Ainley & Associates Limited
195 County Court Boulevard, Suite 300, Brampton, ON L6W 4P7
Tel: (905) 452-5172 Fax: (705) 445-0968
E-mail: brampton@ainleygroup.com

December 29, 2017 File No. 115157

Triton Engineering Services Limited
105 Queen Street West Unit 14
Fergus, ON N1M 1S6

Attn: **Christine Furlong, P.Eng.**
Project Manager

Ref: **Town of Erin, Urban Centre Wastewater Servicing Class EA**
Pumping Station and Forcemains, Technical Memorandum

Dear Ms. Furlong:

We are pleased to present our Technical Memorandum for the "Pumping Stations and Forcemains" for the Urban Centre Wastewater Servicing Schedule 'C' Municipal Class Environmental Assessment (EA).

This Technical Memorandum provides a review of the pumping station sites and forcemain alignment Alternatives and includes those alternatives identified in the Servicing and Settlement Master Plan (SSMP). The Technical Memorandum establishes and evaluates alternative pumping stations and forcemains as a component of Phase 3 of the Municipal Class EA process. The recommended preferred Alternative is presented in the Technical Memorandum which will remain in draft until completion of the public review process.

Yours truly,

AINLEY & ASSOCIATES LIMITED

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Joe Mullan, P.Eng.
Project Manager

Town of Erin

Urban Centre Wastewater Servicing Class Environmental Assessment

Technical Memorandum
Pumping Stations and Forcemains

Draft

December 2017

Ainley Group
CONSULTING ENGINEERS PLANNERS

Urban Centre Wastewater Servicing Class Environmental Assessment

Technical Memorandum
Pumping Station and Forcemains

Project No. 115157

Prepared for:
The Town of Erin

Prepared By:

DRAFT

Simon Glass, E.I.T.

Reviewed By:

DRAFT

Gary Scott, P.Eng.

Ainley Group
195 County Court Blvd., Suite 300
Brampton, ON L6W 4P7

Phone: (905) 452 – 5172
www.ainleygroup.com

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Glossary of Terms

ACS	Assimilative Capacity Study: see assimilative capacity.
Ainley	Primary engineering consultant for the Class EA process.
Air Lock	Air lock occurs in pressurized pipes when a pocket of air develops and obstructs flow. The air pocket will not allow the water to flow freely through the pipe.
Air Release Valve	Air release valves function to release air pockets that collect at each high point of a full pressured pipeline.
Alternative Solution	A possible approach to fulfilling the goal and objective of the study or a component of the study.
Build-out	Refers to a future date where all vacant and underdeveloped lots have been fully developed in accordance with the Town's Official Plan.
Class EA	Municipal Class Environmental Assessment, a planning process approved under the EA Act in Ontario for a class or group of municipal undertakings. The process must meet the requirements outlined in the "Municipal Class Environmental Assessment" document (Municipal Engineers Association, October 2000, as amended). The Class EA process involves evaluating the environmental effects of alternative solutions and design concepts to achieve a project objective and goal and includes mandatory requirements for public consultation.
CVC	Credit Valley Conservation Authority
Design Concept	A method of implementing an alternative solution(s).
EA Act	*Environmental Assessment Act*, R.S.O. 1990, c.E.18 (Ontario)
Effluent	Liquid after treatment. Effluent refers to the liquid discharged from the WWTP to the receiving water.
Evaluation Criteria	Criteria applied to assist in identifying the preferred solution(s).
Fluvial	Related to or found within a river.
Forcemain	A pressurized pipe used to convey pumped wastewater from a sewage pumping station.
Geotechnical Investigation	Study of the engineering behavior of earth materials such as soil properties, rock characteristics, natural slopes, earthworks and foundations, etc.
Gravity sewer	A pipe that relies on gravity to convey sewage.
Horizontal Directional Drilling (HDD)	A trenchless technology method of pipeline construction that could be used for the construction of sewage forcemains or for small diameter sewer construction under watercourse crossings.
Hydrogeological	Study of the distribution and movement of groundwater in soil or bedrock.
Infill	A process of development within urban areas that are already largely developed. Refers specifically to the development of vacant or underdeveloped lots.
Infiltration/Inflow (I&I)	Rainwater and groundwater that enters a sanitary sewer during wet weather events or due to leakages, etc.
Intensification	A process of development within existing urban areas that are already largely developed. Refers specifically to the redevelopment of lots to increase occupancy.
LPS System	Low-Pressure Sewer System refers to a network of grinder pump units installed at each property pumping into a common forcemain.
Master Plan	A comprehensive plan to guide long-term development in a particular area that is broad in scope. It focuses on the analysis of a system for the purpose of outlining a framework for use in future individual projects.
MOECC	Ministry of the Environment and Climate Change, the provincial agency

	responsible for water, wastewater and waste regulation and approvals, and environmental assessments in Ontario.
O&M	Operation and maintenance
Official Plan (OP)	
Open-cut Construction	Method of constructing a pipeline by open excavation of a trench, laying the pipe, and backfilling the excavation.
Preferred Alternative	The alternative solution which is the recommended course of action to meet the objective statement based on its performance under the selection criteria.
Sewage Pumping Station (SPS)	A facility containing pumps to convey sewage through a forcemain to a higher elevation.
ROW	Right-of-way applies to lands which have an access right for highways, roads, railways or utilities, such as wastewater conveyance pipes.
Sanitary Sewer	Sewer pipe that conveys sewage to a sewage pumping station or sewage treatment plant. Part of the sewage collection system.
Service Area	The area that will receive sewage servicing as a result of this study.
Sewage	The liquid waste products of domestic, industrial, agricultural and manufacturing activities directed to the wastewater colleciton system.
Sewage Treatment Plant (STP)	A plant that treats urban wastewater to remove solids, contaminants and other undesirable materials before discharging the treated effluent back to the environment. Referred to in this Class EA as a Wastewater Treatment Plant.
SSMP	Servicing and Settlement Master Plan – the master plan for Erin which was conducted by B.M. Ross in 2014 and establishes the general preferred alternative solution for wastewater.
Study Area	The area under investigation in which construction may take place in order to provide servicing to the Service Area.
Threatened Species	A species likely to become endangered in Canada if the factors affecting its vulnerability are not reversed.
Trenchless technology	Methods of installing a utility, such as a sewer, without excavating a trench, including directional drilling, microtunneling etc.
Triton	Town of Erin engineering consultant
Trunk Sewer	A sewer that collects sewage from a number of tributary sewers.
UCWS Class EA	Urban Centre Wastewater Servicing Class Environmental Assessment
Wastewater	See Sewage
Wastewater Treatment Plant (WWTP)	See Sewage Treatment Plant.
Wet Well	The basin of a sewage pumping station where wastewater is collected before pumping.

1.0 Purpose and Study Background

In 2014, the Town of Erin completed a Servicing and Settlement Master Plan (SSMP) to address servicing, planning and environmental issues within the Town. The study area for the SSMP included Erin Village and Hillsburgh as well as a portion of the surrounding rural lands. The SSMP considered servicing and planning alternatives for wastewater and identified a preferred wastewater servicing strategy for existing and future development in the study area. The SSMP was conducted in accordance with the requirements of the Municipal Class Environmental Assessment (Class EA), which is an approved process under Ontario's Environmental Assessment Act and addressed Phase 1 & components of Phase 2 of the Class EA planning process.

Through the Urban Centre Wastewater Servicing Class EA (UCWS Class EA) the Town is now continuing with a review of Phase 2 and completing Phases 3 & 4 of the Class EA Planning Process to determine the preferred design alternative for wastewater collection for the existing urban areas of the Erin Village and Hillsburgh, and to accommodate future growth. The aforementioned SSMP concluded that the preferred solution for both communities is a municipal wastewater collection system conveying sewage to a single wastewater treatment plant located south east of Erin Village with treated effluent being discharged to the West Credit River servicing a population of 6,000. In completing Phase 2 activities within the UCWS Class EA, the preferred solution, remains as established under the SSMP, however, the serviced population has been increased to 14,559 persons to account for growth in accordance with the Town's Official Plan (OP).

The UCWS Class EA will outline a wastewater servicing plan for a population of 14,559, sufficient to service both existing communities and full build out growth to meet the development potential of future development lands identified in the present OP. Site selection for pumping stations must take into account the full build-out potential for the community to ensure adequate site space is considered in the selection of potential locations. This pumping station and forcemains alternatives technical memorandum is therefore presented on the basis of full build out growth.

2.0 Identification of Potential Pumping Station Sites

Prior to selecting pumping station sites for evaluation, the "Collection System Alternatives" Technical Memorandum compared a range of collection system alternatives and identified a "Blended Gravity and Low Pressure Pump System" as the recommended collection system alternative. The "Collection System Alternatives" technical memorandum compares the collection system technologies on the basis of servicing the existing communities including infill and intensification and shows the cost to service existing areas. In addition, the technical memorandum identifies the "oversizing" required to service growth to full build out. A suggested trunk system that services both existing areas and growth has been identified.

Additional pumping stations may be necessary within any new development areas to convey wastewater to the main system and these would be identified during the planning stages for these new developments.

Based on the topography of Erin Village and Hillsburgh, the need for a total of ten locations have been identified where wastewater needs to be pumped to service existing areas and to convey wastewater from growth areas to the Wastewater Treatment Plant. The general locations for the pumping stations required are outlined in the following sections. For further detail on why pumping stations have been deemed necessary in the locations listed in this section, please refer to the Collection System Alternatives Memorandum where the topography of each area is discussed in detail.

Each of the gravity drainage areas requiring a pumping station is outlined below.

2.1. Hillsburgh-Erin Connection (H-SPS 1)

A pumping station is required at the south end of Hillsburgh in order to convey wastewater to Erin. The boundary of the collection area for this pumping station are shown in ***Appendix A***. Several locations were considered for the pumping station location. Undeveloped properties exist surrounding the intersection of Trafalgar Road and Wellington Road 22; however these properties were eliminated as potential locations due to the environmental constraints at these sites. Other site owners in this area were not willing to have their land considered for a SPS. Potential sites were examined between Gilbey Lane and Jane Street as well as at the junction of Trafalgar Road and the Elora-Cataract Trail. The junction of Trafalgar Road/ Elora-Cataract Trail joins on to a proposed development area and there is an unused road allowance available that would be suitable for a SPS. These potential areas are shown Figure 1. The Trafalgar Road/Elora-Cataract Trail was identified as the preferred site based on property considerations and the ability to service both existing and growth areas. This station will collect all wastewater produced in Hillsburgh for transmission to Erin. This pumping station would have a capacity of 89.2 L/s for the full build-out condition.

Although the elevation of this SPS in Hillsburgh is some 30 m above the proposed Main Street SPS in Erin and the connection is capable of operating under gravity flow, it is proposed to pump the wastewater all the way between Hillsburgh and Erin in order to be able to control the residence time of the wastewater in the system. The Erin – Hillsburgh connection SPS will be provided with an oversized wet well designed to optimise the residence time in the system.

Figure 1 – Hillsburgh to Erin Potential SPS Location

Based on a review of the potential SPS site area, the preferred location for the station is on the east side of Trafalgar Road, at the junction of the Elora-Cataract Trail and Trafalgar Road. Figure 2 presents a conceptual site layout for the station at this location. Sufficient space has been provided for standby power and for installation of odour control equipment. This location would also be suitable for an expanded car parking area as an entrance to the trailway.

2.1.1. Environmental

The consideration of the sites at the intersection of Trafalgar Road and Wellington Road 22 and subsequent dismissal of these alternatives due to the existing environmental constraints resulted in a missed opportunity to review the preferred site during the field season. As such, a full environmental review of the preferred site was not completed as a part of the UCWS Class EA. As the preferred site is a part of a larger lot with development plans, Ainley was able to obtain a Phase 1 Environmental Assessment and an Environmental Impact Study of these development lands from the land owner.

The previous studies identified the presence of thirty-seven bird species in the area. Fourteen of the bird species are considered to be species of conservation concern; however no nesting habitat was identified on the parcel being considered for the pumping station. In addition, there was no potentially significant wildlife habitat identified at the proposed site. The onsite woodland and onsite pond identified are located at the north end of the development parcel, well away from the proposed SPS site.

2.1.2. Heritage and Archaeological

This location has been identified as a site with potential archaeological significance. As such, a stage 2 test pit survey will be required prior to construction at the site.

2.1.3. Geotechnical

Ainley was able to obtain an Environmental Impact Study and a Hydrogeological Report of the property from the land owner.

The previous studies identified that the surficial geology of the site is broadly characterized by a sand and gravel deposits of varying texture interlayered with silt and till. The southwestern portion of the property, close to the proposed SPS location is characterized by surface deposits of glacio-fluvial ‘outwash’ sand and gravel, frequently overlain by several feet of fine sand and silt. The hydrogeological report estimates that the static groundwater level at this location is approximately 4.3 m below grade. The site would provide a suitable foundation for construction of a wastewater pumping station.

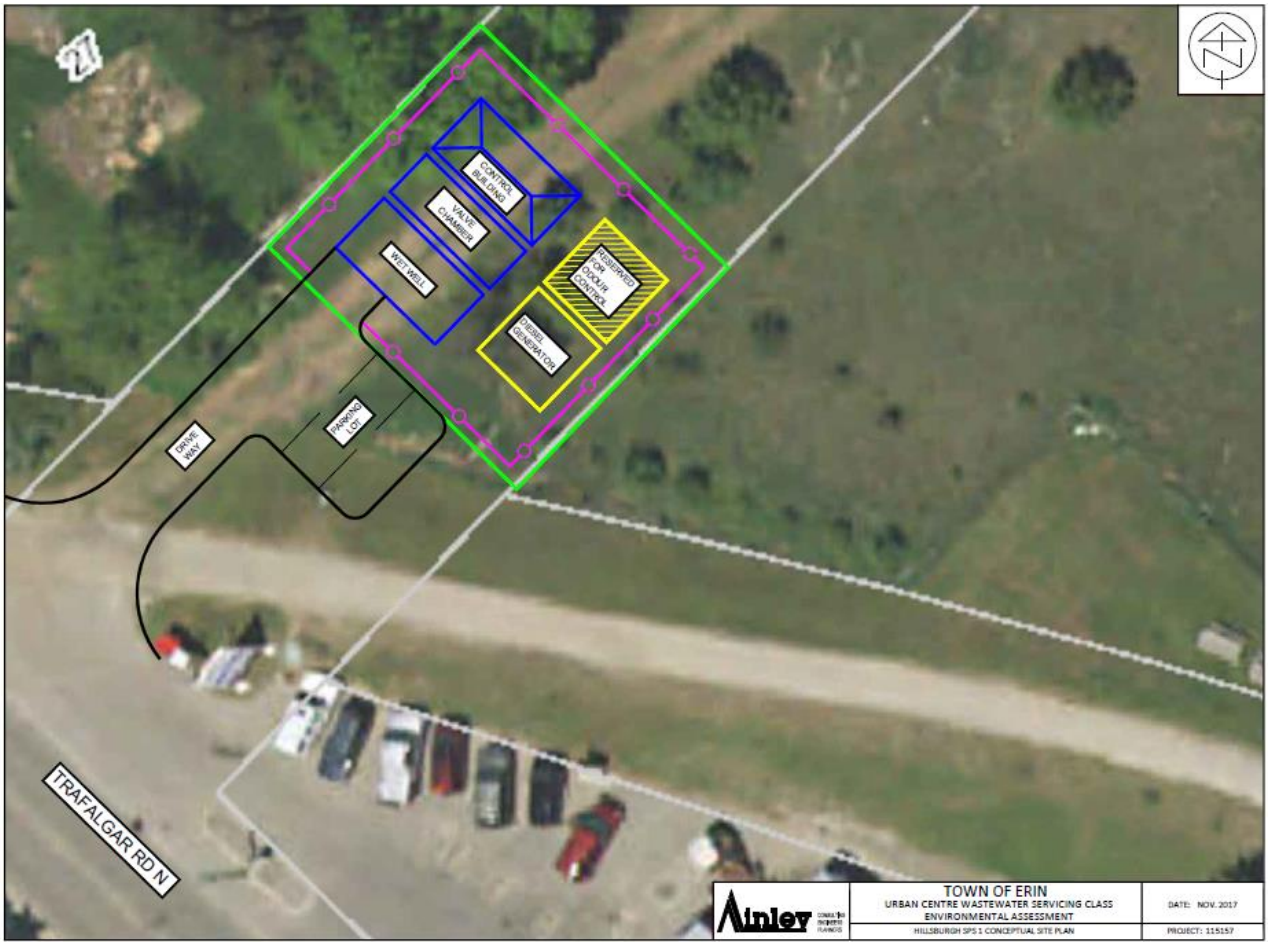


Figure 2 – H-SPS 1 Conceptual Site Plan

2.2. Hillsburgh Town Core (H-SPS 2)

A pumping station will be required for the core residential area in Hillsburgh to convey wastewater to Trafalgar Road. The boundary of the collection area for this pumping station are shown in ***Appendix A***. The potential location of the pumping station situated along Mill Street west of Covert Lane. Two potential areas were identified and are outlined in Figure 3; both of the potential sites are within 100m of a municipal well and potable water pumping station. The operation of a sewage pumping station in this area is not expected to have any impact of the existing well or the potable water pumping station. The forcemain route for this location can be seen in the overall system layout available in ***Appendix A***. A discharge location has been proposed along Trafalgar Road which represents a local high point, allowing for the wastewater to be conveyed by gravity to the main pumping station connecting Hillsburgh to Erin Village. This pumping station will need to have a capacity of 33.1 L/s for the full build-out condition.

Figure 3 – Hillsburgh Town Core Potential SPS Location

Based on a review of the potential SPS site area, the preferred location for the station is on the south side of Mill Street, west of the Health Centre. These lands are owned by the Town of Erin and will not impact existing recreational land use. Figure 4 presents a conceptual site layout for the station at this location. Sufficient space has been provided for standby power and for installation of odour control equipment.

Figure 4 – H-SPS 2 Conceptual Site Plan

2.2.1. Environmental

The Natural Environment Report, completed as a part of the UCWS Class EA describes this site as an urban park beside fresh-moist lowland deciduous forest. There is no wetland present at the site and no amphibian habitat was identified. The site is located in close proximity to a watercourse and, as such, the Natural Environment Report provides recommendations on construction timing and erosion and sediment controls. This site is located in the flood plain of the West Credit River and will require special construction to ensure that it is accessable during flood events. The top of all chambers constructed at this location should be above the flood plain.

2.2.2. Archaeological

This location has been identified as a site with potential archaeological significance. As such, a stage 2 test pit survey will be required prior to construction at the site.

2.2.3. Geotechnical

Indications from borehole information are that this site provides suitable foundation conditions for a Sewage Pump Station.

2.3. Lion's Park Pumping Station (E-SPS 1)

The proposed location for the final sewage pumping station that will pump all wastewater to the WWTP, is within the existing park at the intersection of Hillsview St. and Lions Park Ave. Following a general review of available lands at the South end of Erin the Lions Park area was identified as the preferred location due to the unavailability of other potential sites. The boundary of the collection area for this pumping station and the proposed forcemain route are shown in ***Appendix A***. This station would receive all wastewater collected from both Hillsburgh and Erin Village and convey wastewater to the treatment plant. The potential area for this pumping station is shown in Figure 5. The forcemain route from this station is aligned south along Main Street before diverting east along Wellington Road 52 towards the proposed WWTP location. This pumping station will need to have a capacity of 227.2 L/s for the full build-out condition. The trunk sewer from the north end of the community will pass under the West Credit River just to the north of the proposed SPS site (See Figure 6). Figure 7 provides a photograph of the site.

Figure 5 – Main SPS Alternative 2 Potential Location

Figure 6 – Trunk Gravity Sewer Crossing Location

Figure 7 – E-SPS 1 Site Location Photograph (North Side)

Based on a review of the potential SPS site area, the preferred location for the station is on the west side of Lion's Park. Figure 8 presents a conceptual site layout for the station at this location. Sufficient space has been provided for standby power and for installation of odour control equipment.

2.2.4. Environmental

A portion of the West Credit River Wetland Complex is in close proximity (approximately 20m) to the proposed site. An existing road lies between the proposed site and the watercourse. There were no species of concern at the site or within the watercourse close to the site. The Natural Sciences Report specifies that the pumping station at this site should be designed so as to maintain the existing wetland hydrology. In addition, any tree removals necessary for the construction of an SPS at this site should be completed outside of the migratory bird season. This site is located in the flood plain of the West Credit River and will require special construction to ensure that it is accessable during flood events. The top of all chambers constructed at this location should be above the flood plain.

2.2.5. Archaeological

This location has been identified as a site with potential archaeological significance. As such, a stage 2 test pit survey will be required prior to construction at the site.

2.2.6. Geotechnical

Indications from borehole information are that this site provides suitable foundation conditions for a Sewage Pump Station.

Figure 8 – E-SPS 1 Conceptual Site Plan

2.4. North Erin Pumping Station (E- SPS 2)

A pumping station is required to convey wastewater from the north end of Erin to the high point at the intersection of Main Street and Dundas Street. The boundary of the collection area for this pumping station and the proposed forcemain route are shown in the proposed system layout for Erin in ***Appendix A***. The potential location for this pumping station is shown in Figure 9. The forcemain route for this station is aligned along Main Street connecting to a gravity sewer in the area of Main Street and Dundas Street. This pumping station will need to have a capacity of 151.7 L/s for the full build-out condition. The build-out condition flow rate assumes that all the industrial and commercial development along Wellington Road 124 north of Dundas Street will be conveyed through this station.

Figure 9 – North Erin Potential SPS Location

Figure 10 presents a conceptual site layout for the station at this location. Sufficient space has been provided for standby power and for installation of odour control equipment.

2.4.1. Environmental

A portion of the West Credit River Wetland Complex is in close proximity to the proposed site. An open water vegetation community associated with the wetland complex is adjacent to the site and an amphibian habitat was located within 120m of the site. The Natural Sciences Report specifies that the pumping station at this site should be designed so as to maintain the existing surface water contribution to the wetland and that water quality should be maintained for any water discharged for dewatering.

2.4.2. Heritage and Archaeological

This location has been identified as a site with potential archaeological significance. As such, a stage 2 test pit survey will be required prior to construction at the site.

2.4.3. Geotechnical

Indications from borehole information are that this site provides suitable foundation conditions for a Sewage Pump Station.

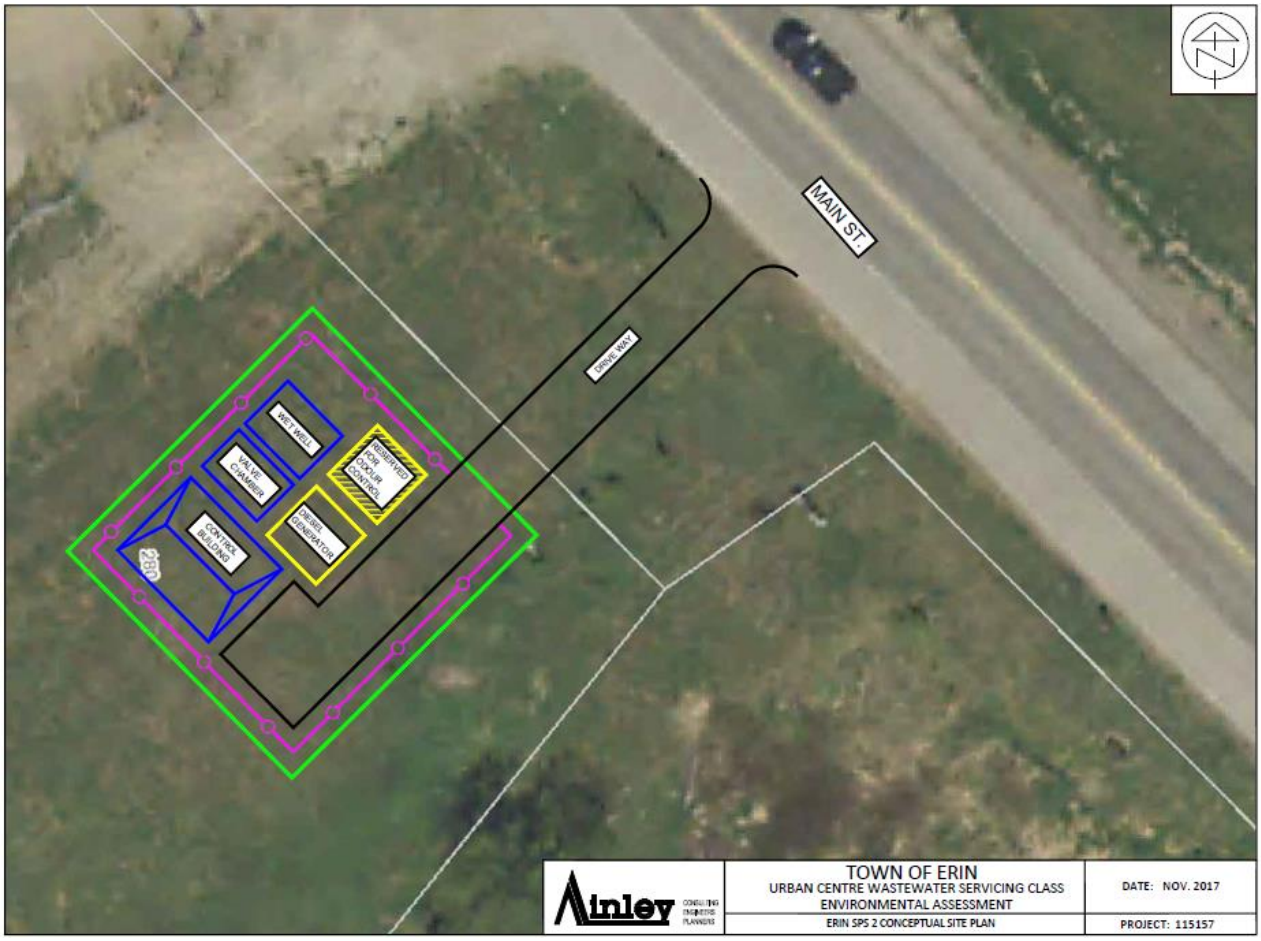


Figure 10 – E-SPS 2 Conceptual Site Plan

2.5. Erin Heights Pumping Station (E-SPS 3)

A pumping station is required for the Erin Heights Drive area to convey wastewater from the subdivision under the river which separates this area from the downtown area of Erin Village and up to the Main Street sewer. The boundary of the collection area for this pumping station and the proposed forcemain route are shown in ***Appendix A***. The potential location for this pumping station is shown in Figure 12. The proposed forcemain route for this station is aligned eastward along Dundas St W. and must cross the West Credit River before reaching Main Street (see Figure 11). This pumping station will need to have a capacity of 5.3 L/s for the full build-out condition. As this is a small pumping station it is proposed that the

wetwell be oversized and a connection provided for a trailer mounted standby power generator in case of prime power loss.The build-out condition flow rate assumes that all the development along 8th Line will be conveyed to Main Street along Dundas and the forcemain would link into the forcemain from the Erin Heights subdivision. This would require a cost sharing agreement with the developer(s) for the river crossing and joint forcemain.

Figure 11 – West Credit River crossing with Dundas Street

Figure 12 – Erin Heights Potential SPS Location

Due to the highly constrained potential site area for the SPS, the preferred location for the station is within the unopened right-of-way at the east end of Erin Heights Drive. Figure 13 presents a conceptual site layout for the station at this location.

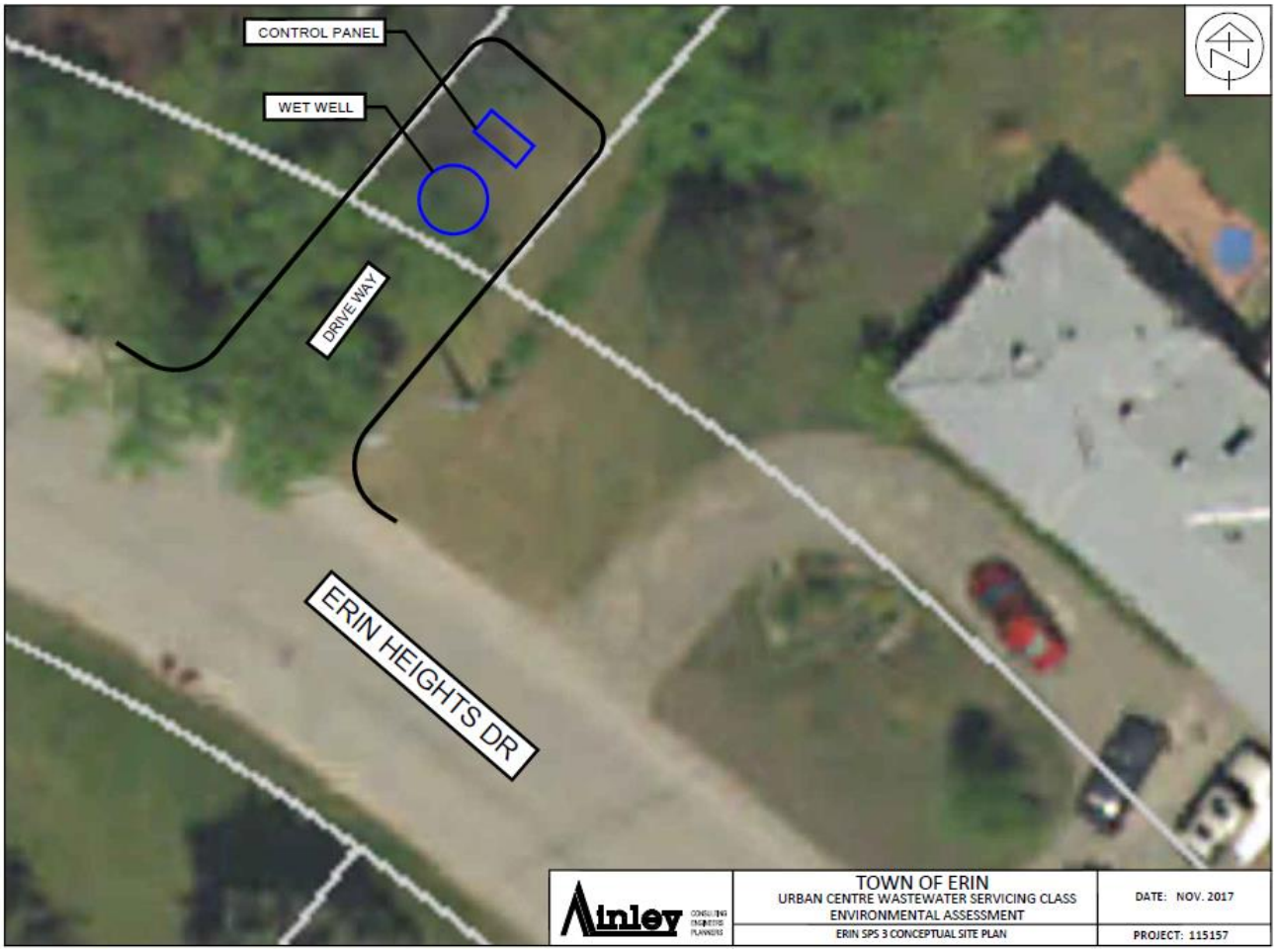


Figure 13 – E-SPS 3 Conceptual Site Plan

2.5.1. Environmental

There are no specific environmental concerns at this site. Any tree removals necessary for the construction of the station should be completed outside of the migratory bird season. The road allowance leads to a trail behind the homes, however it is not known if this trail crosses private lands. The station construction can allow the trail to remain open if necessary.

2.5.2. Archaeological

This location has been identified as a site with potential archaeological significance. As such, a stage 2 test pit survey will be required prior to construction at the site.

2.5.3. Geotechnical

Indications from borehole information are that this site provides suitable foundation conditions for a Sewage Pump Station.

2.6. Erin Industrial Area (E-SPS 4)

A pumping station is required to convey wastewater from the north end of the Erin industrial area along Sideroad 17 including Pioneer Drive. The boundary of the collection area for this pumping station and the proposed forcemain route are shown in the proposed system layout for Erin in ***Appendix A***. The pumping station will be located on Sideroad 17 west of Pioneer Drive. The potential area is outlined in Figure 14. The forcemain route for this station is aligned eastward along Sideroad 17 and diverts south along Main Street to a local high point where the flow continues by gravity. This pumping station will need to have a capacity of 7.8 L/s for the full build-out condition. As this is a small pumping station it is proposed that the wetwell be oversized and a connection provided for a trailer mounted standby power generator in case of prime power loss.

Figure 14 – Erin Industrial Area Potential SPS Location

Based on a review of the potential SPS site area, the preferred location for the station is adjacent to the driveway to the Snow Brothers property. Figure 15 presents a conceptual site layout for the station at this location.

2.6.1. Environmental

There are no specific environmental concerns at this site.

2.6.2. Archaeological

This location has been identified as a site with potential archaeological significance. As such, a stage 2 test pit survey will be required prior to construction at the site.

2.6.3. Geotechnical

Indications from borehole information are that this site provides suitable foundation conditions for a Sewage Pump Station.

Figure 15 – Erin SPS 4 Conceptual Plan

2.7. Dundas St. E Pumping Station (E-SPS 5)

A pumping station is required along Dundas St. E., to convey wastewater from the surrounding residential area to a gravity main on Daniel St. The boundary of the collection area for this pumping station and the

proposed forcemain route are shown in ***Appendix A***. The potential location for this pumping station is shown in Figure 16. This pumping station will need to have a capacity of 5.1 L/s for the full build-out condition. As this is a small pumping station it is proposed that the wetwell be oversized and a connection provided for a trailer mounted standby power generator in case of prime power loss.

Figure 16 – Dundas Street East Potential SPS Location

Figure 17 presents a conceptual site layout for the station at this location.

2.7.1. Environmental

There are no specific environmental concerns at this site. Any tree removals necessary for the construction of the station should be completed outside of the migratory bird season.

2.7.2. Archaeological

This location has been identified as a site with potential archaeological significance. As such, a stage 2 test pit survey will be required prior to construction at the site.

2.7.3. Geotechnical

Indications from borehole information are that this site provides suitable foundation conditions for a Sewage Pump Station.

Figure 17– Erin SPS 4 Conceptual Plan

2.8. Waterford Drive Pumping Station (E-SPS 6)

A pumping station is required at the north end of Waterford Drive, to convey wastewater from the low lying portion of this residential street. The boundary of the collection area for this pumping station and the proposed forcemain route are shown in ***Appendix A***. The potential location for this pumping station is shown in Figure 18. This pumping station will need to have a capacity of 4.4 L/s for the full build-out condition. As this is a small pumping station it is proposed that the wetwell be oversized and a connection provided for a trailer mounted standby power generator in case of prime power loss.

Figure 18 – Waterford Drive Potential SPS Location

Figure 19 presents a conceptual site layout for the station at this location.

2.8.1. Environmental

A portion of the West Credit River Wetland Complex is within 120m of the proposed site. Due to accessibility issues, the presence of amphibian habitat was not assessed in the river reach close to the site. The Natural Sciences Report specifies that the pumping station at this site should be designed so as to maintain the wetland hydrology and that water quality should be maintained for any water discharged for dewatering. In addition, any tree removals necessary for construction at the site should be completed outside of the migratory season.

2.8.2. Archaeological

This location is part of a storm water management facility and has been previously disturbed. As such it is unlikely to have potential for archaeological resources.

2.8.3. Geotechnical

Indications from borehole information are that this site provides suitable foundation conditions for a Sewage Pump Station.

Figure 19 – Erin SPS 6 Conceptual Plan

2.9. Scotch Street Pumping Station (E-SPS 7)

A pumping station is required along Scotch St., to convey wastewater from the surrounding residential area to a gravity main on Daniel St. The boundary of the collection area for this pumping station and the proposed forcemain route are shown in ***Appendix A***. The potential location for this pumping station is shown in Figure 20. This pumping station would need to have a capacity of 2.0 L/s for the full build-out condition however this catchment has been identified as a good candidate location for use of low pressure sewers. The capital cost of the local gravity sewer, pumping station and forcemain is higher than the local grinder pumps and low pressure sewer. The pressure sewer catchment would outlet to the trunk sewer along Daniel Street. It is recommended that the grinder pumps be owned and serviced by the Town.

Figure 20 – Scotch Street Potential SPS Location

2.9.1. Environmental

The only site available for a centralized pumping station is within the existing ROW for this catchment. The grinder pump stations for the homes in this catchment will be located within private property however this area remains within 120m of the West Credit River Wetland Complex. As such, the design and construction of the low pressure system for this area should maintain the wetland hydrology and ensure water quality from any dewatering discharge.

2.9.2. Archaeological

The only site available for a centralized pumping station is within the existing ROW for this catchment. As the land has already been disturbed in this location due to the road construction this site is not considered to have any archaeological potential.

2.9.3. Geotechnical

Indications from borehole information are that this site provides suitable foundation conditions for a Sewage Pump Station

2.10. Wheelock Street Pumping Station (E-SPS 8)

A pumping station is required along Wheelock St., to convey wastewater from a small number of surrounding homes on the low lying street to a gravity main on Daniel St. The boundary of the collection area for this pumping station and the proposed forcemain route are shown in ***Appendix A***. The potential location for this pumping station is shown in Figure 21. This pumping station would need to have a capacity of 0.9 L/s for the full build-out condition, however this catchment has been identified as a good candidate location for use of low pressure sewers. The capital cost of the local gravity sewer, pumping station and forcemain is higher than the local grinder pumps and low pressure sewer. The pressure sewer catchment would outlet to the trunk sewer along Daniel Street. It is recommended that the grinder pumps be owned and serviced by the Town.

Figure 21 – Wheelock Street Potential SPS Location

2.10.1. Environmental

Since this catchment has been identified as a good candidate for low pressure sewers, the grinder pump stations for the homes will be located within private property. The catchment area is in close proximity to the West Credit River. As such, the design and construction of the low pressure system for this area should maintain the wetland hydrology, amphibian habitat, and ensure water quality from any dewatering discharge. Part of this service area, including the sewage pumping station locations, is situated within a CVC regulated area.

2.10.2. Archaeological

A low pressure system has been recommended to service this catchment. As such, the system will be constructed within previously disturbed land within the existing ROW and on private properties and is not expected to have archaeological significance.

2.10.3. Geotechnical

Indications from borehole information are that this site provides suitable foundation conditions for a Sewage Pump Station.

3.0 River Crossings

There are several locations through Erin Village and Hillsburgh where the wastewater collection system will need to cross rivers. The key river crossing locations are shown in Figure 22 and Figure 24 for Erin Village and Hillsburgh respectively.

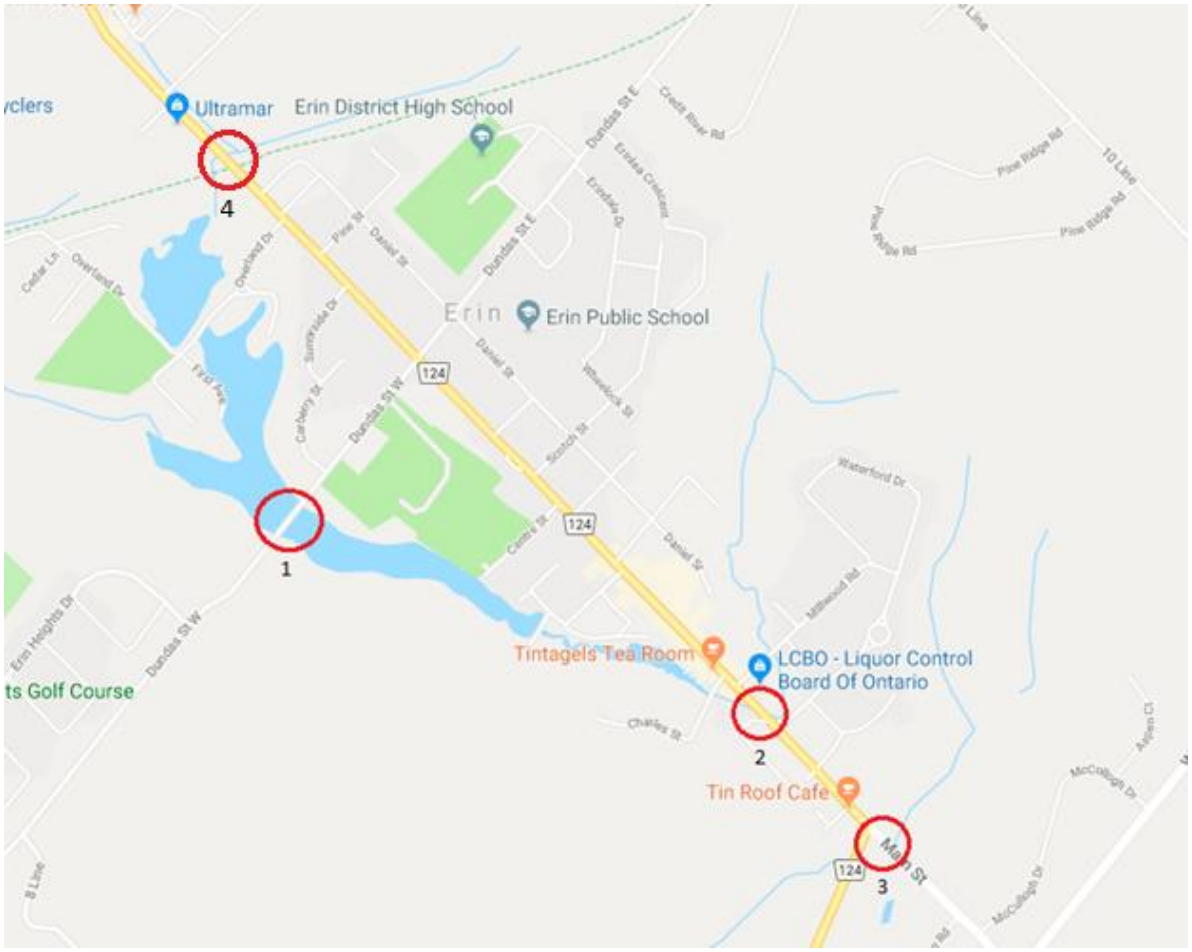


Figure 22 – Erin River Crossing Locations

Figure 23 – Sewer crossing, see crossing 3 in Figure 22

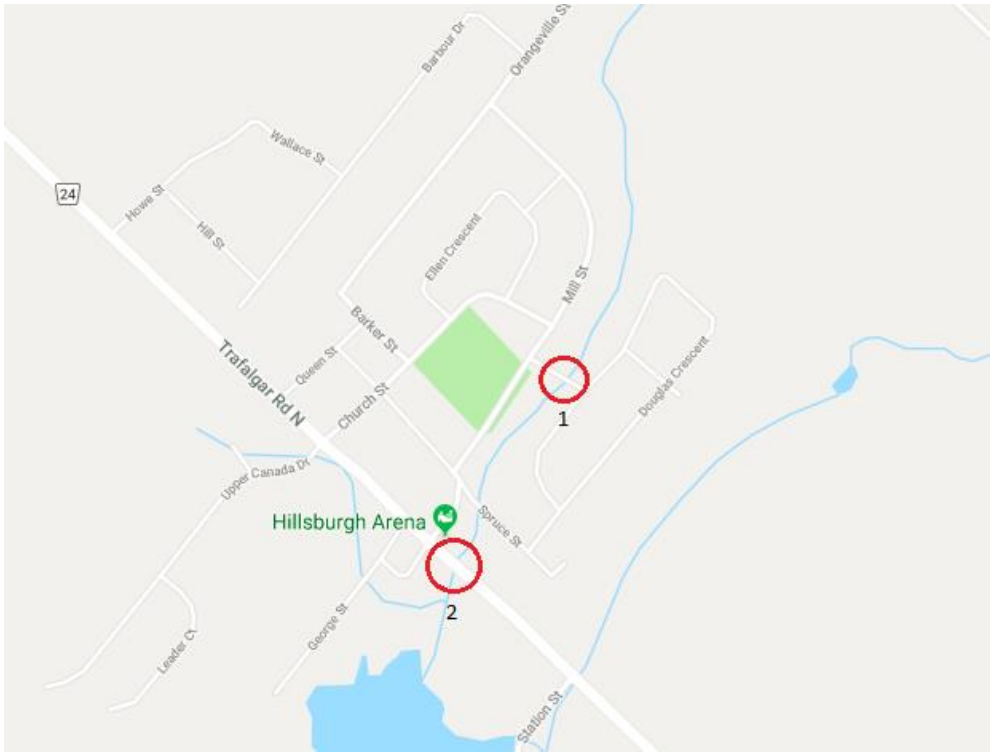


Figure 24 – Hillsburgh River Crossing Locations

In general, construction across rivers is regulated by the local conservation authority. The Credit Valley Conservation Authority (CVC) provides mapping showing the general extent of the regulated areas within the Credit River watershed. The river crossings identified in Figure 22 and Figure 24 are all within areas regulated by the CVC. The extent of the regulated areas is shown in Figure 25 and 26 for Erin Village and Hillsburgh respectively.

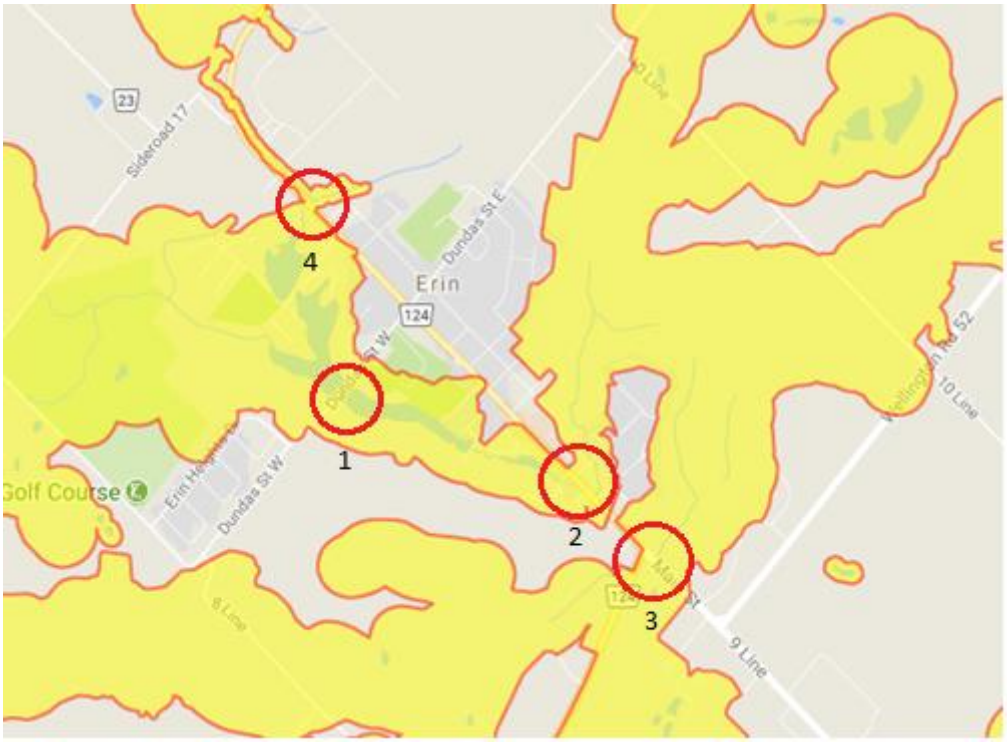


Figure 25 - CVC Regulated Areas in Erin

Figure 26 – CVC Regulated Areas in Hillsburgh

Typically the CVC requires a unique permit for each crossing, the application form for a river crossing permit is provided in ***Appendix B***. In general, a specific method of crossing is not prescribed by the conservation authority however open cut construction is generally not permitted or is severely restricted making it cost prohibitive. As such, a tunneling method will need to be selected during the detailed design for each river crossing. A suitable setback from the watercourse must be provided for the tunnel sending and receiving pits however the specific requirements are typically based on the local requirements.

Adequate separation between the sewer/forcemain obvert and the thalweg of the stream must be maintained. The separation requirements are site specific and are dependent on the scour potential of the watercourse. Depending on available information and the proposed depth, the CVC may require a scour assessment to be prepared by a qualified professional to establish the scour potential. In addition, an erosion and sedimentation plan will be required.

4.0 Forcemain Route Selection Erin Village-Hillsburgh Connection

Three forcemain routes were identified in the SSMP to connect Hillsburgh to Erin Village shown graphically in Figure 27; the first is along the Elora-Cataract Trail for a total length of 5.2 km, the second route is aligned east along Wellington Road 22 and diverts south along 8th Line towards Erin Village for a total length of 6.9 km, the final route option is aligned south on Trafalgar Road and diverts east along Sideroad 17 towards Erin Village for a total length of approximately 7.0 km.

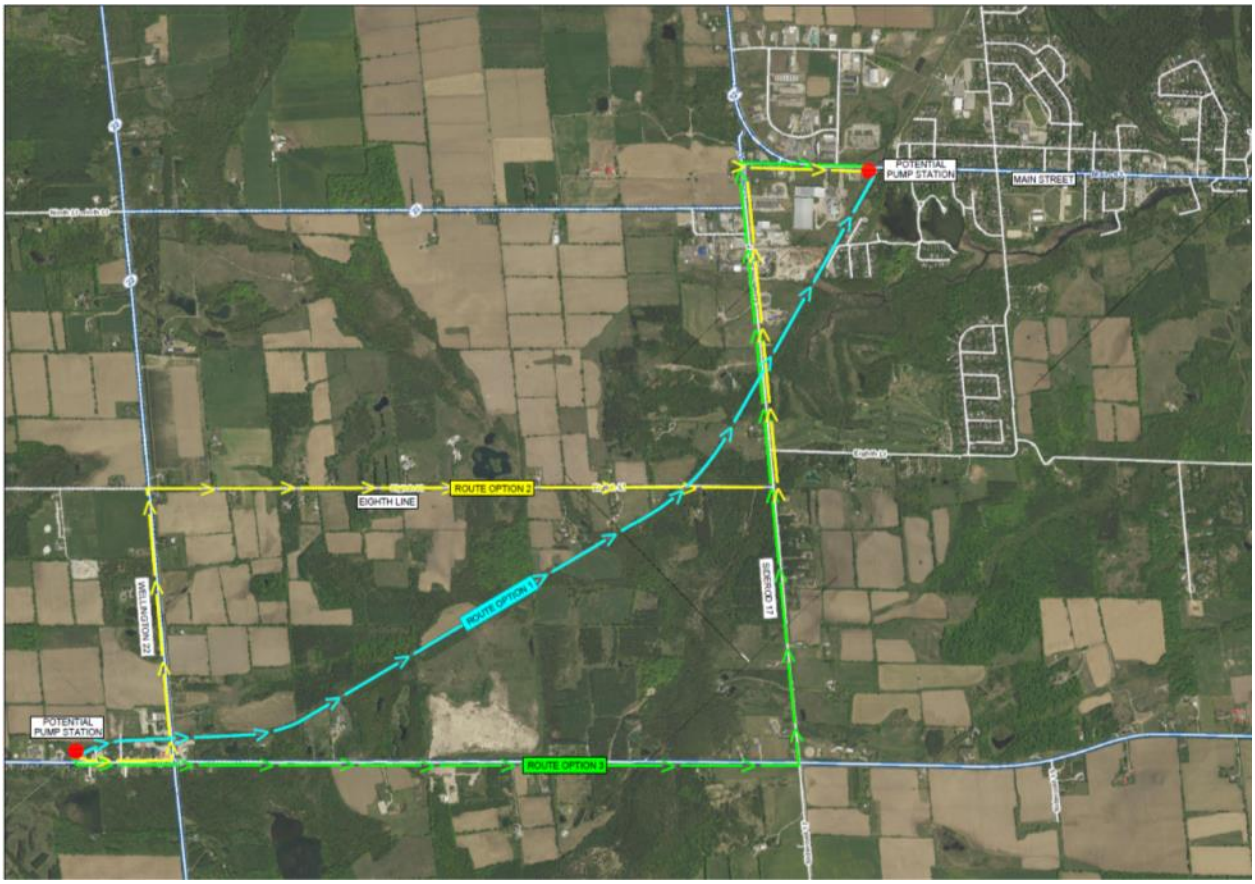


Figure 27 – Hillsburgh to Erin Connection Forcemain Routes

4.1. Forcemain Design Considerations

Based on the review of growth areas and the findings of the updated ACS, there is considerable growth potential for Hillsburgh. In total, the anticipated flow rates for the community could quadruple from the current day to when the community is fully developed. The flow rates are outlined in Table 1.

Table 1 – Hillsburgh Expected Flow Rates, Existing to Build-Out

	Existing Development	Full Build-Out Development
Average Day Flow (m^3/d)	599.4	2,405.1
Peak Day Flow (m^3/d)	2457.5	7,623.9
Peak Day Flow (L/s)	28.5	88.3

The selection of forcemain size and pump sizing will have a significant impact on the capital cost of the system and on the ongoing operational costs. Forcemains are sized to maintain a minimum flow velocity of 0.8 m/s to facilitate scouring inside the pipe and prevent the accumulation of solids. MOECC Guidelines specify a maximum flow velocity of 3.0 m/s however there is an exponential relationship between flow velocity and pumping head (energy) required; maintaining a maximum velocity below 2.0 m/s, an average velocity of 1.2 m/s and minimum velocity of 0.8 m/s is preferred to minimize pumping

costs. The forcemain and pumps should therefore be sized to provide a velocity between 0.8 – 2.0 m/s at the build-out condition and at the existing condition.

For long forcemains of this nature, security and performance are important issues. It is typically recommended to install twin forcemains each designed for half capacity to ensure minimum residence time in the forcemains under most flow scenarios. Twin forcemains also support the need for routine maintenance and the need to keep the system operational while cleaning/repairing one of the forcemains. Twin forcemains would be constructed within the existing right of way likely at the same time during Phase 1.

If a single forcemain is installed between the Erin and Hillsburgh systems, security could be maintained by establishing sufficient off-line storage for an average day at full built-out. A tank with the capacity for a single average day flow at build-out would provide sufficient time for an operations team to locate and repair a forcemain break and return the pumping station to normal operation. A 23m x 23m x 4.7m SWD off-line tank with the necessary valves, piping and transfer pumps would cost approximately $2,800,000. This is greater than the anticipated incremental cost of selecting dual forcemains over a single forcemain.

Based on the above, a twin 200mm forcemain is recommended to provide operational flexibility, particularly with respect to maintaining scouring velocities while development is ongoing. The ability to operate with just one of the two 200mm forcemains would reduce the amount of time wastewater remains in the forcemain and subsequently, reduce the time for septicity to develop. Also, a dual forcemain would provide additional system security; system operation could continue if a break were to occur without additional contingency measures such as off-line storage. Should the Town proceed with a dual forcemain design it is recommended that both forcemains be built concurrently to minimize construction costs.

To prevent leakage from joints it is recommended that the forcemains be constructed of welded polyethylene (PE) pipe. In addition, sufficient pressure control should be provided to prevent transient pressure conditions and to provide on line operational data to identify any operational issues.

4.2. Route Evaluation

4.1.1. Alternative 1 - Elora Cataract Trail

The trail is owned by Credit Valley Conservation (CVC). CVC are open to providing an easement to the Town for this infrastructure construction, see **Appendix C**. The Elora-Cataract Trail is an approximately 9 m wide former railway corridor that has been repurposed as a hiking trail. The former railway bed is approximalty 3.5 m wide and is situated in the centre of the cleared area. The hiking trail consists of approximately 3.0 m wide path, topped with limestone chips. The route provides a gentle downhill slope from Hillsburgh to Erin Village at a total distance of 5.2 km. The 30 m drop means that the pumping station will require minimal energy to convey the wastewater to Erin Village. A geotechnical investigation of the trail identified a relatively consistent makeup of the trail bed from silty sands at the surface to a coarser sand and gravel mixture at depths greater than 3 m. A sample borehole log is provided in **Appendix D**.

Figure 28 – Typical road crossing with ECT

The Natural Sciences Report identified the presence of Western Chorus Frogs within the cattail mineral shallow marsh adjacent to the trail between Side Road 17 and Main Street in Erin Village. The Western Chorus Frog has been identified as a threatened species and therefore care should be taken to ensure that their habitat is maintained. In addition, the habitat surrounding the forcemain route is home to a wide range of bird species. Most notably, the Eastern Wood-peewee which is designated as a species of special concern, and the Golden-winged Warbler and Barn Swallow which are both listed as threatened species. Species at risk within the habitat surrounding the trail includes the Jefferson's Salamander, Eastern Ribbonsnake, Blanding's Turtle, Red Shouldered Hawk, Short-eared Owl, Wood Thrush, Canada Warbler, Hooded Warbler, Yellow-breasted Chat, Henslow's Sparrow, Grasshopper Sparrow, Gypsy Cuckoo Bumblebee, Rusty-patched Bumblebee, and Monarch Butterfly.

Figure 29 – Typical section of the ECT

While it is imperative to protect the habitat of the threatened species, the main anticipated impacts to the terrestrial environment and species would be associated with site preparation, and construction and would involve temporary habitat disruption while avoiding long-term habitat loss. The proposed route is located within an existing right of way and thus both infrastructure and associated impacts are not expected to extend into surrounding natural habitats. To ensure minimal impact to the surrounding habitat and water quality in the area surrounding the trail, construction activities must be maintained on the travelled trailway and confined to periods that minimize impact on all of the species at risk, particularly within the spring period from April-June. The increased presence of humans, as well as machine noise, dust and activity, may disturb amphibians and birds during the sensitive breeding period, potentially causing them to avoid or abandon breeding in a disturbed area during construction. It is therefore recommended that construction activites be strictly controlled to avoid impacts.

Construction of twin 200 mm forcemains along the trail can likely be accomplished in a single trench down the centre of the existing hiking trail. Open cut trenches can be used either using conventional trenches or using trenching machines. Interim air release chambers may be required at creek/culvert crossings and isolation valves would be spaced along the trail, however these would not interfere with the use of the trail after construction. Sections of the trail would be closed during construction for safety reasons given the narrow width of the hiking trail. While it does not appear that any trees would have to be removed, some overhanging branch trimming may be required. While there would be minimal traffic impact, material delivery trucks and excess spoil removal will generate truck traffic during construction. Due to the distance between public roads along the trail, it may be necessary to create truck turning/staging areas along the trail. These can be selected to prevent impacts to the natural environment and can be removed after construction or retained if beneficial to trail use.

4.1.2. Alternative 2 – Wellington Road 22

Approvals for an easement along this route would be required from Wellington County as well as the Town of Erin. The Wellington Road 22/ 8th Line route is a 2-lane ROW with above ground hydro and telephone lines run primarily along the south side of Wellington Road 22 and the west side of 8th Line. The hydro and telephone lines are set well back from the ROW along Wellington Road 22. While Wellington Road 22 is a paved 2-lane road, 8th Line is a narrow gravel sideroad, requiring a lane closure. As such, construction along this ROW will have an impact on local traffic.

This route has significant topographical variability, the intersection of Wellington Road 22 and 8th Line is 37 m higher than the intersection of Wellington Road 22 and Trafalgar Road. The elevation drops off steeply south of Wellington Road 22 along 8th Line and then rises again approximaltty 21.5 m. After this hill, elevations drop off consistently towards Sideroad 17. As with Alternative 3, Sideroad 17 is primarily sloped downwards towards Erin Village with the exception of a 7.5 m elevation change as Sideroad 17 approaches Main Street in Erin Village. A minimum of 4 air release chambers will be required along this route to prevent vacuum/airlock in the forcemain. There is one river crossing along this route on 8th Line at the intersection with Sideroad 17. Required pumping energy would be substantially higher than with Alternative 1.

The Natural Sciences Report did not identify the presence of any species of concern along this potential route.

As with Route 3, this alternative will involve the construction of twin forcemains in a common trench within the road allowance, likely as close to the property line as possible consistant with constructibility. Materials handling would likely necessitate a single lane closure over the length of construction.

4.1.3. Alternative 3 - Trafalgar Road

The Trafalgar Road/ Sideroad 17 route is a 2-lane ROW with above ground hydro and telephone lines running primarily along the west side of Trafalgar Road and the south side of Sideroad 17. The hydro and telephone lines are on the East side of Trafalgar Road for an 800 m span north of Sideroad 17. Trafalgar Road is a heavily traveled roadway and construction along this corridor would likely have significant traffic impacts. Trafalgar Road is a County road; Approvals for this alternative would be required from both the County and the Town of Erin.

This route has significant topographical variability between the pumping station location, and Sideroad 17 along Trafalgar Road. There are two significant hills with changes in elevation of 21 m and 28 m. The larger hill crests near the intersection of Trafalgar Road and Sideroad 17. Sideroad 17 is primarily sloped downwards towards Erin Village with the exception of a 7.5 m elevation change as Sideroad 17 approaches Main Street in Erin Village. A minimum of 5 air release chambers will be required along this route to prevent vacuum/airlock in the forcemain. There are two stream crossings along this route, one is located on Trafalgar Road approximately 660m north of Sideroad 17 and the other is located on Sideroad 17 at the intersection with 8th Line. Required pumping energy would be substantially higher than with Alternative 1.

The Natural Sciences Report identified the presence of Western Chorus Frogs within the lowland creek crossing on Trafalgar Road. The Western Chorus Frog has been identified as a threatened species and therefore care should be taken to ensure that their habitat is maintained. In contrast to the Elora-Cataract Trail route, there were no additional species of risk identified along this route.

4.1.4. Comparison of Alternatives

The advantages and disadvantages of each route option are presented in Table 2.

Table 2 – Advantages and Disadvantages of Forcemain Routes from Hillsburgh to Erin Village

Route	Advantages	Disadvantages
Elora-Cataract Trail (Route Option 1)	▪ CVC willing to entertain easement for mains ▪ Continuous downhill slope ▪ Reduced pumping distance ▪ Substantially lower energy requirements ▪ Lower capital cost	▪ More environmentally sensitive areas adjacent to the route requiring mitigation ▪ Trail would likely need to be closed during construction ▪ Multiple species of concern identified in the area surrounding the trail. ▪ 1 culvert crossing required
Wellington Road 22 (Route Option 2)	▪ Along an existing ROW ▪ Minimal environmental impact for construction	▪ Will require approval from Wellington County ▪ Increased pumping distance ▪ Significant topographical variability ▪ Higher capital cost ▪ Increased long term energy costs ▪ 1 river crossing required
Trafalgar Road (Route Option 3)	▪ Along an existing ROW ▪ Lower environmental impact for construction	▪ Will require approval from Wellington County on Trafalgar Road ▪ Increased pumping distance ▪ Significant topographical variability ▪ Higher capital cost ▪ Increased long term energy costs ▪ Western Chorus Frogs identified along the route. ▪ 2 river crossings required

A capital cost comparison of the potential forcemain routes is provided in Table 3, each assumes a twin 200 mm forcemain.

Table 3 – Capital Cost of Forcemain Alternatives

Alternative	Capital Cost Estimate
Alternative 1 – Elora-Cataract Trail	$ 3,165,000
Alternative 2 – Wellington Road 22	$ 4,440,000
Alternative 3 – Trafalgar Road	$ 4,830,000

5.0 Evaluation Methodology

The evaluation methodology used to select the preferred forcemain alignment option was established in a manner consistent with the principles of environmental assessment planning and decision-making as outlined in Municipal Class Environmental Assessment.

A decision model consistent with the principles of environmental assessment planning and decision making as outlined in Municipal Class Environmental Assessment manual was developed to select the preferred forcemain route.

In developing the decision model, relevant and specific evaluation criteria were identified and compared distinguishing features between the routes. Whereas other components of the UCWS Class EA place a higher emphasis on Technical Criteria, for the forcemain route evaluation, all of the main categories including Environmental, Social/Heritage, Technical and Economic Criteria all play an important role.

Based on the above, the three (3) Alternative Routes will be evaluated against the specific evaluation criteria described in Table 4.

Table 4 – Forcemain Route Alternatives Evaluation Criteria

Primary Criteria	Weight	Secondary Criteria	Weight
Social/Culture	10%	Impacts During Construction	50%
		Traffic Disruption	20%
		Effect on Residential Properties	10%
		Effect on Commercial Properties	10%
		Effect on Industrial Properties	10%
Technical	30%	Operational Performance	20%
		Energy Requirements	30%
		Suitability for Phasing	10%
		Constructability	20%
		Operation and Maintenance Impacts	20%
Environmental	30%	Effect on Surface Water/ Fisheries	30%
		Effect on Vegetation/ Wetlands	30%
		Effect on Groundwater	10%
		Effect on Habitat/ Wildlife	30%
Economic	30%	Capital Cost	70%
		Operational Costs	30%

4.3. Screening Criteria Definitions

4.1.5. Social/Culture, Impacts During Construction

This criterion captures the level of disturbance to the community the proposed solution will have during the construction period. These effects include noise levels, vibration, odours, dust production, as well as the amount of time for which these disturbances will persist.

4.1.6. Social/Culture, Traffic Disruption

This criterion captures the level of impact to traffic flow during the construction process and after construction is complete.

4.1.7. Social/Culture, Effect on Residential Properties

This criterion captures the level of impact that the forcemain route has on individual residential properties. Impacts considered include operation and maintenance activities.

4.1.8. Social/Culture, Effect on Commercial Properties

This criterion captures the level of impact that the forcemain route has on individual commercial properties. Impacts considered include operation and maintenance activities.

4.1.9. Social/Culture, Effect on Industrial Properties

This criterion captures the level of impact that the forcemain route has on individual industrial properties. Impacts considered include operation and maintenance activities.

4.1.10. Technical, Operational Performance

This criteria compares the methods of conveying the wastewater from Hillsburgh to Erin Village and the probability of a forcemain break or blockage.

4.1.11. Technical, Energy Requirements

This criterion captures the total energy required to construct and operate the alternative.

4.1.12. Technical, Suitability for Phasing

This criterion captures the ability to be expanded under a phased development plan. Forcemain designs that allow flexibility in development to promote ease of expansion would have a higher score.

4.1.13. Technical, Constructability

This criterion captures the constructability of each alternative. This would include geotechnical aspects and hydrogeological aspects affecting the design of the forcemain.

4.1.14. Technical, Operational and Maintenance Impacts

This criterion captures the impacts of each site on the operability of the overall system. This would take into consideration, access to the forcemain route and level of effort required by operations staff to operate and maintain the forcemain.

4.1.15. Environmental, Effect on Surface Water/ Fisheries

The criterion captures the impact that the establishment and operation of the forcemain alternative has on the local surface waters both during construction and over the long term and in terms of impacts to water quality and fisheries. Minimizing contamination of the local surface water is rated favourably.

4.1.16. Environmental, Effect on Vegetation/ Wetlands

The criterion captures the impact that the establishment and operation of the system alternative has on the local vegetation and wetlands both during construction and over the long term. Minimizing negative impacts on the local vegetation and wetlands is rated favourably.

4.1.17. Environmental, Effect on Groundwater

The criterion captures the level of groundwater contamination associated with the establishment and operation. Minimizing contamination of the local groundwater is rated favourably.

4.1.18. Environmental, Effect on Habitat/ Wildlife

The criterion captures the impact that the establishment and operation of the system alternative has on the local habitat and wildlife both during construction and over the long term. Minimizing contamination of the local habitat and wildlife is rated favourably.

4.1.19. Economic, Capital Cost

The criterion captures the estimated cost to construct the alternative.

4.1.20. Economic, Operational Cost

The criterion captures the estimated cost to operate the system on a yearly basis.

4.4. Evaluation of Alternatives

4.2.1. Overview

As discussed in Section 3.0 above, the following three (3) forcemain route alternatives were developed:

- Alternative 1 – Along the Elora-Cataract Trail
- Alternative 2 – Along Wellington Road 22/ 8th Line
- Alternative 3 – Along Trafalgar Road/ Side Road 17

A description and layout of these options can be found in Section 3.0.

4.5. Detailed Evaluation of Forcemain Route Alternatives

The evaluation of each of the forcemain alternatives, using the criteria and weightings listed in Table 4 is provided in Table 5.

Using the weighted percentages assigned to each category and criteria, each criteria is then scored from 1 to 5 with one having the most negative effect and 5 the least negative impact. The highest score therefore represents the preferred alternative.

Table 5 – Forcemain Route Decision Matrix

PRIMARY CRITERIA		SECONDARY CRITERIA		ABSOLUTE WEIGHT (WT)	ECT		Trafalgar Road		Wellington Road 22	
CRITERIA	WEIGHT	CRITERIA	WEIGHT		SCORE	WT SCORE	SCORE	WT SCORE	SCORE	WT SCORE
Social/Culture	10%	Impacts During Construction	50	5	2	2	4	4	5	5
		Traffic Disruption/ Truck Traffic	20	2	4	1.6	3	1.2	3	1.2
		Effect on Residential Properties	10	1	5	1	4	0.8	4	0.8
		Effect on Businesses/ Commercial Properties	10	1	5	1	4	0.8	4	0.8
		Effect on Industrial Properties	10	1	5	1	4	0.8	4	0.8
Technical	30%	Operational Performance	20	6	5	6	3	3.6	3	3.6
		Energy Requirements	30	9	5	9	2	3.6	2	3.6
		Suitability for Phasing	10	3	5	3	5	3	5	3
		Constructibility	20	6	2	2.4	4	4.8	4.5	5.4
		Operation and Maintenance Impacts	20	6	3.5	4.2	3	3.6	3	3.6
Environmental	30%	Effect on Surface Water/ Fisheries	30	9	3	5.4	4	7.2	4	7.2
		Effect on Vegetation/ Wetlands	30	9	3	5.4	5	9	5	9
		Effect on Groundwater	10	3	4	2.4	4	2.4	5	3
		Effect on Habitat/ Wildlife	30	9	2	3.6	4	7.2	5	9
Economic	30%	Capital Cost	70	21	5	21	3	12.6	3.5	14.7
		Operational Costs	30	9	5	9	3	5.4	3	5.4
			TOTAL SCORE	**100**		**78**		**70**		**76.1**

Based on the detailed evaluation of the alternatives, Alternative1 returns the highest score and therefore offers the most benefit. The details of the scoring rationale are provided in Table 6.

Table 6 – Criteria Rating Rationale

Criteria	1 - Elora Cataract Trail	2 - Wellington Road 22	3 - Trafalgar Road
Social/ Culture - Impacts During Construction	▪ Potential impact to the homes along Laurel Lane and Heather Avenue that are in close proximity to the trail. Sections of trail closed off during construction.	▪ Forcemain open cut construction along Wellington Road 22 and 8th Line. Potential impact on over 20 homes and several businesses.	▪ Forcemain open cut construction along Trafalgar Road and Sideroad 17. Potential impact on over 20 homes and several businesses.
Social/ Culture - Traffic Disruption	▪ Minimal traffic impact with the exception of locations where the trail intersects local roads.	▪ Single lane closures anticipated over construction area. Traffic impacts anticipated along the route.	▪ Single lane closures anticipated over construction area. Traffic impacts anticipated along the route including busy County Road.
Social/ Culture - Effect on Residential Properties	▪ Minimal long term impact on local properties	▪ Minimal long term impact on local properties	▪ Minimal long term impact on local properties
Social/ Culture - Effect on Businesses/ Commercial Properties	▪ Minimal long term impact on local businesses.	▪ Minimal long term impact on local businesses	▪ Minimal long term impact on local businesses
Social/ Culture - Effect on Industrial Properties	▪ Minimal long term impact on local businesses.	▪ Minimal long term impact on local businesses.	▪ Minimal long term impact on local businesses.
Technical – Operational Performance	▪ Use of twin forcemain to improve performance security . ▪ Consistent downhill slope ideal for avoiding air locks, minimizing the need for vacuum/air release chambers along the route.	▪ Use of twin forcemain to improve performance security. ▪ Route has several rolling hills that will require vacuum/air release chambers, complicating operations	▪ Use of twin forcemain to improve performance security.. ▪ Route has several rolling hills that will require vacuum/air release chambers and complicating operations.
Technical – Energy Requirements	▪ Minimal energy use due to the downhill slope of the trail and the shorter pumping distance	▪ Higher energy use due to the hilly terrain along the route and the longer pumping distance.	▪ Higher energy use due to the hilly terrain along the route and the longer pumping distance.
Technical - Suitability for Phasing	▪ Twin forcemain design supports proper operation and adequate forcemain velocities throughout the growth process.	▪ Twin forcemain design supports proper operation and adequate forcemain velocities throughout the growth process.	▪ Twin forcemain design supports proper operation and adequate forcemain velocities throughout the growth process.
Technical - Constructability	▪ Fairly easy to construct but with timing and space restrictions to minimize impacts on environmental features.	▪ Fairly easy to construct with one river crossing.	▪ Trafalgar Road presents more difficult construction and this alternative includes two river crossings.
Technical - Operation and Maintenance Impacts	▪ Best hydraulic performance ▪ Minimal access for maintenance needed along route (no valve chambers to inspect)	▪ Could present hydraulic operational issues with multiple air valves ▪ Easy access for maintenance	▪ Could present hydraulic operational issues with multiple air valves ▪ Easy access for maintenance
Environmental - Effect on Surface Water/ Fisheries	▪ Natural environment habitat adjacent to trail, sensitive to construction activities. ▪ Western chorus frogs identified along the route. ▪ Timing of construction needs to be carefully planned to minimize impacts.	▪ No major impacts anticipated	▪ Western chorus frogs identified along the route. ▪ Impact can be mitigated with construction timing and proper construction practices.
Environmental - Effect on Vegetation/ Wetlands	▪ May require tree branch trimming which will need to be scheduled to avoid bird breeding season ▪ Wetlands adjacent trail should not be affected. Existing culverts will be tunneled to mitigate potential impact on wetlands.	▪ No major impacts anticipated	▪ No major impacts anticipated
Environmental - Effect on Groundwater	▪ Little impact anticipated	▪ No major impacts anticipated	▪ No major impacts anticipated
Environmental - Effect on Habitat/ Wildlife	▪ Several sensitive bird species identified aloing trail. ▪ Impact can be mitigated with construction timing and proper construction practices.	▪ No major impacts anticipated	▪ No major impacts anticipated
Economic - Capital Cost	▪ Least cost	▪ Approximately 40% more costly than Alternative 1.	▪ Approximately 50% more costly than Alternative 1.
Economic – Operational Cost	▪ Lowest operational cost	▪ Sustantially higher operational costs	▪ Sustantially higher operational costs

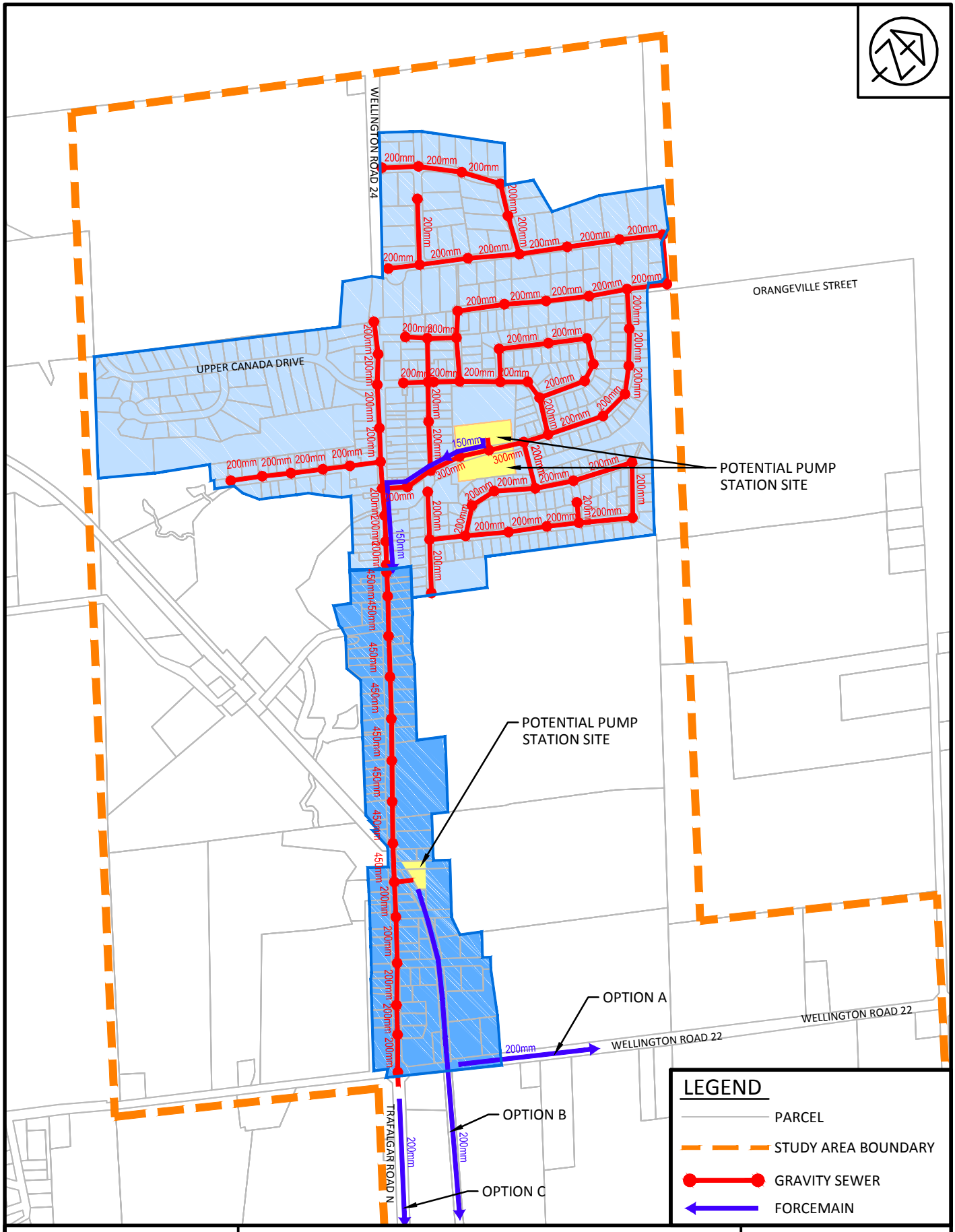
6.0 Conclusions and Recommendations

- The 2014 Servicing and Settlement Master Plan (SSMP) identified that the wastewater from both Erin Village and Hillsburgh would be collected at a single site for treatment and discharge to the West Credit River.
- The UCWS EA is a continuation of the Class EA process and aims to establish the preferred design alternative for the wastewater system servicing of Erin Village and Hillsburgh.
- The Collection System Alternatives Technical Memorandum identified a blended Gravity and Low Pressure Sewer solution as the preferred collection system. This Pumping Stations and Forcemains Technical Memorandum should be read in conjunction with the Collection System Alternatives Technical Memorandum.
- A series of catchment areas were identified throughout both Erin Village and Hillsburgh on the basis of the existing topography. A suggested trunk sewer system was identified to interconnect catchment areas and to convey all sewage to the areas identified for the WWTP. Based on this, some ten (10) catchments were identified as requiring pumping stations.
- A review of the low lying areas where sewage pumping station would be necessary was conducted and actual candidate sites were identified.
- All candidate sites for sewage pumping stations were evaluated for environmental and archaeological significance and geotechnical evaluations were conducted at each site.
- Conceptual design of each station was conducted and this confirmed the need for four (4) large stations with standby power, four (4) smaller stations and two small catchments that would be serviced by a low pressure sewer system.
- A geotechnical evaluation was also conducted for key collection system routes, including forcemain routes to determine potential impacts on constructability.
- The connection of the Hillsburgh collection area to Erin Village is a key aspect of the proposed system and three potential routes for this connection were evaluated:
    - Alternative 1 – Along the Elora-Cataract Trail
    - Alternative 2 – Along Wellington 22 and 8th Line
    - Alternative 3 – Along Trafalgar Road and Sideroad 17
- The Forcemain Alternatives were sized, conceptually designed and costed.
- The evaluation criteria were established with the following weighting for the primary criteria reflecting a balanced approach between Technical, Environmental and Cost:
    - Social/ Cultural Impacts – 10%
    - Technical Impacts – 30%
    - Environmental Impacts - 30%
    - Economic Impacts– 30%
- The relative capital costs for each alternative are summarized as follows:

Alternative	Capital Cost Estimate
Alternative 1 – Elora-Cataract Trail	$ 3,165,000
Alternative 2 – Wellington Road 22	$ 4,440,000
Alternative 3 – Trafalgar Road	$ 4,830,000

- In addition to the costs outlined above, Alternative 2 and Alternative 3 will require larger pumps to pump the wastewater for a longer distance and up to higher elevations resulting in higher long term operating costs.
- Environmental impacts:
    - Western Chorus Frogs were identified in the wooded area beside the Elora-Cataract Trail and along Trafalgar Road. This species of frog was not found along Wellington Road 22.
- Geotechnical impacts are summarized as follows:
    - Generally indicates that the entire area does not present constructibility issues for forcemains.
- Archaeological impacts are not expected to be significant for any of the forcemain alternatives.
    - Since all of the works will take place in established road allowances, or within previously disturbed lands, it is not anticipated that archaeological resources will be encountered.
- Phase 2 archaeological investigations are required for some of the sewage pumping station locaitons.
- The results of the evaluation process indicate that, ***Alternative 1 (Elora-Cataract Trail)*** has the highest score and is the preferred forcemain route alternative.
- The primary reasons for this are:
    - Best technical solution
    - Lowest capital cost for construction
    - Lowest operational costs
    - Potential for mitigation of the environmental concerns for construction.
- In examining the sensitivity of the scoring to changes in the criteria weightings, it should be noted that a 3% decrease in the Economic weighting and corresponding 3% increase in the Environmental weighting would result in Alternative 2 being the preferred alternative. Likewise a 4% decrease in the Technical weighting and 4% increase in Environmental weighting results in Alternative 2 being the preferred alternative. The decision is sensitive to the weightings but is considered valid because of the potential for mitigation of the environmental concerns for construction along the trail. The forcemain will be constructed down the centre of the trail and construction timing can be coordinated to avoid negative impacts of the Western Chorus Frogs and birds.

Appendix A
Gravity Collection System



Ainley CONSULTING ENGINEERS PLANNERS

TOWN OF ERIN

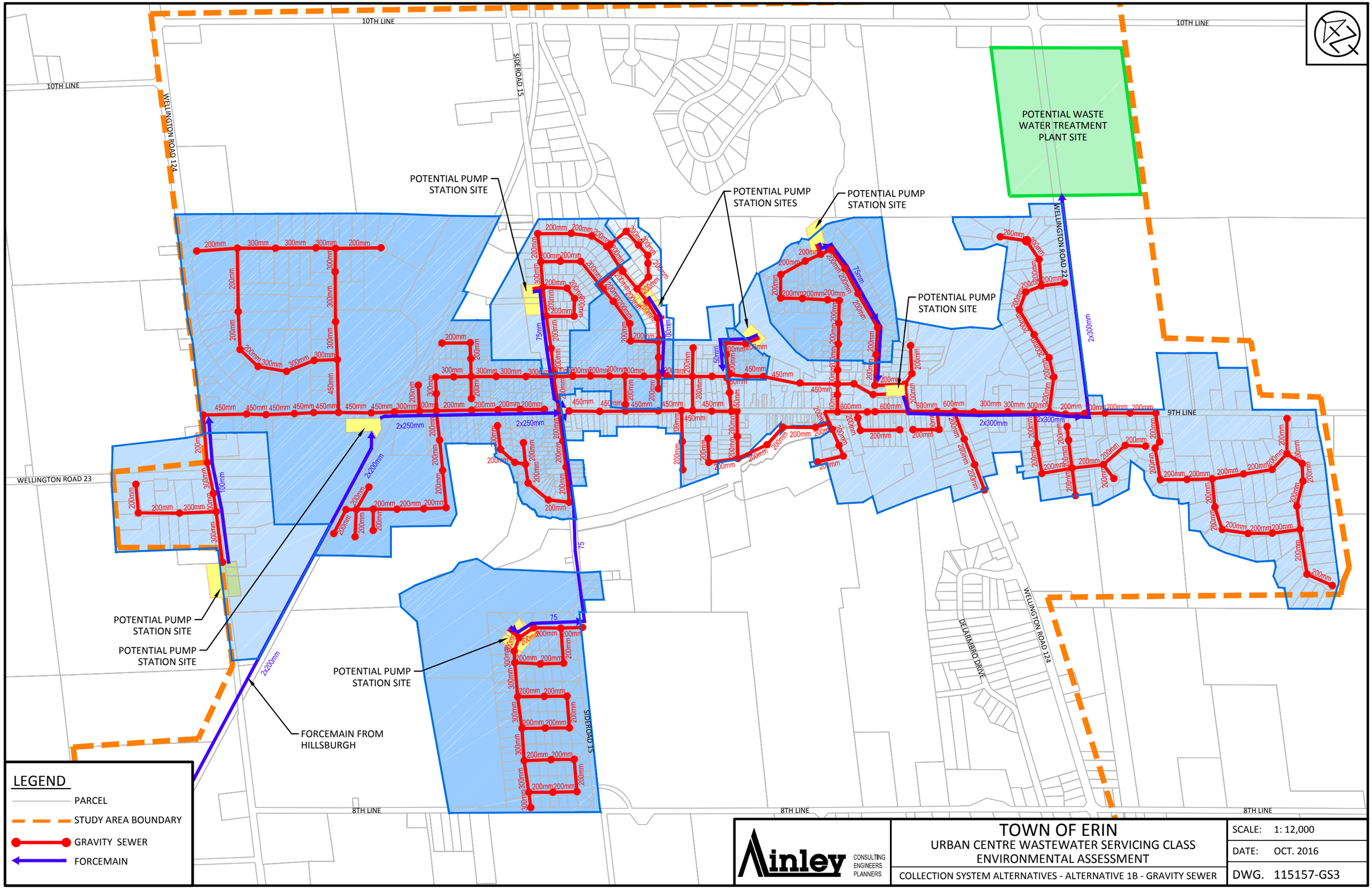
URBAN CENTRE WASTEWATER SERVICING CLASS ENVIRONMENTAL ASSESSMENT

COLLECTION SYSTEM ALTERNATIVES - ALTERNATIVE 1 - GRAVITY

SCALE: 1: 12,500

DATE: MARCH 2017

DWG. 115157-GS1



Ainley CONSULTING ENGINEERS PLANNERS

TOWN OF ERIN

URBAN CENTRE WASTEWATER SERVICING CLASS ENVIRONMENTAL ASSESSMENT

COLLECTION SYSTEM ALTERNATIVES - ALTERNATIVE 1B - GRAVITY SEWER

SCALE: 1: 12,000

DATE: OCT. 2016

DWG. 115157-GS3

Appendix B
River Crossing Application

CVC
CREDIT VALLEY CONSERVATION

1255 Old Derry Road, Mississauga, ON L5N 6R4
Tel: (905) 670-1615 or 1-800-668-5557, Fax: (905) 670-2210
www.creditvalleyca.ca, e-mail: planning@creditvalleyca.ca

For office use only:
File # _____
Fee Received _____

APPLICATION FOR DEVELOPMENT, INTERFERENCE WITH WETLANDS AND ALTERATIONS TO SHORELINES AND WATERCOURSES (Pursuant to Ontario Regulation 160/06)

PLEASE SEE REVERSE SIDE FOR INSTRUCTIONS FOR SUBMITTING PLANS

Ownership Details

Owner's Name _____ Email _____

Organization _____ City/Town _____

Mailing Address _____ Postal Code _____ Phone # _____

Agent's Name _____ Email _____

Organization _____ City/Town _____

Mailing Address _____ Postal Code _____ Phone # _____

Property Location Details

Municipal Street Address _____

Lot _____ Concession/Range _____ City/Town _____

Description of Type of Development / Work Proposed

☐ Development (new structure, replacement structure, addition, site grading/fill placement, pool, deck)
☐ Interference with a Wetland/Alteration of Watercourse

Proposed Start Date: _____ Anticipated Completion Date: _____

Terms and Conditions

1. Any false or misleading statement made on this application will render null and void any permission granted.
2. Authorized representatives of Credit Valley Conservation will be granted entry at any time onto lands which are the subject of this permit application in order to make such surveys, investigations, inspections or other arrangements which such representatives deem necessary.
3. This permit does not absolve the applicant of the responsibility of obtaining necessary permission from applicable federal and provincial agencies or local municipalities.

I, _____ solemnly declare that to the best of my knowledge and belief, all of the above information to be true.

Signature of Owner: _____ Date: _____
Note: Signature or written authorization from the owner is mandatory.

Signature of Agent: _____ Date: _____

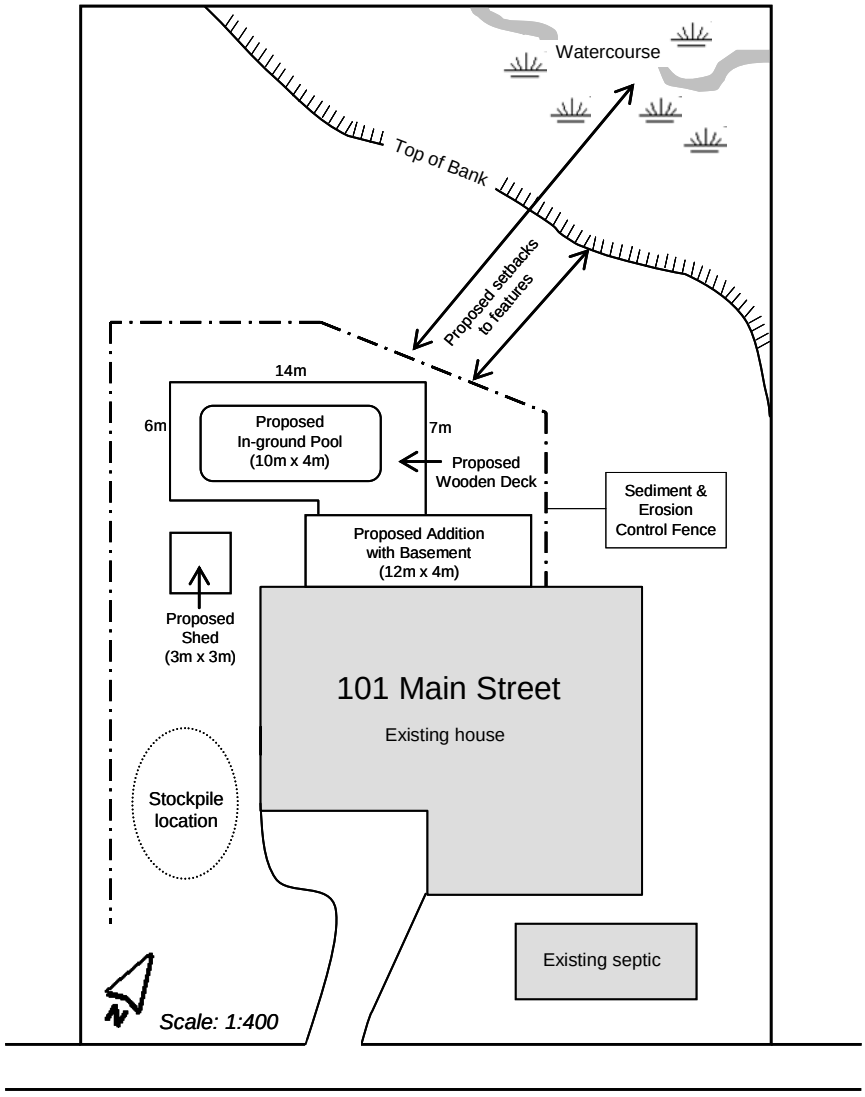
INSTRUCTIONS

Please submit three (3) copies of the following information with this application:

1. Location map of property, in relation to surrounding buildings, roads, lands etc.
2. Site plan indicating the property boundary and the proposed location of development/work.
3. Cross-section(s) of the proposed development/work showing existing and final grades as required.
4. Final stamped engineering drawings of proposed development/work as required.
5. Final stamped technical reports in support of proposal as required.
6. **An application fee will be charged based upon type and scale of project (see most recent fee schedule www.creditvalleyca.ca or contact CVC office at 905-670-1615).**

ALL PLANS SUBMITTED MUST BE FOLDED

Sample Site Plan



NOTICE OF COLLECTION

Pursuant to section 29(2) of the Municipal Freedom of Information and Protection of Individual Privacy Act, 1989, the personal information contained on this form is collected under the legal authority of the Conservation Authorities Act, R.S.O. 1990, c27, as amended. This information is used to assess applications for and, where approved, issue the Permit. Information on this form may be disclosed to Government and Municipal Agencies for review and comment and to members of the public through the Freedom of Information process. The name of the applicant, location of the work and a description of the project may be published in CVC documents including agendas, reports and meeting minutes which may be posted on CVC's website. Questions about the collection of personal information should be directed to the Freedom of Information Coordinator, Credit Valley Conservation Authority, 1255 Old Derry Road, Mississauga, Ontario, L5N 6R4, (905) 670-1615.

Appendix C
CVC Letter

Credit Valley Conservation
inspired by nature

October 30, 2017

Town of Erin
5684 Trafalgar Rd,
Hillsburgh, Ontario N0B1Z0

Via Email

Attn: Nathan Hyde, CAO
Town of Erin

Ref: Town of Erin, Urban Centre Wastewater and Water Servicing Class EA's Proposed Use of the Elora Cataract Trail for Underground Wastewater and Water Pipe Infrastructure

Dear Nathan,

Further to your letter addressed to Jen Dougherty, I understand that a Municipal Class Environmental Assessment is underway. Moreover, the added option of the Elora Cataract Trailway (ECT) as a potential alternative alignment for a wastewater sewer/forcemain connecting Hillsburgh and Erin Village is being included, and with CVC support. To date, CVC staff have issued an Access Permit for CVC Conservation Lands to enter for reconnaissance and study of this route.

It is my understanding that CVC staff are waiting for the EA report to review and provide comment. Once the preferred option is selected, and if that alternative includes using the ECT, then CVC staff will be happy to discuss with the Town of Erin the conditions related to granting a permanent easement.

Regards,

Jeff Payne
Director, Corporate Services
Credit Valley Conservation

Appendix D
Elora Cataract Trail Borehole Logs

LOG OF BOREHOLE BHT1

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-07

REF. NO.: 16-1255

ENCL. NO.:

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**TOPSOIL:** (90 mm)			
0.1	**FILL:** sandy silt, trace to some clay, trace gravel, trace organics, layers of clayey silt, brown, moist, very loose to compact	1	SS	10
		2	SS	4
1.4	**FILL:** sand and silt to silty sand, trace clay, trace gravel, pockets of clayey silt, brown, moist, very loose to compact	3	SS	5
		4	SS	3
		5A	SS	
3.2	**GRAVELLY SAND TO SAND AND GRAVEL:** trace clay, trace silt, containing cobbles and boulders, brown, moist to wet, compact to dense	5B	SS	26
	--- wet	6	SS	46
5.0	**END OF THE BOREHOLE**			

Notes:
1) Water encountered at a depth of 4.6 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 3.5 mBGS upon completion of drilling.
3) Borehole caved at a depth of 3.5 mBGS upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane; 20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%): 10 20 30 40

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ▲ ε=3% Strain at Failure

LOG OF BOREHOLE BHT2

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 205 mm

DATE: 2017-11-17

REF. NO.: 16-1255

ENCL. NO.:

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
0.0	**TOPSOIL:** (170 mm)				
0.2	**FILL:** silty sand, some gravel, trace to some clay, containing rock fragments, containing cobbles and boulders, brown, moist, loose to compact	1	SS	11	
		2	SS	9	
1.4	**GRAVELLY SAND TO SAND AND GRAVEL:** some silt, trace clay, containing rock fragments, containing cobbles and boulders, brown, moist to wet, compact to dense --- wet	3	SS	24	
		4	SS	27	
		5	SS	34	
		6	SS	31	
5.0	**END OF BOREHOLE** Notes: 1) Water encountered at a depth of 2.3 m below ground surface (mBGS) during drilling. 2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.				

Concrete

Bentonite

Sand

Screen

Natural Pack

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane; 20 40 60 80

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)

WATER CONTENT (%): 10 20 30 40

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ▲ ε=3% Strain at Failure

LOG OF BOREHOLE BHT4

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-16

REF. NO.: 16-1255

ENCL. NO.:

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
0.0	**TOPSOIL:** (65 mm)			
0.1	**FILL:** silty sand, trace gravel, brown, moist, loose	1A	SS	7
0.3	**FILL:** gravelly sand, some silt, trace organics, containing cobbles and boulders, dark brown, moist, loose	1B	SS	
0.7	**GRAVELLY SAND TO SAND AND GRAVEL:** trace silt, layers/zones of sand, containing rock fragments, containing cobbles and boulders, brown, moist to wet, compact to very dense	2	SS	39
		3	SS	27
		4	SS	27
		5	SS	24
		6	SS	59
5.0	**END OF BOREHOLE**			

Notes:
1) Water encountered at a depth of 2.3 m below ground surface (mBGS) during drilling.
2) Borehole caved at a depth of 1.4 mBGS upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane; 20 40 60 80

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)

WATER CONTENT (%): 10 20 30 40

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +³, ×³: Numbers refer to Sensitivity; ▲ ε=3% Strain at Failure

LOG OF BOREHOLE BHT5

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 205 mm

DATE: 2017-11-16

REF. NO.: 16-1255

ENCL. NO.:

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER	ELEVATION
0.0	**TOPSOIL:** (70 mm)					
0.1	**FILL:** silty sand, some gravel, trace clay, brown, moist, loose	1	SS	8		Concrete
0.7	**FILL:** sandy silt, trace to some clay, trace gravel, trace organics, trace rootlets, pockets of clayey silt, dark brown to brown, moist, very loose to loose	2	SS	3		Bentonite
	--- brown	3	SS	7		
2.1	**FINE SAND AND SILT TO FINE SANDY SILT:** layers of silt, brown, wet, compact	4	SS	16		
		5	SS	19		Sand
						Screen
4.0	**GRAVELLY SAND:** some silt, trace clay, containing cobbles and boulders, brown, wet, dense	6	SS	31		Natural Pack
5.0	**END OF BOREHOLE**					

Notes:
1)Water encountered at a depth of 2.3 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

DYNAMIC PENETRATION TEST
○ SPT ⇝ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
▲ ε=3% Strain at Failure

LOG OF BOREHOLE BHT6

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-07

REF. NO.: 16-1255

ENCL. NO.:

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER	ELEVATION	DYNAMIC PENETRATION TEST (O SPT, ≈ Cone, blows/0.3m; 20 40 60 80) / SHEAR STRENGTH (kPa) (● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20 40 60 80)	Plastic Limit w_P / Natural Moisture Content w / Liquid Limit w_L — WATER CONTENT (%) (10 20 30 40)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** (75 mm)										
0.1	**FILL:** silty sand, trace to some gravel, trace clay, grey to brown, moist, loose		1	SS	6			O			
	--- brown										
0.7	**FILL:** sandy silt, trace clay, trace gravel, brown, moist, loose		2	SS	7			O			
1.4	**FILL:** silty sand, trace to some gravel, trace clay, brown, moist, loose		3	SS	9			O			
2.1	**FILL:** sandy silt, trace to some clay, trace to some gravel, some organics, dark brown, moist to wet, very loose to loose		4	SS	2			O			
	--- wet		5A	SS	7			O			
3.4	**ORGANIC SILT:** trace to clay, trace rootlets, black, moist, loose		5B	SS							
4.0	**SAND:** trace silt, brown, wet, compact		6A	SS							
4.7	**GRAVELLY SAND:** trace clay, trace silt, containing cobbles and boulders, brown, wet, compact		6B	SS	27			O			
5.0	**END OF BOREHOLE**										

Notes:
1) Water encountered at a depth of 2.3 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 2.7 mBGS upon completion of drilling.
3) Borehole caved at a depth of 3.4 mBGS upon completion of drilling.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ▲ ε=3% Strain at Failure

LOG OF BOREHOLE BHT7

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-08

REF. NO.: 16-1255

ENCL. NO.:

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER ELEVATION	DYNAMIC PENETRATION TEST / SHEAR STRENGTH (kPa)	WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL:** (150 mm)									
0.2	**FILL:** silty sand, trace to some gravel, trace clay, brown, moist, loose to dense		1	SS	9					
1			2A	SS	46					
1.1	**FILL:** sandy silt, trace to some gravel, trace clay, trace organics, trace rootlets, brown, moist, very loose to dense		2B	SS						
1.7	**PEAT:** black, moist, very loose to compact		3A	SS	3					
2			3B	SS						
2.4	**SAND:** trace silt, trace gravel, brown, wet, loose to compact		4A	SS	13					
3			4B	SS						
4.0	**GRAVELLY SAND:** some clay, some silt, layers of clayey silt, grey, wet, dense		5	SS	10					
4										
5			6	SS	34					
5.0	**END OF BOREHOLE**									

Notes:
1) Water encountered at a depth of 0.8 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 1.2 mBGS upon completion of drilling.
3) Borehole caved at a depth of 1.2 mBGS upon completion of drilling.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: Numbers refer to Sensitivity; Strain at Failure

LOG OF BOREHOLE BHT9

PROJECT: Preliminary Geotechnical Investigation for Urban Centre Wastewater Servicing

CLIENT: Ainley Group

PROJECT LOCATION: Town of Erin, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: TY

CHECKED: DL

DIAMETER: 155 mm

DATE: 2017-11-07

REF. NO.: 16-1255

ENCL. NO.:

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
0.0	**TOPSOIL:** (100 mm)				
0.1	**FILL:** silty sand, trace to some clay, trace to some gravel, trace organics, dark brown, moist, very loose to compact	1	SS	11	
		2	SS	7	
		3	SS	3	
2.1	**ORGANIC SILT:** trace clay, trace gravel, trace rootlets, black, moist, loose	4	SS	6	
2.9	**FINE SAND AND SILT:** trace clay, brown, moist, loose	5	SS	7	
4.0	**SAND:** trace silt, brown, wet, compact	6	SS	19	
5.0	**END OF BOREHOLE**				

Concrete

Bentonite

Sand

Screen

Natural Pack

DYNAMIC PENETRATION TEST: ○ SPT ≳ Cone blows/0.3m (20 40 60 80)

SHEAR STRENGTH (kPa): ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane (20 40 60 80)

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)

WATER CONTENT (%) (10 20 30 40)

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%) — GR SA SI CL

Notes:
1) Water encountered at a depth of 3.1 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 4.1 mBGS upon completion of drilling.
3) Borehole caved at a depth of 4.1 mBGS upon completion of drilling.
4) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ▲ ε=3% Strain at Failure