Tribute (Colgan) Limited

Colgan Community Wastewater Treatment Plant and Outfall

Schedule C Class Environmental Assessment Study, Phases 3 and 4

Environmental Study Report

Project Number
BRM-00605584-A0

exp Services Inc.
1595 Clark Blvd
Brampton, ON L6T 4V1
Canada

Date Submitted
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Date Submitted:

October 31, 2018

Executive Summary

Introduction

Tribute Communities has initiated a Schedule C Class Environmental Assessment (EA) for the Community of Colgan Wastewater Treatment Plant, Forcemain and Outfall (Wastewater System). The Wastewater System will be designed to serve a new development in the Hamlet of Colgan (Colgan Development) that has been draft approved by the OMB, as well as allow for future development and existing residences in the area.

This Class EA builds upon part of the 2016 Colgan Master Servicing Plan (MSP) Amendment (completed by Greenland Engineering for the Township of Adjala-Tosorontio), which identified a new wastewater treatment plant, forcemain and outfall as the preferred solution for servicing the wastewater needs of the development.

This Class EA was carried out following the Schedule 'C' planning process of the Municipal Class EA (October 2000 as amended in 2007, 2011 & 2015), as approved under the Environmental Assessment Act (EA Act) R.S.O. 1990, Chapter E.18. The process for Schedule 'C' projects is completed over four phases:

- Phase 1: Problem/Opportunity Statement;
- Phase 2: Alternative Solutions;
- Phase 3: Alternative Design Concepts; and
- Phase 4: Environmental Study Report.

Phases 1 and 2 of this Class EA were addressed through the Colgan MSP Amendment, while Phases 3 and 4 were completed by **exp** Services Inc.

Schedule C projects are required to file an Environmental Study Report (ESR), which documents the planning, decision making process, and consultation practices that lead to the preferred design concept for the preferred solution. This ESR also identifies proposed mitigation measures to minimize or eliminate potential environmental impacts.

This Class EA was initiated in May 2016 and was completed Summer 2018.

Problem / Opportunity Statement

The 2016 MSP Amendment had the following Problem/Opportunity Statement:

- "The Objective of the Colgan Master Servicing Plan Class EA Amendment is to identify and select preferred alternative water supply and storage and wastewater collection, treatment and disposal servicing strategies for the Community of Colgan's anticipated 20-year approved development which minimizes impacts to both the natural and social environments and are both technically feasible and economically sensible."

The updated problem/opportunity statement for this Schedule 'C' Class EA, based on the preferred wastewater treatment and discharge alternative identified in the Amended MSP (Greenland, 2016) is as follows:

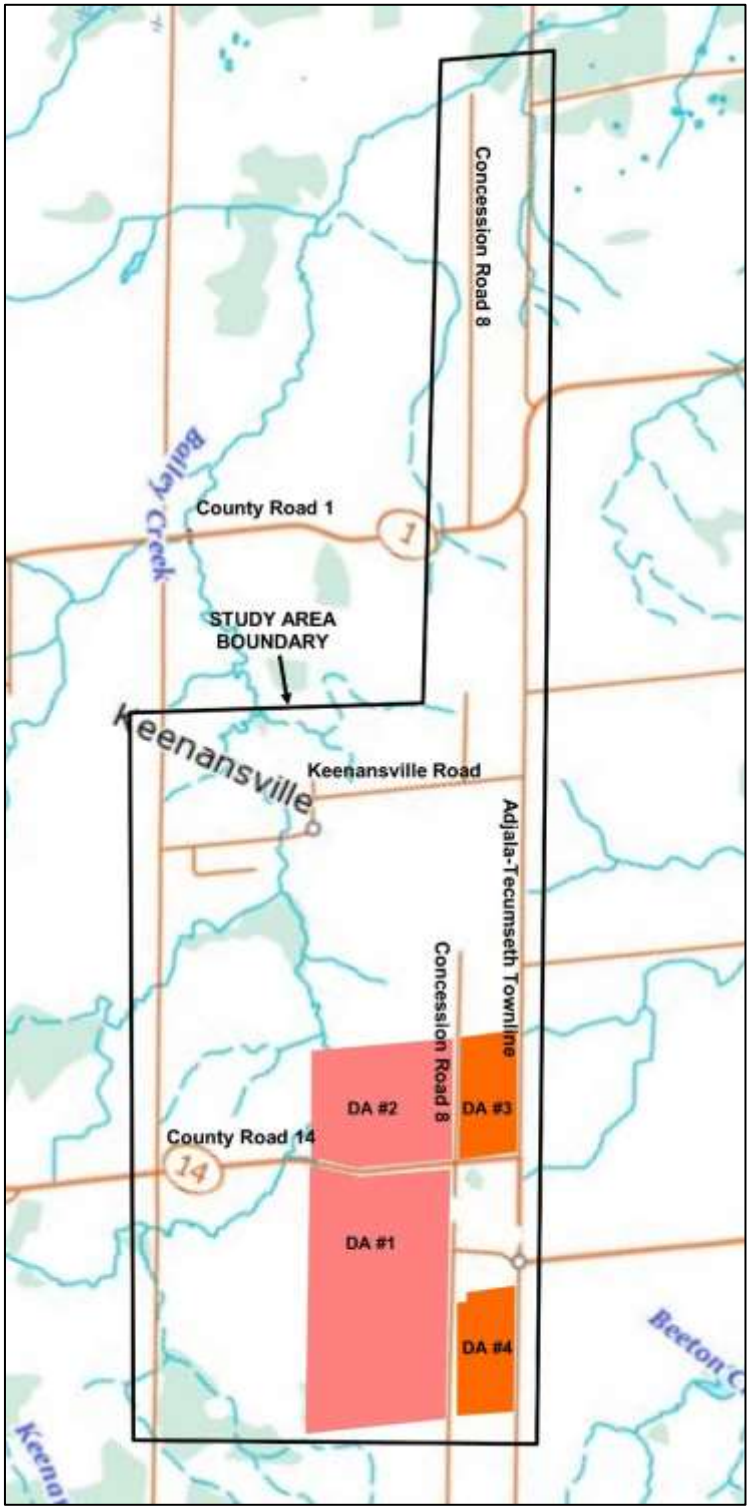
The objective of this study is to identify and select a preferred design concept for the identified preferred wastewater treatment and disposal strategy for the 20-year development horizon.

Project Study Area

The Hamlet of Colgan is a small, rural community within the Township of Adjala-Tosorontio, in the County of Simcoe. Within the Hamlet of Colgan, the 2010 MSP identified four undeveloped land parcels having a total area of approximately 155 ha. Development Areas 1 and 2 are approved for development within the 20-year planning horizon and are the basis for this Class EA project; Development Areas 3 and 4 are deemed to be in the future (timeline has yet to be set) and are not part of this Class EA project. The project study area is depicted in Figure ES-1.

At the start of this Class EA (Phase 3), the northern boundary of the project study area did not extend north further than roughly 400 m north of Keenansville Road. However, it was extended north along Concession Road 8 and Adjala-Tecumseth Townline to Bailey Creek to encompass an alternative outfall location introduced during the Class EA process. This revised study area was presented to the public and agencies during an additional PIC that was advertised and held in April 2018.

Figure ES-1: Project Study Area



Projected Wastewater Servicing Demands

The projected wastewater servicing demand for the 20-year development horizon is 689 m^3/day, with development planned for Development Areas 1 and 2. It is noted that Development Areas 1 and 2 have been draft approved by the OMB subject to the availability of servicing. A red-line revised draft plan was endorsed by Township Council on June 14, 2018 through By-law 18-41. Official Plan Amendment 20 for the revised draft plan was approved by Simcoe County on September 26, 2018[1].

Projected sanitary flows for the 20-year development horizon are contained in the following table.

Table ES-1: Projected Sanitary Flow – 20-year Development Horizon

Parcel	RUs	Pop./RU	Pop.	Per capita domestic flow(2) (L/c/d)	Infiltration (L/c/d)	Avg. sanitary flow (m^3/d)	Peak sanitary flow(4) (m^3/d)
1	315	2.67	841	270	90	303	-
2	329(1)	2.67	878	270	90	316	-
3	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
Existing	87	2.67	232	210(3)	90	70	-
Total	**731**	**2.67**	**1952**	**263(4)**	**90**	**689**	**2017**

Reference: Adapted from Greenland, 2016, Table 2-5.

While the above values apply for the 20-year horizon, the proposed design would allow for future expansion to service all four parcels as well as the existing development. In this condition, the ultimate development scenario, the total average sanitary flow would be 996 m^3/d. This is outlined in the following table.

Table ES-2 Projected Sanitary Flow – Ultimate Development Scenario

Parcel	RUs (ultimate)	Pop./RU	Pop.	Per capita domestic flow (L/c/d)	Infiltration (L/c/d)	Avg. sanitary flow (m^3/d)	Peak sanitary flow(2) (m^3/d)
1	315	2.67	841	270	90	303	-
2	499(1)	2.67	1332	270	90	480	-
3	90	2.67	240	270	90	87	-
4	45	2.67	120	270	90	43	-
Existing	87	2.67	232	270	90	84	-
Total	**1036**	**2.67**	**2,766**	**270**	**90**	**996**	**2,841**

Reference: Adapted from Greenland, 2016, Table 2-5.

[1] Simcoe County. *Committee of the Whole Resolution CCW 2018-471*. September 25, 2018.

Proposed Effluent Limits and Objectives

The proposed effluent requirements for the proposed project are strict and have been reviewed by Ministry of the Environment, Conservation and Parks (MECP) and Nottawasaga Valley Conservation Authority (NVCA). They will minimize the potential for environmental impact from the proposed WWTP. The limits and objectives will be confirmed during the detailed design and Environmental Compliance Approval (ECA) process that is undertaken following completion of the Class EA process. The proposed effluent limits and objectives below are based on the Assimilative Capacity Feasibility Study (ACFS) and correspondence with MECP, and they will ensure that the WWTP discharge will not cause the waterbody receiver to exceed its PWQO values.

Table ES-3 Proposed Design Requirements (Influent Rating: 689 m^3/day)

Parameter	Proposed Effluent Limit *	Proposed Effluent Objective *
Total Phosphorus (TP)	0.07 mg/L P	0.05 mg/L P
Total Ammonia Nitrogen (TAN)	2.08 mg/L (May to October) 5.7 mg/L (November to April)	1.5 mg/L (May to October) 3.0 mg/L (November to April)
Fecal Coliform	100 CFU/100 mL	80 CFU/100 mL
Total Suspended Solids	25 mg/L	15 mg/L
Carbonaceous Biochemical Oxygen Demand ($_C$BOD5)	6 mg/L CBOD	5 mg/L

* To be confirmed during detailed design process and the Environmental Compliance Approval Process

Preferred WWTP and Outfall Site and Forcemain Route

Based on the evaluation described in this section, the preferred WWTP Site, Outfall Site and Forcemain Route include:

- WWTP Site #2 (North), located in Development Area #2; and
- Outfall Location #2 (located on Concession Road 8 at its intersection of Bailey Creek) and its associated forcemain route.

The preferred sites/route are depicted in the figure on the following page.

The preferred technology for the WWTP is a Membrane Bioreactor, with UV disinfection.

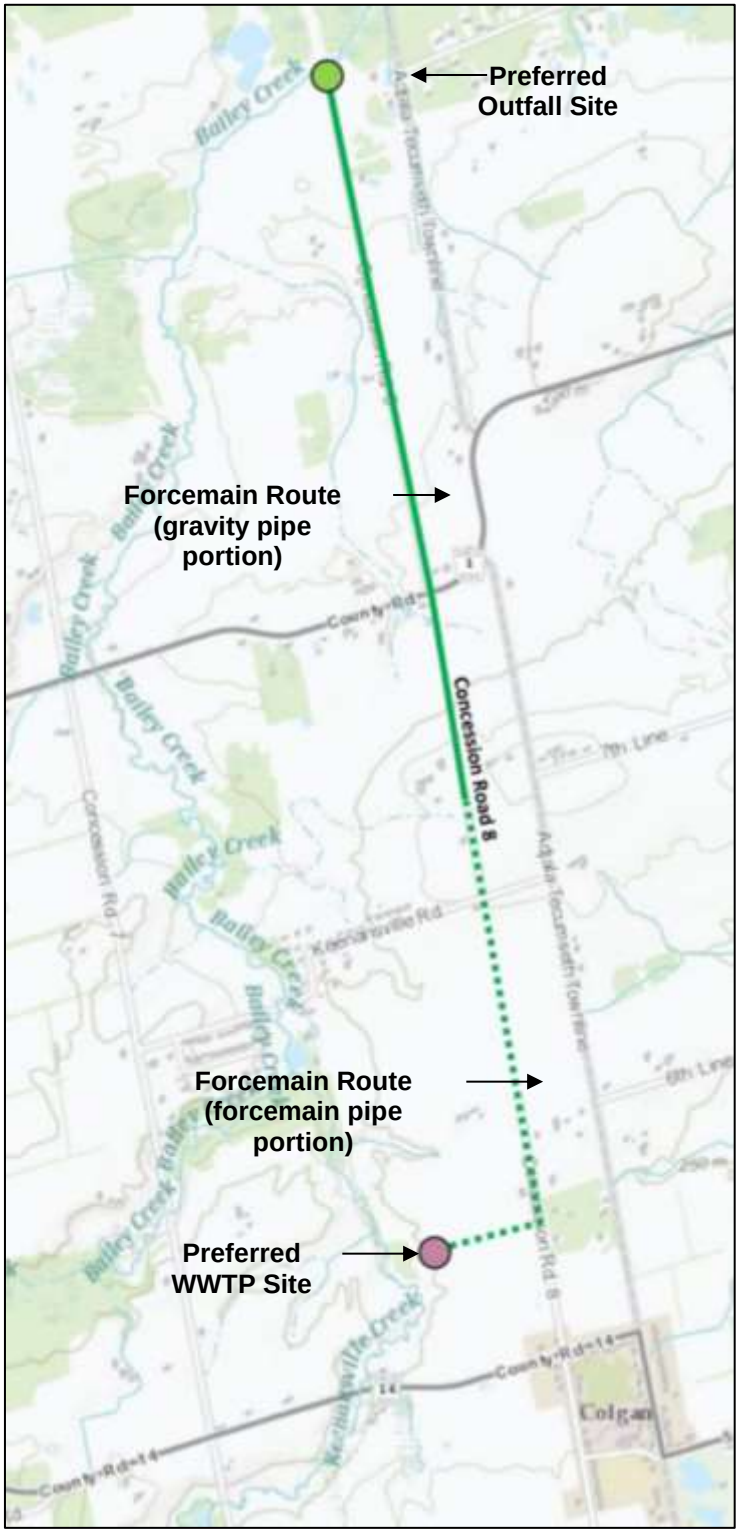
Stakeholder Consultation

Stakeholder (public and agency) consultation is an essential requirement and plays an important part in the Class EA process. This Class EA ensured that stakeholders were informed of the study and given the opportunity to provide input (both written and verbal) on the assessment and evaluation process and alternative designs for the wastewater treatment plant, forcemain and outfall. To achieve this, the minimum consultation requirements outlined in the Class EA process were exceeded. Key consultation events included:

- Public Information Centre #1 (June 20, 2017);
- Information Forum (September 27, 2017); and
- Public Information Centre #2 (April 11, 2018).

In addition, there was regular engagement with MECP and NVCA, including a meeting on October 18, 2016, telephone calls, written correspondence, and their review of the draft ESR. Notification of the study and opportunities for consultation were also provided to Indigenous communities.

Figure ES-2: Preferred WWTP Site, Outfall Site and Forcemain Route



Potential Impacts and Mitigation

The following tables summarize the potential impacts and mitigation measures for the construction and operation of the WWTP, forcemain and outfall.

Table ES-4: WWTP Potential Impacts and Mitigation

WWTP Potential Impacts	Mitigation Measures
Natural Environment	
Erosion and turbidity issues in Keenansville Creek due to construction activities	Develop and implement appropriate erosion and sediment control measures. Consult with NVCA during detailed design of WWTP. WWTP to be located within approved development limits. Erosion and sediment control plan to be included as part of the permit application with NVCA.
Disruption of Aquatic Wildlife in Keenansville Creek	Develop and implement appropriate erosion and sediment control measures
Disruption of Terrestrial Habitat	WWTP site is part of approved development for which a tree compensation plan is in place; construction of WWTP will not result in the removal of any additional trees Detailed design to consider protection of trees, where applicable
Disruption of Terrestrial Wildlife	WWTP construction to be scheduled outside of breeding season Minimize construction footprint during design and construction
Terrestrial Species at Risk (SAR)	Field investigations did not identify presence of Species at Risk (SAR) on the WWTP site If SAR are found within construction site, then construction will be paused, the SAR identified, and steps put in place to relocate or protect the SAR.
Impact on water quality and temperature of receiving water body (Bailey Creek)	Wastewater treated to very strict effluent limits Effluent limits, which will be reviewed by MECP and included in ECA, will ensure protection of the watercourse water quality Advanced wastewater treatment technology selected for WWTP Temperature of treated wastewater to be cooled through 5 km of underground conveyance from the WWTP to outfall

WWTP Potential Impacts	Mitigation Measures
Social Cultural	
Noise and dust nuisances from construction	Standard noise and dust suppression practices to be applied during construction Construction activities to be limited to municipally approved working hours (for construction) Restrict certain types of equipment on site and include the use of a "turn off engines while idle" protocol
Noise and odour nuisances from plant operations	WWTP components to be completely enclosed to minimize noise and odour issues WWTP to include filters or scrubbers to prevent odours from escaping WWTP property Odour levels from WWTP to be maintained below 1 odour unit at property line (as per MECP guidelines) Detailed design to further consider approaches for minimizing noise and odour nuisances from WWTP (e.g., placement of filter vents, noise-dampening construction materials, etc) WWTP will require ECA - Air and Noise to demonstrate that no off-site adverse effects will result from its operation
Noise and air impacts from stand-by power generator	Stand-by power generator to be housed within WWTP facility. Detailed design to consider additional approaches for minimizing noise from operation of stand-by power generator (e.g., noise-dampening construction materials, muffler, etc). NOx emissions to be minimized through appropriate sizing of generator. WWTP will require ECA - Air and Noise to demonstrate that no off-site adverse effects will result from its operation.
Disruption of archaeological resources	WWTP has been previously cleared of archaeological potential, therefore no impact to archaeological resources is anticipated. If any unknown archaeological resources are found during construction, then the construction activities will cease and licensed archaeologist will be brought on site to investigate the significance of the finds.
Disturbance from delivery vehicles or sludge collection trucks	Sludge trucks to visit WWTP approximately two times per week Sludge trucks to schedule visits to WWTP within normal daytime working hours WWTP design to minimize truck reversing on site

WWTP Potential Impacts	Mitigation Measures
Aesthetics / visibility of WWTP	Site to be designed to fit in community and be visually pleasing Architectural considerations to be included in detailed design Site design to include landscape features
Traffic disruption	Limit working hours and truck traffic Designate permitted truck routes
Economic	
Impact on Tax Base	Funding model for project to be developed in consultation with Township. Typically, capital and operating costs for new municipal wastewater infrastructure in Ontario funded through development charges or through the monthly user service fees.
Lower property value	Architectural and landscaping enhancements to minimize the negative impact of WWTP to local housing value Noise-causing and odour-generating aspects of WWTP to be housed within WWTP to minimize potential noise and odour impacts on community

Table ES-5: Forcemain Potential Impacts and Mitigation

Forcemain Potential Impacts	Mitigation Measures
Natural Environment	
Erosion and turbidity issues related to construction Disruption of Aquatic Wildlife in Keenansville Creek	Develop and implement appropriate erosion and sediment control measures where required Erosion and sediment control plan to be included as part of permit application with NVCA (along portion of forcemain within NVCA regulated area)
Disruption of Terrestrial Habitat	Forcemain alignment on Concession Road 8 to be maintained within road ROW Forcemain alignment within subdivision to be within its street network Detailed design to consider protection of trees
Disruption of Terrestrial Wildlife	Forcemain construction to be scheduled outside of breeding season where important habitat is impacted

Forcemain Potential Impacts	**Mitigation Measures**
Terrestrial Species at Risk (SAR)	Field investigations did not identify presence of Species at Risk (SAR) along forcemain route; however, residents have reported presence of snapping turtle. If SAR found within construction site, then construction will be paused, the SAR identified, and steps put in place to relocate or protect the SAR.
Social Cultural	
Noise and dust nuisances from construction	Standard noise and dust suppression practices to be applied during construction Construction activities to be limited to municipally approved working hours (for construction) Restrict certain types of equipment on site and include the use of a “turn off engines while idle” protocol
Disruption of archaeological resources	Forcemain route has been cleared of archaeological potential, therefore no impact to archaeological resources is anticipated in those sections. If any unknown archaeological resources are found during construction, then the construction activities will cease and licensed archaeologist will be brought on site to investigate the significance of the finds.
Traffic disruption	Limit working hours and truck traffic Designate permitted truck routes
Economic	
Impact on Tax Base	Funding model for project to be developed in consultation with Township. Typically, capital and operating costs for new municipal wastewater infrastructure in Ontario funded through development charges or through the monthly user service fees.

Table ES-6: Outfall Potential Impacts and Mitigation

Outfall Potential Impacts	Mitigation Measures
Natural Environment	
Erosion and turbidity issues in Bailey Creek due to construction activities Disruption of Aquatic Wildlife in Bailey Creek	Develop and implement appropriate erosion and sediment control measures for construction and design (to be prepared in consultation with NVCA) Erosion and sediment control plan to be included as part of permit application with NVCA Natural heritage investigations to continue during detailed design to confirm aquatic habitat NVCA to be consulted during detailed design of outfall
Disruption of Terrestrial Habitat	Outfall to be constructed within road ROW Detailed design to consider protection of trees and important habitat NVCA to be consulted during detailed design of outfall
Disruption of Terrestrial / Aquatic Wildlife	Outfall to be constructed within road ROW Detailed design to minimize or eliminate in-creek construction activities Outfall construction to be scheduled outside of breeding season Design and construction activities to minimize construction footprint at site Natural heritage investigations to continue during detailed design to confirm aquatic habitat Outfall design to include erosion control and slope stability attributes NVCA to be consulted during detailed design of outfall
Terrestrial and Aquatic Species at Risk (SAR)	Field investigations did not identify presence of terrestrial SAR at the outfall site. In-stream natural heritage investigations to be completed during detailed design to identify aquatic species within watercourse, including SAR. Detailed design to minimize or eliminate in-creek construction activities and construction timing windows will ensure protection of any aquatic SAR observed in watercourse.

Outfall Potential Impacts	**Mitigation Measures**
Social Cultural	
Noise and dust nuisances from construction	Standard noise and dust suppression practices to be applied during construction Construction activities to be limited to municipally approved working hours (for construction) Restrict certain types of equipment on site and include the use of equipment Implement a “turn off engines while idle” protocol
Noise and odour from plant operations	No odour or noise emissions expected from outfall.
Disruption of archaeological resources	The outfall location has been cleared of archaeological potential, therefore no impact to archaeological resources is anticipated. If any unknown archaeological resources are found during construction, then the construction activities will cease and licensed archaeologist will be brought on site to investigate the significance of the finds.
Traffic disruption	Limit working hours and truck traffic
Economic	
Impact on Tax Base	Funding model for project to be developed in consultation with Township. Typically, capital and operating costs for new municipal wastewater infrastructure in Ontario funded through development charges or through the monthly user service fees.

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1 INTRODUCTION

1.1 Overview

Tribute Communities has initiated a Schedule C Class Environmental Assessment (EA) for the Community of Colgan Wastewater Treatment Plant, Forcemain and Outfall (Wastewater System). The Wastewater System will be designed to serve a new development in the Hamlet of Colgan (Colgan Development) that has been draft approved by the OMB, as well as allow for future development and existing residences in the area.

This Class EA builds upon part of the 2016 Colgan Master Servicing Plan (MSP) Amendment (completed by Greenland Engineering for the Township of Adjala-Tosorontio), which identified a new wastewater treatment plant, forcemain and outfall as the preferred solution for servicing the wastewater needs of the development.

This Class EA was carried out following the Schedule 'C' planning process of the Municipal Class EA (October 2000, as amended in 2007, 2011 & 2015), as approved under the Environmental Assessment Act (EA Act) R.S.O. 1990, Chapter E.18. The process for Schedule 'C' projects is completed over four phases:

- Phase 1: Problem/Opportunity Statement;
- Phase 2: Alternative Solutions;
- Phase 3: Alternative Design Concepts; and
- Phase 4: Environmental Study Report.

Phases 1 and 2 of this Class EA were addressed through the Colgan MSP Amendment, while Phases 3 and 4 were completed by EXP Services Inc.

Schedule C projects are required to file an Environmental Study Report (ESR), which documents the planning, decision making process, and consultation practices that lead to the preferred design concept for the preferred solution. This ESR also identifies proposed mitigation measures to minimize or eliminate potential environmental impacts.

1.2 Purpose of the Project

The purpose of the project is to provide municipal wastewater servicing of the proposed Colgan development, including capacity for the existing development for potential future servicing.

Currently, the Hamlet of Colgan is not serviced by any centralized wastewater collection, treatment, or disposal infrastructure. For existing dwellings, these functions are performed onsite at each dwelling by subsurface septic systems. Existing dwellings include approximately 71 residential units (RUs) and a school (16 RU equivalence).

Four undeveloped land parcels were identified for development in the 2010 Master Servicing Plan (MSP) within the Study Area, which were confirmed through the 2016 MSP Amendment. Two Development Areas have been draft approved by the Ontario Municipal Board (OMB), and draft plans exist for their development.

1.2.1 Proponent

EXP Services Inc. (EXP) was retained by Tribute Communities to complete the Schedule 'C' Class EA for the proposed Colgan WWTP, including a surface water outfall. The following project team was involved in completing this Class EA:

Proponent	Tribute (Colgan) Limited 1815 Ironstone Manor, Unit 1 Pickering, Ontario L1W 3W9 Telephone: (905) 839-3500 Contact: Susan Zucchero, Senior Project Manager Land Development
Prime Consulting Engineer	exp Services Inc. 1595 Clarke Boulevard Brampton, ON L6T 4V1 Telephone: (905) 793-9800 Contact: Jean-Louis Gaudet Project Manager

A steering committee was also formed for the project to provide guidance to the project team and a high level of engagement with the Township and its engineering consultant. The committee included representatives from:

- Township of Adjala-Tosorontio;
- Tribute Communities;
- C.F. Crozier & Associates;
- Greenland Consulting Engineers;
- Jones Consulting; and
- exp Services Inc.

1.3 Class Environmental Assessment Process

All municipalities in Ontario are subject to the provisions of the Ontario Environmental Assessment Act (EAA) and its requirements to prepare a Class EA for applicable public works projects. These requirements can be met by following the Municipal Class EA Process as described by the Ontario Municipal Engineers Association's (MEA) Municipal Class Environmental Assessment document (2000, amended 2007, 2011 and 2015). The Municipal Class EA applies to a group or class of municipal water, wastewater and road projects that occur somewhat frequently and have relatively minor and predictable impacts.

Class EA projects fall into four schedules (i.e. categories) of undertakings depending on the extent of their potential impact. These include:

- Schedule A: Projects are limited in scale; have minimal environmental effects; include normal or emergency operational and maintenance activities; and are pre-approved;

- Schedule A+: Projects are pre-approved, but public is to be advised of project before implementation;
- Schedule B: Projects have the potential for some adverse environmental impacts, such as improvements and expansions to existing facilities, therefore a screening process involving mandatory consultation with potentially affected stakeholders is required;
- Schedule C: Projects have the potential for significant environmental effects, such as construction of new facilities or major expansions to existing facilities, and must proceed through the full Class EA planning process.

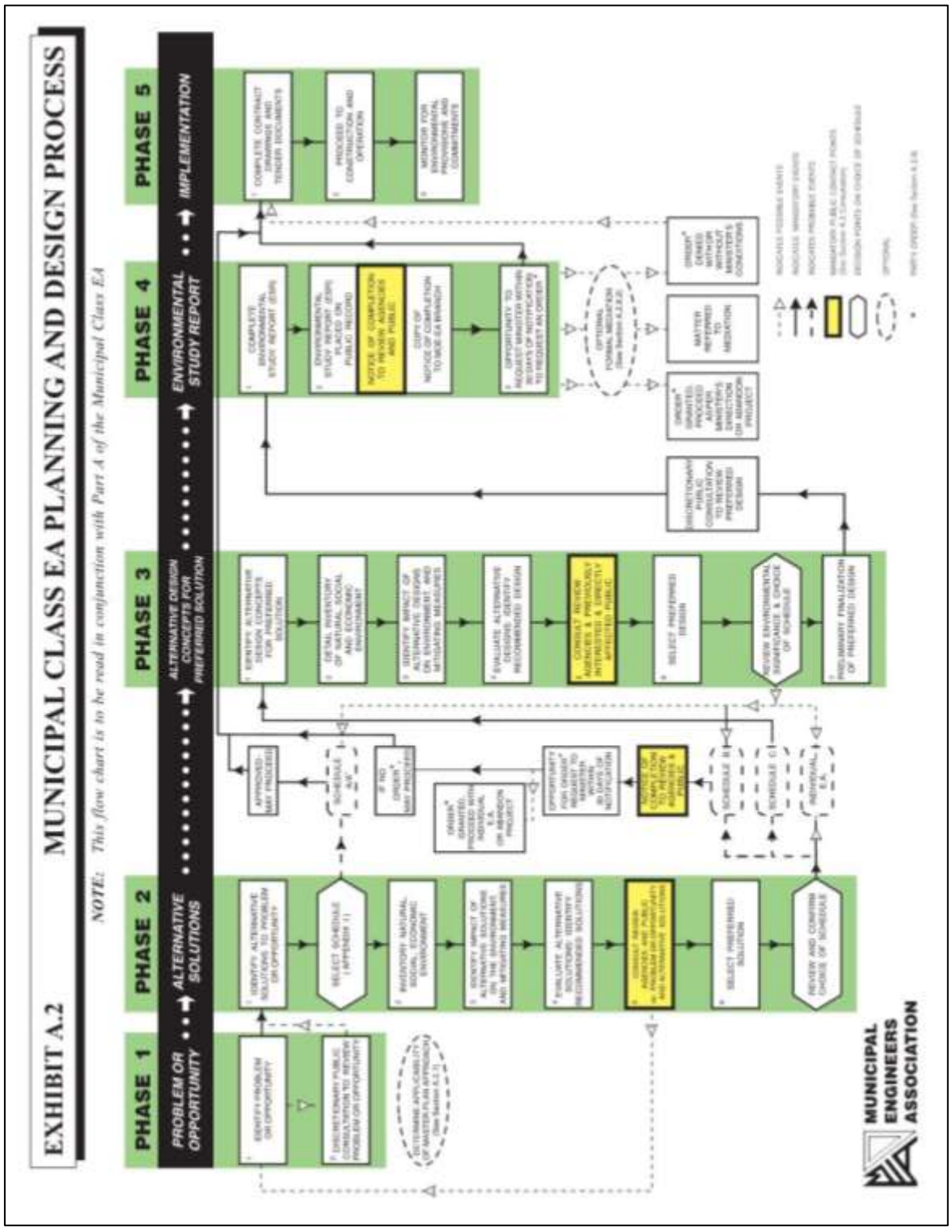
As the Colgan WWTP is a proposed new facility, it is classified as a Schedule C project. Class EA projects may have a public or private proponent. As the proponent for an applicable project, private sector developers must complete the Schedule C Class EA process. There are five phases to a Schedule C Class EA process. These include:

- **Phase 1: Identify the problem (deficiency) or opportunity:** Identify the problem or the opportunity that the Class EA is intended to address.
- **Phase 2: Identify and Evaluate Alternative Solutions:** Identify alternative solutions to the problem or opportunity by taking into consideration the existing environment and establish the preferred solution accounting for public and agency review and input. Document the planning process in a Municipal Class EA project file and make such documentation available for scrutiny by review agencies and the public.
- **Phase 3: Evaluation of Alternative Design Concepts:** Examine alternative methods of implementing the preferred solution based upon the existing environment, public and agency input, anticipated environmental effects, and methods of minimizing negative effects and maximizing positive effects.
- **Phase 4: Environmental Study Report (ESR):** Document, in an Environmental Study Report (ESR), a summary of the rationale and the planning, design and consultation process followed in the project and make such documentation available for scrutiny by review agencies and the public.
- **Phase 5: Implementation:** Complete contract drawings and documents, proceed to construction and operation and monitor construction for adherence to environmental provisions and commitments. Where special conditions dictate, also monitor the operation of the completed facilities.

Phases 1 and 2 were previously completed by the Township under the Master Servicing Plan Amendment Schedule ‘B’ Class EA (Greenland, 2016). Phases 3 and 4 were completed by **exp** Services Inc. on behalf of Tribute Communities. This ESR has been prepared to satisfy Phases 1 to 4 for the proposed Colgan Wastewater System

The following figure illustrates the Municipal Class EA process.

Figure 1: Municipal Class EA Process



1.4 Project Timeline

This Class EA was initiated in May 2016 and was completed Fall 2018. To assist the reader in navigating this ESR, the following table presents the timing of highlights from the Class EA.

Table 1: Key Project Milestones

Date	Milestone
January 2016	Master Servicing Plan Amendment (Phases 1 and 2) Notice of Completion filed • Location of WWTP and outfall included in MSP Amendment
Spring 2016	Wastewater Servicing Class EA (Phases 3 and 4) Initiated
Fall 2016 - Spring 2017	Identification and evaluation of alternatives: • Alternative WWTP location • Alternative forcemain routes to outfall location on Keenansville Road • Alternative WWTP treatment technologies • Alternative outfall designs
June 2017	Public Information Centre #1 (Phase 3) • WWTP location and forcemain route recommended • WWTP treatment technology recommended • Outfall design recommended
September 2017	Information Forum
Fall 2017	Request from Township to investigate possible alternative outfall location
Fall 2017 - Spring 2018	Alternative outfall location identified (Concession Road 8) and evaluated (including associated forcemain routes)
Spring 2018	Alternative outfall designs identified and evaluated (for Concession Road 8 location)
April 2018	Public Information Centre #2 • Alternative outfall location (Concession Road 8) and associated forcemain route recommended • Alternative outfall design recommended
July 2018	Draft ESR Circulated to MECP and NVCA for review and comment
November 2018	Notice of Completion Issued
November 2018	Environmental Study Record placed on public record

2 PROBLEM AND OPPORTUNITY STATEMENT

2.1 Problem and Opportunity Statement

The 2016 MSP Amendment had the following Problem/Opportunity Statement:

- "The Objective of the Colgan Master Servicing Plan Class EA Amendment is to identify and select preferred alternative water supply and storage and wastewater collection, treatment and disposal servicing strategies for the Community of Colgan's anticipated 20-year approved development which minimizes impacts to both the natural and social environments and are both technically feasible and economically sensible."

The updated problem/opportunity statement for this Schedule 'C' Class EA, based on the preferred wastewater treatment and discharge alternative identified in the Amended MSP (Greenland, 2016) is as follows:

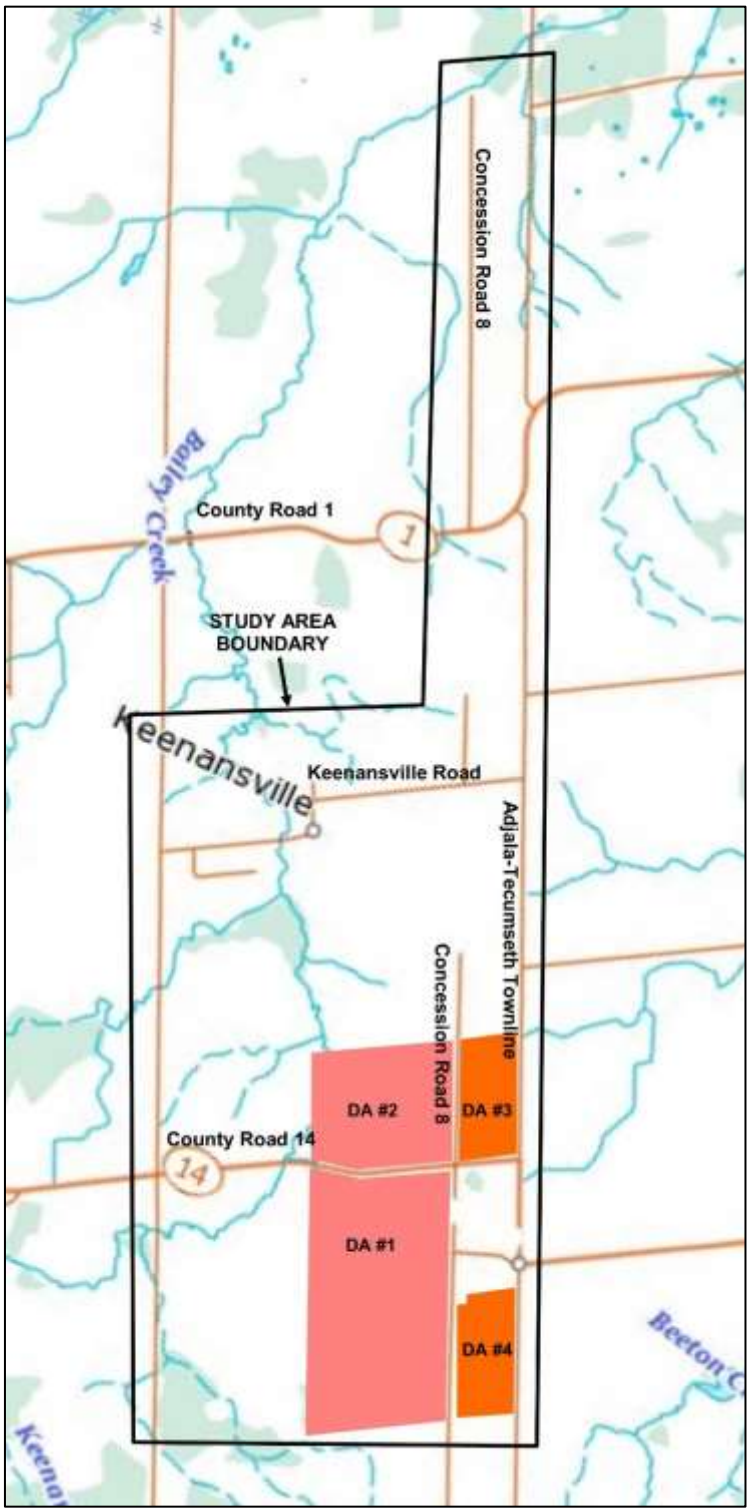
The objective of this study is to identify and select a preferred design concept for the identified preferred wastewater treatment and disposal strategy for the 20-year development horizon.

2.2 Project Study Area

The Hamlet of Colgan is a small, rural community within the Township of Adjala-Tosorontio, in the County of Simcoe. Within the Hamlet of Colgan, the 2010 MSP identified four undeveloped land parcels having a total area of approximately 155 ha. Development Areas 1 and 2 are approved for development within the 20-year planning horizon and are the basis for this Class EA project; Development Areas 3 and 4 are deemed to be in the future (timeline has yet to be set) and are not part of this Class EA project. The project study area is depicted in Figure 2.

At the start of this Class EA (Phase 3), the northern boundary of the project study area did not extend north further than roughly 400 m north of Keenansville Road. However, it was extended north along Concession Road 8 and Adjala-Tecumseth Townline to Bailey Creek to encompass an alternative outfall location introduced during the Class EA process. This revised study area was presented to the public and agencies during an additional PIC that was advertised and held in April 2018.

Figure 2: Project Study Area



3 PROJECT BACKGROUND

3.1 Colgan Master Servicing Plans

3.1.1 Colgan Master Servicing Plan (2010)

A Master Servicing Plan (MSP) was developed for the Community of Colgan, comprised of both water and wastewater servicing for Development Areas 1-4 (see Figure 2). The 2010 MSP identified a subsurface wastewater treatment facility, servicing all development within Colgan, as the preferred solution. The MSP ruled out a treatment and surface water disposal option on the basis that a detailed assimilative capacity study would be required to give it proper consideration. Accordingly, the (then) Ontario Ministry of the Environment[2] expressed concern that the surface water disposal option was not given fair consideration.

3.1.2 Colgan Master Servicing Plan Amendment (2016)

Accordingly, in early 2016 the Township completed a Schedule B Municipal Class EA process to amend the 2010 MSP (Greenland, 2016), in which a detailed Assimilative Capacity Study was completed to address the Ministry's recommendation and properly consider a surface water disposal option for Colgan. The 2016 MSP Amendment considered a variety of options for wastewater treatment and discharge, including:

- A large subsurface septic system;
- A new WWTP with surface water discharge at Bailey Creek;
- A new WWTP with surface water discharge at Keenansville Creek;
- Wastewater treatment at the Tottenham WWTP and discharge into Beeton Creek;
- Development-specific WWTP's (i.e., small scale WWTP's to service each development parcel);
- A new WWTP with discharge via spray irrigation;
- A new WWTP with subsurface disposal and seasonal surface water discharge;
- A new WWTP with subsurface/surface water disposal and water reclamation;
- A new WWTP with surface water discharge into Beeton Creek;
- A new WWTP with hybrid discharge of subsurface disposal and spray irrigation.

The MSP Amendment's evaluation identified the preferred wastewater solution to be a new WWTP with discharge to Bailey Creek at Keenansville Road with a limit of 0.05 mg/L total phosphorous. Phases 3 and 4 of a Schedule C Class EA remained outstanding for the design of the WWTP.

The MSP Amendment identified Development Areas 1 (south) and 2 (north) to be developed in accordance with a 20-year development horizon (with exception to a nursing home in Area 2), with the balance remaining to the ultimate development horizon. The Ontario Municipal Board had approved Areas 1 and 2 for development subject to available servicing. Areas 1 (south) and 2 (north) were owned by different entities at the time, the south section belonged to Tribute Communities. Subsequent to the OMB decision Tribute Communities has purchased both Development Areas 1 and 2.

[2] During the Schedule C Class EA, the Ministry was known as the Ministry of Environment and Climate Change (MOECC) and as of July 2018 the Ministry of the Environment, Conservation and Parks (MOECP).

4 Existing Conditions

4.1 Natural Environment

This section provides a summary of the natural heritage features within the project study area. The summary is based on the Natural Heritage investigations carried out under the Colgan MSP Amendment and the wastewater Class EA (Phases 3 and 4). The natural heritage investigations carried out for the wastewater Class EA are provided in Appendix A.

4.1.1 Aquatic and Terrestrial Environment

The study area does not contain designated sensitive area features, such as Provincially Significant Wetlands, Environmentally Significant Areas, or Area of Natural and Scientific Interest; however, the Concession Road 8 outfall location is located within a portion of the Bailey Creek ravine that is designated by the Simcoe County OP as Greenland, and the Keenansville Road outfall location is located within an area designated as Greenland Linkages. While the southern portion of the project study area is within the Oak Ridges Moraine (ORM), none of the project components are situated within it.

The terrestrial environment in the study area contains a mixture of deciduous shrub thicket, mixed woodland and agricultural lands.

Both alternative WWTP sites are located within agricultural settings, which include a mix of mostly agricultural land and some natural, tree-covered areas. The natural areas are associated with the local drainage system and low-lying depressions. Deciduous forests and coniferous plantations may be found along the sloping topography in the southern portion of the study area, adjacent to and part of the ORM. Both alternative WWTP sites are located partially within Nottawasaga Valley Conservation Authority (NVCA) regulated areas.

The MSP Amendment reports that soils in the area, notably the Schomberg Clay Plain and the ORM, consist of imperfectly drained silty clay loam, and well drained sandy loam. It is reported that the major soil types include Alliston sandy loam, Schomberg silty clay loam, Smithfield silty clay loam, Tioga sandy loam, and Bookton sandy loam. Beneath the soil layer of Simcoe County are rocks of the Ordivician, Silurian, and Precambrian ages, with limestone and shale also present.

With respect to the aquatic environment, both Keenansville Creek and Bailey Creek are located within the study area. They have exhibited poor aquatic habitat attributes and limited fisheries potential. While possessing degraded conditions, Keenansville Creek has been classified as a cold-water stream which provides habitat for Brook Trout. There are also multiple wetland communities within the study area, though within the applicable subwatershed of Innisfil Creek, wetland health is rated as fair.

As the entire main branch of Bailey Creek is broadly characterized as spawning/nursery habitat, it is assumed that this is a general characterization, with the actual fish spawning locations to be determined through further site-specific studies (during detailed design). The Keenansville Road outfall location was observed to contain riffle habitat (including watercress) that may be used by various species of fish during spawning, including Brook Trout.

4.1.2 Species at Risk

Based on data from the Natural Heritage Information Centre (NHIC) and consultation with agencies (i.e., MNRF and NVCA), there are four species at risk that have been recorded within the overall project study area, including:

- Bobolink (Dolichonyx oryzivorus);
- Eastern Meadowlark (Sturnella magna);
- Butternut (Juglans cinerea); and
- Common Snapping Turtle (Chelydra serpentine).

Two field assessments were undertaken to confirm whether these species are in the proposed WWTP, forcemain or outfall locations. Butternut trees were not observed in the study area during field visits in 2015 (in MSP) or 2016 and 2017. For the Bobolink and Eastern Meadowlark, an in-season field assessment and area search in May 2017 identified the alternative WWTP sites as undesirable habitat.

An in-season field assessment and area search in May 2017 at the alternative WWTP sites observed no Bobolink or Eastern Meadowlark birds within the properties, nor suitable habitat for them. Visual and audio siting of both bird species occurred in lands adjacent, indicating their presence in the area but preference for habitat other than that of the alternative WWTP locations.

The May 2017 field assessment also considered the potential for snapping turtle habitat along Concession Road 8 based on reported siting in the area from residents. During the field visit, it was determined that the assessed area along the Concession Road 8 forcemain route (within an area between County Road 14 and Keenansville Road) would not be a suitable nesting area for snapping turtle. While this does not suggest that snapping turtles would not be located beyond the road ROW, it indicates that snapping turtles would not likely be successfully nesting within the area assessed. Residents have noted the presence of snapping turtles near the Keenansville Road and Concession Road 8 alternative outfall locations; however, these have not been verified by the natural heritage team.

The Department of Fisheries and Oceans provides mapping data regarding the distribution of aquatic SAR. The SAR mapping for the Innisfil subwatershed reveals records of Northern Brook Lamprey (Ichthyomyzon fossor) at the downstream portion of Bailey Creek, located approximately 3.8 km downstream of the Concession Road 8 alternative outfall location. Northern Brook Lamprey is designated as Special Concern provincially and federally. While this location is outside of the project study area, it is not known if a barrier to fish movement is present between the alternative outfall location and the lamprey occupied reaches.

4.2 Surface Water and Ground Water

The study area is within the Innisfil Creek Subwatershed, which is reported to be the most degraded of the subwatersheds in the NVCA jurisdiction. Due to the intensive agriculture and lack of riparian cover, the watercourses within the study area, Keenansville Creek and tributaries to Bailey Creek (Camplin Branch), show characteristics of being “below-potential”. Brook trout make habitat within the Keenansville Creek, which is a coldwater stream.

Groundwater vulnerability in portions of Development Areas 1 and 2 is indicated by the low-lying areas and riparian zones where the water table is near the surface. Groundwater recharge is provided in the ORM area, as well as along the Keenansville and Bailey Creeks.

Portions of the Development Area 2 and segments of Bailey Creek are identified as Highly Vulnerable Aquifers.

Wetlands within the study area occur in the mentioned low-lying areas and floodplains, with swamps having a mix of deciduous and coniferous trees, cattails, and marsh grass. These wetlands are regulated by the NVCA under their Development, Interference with Wetlands and Alterations to Shorelines and Watercourses regulation. Upland to the wetlands are areas of mixed deciduous forests. Both the wetland and upland areas are part of a larger natural corridor, linking the ORM to the south and the Nottawasaga River to the northeast.

The Colgan MSP Amendment included an Assimilative Capacity Study (ACS) for the Keenansville, Beeton, and Bailey Creeks. The ACS (through an addendum) calculated the 7Q20 flow [3] for Bailey Creek near the Keenansville alternative outfall site to be about 126 L/s (10,900 m^3/day). The ACS also assessed the watercourse's water quality for Un-ionized ammonia (NH3), Dissolved oxygen (DO), and Total phosphorus (TP). Bailey Creek at Keenansville Road was found to be a Policy 1 receiver for NH3 and DO[4]. The ACS noted high ambient TP concentrations in the creeks and thus originally designated Bailey Creek as a Policy 2 receiver; however, this was reconsidered based on MECP feedback the ACS Addendum identified Bailey Creek at Keenansville Road a Policy 1 receiver.

An Assimilative Capacity Feasibility Study (ACFS) was prepared to assess the feasibility of the Concession Road 8 alternative outfall, from an assimilative capacity perspective (see Appendix B). The ACFS estimated that the 7Q20 flow for Bailey Creek at Concession Road 8 is about 112 L/s (9,680 m3/day). The water quality analysis in the ACFS indicates that Bailey Creek at Concession Road 8 is a Policy 1 Receiver for NH3, DO, and TP.

The ACFS also assessed the thermal condition of the watercourse near Concession Road 8. While the watercourse is classified as a coldwater stream, the temperature data indicates that water temperature is that of a warmwater stream.

4.3 Source Water Protection

Three municipal wells service the Colgan community. These wells are classified as "groundwater under the direct influence" (GUDI), and treatment is thus provided prior to distribution to the community. These wells are located approximately 1.5 km south of the study area, and their wellhead protection zones are located outside of the project study area.

The 2006 Clean Water Act (CWA) protects existing and future sources of municipal drinking water. Under CWA nineteen (19) Source Protection Regions were established. The Colgan WWTP, forcemain and Outfall is located within the South Georgian Bay Lake Simcoe (SGBLS) Source Protection Region. As such, the Approved Source Protection Plan (SPP) for this region was used in assessing key site-specific considerations as they relate to source water protection. Threats, if any, were to be identified as well as any resulting actions required.

Under the Clean Water Act, 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

[3] 7Q20 is a low-flow index used as the basic design flow for receiving watercourses for continuous point source discharges, where 7Q20 is the minimum 7-day flow equalled or exceeded on average 95% of the time, over a 20-year period.

[4] With reference to background water quality, the MECP applies two policies to receiving waters: Policy 1 and Policy 2. Policy 1 receivers have water quality better than the Provincial Water Quality Objectives, and water quality is to be maintained at or above the objective. Policy 2 receivers have water quality that does not meet the Provincial Water Quality Objectives and is not to be degraded further and all practical measures shall be taken to upgrade the water quality to the Objectives.

that is or may be used as a source of drinking water". Twenty-one prescribed threats are identified. Out of these, only one applies to the Colgan Project:

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

Under Threat #2, the specific category under consideration is:

> *2(b) - Wastewater treatment plants/sewer systems.*

The activities that specifically relate to this Class EA include:

- Sewage treatment plant effluent discharges (including lagoons); and
- Treatment plant tanks.

Under the SPP, Policy Number SEWG(b)-3 states that:

> *The future establishment, operation or maintenance of a sewage treatment plant, sewage treatment plant by-pass discharge to surface water, and sewage treatment plant effluent discharge (including lagoons) is prohibited where the activity would be a significant drinking water threat.*

As part of the CWA, vulnerable areas are delineated around surface water intakes and wellheads for every existing and planned municipal residential drinking water system that is located in a Source Protection Area. These vulnerable areas are known as a Wellhead Protection Areas (WHPAs) or surface water Intake Protection Zones (IPZs).

To assess the threat level of the WWTP and outfall, the applicable source water vulnerability scores were compared with the Tables of Drinking Water Threats from the *Clean Water Act, 2006*. Table 2 summarizes the type of vulnerability areas applicable for the WWTP and outfall locations and their associated vulnerability score.

Table 2: Source Waster Protection Vulnerability Scores near Project Components

	WWTP	Keenansville Outfall	Concession Road 8 Outfall
Wellhead Protection Areas (WHPA)	Not in WHPA	Not in WHPA	Not in WHPA
Intake Protection Zones (IPZ)	Not in IPZ	Not in IPZ	Not in IPZ
Highly Vulnerable Aquifers (HVA)	Site is Partially in HVA Vul. Score = 6 (1)	In HVA Vul. Score = 6	In HVA Vul. Score = 6
Significant Groundwater Recharge Areas (SGRA)	Not in SGRA	Not in SGRA	In SGRA Vul. Score = 6

(1) As per the 2017 Technical Rules under the Clean Water Act, all HVAs are assigned a vulnerability score of 6.

Based on the threat types and vulnerability scores noted above and a review of the Tables of Drinking Water Threats for circumstances where "the system is associated with a wastewater treatment facility that is designed to discharge treated sanitary sewage at an average daily rate that is more than 500 but not more than 2,500 cubic metres on an annual basis", there are no circumstances associated with this WWTP and outfall where the threat to drinking water is rated significant.

The greatest threat level raised is “low” and only under circumstances where a spill from the system may result in the presence of the following chemicals in groundwater or surface water:

- BTEX;
- Cadmium;
- Lead;
- Mercury;
- Nitrogen;
- Nitrosodimethylamine-N;
- Polychlorinated Biphenyls (PCBs);
- Trichloroethylene or another DNAPL that could degrade to Trichloroethylene; and
- Vinyl chloride.

Based on the nature of the proposed WWTP, the likelihood there would be the presence of any of these materials in the raw or treated wastewater is very minimal.

Figures 3 to 5 depict the locations of the WWTP site, the Keenansville Outfall location and the Concession Road 8 outfall location with respect to local wellhead protection areas, highly vulnerable aquifers, and significant groundwater recharge areas (there are no local intake protection zones). These maps obtained from Simcoe County are based on the MECP’s Source Water Protection Information Atlas and confirm that no WHPAs or IPZs are present in the study area.

Since there are also some areas of significant groundwater recharge and highly vulnerable aquifers within the study area, this will also be taken into account when completing detailed design and during construction for the WWTP, outfall and forcemain. Tribute Communities will continue consulting with NVCA during the detailed design and construction phases of the project.

Figure 3: Wellhead Protection Areas

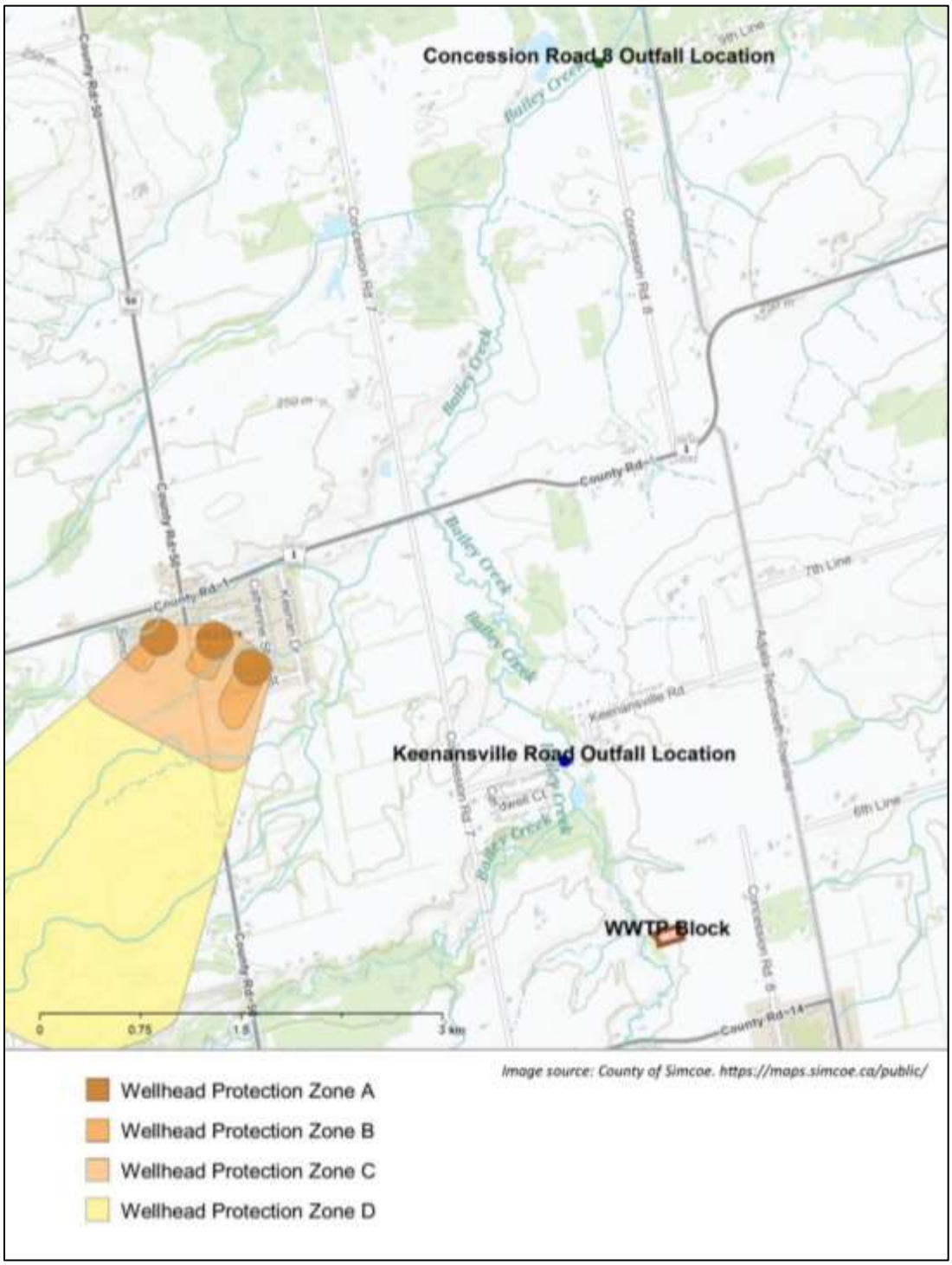


Figure 4: Highly Vulnerable Aquifers

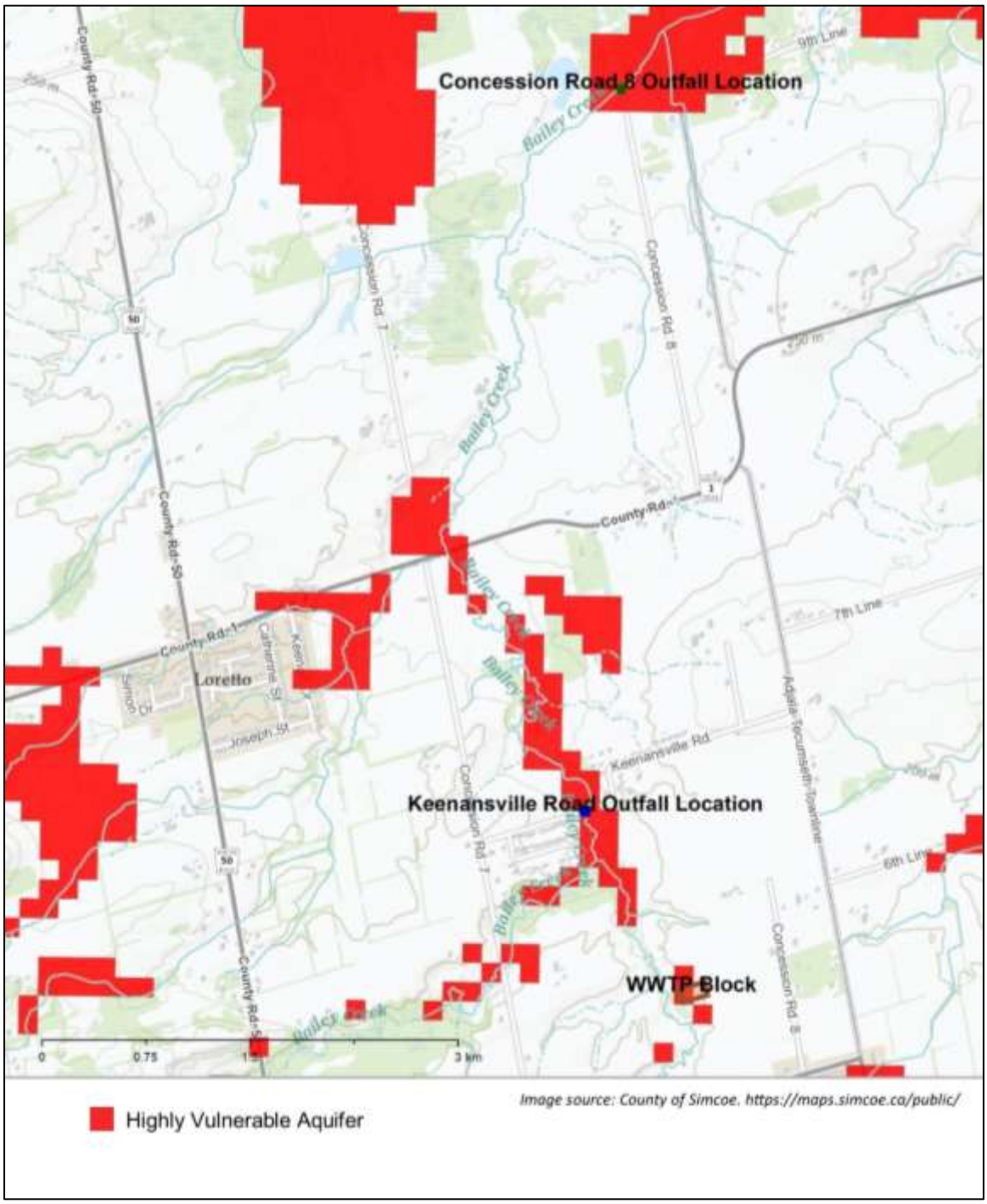
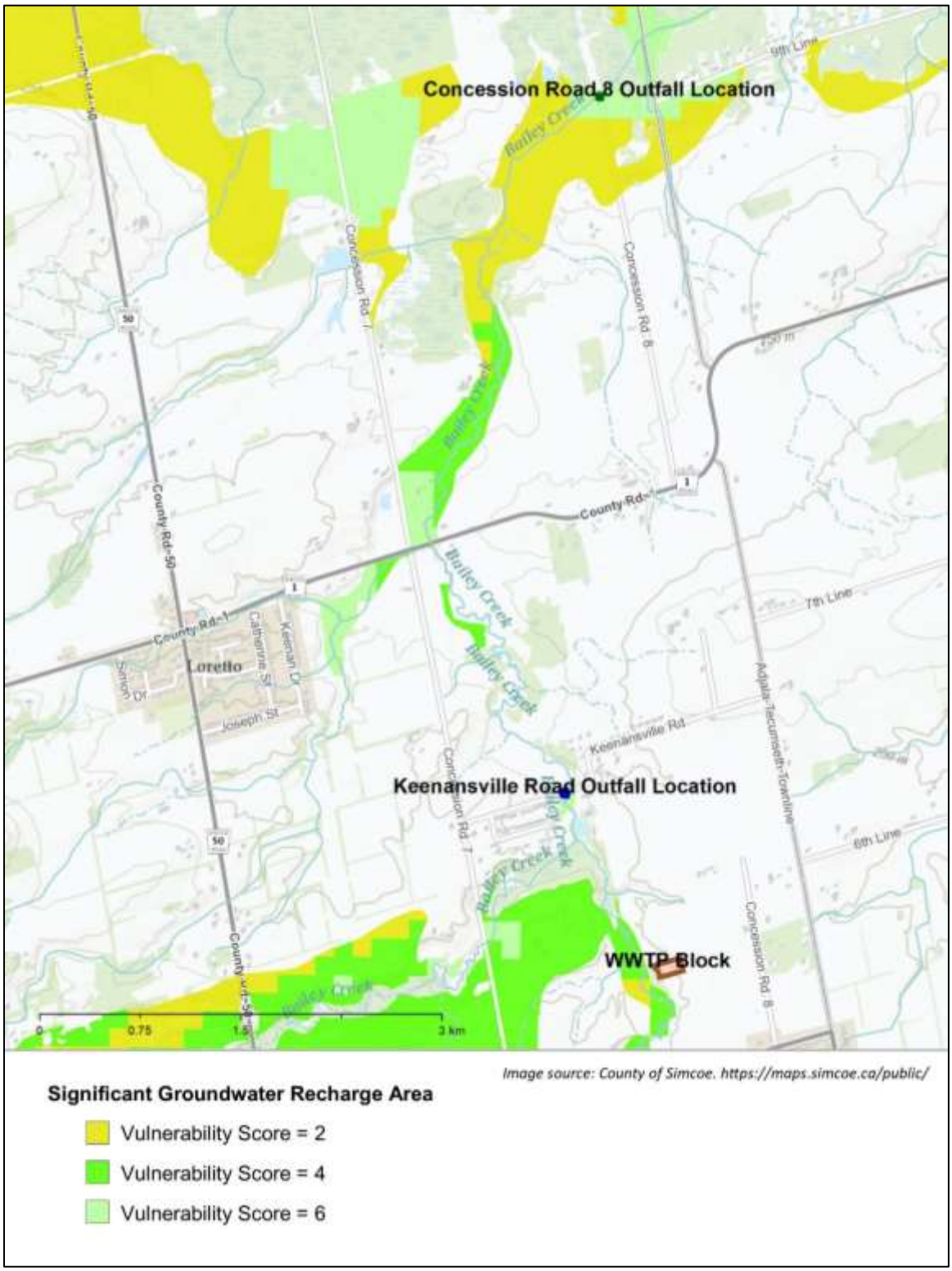


Figure 5: Significant Groundwater Recharge Areas



4.4 Archaeology

The Colgan MSP Amendment and Phases 3 and 4 have included Stage 1 and 2 Archaeological Assessments in areas where the project might have the potential for soil disturbance. The following is based on the results of the archaeological investigations:

- The property where the northern WWTP alternative site is situated does not contain any known archeological resources as per previous assessments (AMICK, 2006a,b). Therefore, no further archaeological assessment was required.
- The original WWTP location south of County Road 14 is situated on previously unassessed land, and the Stage 1 Archaeological Assessment identified that it would require a Stage 2 Archaeological Assessment.
- The western forcemain alignment to the Keenansville Road alternative outfall site along County Road 14 / Concession Road 7 / Keenansville Road and the Keenansville Road alternative outfall site itself was cleared of archeological potential within the road ROW. Stage 2 Archaeological Assessment was recommended for any works outside of the ROW by the Keenansville Road outfall site as it is in proximity to 19th century industrial structures and features. The area within the ROW was cleared of archeological potential.
- A Stage 1 Archaeological Assessment was undertaken for the eastern forcemain route to the Keenansville Road alternative outfall site along Concession Road 8 and Keenansville Road. The disturbed portions of each road ROW were cleared of archeological potential, while a Stage 2 Archaeological Assessment was recommended for the unopened portion of the Concession 8 ROW south of Keenansville Road. No artifacts were recovered and no features were uncovered during the Stage 2 Archaeological Assessment, and thus the route is considered free from further archaeological concern.
- Stage 1 and 2 Archaeological Assessments were undertaken for the Concession Road 8 alternative outfall site as well as its associated forcemain route along Concession Road 8 north of Keenansville Road. The assessment concluded that the forcemain route and outfall location along Concession Road 8 is free from further archaeological concern.

4.5 Municipal Planning

4.5.1 Existing Land Use

The study area is a mix of mostly agricultural land and some natural, tree-covered areas, with a small number of residential properties mostly associated with the agricultural land. The properties where the alterative WWTP sites are located are currently agricultural land; however, the properties have been draft plan approved by the Ontario Municipal Board for residential developments, which will be serviced by the proposed WWTP.

The properties where the alternative WWTP sites are situated are zoned Residential, Open Space, and Institutional under the Township's Official Plan. On June 14, 2018, the Township passed By-Law No. 18-41 to amend their Official Plan to rezone the proposed WWTP block on the north property as Institutional.

The Concession Road 8 alternative outfall location is situated within a municipal drain. The alternative outfall location is situated within Lot 19, Concession 7 in the former Township of

Adjala, which is one of the lots identified for a municipal drain in a 1924 Engineer's Report titled *Adjala and Tecumseth Drainage Bailey Creek Municipal Drain* addressed to the Reeve and Council of the Township of Adjala. OMAFRA describes municipal drains as a type of drainage system that has been used since the 1800's to improve the drainage of agricultural land by serving as a discharge point for agricultural drainage systems. They also remove excess water collected by roadside ditches, residential lots, churches, schools, industrial lands, commercial lands and any other properties in rural areas. Municipal drains are created under the authority of the *Drainage Act*[5].

4.5.2 Population Forecasts

As mentioned the Hamlet of Colgan is not currently serviced by any centralized wastewater collection, treatment, or disposal infrastructure. Existing and projected populations within the Community of Colgan that may be serviced by the proposed WWTP are indicated in the following tables. Table 3 below outlines the population projections for the 20-year development horizon, on which the Colgan WWTP design is based.

Table 3: Development area characteristics with population projections, 20-year

Parcel	Total area	Developable area(1)	Unit density	RUs	Pop./RU	Pop.
1	80.7 ha	49.5 ha	6.4 RU/ha	315	2.67	841
2	39.9 ha	34.1 ha	9.6 RU/ha	329(2)	2.67	878
3	-	-	-	-	-	-
4	-	-	-	-	-	-
Existing	-	-	-	87	2.67	232
Total	**120.6 ha**	**83.6 ha**	**-**	**731**	**2.67**	**1,952**

RUs = residential units. Pop. = population. (1) Some portions of "undevelopable land" may be available for servicing options. (2) 329 residential units. The nursing home, consisting of 170 equivalent residential units, is not planned for construction within the 20 year planning horizon.

The following table outlines the population associated with the ultimate development scenario.

Table 4: Development area characteristics with population projections, ultimate

Parcel	Total area	Developable area(1)	Unit density	RUs (ultimate)	Pop./RU	Pop.
1	80.7 ha	49.5 ha	6.4 RU/ha	315	2.67	841
2	39.9 ha	34.1 ha	14.6 RU/ha	499(2)	2.67	1332
3	16.9 ha	9.0 ha	10 RU/ha(3)	90	2.67	240
4	17.6 ha	4.5 ha	10 RU/ha(3)	45	2.67	120
Existing	-	-	-	87	2.67	232
Total	**155.1 ha**	**97.1 ha**	**-**	**1,036**	**2.67**	**2,766**

RUs = residential units. Pop. = population. (1) Some portions of "undevelopable land" may be available for servicing options. (2) Consisting of 329 RUs and a nursing home with 170 beds considered equivalent to 170 RUs for servicing. (3) No draft plans for development areas 3 and 4 have been developed yet, and so a conservative density has been assigned.

[5] Vander Veen, S. *So, What's a Municipal Drain*. August 2015. Available at http://www.omafra.gov.on.ca/english/engineer/facts/01-059.htm.

5 PROPOSED FUTURE CONDITIONS

5.1 Projected Wastewater Servicing Demands

The projected wastewater servicing demand for the 20-year development horizon is 689 m^3/day, with development planned for Development Areas 1 and 2 (see Table 5). It is noted that Development Areas 1 and 2 have been draft approved by the OMB subject to the availability of servicing. A red-line revised draft plan was endorsed by Township Council on June 14, 2018 through By-law 18-41. Official Plan Amendment for the revised draft plan was approved by Simcoe County on September 25, 2018

Projected sanitary flows for the 20-year development horizon are contained in the following table.

Table 5: Projected Sanitary Flow – 20-year Development Horizon

Parcel	RUs	Pop./RU	Pop.	Per capita domestic flow(2) (L/c/d)	Infiltration (L/c/d)	Avg. sanitary flow (m^3/d)	Peak sanitary flow(4) (m^3/d)
1	315	2.67	841	270	90	303	-
2	329(1)	2.67	878	270	90	316	-
3	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
Existing	87	2.67	232	210(3)	90	70	-
Total	**731**	**2.67**	**1952**	**263(4)**	**90**	**689**	**2017**

Reference: Adapted from Greenland, 2016, Table 2-5.
Notes:
RUs = residential units. Pop. = population.
(1) 329 residential units. The nursing home, consisting of 170 equivalent residential units, is not planned for construction within the 20-year planning horizon.
(2) The MSP Amendment (Greenland, 2016) indicated 240 L/p/d per capita flows, but this has since been updated based on consultation with the MECP.
(3) Existing average daily flow is 210 L/capita/day based on measured water use (as per Greenland, 2016).
(4) Value calculated as population-weighted average of the values used for the individual parcels.
(5) Harmon Peaking Factor of 3.59 used, equal to $1+14/(4+P^{1/2})$ where P=population. Peaking factor applied only to the per capita domestic flow component and not to infiltration.

While the above values apply for the 20-year horizon, the proposed design would allow for future expansion to service all four parcels as well as the existing development. In this condition, the ultimate development scenario, the total average sanitary flow would be 996 m^3/d. This is outlined in the following table.

Table 6: Projected sanitary flow – Ultimate development scenario

Parcel	RUs (ultimate)	Pop./RU	Pop.	Per capita domestic flow (L/c/d)	Infiltration (L/c/d)	Avg. sanitary flow (m^3/d)	Peak sanitary flow[(2)] (m^3/d)
1	315	2.67	841	270	90	303	-
2	499[(1)]	2.67	1332	270	90	480	-
3	90	2.67	240	270	90	87	-
4	45	2.67	120	270	90	43	-
Existing	87	2.67	232	270	90	84	-
Total	**1036**	**2.67**	**2,766**	**270**	**90**	**996**	**2,841**

Reference: Adapted from Greenland, 2016, Table 2-5.
Notes: RUs = residential units. Pop. = population.
(1) Consisting of 307 RUs and a nursing home with 170 beds considered equivalent to 170 RUs for servicing.
(2) Harmon Peaking Factor of 3.47 used, equal to $1+14/(4+P^{1/2})$ where P=population. Peaking factor applied only to the per capita domestic flow component and not to infiltration.

5.2 Proposed Effluent Limits and Objectives

The proposed effluent requirements for the proposed project are strict and have been reviewed by MECP and NVCA. They will minimize the potential for environmental impact from the proposed WWTP. The limits and objectives will be confirmed during the detailed design and Environmental Compliance Approval (ECA) process that is undertaken following completion of the Class EA process. The proposed effluent limits and objectives below are based on the ACFS and correspondence with MECP, and they will ensure that the WWTP discharge will not cause the waterbody receiver to exceed its PWQO values.

Table 7: Proposed Design Requirements (Influent Rating: 689 m^3/day)

Parameter	Proposed Effluent Limit *	Proposed Effluent Objective *
Total Phosphorus (TP)	0.07 mg/L P	0.05 mg/L P
Total Ammonia Nitrogen (TAN)	2.08 mg/L (May to October) 5.7 mg/L (November to April)	1.5 mg/L (May to October) 3.0 mg/L (November to April)
Fecal Coliform	100 CFU/100 mL	80 CFU/100 mL
Total Suspended Solids	25 mg/L	15 mg/L
Carbonaceous Biochemical Oxygen Demand (cBOD5)	6 mg/L CBOD	5 mg/L

* To be confirmed during detailed design process and the Environmental Compliance Approval Process

5.3 Influent Quality Criteria

The influent quality criteria, as detailed in the following table, is based on wastewater quality from similar type of developments in the Province of Ontario.

Table 8: Influent Quality Criteria

Parameter	Capacity / Concentrations
Influent rating (20 years horizon)	689 m^3/day
Total Phosphorus (TP)	7 mg/L
Total Kjeldahl Nitrogen (TKN)	47 mg/L
Fecal coliform (FC)	10,000 – 1,000,000 / 100 mL
Carbonaceous Biochemical oxygen demand (CBOD5)	230 mg/L

Note: the above concentrations are between medium to strong residential wastewater quality as per available information in the Province of Ontario.

6 CONFIRMATION OF PHASE 2 PREFERRED SOLUTIONS

Phase 2 of the 2016 MSP Amendment identified the preferred solution to be a new WWTP with a forcemain and gravity sewer and the outfall to Bailey Creek. During the course of this Class EA (Phase 3), the following Phase 2-level aspects were reviewed to confirm the decisions made for:

- The WWTP site location;
- The forcemain route alignment from the WWTP to the Keenansville outfall discharge location (which was identified in the MSP Amendment); and
- An alternative outfall location and its associated forcemain.

The review and evaluation of the Phase 2-level components are discussed below.

6.1 WWTP Site

6.1.1 Alternative WWTP Sites

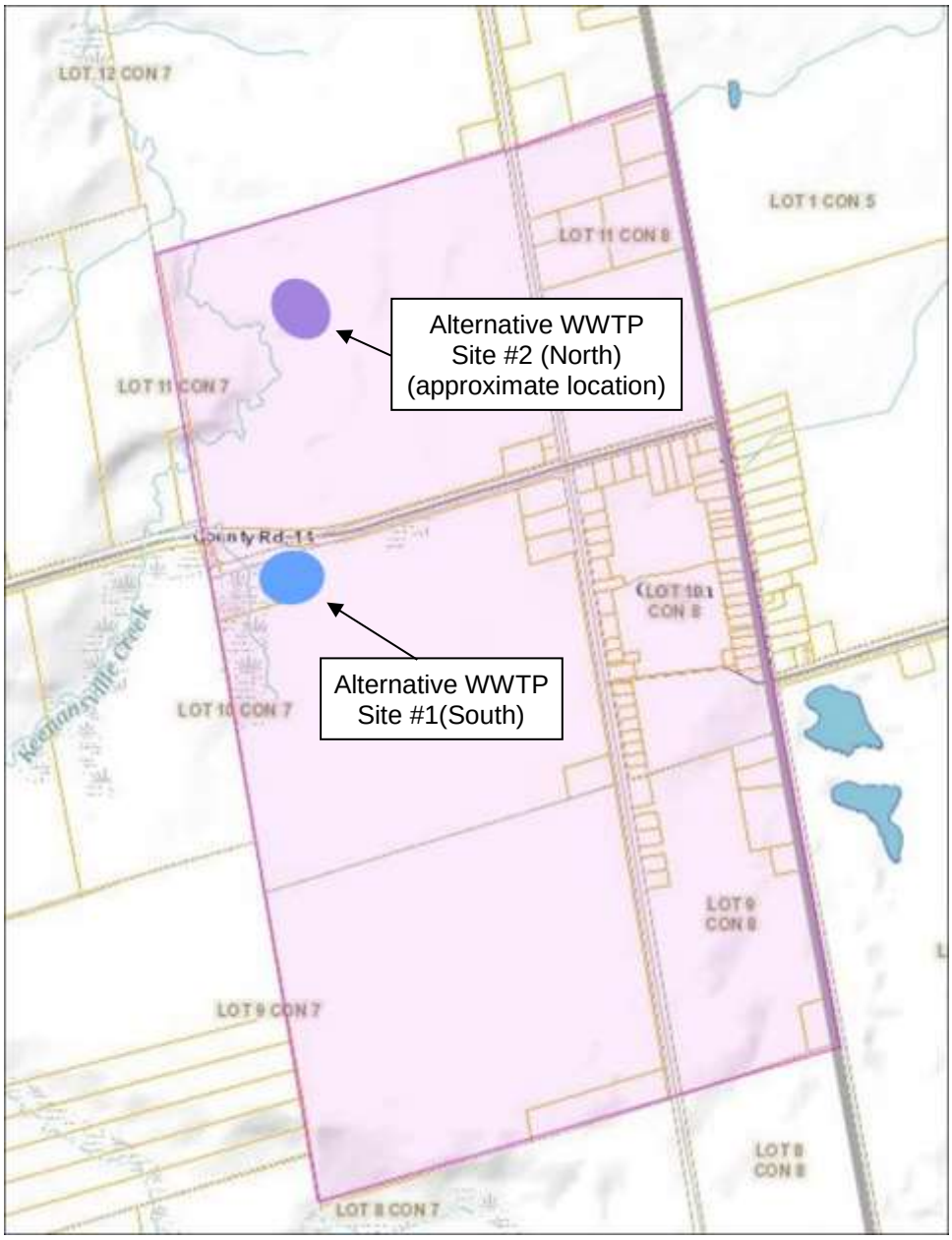
The 2016 Master Servicing Plan Amendment identified a preferred site (hereafter referred to as "Alternative WWTP Site #1" or the south site) for the proposed Colgan WWTP. However, between the conclusion of the MSP and the start of Phase 3, the Class EA proponent purchased "Development Area 2" site (see Figure 2), north of County Road 14. It was on this property that the proposed Colgan Sanitary Pumping Station (SPS) was to be located. The proponent's purchase of this property provided a new opportunity to locate the Colgan WWTP on this property. When an alternative WWTP site was considered for the project (known as Alternative WWTP Site #2), the site plan for the Colgan 2 development was in draft form, and therefore the exact location of the alternative WWTP site was not known. However, it was determined that it would be in the vicinity of the SPS location proposed in the MSP Amendment.

Based on a preliminary consideration of the alternative location, it was determined that WWTP Alternative Site #2 would not require a separate stand-alone SPS. Based on the project team's site visit and preliminary considerations, the project team agreed to assess the north Alternative Site #2 further by evaluating it against the south Alternative Site #1 to determine which would be most preferred.

- Alternative WWTP Site #1 (South): Located south of County Road 14, between Concession Roads 7 and 8, and would require a pumping station in the Colgan 2 development (north of County Road 14) to convey wastewater from the Colgan 2 development to the WWTP. This is the arrangement identified in the 2016 MSP Amendment.
- Alternative WWTP Site #2 (North): located north of County Road 14, between Concession Roads 7 and 8 (slightly north to the location of the originally proposed SPS for Alternative Site #1). A pumping station to facilitate conveyance to the WWTP is not required for this arrangement.

The alternative WWTP sites as presented in PIC #1 are shown in Figure 6.

Figure 6: Alternative WWTP Locations



NOTE: The pumping station associated with the South Alternative Site #1 is not labelled, but would be located at the same location as that of the North Alternative Site #2, with a corresponding forcemain from the SPS to the Alternative Site #1 location (also not shown).

6.1.2 Evaluation of Alternative WWTP Sites

Criteria and Methodology

The evaluation of the alternative WWTP sites used criteria that considered all aspects of the environment, specifically the natural environment, the social/cultural environment, technical and operational considerations, and economic considerations. Each category is comprised of one or more criteria, and each criterion is comprised of one or more indicators.

Each criterion was evaluated comparatively using the following identifiers: *Less Preferred*, *Equally Preferred*, and *More Preferred*. An alternative with better performance relative to the criterion was considered "Most Preferred," with the other considered "Least Preferred". The alternatives were considered "Equally Preferred" for a given criterion if there was no significant preference identified.

Comparative Evaluation

The results of the evaluation are provided in Table 9. The results are summarized to identify preference for each category and for the overall evaluation as well.

Table 9 Comparative Evaluation of Alternative WWTP Sites #1 and #2

Criteria	Alternative WWTP Site #1 (South)	Alternative WWTP Site #2 (North)
Natural Environment		
Potential impact on terrestrial and/or aquatic sensitive species, including species at risk (SAR): • Presence of sensitive species, including SAR	Equally Preferred • Area has historical records of Bobolink and Eastern Meadowlark, which are designated as 'Threatened' under the Endangered Species Act. • No Bobolink or Eastern Meadowlark were observed on field visit in November 2016 • Breeding bird survey and incidental wildlife survey recommended to be done during the breeding bird season (April to August) to confirm that there is no impact to SAR birds. • No impact to aquatic or other SAR expected.	Equally Preferred • Area has historical records of Bobolink and Eastern Meadowlark, which are designated as 'Threatened' under the Endangered Species Act. • No Bobolink or Eastern Meadowlark were observed on field visit in November 2016 • Breeding bird survey and incidental wildlife survey recommended to be done during the breeding bird season (April to August) to confirm that there is no impact to SAR birds. • No impact to aquatic or other SAR expected.

Criteria	Alternative WWTP Site #1 (South)	Alternative WWTP Site #2 (North)
Potential disruption of terrestrial or aquatic habitat • Proximity to or disruption of terrestrial or aquatic habitat • Magnitude of disruption	Equally Preferred • Site #1 is located within an agricultural area. No sensitive vegetation would be displaced through development of the site. • Keenansville Creek natural valley corridor is to the west of the proposed Sanitary Pumping Station site. • Simcoe County Mapping shows that Site #1 is directly adjacent to an unevaluated wetland. However, the unevaluated wetland is not present on the landscape and large portions of this unevaluated wetland unit consist of active agricultural fields. Therefore, no anticipated impacts to wetlands or other aquatic habitat. • Site #1 includes NVCA regulated area and would require a permit.	Equally Preferred • Site #2 is within an agricultural area and an approved development area. Siting of the WWTP in this location would not result in any increase in the number of trees removed or the displacement of sensitive vegetation. The proponent has a tree compensation plan in place for the development that would see the replacement of any trees removed. • Keenansville Creek natural valley corridor is to the west of the proposed Wastewater Treatment Plant site. • Site #2 is not adjacent to any wetland area, therefore, no anticipated impacts to wetlands or other aquatic habitat. • Site #2 includes NVCA regulated area and would require a permit.
Summary – Natural Environment	**Equally Preferred** • Neither site is anticipated to result in any significant environmental impact to the natural environment. Therefore, both sites are equally preferred.	**Equally Preferred** • Neither site is anticipated to result in any significant environmental impact to the natural environment. Therefore, both sites are equally preferred.
Social / Cultural Impacts		
Potential Impact on Archaeological Resources • Presence of archaeological resources • Disruption or disturbance of archaeological resources	Less Preferred • Area for pumping station site and associated forcemain route to WWTP does not require further archaeological assessment. • Site #1 requires Stage 2 archeological assessment to determine whether there is potential impact to archaeological resources.	More Preferred • Site #2 does not require any further archaeological assessment. • No impact to archaeological resources anticipated.

Criteria	Alternative WWTP Site #1 (South)	Alternative WWTP Site #2 (North)
Visual landscape and aesthetic impacts • Visibility from main roadway	Less Preferred • Site #1 is situated adjacent to County Road 14, and therefore directly visible from the county road.	More Preferred • Site #2 is situated further from County Road 14 and will have comparatively lower visibility from the county road.
Noise and odour impacts • Existing houses within 200m of site	Less Preferred • Two existing households less than 200m from Site #1 (135m and 170m), meaning more residents could be potentially impacted from noise during construction.	More Preferred • No existing households within 200m of Site #2 (closest is 370m from site), meaning fewer residents would be potentially impacted from noise during construction.
Traffic impacts and interruption to residents • Traffic disruption during construction • Traffic disruption during operation	Less Preferred • Slightly more construction traffic and disruption along County Road 14, as trucks would be required for construction of the WWTP at Site #1 and for the SPS (located at Site #2). • Sludge trucks would be required to access WWTP through subdivision, as no direct access permitted to WWTP from County Road 14. Approximately two to three sludge and delivery trucks anticipated per week, typically during daytime working hours. No significant traffic disruption anticipated due to sludge trucks.	More Preferred • Slightly less construction traffic and disruption along County Road 14, as no construction access required for the Colgan South site. • Sludge trucks would be required to access WWTP through subdivision. Approximately two to three sludge and delivery trucks anticipated per week, typically during daytime working hours. No significant traffic disruption anticipated due to sludge trucks.
Summary - Social / Cultural Impacts	**Less Preferred** • Additional archeological assessment is required. • WWTP would be more visible from County Road 14. • More opportunity for traffic disruption due to construction.	**More Preferred** • No archaeological impacts anticipated. • WWTP would be less visible from County Road 14. • Less opportunity for traffic disruption due to construction.

Criteria	Alternative WWTP Site #1 (South)	Alternative WWTP Site #2 (North)
Technical / Operational Impacts		
Overall Constructability	Less Preferred • Pumping station required, including piping to WWTP, therefore increased complexity of construction compared to Site #2. • Site #1 is 082 ha, which is about 0.23 ha (or 2,300 m^2) less than Site #2. Smaller site size limits design and construction options.	More Preferred • No pumping station required reducing complexity of construction. • Site #2 is 1.05 ha, about 0.23 ha (2,300 m^2) more than Site #1, which provides greater design and construction flexibility.
Operations	Less Preferred • Building WWTP at Site #1 would require a SPS at Site #2, resulting in two separate wastewater facilities to be operated, monitored and maintained.	More Preferred • Building WWTP at Site #2 has fewer operation/ monitoring/maintenance requirements as it would not require a separate, upstream SPS.
Summary – Technical / Operational Impacts	**Less Preferred** • Pumping station required including piping to WWTP increases complexity of construction and operations.	**More Preferred** • No pumping station required, reducing complexity of construction and operations. • Larger site provides greater design and construction flexibility.
Economic Impacts		
Relative impact on construction costs	Less Preferred • Relatively higher construction costs due to requirement for separate SPS and additional forcemain from SPS to WWTP.	More Preferred • Relatively lower construction costs due to lack of requirement for separate SPS associated forcemain.
Relative impact on operations and maintenance (O&M) costs	Less Preferred • SPS required, with associated SPS operations and maintenance costs	More Preferred • No SPS required, therefore avoids associated operations and maintenance costs
Summary – Economic Impacts	**Less Preferred** • Requirement of SPS leads to relatively higher construction and annual O&M costs.	**More Preferred** • Lack of requirement for SPS avoids associated construction and annual O&M costs.

Criteria	Alternative WWTP Site #1 (South)	Alternative WWTP Site #2 (North)
Overall Rating		
	Less Preferred • This site was deemed less favourable for the social/cultural environment, technical/operational impacts and economic impacts.	**More Preferred** • This site was deemed more favourable for the social/cultural environment, technical/operational impacts and economic impacts.

6.1.3 Preferred WWTP Location

Based on the above comparative evaluation, the North Alternative Site #2 location is the preferred site for the proposed Colgan WWTP.

Between PIC #'s 1 and 2, the location of the preferred WWTP site shifted from that originally proposed in the MSP and presented in PIC #1 to the location shown in Figure 6 (Section 6.1.1). However, this preferred WWTP site was presented at PIC #1 as an approximate location since the draft development plans were not complete at that time. The location of the preferred WWTP location as per the draft development plan was presented at PIC #2. The evaluation above has been updated to reflect the adjusted WWTP location.

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6.2 Forcemain Route Alignment

The forcemain alignment from the WWTP to the ultimately preferred outfall location was undertaken in two separated steps, each associated with an alternative outfall location. The comparative evaluation of the forcemain alignment was based on the preferred WWTP as Alternative #2 (North) site.

The first step involved evaluating alternative forcemain routes to the Keenansville Outfall Location, which was the location identified in the Colgan MSP Amendment. This evaluation is discussed in Section 6.2.1.

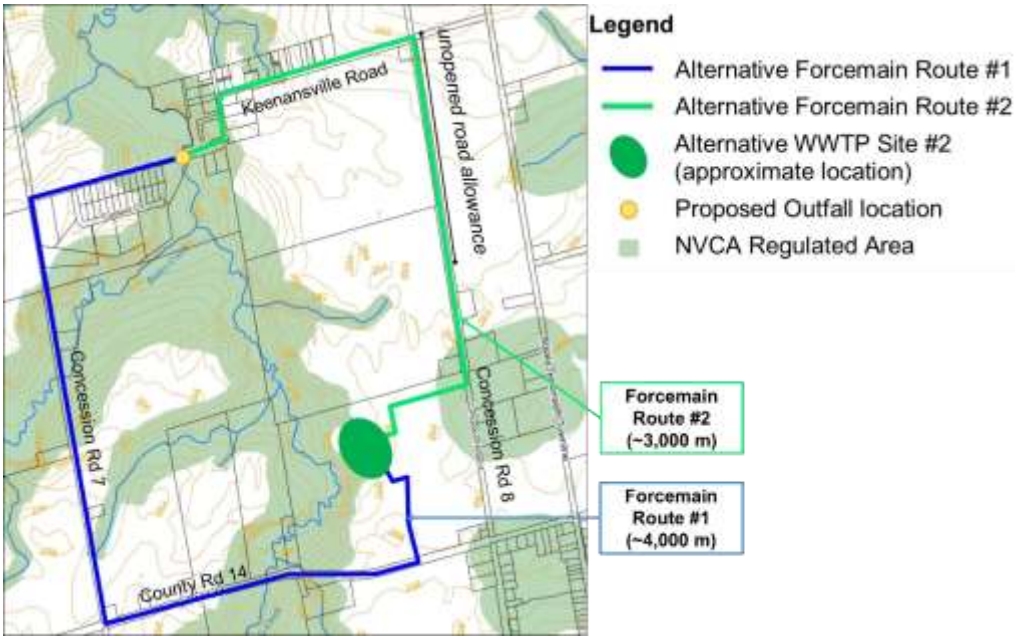
After this evaluation was undertaken and presented at PIC #1, an alternative outfall location and associated forcemain route was identified. The comparative evaluation of this alternative outfall location and forcemain is discussed in Section 6.2.2.

6.2.1 Alternatives Forcemain Routes to Keenansville Outfall Location

Two alternative forcemain routes were identified for evaluation. The two alignments are presented in Figure 7 and include:

- Forcemain Alignment Alternative #1 (West): runs from the preferred WWTP site south to County Road 14, west along County Road 14, north along Concession Road 7, and eastward along Keenansville Road before reaching the proposed outfall at Bailey Creek.
- Forcemain Alignment Alternative #2 (East): runs from the preferred WWTP site east to Concession Road 8, north along Concession Road 8, and west along Keenansville Road before reaching the proposed outfall at Bailey Creek.

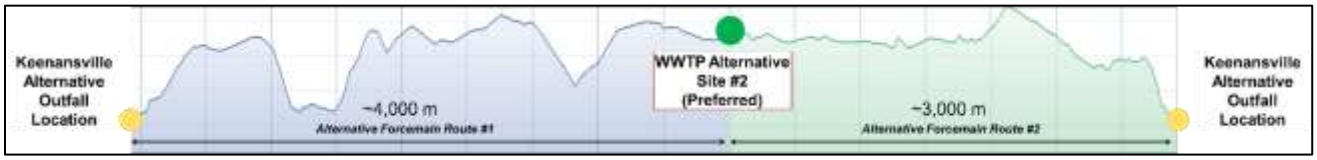
Figure 7: Alternative Forcemain Routes from the Preferred WWTP Site to the Outfall



Note: Depiction of alternative forcemain routes through development parcel are approximate.

For information, Figure 8 shows the elevation profiles of the alternative forcemain routes, both originating from the Preferred (North) Alternative WWTP Site #2. As shown, Alternative Forcemain Route #2 has a more consistent profile.

Figure 8: Elevation profile of alternative forcemain routes



6.2.2 Evaluation of Alternative Forcemain Routes to Keenansville Outfall Location

Criteria and Methodology

The evaluation used criteria considered all aspects of the environment, specifically the natural environment, the social/cultural environment, technical and operational considerations, and economic considerations. Each category is comprised of one or more criteria, and each criterion is comprised of one or more indicators.

Each criterion was evaluated comparatively using the following identifiers: *Less Preferred*, *Equally Preferred*, and *More Preferred*. An alternative with better performance relative to the criterion was considered "Most Preferred," with the other considered "Least Preferred". The alternatives were considered "Equally Preferred" for a given criterion if there was no significant preference identified.

Comparative Evaluation

The results of the evaluation are provided in Table 10. The results are summarized to identify preference for each category and for the overall evaluation.

Table 10: Evaluation of Alternative Forcemain Alignments #1 and #2

Criteria	Forcemain Alignment Alternative #1 (West)	Forcemain Alignment Alternative #2 (East)
Natural Environment		
Potential impact on terrestrial and/or aquatic sensitive species, including species at risk (SAR) • Presence of sensitive species, including SAR	**Equally Preferred** • No species at risk were identified within the alternative forcemain route, meaning no impacts on SAR anticipated.	**Equally Preferred** • Some local landowners report observing the Common Snapping Turtle (designated as 'Special Concern' under the Endangered Species Act) crossing Concession Road 8. • No active signs of snapping turtles or nesting habitat were observed during field visits (November 2016, May 2017). • Monitoring for snapping turtles and snapping turtle nests recommended prior to construction to ensure they are not disturbed. • No terrestrial SAR observed during field visits. • No impact to aquatic or other SAR expected.
Potential disruption of terrestrial or aquatic habitat • Proximity to or disruption of terrestrial or aquatic habitat • Magnitude of disruption	**Least Preferred** • Forcemain alignment crosses three watercourses and their associated valley corridors, with considerations required to minimize impact, particularly during construction. • Alignment travels adjacent to wetlands for approximately 260m (in three sections), with longer distance increasing potential for impacts.	**More Preferred** • Forcemain alignment includes no watercourse crossings, reducing potential impacts. • Unevaluated wetland community noted adjacent to 8th Concession Road • Alignment travels adjacent to wetlands for approximately 65m (in two sections)

Criteria	Forcemain Alignment Alternative #1 (West)	Forcemain Alignment Alternative #2 (East)
Potential impact to surface or groundwater quality • Magnitude of impact • Proximity to surface or groundwater sources / number of creek crossings	**Equally Preferred** • Forcemain alignment includes three watercourse crossings. • Alignment travels adjacent to wetlands for approximately 260m (in three sections). • With adequate mitigation techniques and timing windows during construction, minimal construction impacts on surface or groundwater quality anticipated.	**Equally Preferred** • Forcemain alignment includes no watercourse crossings. • Unevaluated wetland community noted adjacent to Concession Road 8 • Alignment travels adjacent to wetlands for approximately 65m (in two sections) • With adequate mitigation techniques and timing windows during construction, minimal construction impacts on surface or groundwater quality anticipated.
Natural Environment Overall Rating	**Less Preferred** • No SAR (terrestrial or aquatic) were identified within the alignment. • Alignment has greater number of watercourse crossings and a longer distance adjacent to wetlands, increasing potential for watercourse impacts.	**More Preferred** • While some residents report observing snapping turtles in or near the forcemain route, construction mitigation measures and timing windows would minimize potential impact to the SAR. • No terrestrial SAR identified within alignment. • Alignment has no watercourse crossings and a shorter distance adjacent to wetlands, reducing potential for watercourse impacts.
Social / Cultural Environment Impacts		
Potential Impact on Archaeological Resources • Presence of Archaeological Resources • Disruption or disturbance of Archaeological Resources	**Equally Preferred** • Forcemain route cleared of archaeological potential.	**Equally Preferred** • Forcemain route cleared of archaeological potential.

Criteria	Forcemain Alignment Alternative #1 (West)	Forcemain Alignment Alternative #2 (East)
Traffic impacts and interruption to residents • Traffic disruption during construction	**Less Preferred** • Greater length of forcemain on developed municipal roads (approximately 3000m) • Forcemain alignment requires construction along County road (County Road 14). • Greater traffic impacts anticipated due to longer length of road interrupted and inclusion of County Road 14.	**More Preferred** • Forcemain alignment includes shorter length on developed municipal roads (approximately 1470m), with more constructed on unopened road allowance (approximately 820m). • Forcemain alignment does not require construction along County road (County Road 14). • Fewer traffic impacts due to shorter length of road that will undergo construction activity and avoidance of County Road 14.
Social / Cultural Environment Overall Rating	**Less Preferred** • No further archaeological assessment required • Greater anticipated traffic disruption due to construction	**More Preferred** • No further archaeological assessment required • Less opportunity for traffic disruption due to construction
Technical/Operational Impacts		
Overall Constructability • Number of watercourse crossings • Number of peaks/troughs	**Less Preferred** • Forcemain alignment includes three watercourse crossings and associated trenchless construction, which increases construction complexity. • Greater number and magnitude of major changes in elevation, increasing construction complexity.	**More Preferred** • Forcemain alignment includes no watercourse crossings, simplifying construction. • Fewer number and magnitude of major changes in elevation, simplifying construction.
Technical/Operational Overall Rating	**Less Preferred** • More complex construction, including watercourse crossings and more significant elevation changes	**More Preferred** • Simpler construction, with no watercourse crossings and less significant elevation changes

Criteria	Forcemain Alignment Alternative #1 (West)	Forcemain Alignment Alternative #2 (East)
Economic Impacts		
Relative impact on construction costs	**Less Preferred** • Relatively higher construction costs due to longer length (~4,000 m), with most of alignment required to be forcemain. • Forcemain alignment includes a County road and a greater length of developed municipal roads, which would cost more to construct in than alternative. • Increased costs due to trenchless construction at three watercourse crossings	**More Preferred** • Relatively lower construction costs due to shorter length (~3,000 m), with greater portion that can be gravity drained versus pressurized pipe. • Forcemain alignment includes less major roads, decreasing road reconstruction costs • Forcemain alignment includes no watercourse crossings, allowing for use of less expensive construction approaches.
Relative impact on operations and maintenance costs	**Less Preferred** • Longer length of forcemain and greater number and magnitude of elevation changes would increase effluent pumping costs compared to Alternative #2.	**More Preferred** • Shorter length of forcemain and lack of significant elevation changes would result in lower effluent pumping costs than Alternative #1.
Economic Overall Rating	**Less Preferred** • Forcemain construction more expensive, with longer overall length of pipe and trenchless construction at watercourse crossings • Higher pumping costs, associated with longer length of pipe and greater number and magnitude of changes in elevation	**More Preferred** • Forcemain construction less expensive, with shorter overall length of pipe and no watercourse crossings • Lesser pumping costs, associated with shorter length of pipe
Overall Rating		
	Less Preferred • This route was deemed less preferred for each criteria group.	**More Preferred** • This route was deemed more preferred for each criteria group.

6.2.3 Preferred Alternative Forcemain Route to Keenansville Outfall Location

Based on the above evaluation, the Forcemain Alignment Alternative #2 (East) from the preferred WWTP site to the Keenansville Outfall location was identified as more preferred than Forcemain Alignment Alternative #1 (West) as it has several advantages, including:

- Fewer watercourse crossings;
- Less potential environmental impact;
- Less traffic disruption during construction;
- Less disturbance to municipal road infrastructure;
- Shorter forcemain distance;
- Simpler profile (and thus improved constructability); and
- Reduced construction cost.

The recommended WWTP location and forcemain route to the Keenansville Outfall Location was presented at PIC #1. Based on feedback from residents in the subsequent months, the Township requested the proponent to investigate the potential for an alternative outfall location. The identification and evaluation of the alternative outfall location (including its associated forcemain alignment) is discussed in the following section.

6.3 Keenansville Outfall Alternative Designs

While the specific design of the outfall will be completed during detailed design, consultation to date with the MECP and the NVCA have identified a number of design characteristics to be included, such as:

- Erosion control measures - to ensure that flow coming from the outfall will not cause scouring or erosion within the watercourse;
- Slope stability measures - to ensure that the watercourse banks around the outfall will remain stable;
- Watercourse protection during construction - to help ensure there will be minimal impact to the watercourse, the design should include minimal to no in-creek construction activities.

The design alternatives for the Keenansville Outfall focused on which side of the road the outfall would be located if constructed at that site. These alternatives were presented to the public at PIC #1, before the Concession Road 8 alternative outfall site was identified.

With the forcemain approaching the outfall site from the east, the alternative locations considered were the north side of the road or the south side of the road, each on the east side of the watercourse. The locations are depicted in Figure 9. The areas include space for the forcemain headwall, as well as a channel to convey the treated wastewater from the headwall to the watercourse.

Keenansville Outfall Alternative Location A (North) consists of a grassy area situated a few feet below the road grade (see Figure 10). The road ROW north of the road edge slopes down to the grassed area. The possible location of the outfall would fall within private property.

Similarly, Keenansville Outfall Alternative Location B (South) is in a grassed area, a few feet below the road grade. There is room for the outfall within the road ROW, although the ROW narrows by the watercourse (see Figure 11)

Figure 9: Keenansville Alternative Outfall Locations

Figure 10: Keenansville Outfall Alternative Location A (North)

Figure 11: Keenansville Outfall Alternative Location B (South)

Similar to the other evaluations in this process, the comparative evaluation of the alternative outfall locations was against environmental, technical, social/cultural and economic criteria. The results of the evaluation are presented in the following table.

Table 11: Evaluation of Outfall Alternative Designs (Keenansville Road)

Criteria	Alternative Location A (North)	Alternative Location B (South)
Natural Environment		
Impact on watercourse	No impact anticipated (would be designed/constructed using erosion control measures)	No impact anticipated (would be designed/constructed using erosion control measures)
Impact on terrestrial environment/landscape	Some disruption to landscape anticipated, as installation of outfall and discharge channel would be in manicured landscape	Minimal disruption to landscape anticipated, as installation of outfall would make use of existing channel Location also includes existing drainage pipe
Summary	**Less Preferred**	**More Preferred**
Technical		
Constructability	New channel required from outfall source to watercourse. May require some construction at edge of watercourse	Existing channel available on south side, provides opportunity to install outfall with minimal interference with watercourse
Summary	**Less Preferred**	**More Preferred**
Social / Cultural		
Impact on private property	Would require construction of outfall and channel on private property	Outfall location and existing channel on municipal Right-of-Way
Visibility	Limited ability to blend in with local surroundings, highly visible	Less visible from roadway, location already includes existing drainage pipe
Summary	**Less Preferred**	**More Preferred**
Economic		
Capital/construction costs	Likely higher development costs due use of private property	Likely lower development cost due to lack of requirement to obtain property
Summary	**Less Preferred**	**More Preferred**
Overall Summary		
	Less Preferred	**Most Preferred**

Based on the evaluation, the preferred placement of the Keenansville Road alternative outfall is on the south side of Keenansville Road at Bailey Creek.

6.4 Concession Road 8 Alternative Outfall Location

6.4.1 Identification of Concession Road 8 Alternative Outfall Location

As noted above, the Township requested the proponent to look for and consider an alternative outfall location in response to feedback received from the public after PIC #1. After some consideration, a possible alternative outfall location was identified where Concession Road 8 intersects with Bailey Creek.

To assess the feasibility of the possible outfall location and its associated forcemain route, the following tasks were undertaken:

- Preliminary site visit/route walk by EXP;
- Assimilative Capacity Feasibility Study for the possible outfall location, by Greenland Engineering;
- Natural Heritage feasibility assessment, by Matrix Solutions; and
- Stage 1 Archaeological Assessment by Golder Associates.

Based on the results of the aforementioned assessments, the alternative outfall location and its associated forcemain was determined to be feasible and thus incorporated into the Class EA to be comparatively evaluated against the preferred outfall identified in PIC #1.

A high-level description of the alternatives is provided in the following sections. For the purpose of the evaluation, the alternative outfall locations and forcemain routes are identified as such:

- Alternative Outfall Location #1 (Keenansville): The current proposed outfall location at Bailey Creek and Keenansville Road[6]. Its associated forcemain route is the preferred route from the WWTP location to Alternative Outfall Location #1 (Keenansville), based on the evaluation discussed in Section 5.2.
- Alternative Outfall Location #2 (Conc. Rd. 8): The alternative outfall location at Bailey Creek and Concession Road 8. Its associated forcemain route is from the WWTP location to Alternative Outfall Location #2, travelling north on Concession Road 8 to Bailey Creek.

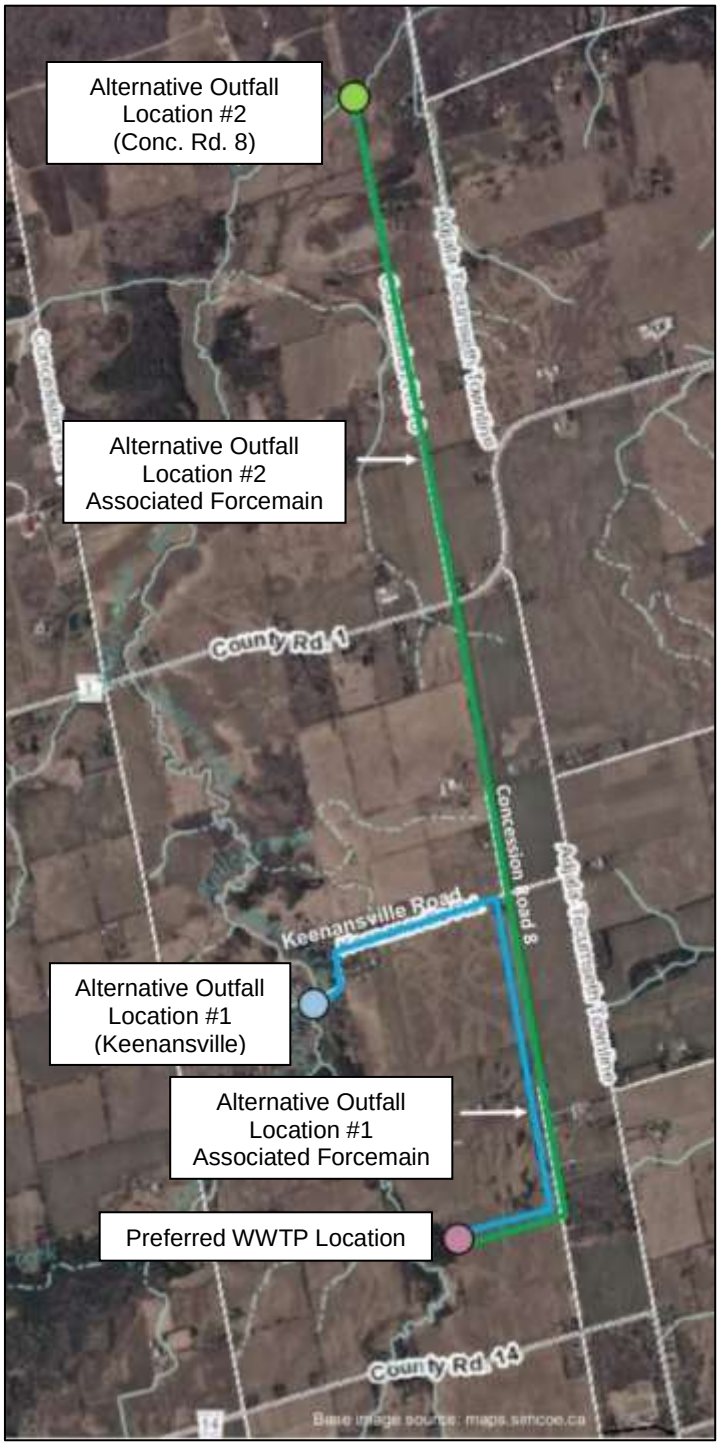
Figure 12 depicts the alternative outfall locations and their associated forcemain routes.

Regarding the forcemain routes to the alternative outfall locations, there are two key things to note:

- The first 1.8 km of both forcemains share a common route, from the WWTP to Concession Road 8, and then along Concession Road 8 to Keenansville Road. This is illustrated in Figure 12, where the alternative routes run in parallel. The evaluation of the alternative routes focuses on the portions of the route that are different as a result of the alternative outfall locations.
- Both alternative forcemain routes from the WWTP to the outfall will include a forcemain (to convey the treated wastewater to the relative high-points) and a gravity pipe (draining the treated wastewater from the high-point to the outfall). However, for simplicity, the entire route is referred to as a forcemain route.

[6] A Phase 3 review of alternative designs for the Keenansville outfall location was undertaken prior to PIC #1. The preferred design was to place the outfall on the south side of Keenansville Road. This was discussed in Section 6.3

Figure 12: Alternative Outfall Locations and Forcemain Routes



6.4.2 Description of Alternative Outfall Sites and Associated Forcemain Routes

6.4.2.1 Alternative Outfall Locations

Alternative Outfall Location #1 (Keenansville) is the outfall location at Bailey Creek and Keenansville Road proposed in the Colgan MSP Amendment and confirmed at PIC #1 during this Class EA (See Section 5.2), while Alternative Outfall Location #2 (Conc. Rd. 8) is the alternative location that was identified between the September 2017 Information Forum and PIC #2.

Figure 13 depicts the two alternative outfall locations (dashed outline in yellow).

Figure 13: Alternative Outfall Locations

The location of Alternative Outfall Location #1 is along a paved road that includes a number of residences located east and west of the alternative outfall location. As the road is bridged over Keenansville Creek by the outfall location, there is an embankment on either side of the road. The closest house to the outfall location is approximately 90m away.

Alternative Outfall Location #2 (Conc. Rd. 8) is more remote, being located at the northern terminus of the travelled roadway of Concession Road 8. As such, the only traffic that would pass this location would be for use of the private driveway crossing Bailey Creek, with the house being more than 400 m away from the alternative outfall location. The closest house to the outfall location is more than 150 m away (but accessed via Adjala-Tecumseth Townline). This outfall location is further downstream of the Keenansville Road outfall location and immediately upstream of a heavily-treed, naturalized area.

The road right-of-way (ROW) by each location is about 20m wide; however, Alternative Outfall Location #2 would have full width of the ROW for outfall placement, while Alternative Outfall Location #1 is situated between the ROW edge and the side of the road (about 9m). The ROW narrows at the creek to about 3m from the road edge.

6.4.2.2 Associated Forcemain Routes

Both of the forcemain routes to their respective outfall locations would run east from the proposed WWTP site through the proposed subdivision to Concession Road 8. The routes then proceed north along Concession Road 8 through an unopened ROW to Keenansville Road. This portion of the forcemain route would include the pressurized forcemain and is common to both alternatives.

The forcemain routes identified are associated with each of the proposed outfall locations. The potential forcemain route for Alternative Outfall Location #1 was previously evaluated and the Alternative Forcemain Route #2 (East) is the preferred alignment. There is only one route alignment for Alternative Outfall Location #2. Since the potential forcemain routes are each associated with a proposed outfall location the routes were not evaluated further as the selection of the preferred outfall location would identify the route alignment. Instead when the outfall locations were comparatively evaluated consideration was given for the potential issues (e.g., length of forcemain, elevation changes, length of gravity pipe) with the associated forcemain route.

From the Concession Road 8/ Keenansville Road intersection, the forcemain for Alternative Outfall Location #1 (Keenansville) travels west along Keenansville Road to Bailey Creek. This portion of the forcemain route along Keenansville Road would consist of gravity pipe. The total length of the route is approximately 2.7 km, including 1.7 km (approximately) of forcemain (common to both routes) and 1.0 km (approximately) of gravity pipe. The route reaches a high-point at the intersection of Concession 8 and Keenansville Road, followed by a general down-slope to the outfall. The forcemain portion of the route would carry the treated wastewater to the high-point, where it would then flow by gravity pipe to Alternative Outfall Location #1 (Keenansville).

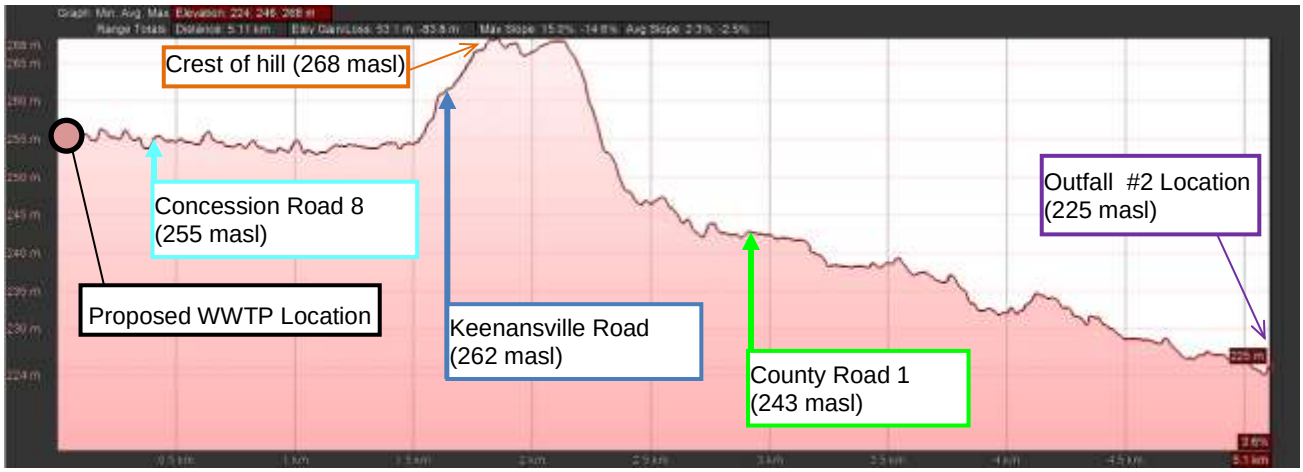
The forcemain associated with Alternative Outfall Location #2 (Conc. 8) continues north along Concession Road 8 from Keenansville Road until it reaches the northern terminus of Concession Road 8 and its intersection with Bailey Creek. The total length of the forcemain route is approximately 5.0 km. The route reaches a high-point approximately 470 m north of the intersection of Concession 8 and Keenansville Road, followed by a general down slope to Alternative Outfall Location #2. The forcemain portion of the route would carry the treated wastewater to the high-point, where it would then flow by gravity pipe to the outfall.

Figures 14 and 15 depict the elevation profiles of the two forcemain routes, including elevations noted at intersecting roads. Table 12 compares the lengths and peak elevations of the forcemain routes.

Figure 14: Elevation Profile of Forcemain Route to Alternative Outfall Location #1 (Keenansville)

masl = metres above sea level

Figure 15: Elevation Profile of Forcemain Route to Alternative Outfall Location #2 (Conc. Rd. 8)



masl = metres above sea level

Table 12: Forcemain Route Lengths and Peak Elevations (Approximate)

Forcemain Alternative	Total Forcemain Length [1]	Pressurized Forcemain Length [2]	Gravity Pipe Length [3]	Peak Elevation	Change in Elevation between WWTP and Forcemain Peak [4]
Forcemain Route to Alternative Outfall Location #1 (Keenansville)	2,720 m	1,670 m	1,040 m	262 masl	12
Forcemain Route to Alternative Outfall Location #2 (Conc. Rd. 8)	5,040 m	2,140 m	2,880 m	268 masl	18
Difference	+ 2,320 m	+ 470 m	+ 1,840	+ 6 m	+ 6 m

Notes:

1. *Total length equals pressurized forcemain length plus gravity pipe length*
2. *Approx. length of the forcemain that is pressurized (i.e., pushing the treated wastewater to peak elevation)*
3. *Approx. length of gravity pipe, where treated wastewater flows from peak height to outfall location*
4. *Equals the peak elevation of the forcemain route (in metres above sea level) minus the approximate elevation of the WWTP (~ 250 masl)*

Based on observations made during the site visits of the alternative forcemain routes, the hydraulic profiles of both routes are considered technically acceptable.

Keenansville Road along the forcemain route to Alternative Outfall Location #1 (Keenansville) is a paved road that has ditches or swales along either side. There is minimal shoulder, with grass situated near the road edge. Figure 16 depicts photographs of Keenansville Road along the potential route. Image 2 in Figure 16 depicts a narrowing in the paved road surface in the s-bend along Keenansville Road. While narrower in this portion, there would be adequate ROW to maintain a single lane of traffic during forcemain construction.

Figure 16: Keenansville Road along Alternative Outfall Location #1 Forcemain Route

1) Looking west from the intersection of Keenansville Road and Concession Road 8

2) Looking south at s-bend in road

The portion of Concession Road 8 north of Keenansville Road is a mix of unopened road allowance and of gravel road with ditches along both sides. The forcemain would be placed within the ROW, potentially within the gravel portion of the road rather than the ditch. The forcemain to Alternative Outfall Location #2 (Conc. Rd. 8) would require crossing Keenansville Road and County Road 1. Based on consultation with the County of Simcoe, this crossing would be completed by trenchless method. Figure 17 depicts photographs of Concession Road 8 along the forcemain route to Alternative Outfall Location #2 (Conc. Rd. 8).

Figure 17: Concession Road 8 along Alternative Outfall Location #2 Forcemain Route

Looking north on Concession Road 8, north of Keenansville Road

Looking south on Concession Road 8, south of County Road 1

There are a number of dwellings located along both associated routes. However, the total number and density of dwellings are greater along the forcemain route to the Alternative Outfall Location #1 (Keenansville). Table 13 compares the number of homes along the associated routes.

Table 13: Number of Dwellings along Forcemain Routes

Route Portion	Number of Homes	Length of Route Portion
Common Portion of Forcemain Routes	7	1.7 km
Alternative Outfall Location #1 (Keenansville) (Keenansville Road, between Concession Road 8 and Keenansville Outfall Location)	29	1.0 km
Alternative Outfall Location #2 (Conc. Rd. 8) Forcemain Route (Concession Road 8, between Keenansville Road and Concession 8 Outfall Location)	8	3.8 km

6.4.3 Comparative Evaluation of Outfall Locations

The evaluation of alternatives is based on criteria that considers the natural environment, the social/cultural environment, technical and operational considerations, and economic

considerations. Each category is comprised of one or more criterion, and each criterion is comprised of one or more indicators. The criteria used in this evaluation builds upon those used in the evaluations completed previously in this Class EA.

Each criterion was evaluated comparatively using the following identifiers: Less Preferred, Equally Preferred, and More Preferred. An alternative with better performance relative to the criteria was considered “More Preferred,” with the other considered “Less Preferred”. The alternatives were considered “Equally Preferred” for a given criterion if there was no significant preference identified.

Table 14 on the following pages presents the evaluation of the outfall locations, which considers the unique portions of their associated forcemain routes. The results are summarized to identify preference for each category and also to present the overall evaluation.

Table 14: Comparative Evaluation of Outfall Locations

Criteria	Alternative Outfall Location #1 (Keenansville)	Alternative Outfall Location #2 (Conc. Rd. 8)
Natural Environment		
Potential impact on terrestrial and/or aquatic sensitive species, including species at risk (SAR)	**Equally Preferred** No designated aquatic species at risk (SAR) were documented at the outfall location. Presence of turtles noted by residents (unverified). However, timing of construction would be outside of nesting window to avoid potential impacts to turtles. Presence of Barn Swallow nest noted by local resident (unverified). However, timing of construction would be outside of breeding window to avoid potential impacts to Barn Swallow. No SAR trees were observed within the forcemain route ROW. No impact to aquatic or terrestrial SAR expected.	**Equally Preferred** No designated aquatic species at risk (SAR) were documented at the outfall location. Construction works to be planned outside of nesting window/breeding seasons to avoid potential impacts. No SAR trees were observed within the forcemain route ROW. No impact to aquatic or terrestrial SAR expected.
Potential disruption of terrestrial or aquatic habitat	**Equally Preferred** Outfall located upstream of wetland. However, after-mixing concentrations to be within Provincial Water Quality Objectives (PWQO). Therefore, no impact anticipated to wetland. Both outfall locations have similar potential habitat for spawning species in vicinity of outfall. However, watercourse after-mixing concentrations to be within PWQO. Therefore, no impact anticipated to aquatic habitat through operation. In-stream construction works to be avoided or minimized. Spawning timing windows to be observed during construction. Therefore, no impact anticipated to aquatic habitat during construction. Forcemain through opened ROW to be contained within ROW. Minimal to no impact on trees anticipated.	**Equally Preferred** Outfall located upstream of wetland. However, after-mixing concentrations to be within PWQO. Therefore, no impact anticipated to wetland. Both outfall locations have similar potential habitat for spawning species in vicinity of outfall. However, watercourse after-mixing concentrations to be within PWQO. Therefore, no impact anticipated to aquatic habitat through operation. In-stream construction works to be avoided or minimized. Spawning timing windows to be observed during construction. Therefore, no impact anticipated to aquatic habitat during construction. Forcemain through opened ROW to be contained within ROW. Minimal to no impact on trees anticipated. Trees along unopened ROW consist of planted hedgerows. Design of forcemain alignment to minimize or avoid impact to trees.

Criteria	Alternative Outfall Location #1 (Keenansville)	Alternative Outfall Location #2 (Conc. Rd. 8)
Potential impact to surface or groundwater quality	**Equally Preferred** Alternative outfall locations have similar assimilative capacity. Minimal to no impact on watercourse expected, as after-mixing concentrations will be below PWQO's. Watercourses at both alternative locations are designated as coldwater systems. Temperature of effluent upon leaving outfall to be consistent with coldwater stream thermal characteristics. No thermal impact is expected. 7Q20 low flow estimates are more than 10 times greater than proposed effluent flow for both alternative outfall locations, which indicates that there is sufficient dilution capacity under low-flow conditions. Forcemain would have no impacts to watercourses as there are no watercourse crossings.	**Equally Preferred** Alternative outfall locations have similar assimilative capacity. Minimal to no impact on watercourse expected, as after-mixing concentrations will be below PWQO's. Watercourses at both alternative locations are designated as coldwater systems. Temperature of effluent upon leaving outfall to be consistent with coldwater stream thermal characteristics. No thermal impact is expected. 7Q20 low flow estimates are more than 10 times greater than proposed effluent flow for both alternative outfall locations, which indicates that there is sufficient dilution capacity under low-flow conditions. Forcemain would have no impacts to watercourses as there are no watercourse crossings.
Summary – Natural Environment	**Both alternatives are Equally Preferred** • Both outfall locations have adequate low flows and similar assimilative capacity. After-mixing concentrations will be below Provincial Water Quality Objectives; therefore, both outfall locations have low potential to impact watercourse quality. • Neither forcemain routes are expected to have a negative impact on the natural environment. • Temperature of effluent upon leaving outfall to be consistent with upper range of coldwater stream thermal characteristics for both locations.	
Social / Cultural		
Potential Impact on Archaeological Resources	**Equally Preferred** Stage 1 and (where necessary) Stage 2 archaeological assessments completed for outfall and forcemain route. No further archaeological assessment is required. No impact to archaeological resources anticipated.	**Equally Preferred** Outfall location has undergone Stage 1 Archaeological Assessment, with no further archaeological assessment required. No impact to archaeological resources anticipated at outfall site. Forcemain route has undergone Stage 1 Archaeological Assessment. One ~570m section of forcemain route requires Stage 2 Archaeological Assessment. No impact to archaeological resources anticipated. C confirmed by Stage 2 archaeological assessment.

Criteria	Alternative Outfall Location #1 (Keenansville)	Alternative Outfall Location #2 (Conc. Rd. 8)
Visual landscape and Construction Disturbance	**Less Preferred** Alternative Outfall Location #1 is situated adjacent to Keenansville Road and may be partially visible from the road. There are about 14 homes that are located within 250m east and west along Keenansville Road. The outfall may be therefore visible to more local residents compared to Alternative Outfall #2. The closest house is located approximately 90m by straight line from the outfall. Given the number of households located within 250 m of Alternative Outfall Location #1, more residents could be potentially impacted by noise from construction.	**More Preferred** Located at the northern terminus of the gravel roadway of Concession Road 8. Due to minimal through traffic, fewer local residents, the outfall would be less visible to local residents. Closest house is ~185m away by straight-line, or about 480m to the closest household on Concession Road 8. Given the lower number of households located within 250 m of Alternative Outfall Location #2, there are fewer residents that could be potentially impacted by noise from construction.
Traffic impacts and interruption to residents	**Less Preferred** Construction of the outfall may require closure of one lane for construction equipment. This may cause some traffic disruptions for those residents living along Keenansville Road or potential through traffic. A greater number of households (~36) are located along the 2.8 km forcemain route (seven households along the common portion of the routes and 29 along Keenansville Road). Greater potential for traffic disruption during construction of the forcemain, particularly along Keenansville Road, where 29 of the homes along this route are located.	**More Preferred** Outfall located at end of an unpaved road. As such, no lane or other traffic restrictions are expected to be required during construction. Therefore, little to no traffic disruption is anticipated during the outfall's construction. Fewer homes (~17) are along the 5 km of the forcemain route, including 7 households along the common portion of the routes and 8 along Concession Road 8. Less potential for traffic disruption from the forcemain construction, as there is no through traffic (minor road) Forcemain route crosses Keenansville Road and County Road 1. Traffic impacts to be minimized through construction techniques (e.g., trenchless construction) and/or timing (e.g., night-time work, alternating single lane closures).
Summary - Social / Cultural	**Less Preferred** • No archaeological impacts anticipated • More opportunity for traffic disruption due to construction of both outfall and forcemain • Outfall location less remote, therefore potentially greater visibility.	**More Preferred** • Based on Stage 1 and Stage 2 findings, no archaeological impacts anticipated. • Less opportunity for traffic disruption from construction of outfall and forcemain • Outfall location more remote, with lower visibility.

Criteria	Alternative Outfall Location #1 (Keenansville)	Alternative Outfall Location #2 (Conc. Rd. 8)
Technical / Operational		
Overall Constructability	Less Preferred Installation of outfall would be within or near steep bank between the road shoulder and the natural grade. This could limit or create challenges for equipment access. The available space for the outfall within the road Right-of-Way and between the edge of road and private property lines is less than Alternative Location #2 (approximately 9 m, narrowing to about 3 m). No significant constructability challenges anticipated for forcemain route.	More Preferred Outfall location is more easily accessible for outfall installation. The full road Right-of-Way (20m) is available for design/construction of the outfall, which provides maximum flexibility for design and construction No significant constructability challenges anticipated for forcemain route.
Ease of Operations and Maintenance	Equally Preferred No maintenance concerns identified for outfall at this location. No maintenance concerns identified for the forcemain along this route. Portion of forcemain route unique to Alternative Forcemain Route #2 (West) includes 1.0 km of gravity pipe.	Equally Preferred No maintenance concerns identified for outfall at this location. No maintenance concerns identified for the forcemain along this route. Portion of forcemain route unique to Alternative Forcemain Route #3 (North) includes 470 m of pressurized forcemain and 2.9 km of gravity pipe. Additional forcemain length does not increase difficulty related to operations or maintenance. Most of added route consists of gravity pipe.
Summary – Technical / Operational	**Less Preferred** • Generally, this outfall location has adequate constructability. However, its location between the edge of the road and the ROW may require some additional effort and consideration compared to alternative Outfall Location #2. • No specific operations or maintenance issues for the forcemain are anticipated.	**More Preferred** • This alternative outfall location would be easier to construct due to the full availability of the road ROW. Similarly, works related to maintenance or repairs would be less disruptive to local traffic. • No specific operations or maintenance issues for the forcemain are anticipated.
Economic		
Relative impact on construction costs	**More Preferred** Estimated construction cost for the outfall and entire length of forcemain (2.8 km) is about $1.4M.	**Less Preferred** Estimated construction cost for the outfall and entire length of forcemain (5.0 km) is about $2.5M.

Criteria	Alternative Outfall Location #1 (Keenansville)	Alternative Outfall Location #2 (Conc. Rd. 8)
Relative impact on operations and maintenance costs	**Equally Preferred** No maintenance concerns identified for either outfall location or forcemain route.	**Equally Preferred** No maintenance concerns identified for either outfall location or forcemain route.
Summary – Economic	**More Preferred** • Relatively lower construction costs due to shorter length of forcemain	**Less Preferred** • Relatively higher construction costs due to longer length of forcemain
Overall Rating		
	Less Preferred As the previous recommended outfall location and forcemain route are in more populated and travelled areas, there may be higher potential for disruption during construction. The previous recommended location for the original outfall is within a narrow portion of the road Right-of-Way (ROW), situated between the side of the road and an adjacent property. Further, the outfall location would be proximate to the embankment alongside the road. This may cause challenges for equipment access during construction as compared to the alternative outfall location. Both outfall locations are similarly acceptable with respect to assimilative capacity, with after-mixing concentrations to be within the PWQO. Both outfall locations release or discharge into similar aquatic environments. Impacts from construction and operation will be minimized through outfall design and construction mitigation measures such as timing windows, etc. There is low potential for archaeological impacts. Neither outfall location or forcemain route are expected to have any specific concerns relating to operations or maintenance. The relative costs of previous recommended outfall location and forcemain route would be lower than the alternative, due to the shorter length of the forcemain.	**More Preferred** The new alternative outfall location and its associated forcemain route are in less populated and travelled areas; therefore, they would create less disruption during construction. The location of the new alternative outfall has the full road ROW available, optimizing constructability when compared to the original recommended outfall location. Both outfall locations are similarly acceptable with respect to assimilative capacity, with after-mixing concentrations to be within the PWQO*. Both outfall locations release or discharge into similar aquatic environments. Impacts from construction and operation will be minimized through outfall design and construction mitigation measures such as timing windows, etc. There is low potential for archaeological impacts. Neither outfall location or forcemain route are expected to have any specific concerns relating to operations or maintenance. The relative costs of the new alternative outfall location and forcemain route would be higher than the previous recommended, due to the longer length of the forcemain.

Based on the evaluation presented above, both alternative outfall locations are suitable for the proposed project. However, while Alternative Outfall Location #2 (Conc. Rd. 8) is farther away and requires a longer forcemain route, it would be easier to construct and construction of the outfall itself and its associated forcemain would have fewer disruptions to the community than Alternative Outfall Location #1 (Keenansville).

6.5 Preferred WWTP and Outfall Site and Forcemain Route

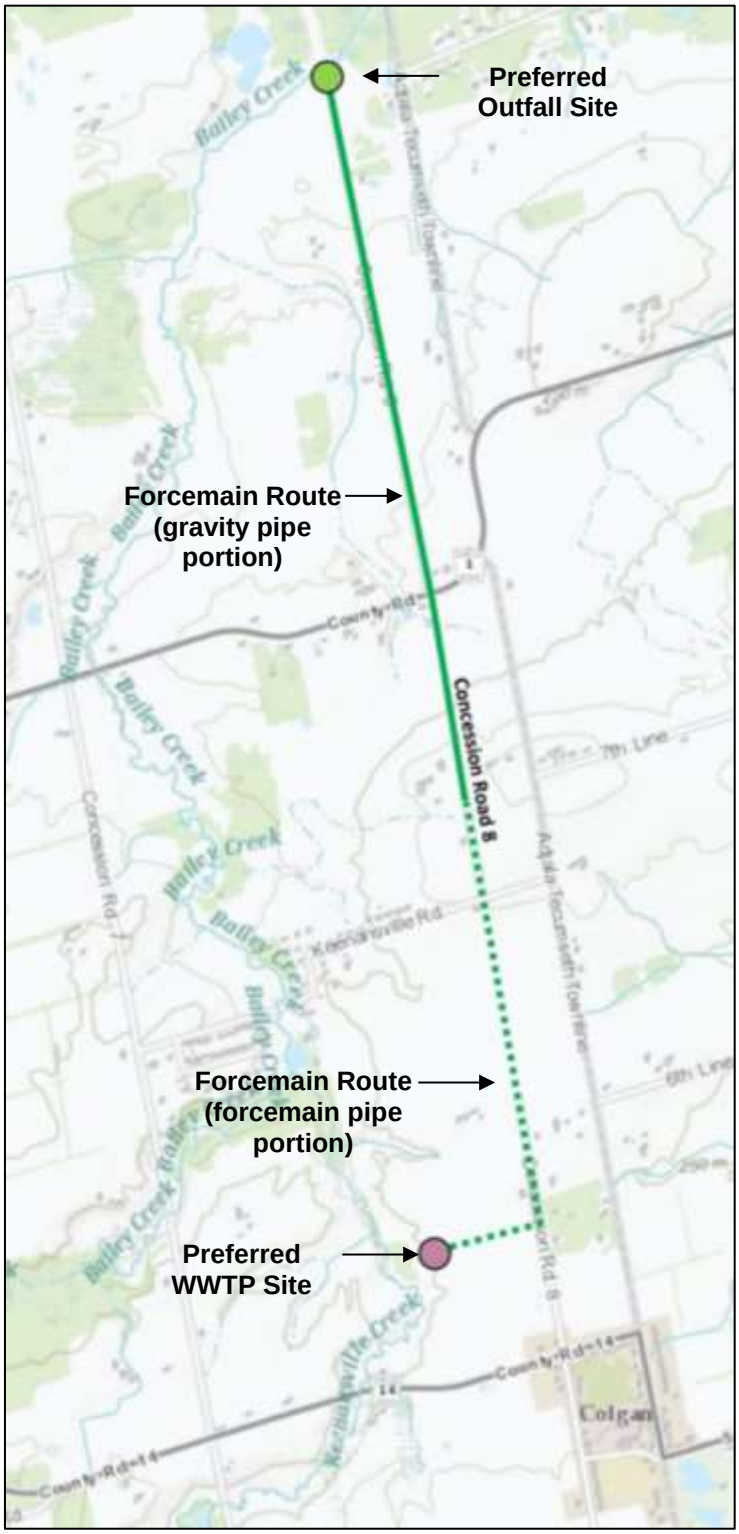
Based on the evaluation described in this section, the preferred WWTP Site, Outfall Site and Forcemain Route include:

- WWTP Site #2 (North); and
- Outfall Location #2 (Concession Road 8) and its associated forcemain route.

The preferred sites/route are depicted in the figure on the following page.

Both outfall locations (Location #1 and #2) are suitable for the proposed project. At the present time the ease of construction and fewer disruptions to the community have resulted in the preferred location being Outfall Location #2 (Concession Road 8). However, if technical-based issues arise during detailed design phase there may be a need to reconsider Outfall Location #1 and its associated forcemain route. As part of the Class EA process while Outfall Location #2 (Concession Road 8) and its associated forcemain route are preferred the intent is to keep the option available for Outfall Location #1 and its associated forcemain should the need arise, since both outfalls locations are suitable.

Figure 18: Preferred WWTP Site, Outfall Site and Forcemain Route



7 ALTERNATIVE DESIGN CONCEPTS FOR THE PREFERRED SOLUTIONS

This section discusses the alternative designs that were considered and evaluated for the preferred WWTP and outfall.

7.1 Wastewater Treatment Plant

Phase 3 of the Class EA process requires the development of alternative design concepts for the preferred solution. Evaluation of the WWTP design concepts consisted of a two-step process:

1. Review and (where applicable) screening of alternative treatment technologies for each stage of wastewater treatment; and
2. Preparation and evaluation of WWTP alternative design concepts.

The screening of the alternative treatment technologies was based on the following three questions:

1. Can the process alternative achieve the treatment objectives for total phosphorous (TP) and ammonia?
2. Is the technology suitable for the physical area and/or the treated capacity of the WWTP?
3. Is the treatment technology proven?

Technology options that met all three screening criteria were carried forward into the alternative WWTP alternative design concepts.

The review of alternative treatment technologies is presented below, followed by a review and evaluation of the alternative WWTP alternative design concepts.

7.1.1 Review and Screening of Alternative Treatment Technologies

There are several technologies to be considered across the stages of treatment. The discussions are organized according to the following selection of major system components:

- Preliminary treatment (including equalization);
- Primary treatment;
- Secondary treatment;
- Tertiary treatment;
- Effluent disinfection; and
- Sludge management.

7.1.1.1 Preliminary Treatment (Including Equalization)

Preliminary Treatment is used to screen out and remove large inorganic solids - such as rags, stones, grit and other debris - from the incoming wastewater. The need for preliminary treatment depends on the raw water characteristics as well as on the type of downstream treatment units. For a conventional suspended growth activated sludge process, screens with 12 mm aperture will be sufficient. For an attached growth process, coarse screens (with 25 mm aperture) and fine screens (<6 mm aperture) are normally required.

An equalization tank can be used to attenuate hydraulic and/or peak loads. For this development, pollutant loads should be relatively constant, since it is only servicing residential units and relatively few commercial units. Wastewater flow volume, however, may vary depending on time of day, season, or whether special or holiday events are underway. These fluctuations in flows can be managed using an equalization tank, which moderates wastewater flows to achieve a relatively constant input with similar concentrations.

7.1.1.2 Primary Treatment

The need for primary treatment depends on the downstream (i.e., secondary) treatment unit and on the sludge handling equipment. During primary treatment, small and suspended solids are settled in a primary clarifier and removed from the wastewater. Use of primary treatment provides better protection to downstream treatment units and reduces the organic loads requiring treatment in secondary treatment units. Conversely, the primary treatment unit requires routine operation and maintenance, such as the removal of sludge from the primary clarifier into the sludge storage tank.

Separate primary treatment is not always required during treatment processes. For example, fine screening during preliminary treatment may be sufficient for small applications, and some secondary treatment technologies (see next section) also complete primary treatment.

7.1.1.3 Secondary Treatment

Review of Secondary Treatment Technologies

During secondary treatment, dissolved organic matter is consumed by natural micro-organisms in aerated tanks or other basins. The main purpose of secondary treatment is to reduce the majority of organic pollutants, such as those resulting in an oxygen demand (measured as BOD_5)[7] and ammonium (NH_4). Secondary treatment typically reduces pollutant loads via aerobic microbiological degradation.

Secondary treatment is the main component of the wastewater treatment process, and as such there are many alternative secondary treatment technologies available. They are described in the table below, grouped according to the following four biological treatment categories:

- Suspended growth systems: microorganisms grow in suspension, facilitated by mixing and/or aeration.
- Attached growth systems: microorganisms grow on fixed media.
- Hybrid processes: combining elements of suspended and attached growth systems.
- Lagoon-based systems: this may involve suspended and/or attached growth of bacteria in large shallow basins or ponds containing wastewater.

During the secondary treatment process, wastewater treated through any one of the above biological treatment units will run through a secondary clarification process that settles and separates biomass (including microorganisms) from the treated wastewater before it proceeds to the next treatment process. The majority of the sludge (including biomass) collected from the secondary clarification process is sent back to the aeration chamber to treat more wastewater by strengthening the microbial culture. This sludge is known as return activated sludge (RAS). Excess sludge not reused in the clarifiers is known as waste activate

[7] BOD_5 refers to biochemical oxygen demand (BOD) over five days.

sludge (WAS). This WAS is pumped to a sludge storage basin and consequently to a sludge thickener and/or digester for further treatment.

Table 15: Description of Secondary Treatment Technology Alternatives

Alternative	Description
Suspended Growth Systems	
Conventional Activated Sludge	Conventional activated sludge systems involve an aeration tank followed by a secondary clarifier. Bacteria grow and consume organic matter and nutrients in the aeration tank before the suspension (known as Mixed Liquor Suspended Solids) is settled in the secondary clarifier. The settled suspension, which includes active bacteria, is partly recycled back to the aeration tank. Conventional activated sludge systems can operate under plug flow or complete mix configurations, with a typical hydraulic retention time of 4-12 hours for plug flow or 4-8 hours for complete mix. Longer retention times are involved for increased nitrification. This process is normally proceeded by mechanical screen. Grit removal may be required depending on application. Use of an equalization tank would reduce the size of the biological reactor as well as the secondary clarifier. The conventional activated sludge process is capable of satisfactory reduction of BOD_5, but is normally insufficient to meet stringent nitrification requirement.
Extended Aeration Activated Sludge	Extended aeration systems are similar to conventional activated sludge systems with an aeration tank followed by a secondary clarifier. It differs in that the aeration tank is much larger, with a hydraulic retention time of 24 hours or longer. The overall system is smaller since primary clarifiers are not required, and the secondary clarifier is of a similar size to those in conventional systems. Due to the longer sludge retention time, the extended aeration process provides better nitrification (+/- 1 mg/L) than the conventional activated sludge process. Proper process control is a key factor to ensure satisfactory performance. The process is normally proceeded by mechanical screen. Grit removal may be required depending on application. Use of equalisation tank will reduce the size of the aeration tank as well as the secondary clarifier.
High-Rate Activated Sludge	High-rate activated sludge systems use the same approach as conventional activated sludge systems, except with a smaller aeration tank and thus a smaller hydraulic retention time, as low as 1-2 hours, resulting in reduced nitrification.
Two-Stage Activated Sludge Process	A two-stage process involves a high-rate activated sludge system followed by a separate tank for nitrification and an additional clarifier whose sludge is recycled to the nitrification tank. Proper process control is a key factor to ensure satisfactory performance. The process is normally proceeded by mechanical screen. Grit removal may be required depending on application. Use of equalisation tank will reduce the size of the biological reactor as well as the secondary clarifier.
Sequencing Batch Reactor Activated Sludge	Sequencing batch reactor (SBR) systems involve suspended bacteria facilitating the consumption of organic matter and nutrients, but with all steps occurring in a single complete mix reactor, processed in batches. As a result, at least two reactors are required for continuous operation, with at least one reactor filling with incoming wastewater. The cycle followed includes filling of the tank, aeration, settling, and withdrawal of supernatant. Sludge wasting typically occurs during the aeration stage. With the sensitivity of this technology to flow variation, additional tanks before the sequence batch reactor tanks may be used for flow equalization and improved mixing. The SBR can be designed as extended aeration process. In this case, it can achieve similar performance as the extended aeration process. The process is normally proceeded by mechanical screen. Grit removal may be required depending on application. Use of equalisation tank will reduce the size of the SBR reactor.

Alternative	Description
Activated Sludge Processes with Multiple Zones	Modifications to activated sludge processes may be made such that there are zones in which anoxic, anaerobic and aerobic conditions are present. This can allow for greater removal of nitrogen and phosphorus and prevent the need for tertiary treatment. Various designs exist such as the Ludzak-Ettinger process, which involves an anoxic zone followed by an aerobic zone. Proper process control is a key factor to ensure satisfactory performance. The process is normally proceeded by mechanical screen. Grit removal may be required depending on application. Use of equalisation tank will reduce the size of the biological reactor as well as the secondary clarifier.
Membrane Bioreactor (MBR)	Membrane bioreactor systems incorporate the same approach as conventional activated sludge systems, but with membranes serving the purpose that a secondary clarifier serves in a conventional system. The membranes are placed in modules within a compartment of the aeration tank or a separate tank. The membranes are subject to a vacuum to enable the effluent to flow through them. The sludge remains in the tank before being recycled back to the aeration tank. While the membranes save footprint compared to secondary clarifiers, they require additional elements to properly function, including fine screening upstream of them. Compressed air distributed at the modules' bases is also used to create air bubbles to scour membrane surfaces. The use of membrane enhances suspended solids removal. With the addition of coagulant, the MBR process is capable to meet stringent phosphorous effluent requirement The process is normally proceeded by fine screen. Grit removal and/or primary clarifier may be required depending on application. Use of equalisation tank will reduce the size of the MBR reactor.
Attached Growth Systems	
Trickling Filter	Trickling filters use a packing material with a high porosity in a column over which wastewater is distributed. The packing material is nonsubmerged filtration media, with wastewater trickling down the material while air flows either in the same direction or in the opposite direction. A biofilm grows on the surface of the packing material and enables the necessary reactions to take place. A portion of the effluent is recycled to ensure that the packing material remains wet. From the filter, the effluent proceeds to a secondary clarifier to settle the suspension that has sloughed off of the media. This process is heavily temperature-dependent. The process is normally proceeded by a suitable screening facility. Grit removal and/or primary clarifier may be required depending on application. Use of equalization tank will reduce the size of the reactor.
Rotating Biological Contactor	Rotating biological contactors involve a fixed media mounted on a rotating shaft. The media is rotated in the direction of the wastewater in which it is partially submerged. This allows oxygen to consistently be introduced to the biofilm that grows on the media. From the filter, the effluent proceeds to a secondary clarifier to settle the suspension that has sloughed off of the media. This process is heavily temperature-dependent. Proper process control is a key factor to ensure satisfactory performance and to avoid mechanical breakdown. Multi-stage reactors are required for nitrification The process is normally proceeded by a suitable screening facility. Grit removal and/or primary clarifier may be required depending on application. Use of equalization tank will reduce the size of the reactor.

Alternative	Description
Integrated Fixed-film Activated Sludge	Integrated fixed-film activated sludge systems include an activated sludge system with the addition of media either suspended in the activated sludge or fixed in the aeration tank. Screens ensure that suspended media is dispersed and prevent it from flowing with the effluent. The added media increases the effective solids retention time thus improving nitrification or reducing footprint required for the same treatment. However, proprietary media is required as well as a high dissolved oxygen (DO) operating concentration compared to conventional activated sludge systems. Multi-stage reactors are required for nitrification The process is normally proceeded by a suitable screening facility. Grit removal and/or primary clarifier may be required depending on application. Use of equalization tank will reduce the size of the reactor.
Moving Bed Bioreactor (MBBR)	Moving bed bioreactors involve suspended media in an aeration tank. However, they differ from integrated fixed-film activated sludge systems since they have no return activated sludge, and have a higher media fill volume fraction. Similar to integrated fixed-film activated sludge systems, proprietary media is required as well as a high DO operating concentration. Multi-stage reactors are required for nitrification The process is normally proceeded by a suitable screening facility. Grit removal and/or primary clarifier may be required depending on application. Use of equalization tank will reduce the size of the reactor.
Lagoon-based Systems	
Lagoons	Lagoons used for secondary treatment may be aerobic, anaerobic or facultative. Aerobic lagoons involve bacteria which thrive under oxygen-rich conditions, anaerobic lagoons involve bacteria which thrive without oxygen, and facultative lagoons involve both types of bacteria. The lagoons are simple to operate. However, they can not provide satisfactory nitrification, especially during the winter. The footprint of the lagoons is the largest among all the secondary treatment alternatives.
Submerged Attached Growth Reactor	A lagoon may be followed by a submerged attached growth reactor. This system involves aeration and submerged aggregate to provide additional surfaces for bacteria to grow. Nitrification is thus improved. Moreover, for nitrate removal, flow can be recirculated back to the lagoon for denitrification. This system can operate well even in cold climates. The lagoons are simple to operate. As it is a lagoon-based reactor, it has a large footprint.
Secondary Clarification	
Gravity Settling Tank	Gravity settling tanks are normally equipped with sludge/scum removal mechanisms. Coagulant may by added to enhance suspended solids and phosphorous removal.
Ballasted Clarification	In this technique, wastewater is first mixed vigorously in a chamber, before having microsand or magnetite added in a second chamber. A third chamber follows, in which contaminants are settled and the microsand or magnetite is separated for reuse. Continuous addition of the microsand or magnetite is however still required since not all added can be reclaimed.
Dissolved Air Flotation (DAF)	Dissolved air flotation involves the use of air bubbles to remove contaminants. To do so, the flow is first pressurized and compressed air added. After sufficient time has passed for the air to dissolve, the flow is then released via a pressure control valve to a flotation tank. In this tank, the air comes out of solution as bubbles which remove contaminants as they rise to the surface. It is noted that in smaller systems, the entire flow is pressurized, while in larger systems, a slight variation is made in which only a portion of the flow is pressurized.

Screening of Secondary Treatment Alternatives

The alternative secondary treatment technologies were reviewed and screened for consideration in the alternative WWTP treatment process designs, based on the screening questions noted previously.

Technology options that met all three screening criteria were carried forward into the alternative WWTP treatment process designs. Table 16 summarizes the results of the secondary treatment screening.

Table 16: Screening of Treatment Technologies: Secondary Treatment

Secondary Treatment Technology	Q1: Treatment Objectives (TP and NH3)	Q2: Size & Capacity	Q3: Proven Technology	Carry Forward Decision & Rationale
Conventional Activated Sludge (CAS)	**No** TP: will require separate treatment NH3: Partial removal only	**Yes** Size of site is tight for CAS, but manageable CAS adequate for treatment capacity	**Yes** Commonly used technology	**No** This process alone is not capable to meet both TP and NH3 objectives.
Extended Aeration Activated Sludge	**Yes** TP: will require separate treatment NH3: Potential for high level of removal	**No** Tankage requirement is larger than CAS process and may be constrained by available treatment plant site limits. Technology adequate for treatment capacity.	**Yes** Commonly used technology	**No** Treatment technology constrained by site size limits.
High-rate Activated Sludge (HRAS)	**No** TP: will require separate treatment NH3: Partial removal only	**Yes** Size of site is tight for HRAS, but manageable HRAS adequate for treatment capacity	**No** Relatively less used	**No** Process alone is not proven to be capable of meet treatment objectives.
Sequencing Batch Reactor (SBR) Activated Sludge	**Yes** TP: will require separate treatment NH3: Potential for high level of removal	**Yes** Size of site is tight for SBR, but manageable SBR adequate for treatment capacity	**Yes** Commonly used technology	**Yes** Process can be designed with long sludge age to achieve nitrification. Separate settling tank is not required.

Secondary Treatment Technology	Q1: Treatment Objectives (TP and NH3)	Q2: Size & Capacity	Q3: Proven Technology	Carry Forward Decision & Rationale
Activated Sludge Processes with Multiple Zones	**Yes** TP: Relatively high removal but additional treatment may be needed. NH3: Potential for high level of removal	**No** Multiple reactors required; constrained by size of site. Adequate for treatment capacity	**No** Relative less used and complex to operate	**No** Large tankage requirement compared to other technologies
Membrane Bioreactor (MBR)	**Yes** TP: Yes NH3: Potential for high level of removal with additional treatment	**Yes** Size of site adequate Adequate for treatment capacity	**Yes** Well-established technology	**Yes** Tertiary treatment unit not required for phosphorus removal
Trickling Filter (attached growth)	**No** TP: will require separate treatment NH3: Potential for high level of removal	**Yes** Size of site is tight for technology, but manageable Adequate for treatment capacity	**Yes** Well-established technology	**No** Will require multi-stage treatment with tricking filters, which is not desirable for this plant.
Rotating Biological Contactor (attached growth)	**No** TP: Not applicable NH3: No	**Yes** Size of site is tight for technology, but manageable Adequate for treatment capacity	**Yes** Well-established technology	**No** Process alone is not proven to be capable of meeting treatment objectives.
Integrated Fixed-film Activated Sludge (attached growth)	**No** TP: will require separate treatment NH3: Potential for good level of removal. Better than extended aeration	**Qualified Yes** Size of site is tight for technology, but manageable Adequate for treatment capacity	**Yes** Well-established technology	**No** Process alone is not capable of meeting TP objectives and would need additional equipment, impacting compactness of plant footprint.

Secondary Treatment Technology	Q1: Treatment Objectives (TP and NH3)	Q2: Size & Capacity	Q3: Proven Technology	Carry Forward Decision & Rationale
Moving Bed Bioreactor (MBBR)	**Yes** TP: Good removal but additional treatment would be needed NH3: Good level of removal. Better than extended aeration	**Yes** Size of site adequate Adequate for treatment capacity	**Yes** Well-established technology	**Yes** Able to meet treatment requirements and meet site constraints. Would require secondary settling tank or clarifier to complete treatment.
Sewage Lagoons with SAGR	**Yes** TP: will require separate treatment NH3: Yes	**No** Size of site is inadequate. Adequate for treatment capacity.	**Yes** Commonly used technology	**No** Application of the process is limited by land availability.

Based on the screening process above, the secondary treatment technologies carried forward to the alternative design concepts include:

- Sequencing Batch Reactor (SBR);
- Membrane Bioreactor (MBR); and
- Moving Bed Bioreactor (MBBR).

7.1.1.4 Secondary Clarification

Effluent from any one of the above biological treatment units runs through a secondary clarification process, which helps to settle and separate biomass (including microorganisms) and allow the remaining wastewater effluent to proceed to the next treatment process. Three potential forms of secondary clarification are: gravity settling tank, ballasted clarification and dissolved air flotation. These technologies are not evaluated since they are linked to the form of secondary treatment used and therefore cannot be evaluated independently.

7.1.1.5 Tertiary Treatment

Review of Tertiary Treatment Technologies

Tertiary treatment provides further removal of suspended solids and total phosphorus, if the effluent criteria have not already been achieved through secondary treatment. Therefore, depending on the secondary treatment technology used, tertiary treatment may or may not be required.

Examples of tertiary treatment technologies are described in the table below. Generally, tertiary treatment can typically be divided under two types:

- Sand filtration: achieves filtration via sand media through which effluent flows, physically removing the contaminant.
- Membrane filtration: achieves filtration via fine porous membranes.

For both types, addition of coagulant is required for phosphorus removal.

Table 17: Tertiary Treatment Technology Alternatives

Alternative	Description
Depth filtration	This proven technology uses sand and/or anthracite as its filtration media. Typically, wastewater is directed downward through the filters however in other configurations it may be directed upwards instead. In order to ensure head loss is minimized, backwashing of the filter is required. In conventional systems this is achieved using multiple filters. The system is designed such that some filters are backwashed while others continue to treat wastewater.
Depth filtration with Continuous Backwash	This technology uses a deep bed of sand as its filtration media. Wastewater is distributed along the bottom of the filter and flows upward through the downward moving sand. The filtrate then exits via weirs at the surface. At the same time, sand and trapped solids are move downwards towards an airlift pipe containing compressed air in the center of the filter. This enables the sand filter media to continuously be cleaned as its surfaces are scoured by the air and trapped solids are separated.
Cloth Media Disc Filtration	This is a proven filtration technology using vertical woven cloth discs or fiber pile construction in addition to granular media or membranes, approximately for 10-micron TSS removal. Phosphorus removal can also be achieved. The disc rotates and any non-submerged area gets submerged and becomes active. Solids are removed by pressure wash using spray nozzles and wash water pump.
Membrane filtration	This proven technology uses membranes as its filtration media. Membrane filtration involves additional design parameters including whether they are operated in a pressure vessel or submerged and subjected to a vacuum. Membranes are also backwashed and chemically cleaned periodically to minimize effects of fouling.

Screening of Tertiary Treatment Alternatives

As with the secondary treatment technologies, the alternative tertiary treatment technologies were reviewed and screened based on the three screening questions described previously. Table 18 summarizes the results of the screening process.

Table 18: Screening of Treatment Technologies: Tertiary Treatment

Technology	Q1 (Objectives)*	Q2 (Size/capacity)	Q3 (Proven)	Carry Forward / Rationale
Depth filtration with periodic backwash	**No** Not sufficient to meet the TP requirements	**Yes**	**Yes**	**No** Not sufficient to meet the TP requirements
Depth filtration with Continuous Backwash	**No** Not sufficient to meet the TP requirements	**Yes**	**Yes**	**No** Not sufficient to meet the TP requirements
Cloth Media Disc Filtration	**No** Not sufficient to meet the TP requirements	**Yes**	**Yes**	**No** Not sufficient to meet the TP requirements
Membrane filtration	**Yes**	**Yes**	**Yes**	**Yes**

**Evaluation for TP. It is not as per screening questions*

Based on the screening above, membrane filtration is the only tertiary treatment technology carried forward.

7.1.1.6 Disinfection

Review of Alternative Disinfection Technologies

Disinfection is used to provide destruction or inactivation of any pathogenic organisms remaining after completion of secondary and tertiary treatment; disinfection is the final stage before release into the environment.

Three approaches to disinfection were considered: chlorination, ozonation, and ultraviolet disinfection. All three approaches rely on contact time, which can relate to the size of the contact chamber used, and hence the technology's physical footprint. These technologies are summarized in the table below.

Table 19: Disinfection Technology Alternatives

Alternative	Description
Chlorination	This proven technology involves the addition of some form of chlorine, applied across a contact chamber which is designed to operate as a plug-flow reactor. Careful consideration must be made for residual chlorine existing after the reaction, and its potential impacts on aquatic life in the area in which the effluent is released, as in most cases chlorine removal is required prior to discharging to the environment. Chlorine achieves disinfection by destroying the organism. Chlorine is very effective at destroying most pathogens (e.g. *E. coli*) yet one of its main limitations is its ineffectiveness with certain protozoa (especially *Cryptosporidium*), for which ozone or UV radiation is required. Other limitations of chlorine disinfection are that it is prone to forming disinfection by-products and can affect the water's taste, both of which are not cause by ozone or UV radiation.
Ozonation	This technology uses ozone bubbled through the wastewater either directly in a contact chamber or in a sidestream that is then injected into the contact chamber. Ozone gas is generated on site using pure oxygen, which can be either generated on-site or using commercially available liquid oxygen (LOX). Ozone also achieves disinfection by destroying pathogens. Its advantages include that it disinfects quicker (thus requiring less contact time and a smaller contact chamber) and that it is effective against chlorine-resistant pathogens such as *Cryptosporidium* and *Giardia*. Its main limitation for drinking water applications is that it leaves no residual disinfectant in the water, which is not a concern for the proposed Colgan WWTP. Other limitations include that it is costly to implement and to operate/maintain, and the possible formation of the disinfection by-product bromate if bromide is present in the water.

Alternative	Description
Ultraviolet (UV) Disinfection	This technology involves the use of UV radiation transmitted through the wastewater to inactivate microorganisms. Thus, it achieves disinfection not through destroying the organism, but through damaging its DNA, rendering it unable to replicate or infect. UV lamps may be arranged either in an open channel reactor or a closed contact chamber. Similarly, different UV lamp technologies and arrangements may be applied. Advantages of UV radiation for the proposed Colgan WWTP include: the absence of a disinfectant residual (thus not requiring removal prior to discharge); the smallest process footprint compared to ozone or chlorine treatments; and its effectiveness against treating chlorine-resistant pathogens. Disadvantages include: initial and operational costs may be higher; potentially high hydraulic headloss through the unit; operational complexity; and it is not effective at disinfecting certain types of viruses.

Screening of Alternative Disinfection Technologies

Screening of the disinfection technologies used the same approach as in the previous sections. For disinfection, the treatment objective used was 80 CFU/100 ml. Table 20 summarizes the results of the screening process.

Table 20: Screening of Treatment Technologies: Disinfection

Technology	Q1 (Objectives)	Q2 (Size/capacity)	Q3 (Proven)	Carry Forward / Rationale
Chlorination	**No**	**Yes**	**Yes**	**No**
Ozonation	**Yes**	May be size constraints. On-site ozone generation unit and a contact chamber are required.	Known but use in wastewater treatment is not common	**No** Site-generation of O3 involves sophisticated mechanical/electrical equipment Requires Contact Tank
Ultraviolet (UV) Disinfection	**Yes**	**Yes**	**Yes**	**Yes** Proven technology and performance Simple equipment Simple Operations and Maintenance

7.1.1.7 Sludge Handling

The sludge produced by the treatment processes used will need to be properly managed. Two general approaches were considered:

- Storage of sludge in an aerated sludge holding tank to be trucked elsewhere for further treatment; or
- Treatment onsite including thickening and dewatering prior to being transported elsewhere for further processing or disposal, in order to reduce the volume of sludge to be disposed.

When on-site treatment takes place, different technologies may be chosen for thickening and dewatering the sludge. For example, a gravity thickener, rotary drum thickener, flotation thickener or centrifuge could be considered for thickening, while a belt-filter press, rotary press or centrifuge could be considered for dewatering.

The specific method for sludge management will be developed during detailed design. The table below provides a summary of the types of treatment.

Table 21: Examples of Sludge Management Treatment

Technology	Description
Onsite aerated storage of unprocessed sludge and treat offsite	Simple installation Higher operating costs for aeration and sludge disposal Optimal alternative to be determined by technical and economic analysis
On site thickening of sludge followed by transportation for off site disposal	Involves more equipment and less operations and maintenance (O&M) Optimal Alternative to be determined by technical and economic analysis
On site thickening and dewatering of sludge followed by transportation for off site disposal	Involves more equipment and less operations and maintenance (O&M) Optimal Alternative to be determined by technical and economic analysis

7.1.2 Identification and Evaluation of Alternative Design Concepts

Based on the results of the screening process, three alternative design concepts were developed. They are summarized in Table 20 and include:

- Sequencing Batch Reactor (SBR) with membrane filter;
- Membrane Bioreactor (MBR); and
- Moving Bed Bioreactor (MBBR) with membrane filter.

Table 22: WWTP Alternative Design Concepts

Concept #	Short Name	Preliminary Treatment	Primary Treatment	Secondary Treatment	Secondary Clarification	Tertiary Treatment (TP <0.05 mg/L)	Disinfection (80 CFU per 100ml)	Sludge Management
1	SBR + membrane filtration	• Equalization tank • Screening	No primary clarifier required (occurs during Secondary Treatment)	Sequencing Batch Reactor	n/a (part of SBR process)	Membrane filtration	UV	• On-site storage and final disposal; or • On-site sludge thickening/dewatering and final disposal *(determined during detailed design)*
2	MBR	• Equalization tank • Screening	Optional primary clarifier (can be part of Secondary Treatment)	Membrane Bioreactor	n/a (included within MBR)	n/a (included within MBR)	UV	• On-site storage and final disposal; or • On-site sludge thickening/dewatering and final disposal *(determined during detailed design)*
3	MBBR + membrane filtration	• Equalization tank • Screening	No primary clarifier required (occurs during Secondary Treatment)	Moving Bed Bioreactor	Dissolved air floatation	Membrane filtration	UV	• On-site storage and final disposal; or • On-site sludge thickening/dewatering and final disposal *(determined during detailed design)*

The three alternative design concepts were evaluated based on the criteria listed in the table below. The alternative concepts were rated more, less and least preferred for each category, and then a most preferred alternative design concept selected.

Table 23: Criteria for Evaluating Short-listed WWTP Treatment Technologies

Evaluation Category	Evaluation Criteria
Natural Environment	Impact on receiving water (effluent quality)
	Impact on terrestrial environment
Technical / Operational	Performance
	Reliability; ease of operation
	Complexity of maintenance
Social / Cultural Impacts	Odour control
	Noise
	Traffic impacts; interruption to residents
	Footprint (i.e. compactness)
Economic	Capital/construction costs
	Operation and maintenance costs

Based on the results of the evaluation in Table 24 (on the subsequent pages), the preferred WWTP design concept was Alternative 2: Membrane Bioreactor (MBR).

Table 24: Detailed Evaluation of Short-listed Secondary Treatment Technologies

Criteria	Alternative 1: SBR + membrane filtration	Alternative 2: MBR	Alternative 3: MBBR + Membrane filtration
Natural Environment			
Impact on receiving water (effluent quality)	Minimal impact anticipated on receiving waters due to high quality effluent	Minimal impact anticipated on receiving waters due to high quality effluent	Minimal impact anticipated on receiving waters due to high quality effluent
Impact on terrestrial environment	No adverse terrestrial impacts anticipated	No adverse terrestrial impacts anticipated	No adverse terrestrial impacts anticipated
Summary	**Equally Preferred**	**Equally Preferred**	**Equally Preferred**
Technical / Operational			
Performance	Can reliably meet effluent quality objectives	Can reliably meet effluent quality objectives	Can reliably meet effluent quality objectives
Reliability / ease of operation	Requires high level of operator involvement to ensure facility meets effluent objectives	Typically requires high level of operator involvement to ensure facility meets effluent objectives; however, potential economies of scale with proposed Everett WWTP (same technology)	Easier to operate (compared to Alternatives 1 and 2) so that effluent objectives are met consistently
Complexity of maintenance	Medium to high level of complexity of maintenance	Medium to high level of complexity of maintenance	Medium to high level of complexity of maintenance
Summary	**Less Preferred**	**More Preferred**	**More Preferred**

Criteria	Alternative 1: SBR + membrane filtration	Alternative 2: MBR	Alternative 3: MBBR + Membrane filtration
Social / Cultural Impacts			
Odour control	Similar potential for odour generation, but can be mitigated though standard odour control measures	Similar potential for odour generation, but can be mitigated though standard odour control measures	Similar potential for odour generation, but can be mitigated though standard odour control measures
Noise	Level of noise moderate and to be mitigated on site	Level of noise moderate and to be mitigated on site	Level of noise moderate and to be mitigated on site
Traffic impacts/interruption to residents	Moderate level of traffic impacts anticipated due to delivery of chemicals required for plant operations and removal of sludge	Moderate level of traffic impacts anticipated due to delivery of chemicals required for plant operations and removal of sludge	Low to moderate level of traffic impacts anticipated due to delivery of chemicals required for plant operations and removal of sludge
Footprint (Compactness)	Medium sized building footprint	Smallest / most compact building footprint	Large building footprint
Summary	**Less Preferred**	**More Preferred**	**Less Preferred**
Economic			
Capital/construction costs	Potentially moderate capital cost	Potentially lowest capital cost	Potentially highest capital cost
Operation and maintenance costs	Potentially highest O&M cost	Potentially moderate O&M cost; however, potential economies of scale with proposed Everett WWTP (same technology)	Potentially moderate O&M cost
Summary	**Less Preferred**	**More Preferred**	**Less Preferred**
Overall Summary			
	Least Preferred Meets technical criteria Effluent quality sensitive to operator involvement Highest overall costs Medium sized building footprint	**More Preferred** Meets technical criteria Effluent quality sensitive to operator involvement Smaller building footprint Lowest capital costs	**Less Preferred** Meets technical criteria Ease of operation will allow consistent and reliable effluent quality Higher capital costs Larger building footprint

7.2 WWTP Outfall

The alternative designs for the WWTP outfall focus on the design characteristics of the outfall and its placement at the outfall site. The specific design of the outfall will be completed during detailed design.

Alternative designs for the Concession Road 8 outfall site is reviewed in the paragraphs that follow.

7.2.1 Outfall Design Characteristics

While the specific design of the outfall will be completed during detailed design, consultation to date with the MECP and the NVCA have identified a number of design characteristics to be included, such as:

- Erosion control measures - to ensure that flow coming from the outfall will not cause scouring or erosion within the watercourse;
- Slope stability measures - to ensure that the watercourse banks around the outfall will remain stable;
- Watercourse protection during construction - to help ensure there will be minimal impact to the watercourse, the design should include minimal to no in-creek construction activities.

The outfall design would also consider seasonal flooding of the watercourse, which according to reports by residents can be severe. The hydraulic profile of the gravity pipe will be designed such that flooding would not cause a backup of the treated wastewater discharge. Further, the outfall design itself should be such that it resists erosion or other impacts during flood events.

The outfall discharge is not expected to exacerbate flood conditions during the flood periods. An addendum to the ACFS (see Appendix B) considered the impact of the WWTP's average daily WWTP flow on flood conditions. Based on flow data from Water Survey of Canada downstream flow stations, discharge flow exiting the outfall would make up less than 0.2% of downstream flood waters.

7.2.2 Concession Road 8 Outfall Design Alternatives

As noted in Section 6, the Concession Road 8 Outfall location is the preferred location for the proposed Colgan WWTP. It was presented as the preferred location in PIC #2, which also presented the evaluation of three alternative design concepts for consideration. Figure 19 depicts the watercourse near the outfall location (looking east from the western boundary of the ROW).

The three alternative outfall design concepts considered for the Concession Road 8 Outfall location are reviewed in Table 25. The alternative outfall design concepts did not undergo a full multi-criteria evaluation, but rather were screened based on their ability to allow for erosion control measures and watercourse protection during construction.

Figure 19: Concession Road 8 Outfall Location

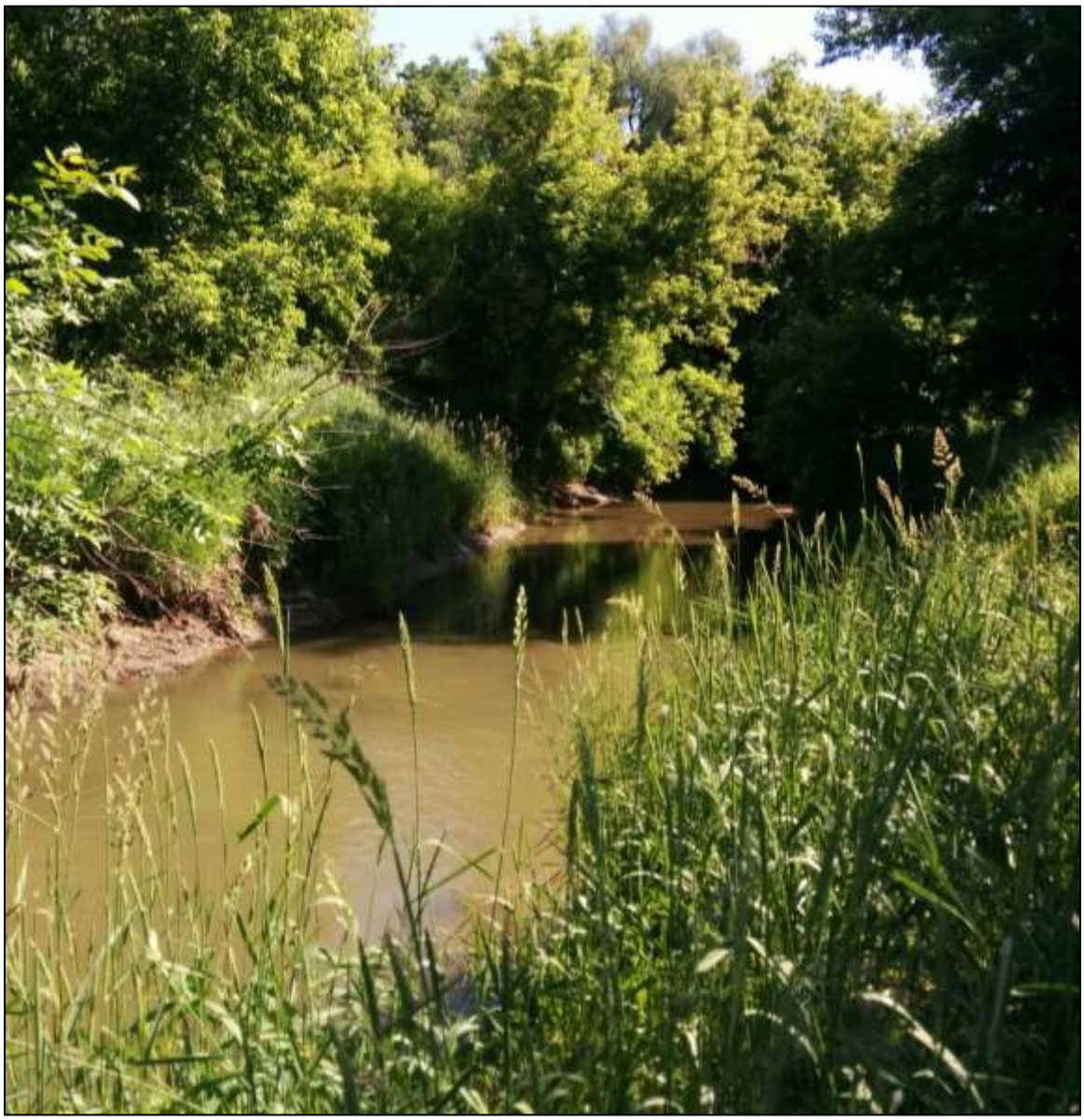
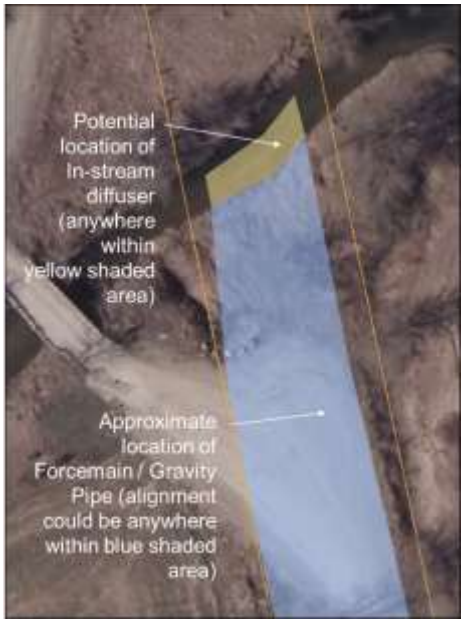
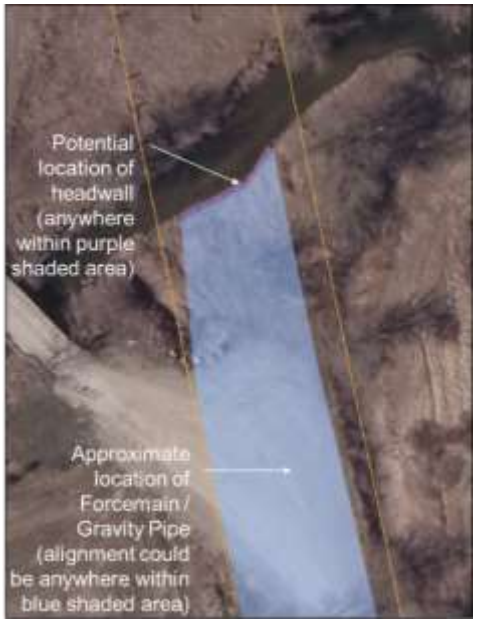
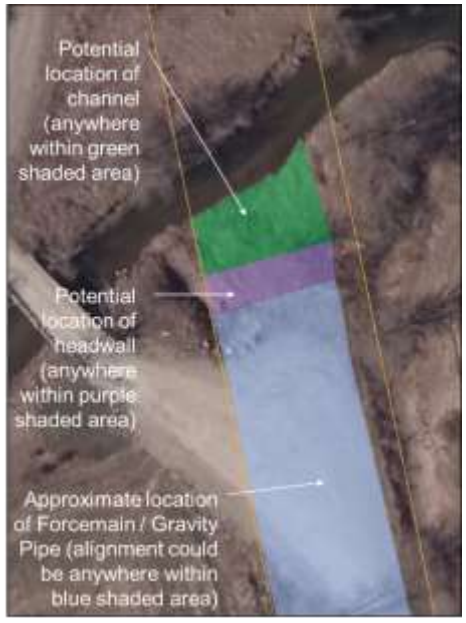


Table 25: Concession Road 8 Outfall Alternative Design Concepts

Alternative Outfall Design #1: In-stream Diffuser	Alternative Outfall Design #2: At-stream Headwall	Alternative Outfall Design #3: Outfall through Channel
		
• Forcemain would discharge directly into watercourse • Flow of treated wastewater distributed using in-stream diffusers **Not recommended, as it would require in-stream works**	• Forcemain headwall positioned at watercourse edge • Treated wastewater to flow directly into watercourse **Not recommended, due to lack of erosion controls**	• Forcemain would empty into ditch/channel, which would empty into watercourse (position of headwall/length of channel/ditch may vary) • Would allow for energy dissipation before entering watercourse • New ditch/channel would include erosion and sediment controls • Would avoid construction within watercourse **Recommended for further consideration in detailed design**

The preferred outfall design concept was Alternative Outfall Design #3: Outfall through Channel, which includes the following characteristics:

- The forcemain would empty into ditch or channel, which would empty into the watercourse. The position of headwall and length of channel or ditch would be determined during detailed design, based on the topography and characteristics of the watercourse embankment.
- The outfall design would allow for energy dissipation of the wastewater effluent flows before entering watercourse, thereby reducing the potential for erosion/scouring.
- The new ditch/channel would include erosion and sediment controls.
- Offsetting the headwall and application of the channel helps to minimize construction within the watercourse, avoiding potential in-stream impacts during construction.

8 PREFERRED DESIGN CONCEPT

8.1 Wastewater Treatment Plant

8.1.1 WWTP Treatment Process

The selected process is membrane-bio reactor (MBR) based wastewater treatment process. This is a multiple-stage treatment process. Description of the treatment process is given below.

Stage 1: Wastewater Collection

Wastewater will travel from homes to be constructed in the planned Colgan development to the wastewater treatment plant (WWTP) through an underground sanitary sewer system. This system and pipes thereof will only be used for wastewater (i.e., from toilets, sinks, showers, washing machines, etc. within the home). No stormwater from overland rain, no run-off from the rainwater leaders and no snow melt runoff will be collected in the sanitary sewer system, nor will these be treated in the WWTP. Since stormwater for the Colgan development will be handled separately in a stormwater pond, rain events or snow melts will not increase the amount of wastewater handled by the Colgan WWTP.

Once the wastewater reaches the WWTP, it will be cleaned and disinfected using a multi-stage treatment process. This treatment process (Stages 2 to 6) will occur within the enclosed WWTP building.

Stage 2. Preliminary and Primary Treatment

During preliminary treatment, the incoming wastewater travels through degritter and fine screens to filter out grits, sands and any large inorganic solids. Wastewater then enters a tank called an equalization basin or chamber. This chamber helps to manage fluctuations in the flow of incoming wastewater and ensures there is a balanced volume of wastewater flowing through the treatment process. The equalization chamber is aerated, which means air bubbles are pumped into the wastewater; this helps to begin and enhance the treatment process.

The preliminary and primary treatment areas will be fully enclosed within the WWTP. Air from within the preliminary and primary treatment areas will be collected and treated by odour control units prior to release to the atmosphere.

Stage 3. Secondary Treatment (including Secondary Clarification and Tertiary Treatment)

The next three steps for wastewater treatment include secondary treatment, secondary clarification and tertiary treatment. These steps will occur within the Membrane Bio-Reactor unit.

A Membrane Bio-Reactor (MBR) uses a combination of a suspended growth bioreactor and a series of micro or ultra-filtration non-submerged membranes to treat wastewater. The suspended growth bio-reactor uses micro-organisms that consume the dissolved organic matter and thus, the majority of the organic matters are removed from the wastewater. This is called the secondary treatment process. Thereafter, all microorganisms including dying microorganisms settle out and are separated from the wastewater stream and this is referred to as secondary clarification. Finally, the membrane filtration system separates suspended and dissolved solids including inorganics and pollutants, such as phosphorus. This portion is called the tertiary treatment process.

The MBR will be fully enclosed within the WWTP. Air from within this area will be collected and treated by odour control units prior to release to the atmosphere.

Stage 4. Disinfection

Once filtered through the Membrane Bio-Reactor, the treated wastewater is disinfected using Ultraviolet (UV) Disinfection technology. This process allows the treated effluent to be disinfected using lamps, but without the use of chemicals (such as chlorine).

Once the treated wastewater finishes the treatment process, it will have met the MECP's strict compliance limits. The treated wastewater will look and smell just like normal surface water in creeks and rivers in the area. Therefore, it will be clear and odourless. Figure 20 depicts examples of treated wastewater from two MBR facilities located in the Muskoka Region. In both examples, the samples are very clear.

Figure 20: Examples of Treated Wastewater from MBR Facilities

1) Treated wastewater from Port Carling wastewater facility (rated capacity of 926 m^3/day)

2) Treated wastewater from Bracebridge wastewater facility (rated capacity of 8,000 m^3/day)

Stage 5. Sludge Storage, Thickening and Removal

Sludge generated through the treatment process will be stored in a separate enclosed tank and then thickened to approximately 5 to 6% solids concentration. The sludge will not be exposed to open air; therefore, this step will not generate odours. Once or twice a week, a sludge hauling truck will come to pump out the sludge from the sludge thickener outlet. The sludge will then be removed for disposal in accordance with MECP requirements.

The sludge handling area will be fully enclosed within the WWTP. Air from within this area will be collected and treated by odour control units prior to release to the atmosphere.

Stage 6. Pipe to the Outfall

Once the treated wastewater has been disinfected, it will be regularly sampled to ensure it meets the MECP's effluent limits. The treated wastewater will then flow via underground pipe to the outfall location at Bailey Creek on Concession Road 8.

The pipe to the outfall will include two sections. The first section consists of a forcemain that will travel east from the WWTP to Concession Road 8. It will then continue north along Concession Road 8 to approximately 470 m north of Keenansville Road, where the forcemain will discharge the treated wastewater into an underground chamber. It is at this point the forcemain is at its maximum elevation. From the chamber, the treated wastewater will then flow by gravity through a pipe installed under the roadway to the outfall location.

Based on a heat transfer analysis calculated for the treated wastewater within the forcemain pipe, the estimated temperature of the treated wastewater at the interchange between forcemain and gravity pipe is about 18°C, which is lower than the watercourse's ambient water temperature as logged by NVCA (see Section 4.3 of the ACFS, Appendix B) and is consistent with coldwater habitat water temperatures. Further reduction in the temperature of the treated wastewater will occur as it travels via 2.9 km through the gravity pipe to the outfall location, with additional chilling during winter.

8.1.2 Treated Wastewater Parameters

The proposed effluent requirements for the proposed project are strict and have been reviewed by the MECP and the NVCA. They will minimize the potential for environmental impact from the proposed WWTP. The limits and objectives will be confirmed during the detailed design and Environmental Compliance Approval (ECA) process that is undertaken following completion of the Class EA process. The proposed effluent limits and objectives below are based on the ACFS and correspondence with MECP, and they will ensure that the WWTP discharge will not cause the receiving watercourse to exceed its PWQO values.

Table 26: Proposed Design Requirements (Influent Rating: 689 m^3/day)

Parameter	Proposed Effluent Limit *	Proposed Effluent Objective *
Total Phosphorus (TP)	0.07 mg/L P	0.05 mg/L P
Total Ammonia Nitrogen (TAN)	2.08 mg/L (May to October) 5.7 mg/L (November to April)	1.5 mg/L (May to October) 3.0 mg/L (November to April)
Fecal Coliform	100 CFU/100 mL	80 CFU/100 mL
Total Suspended Solids	25 mg/L	15 mg/L
Carbonaceous Biochemical Oxygen Demand ($_C$BOD5)	6 mg/L CBOD	5 mg/L

* To be confirmed during detailed design process and the Environmental Compliance Approval Process

Through the course of the EA, residents have raised concerns regarding the treatment of pharmaceuticals. In a review of studies[8,9,10], MBR was found to be one of the more effective technologies for removal of Pharmaceuticals and Personal Care Products (PPCPs). For example:

- MBR was found to have a greater and more consistent removal efficiency for pharmaceuticals than conventional activated sludge technology and other biological treatment processes.
- The majority of PPCPs are effectively removed by MBR, with many exceeding 90% removal.

8.1.3 Stand-by Power

The MECP has mandated the evaluation of emergency standby power requirements for all newly built water and wastewater treatment plants. Diesel generating sets are an obvious choice of standby power application due to their reliability and ease of availability.

A diesel generating (DG) set as required for this treatment plant will be sized by a selected vendor, and arranged to be delivered and installed at the plant site location with all its appurtenances prior to plant commissioning.

The emergency standby power will require testing on a regular basis (e.g., once per month). To minimize the potential for noise disturbance, the emergency standby power unit will be housed within the WWTP.

An air impact assessment was undertaken for this Class EA and considered the impacts from nitrogen oxides during the running of the stand-by power generator. The maximum predicted half-hour nitrogen oxide concentrations from the stand-by power unit is 940 µg/m^3, which is 50% of the MECP's limit of 1,880 µg/m^3 (as stipulated in the MECP's emergency generator guideline, *Information for Proponents Applying for a Certificate of Approval (Air) for an Emergency Generator*, August 2008). Therefore, no air impacts are anticipated from the operation of the stand-by power unit.

8.1.4 Site Plan

The conceptual plan for the WWTP is presented in Figure 21. Additional characteristics of the WWTP that were not noted above include:

- To assist with odour and noise and odour control, the WWTP will be subdivided into three main sections or adjoining buildings. They include:
    - Headworks building: Approximately 30 m x 30 m in size and 5 m high. Includes the blower room, the standby power room, and a control room. The control room will have an office for the Operators and a small laboratory for testing purposes.

[8] Radjenovic, J., Petrovic, M., & Barceló, D. (2007). Analysis of pharmaceuticals in wastewater and removal using a membrane bioreactor. Analytical and Bioanalytical Chemistry, 387(4), 1365–1377.

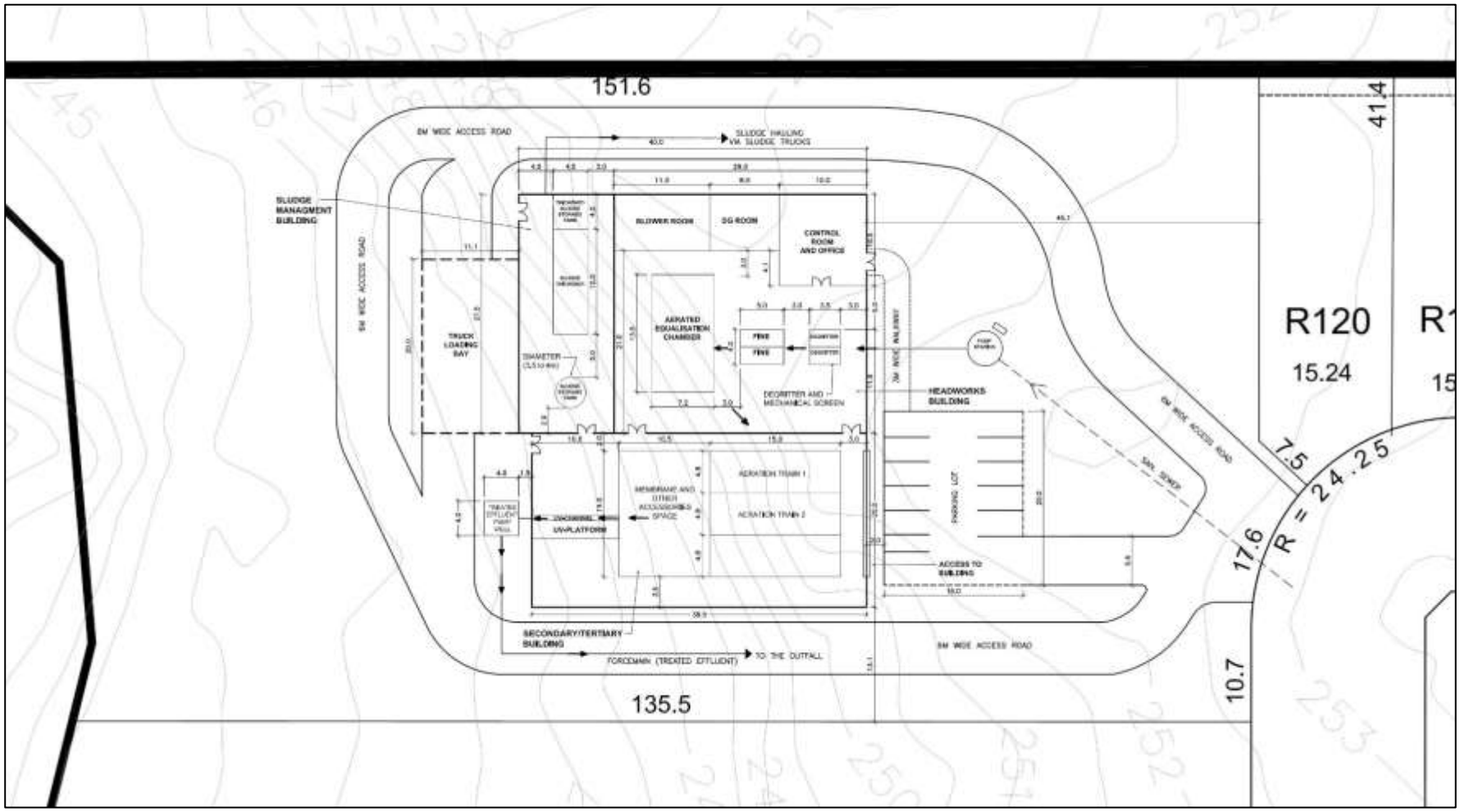
[9] Park, J., Yamashita, N., Park, C., Shimono, T., Takeuchi, D. M., & Tanaka, H. (2017). Removal characteristics of pharmaceuticals and personal care products: Comparison between membrane bioreactor and various biological treatment processes. Chemosphere, 179, 347-358.

[10] Kim, M & Guerra, Paula & Shah, A & Parsa, M & Alaee, Mehran & Smyth, Shirley Anne. (2014). Removal of pharmaceuticals and personal care products in a membrane bioreactor wastewater treatment plant. Water science and technology: a journal of the International Association on Water Pollution Research. 69. 2221-2229.

  - Secondary/Tertiary Building: Approximately 30 m x 30 m in size and 5 m high. Includes the treatment units for secondary and tertiary treatment, such as the MBR and UV-disinfection system.
  - Sludge Management Building: Approximately 25 m x 15 m in size and 5 m high. Houses the sludge storage tank and thickener. There will be an access lane to the sludge management building as trucks need to arrive there, in order to load thickened sludge from that building, for disposal purposes.

- A truck loading bay is recommended. The loading bay would allow for the transfer of sludge to the sludge truck in an enclosed space, thereby preventing the potential for accidental odours during the transfer. The loading bay would also be used for the deliveries of other treatment chemicals, such as alum.
- A perimeter access lane around the building.

Figure 21: WWTP Concept Site Plan



8.1.5 Equipment and Facility Expansion Phasing

The strategy for phasing of the facility from the 20-year development horizon to the ultimate buildout is summarized in the following table. This outlines the number of units to be active for each phase.

Table 27: Proposed Design Requirements

Equipment or Unit	Number Active	
	20-year Development Horizon	Ultimate Buildout
Membrane Bioreactor Units	2	3
Ultraviolet disinfection Units	1	2
Aerations Equalization Tanks	1	1
Degritter	1	1

8.1.6 Odour and Noise Management

EXP Services Inc. (EXP) prepared an Air Impact Assessment Study (see Appendix C) for the proposed Wastewater Treatment Plant (WWTP), based on the ultimate build-out conditions. The MECP D-series guidelines provide recommended separation distances and other control measures for land use planning proposals to prevent or minimize adverse effects from the encroachment of incompatible land uses where a facility either exists or is proposed. Guideline D-2 specifically applies to all development or redevelopment applications for residential or other sensitive land uses adjacent to sewage treatment facilities. The recommended separation distance in the Guideline is 100 metres. A separation distance of less than 100 metres may be permitted with a study demonstrating the feasibility of the distance based on the degree and type of odour mitigation applied to the proposed facility. Further, the guideline allows for the location of sensitive receptors closer than the 100m separation distance where adequate buffer is not available if more effective noise and odour mitigation measures are considered to provide an optimum level of protection between the wastewater treatment facility and adjacent sensitive land uses. It notes that, in such cases, consideration should be given to silencing specific sources of noise, covering certain sections of the plant, and treating collected gases. As noted previously, the treatment processes will be enclosed within the WWTP itself, and air from within the facility will be treated with odour control units prior to release to atmosphere.

The study included an emission inventory and air dispersion modelling assessment to conservatively assess the WWTP's potential odour impact at the property line, at nearby existing sensitive receptors, and within the proposed residential subdivision when the WWTP will be operating at its ultimate capacity. The odour emission inventory was developed based on typical emission rates of the wastewater treatment processes. The modelling assessment was completed using the MECP regulatory model, AERMOD View (Version 9.5.0).

The result of the study showed that the potential emissions were found to be compliant with appropriate MECP point of impingement (POI) limits and hence the D-2 Guideline with the proposed odour control methods. The maximum 10-minute average odour concentrations were below the MECP odour guideline at all offsite locations, including the surrounding existing sensitive receptors and the proposed residential subdivision to be located immediately south and east of the proposed WWTP. For example:

- The maximum predicted 10-minute odour concentration was 0.54 OU (odour units) at the property boundary, which is 54% of the MECP's recommended limit of 1 OU at sensitive receptors.
- The maximum predicted 10-minute H_2S (hydrogen sulphide) concentration was 9.0 µg/m^3, which is 69.8% of the MECP's point of impingement (POI) limit. The maximum predicted 24-hour H_2S concentration was 3.2 µg/m^3, which is 45.7% of the POI limit.
- The contaminant of concern with the greatest percentage of the POI limit at the 10-minute and 24-hour time periods was TRS. Its maximum 10-minute concentration was 9.4 µg/m^3, which is 72.3% of the MECP's POI limit. The maximum predicted 24-hour concentration for TRS was 3.3 µg/m^3, which is 47.1% of the limit.

Based on the above, with the use of the appropriate odour control units no air quality adverse impacts are expected from the normal operation of the proposed WWTP.

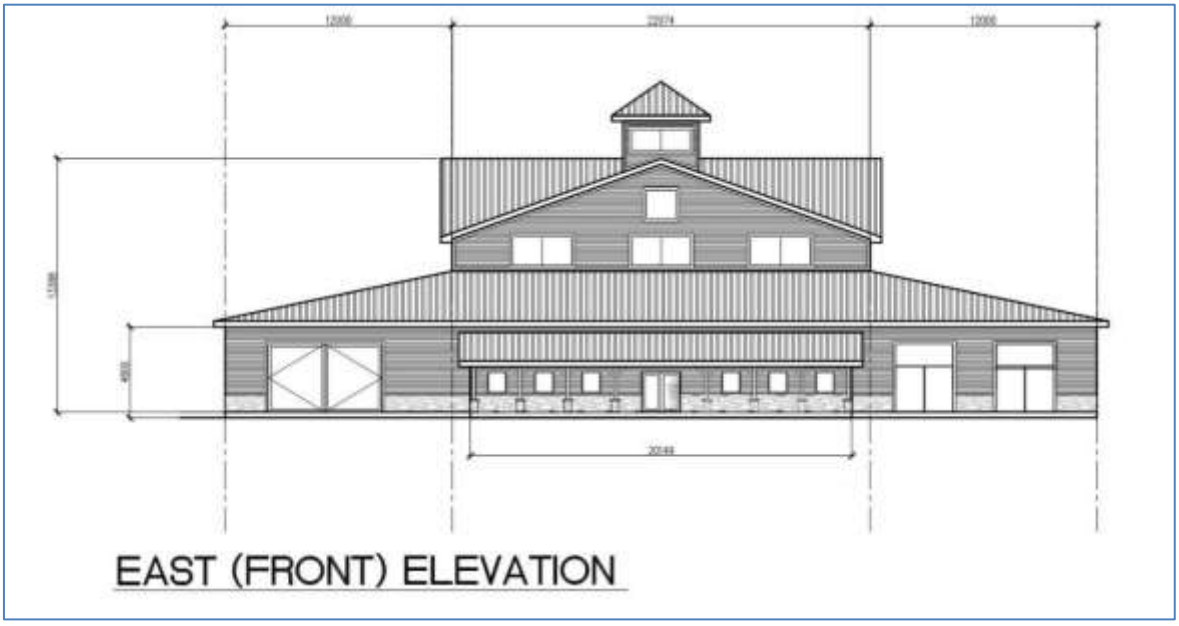
With respect to management of noise nuisances, all sources of stationary noise (e.g., blowers, stand-by power, etc) will be contained within the WWTP itself, and the detailed design will consider opportunities for noise dampening and other mitigation measures. Noise from the infrequent truck traffic will be mitigated through the following measures:

- Timing of sludge collection and delivery of supplies to be during daytime operating hours;
- Loading and unloading operations to be completed within a loading bay situated at the rear of the WWTP; and
- A one-way truck access that goes around the WWTP to avoid the need for reversing, thereby avoid the use of reversing beeper alarms.

8.1.7 Architecture

Given the location of the facility within the community, the WWTP will be designed to be architecturally pleasing and considerate of the local architecture. Examples of WWTP's with this pleasing architecture were presented at the September 2017 information forum. A preliminary conceptual drawing of what the Colgan WWTP may look like is presented in Figure 22.

Figure 22: Preliminary Architectural Concept



8.2 Forcemain

The preferred forcemain will travel east from the WWTP through the planned development to Concession Road 8. Within the development, the forcemain will be located within the planned street allowance and its placement will be coordinated with the development's underground infrastructure, including stormwater mains, sanitary sewer lines, and watermains. The forcemain will continue north along Concession Road 8 from Keenansville Road until it reaches Alternative Outfall Location #2 (Conc. 8), which is located at the northern terminus of Concession Road 8 and its intersection with Bailey Creek. The total length of the forcemain route is approximately 5.0 km. The route reaches a high-point approximately 470 m north of the intersection of Concession 8 and Keenansville Road, followed by a general down slope to Alternative Outfall Location #2. The forcemain portion of the route would carry the treated wastewater to the high-point, where it would then flow by gravity pipe to the outfall.

The portion of Concession Road 8 north of Keenansville Road is a mix of unopened road allowance and of gravel road with ditches along both sides. The forcemain would be placed within the ROW, potentially within the gravel portion of the road rather than the ditch.

8.3 Outfall

The preferred location for the outfall is at Bailey Creek where it intersects with Concession Road 8. The outfall design will be completed during detailed design in consultation with NVCA and will include the following characteristics:

- Erosion control measures - to ensure that flow coming from the outfall will not cause scouring or erosion within the watercourse;
- Slope stability measures - to ensure that the watercourse banks around the outfall will remain stable;

- Watercourse protection during construction - to help ensure there will be minimal impact to the watercourse, the design should include minimal to no in-creek construction activities.

The forcemain headwall would be positioned inland from the watercourse, to be conveyed into the watercourse through a ditch or channel. This will allow for energy dissipation before entering watercourse. The ditch/channel would include erosion and sediment controls.

8.4 Approval Requirements

Permits and approvals required for the project include:

- Nottawasaga Valley Conservation Authority Permit (required for WWTP, outfall and portions of forcemain)
- Environmental Compliance Approval (Wastewater)
- Environmental Compliance Approval (Air and Noise)
- Municipal Site Plan Approval
- Municipal Building Permit
- Permit to Take Water (for construction dewatering if over 400,000 L/day; otherwise, an Environmental Activity and Sector Registry (EASR) for construction dewatering is between 50,000 and 400,000L/day)
- Ministry of Tourism Culture and Sport (Compliance Letter - archaeology)
- Road occupancy permit for County Road 1 forcemain (gravity pipe) crossing

Additional studies are planned to be undertaken to support permit and approval applications, in particular additional detailed natural heritage studies.

8.5 Cost Estimate

The estimated capital cost for this project is $13.5M. This equates to approximately $13,500 per serviced unit, based on the ultimate buildout. Table 26 presents the cost estimate. The cost estimate is a Class 4 level conceptual estimate, with an accuracy level of +/- 25%.

Table 28: Capital Cost Estimate

Item Description	Amount ($)
Wastewater Treatment Plant	
Grit Chamber	$400,000
Mechanical Fine Screen	$400,000
Aerated Equalization Tank	$600,000
MBR Reactor	$2,000,000
Concrete Base for MBR Reactor	$600,000
Chemical Dosing Tank for MBRs	$200,000
Sludge Storage Tank	$600,000
Gravity Belt Thickener	$600,000
Final Sludge Disposal Chamber	$100,000
UV Disinfection	$600,000
Treated Effluent Pump Well	$250,000
DG set for stand-by power	$300,000
Air Blowers with accessories	$300,000
Electrical & SCADA	$350,000
Buildings	$3,500,000
Access Road & Parking lot	$500,000
Landscaping	$150,000
Total Wastewater Treatment Plant	**$11,450,000**
Forcemain / Outfall Based on $500/m	**$2,500,000**
Total Project Cost	**$13,950,000**

The funding model for this project is to be developed in consultation with the Township. Typically, the capital and operating costs for new municipal wastewater infrastructure in Ontario is funded through development charges or through the monthly user service fees.

9 POTENTIAL IMPACTS AND MITIGATION MEASURES

9.1 Summary of Potential Impacts and Mitigation Measures

Tables 29 to 31 summarize the potential impacts and mitigation measures for the construction and operation of the WWTP, forcemain and outfall.

Table 29: WWTP Potential Impacts and Mitigation

WWTP Potential Impacts	Mitigation Measures
Natural Environment	
Erosion and turbidity issues in Keenansville Creek due to construction activities	Develop and implement appropriate erosion and sediment control measures. Consult with NVCA during detailed design of WWTP. WWTP to be located within approved development limits. Erosion and sediment control plan to be included as part of permit application with NVCA.
Disruption of Aquatic Wildlife in Keenansville Creek	Develop and implement appropriate erosion and sediment control measures.
Disruption of Terrestrial Habitat	WWTP site is part of approved development for which a tree compensation plan is in place; construction of WWTP will not result in the removal of any additional trees. Detailed design to consider protection of trees, where applicable.
Disruption of Terrestrial Wildlife	WWTP construction to be scheduled outside of breeding season. Minimize construction footprint during design and construction.
Terrestrial Species at Risk (SAR)	Field investigations did not identify presence of Species at Risk (SAR) on the WWTP site. If SAR found within construction site, then construction will be paused, the SAR identified, and steps put in place to relocate or protect the SAR.

WWTP Potential Impacts	Mitigation Measures
Impact on water quality and temperature of receiving water body (Bailey Creek)	Wastewater treated to very strict effluent limits. Effluent limits, which will be reviewed by MECP and included in ECA, will ensure protection of the watercourse water quality. Advanced wastewater treatment technology selected for WWTP. Temperature of treated wastewater to be cooled through 5 km of underground conveyance from the WWTP to outfall.
Social Cultural	
Noise and dust nuisances from construction	Standard noise and dust suppression practices to be applied during construction. Construction activities to be limited to municipally approved working hours (for construction). Restrict certain types of equipment on site and include the use of a "turn off engines while idle" protocol.
Noise and odour nuisances from plant operations	WWTP components to be completely enclosed to minimize noise and odour issues. WWTP to include filters or scrubbers to prevent odours from escaping WWTP property. Odour levels from WWTP to be maintained below 1 odour unit at property line (as per MECP guidelines). Detailed design to further consider approaches for minimizing noise and odour nuisances from WWTP (e.g., placement of filter vents, noise-dampening construction materials, etc). WWTP will require ECA - Air and Noise to demonstrate that no off-site adverse effects will result from its operation.
Noise and air impacts from stand-by power generator	Stand-by power generator to be housed within WWTP facility. Detailed design to consider additional approaches for minimizing noise from operation of stand-by power generator (e.g., noise-dampening construction materials, muffler, etc). NOx emissions to be minimized through appropriate sizing of generator. WWTP will require ECA - Air and Noise to demonstrate that no off-site adverse effects will result from its operation.

WWTP Potential Impacts	Mitigation Measures
Disruption of archaeological resources	WWTP has been previously cleared of archaeological potential, therefore no impact to archaeological resources is anticipated. If any unknown archaeological resources are found during construction, then the construction activities will cease and licensed archaeologist will be brought on site to investigate the significance of the finds.
Disturbance from delivery vehicles or sludge collection trucks	Sludge trucks to visit WWTP approximately two times per week. Sludge trucks to schedule visits to WWTP within normal daytime working hours. WWTP design to minimize truck reversing on site.
Aesthetics / visibility of WWTP	Site to be designed to fit in community and be visually pleasing. Architectural considerations to be included in detailed design. Site design to include landscape features.
Traffic disruption	Limit working hours and truck traffic. Designate permitted truck routes.
Economic	
Impact on Tax Base	Funding model for project to be developed in consultation with Township. Typically, capital and operating costs for new municipal wastewater infrastructure in Ontario funded through development charges or through the monthly user service fees.
Lower property value	Architectural and landscaping enhancements to minimize the negative impact of WWTP to local housing value. Noise-causing and odour-generating aspects to WWTP to be housed within WWTP to minimize potential noise and odour impacts on community.

Table 30: Forcemain Potential Impacts and Mitigation

Forcemain Potential Impacts	Mitigation Measures
Natural Environment	
Erosion and turbidity issues related to construction Disruption of Aquatic Wildlife in Keenansville Creek	Develop and implement appropriate erosion and sediment control measures where required. Erosion and sediment control plan to be included as part of permit application with NVCA (along portion of forcemain within NVCA regulated area).
Disruption of Terrestrial Habitat	Forcemain alignment on Concession Road 8 to be maintained within road ROW. Forcemain alignment within development to be within its proposed street network, specifically road ROW. Detailed design to consider protection of trees.
Disruption of Terrestrial Wildlife	Forcemain construction to be scheduled outside of breeding season where important habitat is impacted.
Terrestrial Species at Risk (SAR)	Field investigations did not identify presence of Species at Risk (SAR) along forcemain route; however, residents have reported presence of snapping turtle. If SAR found within construction site, then construction will be paused, the SAR identified, and steps put in place to relocate or protect the SAR.
Social Cultural	
Noise and dust nuisances from construction	Standard noise and dust suppression practices to be applied during construction. Construction activities to be limited to municipally approved working hours (for construction). Restrict certain types of equipment on site and include the use of a “turn off engines while idle” protocol.
Disruption of archaeological resources	Forcemain route has been cleared of archaeological potential, therefore no impact to archaeological resources is anticipated in those sections. If any unknown archaeological resources are found during construction, then the construction activities will cease and licensed archaeologist will be brought on site to investigate the significance of the finds.

Forcemain Potential Impacts	**Mitigation Measures**
Traffic disruption	Limit working hours and truck traffic. Designate permitted truck routes.
Economic	
Impact on Tax Base	Funding model for project to be developed in consultation with Township. Typically, capital and operating costs for new municipal wastewater infrastructure in Ontario funded through development charges or through the monthly user service fees.

Table 31: Outfall Potential Impacts and Mitigation

Outfall Potential Impacts	**Mitigation Measures**
Natural Environment	
Erosion and turbidity issues in Bailey Creek due to construction activities Disruption of Aquatic Wildlife in Bailey Creek	Develop and implement appropriate erosion and sediment control measures for construction and design (to be prepared in consultation with NVCA). Erosion and sediment control plan to be included as part of permit application with NVCA. Natural heritage investigations to continue during detailed design to confirm aquatic habitat. NVCA to be consulted during detailed design of outfall.
Disruption of Terrestrial Habitat	Outfall to be constructed within road ROW. Detailed design to consider protection of trees and important habitat. NVCA to be consulted during detailed design of outfall.

Outfall Potential Impacts	**Mitigation Measures**
Disruption of Terrestrial / Aquatic Wildlife	Outfall to be constructed within road ROW. Detailed design to minimize or eliminate in-creek construction activities. Outfall construction to be scheduled outside of breeding season. Design and construction activities to minimize construction footprint at site. Natural heritage investigations to continue during detailed design to confirm aquatic habitat. Outfall design to include erosion control and slope stability attributes. NVCA to be consulted during detailed design of outfall.
Terrestrial and Aquatic Species at Risk (SAR)	Field investigations did not identify presence of terrestrial SAR at the outfall site. In-stream natural heritage investigations to be completed during detailed design to identify aquatic species within watercourse, including SAR. Detailed design to minimize or eliminate in-creek construction activities and construction timing windows will ensure protection of any aquatic SAR observed in watercourse.
Social Cultural	
Noise and dust nuisances from construction	Standard noise and dust suppression practices to be applied during construction. Construction activities to be limited to municipally approved working hours (for construction). Restrict certain types of equipment on site and include the use of equipment Implement a “turn off engines while idle” protocol.
Noise and odour from plant operations	No odour or noise emissions expected from outfall.
Disruption of archaeological resources	The outfall location has been cleared of archaeological potential, therefore no impact to archaeological resources is anticipated. If any unknown archaeological resources are found during construction, then the construction activities will cease and licensed archaeologist will be brought on site to investigate the significance of the finds.
Traffic disruption	Limit working hours and truck traffic.

Outfall Potential Impacts	Mitigation Measures
Economic	
Impact on Tax Base	Funding model for project to be developed in consultation with Township. Typically, capital and operating costs for new municipal wastewater infrastructure in Ontario funded through development charges or through the monthly user service fees.

9.2 Climate Change Impacts, Mitigation and Adaptation

With respect to Climate Change, this project has considered opportunities to mitigate its contributions to greenhouse gas emissions and adapt to potential climate change impacts.

Measures to mitigate greenhouse gas emissions include:

- Where feasible, ensure construction equipment does not idle unnecessarily;
- Replace trees removed as a result of the WWTP, forcemain and outfall construction;
- Consider opportunities for energy efficiency during the detailed design of the WWTP, such as insulating the WWTP where required and using energy efficient lighting.

As has been noted by the members of the local community, Bailey Creek near the outfall location experiences flooding, which may be exacerbated by extreme weather events. The analysis completed in this Class EA demonstrates that the discharge of treated wastewater from the proposed WWTP facility will not contribute to flooding of the watercourse. Similarly, flooding of the watercourse will not impact the forcemain's ability to discharge under flood conditions, given the peak height of the forcemain. The outfall design will consider the periodic flooding of the watercourse and include erosion controls in the outfall design. With respect to the WWTP, it is situated above the regional floodline and therefore should not be negatively impacted by potential flooding.

10 STAKEHOLDER CONSULTATION

Stakeholder (public and agency) consultation is an essential requirement and plays an important part in the Class EA process. This Class EA ensured that stakeholders were informed of the study and given the opportunity to provide input (both written and verbal) on the assessment and evaluation process and alternative designs for the wastewater treatment plant, forcemain and outfall. To achieve this, the minimum consultation requirements outlined in the Class EA process were exceeded. Key consultation events included:

- Public Information Centre #1 (June 20, 2017);
- Information Forum (September 27, 2017); and
- Public Information Centre #2 (April 11, 2018).

In addition, there was regular engagement with MECP and NVCA, including a meeting on October 18, 2016, telephone calls, written correspondence, and a review of the draft ESR by MECP and NVCA.

This section provides a summary of these key activities and the feedback received throughout the course of the study.

10.1 Public Information Centre #1

The first Public Information Centre (PIC) was held on June 20, 2017 from 4:00 pm to 7:00 pm at the Township of Adjala-Tosorontio's Municipal Office at 7855 Sideroad 30 Adjala, Alliston, Ontario.

The event was advertised on the Township's website and in the Alliston Herald on June 8 and 15, 2017. The PIC mailing list is included in Appendix D and includes:

- All stakeholders from the Colgan MSP Amendment mailing list;
- All relevant agency stakeholders;
- All residents within the study area;
- Those stakeholders who had requested a Part 2 Order Request on the Colgan MSP Amendment for matters pertaining to wastewater; and
- First Nations and aboriginal groups.

PIC #1 was organized as a drop-in centre where people could review a series of display boards. Members of the Project Team were also available to hold discussions with attendees on various project topics. The following topics were presented through the display boards:

- Class EA Process including the Problem / Opportunity Statement and the project background and study area;
- Population and design flows for the approved development (20-year planning period);
- Proposed wastewater effluent quality;
- Comparative evaluation of alternative WWTP locations; forcemain routes (from the WWTP to the Keenansville outfall) and the outfall location;
- Key findings of the natural heritage and archaeological investigations; and
- Evaluation of alternative design concepts for the WWTP and outfall (based on the Keenansville outfall site).

Overall, PIC #1 was well attended with 52 attendees. Eleven sets of comment sheets were received that evening, followed by additional comments received by e-mail in the following weeks. A copy of the display boards, the sign-in sheet and comment sheets received are

provided in Appendix D-1. E-mails received subsequently are documented in the correspondence appendix (Appendix D-7). A summary of the concerns raised related to the WWTP, forcemain and outfall and either how they are being addressed or where they are addressed in this ESR is provided in the following table[11].

Table 32: Summary of PIC #1 Comments

Feedback Received through PIC #1	Response / Section Where Addressed[12]
Constructability and Construction Impacts (Forcemain)	
• Forcemain construction impacts, including disruption and duration	• Alternatives selected to minimize disturbances from construction • Mitigation measures will minimize potential noise, dust traffic and other disruptions • See Sections 6.2, 9
• Feasibility to construct forcemain within narrow road allowance on Keenansville Road	• Width of road and ROW feasible for construction of forcemain, offset if the outfall associated with Concession Road 8 is constructed which eliminates the need for construction along Keenansville Road • See Section 6.4.2.2
• Concern that presence of forcemain will limit any potential future widening of Keenansville Road	• Not expected to be an issue. • Forcemain alignment will consider Township design standards. • Township will be consulted on forcemain design.
Constructability and Construction Impacts (Outfall)	
• Clarification on erosion control and slope stability measures	• Erosion control and slope stability measures to be determined during detailed design. • See Section 7.2
WWTP Siting	
• Concern that the proposed north WWTP Site is much more visible and prominent within the draft plan and	• Detailed design to consider aesthetics of WWTP

[11] A number of the comments received were focused on the development itself or other aspects not related to the wastewater servicing, such as planning matters related to the development itself, water servicing, or other matters. Those non-wastewater issues were provided to the proponent but have not been included in the table since they are not part of the Class EA project.

[12] A number of the comments and concerns raised through PIC #1 were discussed in a "Comments and Responses" document and through a presentation to stakeholders at an information forum. The Comments and Responses document and the slides for the information forum are discussed in Section 10.2 and provided in Appendices D-3 and D-4. To avoid repetition, this has not been noted in this column.

Feedback Received through PIC #1	Response / Section Where Addressed[12]
that the WWTP will be highly visible within this new community	• See Section 9
• Suggestion that WWTP should be accessed directly from a Regional Road (County RD 14) and adequately screened from the road and abutting residential properties	• Sludge trucks are required to access WWTP through development, as no direct access permitted to WWTP from County Road 14 as per conditions in OMB decision. • See Section 6.1.2
• Service, pump-out trucks, and chemical deliveries should not have to enter into the residential community to access the treatment plant	• Sludge trucks are required to access WWTP through development, as no direct access permitted to WWTP from County Road 14 as per conditions in OMB decision. • See Section 6.1.2
• Siting of WWTP relative to wet area located near northwest portion of northern development property	• WWTP is not located near area in question
Wastewater Treatment Alternatives	
• Rationale for not using septic tanks or treating the development's wastewater in an existing treatment system	• Preferred wastewater treatment solution identified in MSP Amendment. • See Section 3.1.2 • See also the MSP Amendment (available on the Township's website)
• Clarification on whether consideration was given to locating the outfall on Concession Road 7 between County Rd 14 and Keenansville Rd	• Not considered due to lack of base flow (is upstream of Bailey Creek / Keenansville Creek junction)
Impacts to Watercourse Water Quality / Pollution Control	
• Concern that treated wastewater will pollute Bailey Creek	• Wastewater treated using advanced technology • Treated wastewater discharge parameters strict and will not impact ability of watercourse to achieve PWQO • See Sections 7.1, 8.1 and Appendix B
• Concern that pharmaceuticals and other chemicals will remain in treated wastewater	• Wastewater treated using advanced technology • Studies indicate MBR treatment process effective at removing pharmaceuticals • See Section 8.1

Feedback Received through PIC #1	**Response / Section Where Addressed[12]**
• Potential impact on farm land and other lands from treated wastewater due to flooding	• WWTP discharge will contribute less than 0.2% to flood waters. • See Section 7.2.1 and Appendix B-2
• Clarification on temperature of treated wastewater discharge and potential thermal impact on Bailey Creek	• No thermal impact expected, as treated wastewater discharge will be within acceptable temperature range upon exit of outfall. • See Section 8.1.1 and Appendix B
• Potential impact of treated wastewater discharge on frozen ice in ice-covered watercourse	• No thermal impact expected, as treated wastewater discharge will be within acceptable temperature range upon exit of outfall. • See Section 8.1.1 and Appendix B
• Concern that fecal matter will be included in treated wastewater	• Wastewater treated using advanced technology • Treated wastewater discharge parameters strict and will not impact ability of watercourse to achieve PWQO • See Sections 7.1 and 8.1
• Concern that Bailey's Creek has inadequate flow	• Watercourse data and modeling estimates that Bailey Creek has adequate minimum flows • See Section 4.2 and Appendix B
Community Impacts	
• Clarification on benefits to local community	• Providing environmental protection by ensuring the new development has effective wastewater treatment. • See Section 2.1
• Clarification on whether residents in Hamlet will be forced to connect to WWTP and the potential cost of hooking up	• Township decision to be determined at future time.
• Clarification on whether forcemain would be installed within roadway or private property	• Forcemain to be installed within municipal ROW
• Rationalization of locating outfall within Keenansville Road, when community being serviced is located elsewhere	• Outfall location selected during MSP Amendment process • See Section 3.1.2 • See also the MSP Amendment (available on the Township's website)
Potential Impacts to Species Living in or Using Watercourse	

Feedback Received through PIC #1	Response / Section Where Addressed[12]
• Impact of pharmaceuticals and pesticides in treated wastewater on fish in the creek	• Wastewater treated using advanced technology • Studies indicate MBR treatment process effective at removing pharmaceuticals • See Section 8.1
• Potential impact of 0.05mg/L of Phosphorous on downstream habitat and species	• Treated wastewater discharge parameters strict and will not impact ability of watercourse to achieve PWQO • See Sections 7.1, 8.1 and Appendix B
• Impacts on children swimming in watercourse downstream of outfall	• Treated wastewater discharge parameters strict and will not impact ability of watercourse to achieve PWQO • See Sections 7.1, 8.1 and Appendix B
• Impacts on wildlife drinking from watercourse downstream of outfall	• Treated wastewater discharge parameters strict and will not impact ability of watercourse to achieve PWQO • See Sections 7.1, 8.1 and Appendix B
• Impact of wastewater flow on downstream aquatic habitats	• Treated wastewater discharge parameters strict and will not impact ability of watercourse to achieve PWQO • See Sections 7.1, 8.1 and Appendix B
Natural Heritage Study	
• Concern that natural heritage studies are incomplete and that Bailey Creek at Keenansville Road was inadequately examined	• Studies were completed as part of Class EA process and will continue as part of detailed design • See Section 4.1 and Appendix A
• Concern that results of natural heritage studies do not reflect the understanding of local residents, for example presence of snapping turtles (species at risk) and other species	• Input of residents noted • See Section 4.1 and Appendices A and D-7
• Clarification on timing of natural heritage studies	• Studies were completed as part of Class EA process and will continue as part of detailed design • See Section 4.1, Appendix A

Feedback Received through PIC #1	Response / Section Where Addressed[12]
Noise and Odour	
• Amount of noise from WWTP and sludge trucks and potential impact on local residents	• See Sections 8.1 and 9
• Potential impact of noise from WWTP on birds	• No impact on birds from noise anticipated
• Potential odours coming from WWTP	• WWTP will include measures to mitigate against potential odours, such as being an entirely enclosed facility and using filters • Odour emissions to be less than 1.0 OU at property line, as per MECP requirements • See Sections 8.1 and 9 and Appendix C
• Concern over potential odours coming from discharged treated wastewater	• Treated wastewater to be odourless • See Section 8.1
Watercourse Flooding	
• Concern that WWTP and outfall will exacerbate seasonal flooding of Bailey Creek	• WWTP discharge will contribute less than 0.2% to flood waters. • See Section 7.2.1 and Appendix B-2
• Whether forcemain will still be able to discharge when creek is full/flooded	• Hydraulic profile of gravity pipe will ensure forcemain can still discharge when creek is full/flooded. • See Section 7.2.1
• Clarification required that outfall discharge will make up 10% of the watercourse flow, and the potential impact of this flow on flooding	• WWTP discharge will contribute less than 0.2% to flood waters. • This misconception stems from the point made by the project team that, *at low flow conditions*, the amount of treated wastewater discharge will only amount to 10% of the watercourse flow. At other times, the treated wastewater will be much more dilute. • See Section 7.2.1 and Appendix B-2
Drinking Water	
• Concern that private drinking water wells will be contaminated	• Treated wastewater discharge parameters strict and will not impact ability of watercourse to achieve PWQO

Feedback Received through PIC #1	Response / Section Where Addressed[12]
	• WWTP and its outfall discharge are not considered a significant threat to source water. • See Sections 4.3, 7.1, 8.1 and Appendix B
• Potential impact of treated wastewater on ground water	• WWTP and its outfall discharge are not considered a significant threat to source water. • See Section 4.3
• Potential for threats or impacts to the Areas of High Aquifer Vulnerability	• WWTP and its outfall discharge are not considered a significant threat to source water. • See Section 4.3
Economic Impacts	
• Clarification on start-up costs	• See Section 8.5
• Clarification on how the project will be paid for/funded	• See Section 8.5 • To be determined - separate issue that is addressed outside of the Class EA process
• Concern of potential impact of WWTP and outfall on property values	• See Section 9
• Potential impact on municipal taxes due to construction. Operation and maintenance of WWTP, forcemain and outfall	• See Section 8.5 • To be determined - separate issue that is addressed outside of the Class EA process
Operations	
• Frequency that outfall will be checked/inspected	• See Section 9
• Number/frequency of trucks using Concession Road 8 to service WWTP and their route	• About two trucks (similar in size to a garbage truck) per week
Project Notification	
• Concern over lack of notification or timing of notice delivery in advance of PIC	• Efforts made to ensure all public stakeholders notified • Multiple points of consultation available • Information available on Township's website for those unable to attend PIC • See Section 10
Wastewater Servicing Demand Forecast	
• Concern that the 2.67 PPU factor used in wastewater forecast demand is too low	• Value confirmed by Township planning staff

Feedback Received through PIC #1	Response / Section Where Addressed[12]
• Whether the locations and sizes of the alternative WWTP sites are conducive to future expansion of the WWTP	• WWTP design considers potential for expansion to 996 m^3/day
Cultural Heritage	
• Potential impacts to foundations from historic Town of Keenansville on private property near Keenansville outfall site	• All works to be within ROW, so no potential impact to foundations on private property, offset if the outfall associated with Concession Road 8 is constructed which eliminates the need for construction along Keenansville Road

10.2 Response Document and Information Forum

Based on the level of interest from Stakeholders (specifically the Keenansville community) following PIC #1, an additional method of consultation was undertaken through release of a "Comments and Responses" (C&R) document and the holding of an Information Forum.

The C&R document was prepared to address the questions and comments received from Stakeholders up to September 7, 2017 and included the Class EA study process, clarification on the approved development, and the wastewater components (WWTP, forcemain, and outfall).

The C&R document was distributed to all PIC #1 attendees who had submitted comments. The distribution was coupled with an invitation to attend an Information Forum about the project. The C&R document was posted on the Township's website after the Information Forum, which was held on September 27, 2017 at 6:00 pm at the Township's municipal office.

The purpose of the Information Forum was to provide an opportunity for those PIC #1 attendees that provided comments an additional opportunity to meet with the project team, to receive a more in-depth presentation addressing topics raised in their comments about the proposed project, and to ask additional questions for clarification on issues. While invitations were not sent to the broader community, there were several who learned of the Forum through word-of-mouth and attended. Seventeen invitees and 23 other community members attended the Information Forum.

A follow-up letter was sent to the Forum participants providing responses to questions that were not fully answered during the discussion period, generally since they required more detailed information.

The Forum invitation, slides, attendance and follow-up letter are provided in Appendix D-4.

Comments and questions continued to be received from Stakeholders following the Information Forum. A summary of the comments and questions and where they are addressed in this ESR is provided in the table below[13].

[13] As per PIC #1, there were some comments received that focused on the development itself or other aspects not related to wastewater servicing. Those non-wastewater issues were provided to the proponent but have not been included in the table since they are not part of the Class EA project.

Table 33: Summary of Feedback Received through Information Forum

Feedback Received through Information Forum	Response / Section Where Addressed
Natural Heritage	
• Clarification on when a fisheries study or assessment of endangered or at-risk species would be completed at the outfall	• Fisheries assessment to be completed as part of detailed design.
• Potential impact to wildlife in proximity to outfall	• Treated wastewater discharge parameters strict and will not impact ability of watercourse to achieve PWQO • See Sections 7.1 and 8.1 and Appendix B
WWTP Process	
• Impact of power failures (including extended power failures), and whether the stand-by power is triggered automatically or manually during a power outage	• See Section 8.1.3
• Frequency of treated wastewater sampling	• To be set within MECP Environmental Compliance Approval
• Where will the removed sludge go	• Will be removed for offsite disposal at a facility licensed to receive this • Exact location/service provider to be determined during detailed design
• Effectiveness of treatment process to remove fecal matter, chemicals, pharmaceuticals and other materials	• Wastewater treated using advanced technology • Studies indicate MBR treatment process effective at removing pharmaceuticals • See Section 8.1 and Appendix D-3
• Monitoring of WWTP capacity (frequency and responsibility)	• To be set within MECP Environmental Compliance Approval
• Clarification on contingencies for a major breakdown of critical process equipment	• Raw wastewater will be able to be pumped from WWTP wetwell in the event of a full system breakdown
• Clarification on WWTP by-pass	• WWTP will not have a raw wastewater bypass

Feedback Received through Information Forum	Response / Section Where Addressed
Impacts to Water Quality	
• Impact of flood waters containing treated wastewater on private property	• WWTP discharge will contribute less than 0.2% to flood waters. • See Section 7.2.1 and Appendices B-2, D-3, and D-4
• Impacts on children swimming in watercourse downstream of outfall	• Treated wastewater discharge parameters are strict and will not impact ability of watercourse to achieve PWQO • See Sections 7.1 and 8.1 and Appendix B
• Impacts on wildlife drinking from watercourse downstream of outfall	• Treated wastewater discharge parameters are strict and will not impact ability of watercourse to achieve PWQO • See Sections 7.1 and 8.1, Appendix B
• Potential thermal impacts of treated wastewater	• No thermal impact expected, as treated wastewater discharge will be within acceptable temperature range upon exit at outfall. • See Section 8.1.1 and Appendix B
Forecasting Wastewater Treatment Demand	
• Clarification on maximum buildout (capacity) for WWTP	• See Sections 4.5.2 and 5.1
• Clarification on how retirement home population was considered in forecast	• See Sections 4.5.2 and 5.1
• Ability to include exiting houses in Colgan	• See Sections 4.5.2 and 5.1
• Requirement of existing homes to connect to facility and estimated cost	• Township decision to be determined at future time.
Construction Impacts	

Feedback Received through Information Forum	Response / Section Where Addressed
• Concern over ability to maintain a single lane of traffic on Keenansville Road (around S-bend) during construction	• Width of road and ROW feasible for construction of forcemain, offset if the outfall associated with Concession Road 8 is constructed which eliminates the need for construction along Keenansville Road • See Section 6.4.2.2
• Potential of scheduling construction to avoid nesting/breeding/brooding species (in particular, barn swallows under Keenansville Road bridge)	• Construction phasing will consider nesting/breeding seasons of potentially impacts species • See Section 9
Project Costs	
• Clarification on who is responsible for cost to build, operate and maintain the facility	• See Section 8.5 • To be determined - separate issue that is addressed outside of the Class EA process
• Clarification on operation and maintenance costs	• See Section 8.5 • To be determined - separate issue that is addressed outside of the Class EA process
Odour and Noise	
• Potential odour from treated wastewater at outfall	• Treated wastewater to be odourless • See Section 8.1
Other Comments	
• Potential for thermal difference to create mist or fog conditions near outfall (potential traffic or pedestrian hazard near Keenansville Road bridge)	• No thermal impact expected, as treated wastewater discharge will be within acceptable temperature range upon exit at outfall. • See Section 8.1.1 and Appendix B
• Life expectancy of forcemain pipe	• Approximately 50 years

Feedback Received through Information Forum	Response / Section Where Addressed
• Comparison of WWTP flow to watercourse flow	• WWTP discharge will contribute less than 0.2% to flood waters. • See Section 7.2.1 and Appendices B-2, D-3, and D-4

10.3 Public Information Centre #2

Based on feedback from residents in the subsequent months from holding of the Information Forum, the Township requested the proponent investigate the potential for an alternative outfall location.

A second PIC was held for the project on April 11, 2018 from 4:00 pm to 7:00 pm at the Township's municipal office. The purpose of PIC #2 was to provide Stakeholders with an update on the project, in particular on the identification and evaluation of an alternative outfall location and its associated forcemain.

PIC #2 was also organized as a drop-in centre where people could review a series of display boards. Members of the Project Team were available to hold discussions with attendees on various project topics. The following topics were presented through the display boards:

- Boards from PIC #1 related to the Class EA Process, Problem / Opportunity Statement and the project background and PIC #1 outcomes
- Revised Project study area, updated population and design flows for the approved development;
- Evaluation of the alternative outfall locations (previously recommended Keenansville outfall and the new proposed Concession Road 8 outfall) and their associated forcemain routes;
- Key findings of the natural heritage and archaeological investigations related to the new alternative outfall location; and
- Alternative design concepts for the recommended outfall location.

The notice for PIC #2 was circulated using the following methods:

- Placement of the PIC #2 notice in the Alliston Herald (April 5, 2018);
- E-mail to all stakeholders providing an e-mail address;
- Direct mail to stakeholders within the study area, including those in the extended study area;
- Hand delivery to those properties adjacent to the Concession Road 8 outfall location and Concession Road 8 forcemain route north of Keenansville Road;[14] and
- Posting on the Township's website and current events calendar.

[14] This portion of the study area was added to the project with the identification of the alternative outfall location, and as such those stakeholders may not have had previous exposure to the Class EA. The notices were hand-delivered to ensure they were made aware of the project.

Overall PIC #2 was also well attended with 54 attendees. Six sets of comment sheets were received that evening, followed by additional comments received by e-mail in the following weeks. A copy of the display boards, the sign-in sheet and comment sheets received are provided in Appendix D-5. E-mails received subsequently are documented in the correspondence appendix (Appendix D-7). A summary of the concerns raised about the WWTP, forcemain and outfall and either how they are being addressed or where they are addressed in this ESR is provided in the following table[15].

Table 34: Feedback Received through PIC #2

Feedback Received through PIC #2	Response / Section Where Addressed
Flooding	
• Concern over past flooding and whether additional flow from WWTP will increase magnitude of flooding	• WWTP discharge will contribute less than 0.2% to flood waters. • See Section 7.2.1 and Appendices B-2, D-3, and D-4
• How is the outfall structure going to be protected from flooding	• Outfall design to consider impacts from flood waters • See Sections 7.2.2 and 8.3
Drinking Water	
• Whether private wells will be impacted by the treated wastewater or flood waters containing the treated wastewater	• Wastewater treated using advanced technology • Treated wastewater discharge parameters strict and will not impact ability of watercourse to achieve PWQO • WWTP discharge will contribute less than 0.2% to flood waters. • WWTP and its discharge is not considered a significant threat to source water. • See Sections 4.3, 7.1 and 8.1, Appendix B
• Potential threats/impacts to areas of High Aquifer Vulnerability near WWTP	• WWTP and its discharge is not considered a significant threat to source water. • See Sections 4.3
Water Quality Impact on Watercourse	

[15] A number of the comments received were focused on the development itself or other aspects not relating to the wastewater servicing, such as planning matters related to the development itself, water servicing, or other matters. Those non-wastewater issues were provided to the proponent but have not been included in the table since they are not part of the Class EA project.

Feedback Received through PIC #2	Response / Section Where Addressed
• Concern that treated wastewater will still contain pollutants that could impact watercourse	• Wastewater treated using advanced technology • Treated wastewater discharge parameters strict and will not impact ability of watercourse to achieve PWQO • See Sections 7.1, 8.1
• Potential thermal impacts on watercourse	• No thermal impact expected, as treated wastewater discharge will be within acceptable temperature range upon exit at outfall. • See Section 8.1.1 and Appendix B
Selection of Facility Location	
• Clarification on the rationale for moving the WWTP location	• See Section 6.1
• Clarification on the rationale for moving the outfall location from Keenansville Road to Concession Road 8	• See Section 6.4
• Suggestion that WWTP should be located on original location south of County Road 14, in part so that trucks can access site from County Road 14	• Sludge trucks are required to access WWTP through subdivision, as no direct access permitted to WWTP from County Road 14 as per conditions in OMB decision. • See Section 6.1.2
• Concern that location will be within residential subdivision, including potential odour and aesthetic impacts	• Detailed design to consider odour control and aesthetics of WWTP • See Sections 8.1 and 9
• Siting of WWTP relative to wet area located near northwest portion of northern development property	• WWTP is not located near area in question
Forcemain Route	
• Clarification on whether construction of forcemain will remain within road ROW	• Forcemain to be installed within municipal ROW
• Concern that trees would be impacted or removed due to forcemain construction	• Forcemain to be installed within municipal ROW • Placement of forcemain within ROW to minimize tree impacts
• Loss of access to driveway during construction	

Feedback Received through PIC #2	Response / Section Where Addressed
Wastewater Treatment Process	
• Clarification on whether the WWTP will have a bypass, and if not, what will happen if the WWTP experiences a total shutdown	• Raw wastewater will be able to be pumped from WWTP wetwell in the event of a full system breakdown • WWTP will not have a raw wastewater bypass
• Where will the removed sludge go	• Will be removed for offsite disposal at a facility licensed to receive this • Exact location/service provider to be determined during detailed design
• Clarification on effectiveness of WWTP at removing fecal matter, chemicals, pharmaceuticals and micro-fibres	• Wastewater treated using advanced technology • Studies indicate MBR treatment process effective at removing pharmaceuticals • See Section 8.1 and Appendix D-3
Forecasting Wastewater Treatment Demand	
• Error noted in “Population Design Flow” display board	• Corrected and revised for display boards placed on Township website • Error did not influence reported capacity value for WWTP
• Clarification on whether the proposed WWTP treatment capacity includes the 22 additional units added to the development since PIC #1	• Forecast includes updated number of units
• Clarification on how staff and visitors to retirement home were factored in demand calculations	• The size of the retirement home was assumed to be 170 beds and considered equivalent to 170 residential units for servicing estimates. This includes staff and visitors, just as servicing estimates for households include visitors.
• Clarification on maximum buildout (capacity) for WWTP	• See Sections 4.5.2 and 5.1
Project Costs	
• Clarification on who is responsible for cost to build, operate and maintain the facility	• See Section 8.5 • To be determined - separate issue that is addressed outside of the Class EA process

Feedback Received through PIC #2	Response / Section Where Addressed
Natural Heritage	
• Clarification on whether additional natural heritage studies would be completed	• Additional natural heritage studies planned for summer 2018 / detailed design
• Potential impact of WWTP discharge on aquatic species, including species at risk	• Treated wastewater discharge parameters strict and will not impact ability of watercourse to achieve PWQO • See Sections 7.1 and 8.1 and Appendices A and B
WWTP Operations	
• Who will sample treated wastewater and how often will it be done	• To be set within MECP Environmental Compliance Approval
Odour and Noise	
• Potential air and noise from WWTP	• WWTP will include measures to mitigate against potential odours and noise, such as being an entirely enclosed facility. • Odour emissions to be less than 1.0 OU at property line, as per MECP requirements • See Sections 8.1 and 9 and Appendix C
• Potential odour from treated wastewater at outfall	• Treated wastewater to be odourless • See Section 8.1
Other Comments	
• Late notification of PIC #2	• Efforts made to ensure all public stakeholders notified • Multiple points of consultation available • Information available on Township's website for those unable to attend PIC • See Section 10
• Consideration of in-creek erosion on outfall design	• Erosion control and slope stability measures to be determined during detailed design. • See Section 7.2

10.4 Key Agency Consultation

The Class EA has included consultation with relevant agencies throughout its process. A copy of correspondence with agencies is included in Appendix D-8. Key engagement points have included:

- October 18, 2016 - meeting with MECP and NVCA to provide an update on the project and obtain feedback;
- June 5, 2017 - Distribution of the PIC #1 notice to relevant agency stakeholders (see Appendix D-2 for the PIC#1 stakeholder contact list);
- June 20, 2017 - Distribution of PIC #1 display boards to MECP and NVCA for their information;
- February 26, 2018 - Project update to MECP and distribution of draft study materials for their feedback, including Assimilative Capacity Feasibility Study and memo summarizing the results of the alternative outfall/forcemain route evaluation;
- February 26, 2018 - Project update to NVCA and distribution of draft study materials for their feedback, including Assimilative Capacity Feasibility Study, memo summarizing the results of the alternative outfall/forcemain route evaluation, natural heritage feasibility study for new outfall location, and copies of natural heritage investigations completed for this Class EA (Phases 3 and 4);
- March 20, 2018 - Conference call with NVCA about new outfall location and planned natural heritage investigations;
- April 2, 1018 - Distribution of PIC #2 notice to agency stakeholders;
- May 23, 2018 - Proposed detailed design natural heritage work plan provided to NVCA for their consideration; and
- July 20, 2018 - Distribution of draft ESR to MECP and NVCA for their review and comment.

Table 35: Summary of Agency Feedback

Agency	Summary of Agency Feedback
MECP	• Commentary of parameters for treated wastewater • Request for air quality and odour impact assessment • Request that study consider cBOD and dissolved oxygen, nitrate, and potential thermal impacts • Potential impact on geomorphological conditions in the watercourse to be considered • Request to review draft ESR for 30 days prior to completion of final ESR • Adequate precaution and conservatism incorporated into low-flow estimates of Baily Creek at Concession Road 8 site • Recommended TAN limits of 2 mg/L for warm season and 5.7 mg/L for cold season • Recommends proposed TP target of 0.5 mg/L • Recommendation that ESR include a summary of how issues and concerns raised were addressed • Feedback on Draft ESR (see table 37)
NVCA	• Desire to see “limit of technology” to reduce broader “cumulative impact” subwatershed concerns of multiple WWTP’s • No concerns with relocation of WWTP, provided it lies within previously approved development area and outside of development constraints (i.e., natural heritage and natural hazards) • Provided clarifications on PIC #1 materials (WWTP location evaluation, key findings) • Desire to see fluvial geomorphological analysis for outfall • Noted possible presence of rainbow trout and northern brook lamprey in Bailey Creek • No specific issues raised regarding location of outfall on Concession Road 8 • General agreement with conceptual approach to natural heritage investigations in detailed design, but requested to see proposed workplan • Feedback on Draft ESR (see table 37)
Ministry of Tourism, Culture and Sport	• Request to see archaeological assessment reports in final documentation • Clarification on impacts on built heritage or cultural heritage landscapes
Ministry of Transportation	• No concerns, as project is beyond MTO permit control area
Ministry of Natural Resources and Forestry	• Data on natural heritage features and species at risk provided to Natural Heritage consultants

In addition, the MECP provided certain conditions on the projects related to the Colgan MSP Amendment in response to Part 2 Orders requested for the MSP. Table 36 summarizes the conditions relevant to the Colgan Wastewater EA and the resulting project-related action.

Table 36: Summary of Wastewater-related Minister Conditions related to Colgan MSP Amendment Part 2 Orders

Condition		Resulting Project Action
1	The Township of Adjala-Tosorontio (Township) shall ensure that the Notices of Completion for the Schedule 'C' projects identified in the Colgan Master Servicing Plan Amendment are sent directly to the Part II Order requesters.	• Part 2 Order requestors are on stakeholder consultation list
2	When undertaking the class environmental assessment process for the Schedule 'C' projects identified in the Colgan Master Servicing Plan Amendment, the Township shall provide a copy of the draft Environmental Study Report to the Nottawasaga Valley Conservation Authority for its review and comment at least 30 days prior to the completion of the requisite final Environmental Study Report. The Township shall consider any comments provided by the Nottawasaga Valley Conservation Authority and shall describe in the final Environmental Study Report how those comments were considered and/or addressed.	• Draft ESR to be provided to NVCA • Final ESR to include how comments were considered and addressed
3	Within 30 days of completing the requirements set out in Conditions 1 and 2, the Township shall provide written notification to the Director of the Environmental Assessment and Permissions Branch outlining how it has met those requirements.	• Township to provide letter to Director
4	Not applicable	
5	Not applicable	

As noted above, the MECP and the NVCA were provided with a copy of the draft ESR for their review and comment. Comments received from each agency were reviewed and the ESR and supporting documents updated accordingly. Tables 37 and 38 provides a high-level summary of the comments received from each agency and how they were addressed. The comments from the agencies and the responses to them are provided in Appendix D-8.

Table 37: Summary of MECP Comments on Draft ESR

MECP Draft ESR Comment Summary	How Comments Were Addressed
• Clarification on proposed effluent limits	• Table 7 updated to clarify proposed effluent limits and objectives.
• Various clarifications or suggestions regarding air assessment report, including:	
○ Which process units would be considered odour point sources	• Air assessment report was updated accordingly
○ Air impacts of specific contaminants of concern be included, in particular dimethyl sulphide and dimethyl disulphide from the wastewater treatment process and NOx emissions from the stand-by generator	• Air assessment report updated to discuss specified air contaminants
○ Recommendation that AERMOD air assessment modeling be used instead of Screen 3	• Air impact assessment modelling was re-run using AERMOD • Air assessment report was updated accordingly
○ Request for manufacturer's guarantee that odour control units will achieve 95% removal efficiency	• Manufacturer information of typical odour control units included in updated air assessment report
○ Recommendation that WWTP maintain a 100 m setback from sensitive receptors	• ESR describes additional odour control measures in lieu of 100 m setback • Air impact assessment report indicates that no air impacts are anticipated at the WWTP property line or beyond

Table 38: Summary of NVCA Comments on Draft ESR

NVCA Draft ESR Comment Summary	How Comments were Addressed
• Need for WWTP buildings / structures to be located outside of natural hazard areas. • Potential need for Natural Hazard Study and / or localized erosion study depending on actual location of WWTP	• WWTP is above floodline and within limits of approved development • Final location of WWTP to b reviewed with NVCA during detailed design
• Appropriate erosion and sediment control measures to be included as part of the design	• Agreed.
• Clarification on fluvial geomorphological analysis for new proposed location of outfall	• Additional investigations to be undertaken as par of detailed design and to be shared with NVCA
• Confirmed satisfaction with summary of source water protection implications	• No response required
• Recommendation that WWTP building envelope remain outside of naturalized space and slope hazard areas	• WWTP set within approved development limits • Balance attempted between protection of existing trees and setback from future homes • Trees on block slated for removal based on development and fall within tree compensation plan • Design will consider protection of trees where feasible
• Aerial imagery shows potential wetland feature on development along proposed forcemain route.	• Forcemain route based on approved street layout of subdivision. • Forcemain to be located within street allowance, consistent with other underground infrastructure such as stormwater mains, sanitary sewer lines and watermains. • No prior concern raised by NVCA over this feature
• Request for detailed strategy for outfall vegetated channel	• NVCA to be consulted during detailed design of outfall

10.5 Indigenous Community Consultation

Consultation with Indigenous Communities was undertaken through the distribution of the PIC #1 and PIC #2 notices by e-mail, courier or mail, and/or fax (where applicable). Table 39 below summarizes the groups contacted and method of distribution. No comments were received in response.

The distribution list (see Appendix D-6) was based on the MSP Amendment distribution list.

Table 39: Summary of Indigenous Community Consultation

Organization	PIC #1 Distribution	PIC #2 Distribution
Chippewas of Rama First Nation	Courier, E-mail, Fax	Courier, E-mail, Fax
Métis Nation of Ontario	Courier	Courier, E-mail
Chippewas of Georgina Island	Mail, E-mail, Fax	Mail, E-mail, Fax
Georgian Bay Métis Council	Courier, E-mail	Courier, E-mail
Saugeen Ojibway Nation	Courier, Fax	Courier, E-mail, Fax
Moon River Métis Council	Courier, E-mail	Courier, E-mail
Beausoleil First Nation	Courier, E-mail, Fax	Courier, E-mail, Fax
Ministry of Aboriginal Affairs	Mail	E-mail
Aboriginal Affairs and Northern Development Canada	Mail	E-mail