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December 13, 2017 File No. 115157

Triton Engineering Services Limited
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Fergus, ON N1M 1S6

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

Ref: **Town of Erin, Urban Centre Wastewater Class EA**
Wastewater Collection Alternatives, Technical Memorandum

Dear Ms. Furlong:

We are pleased to present the Project File Report for the "Wastewater Collection System" for the Urban Centre Wastewater Servicing Schedule 'C' Municipal Class Environmental Assessment (EA).

This Technical Memorandum provides a review of the Wastewater Collection System Alternatives and includes those alternatives identified in the Servicing and Settlement Master Plan (SSMP). The Technical Memorandum establishes and evaluates alternative for the collection system 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
Wastewater Collection System Alternatives

First Draft

December 2017

Urban Centre Wastewater Servicing
Class Environmental Assessment

Technical Memorandum
Wastewater Collection System Alternatives

Project No. 115157

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The Town of Erin

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Glossary of Terms

ACS	Assimilative Capacity Study: see assimilative capacity.
ADF	Average Daily Flow, typically presented through the report in units of cubic metres per day (m3/d).
Ainley	Primary engineering consultant for the Class EA process.
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.
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).
Forcemain	A pressurized pipe used to convey pumped wastewater from a sewage pumping station.
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.
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.
kWh	Kilowatt Hour, a composite unit of energy equivalent.
Lifecycle Cost	The total cost of facility ownership. It takes into account all costs of acquiring, owning, operating, and disposing of an asset.
Lift Station	See Sewage Pumping Station.
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.
MEA	The Ontario Municipal Engineers Association (MEA) is an association of public sector Professional Engineers in the full time employment of municipalities performing the various functions that comprise the field of municipal engineering.
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.
NPV	Net Present Value is the value in the present of a sum of money, in contrast to some future value it will have when it has been invested at compound interest.
O&M	Operation and maintenance
Open-cut Construction	Method of constructing a pipeline by open excavation of a trench, laying the pipe, and backfilling the excavation.
Peak Flow	An estimation of the maximum volume of wastewater generated over a single day. The peak day flow is calculated by multiplying the ADF by the Harmon Peaking Factor.
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.
Private Treatment System	Lot-level or communal sewage treatment methods, such as septic systems or aerobic treatment systems, which remain in private ownership.
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.
Screening Criteria	Criteria applied to identify the short-list of alternative solutions from the long-list of alternative solutions.
Septic Waste	Wastewater characterised by the absence of dissolved oxygen and high concentration of sulphides and odours.
Service Area	The area that will receive sewage servicing as a result of this study.
Service Life	The length of time that an infrastructure component is anticipated to remain in use assuming proper preventative maintenance.
Sewage	The liquid waste products of domestic, industrial, agricultural and manufacturing activities directed to the wastewater collection 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.
STEP/STEG	Septic Tank Effluent Pumping/ Septic Tank Effluent Gravity, refers to a method of wastewater collection which collects the liquid portion of waste from the septic tanks while the solids remain for removal and treatment by a separate method.
Study Area	The area under investigation in which construction may take place in order to provide servicing to the Service Area.
Trenchless technology	Methods of installing a utility, such as a sewer, without excavating a trench, including directional drilling, microtunneling etc.
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.

1.0 Introduction

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 Centres 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 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 the 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 service population potential has increased to 14,559 persons based on the Assimilative Capacity Study review completed under this Class EA.

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. However, at present there are no approved developments for designated growth areas and no basis to determine local collection systems for these development areas. As such, this "Collection System Alternatives" technical memorandum compares the collection system technologies on the basis of servicing the existing communities including infill and intensification and potential growth within the urban boundaries. This technical memorandum shows the cost to service existing developed areas and convey the wastewater to the treatment plant. In addition, this technical memorandum identifies the "oversizing" required to the trunk network to service growth to full build out.

During Phase 3 of the UCWS Class EA, the SSMP's preferred solution is refined and a preferred design concept for wastewater collection is identified. This Class EA process follows the planning and design process for Schedule 'C' projects as described in the Municipal Class Environmental Assessment Document (October 2000 as amended in 2007, 2011 & 2015), published by the Municipal Engineer's Association.

1.1 Objectives

The objective of this technical memorandum is as follows:

- Identify the range of collection system alternatives
- Present the advantages and disadvantages of each system as it applies to the Town of Erin
- Screen out alternatives that do not meet the requirements of the community
- Establish evaluation criteria
- Evaluate system capital costs, maintenance costs, and lifecycle costs
- Compare the "short list" of collection alternatives under the evaluation criteria

- Select a recommended system alternative

2.0 Defining Collection Areas

In order to develop the layout of a proposed wastewater collection system, it is essential to review the topography of the Town. No matter which alternative system is used, there are geographical features which will necessitate the use of pumping facilities in order to transmit all of the wastewater to the treatment plant location. In examining the planned service areas, the natural topographical restraints dictate how the wastewater will generally be conveyed to the WWTP from each area of the two communities. Wastewater collection systems are generally composed of two main elements:

- A “Trunk System” that conveys wastewater through all of the individual areas, all the way to a Wastewater Treatment Plant (WWTP). It generally consists of main sewers, pumping stations and forcemains that form the back bone of the system
- “Collection Areas” servicing properties in a specific area and connecting to the Trunk System by gravity or by pumping depending on the topography in the areas and the system adopted.

The Trunk System would consist of main trunk lines, pumping stations and forcemains that intercept individual Collection Areas and convey wastewater through the entire system from Hillsburgh to the WWTP south of Erin Village. The most efficient Trunk System typically passes through or close to all of the individual “Collection Areas” making best use of gravity. It should also pass as close as possible to planned future development areas.

Collection Areas are developed by examining the pattern of development as well as topography and the natural drainage patterns throughout the service area. Since both Erin Village and Hillsburgh may be characterised as undulating, this presents challenges for the development of a wastewater collection system and results in multiple Collection Areas to service the existing communities. An example of the challenges presented by the natural topography would be the river valley between the Erin Heights subdivision and Main Street through Erin Village necessitating a pumping station to convey wastewater from the Erin Heights Collection Area to the Trunk System through the village.

During Phase 2 of the UCWS Class EA, in reviewing the condition of existing septic systems, “Decision Areas” were developed essentially representing “Collection Areas” in order to assist in determining the extent of the potential service area. This section of the Technical Memorandum discusses in detail the potential challenges for the establishment of a collection system within each “Decision Area” as defined by the Septic System Overview Memorandum. The challenges are discussed in general as they apply to all potential collection system alternatives. The impacts specific to each collection system technology will be discussed through Section 3.0.

2.1 Erin Village – Industrial Area

The industrial area in Erin is located at the north end of Erin Village primarily located along Thompson Crescent, Erinville Drive, Erin Park Drive, and Pioneer Drive.

There are two locations within this area which present challenges for the establishment of a wastewater collection network, shown in Figure 1:

- The intersection of Sideroad 17 and Shamrock Road is at a significantly higher elevation compared to the intersection of Pioneer Drive and Sideroad 17.
- The turning circle at the south end of Erin Park Drive is 4.25 m below the intersection of Erin Park Drive and Erinville Drive.

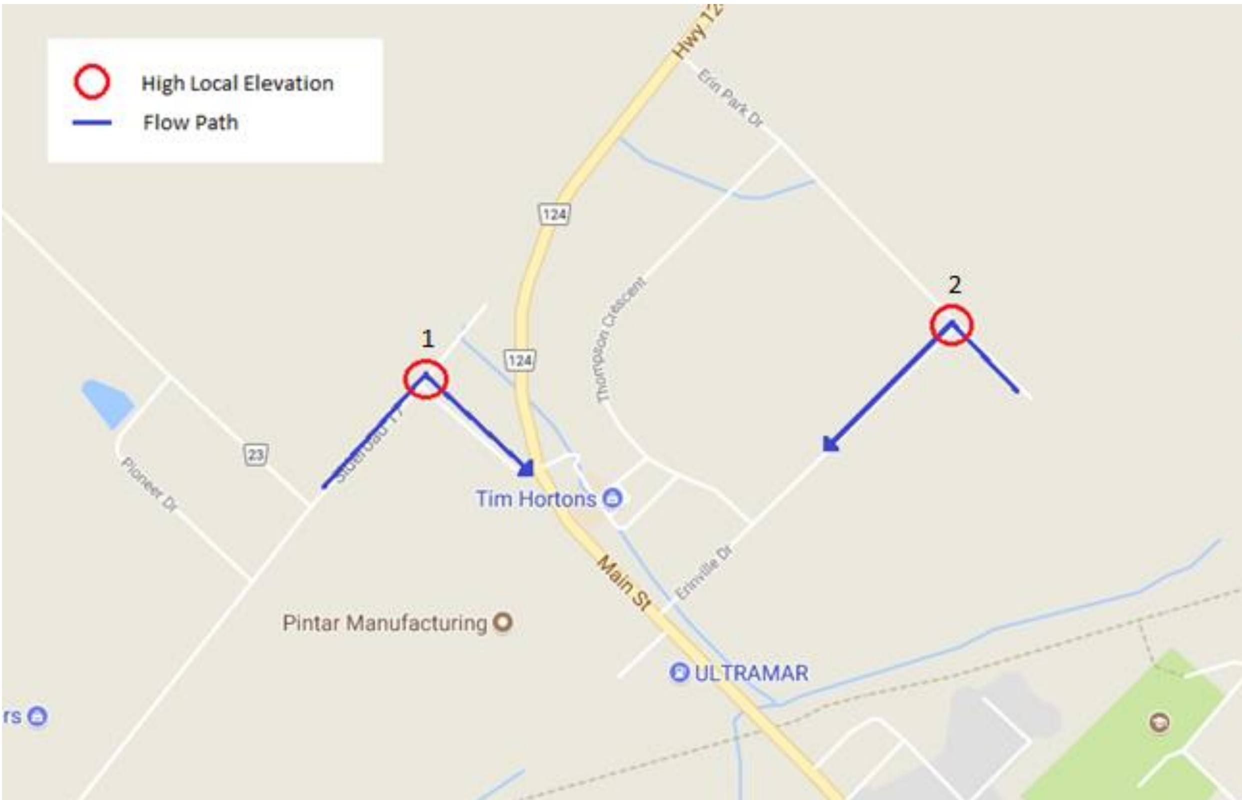


Figure 1 – Industrial Area Design Challenges

2.2 Erin Village – Town Core 1

The area designated as Erin Town Core 1 comprises the majority of Erin Village and is primarily residential development. The area is bounded at the north end by Elora Cataract Trail and on the south end by the West Credit River.

There are five locations within this area which present challenges for the establishment of a wastewater collection system, shown in Figure 2:

- The intersection of Boland Drive and Dundas Street East is at an elevation 2 m below the surrounding area. In order to achieve adequate fall from Erinlea Crescent to Daniel Street along Dundas Street East, the sewer cover quickly reaches 9 m depth.
- The intersection of May Street and Pine Street is approximately 3 m below the surrounding area. In order to achieve adequate fall from the north end of May St. to Daniel St., the sewer along Daniel St. would need to be placed at a minimum depth of 5.3 m.
- Carberry Street and Dundas Street West both drop off rapidly in elevation when approaching the West Credit River. The intersection of Carberry Street and Dundas Street West is 3 m below the intersection of Dundas Street West and Main Street.
- There is a low lying area at the intersection of the south end of Erinlea Crescent and Scotch Street. The low lying area at this intersection is 2 m below the surrounding area.
- The fifth and final challenge is Wheelock St. connected to East Church St. The east end of Wheelock St. is 6 m below the intersection of East Church St. and Daniel Street.

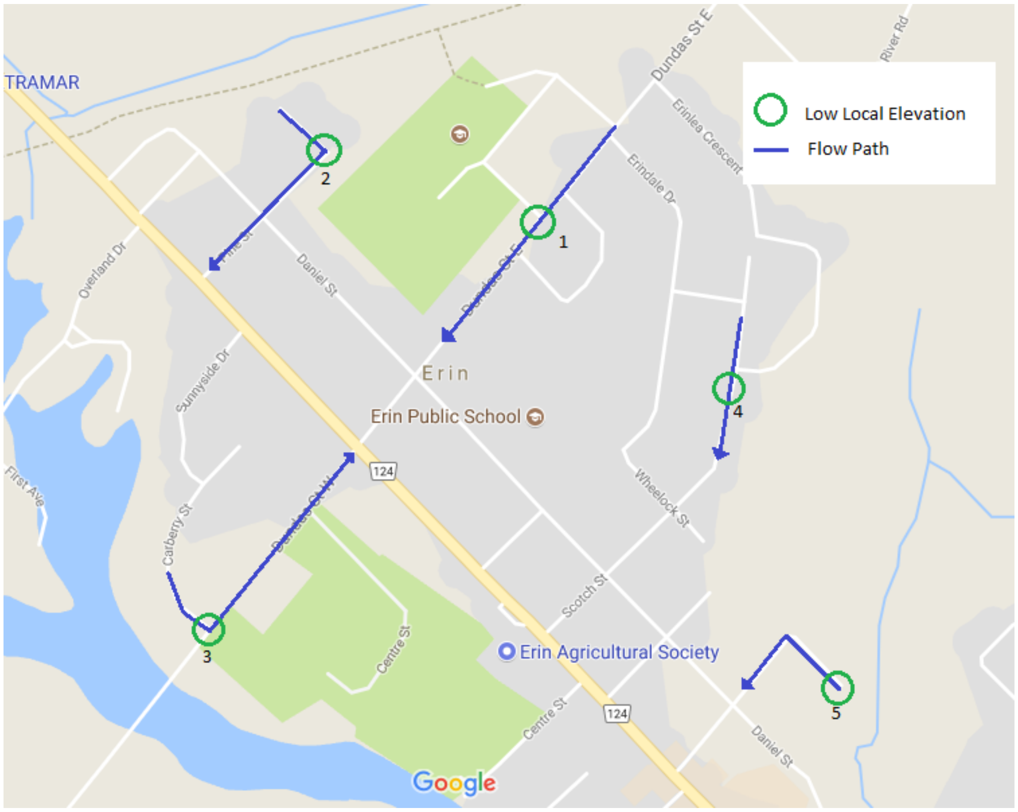


Figure 2 – Erin Town Core 1 Design Challenges

2.3 Erin Village - Town Core 2

The area designated as Erin Town Core 2 is at the south end of the Erin Village and primarily consists of residential development. The area is bounded at the north end the West Credit River and on the south end by Wellington 124 Rd.

There are two locations within this area which present challenges for the establishment of a sewer network, shown in Figure 3:

- The north end of Waterford Drive which is at an elevation 6 m below Main Street.
- There is a creek crossing south east of the intersection of Main Street and Wellington 124.
- There is a river crossing near the intersection of Water St. and Main St.

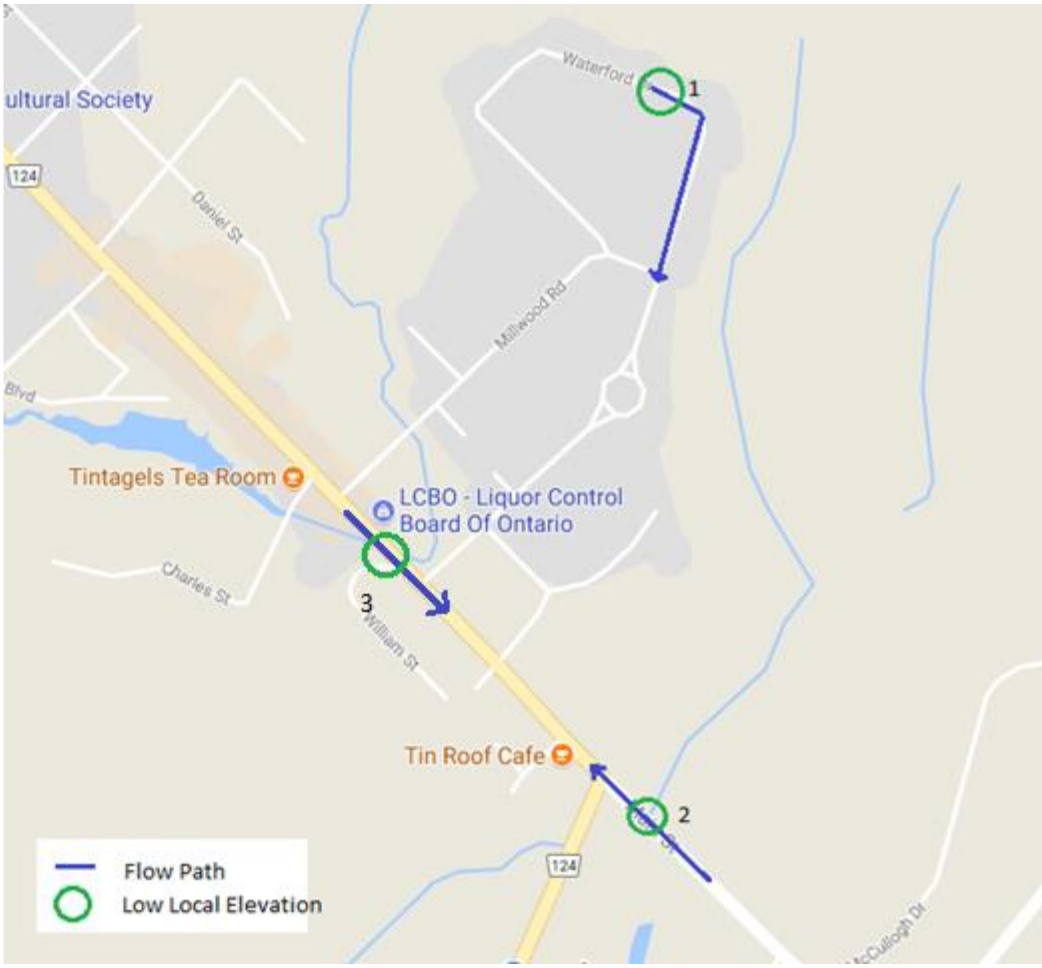


Figure 3 – Erin Town Core 2 Design Challenges

2.4 Erin Village – South East Erin

The area designated as South East Erin is primarily a residential area with limited commercial properties and covers the properties in Erin along 9th Line south of Wellington Rd 124. There are no significant drainage challenges for this area. The area naturally slopes down to the intersection of Main St. and Wellington Road 124.

2.5 Erin Village – Erin Heights

The Erin Heights area is a residential subdivision which is separated from the downtown by the West Credit River valley.

The elevations within this area are highly variable with the lowest point located at approximately 145m of Erin Heights Dr. north of Dundas Street West with an elevation 10-30 m lower than the surrounding area. The steep topography forms a natural drainage to the low lying area however there is no natural outlet to Main Street. Drainage from this subdivision to a trunk sewer in the core of Erin is not feasible by any means other than pumping.

2.6 Hillsburgh - Town Core 1 and 2

The areas designated as Hillsburgh Town Core 1 and 2 comprise the majority of the community and are primarily residential development, along with the majority of commercial properties in Hillsburgh. In total, these areas are bounded at the north by Howe St., Trafalgar Road on the west and to the south by Douglas Cres.

There is one challenge to servicing this area, shown in Figure 4:

- A stream runs parallel to Mill St. and separates the Town Core 1 and Town Core 2 areas. It is suggested that a single crossing of the stream be established along Covert Lane. A pump station will be required for this collection area regardless of system type.

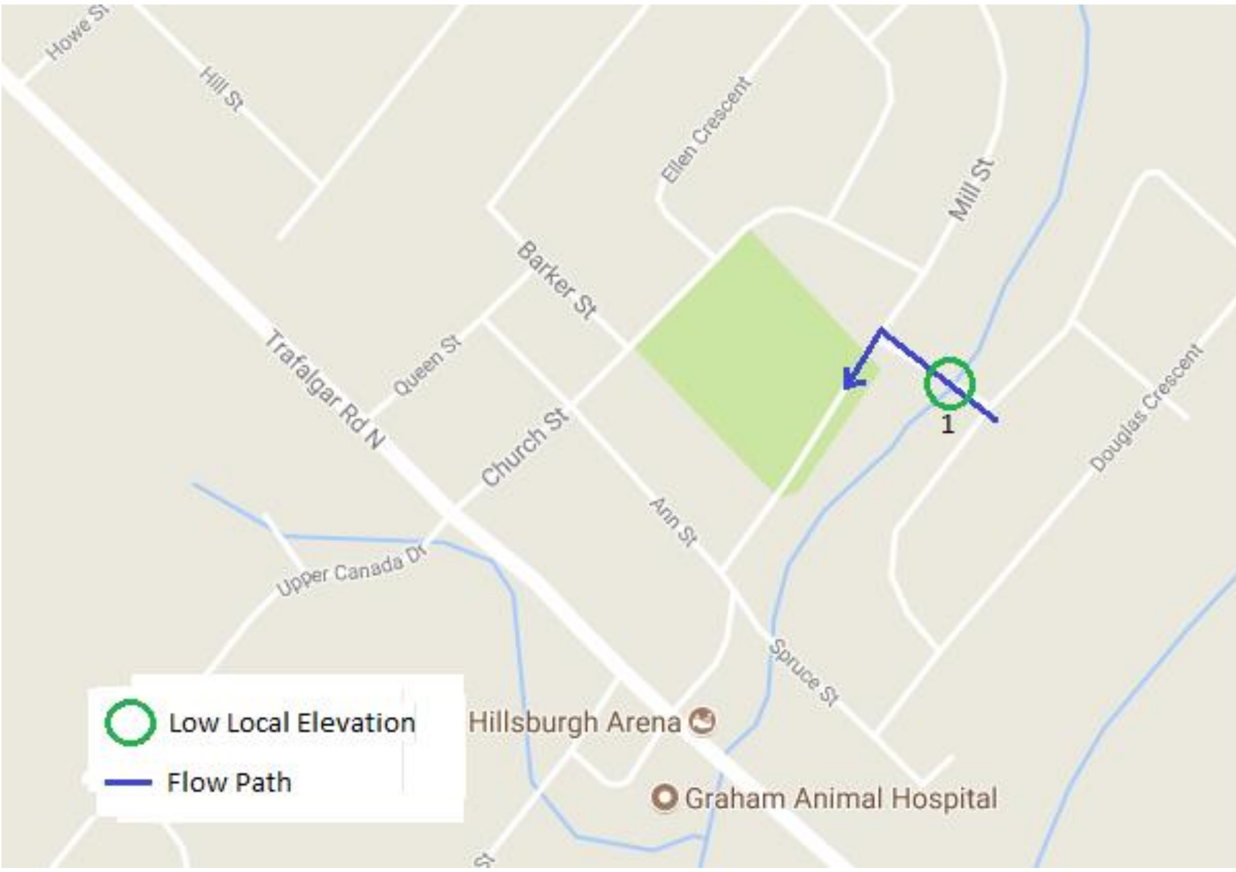


Figure 4 – Hillsburgh Town Core 1 and 2 Design Challenges

2.7 Hillsburgh - George Street

George Street is a short residential street on the west side of Trafalgar Road.

There are no design challenges for this area; George Street can be connected to the Hillsburgh Town Core Area 1 and 2 collection area.

2.8 Hillsburgh - South Trafalgar Road

South Trafalgar Road includes all the properties along Trafalgar Road south of Mill Street. A sewage pumping station will be required at the south end of Trafalgar Rd. to accept waste from this area and transmit it to Erin Village.

There is one challenge to servicing this area, shown in Figure 5:

- A stream crosses Trafalgar Road directly south of the Hillsburgh Arena.

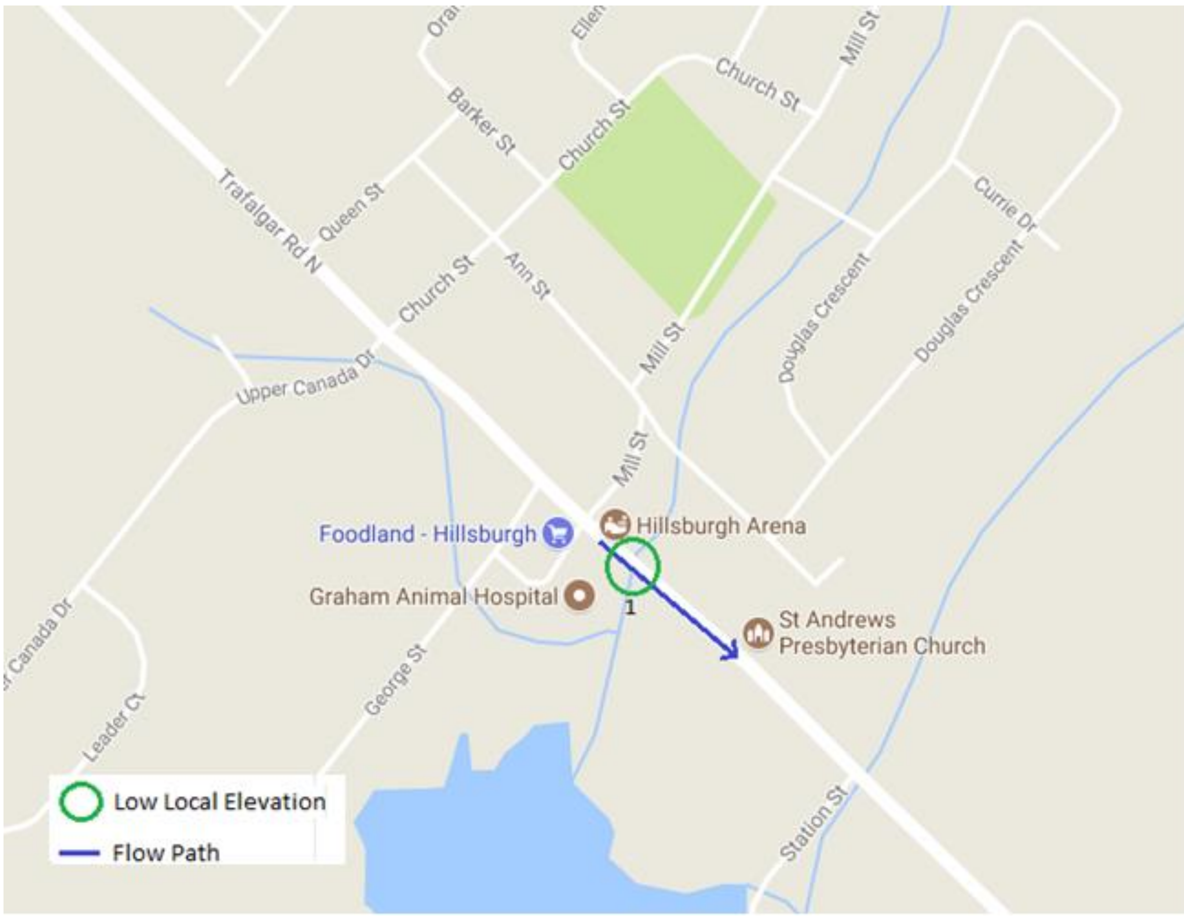


Figure 5 – South Trafalgar Road Design Challenges

3.0 Phase 3A: Identify Alternative Design Challenges for the Wastewater Collection System

Phase 3 of the Class EA process can generally be separated into two parts: the identification of alternative design concepts and the evaluation of alternative designs. A primary objective of Phase 3A is the identification of feasible alternative design concepts for a preferred solution. For Phase 3A, the six (6) alternatives design concepts considered for sanitary drainage include:

- Gravity Sewers
- Modified Gravity Sewers
- Gravity/Low Pressure Sewer Blended Sewer System

- STEG/STEP Sewer System
- Low Pressure Sewer System
- Vacuum Sewer System

3.1 Gravity Sewers

3.1.1 Description

Gravity sewer systems are a proven, reliable technology, requiring minimal maintenance. They typically have a long service life with low operating costs. Wastewater from each source is conveyed through a building sewer to a collection line. If gravity flow is not possible throughout the system, lift stations (pumps) are used. Lift stations are installed at the lowest elevations of the network in order to pump the sewage to another gravity line, to convey wastewater over hills, and/or up to a trunk system that conveys the wastewater to the WWTP.

3.1.2 Conceptual Planning

In order to properly consider the economic and technical impacts of a gravity system for the service areas, a conceptual system layout was developed.

A potential gravity system design alternative was developed using the SewerGEMS sanitary modeling platform. Building upon the issues identified in Section 2, the collection system has been separated into four primary catchments / collection service areas. The catchment areas are shown graphically in ***Appendix A*** and the catchments identified are discussed herein. Additionally, 4 sub-catchments have been identified all discharging to Catchment 4.

A trunk system was developed to convey wastewater from all of the existing catchments through to the WWTP. The trunk network is shown graphically in ***Appendix B***. This trunk system consists of the following elements:

- a sewer on Trafalgar Road in Hillsburgh
- a pumping station at the junction of the Elora Cataract Trail and Trafalgar Road in Hillsburgh
- forcemains from the Hillsburgh pumping station to a pumping station on Main Street in North Erin Village
- a pumping station on Main Street in North Erin Village
- a forcemain from the North Erin Village pumping station along Main Street to the intersection of Main Street and Dundas Street
- a trunk sewer down Main Street and Daniel Street to a pumping station in South Erin Village
- a pumping station in South Erin Village
- forcemains from the South Erin Village pumping station to the WWTP site

Hillsburgh Town Core (Catchment 1)

The Hillsburgh Town Core catchment collects all wastewater from the main residential area of Hillsburgh including the properties along George Street. It is recommended that this catchment should terminate at a location on Mill St south of Covert Lane. One stream crossing will be required for this catchment to transmit flow from the Douglas Crescent Area to the proposed pumping station location. The pumping station at this location will pump to the north end of Catchment 2.

Trafalgar Road North (Catchment 2)

The Trafalgar Road North catchment collects all wastewater along Trafalgar Road South of the main residential area. A potential pumping station location has been identified at the intersection of Trafalgar Road North and the Elora Cataract Trail. The trunk sewer for this catchment would transmit flow from Catchment 1 and Catchment 2. The pumping station at this location will pump wastewater from Hillsburgh to Erin Village.

North Erin Village (Catchment 3)

The North Erin Village catchment collects all wastewater from the industrial area and a portion of the wastewater from the core residential area. A potential pumping station location for this catchment has been identified near the intersection of the Elora Cataract Trail and Main Street in Erin Village. The pumping station at this location will pump wastewater to the trunk sewer that's starts at the intersection of Main St. and Dundas St. in Erin Village.

South Erin Village (Catchment 4)

The South Erin Village catchment collects waste from locations within Erin Village, south of Scotch St. In addition, this catchment also includes the Erin Heights Dr. subdivision. It is recommended that this catchment should terminate around the intersection of Main St. and Wellington Road 124 or alternatively in Lion's Park. All waste from Hillsburgh and Erin Village will ultimately pass through this station and be transmitted to the preferred treatment plant location.

Erin Heights, Sub-Catchment 1

The Erin Heights subdivision is separated from the downtown of Erin Village by a significant river valley intersecting Dundas St. W. west of Carberry St. In addition, the Erin Heights subdivision is situated on a significant slope with an elevation difference of over 30 m between the highest location at the west side of the subdivision and the lowest location at the northern most extent of Erin Heights Drive. Based on the local topography, a pumping station will be required at the north end of the sub-catchment.

Dundas St. E., Sub-Catchment 2

The intersection of Dundas St. East and Tomwell Crescent is a local low point which lies at an elevation of 5 m below the surrounding area. Connecting this low lying area to a gravity main along Daniel St. or Main St. would require an excessively deep excavation, in excess of 9 m at some points, in order to convey wastewater to the primary pump stations for either North Erin Village or South Erin Village. A local pumping station is one option to eliminate the requirement for such a deep trunk sewer excavation.

Scotch St., Sub-Catchment 3

A section of Scotch St., north of the intersection with Wheelock St. lies at an elevation 4 m below the surrounding area. Connecting this low lying area to a gravity main along Daniel St. would require a section of the Daniel St. sewer to be constructed at a depth of up to 10 m. A local pumping station eliminates the requirement for an excessively deep trunk sewer along Daniel St. This pumping station would lift wastewater to a sewer on Main St. or Daniel St. which would eventually reach the primary pumping station for the south end of Erin Village.

Wheelock St., Sub-Catchment 4

The east end of Wheelock St. lies at an elevation of 6 m below the intersection of East Church St. and Daniel St. Due to this drop in elevation in this area, connecting the few homes on this street to a gravity sewer on Daniel St. would require the trunk sewer to be constructed at a depth in excess of 10 m. A local pumping station eliminates the requirement for an excessively deep trunk sewer along Daniel St. This pumping station would lift wastewater to a sewer on Daniel St. which would eventually reach the primary pumping station for the south end of Erin Village.

3.1.3 Gravity Conceptual Plan (Downtown Servicing)

After the baseline gravity collection system layout was completed, a more focused assessment of servicing the downtown core area of Erin was conducted. There are a series of commercial buildings along Main St. between East Church St. and Millwood Rd. which would be difficult to connect to a sewer main along Main St. Instead, it is proposed that the main trunk be situated on Daniel St and continue along the driveway which extends from the end of Daniel St. to Millwood Rd; this sewer would service the commercial buildings on the east side of Main St. In addition, a gravity main would be required along the path extending from Church Blvd. to Charles St. behind the buildings on the west side of Main St. for servicing. The proposed gravity sewer alignment is provided graphically in ***Appendix C***.

3.1.4 Analysis of Gravity Sewer Alternatives

Alternative 1A – Traditional Gravity Sewer System

The traditional gravity sewer system consisting of the Catchment area servicing and the trunk system is described in Section 3.1. This approach will require owners to remove their septic tank and connect to the new system at the street line. Advantages and disadvantages of traditional gravity sewers are listed in Table 1.

Table 1 – Advantages and Disadvantages for Traditional Gravity Sewer System

Advantages	Disadvantages
▪ Widely used throughout Ontario and the developed world ▪ Secure operation not dependent on power supply ▪ Not a proprietary technology ▪ Suitable for areas with natural slope/terrain ▪ Proven technology with good track record ▪ Familiarity with the operation and maintenance ▪ System primarily constructed in the road allowances ▪ There are no mechanical components on private properties for gravity connections and little routine maintenance is associated with connections and main sewers ▪ Operational costs for the gravity sewer systems mainly associated with lift stations. ▪ Lift Station operation is made secure through the use of a stand by power unit and can be fully automated. ▪ New developments where all utilities are being placed in new streets, typically have a reduced	▪ Deeper excavations may require some excavations in Bedrock to achieve gravity flow ▪ Potential for inflow and infiltration due to leaky pipes/manholes in the future ▪ Due to topography within study area, multiple lift stations are required ▪ Property will be required to facilitate the installation of the lift stations and sewer easements through Main Street ▪ Homeowner connection costs can be high where lots slope below road. ▪ MOECC design guidelines require a minimum 200mm diameter for gravity sewers. ▪ Septic tanks and tile beds to be decommissioned by the property owner.

Advantages	Disadvantages
cost for gravity sewers. ▪ No municipally owned sewer components to operate and maintain on private property ▪ Both liquid and solid components of sewage. removed from the property at the same time.	

Alternative 1B – Modified Gravity System

A modified gravity sewer system is similar in principle to a traditional gravity sewer system, however, whereas the traditional gravity system services properties down to basement level, the Modified gravity system is installed at a shallower depth of cover and does not provide full basement servicing in all or portions of the service area. Because of the decreased depth, the initial capital costs of the collection system are typically less than the costs associated with a traditional gravity sewer installation.

Advantages and disadvantages of modified gravity sewers are listed in the Table 2.

Table 2 - Advantages and Disadvantages for Modified Gravity Sewer System

Advantages	Disadvantages
▪ Sewer Pipe installed at minimal excavation depth ▪ Initial Capital cost is less compared to traditional gravity sewers ▪ Other advantages same as traditional gravity system	▪ Leaves some plumbing fixtures in basements to be pumped to the sewer at the Owners expense ▪ Results in different service levels for different community members ▪ Other disadvantages same as traditional gravity system

Alternative 1C – Blended Gravity/LPS System

The blended gravity/low-pressure sewer system is by-in-large a traditional gravity system however, where isolated low-lying areas exist, grinder pump units are utilised instead of creating a local drainage area with a small centralised pumping station. Due to the relatively high capital cost of establishing, operating and maintaining small centralised pumping stations, this alternative takes advantage of the pre-packaged design of the grinder pump units available on the market to service small isolated areas.

Advantages and disadvantages of the blended gravity/LPS sewers are listed in the Table 3.

Table 3 - Advantages and Disadvantages for Blended Gravity/LPS Sewer System

Advantages	Disadvantages
▪ Suitable for areas with natural slope/terrain ▪ Familiarity with the operation and maintenance ▪ System primarily constructed in the road allowances ▪ Operational costs for the gravity sewer systems mainly associated with lift stations. ▪ Lift Station operation can be automated. ▪ Avoids construction of multiple small lift stations. ▪ Simple connection solution for difficult connections.	▪ Deeper excavations may require some excavations in bedrock to achieve gravity flow ▪ Potential for I/I due to leaky pipes/manholes in future ▪ Property will be required to facilitate the installation of the centralized lift stations ▪ Capital costs higher than other alternatives ▪ Homeowner connection costs can be high where lots slope below road ▪ Creates a two-tier collection system with different requirements for different home owners. ▪ Disadvantages of grinder pump operation applies to a small portion of the overall user base. (See Section 3.3)

3.2 STEP/STEG System

3.2.1 Description

Septic tank effluent gravity (STEG) tanks trap and retain solids at the point of discharge and transfer, by gravity flow, relatively clear effluent to the next treatment stage. STEP (septic tank effluent pump) tanks are similar, but instead pump the effluent because the treatment unit may be at a different elevation where gravity is not feasible.

STEG and STEP sewers use septic tanks on individual properties to provide liquid/solid separation before the liquid is conveyed through the collection system. The raw sewage from the building flows into a watertight underground septic tank, where the primary treatment of liquid/solid separation occurs. Typically these systems involve replacement of existing septic tanks with custom design tanks. Following the primary treatment, the effluent is conveyed by gravity (STEG) or by pump (STEP) into a 100 mm or 200 mm diameter gravity effluent sewer. Through the primary clarification process, the solids in each individual septic tank are stored to later be pumped out and disposed of at a wastewater treatment plant. The individual tanks are owned by the municipality, but are located on private property. To access the septic tanks for maintenance, legal agreements for permission to enter are required.

A typical STEP/STEG system is built on three main components: interceptor tanks, small bore sewers, and optimized wastewater treatment works. Lot-level interceptor tanks provide at-source separation of sewage solids, while a network of small bore sewers conveys the liquid effluent to the treatment facility. The single chamber tanks are equipped with a proprietary hydraulic mixer present immediately upon sewage entering the tank. There is also a flow attenuator which uses gravity to convey the effluent out of the tank and into the sanitary lateral. This attenuation, coupled with the inner tank surface area provides peak flow buffering so that the maximum design peaking factor is 2 regardless of system size. In some cases, depending on the individual property limitations, a pump may have to be employed to move the effluent out of the tank and into the sanitary lateral.

The small bore sewer pipes are not constrained by the minimum scouring velocity in conventional sewers because sewage solids are removed at the source, significantly reducing the potential for sewer blockages. The systems are assembled from high-density polyethylene (HDPE) pipe and fittings that are thermally fused to create a flexible and watertight collection network. Seamless joints between pipe sections and fittings ensure that there is no infiltration and no leakage of sewage to the environment. This reduces the amount of extraneous flow reaching the sewage treatment stage. Both STEP and STEG can be combined within a given collection system.

3.2.2 Conceptual Planning for STEP/STEG

A potential STEP/STEG system design alternative was provided to Ainley by a STEP/STEG system supplier and was subsequently modified by the Ainley team based on our review of the Town's topography and anticipated flows. There are four primary catchments identified for the STEP/STEG system which mirror the primary catchments for the gravity system. The catchment areas are shown graphically in ***Appendix D***. The catchments identified are described herein.

The STEP/STEG system essentially operates as a gravity sewer system with subsections of the overall system operating as a low-pressure system. Due to the topography of the community in order to establish a functional collection system a trunk system similar that required for the gravity collection system was adopted. All of the small sub-catchment zones identified for the gravity collection system will be serviced with STEP systems.

Hillsburgh Town Core (Catchment 1)

The Hillsburgh Town Core catchment collects all wastewater from the main residential area of Hillsburgh including the properties along George Street. It is recommended that this catchment should terminate at a location near Mill St south of Covert Lane. One stream crossing will be required for this catchment to transmit flow from the Douglas Crescent Area to the proposed pumping station location. The pumping station at this location will pump to the north end of Catchment 2.

Trafalgar Road North (Catchment 2)

The Trafalgar Road North catchment collects all wastewater along Trafalgar Road South of the main residential area. The trunk sewer along Trafalgar Road N will terminate at a location close to the intersection of Trafalgar Road N and Wellington Road 22. This trunk sewer will also transmit flow from Catchment 1. The pumping station at this location will pump waste from Hillsburgh to the north end of Catchment 3 in Erin Village.

North Erin Village (Catchment 3)

The North Erin Village catchment collects all wastewater from the industrial area and a portion of the wastewater from the core residential area. It is recommended that this catchment should terminate at the junction of the Elora Cataract Trail and Main Street. The pumping station at this location will pump wastewater to the trunk sewer along Main Street in Erin Village.

South Erin Village (Catchment 4)

The South Erin Village catchment collects wastewater from locations within Erin Village south of Scotch St. in addition this catchment also includes the Erin Heights Dr. subdivision. It is recommended that this catchment should terminate around the intersection of Main St. and Wellington Road 124 or alternatively in Lion's Park. All wastewater from Hillsburgh and the Erin Village will ultimately pass through this station and be transmitted to the preferred treatment plant location.

3.2.3 Analysis of STEP/STEG

Ownership of STEP/STEG Systems

Ownership considerations of the STEP/STEG system are unique since there are two connection variants depending on the location within the community. The ownership of each septic tank/ septic tank pump is a decision which must be made in establishing a STEP/STEG system, i.e. whether the Town should own and maintain all of the septic tanks/ pumps or if the tanks/pumps should be owned and maintained by each property owner. It is likely that community members who would be required to connect using the STEP system may take issue with the additional costs they would face in comparison to those with a STEG system. At a minimum, it is recommended that there should be no difference in the ownership philosophy between the STEP and STEG systems.

In order to avoid conflicts with residents, it is recommended that, should a STEP/STEG sewer system be chosen, the Town should consider opportunities to ensure level costs for system use for all residents. In essence, the Town should consider a method for residents on STEP systems to recover the cost of electricity for pumping effluent. In either a Town or private ownership model, access to each tank would need to be maintained in order to facilitate the regular tank inspection/cleanout process. In either case, home owners would be required to maintain sufficient access to their septic tanks/pumps.

Operation of STEP/STEG Collection

It is estimated that the energy use for each individual STEP pump will cost $20-40/year for each residence connected in this manner. It should be noted that there will be a small energy cost variation to each system user based on their relative distance to the relevant discharge point. This variation will not be as significant as with the low-pressure system. This energy use cost will only affect users who are required to connect using the STEP system and not those able to connect under the STEG system.

Due to the nature of the STEP/STEG collection process, each septic tank will continue to require regular cleanouts. STEP/STEG system suppliers estimate that cleanouts will be required on an 8-year cycle however the EPA Guidelines for Septage Treatment and Disposal recommend a 3-5 year cleanout cycle. The regular cleanouts are estimated to be approximately $375/ cleanout and should be covered by the system owner.

Since these tanks do not function like a regular septic tank, their operation affects the downstream sewers. If home owners fail to have the tanks pumped out in a timely manner, this could result in solids being sent to the smaller diameter sewers potentially causing blockages. For this reason, it is recommended that the Town owns and operates the entire system.

A consideration that must be made with the STEP/STEG systems is the potential for bacterial upsets to occur in the septic tank caused by misuse of the system by residents. Bacterial processes are very sensitive to system inputs and issues may occur if harmful chemicals such as bleach are released into the tank. In the event that chlorine reaches the septic tank sludge bulking may occur, if the upset is severe enough the sludge could possible enter the effluent chamber and be released to the collection system. Due to the small sewer size recommended for the STEP/STEG system, fowling from sludge entering the system may cause blockages. To avoid problems with the operation of a STEP/STEG system, an education program is recommended in order to notify the public on the proper use and maintenance of these systems.

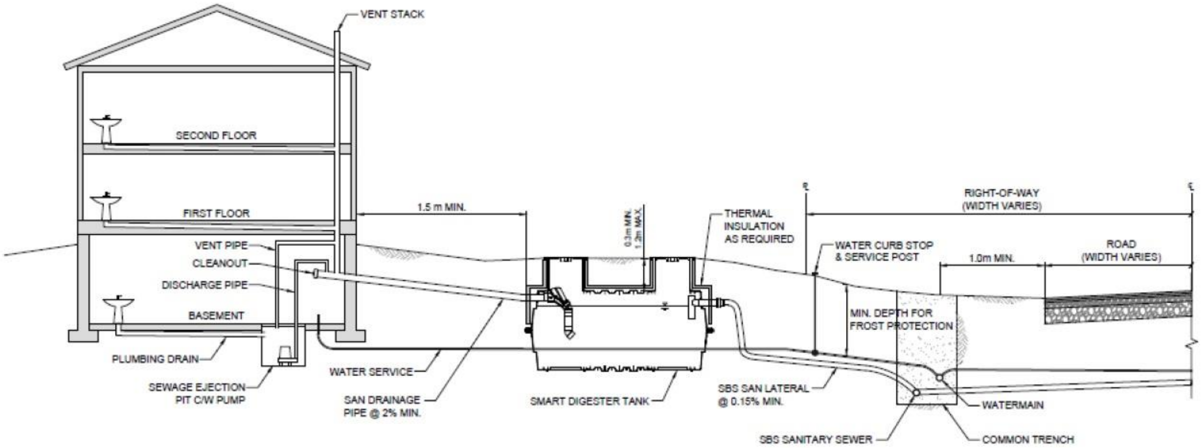


Figure 6 – Schematic of STEG/STEP System from Clearford Water System Inc.

Advantages and disadvantages of STEG and STEP are listed in Table 3.

Table 4 - Advantages and Disadvantages of STEP/STEG System

Advantages	Disadvantages
▪ Potentially less excavation required for sewer pipes ▪ Where STEP used, pipes can be installed to follow the surface topography, remaining at a relatively constant depth below the surface ▪ Minimal inflow and infiltration into the system so smaller pipes and lower flow to WWTP ▪ Solids not pumped to WWTP so smaller pipes and less capital costs for pipes ▪ Lower initial capital costs due to shallower placement and small size of pipes ▪ Low pump maintenance compared to grinder pumps (low pressure system).	▪ All private properties require an Interceptor Tank similar to a Septic Tank ▪ Small diameter pipes subject to blockage if interceptor tanks do not function properly ▪ On lot components require maintenance (Solids Removal, Pump Maintenance). ▪ If Interceptor tanks Municipally owned, legal access agreement is needed for maintenance ▪ Municipality may also be responsible for solids pump out if they own the tanks ▪ Property owners still have the restriction of having a septic tank system ▪ Power needs to be available all the time for STEP. Power failure results in properties having no wastewater outlet ▪ Property owners will be required to supply and pay for power to the onsite pump at their property. ▪ STEP/STEG is a proprietary technology which means maintenance and procurements of parts will be through the same supplier which could increase capital and maintenance costs. ▪ Existing Septic tanks will need to be

Advantages	Disadvantages
	decommissioned by the Town ▪ Tile bed decommissioned by the property owner. ▪ Not widely used in Canada and not on this scale ▪ Developers for growth areas would be required to use the same system and this may affect house prices as the system does not provide a secure sewer outlet ▪ Production of odour is common from improper house ventilation, manholes and system vents. ▪ Effluent tends to be corrosive due to the presence of hydrogen sulphide gas from septic sewage. ▪ Odour control needed at all SPS's.

3.3 Low Pressure System

3.3.1 Description

A Low Pressure System would require homes to have an outdoor "grinder pump" buried in the front yard instead of a septic tank. This would chop up the waste before pumping it into the public system

Pressurised sewers differ from conventional gravity collection systems, because they use pumps (grinder) instead of gravity to transport wastewater. The primary effluent is delivered to the collection tank (with a grinder pump) by gravity where it is ground up before being transported into the pressurised system by pumps. A typical arrangement is for each connection (or a small cluster of connections) to have a basin that receives wastewater. Within that basin is a grinder pump and when the basin fills to a set point, the pump is activated and injects the wastewater into the sewer. Throughout the collection system, there are many basins with pumps injecting wastewater into the sewer; these pumps convey the wastewater to the treatment facility. The system consists of conventional drain, waste and vent (DWV) piping within the residence connected to the grinder pump basin inlet. The grinder pump may be installed above or below grade, indoors or outdoors. The pump and basin are typically owned by the municipality and located on private property, so easements would be required for maintenance purposes.

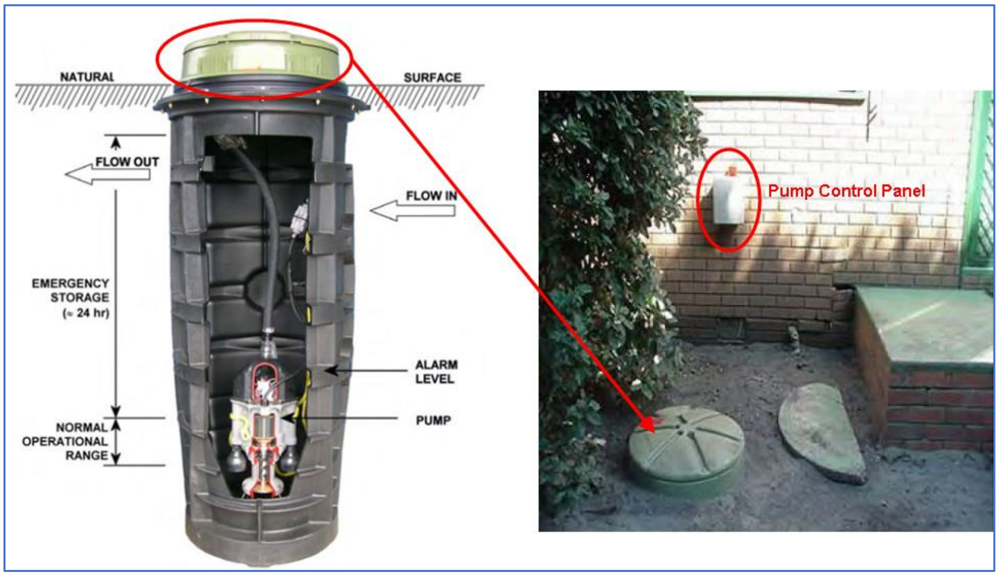


Figure 7 – Low Pressure System Grinder Chamber with an Outdoor Pump Control Panel

Depending on flow factors and the system design model used, the grinder installation may serve one or more residences, or several families in the case of apartment buildings, however the need to provide power to each pump likely would limit the system size to each individual property or condominium. Grinder pumps discharge a finely ground slurry into small–diameter pressure piping. In a completely pressurized collection system, all the piping downstream from the grinder pump (including laterals and mains) will normally be under low pressure (40-60 psig). Pipe sizes will start at 1 1/4 inches for house connections (compared to 4 or 6 inches in gravity systems) and will be proportionally smaller than the equivalent gravity pipeline throughout the system. All pipes are arranged as zone networks without loops. Depending on topography, size of the system and planned rate of buildout, appurtenances may include valve boxes, flushing arrangements, air release valves at significant high points, check valves and full-ported stops at the junction of each house connection with the low pressure sewer main. Low pressure sewers may be combined within a given collection system. Typical details of the Low Pressure System are shown in Figure 7 and 8.

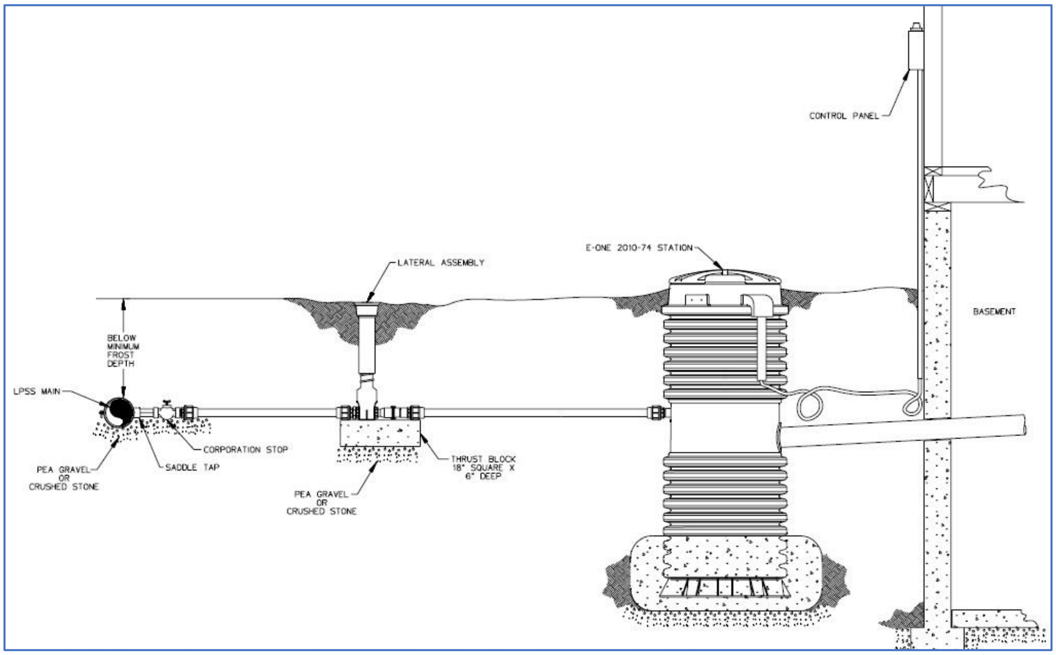


Figure 8 – Schematic of Low Pressure System from Environment One Corporation (E/One)

3.3.2 Conceptual Planning for Low Pressure Sewer System

A potential low-pressure system design alternative was provided to Ainley by a low-pressure system supplier and was subsequently modified by the Ainley team based on our review of the Town's topography and anticipated flows. There are three primary catchments identified for the pressure sewer. Pressure sewer systems are not generally designed to have multiple catchments in the same way as a gravity system; due to the geographical separation between Hillsburgh and Erin Village, multiple catchments are necessary. The catchment areas are shown graphically in ***Appendix E***. The catchments identified are outlined described herein.

Hillsburgh (Catchment 1)

The Hillsburgh catchment collects all waste from within Hillsburgh. It is recommended that this catchment should terminate at the proposed pumping station location at the junction of Trafalgar Road and the Elora Cataract Trail.

North Erin Village (Catchment 2)

The North Erin Village catchment collects all waste from the industrial area and a portion of the waste from the core residential area. The pumping station for this catchment will also receive all the waste from Hillsburgh. It is recommended that this catchment should terminate at the proposed pumping station location near the junction of Main Street and the Elora Cataract Trail. Pumping into the low pressure collection system would conflict with the operation of the grinder pump system; as such it is recommended that the forcemain from this station extend to the pumping station for South Erin Village (Catchment 3).

South Erin Village (Catchment 3)

The South Erin Village catchment collects waste from locations within Erin Village south of Scotch St. in addition this catchment also includes the Erin Heights Dr. subdivision. It is recommended that this catchment should terminate in Lion's Park. All waste from Hillsburgh and Erin Village will ultimately pass through this station and be transmitted to the treatment plant location.

3.3.3 Analysis of Low Pressure Sewer System

Ownership of Low-Pressure Pumps

The ownership of each low pressure pumping station is a decision which must be made in establishing a low pressure system, i.e. whether the Town should own and maintain all of the pumping stations or if the stations should be owned and maintained by each property owner. It should be noted that a few communities in Ontario which have opted for a low pressure sewer system have received public backlash for their decision to have the grinder pump stations privately owned. For the community of St. Davids, Niagara on the Lake, the issue of grinder pumps failing within 8 years of installation has become highly politicised with demands that the stations should be owned and maintained by the Town to ensure private residents are not responsible for covering the cost of repairs which, for some residents, have exceeded $2,000.

In order to avoid conflicts with residents it is recommended that, should a low-pressure sewer system be selected, the Town ownership model should be selected. While Town ownership of the grinder pump units resolves the issue of public complaints caused by replacement costs, it raises an issue related to access. Should the Town have ownership of the grinder pump units, access to each station would be required to ensure public works could resolve operational issues of each station. Home owners would be required to maintain access to their grinder pump station, particularly during the winter months. Home owners would still be responsible for pumping costs and would still experience loss of a wastewater outlet in the event their power is lost.

Operation of Low Pressure Pumps

Based on energy use estimations from suppliers of low-pressure sewer pumps, the yearly energy use for each individual pump will fall between 85-170 kWh/year. However, this estimation does not account for periods of pump operation where the pump is dead-heading (operating without being able to discharge). Based on the energy use estimations it is assumed that the operation of the grinder pump units will cost between $30-50/year for each resident. It should be noted that the energy cost to each system user will increase as a function of the relative distance to the discharge point.

A consideration that must be made with a low pressure system is the potential for power outages affecting the system operation. In a conventional gravity sewer system the collection and pumping of sanitary waste is centralised and generators are typically kept on site in case of a power outage. In short, there is an increased risk of system backups during power outages for individual users of the low-pressure system. The typical tank size for the grinder pump packages is 380 L which is equivalent to approximately 9 hours of use for a typical household. However it should be recognised that a power failure could occur when the tank is almost full thus preventing its use almost immediately.

Centralised Pumping Stations

While the core concept of the low-pressure system is to rely on the collective pumping capacity of the individual grinder pumps there are some feasibility issues with this as a complete solution.

Due to the distance and elevation variability between Erin and Hillsburgh a centralised pumping station is recommended. There are technical challenges related to pumping long distances, primarily, as the pumping distance increases there is a linear increase in dynamic headloss and by extension an increase in the energy required. Additionally, with long pumping distances in a pressurised forcemain there is a high probability that the sewage will become septic and highly odourous. A centralised station for pumping between the two communities will require an odour control system. A conceptual design has been developed involving establishing a central pumping station for Hillsburgh to discharge to the north end of Erin Village.

Another challenge which must be accounted for in the overall system design is control over the discharge to the treatment plant headworks. With a system of hundreds of individual pumping units automation and control of the discharge would have an incredible level of complexity and would also require significant investment in an overarching control system linked to each station. To address this complexity our solution involves establishing a pumping station in the south end of Erin Village to control discharge to the treatment plant.

Advantages and disadvantages of low pressure sewage collection systems are listed in the Table 5.

Table 5 - Advantages and Disadvantages for Low Pressure Collection Systems

Advantages	Disadvantages
▪ Less excavation required ▪ Can be installed to follow the surface topography, remaining at a relatively constant depth below the surface (below the frost line) ▪ Minimal inflow and infiltration into the system so smaller pipes and lower flow to WWTP ▪ Lower initial capital costs due to shallower placement and small size of pipes.	▪ Homes will require grinder pump unit on private property ▪ Municipally owned grinder pumps would require maintenance of over 1500 pump systems and requires access to each property ▪ If pump owned by each property owner presents ongoing operation and maintenance costs for each homeowner ▪ Each property owners will be required to supply and pay for power to the onsite pump ▪ Power failure results in properties having no wastewater outlet ▪ Odour concern due to the presence of vents on collection chambers and within downstream sewers and centralized pumping stations ▪ History of pump blockages and malfunctions cause ongoing issues for homeowners ▪ Does not provide secure alternative as the system depends on power supply at each property local control panels need to be installed inside each home/property ▪ Low pressure system is a proprietary technology which means maintenance and procurements of parts will be through same supplier which could increase capital and maintenance costs ▪ Pumps have 15 year life but operating history indicates failure occurs in less time ▪ Developers for growth areas would be required to use the same system and this may affect house prices as the system does not provide a secure sewer outlet

3.4 Vacuum Sewer System

3.4.1 Description

A vacuum sewer system is similar to a low pressure system, except that vacuum is drawn on the collection system by a central vacuum station, pulling the wastewater through the system rather than pushing it through the system with a series of pumps.

A Vacuum Sewer System Relies on a Central Vacuum Station to "Suck" Wastewater from Each Valve Pit

A traditional gravity line carries wastewater from the individual property to a valve pit. There can be multiple properties connected to a single valve pit. The wastewater collects in the valve pit until it reaches a predetermined volume, at which point the vacuum interface valve inside the valve pit opens. The valve pit has an air intake line that is open to atmosphere, so when the valve opens inside the valve pit, the negative pressure from the vacuum sewer main pulls the wastewater into the vacuum sewer main. When the sewage levels within the pit reach a predetermined minimum, the vacuum valve closes and atmospheric pressure is restored within the valve pit. After the valve closes, the sewage travels along the vacuum sewer main as far as its momentum will allow. It will sit in the vacuum main until either the same valve pit or another one connected to the vacuum sewer main has reached its maximum volume and the process gets repeated. Each time a vacuum interface valve is opened along the vacuum sewer main, it moves the wastewater closer to the vacuum station. Within each vacuum station there are vacuum pumps keeping vacuum on the system at a constant level and a collection tank. When the collection tank reaches a specific volume of sewage, it is pumped into a forcemain and carried to the treatment plant.

Like gravity sewers, vacuum sewers are installed on a slope toward the vacuum station, but with periodic lifts installed to return it to a shallower elevation, resulting in a vertical zigzag configuration. The vacuum valve pits are typically owned by the municipality and located on private property, so easements would be required for maintenance purposes. The equipment in the station includes a collection tank, a vacuum reservoir tank, vacuum pumps, sewage pumps, pump controls and an emergency generator. Vacuum stations can take advantage of available slope in the terrain, but are most economical in a flat terrain. Vacuum sewer systems may be combined with other collection system technologies. Below is a diagram of AIRVAC's vacuum sewer collection system (Figure 9).

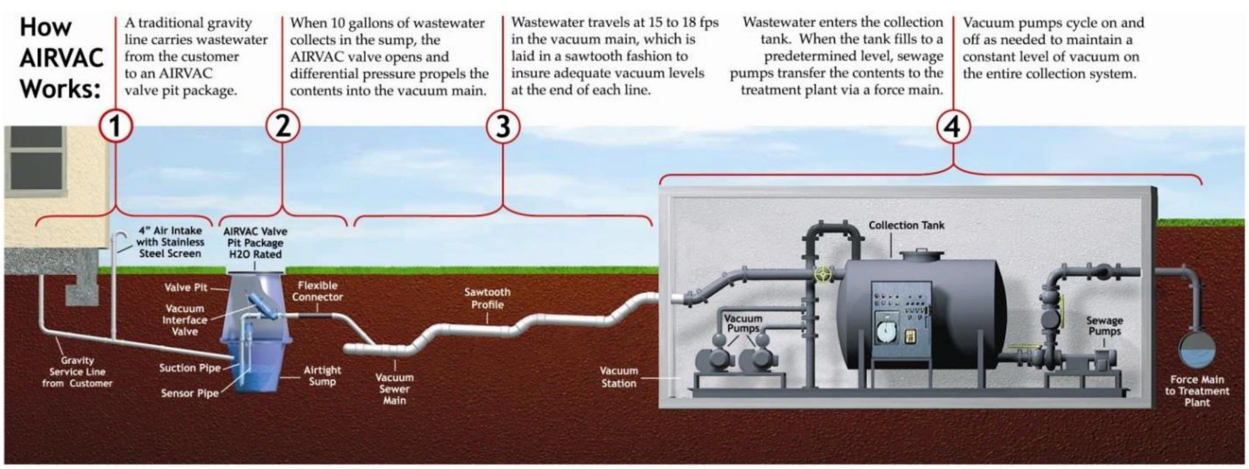


Figure 9 – Schematic of Vaccum Sewer System from AIRVAC

3.4.2 Conceptual Planning for Vacuum Sewer System

A potential vacuum system design alternative was provided to Ainley by a vacuum system supplier and was subsequently modified by the Ainley team based on our review of the Town's topography. There are three primary catchments identified for the vacuum sewer. The catchment areas are shown graphically in ***Appendix F***. The catchments identified are outlined below. Additionally, 3 sub-catchments have been identified all discharging to Catchment 3.

Hillsburgh (Catchment 1)

The Hillsburgh catchment collects all wastewater from within Hillsburgh. It is recommended that this catchment should terminate close to the junction of Trafalgar Road and the Elora Cataract Trail. Since it is not feasible to pump into a vacuum collection main, this station will discharge directly into the pumping station for Catchment 2.

North Erin Village (Catchment 2)

The North Erin catchment collects all wastewater from the industrial area and a portion of the wastewater from the core residential area. It is recommended that this catchment should terminate at the proposed pumping station location adjacent to the junction of Main Street and the Elora Cataract Trail. Since it is not feasible to pump into a vacuum collection main, this station will discharge directly into the pumping station for Catchment 3.

South Erin Village (Catchment 3)

The South Erin catchment collects wastewater from locations within Erin Village south of Scotch St. in addition this catchment also includes the Erin Heights Dr. subdivision. It is recommended that this catchment should terminate in Lion's Park. All wastewater from Hillsburgh and Erin Village will ultimately pass through this station and be transmitted to the treatment plant location.

Erin Heights, Sub-Catchment 1

The Erin Heights subdivision is separated from the downtown of Erin Village by a significant river valley intersecting Dundas St. W. west of Carberry St. In addition the Erin Heights subdivision is situated on a significant slope with an elevation difference of over 30 m between the highest location at the west end of the subdivision and the lowest location where Erin Heights Drive diverts east towards Dundas Street West Based on the local topography, a vacuum station will be required at the north end of the catchment and will likely be situated within the road allowance. Since it is not feasible to pump into a vacuum collection main, this station will discharge directly into the previously identified forcemain from the pumping station for Catchment 2. It should be noted that there is minimal space available for the construction of a vacuum station for this catchment and it would represent a significant design challenge.

Dundas St. E., Sub-Catchment 2

The intersection of Dundas St. East and Tomwell Crescent is a local low point which lies at an elevation of 5 m below the surrounding area. Connecting this low lying area to a gravity main along Daniel St. or Main St. would require deep excavation, in excess of 7m at some points in order to convey wastewater to the primary vacuum stations for either North Erin Village or South Erin Village. A local vacuum station is one option to eliminate the requirement for such a deep trunk sewer excavation. Since it is not feasible to pump into a vacuum collection main, this station will discharge directly into the previously identified forcemain from the pumping station for Catchment 2.

Scotch St., Sub-Catchment 3

There is a section of Scotch St. north of the intersection with Wheelock St. which lies at an elevation 4 m below the surrounding area. Connecting this low lying area to a gravity main along Daniel St. would require a section of the Daniel St. sewer to be constructed at a depth of up to 8 m. A local vacuum station eliminates the requirement for an excessively deep trunk sewer along Daniel St. Since it is not feasible to pump into a vacuum collection main, this station will discharge directly into the previously identified forcemain from the pumping station for Catchment 2.

3.4.3 Analysis of Vacuum Sewer System

Ownership of Vacuum Pits

The ownership of each vacuum pit is a decision which must be made in establishing a vacuum collection system, i.e. whether the Town should own and maintain all of the vacuum pits or if the pits should be owned and maintained by each property owner. In contrast to a low pressure sewer system the vacuum pits have limited mechanical components and are comparatively less likely to experience operational issues. It is possible for clogs to occur within the vacuum collection pits causing a disruption to the service. It is unlikely that all homeowners will be both willing and able to maintain their own vacuum pit. It is preferable for the Town to maintain ownership and responsibility for the vacuum system components to ensure operation.

Operation of Vacuum Collection

Unlike the operation of a low pressure system, the energy required to draw wastewater through the vacuum collection system is centralised at the vacuum collection stations. As such, the operation of the collection system during power outages can be managed through ensuring back-up power generation at each vacuum station. In this respect, the operation of a vacuum sewer system is similar to a gravity collection system, there is no variability in costs to the users of the system as all operational costs are centralised.

Unlike a conventional gravity system, it is not possible to connect a pumping station to a separate section of vacuum sewer. In short, each vacuum sewer catchment must be independent and must discharge to either the treatment site or the wetwell of a pumping station. Due to this particular property of vacuum collection systems this technology is not ideal for locations with high topographical variability. For locations with high topographic variability many small vacuum catchments are required and results in a requirement for numerous forcemains and increases the number of pumps required to generate the negative line pressure which ultimately negates the advantage of shallower pipe construction. Further, the operation of the vacuum pumps required to provide the suction and lift to the vacuum stations are expensive to operate due to the high energy demand.

For Hillsburgh and the Erin Village, a total of 7 vacuum stations would be required to service the existing community, 6 for Erin Village and 1 for Hillsburgh.

Advantages and disadvantages of vacuum sewage collection system are listed in the Table 6.

Table 6 - Advantages and Disadvantages Vacuum Sewage Collection System

Advantages	Disadvantages
▪ Less excavation required ▪ Can be installed to follow the surface topography, remaining at a relatively constant depth below the surface (below the frost line) ▪ Small pipe diameters are sufficient if vacuum	▪ Vacuum sewer systems can provide a lift of only 3 metres ▪ Homes will require a valve pit on their property ▪ Best suited for flat areas with poor soils and/or high groundwater unlike Erin and

Advantages	Disadvantages
stations properly located ▪ The risk of clogging is low because of pressure differential in pipes ▪ The vacuum station can typically cover a distance of 3 km if the terrain flat enough ▪ Minimal Inflow and Infiltration into the system so smaller pipes and lower flow to WWTP ▪ Lower initial capital costs due to shallower placement and small size of pipes	Hillsburgh. ▪ Systems typically Municipally owned requiring access to each property for maintenance. ▪ Odor concern due to the presence of vents on valve pits and at vacuum stations. ▪ Vacuum systems are proprietary which means maintenance and procurements of parts will be through same supplier which could increase capital and maintenance costs. ▪ System integrity needs to be constantly monitored. ▪ Vacuum station failure quickly affects sewage flow from each property as there is no inherent storage capacity compared to gravity sewers ▪ Vacuum pipe leaks also affect operation of system and can affect sewage servicing from many properties ▪ The system needs more specialist maintenance and operation. ▪ Limited installations in Canada.

4.0 Phase 3B: Overview of Evaluation Methodology

The evaluation methodology used to select the preferred solution for sewage collection for the UCWS Class EA 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 sewage collection system.

In general, the sewage collection system evaluation for this project follows the approach described below:

- Develop screening criteria for both the long and short list;
- Develop a long list of viable technologies;
- Screen the long list of strategies to create a short list of alternatives;
- Development of alternative design concepts for the short list of alternatives;
- Complete detailed evaluation of the short list of alternatives; and
- Identify preliminary preferred alternative solution.

The long list screening criteria identified alternatives that would meet the fundamental project requirements. The short list criteria are scored numerically in four categories: social, technical, economic and environment.

4.1 Description of the Evaluation Criteria

As indicated above, two stages of evaluation were required to enable the preferred alternative solution for wastewater collection to be identified: long list screening criteria and short list evaluation criteria

The first set of criteria was used to screen a long list of collection system options to a short list of collection system alternatives. The purpose of the preliminary screening is to identify only those collection system technologies that are considered "feasible" for this project and eliminate those technologies that do not suit the project constraints and opportunities. This step in the evaluation process ensures that only technologies that fit the project requirements are considered in the next step. Table 7 sets out the criteria used to screen the long list of wastewater collection system options.

Table 7 – Long List Screening Criteria

Criteria	Description
Track Record	Demonstrated track record of ability to collect sewage of a similar sized community and climactic conditions.
Scalability	Demonstrated reliability of full scale experience in similar size.
Staging / phasing	Ability to expand to suit housing development's growth requirements.
Operational and Maintenance (O&M)	Ability to maintain low operation and maintenance costs.
Cost	Have a capital cost commensurate with the benefits provided.

The application of the Long List Criteria to the collection system alternatives is presented in Table 8.

Table 8 – Criteria Rating Rationale

No.	Technology	Description	Screening Criteria						Rationale
			Track Record	Scalability	Staging / Phasing	O&M	Cost	Carry Forward	
1	Traditional Gravity Sewers	▪ Wastewater from each property is conveyed through a connecting sewer to the street/property line where it connects to a gravity sewer. ▪ Typically gravity systems consist of a combination of gravity sewers with pumping stations installed at the lowest elevations of the system, forcemains to convey the sewage to another gravity line at a higher elevation and eventually to the WWTP.	✓	✓	✓	✓	✓	Yes	▪ The technology is the simplest to operate. ▪ Widely used throughout the developed world ▪ The undulating topography in the Erin Village and Hillsburgh suits the use of a gravity system
2	Modified Gravity Sewers	▪ Modified gravity sewers are similar to traditional gravity sewer system but it is installed with a decreased depth of cover.	X	X	✓	✓	✓	No	▪ Does not provide the same level of service to all properties and leaves some property owners responsible for servicing any plumbing in their basements
3	Blended Gravity/ LPS	▪ While generally the Erin Hillsburgh area is suitable for a gravity system, there are some small catchment areas from 4 to 30 houses that would require a pumping station to convey the wastewater to the trunk system. For these smaller more confined low-lying areas grinder pump systems could be used to lift waste to higher gravity mains.	✓	✓	✓	✓	✓	Yes	▪ The technology may provide a lower cost solution for isolated areas or properties at a lower cost than using a gravity/pumping station solution
4	Septic Tank Effluent Gravity Sewer (STEG) and Septic Tank Effluent Pump Sewer (STEP)	▪ STEG and STEP sewers use customized septic tanks on the individual properties to provide liquid/solid separation before conveying just the liquid component through the collection system for treatment.	✓	✓	✓	✓	✓	Yes	▪ The technology reduces the potential for inflow and infiltration into the collection system and reduces WWTP capacity
5	Low Pressure Sewer System	▪ Pressurised sewers differ from conventional gravity collection systems, because they use pumps (grinder) instead of gravity to transport wastewater.	✓	✓	✓	✓	✓	Yes	▪ The technology has the potential to reduce construction cost of the collection system through reduction in sewer size and the lower depth of burial needed for the pipes
6	Vacuum Sewer System	▪ A vacuum sewer system is similar to a low pressure system, except that vacuum created by a central vacuum station, pulls the wastewater through the system rather than pushing it through the system with a series of pumps.	✓	✓	✓	✓	✓	Yes	▪ The technology reduces the potential for inflow and infiltration into the collection system and reduces WWTP capacity

4.2 Screening of Short List of Sewage Collection System Technologies

In order to select a preferred alternative from the short list, a secondary screening process is applied. The short list of technologies, carried forward from the long list screening, is evaluated against the specific screening criteria described in Table 9 below:

Table 9 – Sewage Collection System Short List Evaluation Criteria

Primary Criteria	Weight	Secondary Criteria	Weight
Social/Culture	15%	Impacts During Construction	20%
		Traffic Disruption/ Truck Traffic	10%
		Effect on Residential Properties	30%
		Effect on Businesses/ Commercial Properties	30%
		Effect on Industrial Properties	10%
Technical	35%	Technology Robustness	30%
		Energy Requirements	20%
		Suitability for Phasing	10%
		Construction Impacts	20%
		Operation and Maintenance Impacts	10%
Economic	40%	Capital Cost	30%
		Life Cycle Net Present Value	40%
		Annual Operation and Maintenance	30%
Environmental	10%	Sustainability	15%
		Greenhouse Gas Generation	5%
		Effect on Groundwater	20%
		Effect on Surface Water/ Fisheries	20%
		Effect on Vegetation/ Wetlands	20%
		Effect on Habitat/ Wildlife	20%

4.2.1 Screening Criteria Definitions

Social/Culture, Impacts During Construction

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

Social/Culture, Traffic Disruption/Truck Traffic

This criterion captures the level of traffic disruption necessary to facilitate construction of the system. This criterion assumes that proper construction staging and traffic management plans are enacted during construction to mitigate disturbances. Also included are ongoing traffic disruptions and truck traffic required for the operation of each system.

Social/Culture, Effect on Residential Properties

This criterion captures the level of impact that establishing and maintaining a collection system alternative has on individual residential properties. Impacts considered include replumbing within the home, disturbance to landscaping, tree removals and necessary permanent fixtures on the property.

Social/Culture, Effect on Commercial Properties

This criterion captures the level of impact that establishing and maintaining a collection system alternative has on individual commercial properties. Impacts considered include loss of business, replumbing within the building, disturbance to landscaping, tree removals and necessary permanent fixtures on the property.

Social/Culture, Effect on Industrial Properties

This criterion captures the level of impact that establishing and maintaining a collection system alternative has on individual industrial properties. Impacts considered include loss of business, replumbing within the building, disturbance to landscaping, tree removals and necessary permanent fixtures on the property.

Technical, Technology Robustness

The robustness of a technology is related to the ability of the system to cope with changing system demands and adverse events. Examples would include the ability of the system to cope with unexpected high flow events or continue operation during an extended power outage.

Technical, Energy Requirements

This criterion will capture the amount of energy required to operate the system on an ongoing basis. Systems with lower energy use will be rated more favourably.

Technical, Suitability for Phasing

This criterion captures the capacity of a system to be expanded under a phased development plan. Systems which require minimal component upgrades as the system expands will be rated more favourably.

Technical, Constructability

This criterion captures the impact of the selected system design on the overall constructability of the system. Systems that can be constructed with minimal conflict with existing structures and utilities will be rated more favourably.

Technical, Operational and Maintenance Impacts

This criterion captures the level of effort required by operations staff to operate and maintain the system alternative on an annual basis. Systems which require minimal operational intervention will be rated more favorably.

Economic, Capital Cost

The criterion captures the estimated capital cost for the initial establishment of the system alternative.

Economic, Annual Operation and Maintenance

The criterion captures the estimated cost to operate and maintain the system on an annual basis. Major system component replacements and repairs are not considered as a part of this criteria.

Economic, Life Cycle Net Present Value

The criterion captures the estimated net present value of complete replacement of the proposed system and operation and maintenance of the system to the end of the first life cycle. For the purposes of analysis within this report an 80-year life cycle has been assumed.

Environmental, Sustainability

This criterion captures the level of ease or difficulty with which the system can be maintained on a long term basis. Systems that require a high level of replacement components will be ranked less favourably, particularly where system components are proprietary and may not exist on the market into the future.

Environmental, Greenhouse Gas Generation

The criterion captures the amount of greenhouse gas generation associated with the establishment and operation of the system alternative. Minimizing greenhouse gas generation is rated favourably.

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.

Environmental, Effect on Surface Water/ Fisheries

The criterion captures the impact that the establishment and operation of the system alternative has on the local surface waters. Minimizing contamination of the local surface water is rated favourably.

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. Minimizing contamination of the local vegetation and wetlands is rated favourably.

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. Minimizing contamination of the local habitat and wildlife is rated favourably.

4.3 Short Listed Treatment Technologies

4.3.1 Overview

Based on the preceding evaluation, a short list of Sewage Collection System technologies was developed. Those technologies that are considered to be feasible candidates for the collection system are listed below.

- Traditional Gravity Sewers
- Blended Gravity/LPS System
- STEP/STEG sewers
- Low Pressure sewers
- Vacuum Sewer system

4.3.2 Cost Comparison of Short Listed Technologies

The following general assumptions were made in preparation of the cost estimates:

- Estimates of probable capital costs have been developed based on prices obtained from suppliers and from data in Ainley's possession from projects of similar nature and scope. However, the cost estimates presented in this report may be significantly affected by a number of factors which cannot be readily forecast which include amongst others, volume of work in hand or in prospect for contractors or suppliers at the time of the tender calls, future labour contract settlements, inflation and market escalation. For this reason, the actual costs may be different from those presented in this report. However, for the purpose of a relative economic evaluation amongst all options under consideration, it should be highlighted that costs for all options were calculated under the same assumptions and rationale, thus, should prices change over time, the changes would apply proportionally for all options and the results of the comparative cost evaluation would remain unaltered.
- All costs are presented in 2017 Canadian dollars.
- Net present value costs are based on 80 years of operation, maintenance, and component replacement. Capital costs are excluded.
- Inflation and escalation to account for actual expected prices at the time of tendering cannot be accounted for at this time.
- All taxes have been excluded.
- Life cycle costs have been estimated based on an inflation rate of 4%.

Table 10 presents the life cycle cost estimates for the 5 short listed collection system alternatives. ***Appendix G*** includes the details of the cost estimates.

Table 10 – Cost Estimate for System Alternatives

Collection Alternative	Capital Cost	Connection Cost (Home Owner)	Total Capital Cost	System Replacement and Operation NPV	Total Cost (Capital Cost + NPV)
Gravity Sewers	$45,482,000	$10,210,000	$55,692,000	$7,772,000	$63,464,000
Blended Alternative	$43,276,000	$8,930,000	$52,206,000	$7,535,000	$59,741,000
Pressure Sewers	$56,130,000	NIL	$56,130,000	$12,944,000	$69,074,000
Vacuum Sewers	$50,852,800	NIL	$50,852,800	$9,770,000	$60,622,800
STEP/STEG Collection	$52,502,400	NIL	$52,502,400	$8,999,000	$61,501,400

4.3.3 Detailed Evaluation of Collection Options

The evaluation of the short listed sewage collection system options, using the criteria and weightings listed in Table 9 is provided in Table 13.

Table 11 – Weighted Scoring of Short Listed Sewage Collection System Alternatives

PRIMARY CRITERIA		SECONDARY CRITERIA		ABSOLUTE WEIGHT (WT)	Gravity sewer		Blended Grav/ LPS		STEG/STEP		Low Pressure		Vacuum	
CRITERIA	WEIGHT	CRITERIA	WEIGHT		SCORE	WT SCORE	SCORE	WT SCORE	SCORE	WT SCORE	SCORE	WT SCORE	SCORE	WT SCORE
Social/Culture	15%	Impacts During Construction	20	3	2	1.2	2.5	1.5	3	1.8	5	3	3	1.8
		Traffic Disruption/ Truck Traffic	10	1.5	2	0.6	3	0.9	4	1.2	5	1.5	4	1.2
		Effect on Residential Properties	30	4.5	4	3.6	3	2.7	2	1.8	3	2.7	3	2.7
		Effect on Businesses/ Commercial Properties	30	4.5	4	3.6	4	3.6	2	1.8	3	2.7	3	2.7
		Effect on Industrial Properties	10	1.5	4	1.2	4	1.2	2	0.6	3	0.9	3	0.9
Technical	40%	Technology Robustness	30	12	5	12	5	12	4	9.6	2	4.8	3	7.2
		Energy Requirements	20	8	4	6.4	4	6.4	5	8	5	8	2	3.2
		Suitability for Phasing	10	4	4	3.2	4	3.2	4	3.2	5	4	3	2.4
		Constructability	20	8	3	4.8	3	4.8	4	6.4	5	8	4	6.4
		Operation and Maintenance Impacts	20	8	4	6.4	5	8	4	6.4	3	4.8	3	4.8
Environmental	15%	Sustainability	15	2.25	5	2.25	5	2.25	4	1.8	4	1.8	3	1.35
		Greenhouse Gas Generation	5	0.75	3	0.45	3	0.45	4	0.6	4	0.6	2	0.3
		Effect on Groundwater	20	3	4	2.4	4	2.4	4	2.4	3	1.8	5	3
		Effect on Surface Water/ Fisheries	20	3	5	3	5	3	5	3	5	3	5	3
		Effect on Vegetation/ Wetlands	20	3	5	3	5	3	5	3	5	3	5	3
		Effect on Habitat/ Wildlife	20	3	5	3	5	3	5	3	5	3	5	3
Economic	30%	Capital Cost	30	9	3	5.4	4	7.2	4	7.2	4	7.2	5	9
		Operational Costs	40	12	5	12	5	12	4	9.6	3	7.2	2	4.8
		Net Present Value Costs	30	9	5	9	5	9	4	7.2	3	5.4	3	5.4
			TOTAL SCORE	**100**		**83.5**		**86.6**		**78.6**		**73.4**		**66.15**

Based on detailed evaluation of the alternatives, Option No 2 – Blended Gravity Sewers/ Low Pressure System returns the highest score and therefore offers the most benefit.

The details of the scoring and rationale have been provided in Table 14.

Table 12 – Criteria Rating Rationale

Criteria	Gravity Sewer	Blended Gravity / LPS	STEP / STEG	Low Pressure Sewer	Vacuum Sewer
Social/ Culture - Impacts During Construction	▪ Dust production, vibration and noise typical with open cut construction to be anticipated for sewers and SPS.	▪ See Gravity Sewer ▪ See Pressure Sewer for select areas.	▪ Dust production, vibration and noise typical with open cut construction to be anticipated for sewers and SPS.	▪ Dust production, vibration and noise typical with open cut construction to be anticipated for SPS. ▪ Noise and vibration typical with directional drilling construction of sewers.	▪ Dust production, vibration and noise typical with open cut construction to be anticipated.
Social/ Culture - Traffic Disruption/ Truck Traffic	▪ The majority of sewer construction will be completed using open cut construction methods. ▪ Short to medium term traffic diversions and road closures.	▪ See Gravity Sewer ▪ See Pressure Sewer for select areas.	▪ The majority of sewer construction will be completed using open cut construction methods. ▪ Short to medium term traffic diversions and road closures. ▪ Long term reliance on septage haulers	▪ Sewer construction will be completed using a mix of open cut construction methods and directional drilling. ▪ Short to medium term traffic diversions and road closures.	▪ The majority of sewer construction will be completed using open cut construction methods. ▪ Short to medium term traffic diversions and road closures.
Social/ Culture - Effect on Residential Properties	▪ Construction of sewer lateral may require tree removals. ▪ Disruption of landscaping. ▪ Interior plumbing modifications potentially required.	▪ See Gravity Sewer ▪ See Pressure Sewer for select areas	▪ Construction of sewer lateral may require tree removals. ▪ Disruption of landscaping. ▪ New septic tank will need to be installed on the property. ▪ Access to the septic tank must be maintained for regular cleanouts. ▪ Potential for septage spills from tank cleanouts. ▪ Interior plumbing modifications potentially required. ▪ Potential for odours.	▪ Construction of sewer lateral may require tree removals. ▪ Disruption of landscaping. ▪ Low pressure pump system including controls will need to be installed on the property. ▪ Access to pump will need to be maintained to facilitate maintenance. ▪ Interior plumbing modifications potentially required. ▪ Potential for odours.	▪ Construction of sewer lateral may require tree removals. ▪ Disruption of landscaping. ▪ Vacuum pit will need to be installed on the property. ▪ Access to the vacuum pit will need to be maintained for maintenance. ▪ Interior plumbing modifications potentially required. ▪ Potential for odours.
Social/ Culture - Effect on Businesses/ Commercial Properties	▪ Construction of sewer lateral may require tree removals. ▪ Disruption of landscaping. ▪ Interior plumbing modifications potentially required.	▪ See Gravity Sewer • See Pressure Sewer for select areas.	▪ Construction of sewer lateral may require tree removals. ▪ Disruption of landscaping. ▪ New septic tank will need to be installed on the property. ▪ Access to the septic tank must be maintained for regular cleanouts. ▪ Interior plumbing modifications potentially required. ▪ Potential for odours.	▪ Construction of sewer lateral may require tree removals. ▪ Disruption of landscaping. ▪ Low pressure pump system including controls will need to be installed on the property. ▪ Access to pump will need to be maintained to facilitate maintenance. ▪ Interior plumbing modifications potentially required. ▪ Potential for odours.	▪ Construction of sewer lateral may require tree removals. ▪ Disruption of landscaping. ▪ Vacuum pit will need to be installed on the property. ▪ Access to the vacuum pit will need to be maintained for maintenance. ▪ Interior plumbing modifications potentially required. ▪ Potential for odours.
Social/ Culture - Effect on Industrial Properties	▪ Construction of sewer lateral may require tree removals. ▪ Disruption of landscaping. ▪ Interior plumbing modifications potentially required.	▪ See Gravity Sewer • See Pressure Sewer for select areas.	▪ Construction of sewer lateral may require tree removals. ▪ Disruption of landscaping. ▪ New septic tank will need to be installed on the property.	▪ Construction of sewer lateral may require tree removals. ▪ Disruption of landscaping. ▪ Low pressure pump system including controls will need to be	▪ Construction of sewer lateral may require tree removals. ▪ Disruption of landscaping. ▪ Vacuum pit will need to be installed on the property.

Criteria	Gravity Sewer	Blended Gravity / LPS	STEP / STEG	Low Pressure Sewer	Vacuum Sewer
			▪ Access to the septic tank must be maintained for regular cleanouts. ▪ Interior plumbing modifications potentially required. ▪ Potential for odours.	installed on the property. ▪ Access to pump will need to be maintained to facilitate maintenance. ▪ Interior plumbing modifications potentially required.	▪ Access to the vacuum pit will need to be maintained for maintenance. ▪ Interior plumbing modifications potentially required.
Technical - Technology Robustness	▪ Gravity sewers are designed to accommodate peak flow discharges and can accommodate high flow events without any adverse impacts. ▪ Loss of power has no effect on the ability of gravity sewers to transmit sewage to pumping stations. ▪ Loss of power at pumping stations is managed through the establishment of on-site power generation. ▪ Sewer line breaks may result in extraneous flows entering the collection system or exfiltration of wastewater into the groundwater	▪ See Gravity Sewer ▪ See Pressure Sewer for select areas.	▪ STEP/STEG sewers are designed to accommodate the liquid portion of sewage discharges only. ▪ Small bore sewers may be subject to fowling if septic tank upsets occur. ▪ Loss of power will result in the inability of individual pumps to operate for STEP systems. ▪ Loss of power at pumping stations is managed through the establishment of on-site power generation.	▪ Pressure sewers are designed to accommodate peak flow discharges and can accommodate high flow events without any adverse impacts. ▪ Loss of power will result in the inability of individual pumps to operate. ▪ Loss of power is managed through the storage volume of individual pump pits however power outages exceeding 24 hrs will be problematic.	▪ Vacuum sewers are designed to accommodate peak flow discharges and can accommodate high flow events without any adverse impacts. ▪ Loss of power will result in the inability of the system to transmit sewage to vacuum stations. ▪ Loss of power at vacuum stations is managed through the establishment of on-site power generation.
Technical - Energy Requirements	▪ Energy use is centralized at pumping stations.	▪ See Gravity Sewer ▪ See Pressure Sewer for select areas.	▪ Energy use required for STEP systems. ▪ Energy use required at pumping stations.	▪ Energy use required for low pressure pump systems. ▪ Energy use required at pumping stations.	▪ Energy use required to operate vacuum collection ▪ Energy use required at centralised pumping stations
Technical - Sustainability for Phasing	▪ Split wetwell design can accommodate near term flows as development occurs. ▪ Pump upgrades typically required over time to accommodate greater flow rates.	▪ See Gravity Sewer ▪ See Pressure Sewer for select areas.	▪ Split wetwell design can accommodate near term flows as development occurs. ▪ Pump upgrades typically required over time to accommodate greater flow rates. ▪ Low lying areas easily accommodated by relying on STEP systems.	▪ LPS systems work functionally as a "one size fits all" solution. Expansion through phasing accommodated by properly sized trunk sewers which may be difficult with uncertain growth.	▪ Vacuum stations oversized to accommodate growth. ▪ Pump upgrades typically required over time to accommodate greater flow rates.
Technical - Constructability	▪ Typical construction impacts associated with open cut sewer construction. ▪ Impacts to water crossings and environmentally sensitive areas mitigated through selective use of tunneling.	▪ See Gravity Sewer ▪ See Pressure Sewer for select areas.	▪ Typical construction impacts associated with open cut sewer construction. ▪ Impacts to water crossings and environmentally sensitive areas mitigated through selective use of tunneling.	▪ Typical construction impacts associated with open cut sewer construction. ▪ Impacts to water crossings and environmentally sensitive areas mitigated through selective use of tunneling.	▪ Typical construction impacts associated with open cut sewer construction. ▪ Impacts to water crossings and environmentally sensitive areas mitigated through selective use of tunneling.

Criteria	Gravity Sewer	Blended Gravity / LPS	STEP / STEG	Low Pressure Sewer	Vacuum Sewer
Technical - Operation and Maintenance Impacts	▪ Gravity sewers are subject to fowling, reducing capacity over time. ▪ Gravity sewers are subject to infiltration increasing the hydraulic load on pumping stations and the WWTP. ▪ Major mechanical operation and maintenance requirements are centralized at pumping stations ▪ Standard mechanical components and operation that operators are familiar with. ▪ Minimizes the number of pumps required to operate the system which generally reduces operation and maintenance requirements.	▪ See Gravity Sewer ▪ See Pressure Sewer for select areas.	▪ Regular septic tank cleanouts required ▪ Septic systems are sensitive to improper use; bulking can occur and may get transmitted into the system which is designed for only water. ▪ Gravity sewers are subject to infiltration increasing the hydraulic load on pumping stations and the WWTP. ▪ Mechanical operation and maintenance requirements are dispersed throughout the community on private lots. ▪ Lies between minimum and maximum number of pumps required to operate the system. Middle range maintenance requirements. ▪ Commercial entities may introduce clogging issues.	▪ Pressure sewers minimize fowling over time and should maintain consistent capacity ▪ Centralized pumping stations still required due to the highly variant topography and the geographical separation between Erin and Hillsburgh ▪ Maximizes the number of pumps required to operate the system which generally increases operation and maintenance requirements	▪ Sawtooth vacuum sewer design may create optimal conditions for sedimentation ▪ Vacuum sewer breaks will eliminate system functionality within the catchment area. ▪ Atypical system type which operators will likely be unfamiliar with. ▪ Similar pumping arrangement to gravity sewers, however pumps cannot discharge into vacuum sewer catchments. Pumps must discharge to downstream pumping stations maximizing forcemain lengths. High potential H2S formation.
Economic - Capital Cost	▪ Presented in Table 10.	▪ Presented in Table 10.	▪ Presented in Table 10.	▪ Presented in Table 10.	▪ Presented in Table 10.
Economic - Life Cycle Net Present Value	▪ Presented in Table 10.	▪ Presented in Table 10.	▪ Presented in Table 10.	▪ Presented in Table 10.	▪ Presented in Table 10.
Economic - Annual Operation and Maintenance	▪ Presented in Table 10.	▪ Presented in Table 10.	▪ Presented in Table 10.	▪ Presented in Table 10.	▪ Presented in Table 10.
Environmental - Sustainability	▪ Long lifespan anticipated for most system components ▪ No use of proprietary equipment which may be removed from the market	▪ See Gravity Sewer ▪ See Pressure Sewer for select areas.	▪ Use of proprietary equipment in selective areas for STEP ▪ Long lifespan anticipated for linear infrastructure. ▪ Anaerobic conditions from septic tanks may produce corrosive gases causing system wear	▪ Use of proprietary equipment throughout the system ▪ Short lifespan anticipated for grinder pump systems	▪ Use of proprietary equipment throughout the system ▪ Increased system complexity and potential for mechanical issues.
Environmental - Greenhouse Gas Generation	▪ GHG production associated with power consumption on the low end of alternatives. ▪ GHG production associated with construction on the high end of alternatives (deeper sewer construction, high volume of concrete used)	▪ See Gravity Sewer ▪ See Pressure Sewer for select areas.	▪ GHG production associated with power consumption in the mid-range of alternatives. ▪ GHG production associated with construction on the high end of alternatives (deeper sewer construction, high volume of concrete used) ▪ GHG production as a result of ongoing need for hauling septage	▪ GHG production associated with power consumption in the mid-range of alternatives. ▪ GHG production associated with construction in the mid-range of alternatives	▪ GHG production associated with power consumption on the high end of alternatives. ▪ GHG production associated with construction on the low end of alternatives (shallow sewer construction, less concrete used)
Environmental - Effect on	▪ Potential for moderate	▪ See Gravity Sewer	▪ Potential for moderate exfiltration of	▪ Potential for significant exfiltration of	▪ Low potential for groundwater

Criteria	Gravity Sewer	Blended Gravity / LPS	STEP / STEG	Low Pressure Sewer	Vacuum Sewer
Groundwater	exfiltration of wastewater in broken sewers. Assumes groundwater elevation is below the pipe depth. ▪ Potential for forcemain breaks and exfiltration of waste into the groundwater	▪ See Pressure Sewer for select areas.	wastewater in broken gravity sewers. Assumes groundwater elevation is below the pipe depth. ▪ Potential for significant exfiltration of wastewater from broken pressure sewers. Groundwater level independent. ▪ Potential for forcemain breaks and exfiltration of waste into the groundwater	wastewater from broken pressure sewers. Groundwater level independent. ▪ Potential for forcemain breaks and exfiltration of waste into the groundwater	contamination. ▪ Broken lines may result in significant inflow due to negative line pressure. ▪ Potential for forcemain breaks and exfiltration of waste into the groundwater
Environmental - Effect on Surface Water/ Fisheries	▪ System predominantly constructed in existing ROW, minimizing effect on water/fisheries.	▪ See Gravity Sewer	▪ System predominantly constructed in existing ROW, minimizing effect on water/fisheries.	▪ System predominantly constructed in existing ROW, minimizing effect on water/fisheries.	▪ System predominantly constructed in existing ROW, minimizing effect on water/fisheries.
Environmental - Effect on Vegetation/ Wetlands	▪ System predominantly constructed in existing ROW, minimizing effect on vegetation/wetlands.	▪ See Gravity Sewer	▪ System predominantly constructed in existing ROW, minimizing effect on vegetation/wetlands.	▪ System predominantly constructed in existing ROW, minimizing effect on vegetation/wetlands.	▪ System predominantly constructed in existing ROW, minimizing effect on vegetation/wetlands.
Environmental - Effect on Habitat/ Wildlife	▪ System predominantly constructed in existing ROW, minimizing effect on habitat/wildlife.	▪ See Gravity Sewer	▪ System predominantly constructed in existing ROW, minimizing effect on habitat/wildlife.	▪ System predominantly constructed in existing ROW, minimizing effect on habitat/wildlife.	▪ System predominantly constructed in existing ROW, minimizing effect on habitat/wildlife.

5.0 Conclusions and Recommendations

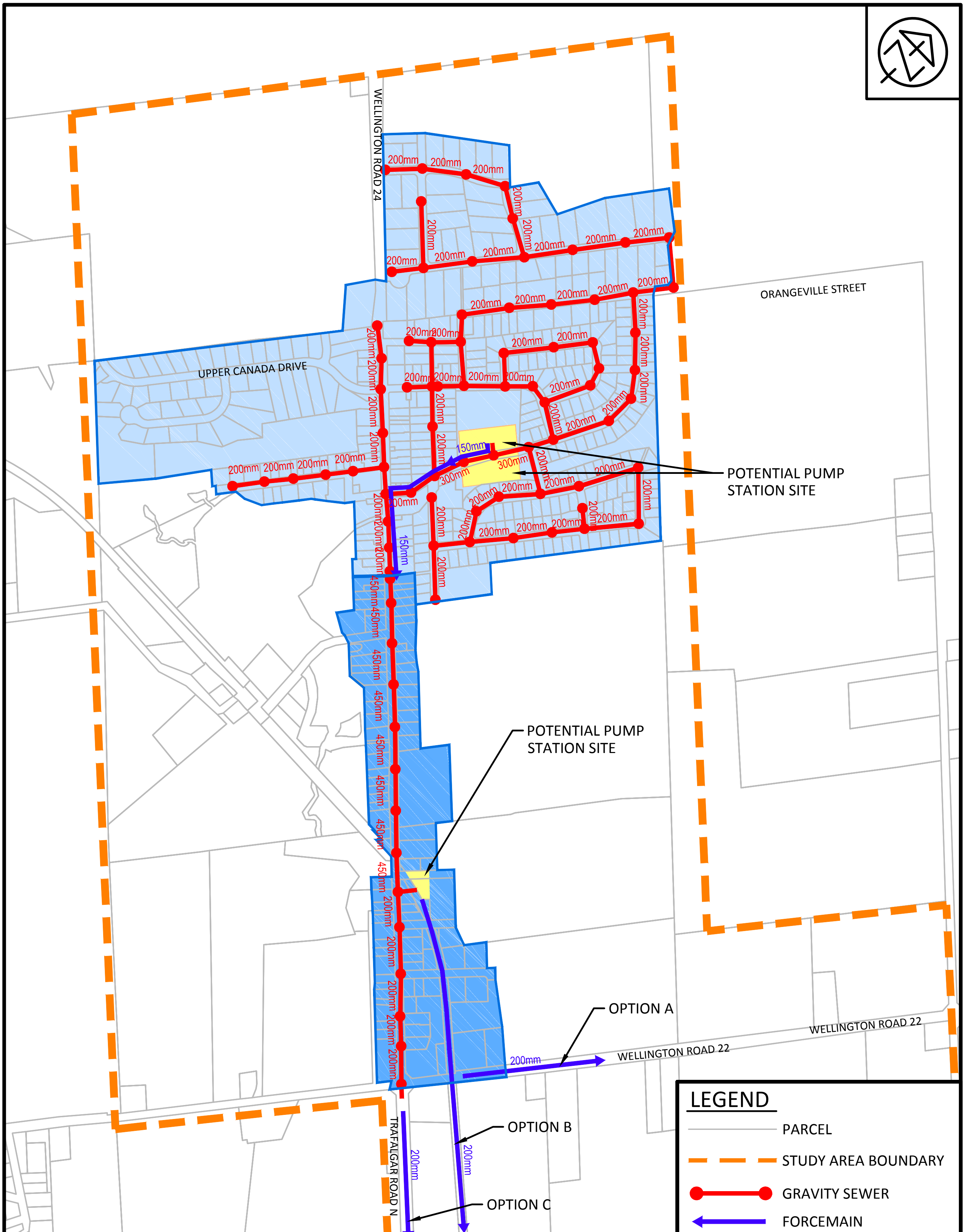
- In 2014 the Town of Erin completed a Servicing and Settlement Master Plan (SSMP) to address servicing, planning and environmental issues within the Town.
- The SSMP considered servicing and planning alternatives for wastewater and identified a centralised collection and treatment system as the preferred waste management alternative.
  - The SSMP concluded that the wastewater collection system will convey sewage to a single wastewater treatment plant located south east of the Erin Village with treated effluent being discharged 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 wastewater collection for the existing urban areas of the Erin Village and Hillsburgh.
- In total, six different collection system alternatives are considered in the evaluation including:
  - Traditional Gravity Sewers
  - Modified Gravity Sewers
  - Blended Gravity/ LPS
  - Septic Tank Effluent Gravity Sewer (STEG) and Septic Tank Effluent Pump Sewer (STEP)
  - Low Pressure Sewer System
  - Vacuum Sewer System
- A detailed description of how each system alternative operates, the advantages and disadvantages of each system and the key issues affecting each system in the context of Erin is provided in Section 2.0.
- Modified gravity sewers were eliminated from the long list of alternatives on the basis that there would be difficulty accommodating deep basements with expansion of the collection system into new service areas. All other alternatives were carried forward for further evaluation.
- The evaluation criteria were established with the following weighting for the primary criteria:
  - Social/ Cultural Impacts – 15%
  - Environmental Impacts - 10%
  - Technical Aspects – 35%
  - Economics – 40%
- The capital costs, annual operation and maintenance costs, and net present value were calculated for each system and are presented below:

Table 13 – Capital and NPV Costs for System Alternatives

Collection Alternative	Capital Cost	Connection Cost (Home Owner)	Total Capital Cost	System Replacement and Operation NPV	Total Cost (Capital Cost + NPV)
Gravity Sewers	$45,482,000	$10,210,000	$55,692,000	$7,772,000	$63,464,000
Blended Alternative	$43,276,000	$8,930,000	$52,206,000	$7,535,000	$59,741,000
Pressure Sewers	$56,130,000	NIL	$56,130,000	$12,944,000	$69,074,000
Vacuum Sewers	$50,852,800	NIL	$50,852,800	$9,770,000	$60,622,800
STEP/STEG Collection	$52,502,400	NIL	$52,502,400	$8,999,000	$61,501,400

- Based on the overall evaluation of system alternatives under the evaluation criteria the “Blended Gravity/ LPS” alternative was selected.
- The blended system is the second most expensive on a capital cost basis however the annual operation and maintenance costs are the lowest overall.
- Mapping of the proposed system is available in Appendix A of this report.

Appendix A
Gravity Collection System Design Basis



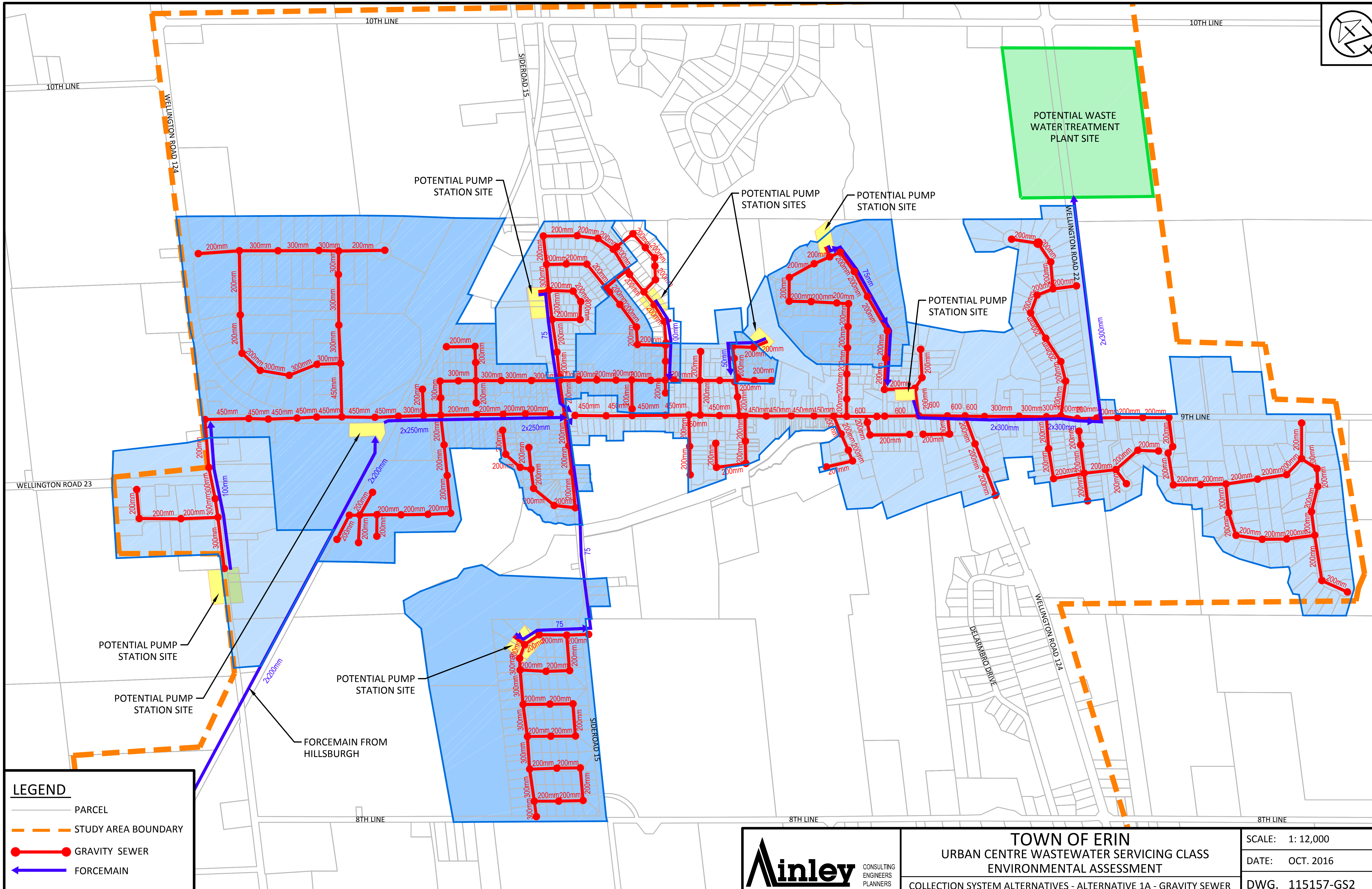
Ainley CONSULTING ENGINEERS PLANNERS

TOWN OF ERIN

URBAN CENTRE WASTEWATER SERVICING CLASS ENVIRONMENTAL ASSESSMENT

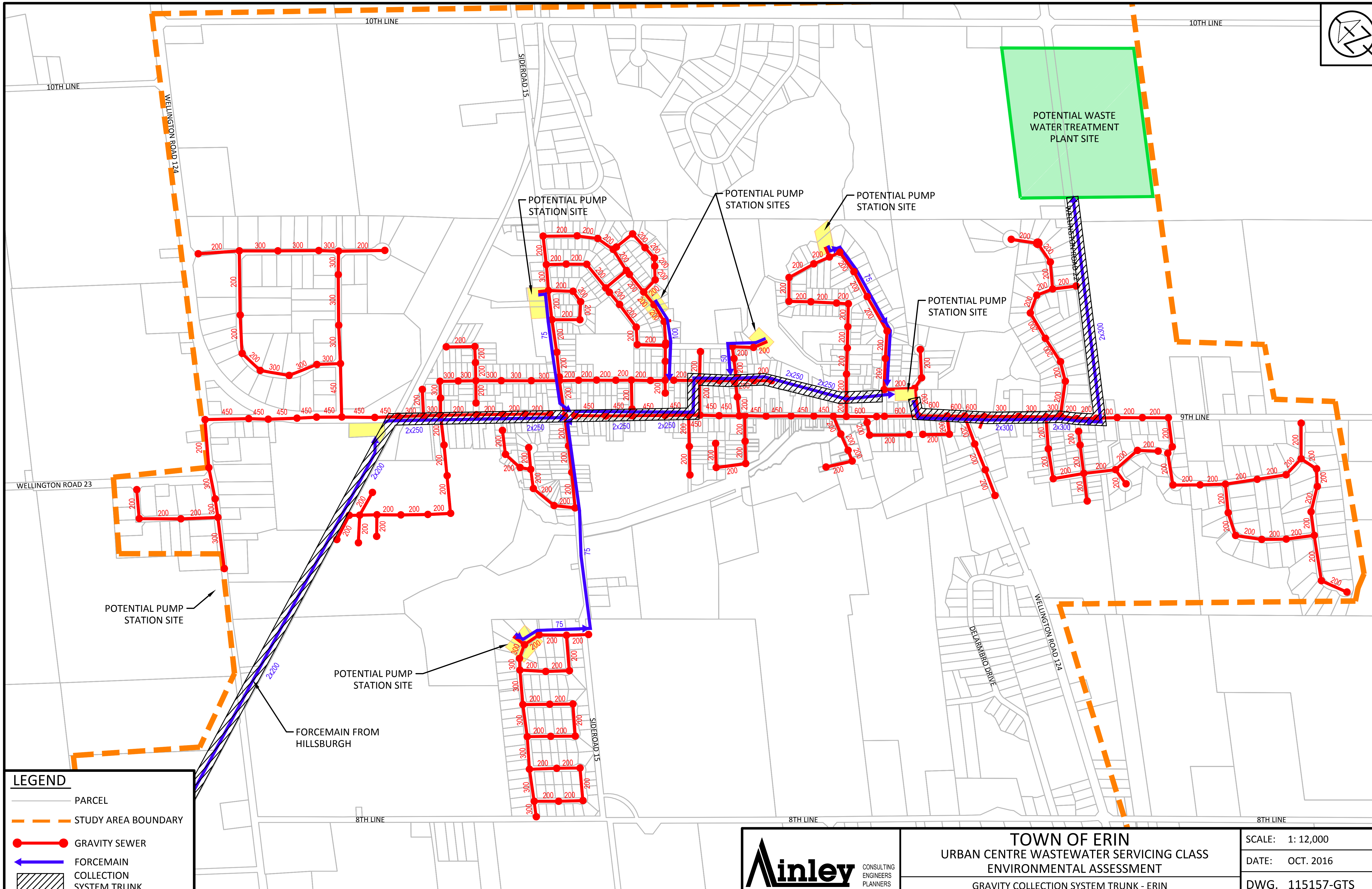
COLLECTION SYSTEM ALTERNATIVES - ALTERNATIVE 1 - GRAVITY

SCALE:	1: 12,500
DATE:	MARCH 2017
DWG.	115157-GS1



10TH LINE
10TH LINE
10TH LINE
SIDEROAD 15
WELLINGTON ROAD 124
WELLINGTON ROAD 22
WELLINGTON ROAD 23
9TH LINE
8TH LINE
8TH LINE
8TH LINE
SIDEROAD 15
DELARMBRO DRIVE
WELLINGTON ROAD 124
POTENTIAL WASTE WATER TREATMENT PLANT SITE
POTENTIAL PUMP STATION SITE
POTENTIAL PUMP STATION SITES
POTENTIAL PUMP STATION SITE
POTENTIAL PUMP STATION SITE
POTENTIAL PUMP STATION SITE
POTENTIAL PUMP STATION SITE
POTENTIAL PUMP STATION SITE
FORCEMAIN FROM HILLSBURGH
2x200mm
2x250mm
2x300mm
100mm
75mm
50mm
75
LEGEND
PARCEL
STUDY AREA BOUNDARY
GRAVITY SEWER
FORCEMAIN
Ainley CONSULTING ENGINEERS PLANNERS
TOWN OF ERIN
URBAN CENTRE WASTEWATER SERVICING CLASS ENVIRONMENTAL ASSESSMENT
COLLECTION SYSTEM ALTERNATIVES - ALTERNATIVE 1A - GRAVITY SEWER
SCALE: 1: 12,000
DATE: OCT. 2016
DWG. 115157-GS2

Appendix B
Collection System Trunk Network


10TH LINE
SIDEROAD 15
WELLINGTON ROAD 124
POTENTIAL WASTE WATER TREATMENT PLANT SITE
POTENTIAL PUMP STATION SITE
POTENTIAL PUMP STATION SITES
9TH LINE
WELLINGTON ROAD 23
FORCEMAIN FROM HILLSBURGH
DELARMBRO DRIVE
8TH LINE
LEGEND
PARCEL
STUDY AREA BOUNDARY
GRAVITY SEWER
FORCEMAIN
COLLECTION SYSTEM TRUNK
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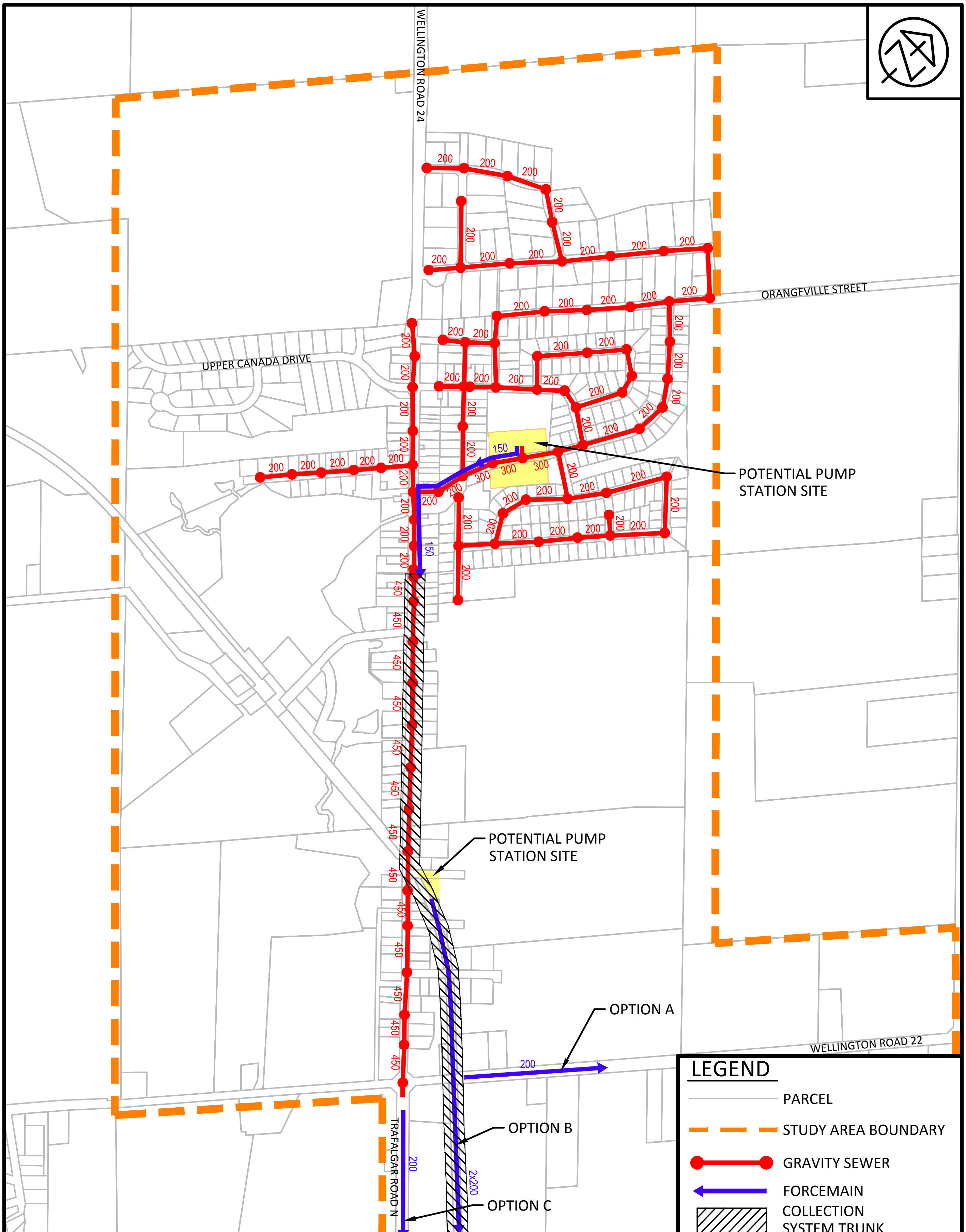
URBAN CENTRE WASTEWATER SERVICING CLASS ENVIRONMENTAL ASSESSMENT
GRAVITY COLLECTION SYSTEM TRUNK - ERIN
SCALE: 1: 12,000
DATE: OCT. 2016
DWG. 115157-GTS



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TOWN OF ERIN

URBAN CENTRE WASTEWATER SERVICING CLASS ENVIRONMENTAL ASSESSMENT

GRAVITY COLLECTION SYSTEM ALTERNATIVES - HILLSBURGH

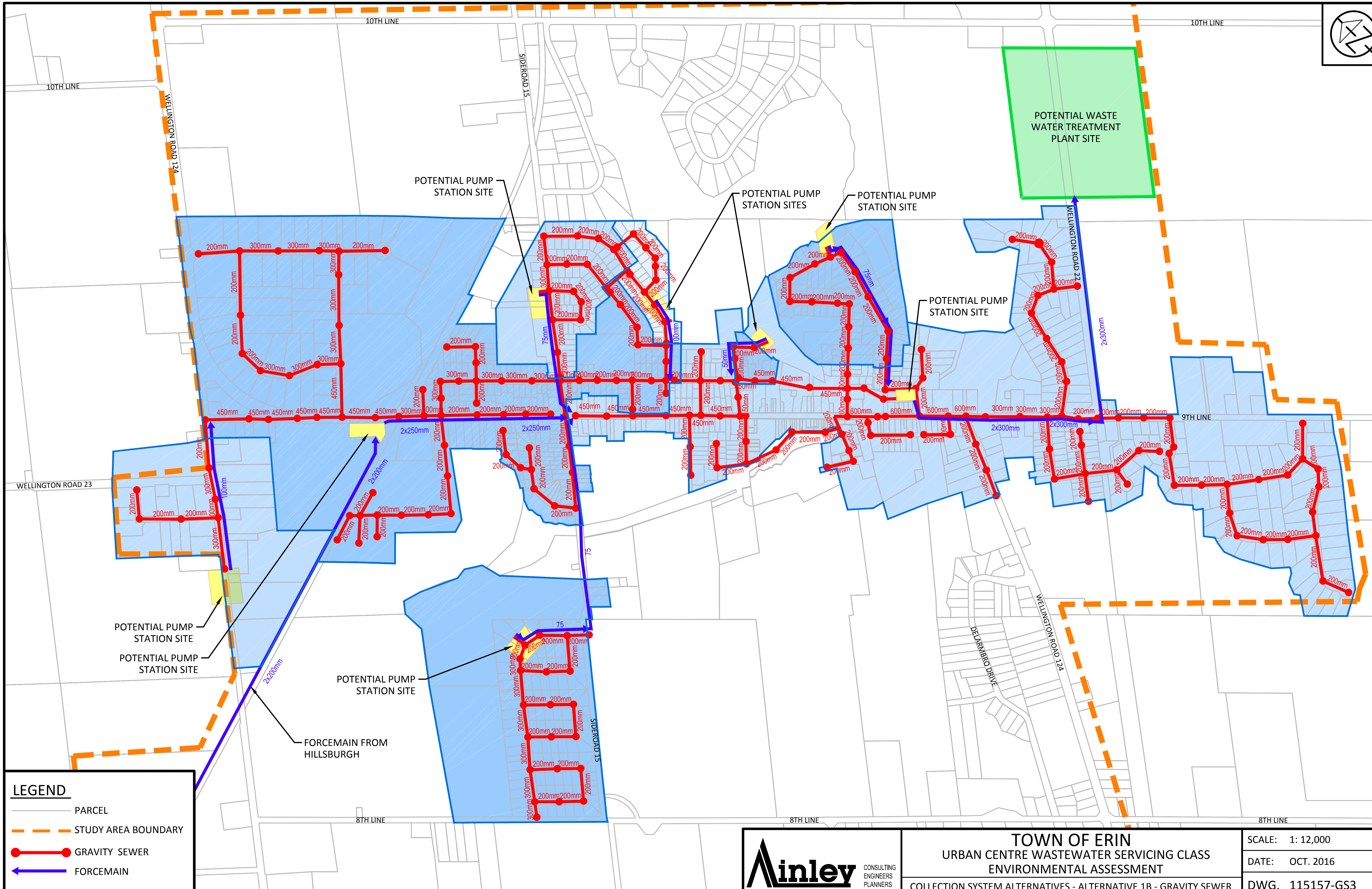
SCALE: 1: 12,500

DATE: OCT. 2016

DWG. 115157-GTS

Appendix C

Gravity Collection System – Alternative Downtown Servicing in Erin



LEGEND

- PARCEL
- STUDY AREA BOUNDARY
- GRAVITY SEWER
- FORCEMAIN

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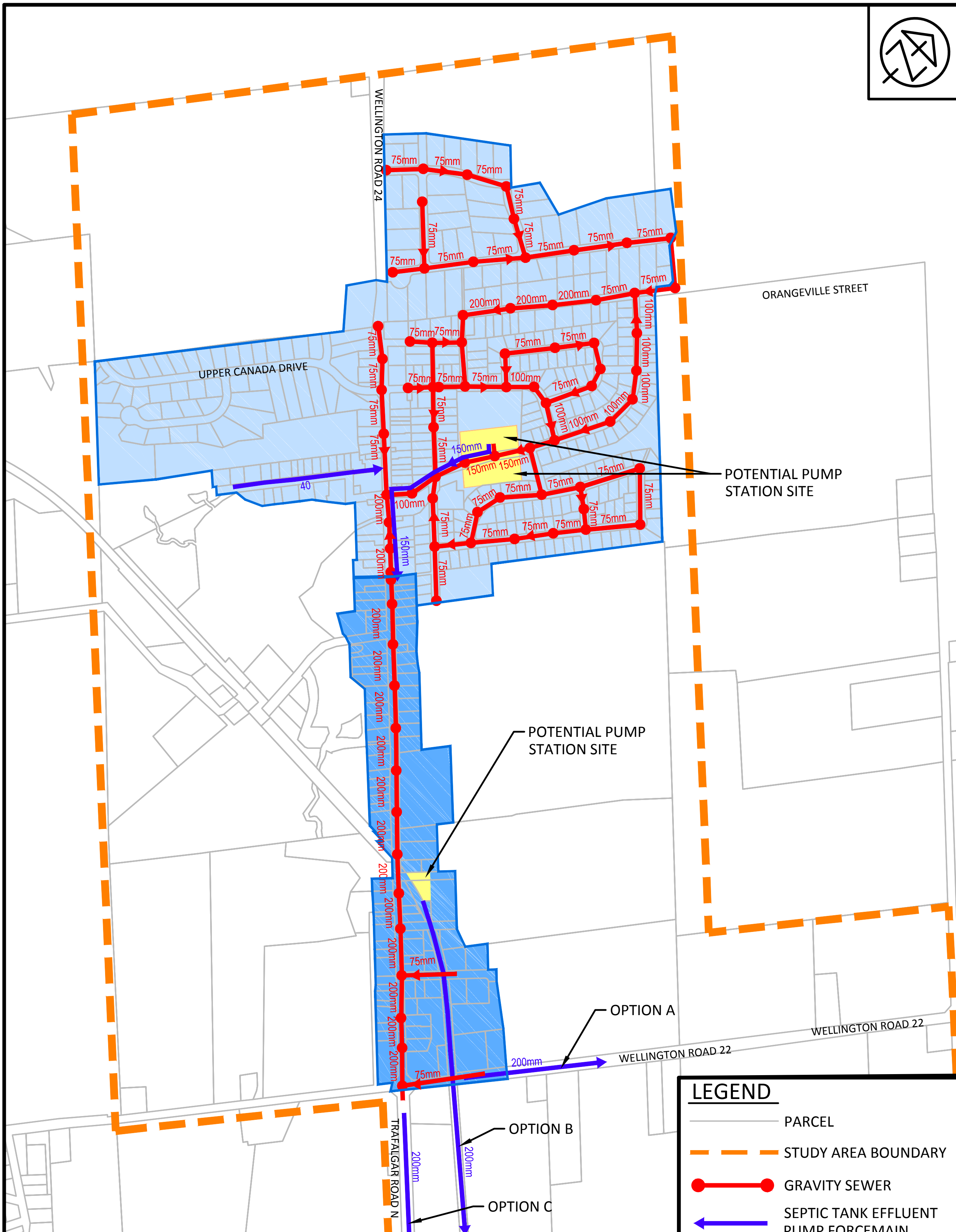
TOWN OF ERIN
URBAN CENTRE WASTEWATER SERVICING CLASS ENVIRONMENTAL ASSESSMENT
COLLECTION SYSTEM ALTERNATIVES - ALTERNATIVE 1B - GRAVITY SEWER

SCALE: 1: 12,000
DATE: OCT. 2016
DWG. 115157-GS3

Appendix D
STEP/STEG Collection System Design Basis



Ainley CONSULTING ENGINEERS PLANNERS

TOWN OF ERIN

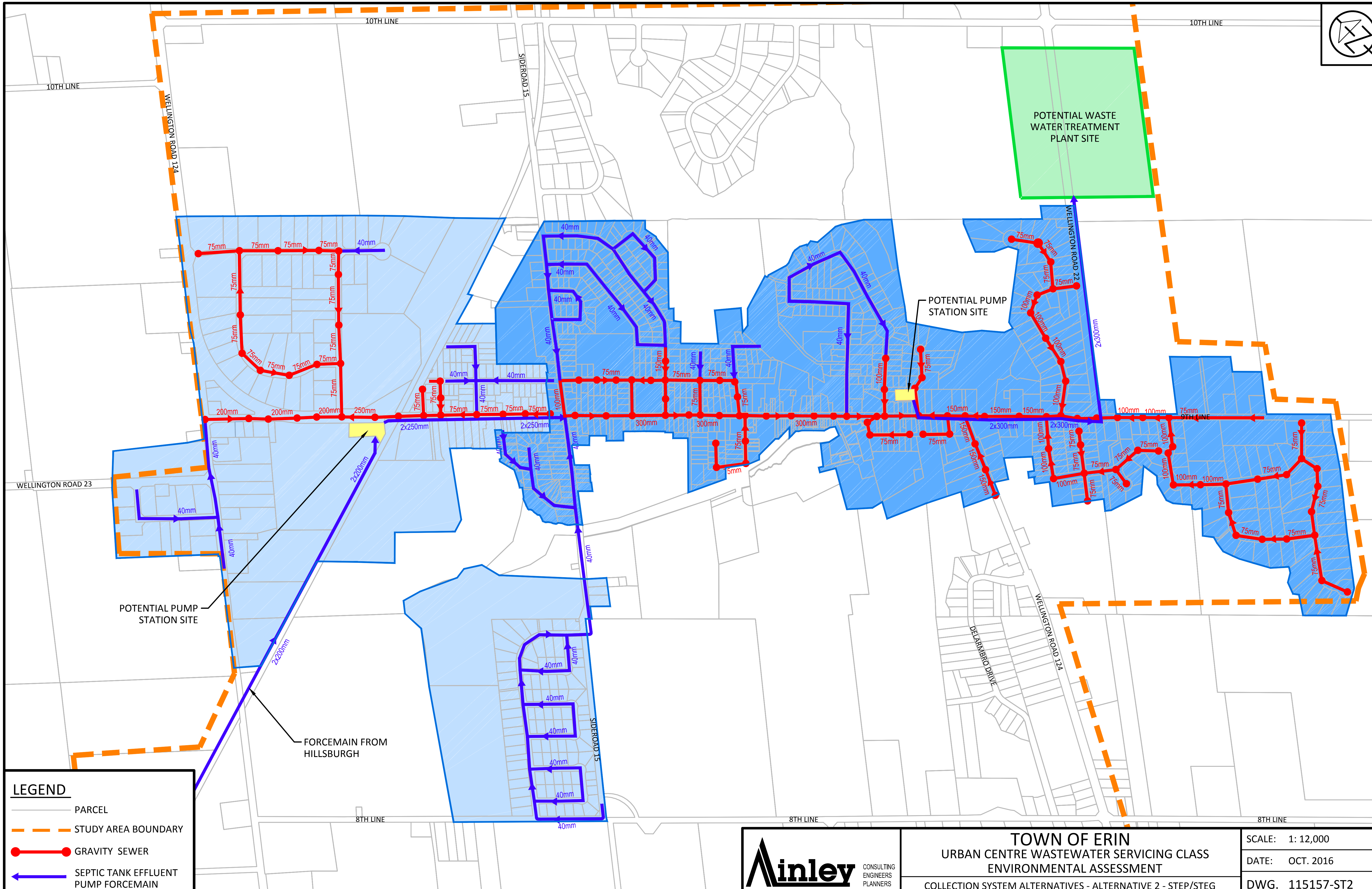
URBAN CENTRE WASTEWATER SERVICING CLASS ENVIRONMENTAL ASSESSMENT

COLLECTION SYSTEM ALTERNATIVES - ALTERNATIVE 2 - STEP/STEG

SCALE: 1: 12,500

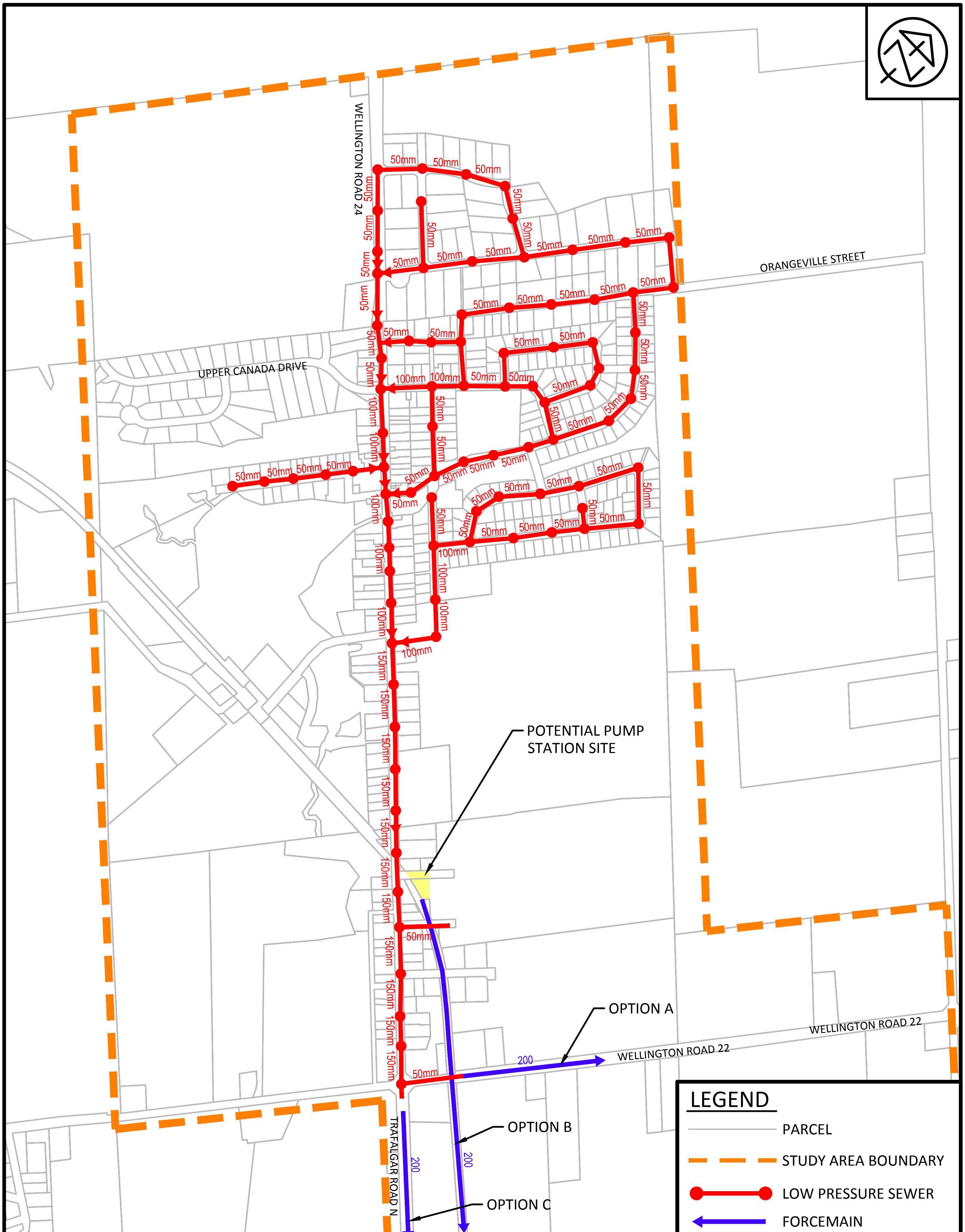
DATE: MARCH 2017

DWG. 115157-ST1



10TH LINE
SIDEROAD 15
WELLINGTON ROAD 124
WELLINGTON ROAD 22
WELLINGTON ROAD 23
9TH LINE
8TH LINE
DELARMBRO DRIVE
POTENTIAL WASTE WATER TREATMENT PLANT SITE
POTENTIAL PUMP STATION SITE
POTENTIAL PUMP STATION SITE
FORCEMAIN FROM HILLSBURGH
2x200mm
2x250mm
2x300mm
LEGEND
PARCEL
STUDY AREA BOUNDARY
GRAVITY SEWER
SEPTIC TANK EFFLUENT PUMP FORCEMAIN
Ainley CONSULTING ENGINEERS PLANNERS
TOWN OF ERIN
URBAN CENTRE WASTEWATER SERVICING CLASS ENVIRONMENTAL ASSESSMENT
COLLECTION SYSTEM ALTERNATIVES - ALTERNATIVE 2 - STEP/STEG
SCALE: 1: 12,000
DATE: OCT. 2016
DWG. 115157-ST2

Appendix E
Low Pressure Collection System Design Basis



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TOWN OF ERIN

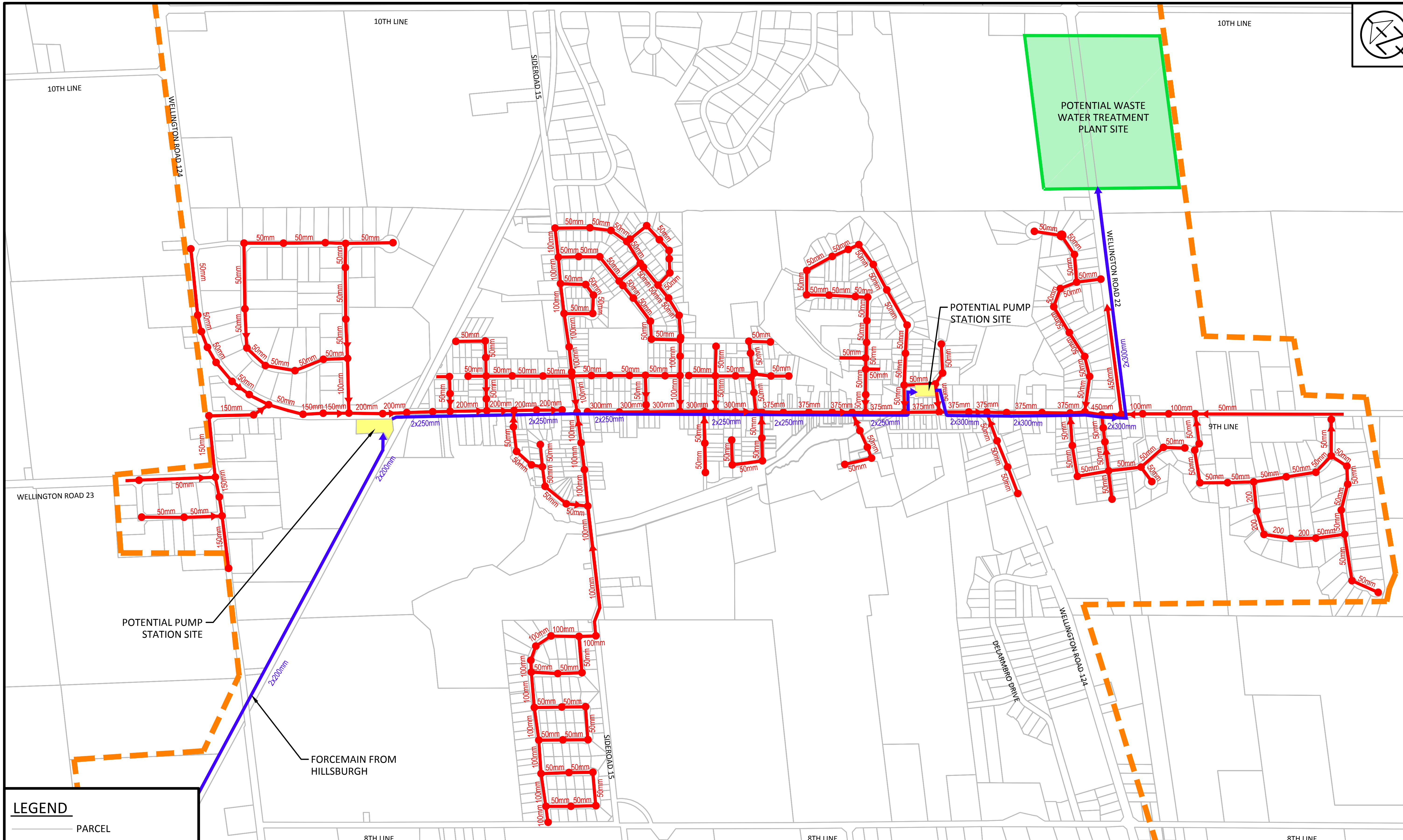
URBAN CENTRE WASTEWATER SERVICING CLASS ENVIRONMENTAL ASSESSMENT

COLLECTION SYSTEM ALTERNATIVES - ALTERNATIVE 3 - LOW PRESSURE

SCALE: 1: 12,500

DATE: MARCH 2017

DWG. 115157-LP1



LEGEND

PARCEL

STUDY AREA BOUNDARY

LOW PRESSURE SEWER

FORCEMAIN

Ainley CONSULTING ENGINEERS PLANNERS

TOWN OF ERIN

URBAN CENTRE WASTEWATER SERVICING CLASS ENVIRONMENTAL ASSESSMENT

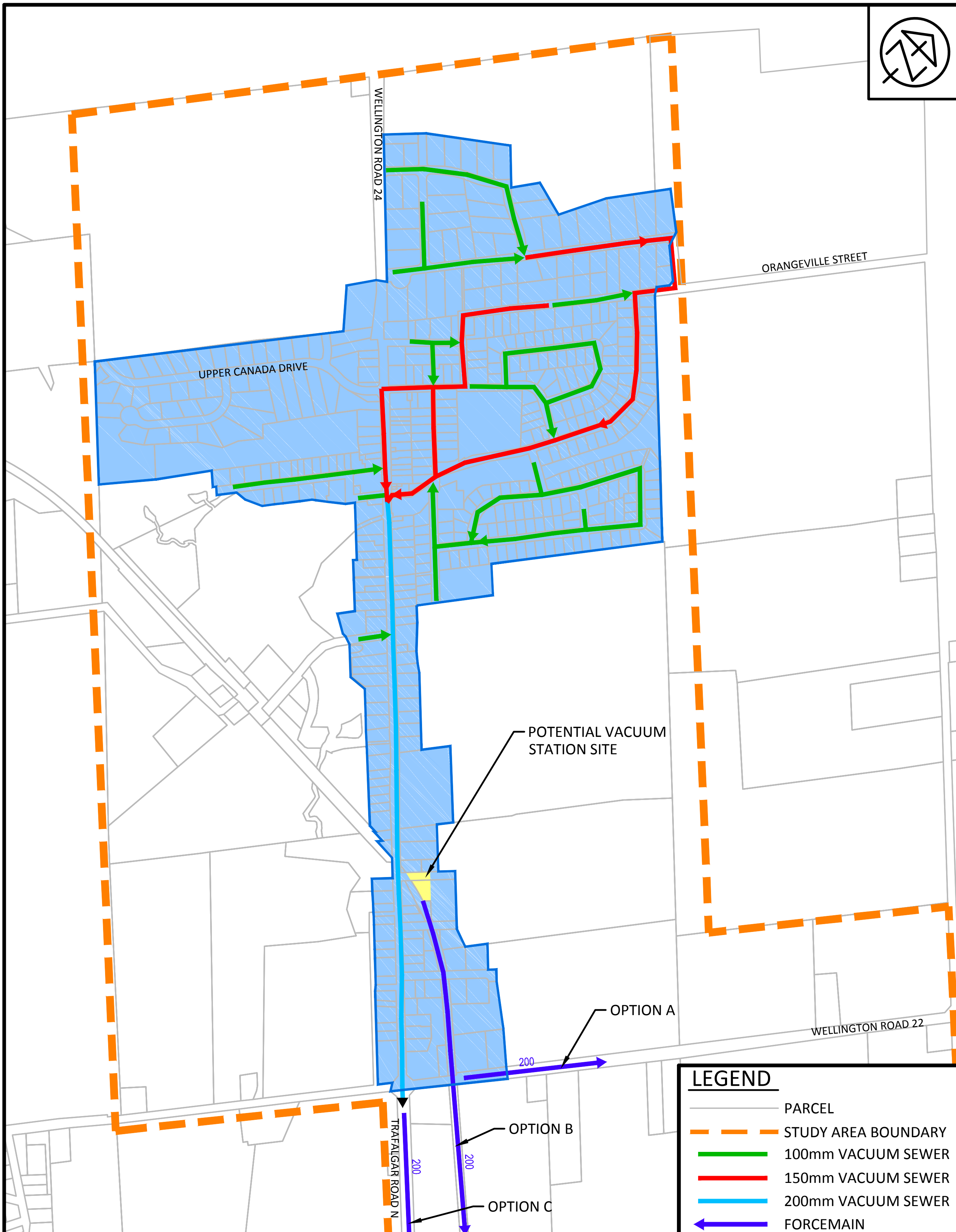
COLLECTION SYSTEM ALTERNATIVES - ALTERNATIVE 3 - LOW PRESSURE

SCALE: 1: 12,000

DATE: OCT. 2016

DWG. 115157-LP2

Appendix F
Vacuum Collection System Design Basis



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TOWN OF ERIN

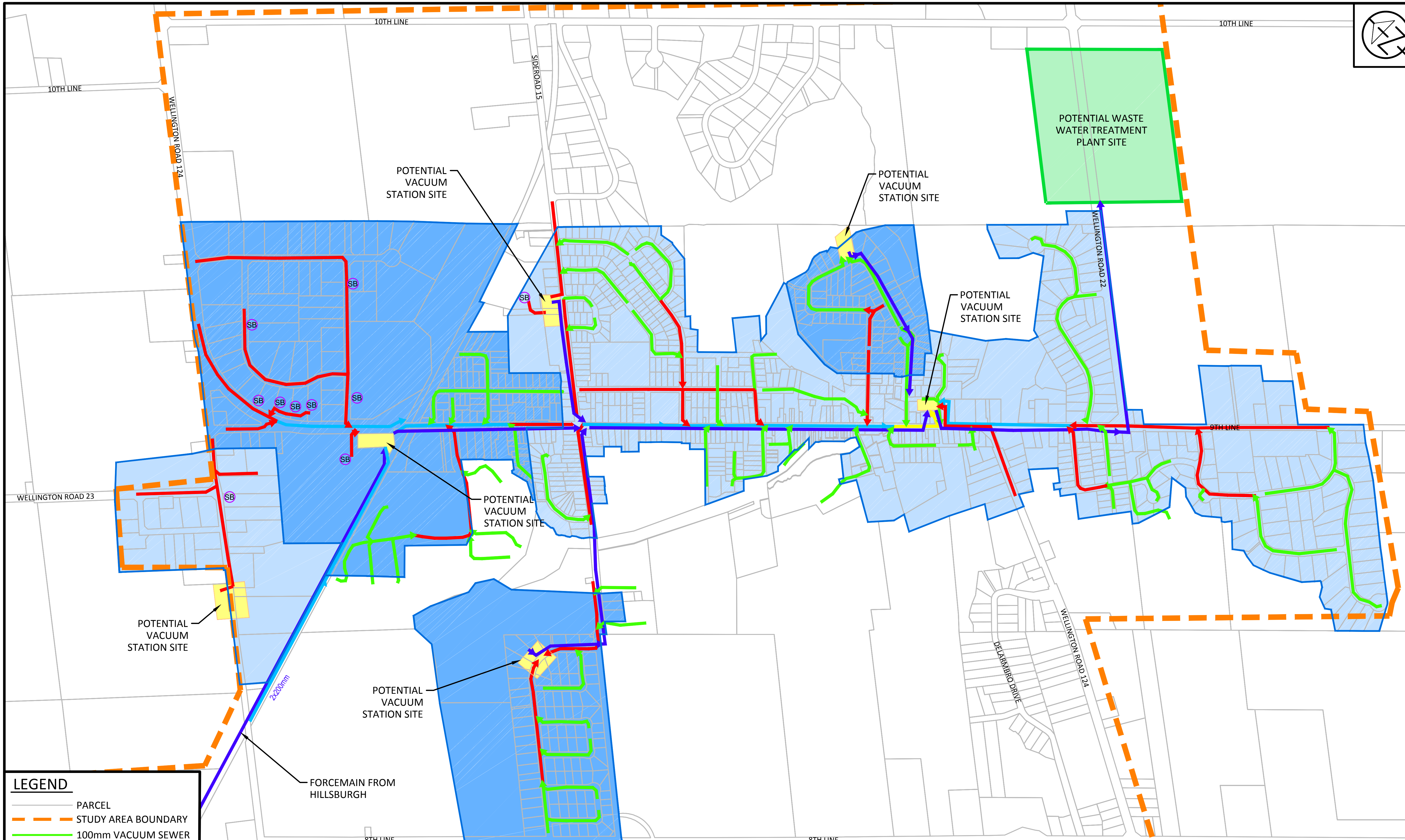
URBAN CENTRE WASTEWATER SERVICING CLASS ENVIRONMENTAL ASSESSMENT

COLLECTION SYSTEM ALTERNATIVES - ALTERNATIVE 4 - VACUUM

SCALE: 1: 12,500

DATE: OCT. 2016

DWG. 115157-V1



Ainley CONSULTING ENGINEERS PLANNERS

TOWN OF ERIN

URBAN CENTRE WASTEWATER SERVICING CLASS ENVIRONMENTAL ASSESSMENT

COLLECTION SYSTEM ALTERNATIVES - ALTERNATIVE 4 - VACUUM

SCALE: 1: 12,000

DATE: OCT. 2016

DWG. 115157-V2

Appendix G

Costs Memorandum

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 13, 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**
Collection System Costing, Technical Memorandum

Dear Ms. Furlong:

We are pleased to present our Technical Memorandum for the "Collection System Costing" for the Urban Centre Wastewater Servicing Schedule 'C' Municipal Class Environmental Assessment (EA).

This Technical Memorandum provides an outline of the costing basis for the alternative sanitary collection systems. The estimated capital cost and net present value of the systems are presented within. The costs presented are developed on the basis of servicing the existing community including infill and intensification potential.

Should you have any questions or require clarifications, please contact the undersigned.

Yours truly,

AINLEY & ASSOCIATES LIMITED

____

Gary Scott, M.Sc., P.Eng.
Senior Project Advisor

Town of Erin

Urban Centre Wastewater Servicing
Class Environmental Assessment

Technical Memorandum
Collection System Costing

First Draft

December 2017

Urban Centre Wastewater Servicing Class Environmental Assessment

Technical Memorandum Collection System Costing

Project No. 115157

Prepared for:
The Town of Erin

Prepared By:

DRAFT

Gary Scott, M.Sc., P.Eng.

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www.ainleygroup.com

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Glossary of Terms

ACS	Assimilative Capacity Study: see assimilative capacity.
ADF	Average Daily Flow, typically presented through the report in units of cubic metres per day (m3/d).
Ainley	Primary engineering consultant for the Class EA process.
Alternative Solution	A possible approach to fulfilling the goal and objective of the study or a component of the study.
Assimilative Capacity	The ability of receiving water (lake or river) to receive a treated effluent discharge without adverse effects on surface water quality, eco-system and aquatic life.
BOD_5	Biochemical oxygen demand is the amount of dissolved oxygen needed by aerobic biological organisms to break down organic material present in a given water sample at 20 ^{o}C over a 5-day period.
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.
CCME	Canadian Council of Ministers of the Environment is comprised of the environment ministers from the federal, provincial and territorial governments. The council determines national environmental priorities and determines work needed to achieve positive environmental results, focusing on issues that are Canada-wide in scope.
CEAA	*Canadian Environmental Assessment Act*, S.C. 1992, c.37 (Federal)
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).
Discharge Potential	The volume of effluent the receiving water can accommodate based on the assumptions and results of an assimilative capacity study.
DFO	Department of Fisheries and Oceans, the federal agency responsible for developing and implementing policies and programs in support of Canada's economic, ecological and scientific interests in ocean and inland waters.
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.
Equivalent Population	Equivalent Population represents Residential Population plus Institutional/ Commercial/Industrial wastewater flow sources expressed as the equivalent number of residents, while Residential Population represents the "actual" population exclusive of Institutional/ Commercial/ Industrial wastewater flows.

ESR	Environmental Study Report, a report prepared at the culmination of Phase 4 of the Class EA process under a Schedule C planning process.
Evaluation Criteria	Criteria applied to assist in identifying the preferred solution(s).
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.
Harmon Peaking Factor	A standard formula used for the estimation peak day flows based on the average daily flow (ADF).
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.
HSEL	Hardy Stevenson and Associates Limited is the firm conducting the public consultation process for this Class EA.
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.
L/c/d	Litres per capita per day.
LPS System	Low-Pressure Sewer System refers to a network of grinder pump units installed at each property pumping into a common forcemain.
LSSDS	Large subsurface disposal systems.
m^3/ha/d	Cubic metres per hectare per day.
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.
MNR	Ministry of Natural Resources, the provincial agency responsible for the promotion of healthy, sustainable ecosystems and the conservation of biodiversity in Ontario.
NPV	Net Present Value is the value in the present of a sum of money, in contrast to some future value it will have when it has been invested at compound interest.
O&M	Operation and maintenance
Open-cut Construction	Method of constructing a pipeline by open excavation of a trench, laying

	the pipe, and backfilling the excavation.
Part II Order	A component of the Class EA process providing an opportunity to request the Minister of Environment and Climate Change to require the proponent to comply with a Part II of the EA Act and prepare an Individual Environmental Assessment.
Peak Flow	An estimation of the maximum volume of wastewater generated over a single day. The peak day flow is calculated by multiplying the ADF by the Harmon Peaking Factor.
PIC	Public Information Centre
PLC	Public Liaison Committee
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.
Private Treatment System	Lot-level or communal sewage treatment methods, such as septic systems or aerobic treatment systems, which remain in private ownership.
Sewage Pumping Station (SPS)	A facility containing pumps to convey sewage through a forcemain to a higher elevation.
PWQO	Provincial Water Quality Objectives (PWQO) are numerical criteria which serve as chemical and physical indicators representing a satisfactory level for surface waters (i.e. lakes and rivers). The PWQO are set at a level of water quality which is protective of all forms of aquatic life and all aspects of the aquatic life cycles during indefinite exposure to the water.
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.
Screening Criteria	Criteria applied to identify the short-list of alternative solutions from the long-list of alternative solutions.
Service Area	The area that will receive sewage servicing as a result of this study.
Service Life	The length of time that an infrastructure component is anticipated to remain in use assuming proper preventative maintenance.
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.
STEP/STEG	Septic Tank Effluent Pumping/ Septic Tank Effluent Gravity, refers to a method of wastewater collection which collects the liquid portion of waste from the septic tanks while the solids remain for removal and treatment by a separate method.
Study Area	The area under investigation in which construction may take place in order to provide servicing to the Service Area.

TKN	Total Kjeldahl Nitrogen is the sum of organic nitrogen, ammonia (NH_3), and ammonium (NH_4+) in the wastewater.
TP	Total Phosphorus is a measure of the concentration of all phosphorus compounds in the wastewater.
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.
TSS	Total Suspended Solids is a measure of the concentration of suspended solids in a sample of wastewater. Includes both fixed and volatile suspended solids.
UCWS Class EA	Urban Centre Wastewater Servicing Class Environmental Assessment
Wastewater	See Sewage
Wastewater Treatment Plant (WWTP)	See Sewage Treatment Plant.

1.0 Introduction

This Technical Memorandum has been prepared as an appendix to the Wastewater Collection Alternatives Technical Memorandum. The information provided is in support of the Town of Erin Urban Centre Wastewater Servicing Environmental Assessment (UCWWS EA). Properties within the Village of Erin and Hillsburgh are currently serviced by individual private septic systems. The Servicing and Settlement Master Plan (SSMP), completed by B.M. Ross in 2014, selected a communal wastewater collection system for both communities as the preferred alternative solution to deal with issues related to the private systems. The SSMP completed part of Phase 1 and part of Phase 2 of the Class Environmental Assessment process and the Town is now engaged in completing these two phases and moving on to complete Phase 3 and Phase 4 of the Class EA process.

This Technical Memorandum outlines the costing basis for the alternative sanitary collection systems. The estimated capital cost and net present value of the systems are presented within. The costs presented are developed on the basis of servicing the existing community including infill and intensification potential.

2.0 Objectives

The objectives of this report are as follows:

- Define the basis for cost estimates
- Estimate cost of alternatives

3.0 Cost Estimation Basis

Table 1 provides installation cost for sewers at varying sizes and depths given the following assumptions:

- All costs are in 2017 dollars
- Excavation in overburden soils
- Moderate dewatering required
- Construction in one lane
- Prices include backfill to subgrade and restoration of road surface
- Full road reconstruction/ curb and sidewalk are not included
- Cost of rock excavation is extra over sanitary sewer cost per metre
- Where rock excavation is anticipated the assumption of cost is $200/m^3$
- The price for installation at depths not listed will be interpolated or extrapolated from this table
- $2000/ service to property line for gravity connections (city owned)
- $1400/ service to property line for pressure connections (city owned)

Table 1 – Open Cut Sewer Cost Estimating Basis (per metre costs)

	Diameter (mm)							
Depth (m)	150	200	250	300	375	450	525	600
2	$320	$360	$400	$440	$480	$520	$680	$840
3	$360	$400	$440	$480	$520	$560	$720	$880
4	$400	$440	$480	$520	$560	$600	$760	$920
5	$440	$480	$520	$560	$600	$640	$800	$960
6	$480	$520	$560	$600	$640	$680	$840	$1,000
7	$520	$560	$600	$640	$680	$720	$880	$1,040
8	$560	$600	$640	$680	$720	$760	$920	$1,080

The same general assumptions have also been made for the costing of forcemains. Table 2 provides installation cost for forcemain at varying sizes and depths used for cost estimation.

Table 2 – Forcemain Cost Estimation Basis (per metre costs)

Depth (m)	50/75	100	150	200	250	300	375	450
2	$300	$340	$380	$430	$480	$530	$580	$620
2.5	$315	$360	$405	$455	$505	$555	$603	$645
3	$330	$380	$430	$480	$530	$580	$625	$670
4	$380	$430	$480	$530	$575	$625	$670	$720

Table 3 provides the basis for the pricing of individual sanitary manholes. The price for installation at depths not listed will be interpolated or extrapolated from this table.

Table 3 – Sanitary Manhole (1200 mm diameter) Cost Estimation Basis

Depth (m)	Cost
3	$ 6,000
4	$ 7,500
5	$ 9,000
6	$ 10,500
7	$ 12,000

For reaches of sewer where open cut construction would not be feasible, it will be assumed that microtunneling will be used as the alternative construction method. This alternative is used for costing purposes due to the relatively high rock table in the community and the efficacy of this tunneling method in rock. Microtunneling requires both a launch and reception shaft for each section of sewer installation. For the purpose of the cost estimation, it will be assumed that 900 mm internal diameter (I.D.) concrete jacking pipe will be used for the tunnel casing which requires 5 m I.D. launch and reception shafts. Table 4 provides a list of costing benchmarks used through this report.

Table 4 – Sanitary Manhole (1200 mm diameter) Cost Estimation Basis

Component	Cost
Launch/Reception Shaft (4m to 8m depth)	$ 300,000 ea.
Launch/ Reception Shaft (8m to 12m depth)	$ 375,000 ea.
Launch Reception Shaft (> 12 m depth)	$ 550,000 ea.
900 mm I.D. Casing w/ Sewer Installed	$ 4,950/m

Directional drilling has been proposed as an inexpensive alternative to open cut construction for small bore sewers at shallow depths. For the purposes of comparison, contractors that perform this style of construction were contacted for typical unit rates of construction in overburden soils. Based on the feedback received, directional drilling is generally more expensive than open cut construction, particularly at shallow depths. It should be noted that, due to the climate in Erin, all sewers must be installed at sufficient depth to avoid freezing during the winter (>1.8 m depth).

Directional drilling is most advantageous where surface features would be impacted by construction that would be expensive to rehabilitate. Typical construction costs range between $600-$950/m for 100mm to 300mm pipes not including the launch pits or the pipe materials. As such, for sections of sewer where open cut construction is a feasible option, we have costed on that basis. Where river crossings are required, the respective tunneling rates will apply.

Figure 1 provides the basis for the pricing of the pumping stations based on design capacity. The capital costs for the construction of sewage pumping stations are based on historical tender cost for pumping stations ranging in capacity from 10 L/s to 250 L/s. A line of best fit was established to be used as a basis for estimating construction costs for the EA.

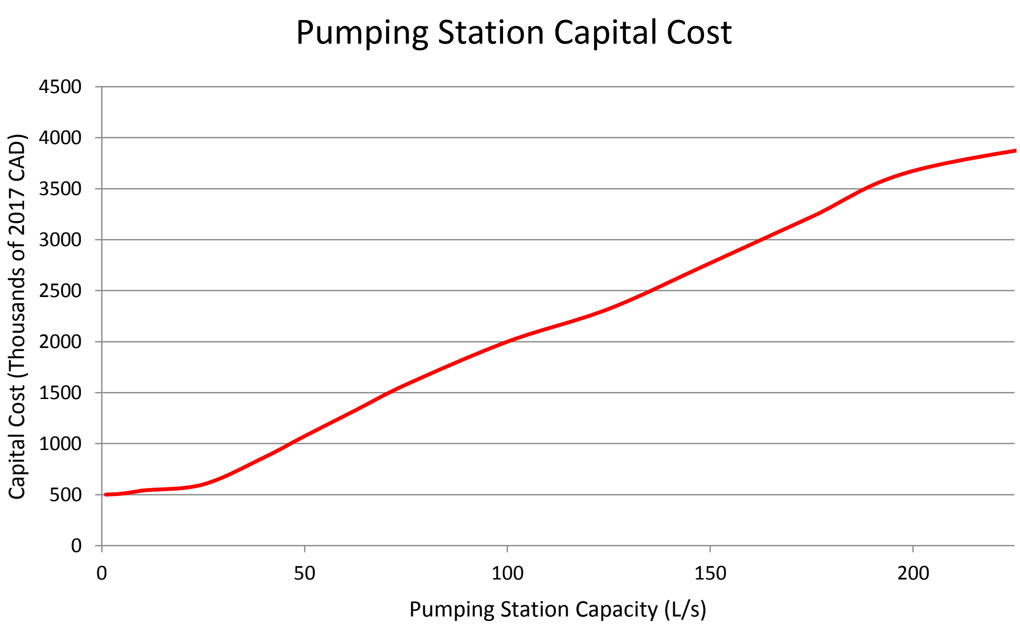


Figure 1 – Capital Cost of Pumping Stations Based on Capacity

Figure 2 provides the basis for the pricing of the operation and maintenance costs for pumping stations based on design capacity. Operations staff from several communities were consulted to determine approximate yearly O&M costs for pumping stations of various sizes. A line of best fit was established through the range of estimates to be used as a basis for estimating yearly O&M costs for the EA.

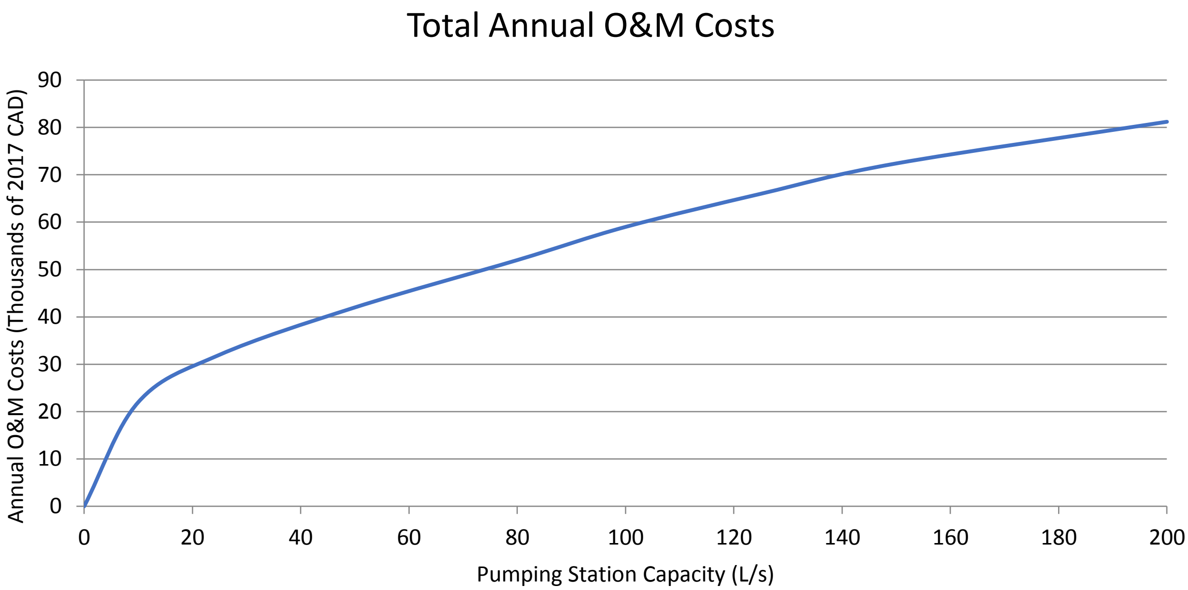


Figure 2 – Operation and Maintenance Costs of Pumping Stations Based on Capacity

4.0 Gravity System Alternative Capital and Operating Costs

The estimated capital costs for the gravity system are outlined in Table 5. A detailed summary of the sewer installation costing is provided in ***Appendix A***. A detailed summary of the pumping station and forcemain costing is also provided in ***Appendix A***. An assessment of connection costs to the system from each property was conducted and is provided in ***Appendix B***.

Table 5 – Gravity System Capital Cost Summary

System	Estimated Cost (2017 CAD$)
Gravity Sewer Installation	$ 12,910,000.00
Manhole Installation	$ 2,525,000.00
Service Connections (1550)	$ 3,100,000.00
Pumping Stations	$ 7,455,000.00
Forcemains	$ 4,750,000.00
Capital Cost Sum	**$ 30,740,000.00**
Contractor Overhead & Profits (15%)	$ 4,611,000.00
Contingency (15%)	$ 4,611,000.00
Engineering/ Contract Administration (10%)	$ 3,740,000.00
Approvals	$ 500,000.00

System	Estimated Cost (2017 CAD$)
Portable Generator	$ 150,000.00
Land Acquisition	$ 500,000.00
Utility Relocations	$ 630,000.00
Total Capital Cost (Town Responsibility)	**$ 45,482,000.00**
Connections (Property Owner Responsibility)	$ 10,210,000.00

The operational and replacement costs have been assessed over an 80-year life cycle and are presented in Table 6. The costs are expressed in terms of net present value in 2017 Canadian dollars. The 80-year life cycle was selected as this is the maximum expected useful life of a system component.

Net present value is calculated following Equation 1. For the purposes of calculation, an interest rate (i) of 4% was used in the calculation of net-present value. Where the lifecycle of a system component does not divide equally within the 80 year span assumed for the analysis, the "incurred cost" is proportionately reduced.

Equation 1 – Net-Present Value Calculation

$$NPV = \sum_{x}^{80} \frac{Incurred\ Cost}{(1+i)^x}$$

Example: Manholes with an assumed 50-year life.

$NPV = \$2,525,000.00 * (1 + 0.04)^{-50} + (30/50)* \$2,525,000.00 * (1 + 0.04)^{-80} = \$421,000.00$

Table 6 – NPV of Gravity System Operation and Replacement

80 Year Lifecycle Analysis	Life / Maintenance Cycle	Present Value
Gravity Sewers	80	$ 560,000.00
Manholes	50	$ 421,000.00
Pumping Stations	60	$ 816,000.00
Forcemains	80	$ 206,000.00
CCTV/Flow Monitoring ($15/m)	10	$ 567,000.00
SPS Operation/ Maintenance	Yearly	$ 5,202,000.00
Operation and Replacement Net Present Value		**$ 7,772,000.00**

5.0 Blended Alternative Gravity/LPS

Using the gravity system design as a basis, a gravity system alternative utilizing low pressure systems for small catchments in low lying areas was developed. The blended alternative assumes full gravity servicing with the exception of Dundas St. E. Sub-catchment, Scotch St. Sub-catchment, Wheelock St. Sub-catchment, and Waterford Dr. Sub-catchment which would be serviced using low-pressure grinder pump systems. A detailed summary of the sewer installation costing is provided in ***Appendix A***. A detailed summary of the pumping station and forcemain costing is also provided in ***Appendix A***. An assessment of connection costs to the system from each property was conducted and is provided in ***Appendix B***.

5.1. Detailed Evaluation of Site Alternatives

The estimated capital costs for the Blended Collection System are outlined in Table 7.

Table 7 – Blended System Capital Cost Summary

System	Estimated Cost (2017 CAD$)
Gravity Sewer Installation	$ 12,350,000.00
Pressure Sewer Installation	$ 400,000.00
Service Connections (1497/53)	$ 3,070,000.00
Connections (53 –house to the curb)	$ 320,000.00
Manhole Installation	$ 2,060,000.00
Grinder Pump Stations (53)	$ 360,000.00
Pumping Stations	$ 6,450,000.00
Forcemains	$ 4,630,000.00
Capital Cost Sum	**$ 29,640,000.00**
Contractor Overhead & Profits (15%)	$ 4,446,000.00
Contingency (15%)	$ 4,446,000.00
Engineering/ Contract Administration (10%)	$ 2,964,000.00
Approvals	$ 500,000.00
Portable Generator	$ 150,000.00
Land Acquisition	$ 500,000.00
Utility Relocations	$ 630,000.00
Total Capital Cost	**$ 43,276,000.00**
Connections (to the curb)	$ 8,930,000.00

The operational and replacement costs have been assessed over an 80-year life cycle and are presented in Table 8. The costs are expressed in terms of net present value in 2017 Canadian dollars. The 80-year life cycle was selected as this is the maximum expected useful life of a system component.

Table 8 – NPV of Blended System Operation and Replacement

80 Year Lifecycle Analysis	Life / Maintenance Cycle	Present Value
Gravity Sewer	80	$ 536,000.00
Pressure Sewer	80	$ 17,000.00
Manholes	50	$ 343,000.00
Grinder Pump Stations	15	$ 144,000.00
Pumping Stations	60	$ 706,000.00
Forcemains	80	$ 201,000.00
CCTV/Flow Monitoring ($15/m)	10	$ 478,000.00

80 Year Lifecycle Analysis	Life / Maintenance Cycle	Present Value
SPS Operation/ Maintenance	Yearly	$ 5,110,000.00
Operation and Replacement Net Present Value		**$ 7,535,000.00**

6.0 Vacuum System Alternative Design

6.1. Vacuum System Capital and Operating Costs

The estimated capital costs for the vacuum system are outlined in Table 9. A detailed summary of the sewer installation costing is provided in ***Appendix A***. A detailed summary of the pumping station and forcemain costing is also provided in ***Appendix A***. An assessment of connection costs to the system from each property was conducted and is provided in ***Appendix B***.

Table 9 – Vacuum Sewer Capital Cost Estimates

System	Estimated Cost (2017 CAD$)
Vacuum Sewers	$ 9,130,000.00
Isolation Valves (150)	$ 300,000.00
Vacuum Pits (1550)	$ 3,100,000.00
Service Connections	$ 2,170,000.00
Connections (house to the curb)	$ 9,250,000.00
Vacuum Stations	$ 2,940,000.00
Pumping Stations	$ 3,830,000.00
Forcemains	$ 4,582,000.00
Capital Cost Sum	**$ 35,302,000.00**
Contractor Overhead & Profits	$ 5,295,300.00
Contingency	$ 5,295,300.00
Engineering/ Contract Administration	$ 3,530,200.00
Approvals	$ 500,000.00
Land Acquisition	$ 500,000.00
Utility Relocations	$ 430,000.00
Total Capital Cost	**$ 50,852,800.00**

The operational and replacement costs have been assessed over an 80-year life cycle and are presented in Table 10. The costs are expressed in terms of net present value in 2017 Canadian dollars. The 80-year life cycle was selected as this is the maximum expected useful life of a system component.

Table 10 – NPV of Vacuum System Operation and Replacement

80 Year Lifecycle Analysis	Life / Maintenance Cycle	Present Value
Vacuum Sewers	80	$ 396,000.00
Isolation Valves	15	$ 359,000.00
Vacuum Pits	40	$ 780,000.00

80 Year Lifecycle Analysis	Life / Maintenance Cycle	Present Value
Vacuum Stations	50	$ 490,000.00
Pumping Stations	60	$ 419,000.00
Forcemains	80	$ 199,000.00
SPS/ Vac Station Operation/ Maintenance	Yearly	$ 7,127,000.00
Operation and Replacement Net Present Value		**$ 9,770,000.00**

7.0 Low Pressure System Alternative Design

7.1. Low Pressure System Capital and Operating Costs

The estimated capital costs for the Low Pressure System are outlined in Table 11. A detailed summary of the sewer installation costing is provided in ***Appendix A***. A detailed summary of the pumping station and forcemain costing is also provided in ***Appendix A***. An assessment of connection costs to the system from each property was conducted and is provided in ***Appendix B***.

Table 11 – Low-Pressure Sewer Capital Cost Estimate

System	Estimated Cost (2017 CAD$)
Pressure Sewer Installation	$ 9,200,000.00
Grinder Pump Stations (1550)	$ 10,540,000.00
Service Connections (1550)	$ 2,170,000.00
Connections (house to the curb)	$ 9,250,000.00
Pump Stations	$ 3,930,000.00
Forcemains	$ 3,960,000.00
Capital Cost Sum	**$ 39,050,000.00**
Contractor Overhead & Profits	$ 5,857,500.00
Contingency	$ 5,857,500.00
Engineering/ Contract Administration	$ 3,905,000.00
Approvals	$ 500,000.00
Land Acquisition	$ 500,000.00
Utility Relocations	$ 460,000.00
Total Capital Cost	**$ 56,130,000.00**

The operational and replacement costs have been assessed over an 80-year life cycle and are presented in Table 12. The costs are expressed in terms of net present value in 2017 Canadian dollars. The 80-year life cycle was selected as this is the maximum expected useful life of a system component.

Table 12 – NPV of Low Pressure System Operation and Replacement

80 Year Lifecycle Analysis	Life / Maintenance Cycle	Present Value
Grinder Pump Stations	15	$ 4,206,000.00
Pressure Sewer	80	$ 399,000.00

80 Year Lifecycle Analysis	Life / Maintenance Cycle	Present Value
Pumping Stations	60	$ 430,000.00
Forcemains	80	$ 160,000.00
SPS/LPS Operation/ Maintenance	Yearly	$ 7,749,000.00
Operation and Replacement Net Present Value		**$ 12,944,000.00**

8.0 STEP / STEG System Alternative Design

8.1. STEP / STEG System Capital and Operating Costs

The estimated capital costs for the STEP/STEG are outlined in Table 13. A detailed summary of the sewer installation costing is provided in ***Appendix A***. A detailed summary of the pumping station and forcemain costing is also provided in ***Appendix A***. An assessment of connection costs to the system from each property was conducted and is provided in ***Appendix B***.

Table 13 – STEP / STEG Collection Capital Cost Estimate

System	Estimated Cost (2017 CAD$)
STEP/STEG Collection Network	$ 10,900,000.00
Interceptor Tanks (1550)	$ 5,425,000.00
STEP Pumps (710)	$ 497,000.00
Service Connections (840/710)	$ 2,674,000.00
Connections (house to curb)	$ 9,250,000.00
Pump Stations	$ 3,930,000.00
Forcemains	$ 3,690,000.00
Capital Cost Sum	**$ 36,366,000.00**
Contractor Overhead & Profits	$ 5,454,900.00
Contingency	$ 5,454,900.00
Engineering/ Contract Administration	$ 3,636,600.00
Approvals	$ 500,000.00
Land Acquisition	$ 500,000.00
Utility Relocations	$ 590,000.00
Total Capital Cost	**$ 52,502,400.00**

The operational and replacement costs have been assessed over an 80-year life cycle and are presented in Table 14. The costs are expressed in terms of net present value in 2017 Canadian dollars. The 80-year life cycle was selected as this is the maximum expected useful life of a system component.

Table 14 – NPV of STEP / STEG System Operation and Replacement

80 Year Lifecycle Analysis	Life / Maintenance Cycle	Present Value
Collection Network	80	$ 473,000.00
Interceptor Tanks	50	$ 829,000.00

80 Year Lifecycle Analysis	Life / Maintenance Cycle	Present Value
Pump Stations	50	$ 655,000.00
Forcemains	80	$ 160,000.00
Tank Cleanouts	10	$ 1,544,000.00
SPS Operation/ Maintenance	Yearly	$ 5,338,000.00
Operation and Replacement Net Present Value		**$ 8,999,000.00**

9.0 Capital Cost Comparison

An overall cost comparison is presented in Table 15. The vacuum sewer system has a low capital cost however due to the high energy use required to run the system the vacuum sewer also has the highest operation and system replacement NPV. In contrast, the gravity sewer system has the highest estimated capital cost but has a low operation and replacement NPV.

Table 15 – Cost Comparison of Alternative Collection Technologies

Collection Alternative	Capital Cost	Connection Cost (Home Owner)	Total Capital Cost	System Replacement and Operation NPV	Total Cost (Capital Cost + NPV)
Gravity Sewers	$45,482,000	$10,210,000	$55,692,000	$7,772,000	$63,464,000
Blended Alternative	$43,276,000	$8,930,000	$52,206,000	$7,535,000	$59,741,000
Pressure Sewers	$56,130,000	NIL	$56,130,000	$12,944,000	$69,074,000
Vacuum Sewers	$50,852,800	NIL	$50,852,800	$9,770,000	$60,622,800
STEP/STEG Collection	$52,502,400	NIL	$52,502,400	$8,999,000	$61,501,400

10.0 Full Build-Out Scenario Trunk Upgrades

The cost analysis for the collection system has been based on servicing the existing community of Erin, including infill and intensification potential. The UCWS EA has identified a full-build-out scenario which includes significant development that would impact the proposed infrastructure. The primary components affected by potential growth are listed in Table 16 below along with their associated capital cost.

Table 16 – Collection System Trunk Components Affected by Growth

System Component	Description of Component	Capital Cost to Service Existing Community
Erin Village Trunk Sewer (Dundas Street East to Water Street	1260 m of sewer including 140 m of tunneling. Sewer diameter 450 mm.	$ 1,250,000
Hillsburgh Village Trunk Sewer (Douglas Crescent to Elora Cataract Trail)	750m of sewer. Sewer diameter 250mm.	$ 330,000
Erin Industrial Area Sewer	250 m of sewer. Sewer diameter	$ 90,000

System Component	Description of Component	Capital Cost to Service Existing Community
(Shamrock Road to Erin SPS 2)	200mm.	
Erin Heights Subdivision Sewer (along Erin Heights Drive)	600m of sewer. Sewer diameter 200mm.	$ 240,000
Hillsburgh SPS 1 (transmission to Erin)	Station capacity 24 L/s.	$ 550,000
Hillsburgh SPS 1 Forcemain (transmission to Erin along ECT)	4,650 m of forcemain. Forcemain diameter 200mm.	$ 2,110,000
Erin SPS 2 (transmission to Erin Village Trunk Sewer)	Station capacity 70 L/s.	$ 1,480,000
Erin SPS 2 Forcemain (transmission to Erin Village Trunk Sewer)	800 m of forcemain. Forcemain diameter 250mm.	$ 400,000
Erin SPS 3 (Erin Heights to Erin Village Trunk Sewer)	Station capacity 6 L/s.	$ 150,000
Erin SPS 3 Forcemain (Erin Heights to Erin Village Trunk Sewer)	1050m of forcemain. Forcemain diameter 75 mm.	$ 330,000
Erin SPS 1 (transmission station to the treatment facility)	Station capacity 91 L/s.	$ 1,900,000
Erin SPS 1 Forcemain (transmission station to the treatment facility)	1940 m of forcemain. Forcemain diameter 250mm.	$ 850,000
Sub-Total		$ 9,680,000
Engineering (10%)		$ $ 968,000
Contractor Overhead/ Profits (15%)		$ 1,452,000
Contingency (15%)		$ 1,452,000
Total		**$ 13,552,000**

In consideration of the upgrades required to service the full growth potential of the Town, Table 17 outlines the required upgrades to the trunk system components. The cost of the upgraded components is presented to provide an understanding of the incremental cost of upgrading the collection network to service the full build-out scenario. This cost does not include the costs associated with local sewers and pumping stations for each development. Developers would have a cost to connect to the trunk system.

Table 17 – Collection System Trunk Upgrades for Full Build-Out

System Component	Description of Upgrades	Capital Cost
Erin Village Trunk Sewer (Dundas Street East to Water Street	1260 m of sewer including 140 m of tunneling. Increasing sewer diameter from 450 mm to 600mm.	$ 2,050,000
Hillsburgh Village Trunk Sewer (Douglas Crescent to Elora Cataract Trail)	750m of sewer. Increase sewer diameter from 250mm to 375mm	$ 450,000
Erin Industrial Area Sewer (Shamrock Road to Erin SPS 2)	250 m of sewer. Increase sewer diameter from 200mm to 300mm.	$ 150,000
Erin Heights Subdivision Sewer	600m of sewer. Increase sewer	$ 320,000

System Component	Description of Upgrades	Capital Cost
(along Erin Heights Drive)	diameter from 200mm to 300mm.	
Hillsburgh SPS 1 (transmission to Erin)	Increase capacity of the station from 24 L/s to 90 L/s.	$ 1,870,000
Hillsburgh SPS 1 Forcemain (transmission to Erin along ECT)	4,650 m of forcemain. Increase from single 200mm forcemain to 2 x 200mm forcemain.	$ 3,165,000
Erin SPS 2 (transmission to Erin Village Trunk Sewer)	Increase capacity of the station from 70 L/s to 152 L/s.	$ 2,800,000
Erin SPS 2 Forcemain (transmission to Erin Village Trunk Sewer)	800 m of forcemain. Increase diameter from 250mm to 400mm.	$ 980,000
Erin SPS 3 (Erin Heights to Erin Village Trunk Sewer)	Increase capacity of the station from 6 L/s to 39 L/s.	$ 900,000
Erin SPS 3 Forcemain (Erin Heights to Erin Village Trunk Sewer)	1050m of forcemain. Increase diameter from 75mm to 200mm.	$ 480,000
Erin SPS 1 (transmission station to the treatment facility)	Increase capacity of the station from 91 L/s to 228 L/s.	$ 3,870,000
Erin SPS 1 Forcemain (transmission station to the treatment facility)	1940 m of forcemain. Increase diameter from 250mm to 450mm.	$ 1,170,000
Sub-Total		$ 18,205,000
Engineering (10%)		$ 1,820,500
Contractor Overhead/ Profits (15%)		$ 2,730,750
Contingency (15%)		$ 2,730,750
Total		**$ 25,487,000**

Appendix A
Detailed Sewer Costing Information

Blended System Costing for Local Sewers

Area	Length of Pipe	Size of Pipe	Average Depth		Cost Estimate
Industrial to main SPS	581.1	200	3	$	232,440.00
	160.9	200	5.25	$	78,841.00
	475	300	3	$	228,000.00
	135	300	5.5	$	78,300.00
	256	300	7.25	$	145,920.00
	301	450	3	$	168,560.00
	420	200	3	$	168,000.00
	485	300	3	$	232,800.00
Town Core 1 to Main SPS	1360	200	3	$	544,000.00
	223	200	3.5	$	93,660.00
	119	200	3.8	$	51,408.00
	422	200	4.1	$	187,368.00
	125	200	4.65	$	58,250.00
	65	200	5.5	$	32,500.00
	54	200	5.9	$	27,864.00
	93	200	6.5	$	50,220.00
	297	200	7.3	$	169,884.00
	60	300	5.6	$	35,040.00
	90	300	6.2	$	54,720.00
	330	300	6.5	$	204,600.00
	200	300	7.1	$	128,800.00
Dundas SPS Drainage area	580	200	3	$	232,000.00
	247	200	3.1	$	99,788.00
	163	200	3.3	$	67,156.00
	165	200	3.8	$	71,280.00
	139	200	4.2	$	62,272.00
	87	200	4.4	$	39,672.00
	91	300	3.9	$	46,956.00
Earinlea Crescent Drainage	338	100	2	$	94,640.00
	77	100	2.2	$	22,176.00
	137	100	2.5	$	41,100.00
	48	100	3	$	15,360.00
Erin Heights	1443	200	3	$	577,200.00
	605.4	300	3	$	290,592.00
Waterford Drive Catchment	852	200	3	$	340,800.00
	117	200	3.5	$	49,140.00
	90	200	3.9	$	39,240.00
Main St. Trunk	377	450	3.1	$	212,628.00
	122	450	3.6	$	71,248.00
	84	450	3.9	$	50,064.00
	65	450	4.4	$	40,040.00
	20	450	4.6	$	12,480.00
	277	450	4.8	$	175,064.00
	105	600	4.4	$	81,480.00

	246	600	3.5	$	182,040.00
	129	600	3.8	$	97,008.00
Town Core 1 to Main St. Trunk	646	200	3	$	258,400.00
	78	200	3.8	$	33,696.00
	210	200	4.5	$	96,600.00
	191	200	4	$	84,040.00
Town Core 2 to Main St. Trunk	710	200	3	$	284,000.00
	107	200	3.6	$	45,368.00
	73	200	4.5	$	33,580.00
	98	200	4.2	$	43,904.00
South Erin	1143.2	200	3.7	$	489,289.60
	357	200	4	$	157,080.00
	851	200	3	$	340,400.00
	66	200	3.1	$	26,664.00
	70	200	4.3	$	31,640.00
	121	200	3.5	$	50,820.00
	508	200	3.3	$	209,296.00
	169	200	4.2	$	75,712.00
	92	200	4.4	$	41,952.00
	100	200	4.55	$	46,200.00
	89	200	5.4	$	44,144.00
	94	200	4.8	$	44,368.00
	112	200	5.9	$	57,792.00
	27	200	6.7	$	14,796.00
	102	200	6	$	53,040.00
	51	300	3.9	$	26,316.00
	215	300	4.6	$	116,960.00
Wheelock St Catchment	61	100	2.3	$	17,812.00
	62	100	3.3	$	20,584.00
	71	100	3	$	22,720.00
	114	100	2	$	31,920.00
Trailer Park to Main SPS	104.4	200	5.59	$	52,575.84
	107.2	200	4.26	$	48,282.88
	131.8	200	3.06	$	53,036.32
	79.1	200	3.09	$	31,924.76
	156.3	200	3.24	$	64,020.48
	36.3	200	3.41	$	15,115.32
	253	200	3	$	101,200.00
	90.6	200	3.24	$	37,109.76
	94.1	200	3.25	$	38,581.00
Hillsburgh - TownCore 1/2	5000.5	200	3	$	2,000,200.00
	586.2	200	3.5	$	246,204.00
	62.4	200	3.7	$	26,707.20
	535.5	200	3.2	$	218,484.00
	88.5	200	3.61	$	37,559.40
	95.4	200	4.21	$	42,777.36
	116.7	200	5.11	$	56,529.48

	76.1	200	4.26	$	34,275.44
	64.9	200	5.18	$	31,619.28
	101.1	200	5.59	$	50,913.96
	87.5	300	4.7	$	47,950.00
	79	300	4.02	$	41,143.20
	73.9	300	4.59	$	40,172.04
Trafalgar Trunk	731.6	450	3	$	409,696.00
	195.4	450	3.2	$	110,987.20
	202.9	450	3.5	$	117,682.00
	103.1	450	3.8	$	61,035.20
				$	12,797,474.72

Gravity System Costing for Local Sewers

Area	Length of Pipe	Size of Pipe	Average Depth	Cost Estimate
Industrial to main SPS	581.1	200	3	$ 232,440.00
	160.9	200	5.25	$ 78,841.00
	475	300	3	$ 228,000.00
	135	300	5.5	$ 78,300.00
	256	300	7.25	$ 145,920.00
	301	450	3	$ 168,560.00
	420	200	3	$ 168,000.00
	485	300	3	$ 232,800.00
Town Core 1 to Main SPS	1360	200	3	$ 544,000.00
	223	200	3.5	$ 93,660.00
	119	200	3.8	$ 51,408.00
	422	200	4.1	$ 187,368.00
	125	200	4.65	$ 58,250.00
	65	200	5.5	$ 32,500.00
	54	200	5.9	$ 27,864.00
	93	200	6.5	$ 50,220.00
	297	200	7.3	$ 169,884.00
	60	300	5.6	$ 35,040.00
	90	300	6.2	$ 54,720.00
	330	300	6.5	$ 204,600.00
	200	300	7.1	$ 128,800.00
Dundas SPS Drainage area	580	200	3	$ 232,000.00
	247	200	3.1	$ 99,788.00
	163	200	3.3	$ 67,156.00
	165	200	3.8	$ 71,280.00
	139	200	4.2	$ 62,272.00
	87	200	4.4	$ 39,672.00
	91	300	3.9	$ 46,956.00
Earinlea Crescent Drainage	338	200	3	$ 135,200.00
	77	200	3.2	$ 31,416.00
	137	200	3.5	$ 57,540.00
	48	200	4	$ 21,120.00
Erin Heights	1443	200	3	$ 577,200.00
	605.4	300	3	$ 290,592.00
Waterford Drive Catchment	852	200	3	$ 340,800.00
	117	200	3.5	$ 49,140.00
	90	200	3.9	$ 39,240.00
Main St. Trunk	377	450	3.1	$ 212,628.00
	122	450	3.6	$ 71,248.00
	84	450	3.9	$ 50,064.00
	65	450	4.4	$ 40,040.00
	20	450	4.6	$ 12,480.00
	277	450	4.8	$ 175,064.00
	105	600	4.4	$ 81,480.00

	246	600	3.5	$	182,040.00
	129	600	3.8	$	97,008.00
Town Core 1 to Main St. Trunk	646	200	3	$	258,400.00
	78	200	3.8	$	33,696.00
	210	200	4.5	$	96,600.00
	191	200	4	$	84,040.00
Town Core 2 to Main St. Trunk	710	200	3	$	284,000.00
	107	200	3.6	$	45,368.00
	73	200	4.5	$	33,580.00
	98	200	4.2	$	43,904.00
South Erin	1143.2	200	3.7	$	489,289.60
	357	200	4	$	157,080.00
	851	200	3	$	340,400.00
	66	200	3.1	$	26,664.00
	70	200	4.3	$	31,640.00
	121	200	3.5	$	50,820.00
	508	200	3.3	$	209,296.00
	169	200	4.2	$	75,712.00
	92	200	4.4	$	41,952.00
	100	200	4.55	$	46,200.00
	89	200	5.4	$	44,144.00
	94	200	4.8	$	44,368.00
	112	200	5.9	$	57,792.00
	27	200	6.7	$	14,796.00
	102	200	6	$	53,040.00
	51	300	3.9	$	26,316.00
	215	300	4.6	$	116,960.00
Wheelock St Catchment	61	200	3.3	$	25,132.00
	62	200	4.8	$	29,264.00
	71	200	4	$	31,240.00
	114	200	3	$	45,600.00
Trailer Park to Main SPS	104.4	200	5.59	$	52,575.84
	107.2	200	4.26	$	48,282.88
	131.8	200	3.06	$	53,036.32
	79.1	200	3.09	$	31,924.76
	156.3	200	3.24	$	64,020.48
	36.3	200	3.41	$	15,115.32
	253	200	3	$	101,200.00
	90.6	200	3.24	$	37,109.76
	94.1	200	3.25	$	38,581.00
Hillsburgh - TownCore 1/2	5000.5	200	3	$	2,000,200.00
	586.2	200	3.5	$	246,204.00
	62.4	200	3.7	$	26,707.20
	535.5	200	3.2	$	218,484.00
	88.5	200	3.61	$	37,559.40
	95.4	200	4.21	$	42,777.36
	116.7	200	5.11	$	56,529.48

	76.1	200	4.26	$	34,275.44
	64.9	200	5.18	$	31,619.28
	101.1	200	5.59	$	50,913.96
	87.5	300	4.7	$	47,950.00
	79	300	4.02	$	41,143.20
	73.9	300	4.59	$	40,172.04
Trafalgar Trunk	731.6	450	3	$	409,696.00
	195.4	450	3.2	$	110,987.20
	202.9	450	3.5	$	117,682.00
	103.1	450	3.8	$	61,035.20
				$	12,907,674.72

Low Pressure System Costing for Local Sewers

Area	Length of Pipe	Average Depth	Pipe Size	Cost
Industrial to main SPS	581.1	2	100	$ 162,708.00
	160.9	3.75	100	$ 56,315.00
	475	2	200	$ 133,000.00
	135	4.5	200	$ 62,100.00
	256	4.75	200	$ 120,320.00
	301	2	250	$ 120,400.00
	420	2	100	$ 117,600.00
	485	2	200	$ 174,600.00
Town Core 1 to Main SPS	1360	2	100	$ 380,800.00
	223	2.5	100	$ 66,900.00
	119	2.8	100	$ 37,128.00
	422	3.1	100	$ 136,728.00
	125	3.15	100	$ 40,750.00
	65	4	100	$ 23,400.00
	54	4.4	100	$ 20,304.00
	93	5	100	$ 37,200.00
	297	5.3	100	$ 122,364.00
	60	3.6	200	$ 25,440.00
	90	4.2	200	$ 40,320.00
	330	4.5	200	$ 151,800.00
	200	4.6	200	$ 92,800.00
Dundas SPS Drainage area	580	2	100	$ 162,400.00
	247	2.1	100	$ 70,148.00
	163	2.3	100	$ 47,596.00
	165	2.8	100	$ 51,480.00
	139	3.2	100	$ 45,592.00
	87	3.4	100	$ 29,232.00
	91	2.9	200	$ 36,036.00
Earinlea Crescent Drainage	338	2	100	$ 94,640.00
	77	2.2	100	$ 22,176.00
	137	2.5	100	$ 41,100.00
	48	3	100	$ 15,360.00
Erin Heights	1443	2	100	$ 404,040.00
	605.4	2	200	$ 217,944.00
Waterford Drive Catchment	852	2	100	$ 238,560.00
	117	2.5	100	$ 35,100.00
	90	2.9	100	$ 28,440.00
Main St. Trunk	377	2.1	250	$ 152,308.00
	122	2.6	250	$ 51,728.00
	84	2.9	250	$ 36,624.00
	65	3.4	250	$ 29,640.00
	20	3.6	250	$ 9,280.00
	277	3.8	250	$ 130,744.00
	105	3.4	300	$ 52,080.00

	246	2.5	300	$	113,160.00
	129	2.8	300	$	60,888.00
Town Core 1 to Main St. Trunk	646	2	100	$	180,880.00
	78	2.8	100	$	24,336.00
	210	3.5	100	$	71,400.00
	191	3	100	$	61,120.00
Town Core 2 to Main St. Trunk	710	2	100	$	198,800.00
	107	2.6	100	$	32,528.00
	73	3.5	100	$	24,820.00
	98	3.2	100	$	32,144.00
South Erin	1143.2	2.7	100	$	352,105.60
	357	3	100	$	114,240.00
	851	2	100	$	238,280.00
	66	2.1	100	$	18,744.00
	70	3.3	100	$	23,240.00
	121	2.5	100	$	36,300.00
	508	2.3	100	$	148,336.00
	169	3.2	100	$	55,432.00
	92	3.4	100	$	30,912.00
	100	3.55	100	$	34,200.00
	89	3.9	100	$	31,684.00
	94	3.8	100	$	33,088.00
	112	3.9	100	$	39,872.00
	27	4.7	100	$	10,476.00
	102	4	100	$	36,720.00
	51	2.9	200	$	20,196.00
	215	3.6	200	$	91,160.00
Wheelock St Catchment	61	2.3	100	$	17,812.00
	62	3.3	100	$	20,584.00
	71	3	100	$	22,720.00
	114	2	100	$	31,920.00
Trailer Park to Main SPS	104.4	3.59	100	$	35,871.84
	107.2	2.26	100	$	31,130.88
	131.8	2.06	100	$	37,220.32
	79.1	2.09	100	$	22,432.76
	156.3	2.24	100	$	45,264.48
	36.3	2.41	100	$	10,759.32
	253	2	100	$	70,840.00
	90.6	2.24	100	$	26,237.76
	94.1	2.25	100	$	27,289.00
Hillsburgh - TownCore 1/2	5000.5	2	100	$	1,400,140.00
	586.2	2.5	100	$	175,860.00
	62.4	2.7	100	$	19,219.20
	535.5	2.2	100	$	154,224.00
	88.5	2.61	100	$	26,939.40
	95.4	3.21	100	$	31,329.36
	116.7	3.61	100	$	40,191.48

	76.1	2.76	100	$ 23,621.44
	64.9	3.68	100	$ 22,533.28
	101.1	4.09	100	$ 36,759.96
	87.5	3.2	200	$ 35,700.00
	79	2.52	200	$ 30,083.20
	73.9	3.09	200	$ 29,826.04
Trafalgar Trunk	731.6	2	250	$ 292,640.00
	195.4	2.2	250	$ 79,723.20
	202.9	2.5	250	$ 85,218.00
	103.1	2.8	250	$ 44,539.20
				$ 9,168,916.72

STEP/STEG Costing for Local Sewers

Area	Length of Pipe	Size of Pipe	Average Depth	Cost Estimate
Industrial to main SPS	581.1	100	2	$ 162,708.00
	160.9	100	3.75	$ 56,315.00
	475	200	2	$ 133,000.00
	135	200	4.5	$ 62,100.00
	256	200	4.75	$ 120,320.00
	301	250	2	$ 120,400.00
	420	100	2	$ 117,600.00
	485	200	2	$ 174,600.00
Town Core 1 to Main SPS	1360	100	2	$ 380,800.00
	223	100	2.5	$ 66,900.00
	119	100	2.8	$ 37,128.00
	422	100	3.1	$ 136,728.00
	125	100	3.15	$ 40,750.00
	65	100	4	$ 23,400.00
	54	100	4.4	$ 20,304.00
	93	100	5	$ 37,200.00
	297	100	5.3	$ 122,364.00
	60	200	3.6	$ 25,440.00
	90	200	4.2	$ 40,320.00
	330	200	4.5	$ 151,800.00
	200	200	4.6	$ 92,800.00
Dundas SPS Drainage area	580	200	3	$ 232,000.00
	247	200	3.1	$ 99,788.00
	163	200	3.3	$ 67,156.00
	165	200	3.8	$ 71,280.00
	139	200	4.2	$ 62,272.00
	87	200	4.4	$ 39,672.00
	91	300	3.9	$ 46,956.00
Earinlea Crescent Drainage	338	200	3	$ 135,200.00
	77	200	3.2	$ 31,416.00
	137	200	3.5	$ 57,540.00
	48	200	4	$ 21,120.00
Erin Heights	1443	100	2	$ 404,040.00
	605.4	200	2	$ 217,944.00
Waterford Drive Catchment	852	100	2	$ 238,560.00
	117	100	2.5	$ 35,100.00
	90	100	2.9	$ 28,440.00
Main St. Trunk	377	450	3.1	$ 212,628.00
	122	450	3.6	$ 71,248.00
	84	450	3.9	$ 50,064.00
	65	450	4.4	$ 40,040.00
	20	450	4.6	$ 12,480.00
	277	450	4.8	$ 175,064.00
	105	600	4.4	$ 81,480.00

	246	600	3.5	$	182,040.00
	129	600	3.8	$	97,008.00
Town Core 1 to Main St. Trunk	646	200	3	$	258,400.00
	78	200	3.8	$	33,696.00
	210	200	4.5	$	96,600.00
	191	200	4	$	84,040.00
Town Core 2 to Main St. Trunk	710	200	3	$	284,000.00
	107	200	3.6	$	45,368.00
	73	200	4.5	$	33,580.00
	98	200	4.2	$	43,904.00
South Erin	1143.2	200	3.7	$	489,289.60
	357	200	4	$	157,080.00
	851	200	3	$	340,400.00
	66	200	3.1	$	26,664.00
	70	200	4.3	$	31,640.00
	121	200	3.5	$	50,820.00
	508	200	3.3	$	209,296.00
	169	200	4.2	$	75,712.00
	92	200	4.4	$	41,952.00
	100	200	4.55	$	46,200.00
	89	200	5.4	$	44,144.00
	94	200	4.8	$	44,368.00
	112	200	5.9	$	57,792.00
	27	200	6.7	$	14,796.00
	102	200	6	$	53,040.00
	51	300	3.9	$	26,316.00
	215	300	4.6	$	116,960.00
Wheelock St Catchment	61	200	3.3	$	25,132.00
	62	200	4.8	$	29,264.00
	71	200	4	$	31,240.00
	114	200	3	$	45,600.00
Trailer Park to Main SPS	104.4	200	5.59	$	52,575.84
	107.2	200	4.26	$	48,282.88
	131.8	200	3.06	$	53,036.32
	79.1	200	3.09	$	31,924.76
	156.3	200	3.24	$	64,020.48
	36.3	200	3.41	$	15,115.32
	253	200	3	$	101,200.00
	90.6	200	3.24	$	37,109.76
	94.1	200	3.25	$	38,581.00
Hillsburgh - TownCore 1/2	5000.5	200	3	$	2,000,200.00
	586.2	200	3.5	$	246,204.00
	62.4	200	3.7	$	26,707.20
	535.5	200	3.2	$	218,484.00
	88.5	200	3.61	$	37,559.40
	95.4	200	4.21	$	42,777.36
	116.7	200	5.11	$	56,529.48

	76.1	200	4.26	$	34,275.44
	64.9	200	5.18	$	31,619.28
	101.1	200	5.59	$	50,913.96
	87.5	300	4.7	$	47,950.00
	79	300	4.02	$	41,143.20
	73.9	300	4.59	$	40,172.04
Trafalgar Trunk	731.6	450	3	$	409,696.00
	195.4	450	3.2	$	110,987.20
	202.9	450	3.5	$	117,682.00
	103.1	450	3.8	$	61,035.20
				$	11,686,588.72

Vacuum System Costing for Local Sewers

Area	Length of Pipe	Average Depth	Pipe Size	Cost
Industrial to main SPS	581.1	2	100	$ 162,708.00
	160.9	3.75	100	$ 56,315.00
	475	2	200	$ 133,000.00
	135	4.5	200	$ 62,100.00
	256	4.75	200	$ 120,320.00
	301	2	250	$ 120,400.00
	420	2	100	$ 117,600.00
	485	2	200	$ 174,600.00
Town Core 1 to Main SPS	1360	2	100	$ 380,800.00
	223	2.5	100	$ 66,900.00
	119	2.8	100	$ 37,128.00
	422	3.1	100	$ 136,728.00
	125	3.15	100	$ 40,750.00
	65	4	100	$ 23,400.00
	54	4.4	100	$ 20,304.00
	93	5	100	$ 37,200.00
	297	5.3	100	$ 122,364.00
	60	3.6	200	$ 25,440.00
	90	4.2	200	$ 40,320.00
	330	4.5	200	$ 151,800.00
	200	4.6	200	$ 92,800.00
Dundas SPS Drainage area	580	2	100	$ 162,400.00
	247	2.1	100	$ 70,148.00
	163	2.3	100	$ 47,596.00
	165	2.8	100	$ 51,480.00
	139	3.2	100	$ 45,592.00
	87	3.4	100	$ 29,232.00
	91	2.9	200	$ 36,036.00
Earinlea Crescent Drainage	338	2	100	$ 94,640.00
	77	2.2	100	$ 22,176.00
	137	2.5	100	$ 41,100.00
	48	3	100	$ 15,360.00
Erin Heights	1443	2	100	$ 404,040.00
	605.4	2	200	$ 217,944.00
Waterford Drive Catchment	852	2	100	$ 238,560.00
	117	2.5	100	$ 35,100.00
	90	2.9	100	$ 28,440.00
Main St. Trunk	377	2.1	250	$ 152,308.00
	122	2.6	250	$ 51,728.00
	84	2.9	250	$ 36,624.00
	65	3.4	250	$ 29,640.00
	20	3.6	250	$ 9,280.00
	277	3.8	250	$ 130,744.00
	105	3.4	300	$ 52,080.00

	246	2.5	300	$	113,160.00
	129	2.8	300	$	60,888.00
Town Core 1 to Main St. Trunk	646	2	100	$	180,880.00
	78	2.8	100	$	24,336.00
	210	3.5	100	$	71,400.00
	191	3	100	$	61,120.00
Town Core 2 to Main St. Trunk	710	2	100	$	198,800.00
	107	2.6	100	$	32,528.00
	73	3.5	100	$	24,820.00
	98	3.2	100	$	32,144.00
South Erin	1143.2	2.7	100	$	352,105.60
	357	3	100	$	114,240.00
	851	2	100	$	238,280.00
	66	2.1	100	$	18,744.00
	70	3.3	100	$	23,240.00
	121	2.5	100	$	36,300.00
	508	2.3	100	$	148,336.00
	169	3.2	100	$	55,432.00
	92	3.4	100	$	30,912.00
	100	3.55	100	$	34,200.00
	89	3.9	100	$	31,684.00
	94	3.8	100	$	33,088.00
	112	3.9	100	$	39,872.00
	27	4.7	100	$	10,476.00
	102	4	100	$	36,720.00
	51	2.9	200	$	20,196.00
	215	3.6	200	$	91,160.00
Wheelock St Catchment	61	2.3	100	$	17,812.00
	62	3.3	100	$	20,584.00
	71	3	100	$	22,720.00
	114	2	100	$	31,920.00
Trailer Park to Main SPS	104.4	3.59	100	$	35,871.84
	107.2	2.26	100	$	31,130.88
	131.8	2.06	100	$	37,220.32
	79.1	2.09	100	$	22,432.76
	156.3	2.24	100	$	45,264.48
	36.3	2.41	100	$	10,759.32
	253	2	100	$	70,840.00
	90.6	2.24	100	$	26,237.76
	94.1	2.25	100	$	27,289.00
Hillsburgh - TownCore 1/2	5000.5	2	100	$	1,400,140.00
	586.2	2.5	100	$	175,860.00
	62.4	2.7	100	$	19,219.20
	535.5	2.2	100	$	154,224.00
	88.5	2.61	100	$	26,939.40
	95.4	3.21	100	$	31,329.36
	116.7	3.61	100	$	40,191.48

	76.1	2.76	100	$ 23,621.44
	64.9	3.68	100	$ 22,533.28
	101.1	4.09	100	$ 36,759.96
	87.5	3.2	200	$ 35,700.00
	79	2.52	200	$ 30,083.20
	73.9	3.09	200	$ 29,826.04
Trafalgar Trunk	731.6	2	250	$ 292,640.00
	195.4	2.2	250	$ 79,723.20
	202.9	2.5	250	$ 85,218.00
	103.1	2.8	250	$ 44,539.20
				$ 9,168,916.72

Existing Community Pumping Stations

Station (Existing Community)	Station Capacity (L/s)	Capital Cost	Forcemain Size	Length	Cost	O&M	Required for:
Transmission Station to Erin (H-SPS 1)	24.0	$ 550,000.00	200.00	4630.00	$ 2,110,000.00	$ 32,000.00	GRAV, LPS, VAC, STEP/STEG, GRAV+LPS
Main Station Hillsburgh (H-SPS 2)	20.1	$ 470,000.00	150.00	550.00	$ 230,000.00	$ 32,000.00	GRAV, STEP/STEG, GRAV+LPS
Main SPS to the WWTP (E-SPS 1)	90.6	$ 1,900,000.00	350.00	1400.00	$ 850,000.00	$ 57,000.00	GRAV, LPS, VAC, STEP/STEG, GRAV+LPS
Main SPS in Industrial Area (E-SPS 2)	69.8	$ 1,480,000.00	300.00	1300.00	$ 730,000.00	$ 49,000.00	GRAV, VAC, STEP/STEG, GRAV+LPS
Erin Heights Catchment (E-SPS 3)	5.2	$ 510,000.00	75.00	750.00	$ 240,000.00	$ 7,500.00	GRAV, GRAV+LPS
North-west Industrial Station (E-SPS 4)	7.8	$ 520,000.00	100.00	500.00	$ 180,000.00	$ 15,000.00	GRAV, GRAV+LPS
Dundas St E Catchment (E-SPS 5)	5.1	$ 510,000.00	75.00	400.00	$ 130,000.00	$ 7,500.00	GRAV, GRAV+LPS
Waterford Drive Catchment (E-SPS 6)	4.4	$ 510,000.00	75.00	500.00	$ 160,000.00	$ 7,500.00	GRAV, GRAV+LPS
Erinlea Crescent Catchment (E-SPS 7)	2.0	$ 505,000.00	50.00	150.00	$ 50,000.00	$ 5,000.00	GRAV
Wheelock St. Catchment (E-SPS 8)	0.9	$ 500,000.00	50.00	200.00	$ 70,000.00	$ 5,000.00	GRAV
		$ 7,455,000.00			$ 4,750,000.00		

Full Buildout Gravity System Pumping Stations

Station (Build-out Community)	Station Capacity (L/s)	Capital Cost	Forcemain Size	Length	Cost	O&M
Transmission Station to Erin (H-SPS 1)	89.2	$ 1,870,000.00	2 x 200.00	4630.00	$ 3,165,000.00	$ 57,000.00
Main Station Hillsburgh (H-SPS 2)	33.1	$ 730,000.00	200.00	550.00	$ 380,000.00	$ 35,000.00
Main SPS to the WWTP (E-SPS 1)	227.2	$ 3,870,000.00	2 x 300.00	1400.00	$ 1,170,000.00	$ 85,000.00
Main SPS in Industrial Area (E-SPS 2)	151.7	$ 2,800,000.00	2 x 250.00	1300.00	$ 980,000.00	$ 72,000.00
Erin Heights Catchment (E-SPS 3)	5.2	$ 510,000.00	75.00	750.00	$ 240,000.00	$ 7,500.00
North-west Industrial Station (E-SPS 4)	7.8	$ 520,000.00	100.00	500.00	$ 180,000.00	$ 15,000.00
Dundas St E Catchment (E-SPS 5)	5.1	$ 510,000.00	75.00	400.00	$ 130,000.00	$ 7,500.00
Waterford Drive Catchment (E-SPS 6)	4.4	$ 510,000.00	75.00	500.00	$ 160,000.00	$ 7,500.00
Erinlea Crescent Catchment (E-SPS 7)	2.0	$ 505,000.00	50.00	150.00	$ 50,000.00	$ 5,000.00
Wheelock St. Catchment (E-SPS 8)	0.9	$ 500,000.00	50.00	200.00	$ 70,000.00	$ 5,000.00
		$ 12,325,000.00			$ 6,525,000.00	

Appendix B
Condition Costing Information

Appendix B

Connection Costing

In order to develop an accurate assessment of connection costs throughout Erin and Hillsburgh a street-by-street survey was conducted to assess the level of difficulty to connect homes to a collection system. Constructability aspects considered included the amount of landscaping which would be required to connect, the distance from the existing septic system to the street, tree and shrub removals/ replacement, and any driveway, curb and/or sidewalk repairs which would be necessary.

Each property was assessed for connection difficulty and rated on a five point scale for plumbing cost and for landscaping cost. The connection difficulty ratings for landscaping and plumbing are independent and are not inherently linked. For example, a property could receive a landscaping rating of 5 with a plumbing rating of 1.

The costs associated with each plumbing rating are summarized in Table 1. For the plumbing ratings a capital cost for both “gravity based systems” and “pressure based systems” are provided. For the purpose of the overall costing analysis the gravity based system cost will apply to the gravity collection alternative, STEG areas (within the overall STEP/STEG system), and vacuum sewer. The pressure system cost applies to the LPS alternative and STEP areas (within the overall STEP/STEG system).

Table 1 – Service Connection Costing for Plumbing

Plumbing Rating	Unit	Gravity Based System Cost	Pressure System Cost
1 – Simple Connection	15-20m of sanitary lateral Decommission existing tank	$ 3,200 $ 500	$ 2,700 $ 500
Total		**$ 3,700**	**$ 3,200**
2 – Through Driveway	15-20m of sanitary lateral Decommission existing tank Remove/Replace D/W Asphalt	$ 3,200 $ 500 $ 350	$ 2,700 $ 500 $ 350
Total		**$ 4,050**	**$ 3,550**
3 – Long Distance	21-30m of sanitary lateral Decommission existing tank	$ 4,200 $ 500	$ 3,500 $ 500
Total		**$ 4,700**	**$ 4,000**
4 – Long Distance, Through Driveway	21-30m of sanitary lateral Decommission existing tank Remove/Replace D/W Asphalt	$ 4,200 $ 500 $ 350	$ 3,500 $ 500 $ 350
Total		**$ 5,050**	**$ 4,350**
5 – Interior Replumbing (Commercial Area)	15-20m of sanitary lateral Decommission existing tank Remove/Replace D/W Asphalt Remove/Replace Curb Remove/ Replace Sidewalk Interior Replumbing to the front	$ 3,200 $ 500 $ 350 $ 390 $ 290 $ 10,000	$ 2,700 $ 500 $ 350 $ 390 $ 290 $ 10,000
Total		**$ 14,730**	**$ 14,230**

The costs associated with each landscaping rating are summarized in Table 2.

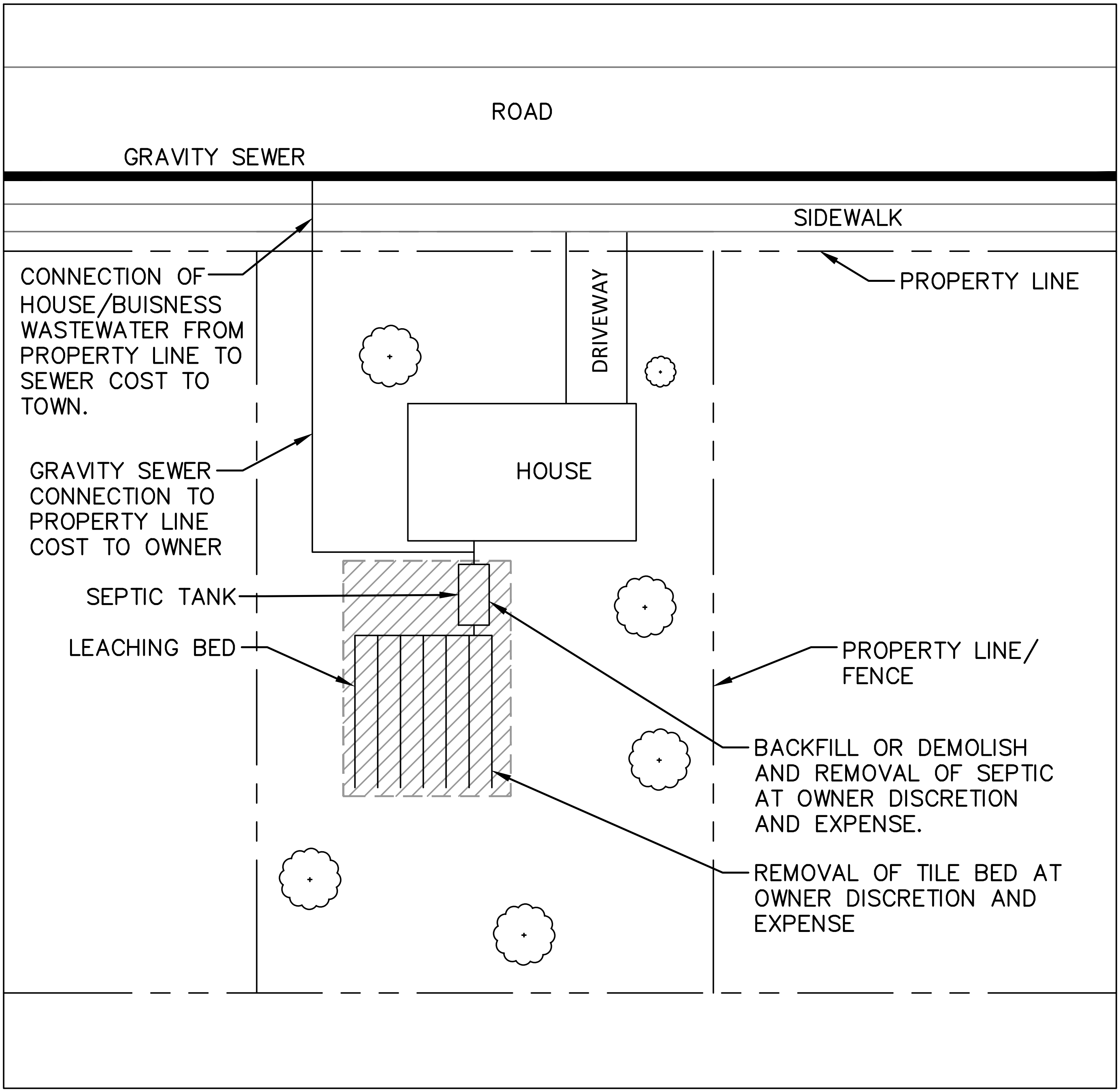
Table 2 – Service Connection Costing for Landscaping

Landscaping Rating	Unit	Gravity Based System Cost
1 – Minor Grass Replacement	30 m^2 – Sod and Topsoil	$ 540
Total		**$ 540**
2 – Major Grass Replacement	60 m^2 – Sod and Topsoil	$ 1,080
Total		**$ 1,080**
3 – Shrub/Garden Impacts	30 m^2 – Sod and Topsoil Shrub/Hedge Replacement	$ 540 $ 750
Total		**$ 1,290**
4 – Single Tree Replacement	30 m^2 – Sod and Topsoil Tree Removal/Replacement	$ 540 $ 2,500
Total		**$ 3,040**
5 – Multiple Tree Replacements	30 m^2 – Sod and Topsoil Multiple Tree Removal/Replacement	$ 540 $ 5,000
Total		**$ 5,540**

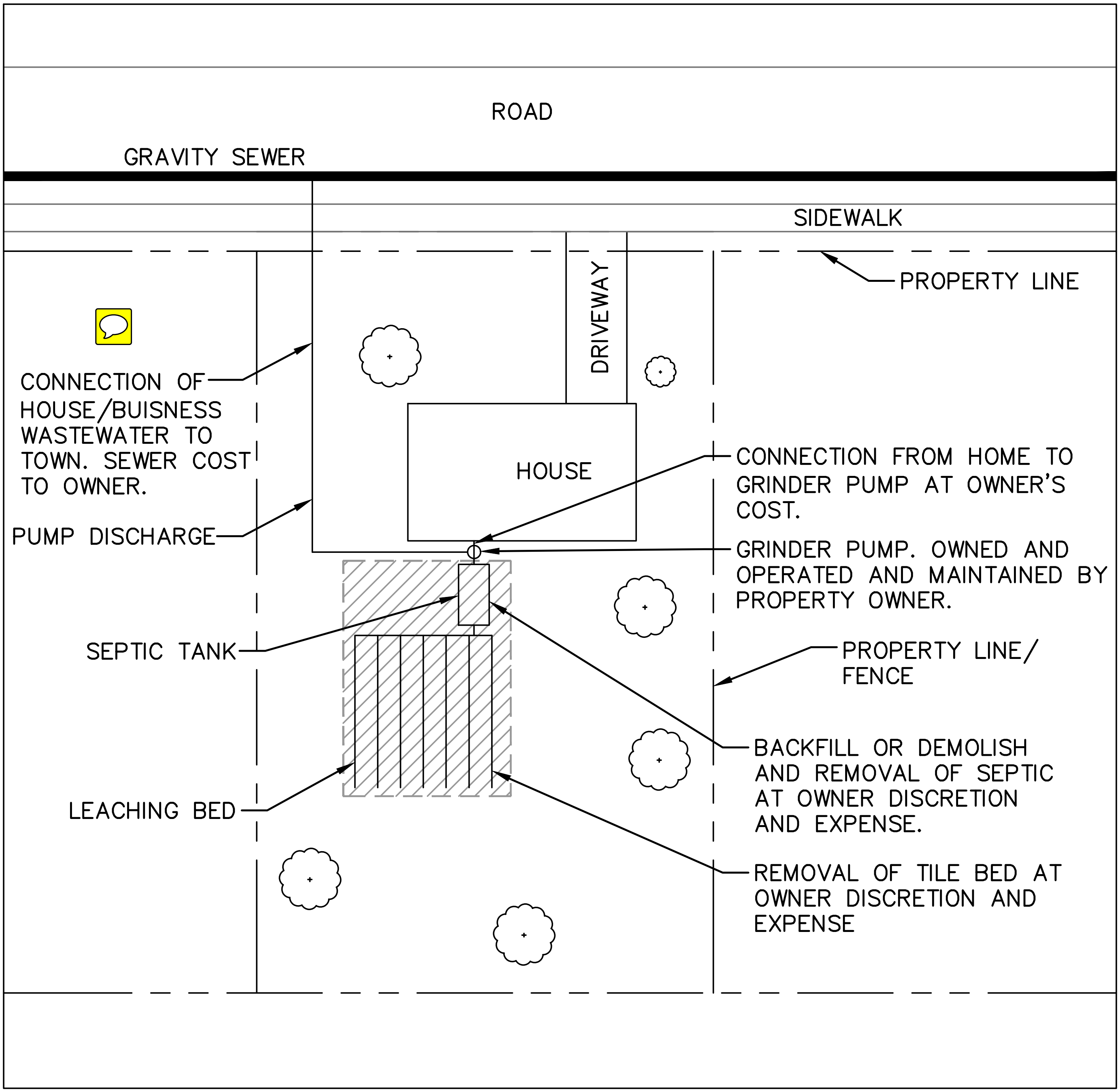
Following from the connection costing basis presented, a total capital cost for the connection of existing properties within the service area will be $ 10,210,000 for the gravity system or $9,250,000 for the pressure system or vacuum system.

With each collection system alternative there is some variation in the portion of the service connection for which each property owner will be responsible. A series of drawings are provided in overleaf which outline the Town and property owner portions of the service connection.

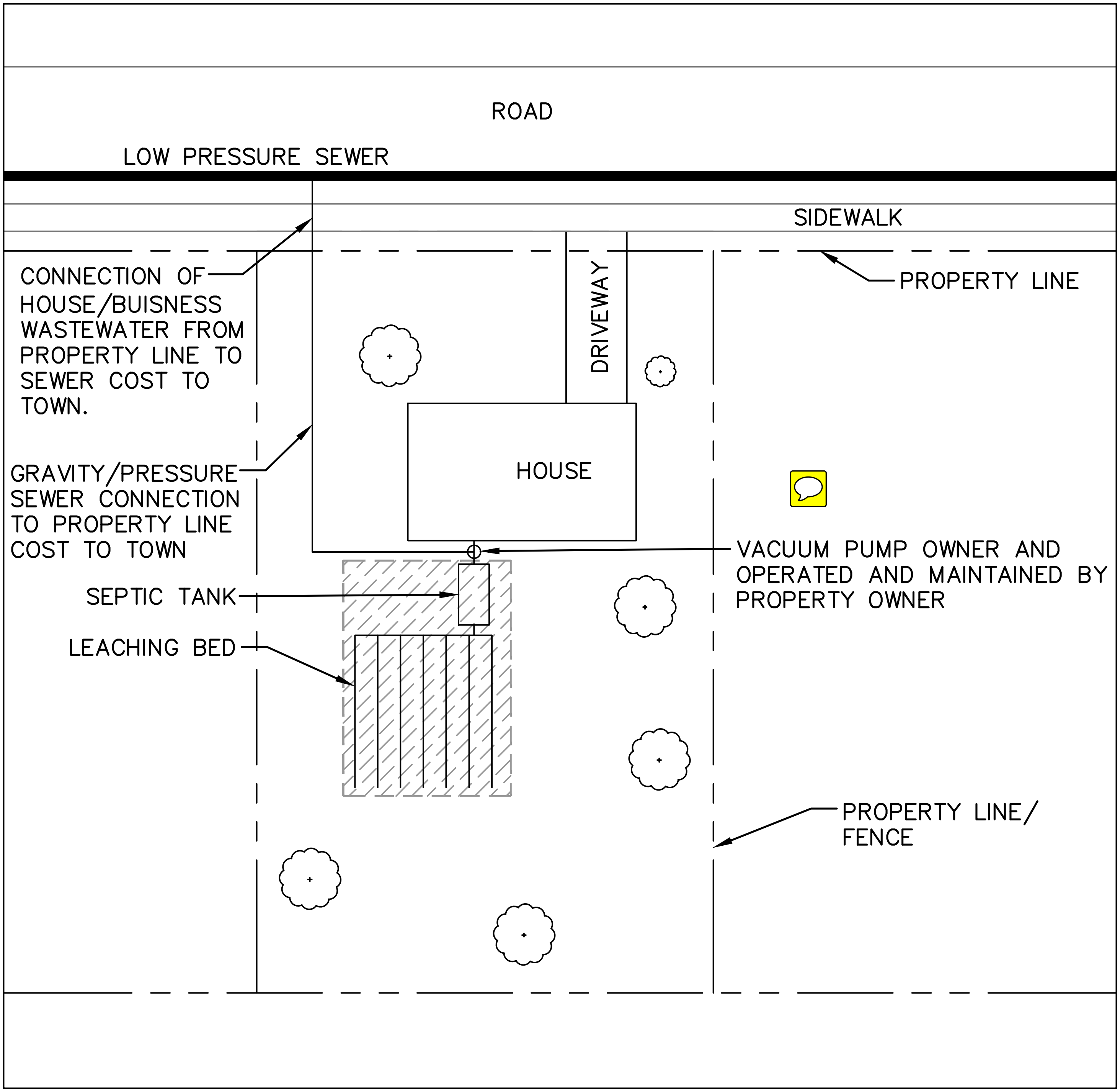
ALTERNATIVE 1
GRAVITY SYSTEM
GRAVITY CONNECTION



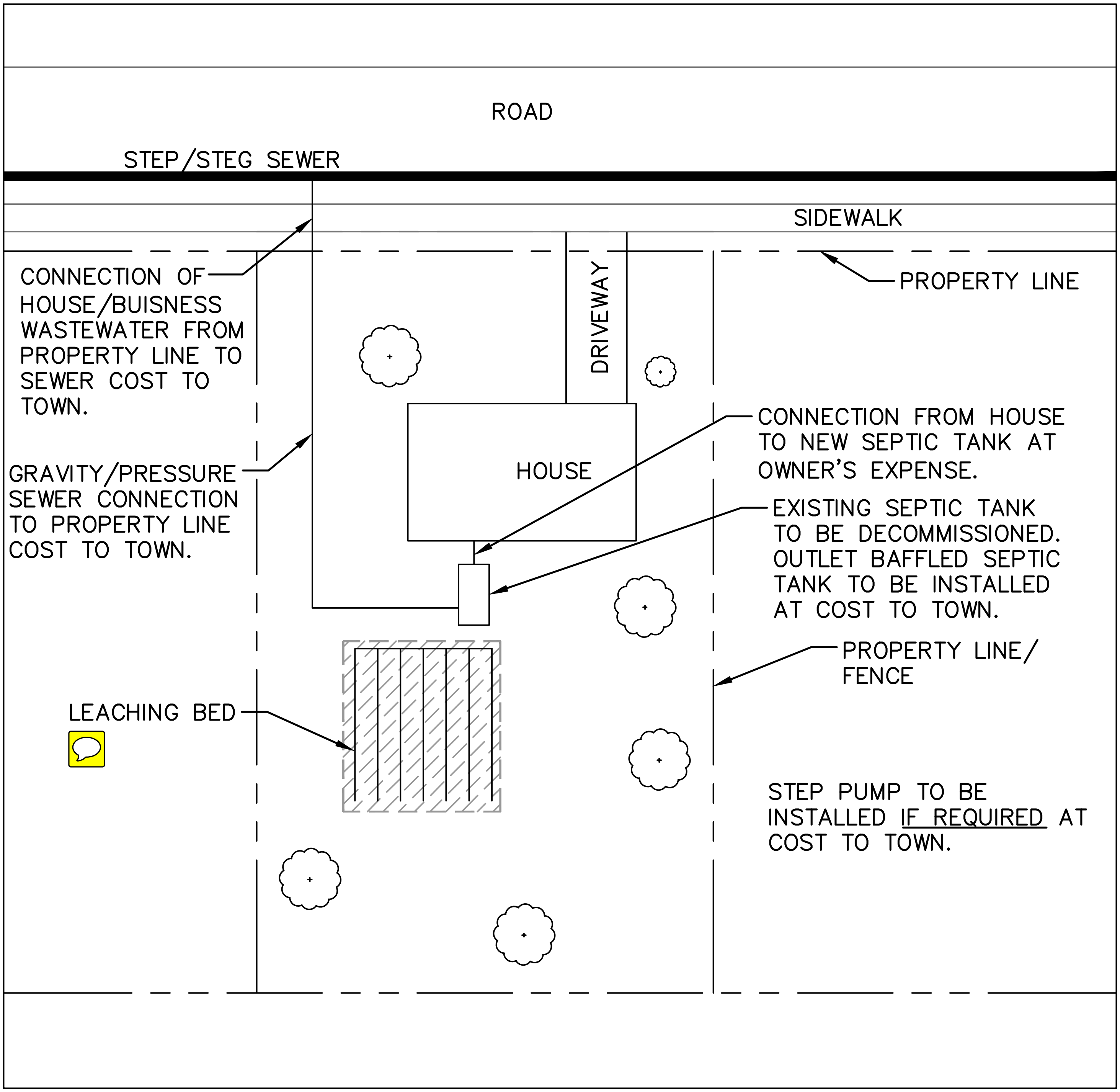
ALTERNATIVE 1
GRAVITY SYSTEM
PUMPED CONNECTION



ALTERNATIVE 3
LOW PRESSURE SYSTEM



ALTERNATIVE 2
STEP/STEG SYSTEM



ALTERNATIVE 4
VACUUM SYSTEM