exchange vessels and a resin regenerating system.

Other alternative technologies available for manganese and iron removal for Well CE06 include:

- Oxidation and Physical Filtration
- Biological Filtration

13.2.2.1 Oxidation and Physical Filtration

This process consists in the oxidation of soluble manganese and iron to form solid precipitates (manganese dioxide and iron hydroxide) which can be removed by filtration. An oxidizing agent such as chlorine is typically injected upstream of the filters to

produce iron and manganese precipitates, which are subsequently removed by gravity or pressure filtration.

As an example, the existing Palgrave Well 4 Drinking Water System currently employs greensand filtration preceded by chlorine injection (in the form of sodium hypochlorite) to remove soluble iron. The greensand filtration system consists of a pressurized filtration system which employs a media with special manganese oxide coating. The oxidation and greensand filtration system is typically designed to meet the required levels of removal of manganese and iron. The filters are designed to meet the required filtration rate, backwash frequency and the residue management system designed to handle the load from the filter backwashes.

The process is simple to operate, and operating staff are familiar with it, as it is currently in use at other groundwater facilities in the Northern Peel Drinking Water Systems.

13.2.2.2 Biological Filtration

Biological filtration consists in the oxidation of iron and manganese via naturally occurring bacteria, which when placed in the right environment and given the appropriate oxidation-reduction potential, are able to catalyze the oxidation reaction of iron and manganese (chemicals are not required). A pilot test is typically required to determine its feasibility and establish operating conditions.

The required bacteria for the biological filtration process, are already found in most iron and manganese containing wells and allow the simultaneous oxidation and filtration of these metals at rates two to four times higher than conventional systems. The biological filters must be backwashed periodically to remove the accumulated metal oxides. The systems allow for the elimination of all strong oxidants, and as such they have much lower backwash requirements, resulting in reduced backwash water quantities (Williams, Paul. Biological iron and manganese removal as a viable alternative for groundwater treatment", ONDEO Degremont, 2002).

These filters require a seeding period to reach the required bacteria concentration on the media to optimize oxidation. The seeding period is typically one day to one week for iron filters and 3 weeks to 3 months (typically less than one month) for manganese filters. (Gage. Biological iron and manganese removal, pilot and full scale applications, 2001).

Due to their catalytic nature, the biological filters can operate at higher filtration rate than other technologies, and consequently require a lower footprint. The biological filters provide high efficiency removal of iron and manganese and generate treated water with iron and manganese concentrations at detection levels. The sludge produced is denser

than other technologies and results in better settling and handling (Gage, 2001). The filters are particularly effective with groundwater containing ammonia and arsenic.

On the other hand, these filters require tight monitoring and control to ensure the health and condition of the bacteria for the process to be effective. The process is prone to upsets based on the nature of the media. In addition, the process is labour intensive and not recommended to be evaluated further.

13.2.3 Summary

According to the treatment requirements and technologies recommended for further consideration, alternative design concepts for the new water treatment plant (WTP) treating groundwater from new Well CE6 will include:

Disinfection

- Option 1 – Disinfection through chlorination only
- Option 2 – Disinfection through UV irradiation only
- Option 3 – Disinfection through a combination of chlorination and UV irradiation

Manganese and Iron Removal

- Option 1 – Greensand Filtration

In line with current operational practices in the Caledon East Drinking Water System, secondary disinfection will be achieved through chlorination. Consistent with existing operational practices at other groundwater-based treatment facilities in the Region, the new water treatment facility, regardless of the treatment train provided, will be equipped with an indoor emergency standby power system.

Major requirements, common to all alternative design concepts, are summarized as follows:

- The well casing will be complete with a pitless adapter to incorporate a new submersible pump rated for 50 L/s
- The disinfection system must provide, at a minimum, 4-log (99.99%) removal or inactivation of viruses
- The free chlorine residual in the water distribution system is recommended to be at minimum 0.2 mg/L
- As recommended in the MECP design guidelines; chemical storage should be provided for at least 30 days consumption

- Water storage will not be provided onsite. Consistent with the Caledon East system, treated water will be conveyed directly to either the distribution system or the Caledon East Reservoir
- A permanent emergency standby power genset will be housed inside the new building to provide standby power should a power failure occur
- Access to the new treatment facility will be provided by a new access road directly off Castlederg Sideroad. Adequate access will be provided for truck and material delivery access.
- Provision will be made for additional room space in the process area to accommodate a filtration system for control/removal of iron/manganese, should it be required in the future.

14 Class EA Study Phase 3 – Identification of Alternative Design Concepts

The next phase in the Class EA process, Phase 3, involves identifying and evaluating alternative design concepts for the preferred solution. This entails a detailed examination of alternative methods for implementing the preferred solution identified in Phase 2, and the potential impacts of such concepts in the overall environment.

The major infrastructure components of the preferred alternative solution were categorized into two (2): vertical infrastructure which comprises the new water treatment plant, and linear infrastructure which comprises the 1.0 km feedermain connection. Alternative design concepts were developed separately for both components.

For vertical infrastructure, a review of treatment technologies for the new water treatment plant was completed to support activities in Phase 3, as presented in Section 13. Subsequently, alternative design concepts were developed to reflect potential treatment processes and layout configurations for the new water treatment plant.

This section presents alternative methods for implementing the preferred alternative solution, referred herein as alternative design concepts for major infrastructure components, including vertical infrastructure: new water treatment plant, and linear infrastructure: 1.0 km feedermain connection.

14.1 Overview of Alternative Design Concepts

The preferred alternative solution involves construction of a new water treatment plant to treat raw water from the new supply well CE6, and a feedermain interconnecting the new treatment facility to the existing distribution system on Airport Road.

Key considerations for New Water Treatment Plant:

- Proximity to production well location (Well CE6)
- Viability for property acquisition
- Treatment trains/technologies to satisfy the disinfection requirements and provision for future iron/manganese removal (in anticipation of more stringent regulations)
- Building layout configurations

Key considerations for Interconnecting Feedermain:

- Available pipe installation methods, open cut vs trenchless

- One (1) route was established for the interconnecting feedermain, reflecting the shortest possible length between the 2 connection points – the new treatment plant at the CE6 well site and the existing Caledon East distribution system on Airport Road. Shortest route results in least potential impacts.

Alternative design concepts for the new water treatment plant represent alternative treatment trains and their respective building layout configurations. Alternative treatment trains were developed based on the recommended treatment technologies, summarized in Section 13.2.3. The proposed building footprint was conceptualized assuming the future installation of greensand filters for iron/manganese removal through oxidation and physical filtration process.

Only one (1) route for the required feedermain interconnection was established, as shown previously in **Figure 10**, representing the shortest possible pipe length between the two (2) connection points – the new water treatment plant at the CE6 well site and the existing Caledon East distribution system on Airport Road. The shortest, and most obvious route, will result in the lowest impacts from every perspective and therefore, is considered the only routing option for consideration in the Class EA study. Nonetheless, alternative design concepts for the feedermain interconnection were established and assessed based on feasible pipe installation methodologies, discussed later in this report.

The following sections describe the alternative design concepts considered for vertical and linear infrastructure and the results of the comparative detailed assessment of the alternatives.

14.2 Alternative Design Concepts for Vertical Infrastructure – New Water Treatment Plant

Two (2) alternative design concepts for treatment trains to be implemented at the new water treatment plant were developed to include:

- Option WTP1: Disinfection through chlorination only
- Option WTP2: Disinfection through a combination of chlorination and UV irradiation

The need to provide a chlorine residual in the distribution system for the protection of water quality eliminates UV disinfection alone as a viable option for consideration in this study.

Both options, WTP1 and WTP2, will have the following common components:

- A well pump to operate at the existing PTTW capacity of 50 L/s. Well pump to be installed in the existing CE6 production well. Well CE6 will be equipped with a pitless adaptor for connection to new water treatment building.
- A treatment building to house all process, mechanical, electrical and emergency standby equipment, and associated valves and instrumentation. The treatment building will have sufficient footprint for provisional installation of greensand vertical pressure filters in the future. To establish a preliminary building footprint, it has been assumed that three (3) greensand filter units will be provided with a firm treatment capacity of 50 L/s. A building footprint of approximately 18 m x 23 m has been established.
- A process wastewater management system comprising a decanting tank for backwashing of the future greensand filters. Trucks will transport the sludge offsite for disposal – only required when the greensand filters are in place and operational.
- Chlorine addition for secondary disinfection.
- Access road to the site.

A description and simplified process schematics for each design concept follows.

14.2.1 Option WTP1

Option WTP1 consists of the following:

- Chlorine disinfection to provide the 4-log virus inactivation.
- A chlorine contact chamber to provide the necessary contact time for disinfection. The diameter and configuration of the chamber will be selected based on a minimum chlorine residual to ensure that an appropriately sized chlorine contact chamber can be accommodated within the site.

A simplified schematic of the treatment system proposed for Option WTP1 is shown in **Figure 20.**

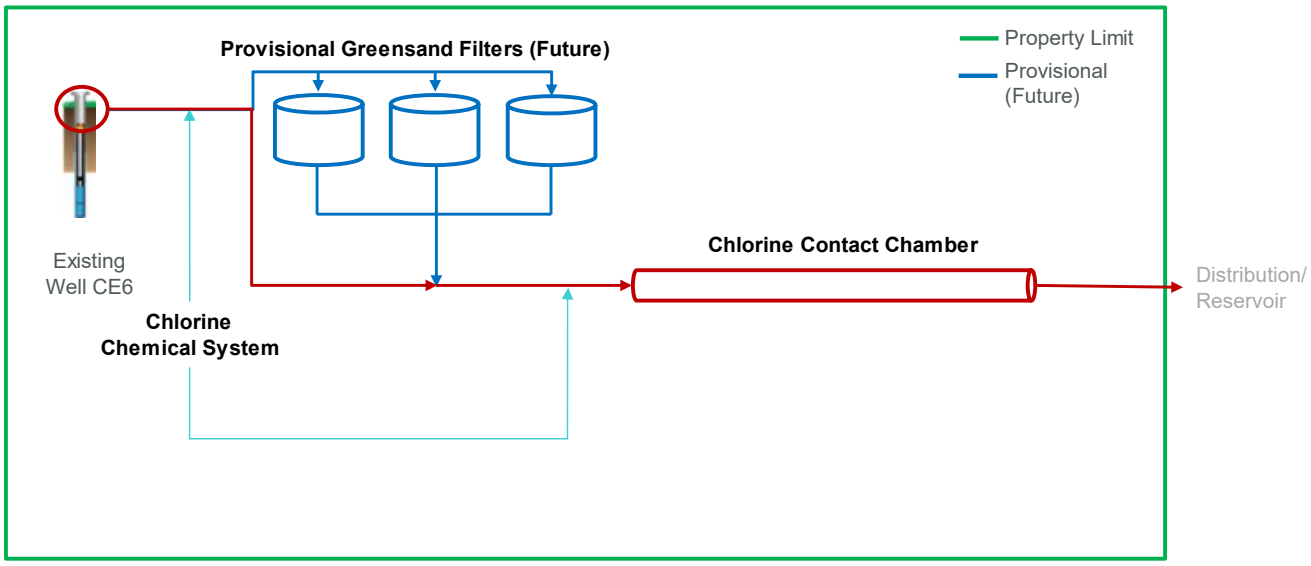

Figure 20: Schematic of Option WTP1

14.2.2 Option WTP2

Option WTP2 consists of the following:

- A combination of chlorine disinfection and UV irradiation to provide the 4-log virus inactivation. The chlorination and UV systems can be designed to provide flexibility in terms of log inactivation. For example, each system can be designed to independently provide 2-log virus inactivation, for a total combined 4-log virus inactivation. Alternatively, the Region may wish to provide 3-log virus inactivation through chlorination alone, and the remaining 1-log virus inactivation through UV. This latter configuration relies more heavily on the chlorination process. A treatment combination of 2-log removal through chlorination and 2-log removal through UV irradiation has been assumed.
- A chlorine contact chamber to provide the necessary contact time for disinfection. The diameter and configuration of the chamber will be selected based on a minimum chlorine residual to ensure that an appropriately sized chlorine contact chamber can be accommodated within the site.

A simplified schematic of the treatment system proposed for Option WTP2 is shown in **Figure 21.**

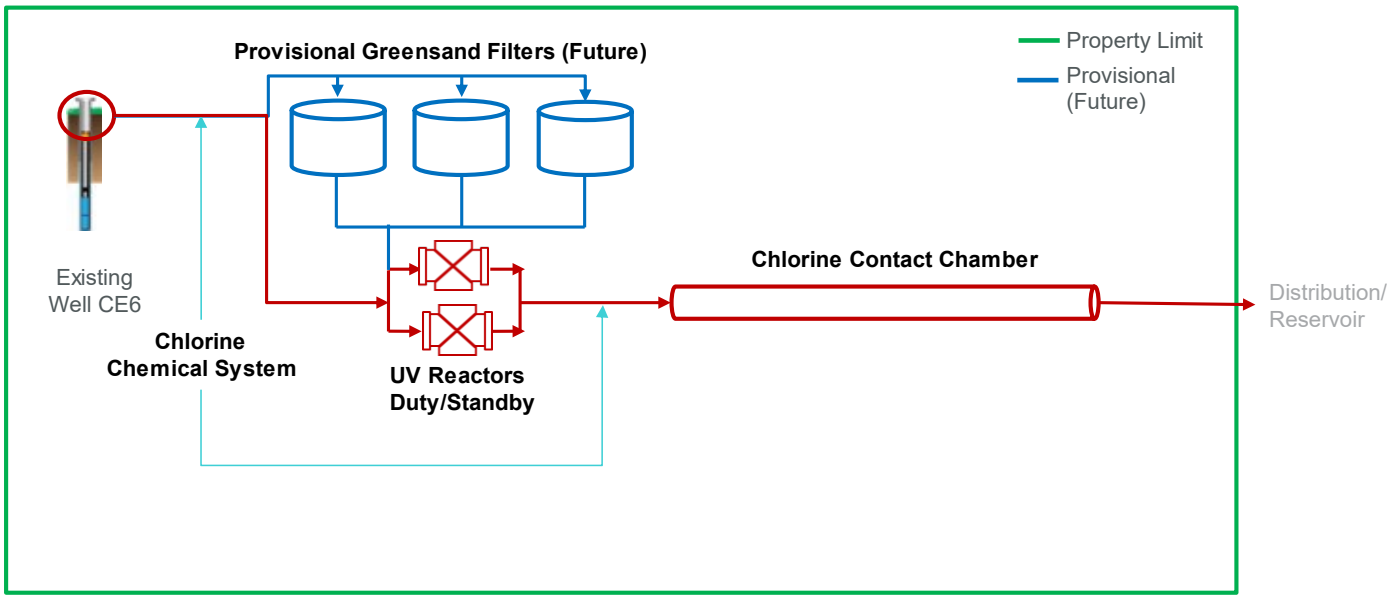

Figure 21: Schematic of Option WTP2

Compared to disinfection through chlorination alone (Option WTP1), UV reactors will increase overall process complexity. Considerations for UV reactors include additional maintenance and energy usage, routine lamp replacement, and the provision of a duty/standby configuration to ensure redundancy.

14.3 Alternative Design Concepts for Linear Infrastructure – Interconnecting Feedermain

As described in previous sections, an interconnecting feedermain of approximately 1 km in length will be necessary to connect the new water treatment plant to be built on new well CE6 site and the existing distribution system on Airport Road (refer to **Figure 10**).

The new 300mm diameter feedermain will extend westbound on Castlederg Sideroad (approximately 580m long) and then northbound on Airport Road (approximately 430m long) to the connection point to the distribution system.

The following three (3) alternative design concepts were developed for the interconnecting feedermain to reflect feasible pipe installation methods, including open cut and trenchless methods:

- Option F1: Pipe installation predominantly by open-cut method with no trenchless sections
- Option F2: Pipe installation predominantly by trenchless methods with minimum open cut sections

- Option F3: Pipe installation by a combination of open cut and trenchless methods

All three (3) design concepts assume that the 300 mm feedermain pipe will be installed within the existing road-right-of ways (ROW) through Horizontal Directional Drilling (HDD). A description of each design concept follows.

14.3.1 Option F1

Option F1 comprises installation of the entire feedermain length of 1 km through open cut methods within the existing R.O.W along Castlederg Side Road and Airport Road, as depicted in **Figure 22**.

14.3.2 Option F2

Option F2 comprises installation of the entire feedermain length of 1 km through trenchless methods within the existing R.O.W along Castlederg Side Road and Airport Road, as depicted in **Figure 23**.

14.3.3 Option F3

Option F3 comprises installation of the feedermain through a combination of open cut and trenchless methods, including trenchless installation method within R.O.W along Castlederg Side Road and open cut installation method within R.O.W. along Airport Road, as depicted in **Figure 24**.

Figure 22: Schematic of Feedermain Option F1

Figure 23: Schematic of Feedermain Option F2

Figure 24: Schematic of Feedermain Option F3

14.4 Opinion of Probable Costs

Opinion of probable capital costs were developed for each design concept. Details of cost estimates are provided in **Appendix Q**.

14.4.1 Capital Costs

The following general assumptions were made when developing the capital costs for the design concepts:

- Cost estimates are based on 2023 construction costs. Inflation and escalation for the actual expected prices at the time of construction cannot be accounted for at this time.
- Estimates of probable capital costs provided by CIMA+ have been developed on a high-level conceptual design basis and based on prices and data in CIMA's possession, as well as previous experience from projects of similar nature and scope.
- In accordance with ASTM E 2516-06 (Standard Classification for Cost Estimate Classification System) the preliminary opinion of total project costs is anticipated to be within a range of -30% and +50%, based on a Class 4 level of accuracy.
- All taxes (including the 13% HST) have been excluded.
- Cost of the greensand filtration system, expected to be installed in the future, has been excluded.

Capital costs for the proposed vertical infrastructure components generally included:

- Cost to construct a traditional construction one-storey building of approximately 18 m x 23 m
- Costs of major process equipment including well pump, chemical feeding and storage systems, UV systems, and process piping and instrumentation,
- Costs of building services such as electrical equipment, HVAC, and emergency standby generator and fuel tank
- Cost of site works including new driveway, site grading, etc.

Capital costs for the proposed horizontal infrastructure components generally included:

- 1 km watermain installation and restoration costs for 300 mm diameter PE pipe with maximum installation length of +/- 180m.
- Pipe installation via trenchless methods assumes Horizontal Directional Drilling (HDD).

14.4.2 Operating & Maintenance Costs

Annual operation and maintenance (O&M) costs accounted for in the vertical infrastructure analysis include electricity, chemical usage, and other general operating and maintenance costs such as labour and lab analysis. Since CE6 is not expected to be a primary well for the system, for cost estimate purposes it has been assumed that the facility operates 50% of the year.

The annual O&M for the 1km interconnecting feedermain are anticipated to be fairly low (valves and chambers not necessarily needed) and comparable for all options, and thus, not included in the costing analysis. Consistently, life cycle costs were not prepared for linear infrastructure. Evaluation of design concepts for linear infrastructure has been made with consideration to a relative assessment of capital costs within the economic criteria.

14.4.3 Lifecycle Costs

Lifecycle costs were calculated based on a 20-year life expectancy. Lifecycle costs have been estimated based on:

- A 20-year amortization period
- An inflation rate of 4.0% and an assumed interest rate of 3.8%

Estimates for the Net Present Value (NPV) of the 20-year lifecycle costs for alternative design concepts for vertical infrastructure are provided in the section below. Detailed lifecycle cost calculations are included in **Appendix Q.**

14.4.4 Summary of Probable Costs

Table 22 summarizes the estimated opinion of probable costs for the alternative design concepts under consideration, as outlined in Section 14.1. The costing information has been used in the economic assessment of the options.

Table 22: Alternative Design Concepts – Opinion of Probable Costs

Alternative Design Concept	2023 Capital Cost	Annual O&M Costs	NPV
Vertical Infrastructure – New Water Treatment Plant			
Option WTP1: Disinfection through chlorination only	$6.3 Million	$103,700	$8.6 Million
Option WTP2: Disinfection through a combination of chlorination and UV irradiation	$7.3 Million	$123,600	$10.1 Million
Linear Infrastructure – 1.0 km Feedermain			
Option F1: Pipe installation predominantly by open-cut method with no trenchless sections	$1.4 Million	-	-
Option F2: Pipe installation predominantly by trenchless methods with minimum open cut sections	$1.7 Million	-	-
Option F3: Pipe installation by a combination of open cut and trenchless methods	$1.6 Million	-	-

15 Field Work Investigation and Studies

To support the evaluation of alternative design concepts outlined in Section 14, field investigations were conducted to identify potential impacts and mitigation measures for each option. The scope of the field work was limited to areas that could potentially be impacted by the construction of proposed new infrastructure.

The following field studies were carried out in 2022 by a team of sub-consultants:

- Natural Environment Study
- Phase One Environmental Site Assessment
- Stage 1/2 Archaeological Assessment
- Cultural Heritage Study
- Utility Locates and a Topographical Survey.

This section provides a summary of the key findings and recommendations from the field studies, which were incorporated into the evaluation of alternative design concepts in the next section of the report. Stand-alone reports have been prepared separately for each investigation and included in the appendices.

15.1 Natural Environment Study

In 2022, Golder Associates Ltd. (Now WSP) conducted a natural environment study in association with this Class EA study. The study area was specifically delineated to capture the areas to be potentially impacted, directly or indirectly, by the proposed works. Field investigations were carried out to further supplement the baseline natural study also completed by Golder in July 2021, which identified potential constraints for each of the alternative routes.

A site reconnaissance was conducted in October 2022 to verify the existing conditions within the subject areas and assess the impacts and mitigation measures associated with the proposed infrastructure. Potential ecological impacts of the proposed infrastructure under the different design concepts were assessed under the Provincial Policy Statement, Greenbelt Plan, Oak Ridges Moraine Conservation Plan, The Growth Plan for the Greater Golder Horseshoe, the Town of Caledon Official Plan and Peel Region Official Plan, as well as other relevant legislation, including the ESA.

Specific details of the field investigations can be found in the stand-alone Natural Environment Report included in **Appendix G.** An overview of key findings is presented below:

- **Vegetation:** The study area is mainly made up of agricultural areas, with commercial and residential areas interspersed, and two (2) existing local roads (Castlederg Sideroad and Airport Road). Natural ecosystems, such as wetlands and forests, are present in relatively small amounts at some distance from the proposed works. Within the study area, no Species at Risk (SAR) plant species or vegetation communities that are provincially significant or rare were found. Three (3) plant species were identified as rare; however, they do not warrant specific transplanting or other active mitigation measures. The species recorded were primarily disturbance-tolerant and early successional in character, as anticipated for the site conditions.
- **Wildlife**: No threatened or endangered species were observed on the site or in the study area during the site reconnaissance. However, two species, Rusty Blackbird and Monarch, are designated as Special Concern under the ESA. Fourteen (14) wildlife species listed under the ESA were assessed to have moderate potential to occur in the study area, five of which are designated as threatened or endangered: Bobolink, Eastern Meadowlark, Butternut, Little Brown and Northern Myotis, and Tri-colored Bat. The other nine (9) species are designated as Special Concern and do not receive regulatory protection under the ESA. The hay field (OAGM) in the northwestern portion of the study area may provide habitat suitable for breeding for Bobolink and Eastern Meadowlark, but none of the 5 endangered or threatened species are expected to be impacted by the proposed project with the implementation of standard mitigation measures.
- **Fish Habitat:** There are no documented rare or SAR fish species in the two (2) tributaries within the study area, the West Humber River and the Little Credit River. The tributaries were found to be dry or with little to no flow in the channels. Both tributaries are considered secondary fish habitats for the West Humber and Little Credit rivers. Fish and fish habitat are not expected to be impacted by the proposed project with the implementation of the standard mitigation measures.
- **Significant Wetlands:** The site does not have any significant wetlands. There is an evaluated, non-significant wetland Mono Road Wetland Complex located off-site within the western portion of the study area, as well as a small (~0.1 ha) unevaluated wetland on-site. No direct impacts are anticipated from the project works on the vegetation units associated with these wetlands; however, mitigation measures are recommended to prevent potential indirect impacts.
- **Significant Woodlands:** No direct impacts to woodlands are expected. Furthermore, implementation of General Best Management Practices is expected to prevent potential adverse indirect impacts.

- **Significant Wildlife Habitat:** five (5) types of candidate Significant Wildlife Habitat (SWH) and one confirmed were identified to have the potential to occur on the site or in the study area. The presence of some candidate SWH could not be confirmed as the reconnaissance was conducted outside of the core wildlife season. Potential impacts on species such as Monarch butterflies, Yellow-banded Bumblebees, Barn Swallows, Red-headed Woodpeckers, Short-eared Owls, Eastern Ribbonsnakes, and Snapping Turtles were identified, however, the study concludes that adherence to the mitigation measures will be sufficient to protect these species.

The stand-alone report included in **Appendix G** outlines a set of Best Management Practices to mitigate damage to natural features during site preparation and construction. Specific measures are also outlined to protect nesting migratory birds and reptiles, such as avoiding vegetation removal during nesting season and protecting turtle nests with a 10 m buffer.

15.2 Phase 1 Environmental Site Assessment

In April 2021, WSP completed a Contamination Overview Study (COS) for this Class EA study, which identified 20 Areas of Potential Environmental Concern (APEC) within the general project area, including gas stations, a dry cleaner, automobile salvage facilities, and former railway tracks with potential impact on soil conditions. Underground fuel oil storage tanks and historical orchards with potentially contaminated soil were also found. Consistent with the recommendations of the 2021 COS, a Phase One Environmental Site Assessment (ESA) for lands in the vicinity of APECs was completed.

Phase One ESA was completed in February 2023 and limited to the property where the new water treatment plant under Options WTP1 and WTP2, is proposed to be located, as well as adjacent lands within a 250m radius. The study included review of available current and historical information, and a site reconnaissance in November 2022.

Key findings of the Phase One ESA are:

- Well CE6 site is not considered to be an enhanced investigation property. The eastern part of the property had one monitoring well and two water supply wells.
- The Property has included vegetated land since prior to 1946 and was once traversed by railway tracks. Inferred fill material may be present on the eastern portion of the Phase One Property.
- The surrounding properties include residential, commercial, and agricultural land uses. Pole mounted transformers were noted on the south side of Castlederg Side Road.

- No utility drawings were accessible, and there could be underground utilities such as water, sewer, or natural gas. The presence of these utilities could impact the movement of groundwater as well as any contaminants of concern.
- Three (3) APEC areas, shown in **Figure 15**, were identified as follows:
    - APEC 1, located in the eastern portion of the property, and potentially contaminated by the importation of fill material of unknown quality. The media potentially impacted is soil.
    - APEC 2, also located in the eastern portion of the property, and potentially contaminated by historical railway tracks. The media potentially impacted is soil.
    - APEC 3, located in the northeastern portion of the property along a former roadway where de-icing salts were applied (removed by 1958). The media potentially impacted is soil and groundwater.
- A recommendation to complete a Phase Two ESA for the submission of a Record of Site Condition is made in the report, included in **Appendix R.**

Figure 25: Areas of Potential Environmental Concern – Phase 1 Environmental Site Assessment

15.3 Stage 2 Archaeological Assessment

The Stage 1 Archaeological Assessment (AA) conducted by WSP in July 2021 recommended a Stage 2 AA for some road sections and the CE6 well site. Subsequently, a Stage 2 AA was conducted in October 2022 for the area along Airport Road and Castlederg Side Road, as well as the CE6 well site. The areas were subject to a shovel test pit survey as part of the assessment.

As detailed previously in Section 3.7, the Stage 2 AA involved engagement with, and participation by representatives from Indigenous Communities whose traditional territories encompass the study area, including SNFN, HDI, and MCFN.

The Stage 2 AA concluded that there are no archaeological resources or sites within the study area and therefore, it is free from further archaeological concern. The complete report is included in **Appendix K.** Communication records with the indigenous groups involved in the fieldwork are included as supplementary documentation along with the report.

15.4 Cultural Heritage Assessment

Further to the recommendations of the Cultural Heritage Resources Review conducted by WSP in June 2021, a Cultural Heritage Field Investigation and Impact Assessment was conducted in October 2022 for the preferred alternative solution.

The impact assessment study concluded that there will be no impacts to either built heritage resources or cultural heritage landscape features. Recommendations include planning staging and construction activities to avoid impacts to the identified heritage resources and contacting a heritage consultant if future work requires expansion of the study area to confirm impacts on heritage resources. The complete report is included in **Appendix S.**

15.5 Utility Locates and Topographic Survey

A utility locates investigation and a topographic survey of the proposed site and local roads following the route for the proposed interconnecting feedermain were completed.

The utility locates confirmed that other than underground telecommunication services (i.e., Bell), there are no municipal water, sewage, or stormwater services along the subject section of Castlederg Road. Municipal sewage services exist on the east side of the road section investigated on Airport Road.

16 Class EA Study Phase 3 – Evaluation of Alternative Design Concepts

A comprehensive comparative evaluation of the alternative design concepts identified in Section 14 was completed, taking into account the findings and recommendations from the field studies and investigations outlined in Section 15. This section presents the evaluation results of the alternative design concepts for both vertical and linear infrastructure, leading to the identification of the preferred design concept.

The results of the detailed evaluation, including conclusions and recommendations of field investigations, were presented to all stakeholders including the public, review agencies and indigenous communities at PIC 2 for feedback and confirmation.

16.1 Evaluation Summary Results –Vertical Infrastructure

Two (2) alternative design concepts, WTP1 and WTP2, developed for the proposed new water treatment plant to be built in the vicinity of the new well CE6, were evaluated as described in previous sections of this report. The detailed evaluation matrix can be found in **Appendix T.** The overall scoring and ranking results of the detailed assessment are summarized in **Table 23**.

Table 23: Detailed Evaluation Summary Results – Vertical Infrastructure, New WTP

Option ID	Description	Total Score	Rank
WTP1	Disinfection through chlorination only	●	1
WTP2	Disinfection through a combination of chlorination and UV irradiation	◕	2

The results of the comparative evaluation for the vertical infrastructure design concepts indicate that Option WTP1: disinfection through chlorination only, provides more benefits to this project compared to Option WTP2, mainly resulting from the significantly lower process complexity and associated lower operational and maintenance requirements for a single disinfection process, i.e., chlorination, which is well used and known in the Region and is typically the dominant type of disinfection technology for small-scale groundwater-based systems.

Other additional benefits and advantages of Option WTP1 include:

- Chlorination has minimal energy requirements associated with the operation of chemical metering pumps, compared to the UV reactors which require higher

electricity consumption to power the lamps. UV lamps also require frequent maintenance and replacements which translates into increased labour and costs over time.

- Chlorine disinfection alone requires the least amount of process and electrical equipment than UV irradiation, resulting in a significantly lower capital cost.

16.2 Evaluation Summary Results – Linear Infrastructure

Three (3) alternative design concepts, F1, F2 and F3, developed for the proposed interconnecting feedermain – to be installed from the new water treatment plant to the interconnection point on Airport Road, were evaluated as described in previous sections of this report. The detailed evaluation matrix can be found in **Appendix T.** The overall scoring and ranking results of the detailed assessment are summarized in **Table 24**.

Table 24: Detailed Evaluation Summary Results – Linear Infrastructure, New Feedermain

Option ID	Description	Total Score	Rank
F1	Pipe installation predominantly by open-cut method with no trenchless sections	◕	2
F2	Pipe installation predominantly by trenchless methods with minimum open cut sections	●	1
F3	Pipe installation by a combination of open cut and trenchless methods	◕	2

The results of the comparative evaluation for the horizontal infrastructure design concepts indicate that Option F2: Pipe installation predominantly by trenchless methods with minimum open cut sections, provides the most benefits to this project compared to Options F1 and F3, for the following reasons:

- Avoids reoccurring disruption on Castlederg Sideroad from repetitive construction activities. Installation method consistent with expectations from Town of Caledon.
- Lowest potential for disruption to neighboring residents and local road users due to reduced noise and dust generation from construction activities.
- Reduces constructability challenges with crossing of existing ditches along the route.
- Low potential to impact streetscape and traffic during construction, particularly avoiding traffic impacts on a major local road such as Airport Road.
- Lowest potential for GHG emissions from construction activities.

17 Preferred Recommended Alternative Design Concept

17.1 Description

The preferred alternative design concept recommended for implementation has been selected with consideration to the results of the evaluation process and feedback obtained from the public throughout the Class EA study.

The results of the decision-making process followed in this Class EA study support the selection of Option WTP1: disinfection through chlorination only for water treatment (vertical infrastructure) and Option F2: Pipe installation predominantly by trenchless methods with minimum open cut sections for feedermain installation (linear infrastructure).

The schematic of the preferred design concept for vertical infrastructure is given in **Figure 26**. The key advantages of this design concept are reduced complexity of the treatment process, decreased operational and maintenance needs, lower energy requirements, and reduced costs compared to alternative options.

The schematic of the preferred design concept for linear infrastructure is given in **Figure 27**. The key advantages of this design concept are minimal recurring disruptions along Castlederg Sideroad, reduced inconvenience for residents and road users, and minimum impacts on streetscape and traffic during construction.

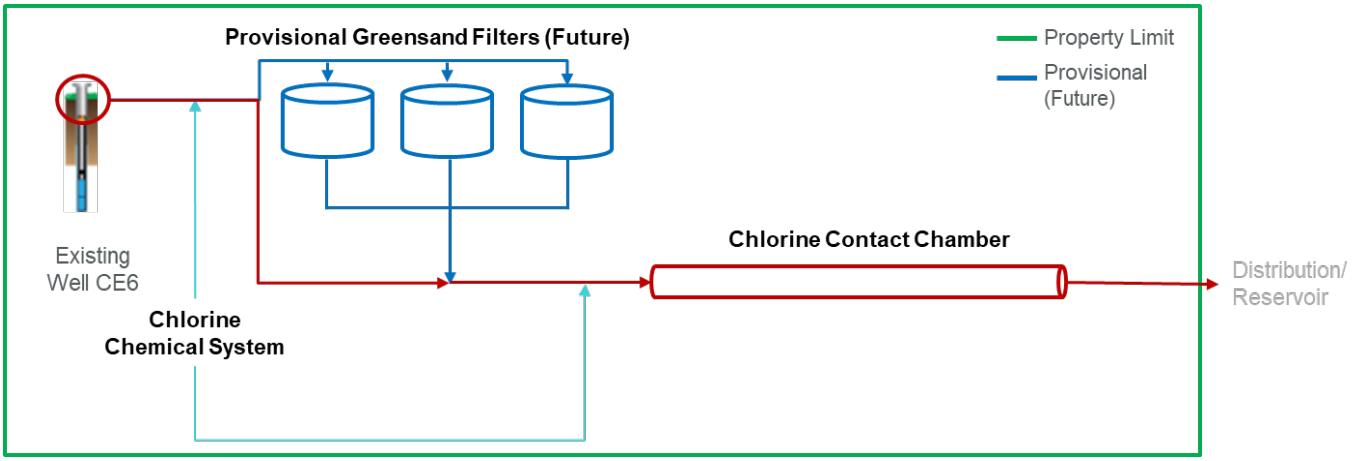

Figure 26: Preferred Vertical Infrastructure (Water Treatment) Design Concept

Figure 27: Preferred Linear Infrastructure (Feedermain) Design Concept

Following are the key components and considerations for the preferred recommended alternative design concept:

- Construction of a new water treatment plant on a vacant lot that currently sits the new supplementary supply well CE6, a monitoring well and an observation well. All wells were developed by the Region during the groundwater exploration program to identify a new source of supply.
    - The new supply well, CE6, is already in place with an existing permitted taking capacity of 4,320 m^3/day (50 L/s) as per PTTW # P-300-2095321129 Version: 1.0, issued on December 30, 2020. A groundwater vulnerability assessment which included delineation of the wellhead protection areas (WHPAs) for the new well CE6 has been completed by the Region as a separate assignment, in accordance with the *Clean Water Act,* to form the basis for the water quality threats assessment.

  - A new water treatment plant providing treatment for disinfection through chlorination alone will be built in the immediate vicinity of the new well CE6. The new building will have sufficient footprint to allow for future installation of greensand filters, if considered necessary. A building footprint of approximately 18 m x 23 m has been established. A preliminary site plan illustrating a conceptual site layout for the new water treatment plant at the CE6 well site has been developed, as shown in **Figure 28**. Preliminary conceptual site plan layouts have been developed to ensure the necessary infrastructure can be accommodated within the limits of the existing site and the constraints imposed by the limits of the TRCA floodplain regulated areas.
  - Property acquisition with the Town of Caledon will continue to secure the site for the new water treatment plant. All proposed new infrastructure will be located respecting the minimum 10m setback from the TRCA regulated floodplain areas.
- Installation of a 1km long feedermain to provide for the connection between the new CE6 water treatment plant and the existing Caledon East distribution system on Airport Road. The 300mm diameter feedermain will be installed primarily through trenchless methods along Castlederg Road and Airport Road.

The components of the preliminary preferred design concept recommended for the new Supplementary Water Supply Source for the Palgrave/Caledon East DWS was confirmed with input from the Region and formally presented to the public at PIC 2.

The preliminary preferred design concept was also discussed with representatives from the Town of Caledon during a virtual Teams Meeting on September 21, 2023. Conceptual site plan layouts were also distributed and reviewed with the Town of Caledon to support the ongoing land acquisition process. Key comments provided by the Town included:

- The conceptual site layout to have only one (1) access driveway from Castlederg Sideroad to the CE6 well site.
- Commitment from the Region to a degree of architectural control / higher architectural aesthetics for the building reflects the character of the surrounding areas.
- The proposed property line for the parcel of land to be acquired, north of Castlederg Sideroad to reflect the ultimate planned ROW width of 26 m (existing 13 m from centreline for a 26 m ROW).

The Town confirmed that subject to addressing the above noted comments, they would be in support of the proposed preliminary preferred solution and the project in general. The Region will continue the property acquisition process in direct consultation with the Town of Caledon to secure the new municipal site, housing existing CE6 production, monitoring and observation wells and the new water treatment plant.

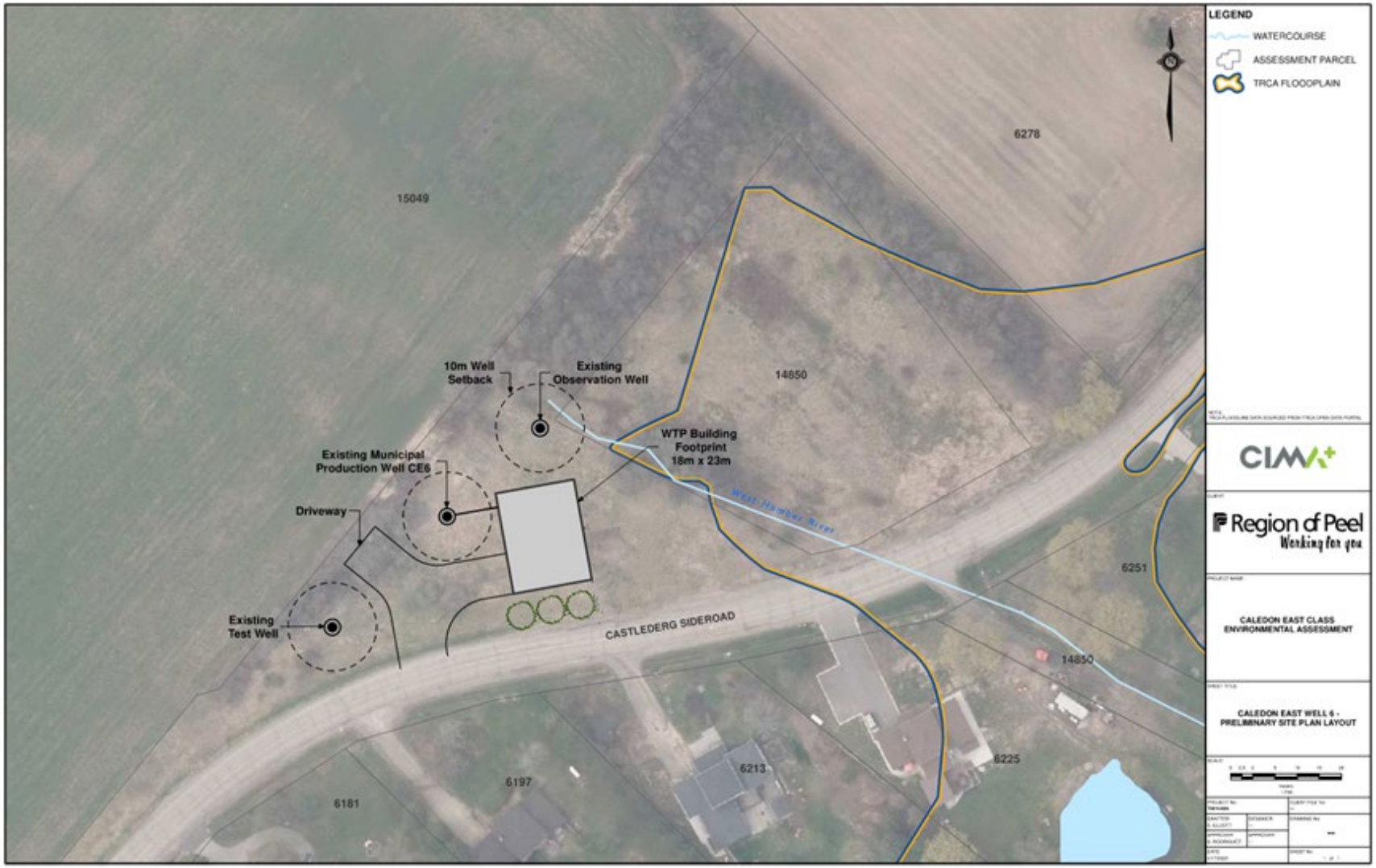

Figure 28: Conceptual Site Plan – New Water Treatment Plant on CE6 well site

17.2 Implementation Schedule

The implementation of the preferred design concept is anticipated to follow the timeline outlined in **Table 25**, contingent upon the property acquisition process, currently underway between the Region and the Town of Caledon.

Table 25: Proposed Implementation Schedule

Next Steps	Proposed Implementation Timeline
Detailed Design	2024/2025
Construction	2025

17.3 Permits and Approvals

Permits, approvals, and completion of additional studies, anticipated in association with the proposed works in Caledon East are shown in **Table 26**. Consultation with regulatory agencies will continue during the design stages of the project to confirm the need for any additional permits and/or approvals.

Table 26: Required Permits and Approvals

Approval Agency	Permit/Approval Required
Ministry of the Environment, Conservation and Parks (MECP)	• Amendment to Municipal Drinking Water Works Permit • Amendment to Municipal Drinking Water License
Town of Caledon	• Site Plan Approval • Building Permit • Road Occupancy Permits (ROP)
Toronto and Region Conservation Authority (TRCA)	• Required permits to be confirmed
Electrical Safety Authority (ESA)	• Approval for Emergency Standby Generator

18 Anticipated Potential Impacts and Mitigation Measures

18.1 Socio-Cultural

18.1.1 Archaeological Resources

Findings of the Stage 1 and Stage 2 Archaeological Assessments carried out as part of the study concluded that the project area is free from archaeological concerns. Consequently, the construction disturbance activities related to the Project within the project area are not expected to cause any archaeological impacts.

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, 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.

18.1.2 Built Heritage Resources and Cultural Heritage Landscapes

Golder (now a part of WSP) was retained as a sub-consultant to assess the built heritage resources and cultural heritage landscapes in support of the Class EA Study. WSP's findings and recommendations are documented in the "Cultural Heritage Report: Existing Conditions and Preliminary Impact Assessment" (dated February, 2023) and is attached in **Appendix S**.

The study identified five (5) built heritage resources (BHRs) and one (1) cultural heritage landscape (CHL) with known or potential cultural heritage value or interest

(CHVI) within the Study Area. However, the preliminary impact assessment determined that there would be no adverse impacts on the BHRs or CHL.

The Cultural Heritage Report includes the following mitigation recommendations:

- Staging and construction activities should be carefully located and planned to prevent any negative impacts on the identified BHRs and CHL.
- In case of future work that involves the expansion of the New Supplementary Water Supply Source for the Palgrave/Caledon East Drinking Water System Class EA Study Area, it is advisable to engage a qualified heritage consultant to assess the impacts of the proposed work on known or potential BHRs and CHLs.

18.1.3 Noise / Vibrations

Construction and operational activities associated with the new well, water treatment plant and feedermain may generate noise and vibrations, which could potentially affect the surrounding socio-cultural environment, including nearby residences.

Although a low impact from potential disturbances from operations and maintenance activities is anticipated, some temporary noise effects may occur due to construction traffic and equipment. The proposed mitigation measures include the following:

- Noise and Vibration Monitoring: Conduct regular monitoring of noise and vibration levels during construction and operation to ensure compliance with applicable noise regulations and guidelines. This monitoring should be carried out using appropriate equipment and methodologies.
- Noise Control Measures: Implement noise control measures, such as the use of noise barriers, equipment insulation, or mufflers, to minimize the potential impact of construction and operational noise on nearby receptors. These measures should be implemented in accordance with local noise control bylaws and regulations.
- Construction Scheduling: Schedule construction activities during daytime hours and avoid or minimize construction activities during sensitive periods, such as early mornings, evenings, and weekends, to minimize the disturbance caused by noise and vibrations.

18.1.4 Dust / Mud

Construction traffic and activities, particularly excavation and earthmoving, can generate dust and mud, which may cause nuisances to nearby residents and other receptors.

These nuisances may include reduced air quality, visual impacts, and increased risks of slips and falls. The proposed mitigation measures include the following:

- Dust and Mud Control Measures: Implement dust and mud control measures, such as water spraying, dust suppression techniques, and temporary sediment control measures, to minimize the generation and spread of dust and mud during construction activities. These measures should be applied in accordance with relevant regulations and guidelines.
- Construction Site Maintenance: Regularly clean and maintain the construction site to prevent the accumulation of dust and mud on public roads, sidewalks, and neighboring properties. This maintenance should include street sweeping, site drainage management, and prompt removal of excess mud or dirt.
- Public Communication: Inform nearby residents and businesses about the construction activities and associated dust and mud control measures through public notifications, signage, or community meetings. This communication will help manage expectations and address any concerns raised by the local community.

18.1.5 Traffic

The project entails the installation of a 1km-long feedermain to connect the new CE6 water treatment plant with the existing Caledon East distribution system on Airport Road. The selected route for the feedermain follows low traffic volume sections on Castlederg Road and Airport Road, minimizing disruptions as it will be primarily installed using trenchless methods. Furthermore, the proposed works are situated outside of the future Castlederg Sideroad right of way (ROW) of 26m and there will be only one driveway access point to the site. Safety and sightline impacts of the proposed driveway will be considered in the detailed design, with consultation from Town Engineering prior to finalizing the driveway location. All necessary mitigation measures, including signage on Castlederg Road, will be addressed.

The increased construction activities may lead to higher traffic volume and congestion in the project area. Short-term construction impacts will be experienced by few residential houses located across the CE6 well site. The construction phase will result in increased truck traffic on Castlederg Road and Airport Road for the delivery of construction equipment, materials, and potentially the removal of excavated material from the site. This has the potential to disrupt regular traffic patterns and impact the safety and convenience of road users. Proposed mitigation measures include the following:

- Traffic Management: This includes measures such as temporary traffic control signage, road closures, detour routes, and coordination with local authorities and

emergency services. Any lane closures will be completed in accordance with best practices to protect safety to the workers and to the general public. All standard best practices for vehicle and pedestrian safety will be employed throughout the construction areas. All construction will adhere to strict safety guidelines.

- Construction Phasing: Plan and schedule construction activities in phases to minimize traffic disruptions and ensure the smooth flow of vehicles. Consider implementing off-peak construction hours or alternate routes to further reduce impacts on traffic congestion.
- Public Awareness: Communicate the construction schedule, traffic management plan, and any potential disruptions to the local community through various channels, such as website postings, social media updates, and local news outlets. Encourage the use of alternative transportation modes where possible and provide clear directions to minimize inconvenience for road users.

18.1.6 Visual Impacts

The construction of a new water treatment plant may have potential impacts on plant architectural aesthetics, particularly concerning the visual appearance to neighboring areas. To address this, measures will focus on ensuring the plant's architectural aesthetics blend well with the surroundings. Mitigation efforts will include incorporating design elements that harmonize with the existing landscape and utilizing screening and landscaping measures such as trees, shrubs, or fencing to minimize visual impact. Visual impacts of the proposed driveway will be considered in the detailed design, with consultation from Town Engineering.

18.2 Disturbance to Natural Environmental Features

A detailed assessment of potential impacts and mitigation measures to the natural environmental features can be found in the Natural Environment Report, WSP Canada, January 2023, attached in **Appendix G**. Key points have been summarized below:

- The ROW Cultural Meadow (Vegetation Unit 1) and the Caledon East 6 Municipal Supply Well property (Vegetation Unit 4) were identified as Candidate and Confirmed Significant Wildlife Habitat SWH.
- Species such as Monarch and Yellow-banded Bumblebees, Barn Swallows, Red-headed Woodpeckers, and Short-eared Owls, which serve as foraging visitants, are not expected to experience direct and substantial impacts.

- The project may cause minor and temporary disruptions to foraging habitats for these species, with subsequent restoration post-construction.
- Eastern Ribbonsnake, while lacking potential suitable habitat on the project site, may traverse Airport Road to access the Mono Road Wetland Complex, posing potential risks if they enter the construction zone.
- Snapping Turtle, although lacking on-site habitat, may cross Airport Road while moving between wetland habitats, making them susceptible to the construction activities.

To address these considerations, the following mitigation measures are recommended:

- General Best Management Practices: These include re-stabilizing and re-vegetating exposed surfaces, appropriate vegetation clearing techniques, proper disposal of cut and grubbed material, equipment cleaning to prevent invasive species spread, and the use of standard practices like sediment and erosion controls.
- Migratory Birds: Measures to protect nesting migratory birds include avoiding vegetation removal during nesting season unless preceded by a nesting survey, installing buffers around active nests, and avoiding disturbance of active nests.
- Reptiles: Prior to work each day, the Contractor should examine the construction areas to ensure no SAR turtles or snakes have entered the construction zone. Nesting turtles should not be disturbed, and nests should be protected and relocated if necessary. Mesh or netting stabilization materials that could entangle wildlife should be avoided.
- Significant Wildlife Habitat: Disturbed areas should be re-vegetated with native seed mix to enhance Monarch and Yellow-banded Bumblebee habitat. All disturbed areas will be restored to pre-construction conditions.

With the implementation of these mitigation measures, it is expected that there will be no negative impacts on significant natural features and functions in the Study Area. Additionally, new infrastructure will be built outside of TRCA floodplain area limits and appropriate setbacks will be maintained. Erosion and sediment control measures will be implemented to mitigate any impacts to surface water sources and the surrounding environment.

18.3 Geotechnical and Hydrogeological Conditions

The hydrogeological assessment conducted by Geo Kamp (July 2021), as discussed in Section 12.1.2 found no major concerns for the new well CE6 and pipeline construction,

with no significant interference expected with existing wells or surface water. Groundwater control during construction is not needed, and the construction avoids the sensitive Melt Water Aquifer Complex and floodplain areas.

The geotechnical study completed by Golder Associates Ltd (August 2021), as discussed in Section 12.1.3 also revealed favorable conditions, with no major roadblocks identified and suitable soil conditions for conventional construction. In summary, both assessments indicate positive conditions and minimal geotechnical and hydrogeological concerns in the study area.

18.4 Source Water Protection

18.4.1 Impacts on Existing Groundwater Users and Surface Water Features

The construction and testing of CE6 as part of the Well Construction Program in 2020 included an assessment of its impacts on existing groundwater users and surface water features, as discussed in Section 1.2.2. This assessment involved a 3-day constant rate pumping test, monitoring 23 groundwater and surface water stations, including 2 observation wells, 6 surface water locations, and 14 local domestic wells.

The identification of potential groundwater receptors near CE6 involved obtaining 67 water well records from the MECP database and conducting a door-to-door survey to confirm the location and details of private domestic wells within a 500m radius or anticipated zone of influence. This survey identified 14 domestic wells within the anticipated zone of influence, which were monitored before, during, and after the test pumping of CE6. The locations of these wells and monitored stations are depicted in **Figure 3** of the ESR.

Key findings from the impact assessment included:

- Most monitored wells in the vicinity of CE6 were shallow (less than 30m), with no drawdown observed at sustained pumping rates of 50 L/s.
- The cone of influence for CE6 within the Buried Bedrock Valley was approximately 6 km.
- Long-term impacts on existing groundwater users are not expected based on the conceptual understanding of the shallow and semi-confined to confined groundwater system.
- Surface water level monitoring at 6 locations including a pond, a Hand Auger Station, and the West Humber River indicated no influence from CE6 pumping on surface water features.

- Overall, the operation of CE6 is unlikely to significantly interfere with existing domestic wells or surface water features.

As noted above, long-term impacts to other groundwater and surface water features are not expected under the proposed pumping conditions for CE6. However, if an unacceptable impact is reported and believed to be caused directly from municipal water takings, a contingency plan, including the following key actions are recommended:

- Temporarily stall water takings at the well until it is proven that the unacceptable impact is unrelated to the operation of the well.
- Prepare a detailed report on the unacceptable impact, including information on the reporter, location and damages incurred.
- Validate the claims against the operation of the well using historical pumping test evaluations to assess the likelihood of the impact being a direct result of the well.
- If the impact is confirmed as a direct result of the well operation and affects groundwater quantity or quality in a private well, implement a plan to mitigate damages and prevent future occurrences.
- If the impact is confirmed and affects the natural functions of the surrounding ecosystem, establish a plan to mitigate further impacts to the ecosystem.
- If the impact is determined to be unrelated to the well's operation, reinstate the well, and resume pumping. Maintain a record of the impact report for three (3) years.

In addition to the pumping test of 2020, a hydrogeological assessment was conducted by GeoKamp Limited in 2021 to assess the potential routes considered in the study to connect CE6 to the existing Caledon East DWS. Based on the findings of the study, the construction of 1 km feedermain along Castlederg Sideroad and Airport Road is not expected to have impacts on surface water features since the feedermain avoids crossing any watercourses. The feedermain will be installed primarily through trenchless methods along Castlederg Road and Airport Road, and excavations during construction could be up to 5 m in depth. Dewatering challenges are not expected, and the route is expected to be relatively dry since it avoids the Caledon East Meltwater Channel.

It is recommended that private groundwater wells situated within 200 meters of the proposed infrastructure be inventoried and monitored both before and after construction to ensure the protection of local water resources.

In summary, the Project is not expected to affect the quantity or quality of groundwater or surface water features in the area and any conditions from WHPA policies will be included in the amended Municipal Drinking Water License.

18.4.2 Drinking Water Vulnerability Analysis and Threats Evaluation

As per the Clean Water Act, 2006, a drinking water threat is defined as an activity or condition that adversely affects or has the potential to adversely affect the quality or quantity of any water that is or may be used as a source of drinking water.

Ontario Regulation O. Reg. 287/07 under the 2006 Clean Water Act, has prescribed 22 threats for which policies must be written in areas where these threats could be significant. The following threats were identified to be associated with CE6:

- **Threat #2. The establishment, operation or maintenance of a system that collects, stores, transmits, treats, or disposes of sewage.**

  The sources for this threat are associated with existing residential land uses in the vicinity of the CE6 area. Specific actions related to septic systems governed under the Building Code Act and the Ontario Building Code, are to be implemented by the local Municipality. The responsible authority for policy implementation in this specific case is the Town, which addressed septic systems through the Town's Septic Re-inspection Program for on-site sewage disposal systems that discharge 10,000 litres and less.

- **Threat #3. The application of agricultural source material to land.**
- **Threat #4. The storage of agricultural source material.**
- **Threat #5. The management of agricultural source material.**
- **Threat #8. The application of commercial fertilizer to land.**
- **Threat #9. The handling and storage of commercial fertilizer.**
- **Threat #21. The use of land as livestock grazing or pasturing land, an outdoor confinement area or a farm-animal yard.**

  The Source Protection Updates for the Communities of Palgrave, Caledon East, and Caledon Village, completed by Aqua Insight, December 2022, included a review of all agricultural and non-agricultural Managed Land parcels within the WHPAs for CE6.

  The assessment targeted areas with a vulnerability score of 6 or higher, as defined in the 2021 Director's Technical Rules (MECP), indicating Moderate or Significant drinking water threats. For CE6, within WHPA-A (vulnerability score of 10) and WHPA-B (vulnerability score of 6), the analysis revealed that WHPA-A had 40% to 80% Managed Lands due to the presence of residential land uses, while WHPA-B had more than 80% Managed Lands. As shown in **Figure 29**, the land use type was predominantly classified as Agricultural Managed Lands, indicating the potential for

these lands to receive agricultural source material (ASM) or fertilizer. Residential areas were conservatively interpreted to have 80% pervious surface where fertilizer could be applied, in consistency with the Town of Caledon Official Plan.

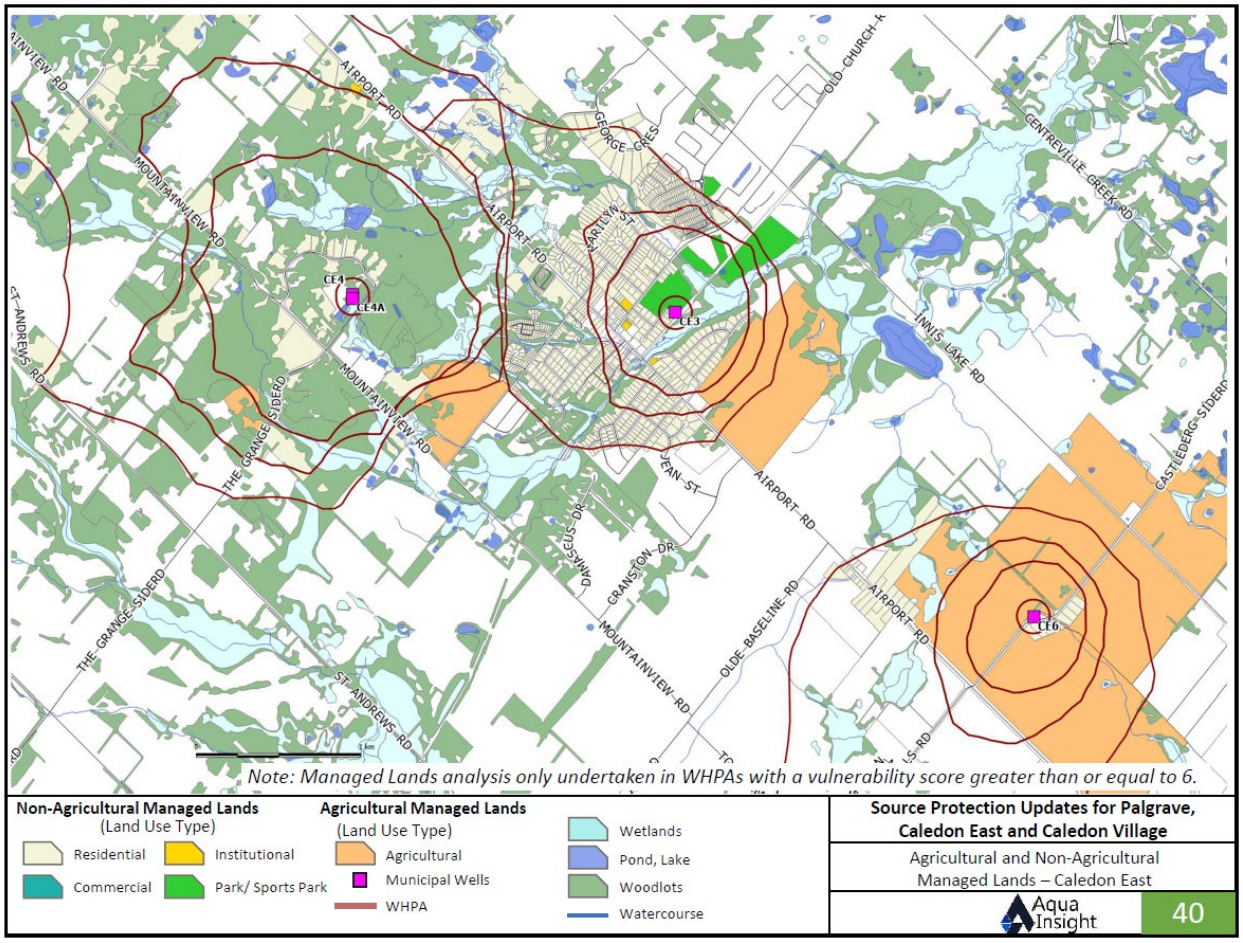

Figure 29: Managed Lands within CE6 WHPAs

In addition, Aqua Insight's assessment included mapping livestock density to understand water quality impacts related to the storage, generation, and application of agricultural source material. Livestock-related threats were evaluated based on nutrient units generated per acre. The analysis determined that WHPA-A had a livestock density less than 0.5 nutrient units per acre, which can be categorized as low potential threats as defined by the thresholds in the Technical Rules (MECP, 2021). Conversely, WHPA-B had a density ranging from 0.5 to 1.0 nutrient units per acre, categorizing it as a moderate potential threat.

Consequently, the Threats # 3, 4, 5, 8, 9 and 21 were identified to be potential threats associated with CE6.

- **Threat #10. The application of pesticide to land.**
- **Threat #11. The handling and storage of pesticide.**

  Before the initiation of the Region's 2019 Groundwater Exploration program, a comprehensive screening of the test drilling site for CE6 took place in 2014 to assess potential environmental risks. An Ecolog ERIS Ltd. search was conducted within a 600-meter radius of the proposed test drilling targets. The outcomes of this search, detailed in **Appendix U** of the report, identified three mappable records in the Pesticide Register related to the CE6 area (Site D). The reported presence of pesticides in proximity to CE6 was likely associated with the Glen Echo Nursery.

  Although the nursery itself does not fall within the WHPA-A and WHPA-B designations for CE6, Threats #10 and #11 were recognized for CE6 based on this information.

- **Threat #12. The application of road salt.**
- **Threat #13. The handling and storage of road salt.**

  The Source Protection Updates for the Communities of Palgrave, Caledon East, and Caledon Village, completed by Aqua Insight, December 2022, included an assessment of the potential threats related to winter road salt application. Consideration to the percentage of impervious surface area (e.g., roads, parking lots) was part of the impervious cover assessment exercise. Within the Caledon East area, road salt application on all roads within the WHPAs were classified as Low Drinking Water Threats, using the Circumstance Tables in the Technical Rules (MECP, 2021). The report Source Protection Updates for the Communities of Palgrave, Caledon East, and Caledon Village by Aqua Insight (December 2022) has been attached as **Appendix I**.

  Recent feedback received from the MECP revealed that storage of road salt could become a significant threat based on how it is stored and regardless of the percentage of impervious surface area. The following policies in the CTC Source Protection Plan apply to Low/Moderate drinking water threats related to the application, handling, and storage of road salt:

  - SAL-12: Encourages municipalities to mandate a salt management plan for unassumed roads and private parking lots exceeding 200 square meters in specified Wellhead Protection Areas (WHPAs) and Highly Vulnerable Areas (HVA), where road salt application poses a moderate or low drinking water threat. The plan should focus on minimizing salt usage through alternative measures while ensuring public safety, and it should involve the requirement

for trained individuals in road salt application, potentially including technicians, technologists, winter maintenance supervisors, patrollers, equipment operators, mechanics, and contract employees.

- SAL-13: Encourages municipalities to annually report sodium and chloride monitoring results to the Source Protection Authority in areas where the application, handling, and storage of road salt pose a moderate or low drinking water threat. The Source Protection Authority shall assess the information for trends and advise the Source Protection Committee on the need for development of new source protection plan policies to prevent potential drinking water issues.

The Region is implementing a winter maintenance pilot project with best management practices (BMPs) to minimize salt usage and its impact on municipal wells. BMPs include adhering to Site Plans for snow pile locations and salt instructions, removing snow before applying de-icing products, having Smart About Salt certified contractors, sweeping and removing excess salt or de-icing products, considering temperature and conditions before application, and requiring monthly tracking of salt usage at each well facility by contractors.

- ***Threat #15. The handling and storage of fuel***

  The handling and storage of fuel poses a potential threat for CE6, contingent upon the system configuration. The preferred recommended design concept, identified in this Class EA study and outlined in this report, proposes the construction of a new water treatment plant in the immediate vicinity of CE6. If an emergency standby diesel generator is considered for the new treatment plant, it would necessitate a fuel tank, making this threat relevant. Additionally, due to the presence of agricultural lands, heavy machinery and agricultural equipment powered by fuels like diesel pose a risk of fuel spills through accidental leaks or improper handling.

- ***Threat #16. The handling and storage of a dense non-aqueous phase liquid (DNAPL)***

  This threat has not been identified as a significant threat resulting from the operation of the CE6 system, following the proposed recommendations of the Class EA study. However, construction activities associated with the project may introduce potential temporary risks related to fuel and DNAPL. Heavy machinery and construction equipment, powered by fuels like diesel, pose a risk of fuel spills through accidental leaks or improper handling. Additionally, the use of DNAPLs, such as degreasers and industrial chemicals during construction, can contribute to soil and water

contamination. Stormwater runoff from construction sites may carry pollutants, including residues of fuel and DNAPL, into nearby water bodies.

To address potential risks during construction, the following mitigation measures are proposed:

- Implement erosion and sediment control measures to prevent contaminated runoff. This includes installing silt fences, sediment basins, and other Best Management Practices (BMPs) to minimize the transport of pollutants to water bodies.
- Conduct regular inspections of the construction site to identify and address potential sources of fuel spills and DNAPL contamination promptly.
- Implement monitoring programs to assess the quality of soil, groundwater, and surface water during and after construction to detect any signs of contamination.
- Implement proper storage and handling practices for fuel and chemicals used in construction to minimize the risk of spills. This includes ensuring equipment maintenance and proper disposal procedures for contaminated materials.
- Obtain all necessary permits for construction activities and promptly report incidents to relevant environmental authorities.
- Develop comprehensive spill response plans outlining procedures for containing and cleaning up fuel spills and DNAPL releases. This includes having appropriate spill response kits and equipment on-site.
- Ensure that construction personnel are adequately trained in spill response and emergency procedures. This includes understanding the hazards associated with fuel and DNAPL and knowing how to use personal protective equipment.

18.5 Climate Change

Construction/operation of a new well and treatment plant will result in additional energy requirements and greenhouse gas emissions due to heating, lighting, pumping/electrical requirements as well as O&M trucks and chemical delivery needs. In addition, the existing landscape of the area would need to be altered to accommodate new infrastructure.

Implementation of the following climate mitigation measures should be considered to reduce the long-term generation of carbon emissions arising mainly from operation of the new treatment facility and to enhance carbon storage due to proposed changes in the landscape:

- Construction equipment should be appropriately maintained to ensure that exhaust emissions meet industry standards.
- Use of energy efficiency features within the treatment facility such as LED lighting features and insulation to reduce the energy needs. Moreover, using energy-efficient pumps and equipment and optimizing system design would also contribute to the mitigation of climate change impacts.
- Chemical delivery is expected to be minimal; however, delivery could be scheduled on a monthly/bi-monthly basis in order to reduce the number of delivery trucks to/from the new reservoirs and new facilities.
- Implementation of an adequate landscape plan, comprising planting of new trees and local non-invasive vegetation species within the new site to contribute to carbon sinks.

19 Class EA Phase 4 – Conclusions and Recommendations of the Environmental Study Report

Through completion of a Municipal Class EA study, construction of a new water treatment plant in the vicinity of the new supplementary supply well CE6 and installation of a 1km long feedermain, primarily through trenchless methods along Castlederg Road and Airport Road, has been identified as the preferred recommended design concept for the new supplementary water supply source required to meet the long-term servicing needs of the serviced area. Individual assessments of the natural, socio-cultural, technical environments were conducted to inventory and evaluate the existing conditions of the project area.

No significant concerns were raised during the consultation process. Potential impacts associated with the implementation of the design concept were identified as well as available mitigation measures. Due to the nature of this project, some inevitable short-term effects in terms of dust, noise, and truck traffic will be felt around the construction areas and during construction only. However, potential social effects can be further reduced by implementation of mitigation measures outlined in this report. Therefore, no significant environmental, socio-cultural, archaeological or heritage resource impacts are anticipated because of this project.

The Region will continue the property acquisition process in direct consultation with the Town of Caledon to secure the new municipal site. It is recommended that the Region proceed with the detailed design and construction of the preferred design concept, as outlined in this report, subject to receiving the necessary approvals. This Environmental Study Report is being filed for a 30-day public review period. Given that no major objections or Section 16 Orders are received during the review period, the proposed works will proceed as planned.

20 References

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A

Appendix A: Groundwater Development Program, Village of Caledon East, Geo Kamp Limited, 2020

B

Appendix B: Well Construction Program, Caledon East Well No.6, Geo Kamp Limited, October 2020

C

Appendix C: Master Project Mailing List

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Appendix D: Project Notices

E

Appendix E: Public Consultation

F

Appendix F: Agency Consultation

G

Appendix G: Baseline Natural Features Report, Golder Associates Ltd., July 2021 & Natural Environment Report, Golder Associates Ltd., January 2023

H

Appendix H: Hydrogeologic Assessment Report, Geo Kamp Ltd., July 2021

Appendix I: Source Protection Updates for the Communities of Palgrave, Caledon East and Caledon Village, Aqua Insight Inc., December 2022

J

Appendix J: Stage 1 Archaeological Assessment Report, Golder Associates Ltd., July 2021

K

Appendix K: Stage 1 and 2 Archaeological Assessment Report, Golder Associates Ltd., February 2023

L

Appendix L: Indigenous Communities Consultation

M

Appendix M: Geotechnical Desktop Study, Golder Associates Ltd., November 2021

N

Appendix N: Traffic Assessment Report, CIMA+, May 2021

O

Appendix O: Contamination Overview Study, Golder Associates Ltd., April 2021

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Appendix P: Comparative Evaluation Matrix – Alternative Solutions

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Appendix Q: Cost Estimates

R

Appendix R: Phase One Environmental Site Assessment. Golder Associated Ltd., February 2023

S

Appendix S: Cultural Heritage Report: Existing Conditions and Preliminary Impact Assessment, Golder Associated Ltd., February 2023

T

Appendix T: Detailed Evaluation Matrix – Alternative Design Concepts

U

Appendix U: Ecolog ERIS Reports, Groundwater Development Program, Volume 2, Geo Kamp Ltd, November 2014


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