Township of Puslinch

TECHNICAL MEMORANDUM NO.2
DEVELOPMENT AND ASSESSMENT OF WATER AND SEWAGE SERVICING OPTIONS

CIMA+
Partners in excellence
5935 Airport Road, Suite 500
Mississauga, Ontario
L4V 1W5
Canada
Phone: (905) 695-1005
Fax: (905) 695-0525
www.cima.ca

FINAL
May 8, 2018

T000866A

Table of Contents

List of Tables

List of Figures

List of Appendices

1. Introduction

1.1 Background

The Township of Puslinch (Township) is undertaking a Feasibility Study to assess the feasibility of implementing municipal water and sewage services within key areas of the Township. Currently, water and wastewater services in the Township consist of individual on-site wells and septic systems, as well as a few small and private communal water and sewage systems servicing individual developments.

The Township is surrounded by growing urban centres on all four sides with increasing demands for resources and land. The natural setting surrounding the Township and its accessibility to major markets and urban centres make this area an attractive place for development. Realizing this potential and the limitations on opportunities for growth resulting from lack of servicing, the need to assess the viability of implementing municipal water and sewage services for key areas within the Township was identified.

As part of the Feasibility Study, key steps have been undertaken to provide the foundation of the planning and assessment processes typically followed in this type of studies. As such, the following steps have now been completed with their results documented in a separate technical memorandum as follows:

+ *Technical Memorandum No.1 (TM-1) – Study Area Characterization and Water & Wastewater Demands Analysis.* TM-1 provides a description of the general characteristics of the study area in terms of existing land uses, population and employment projections, and existing water and sewage uses. General criteria in terms of proposed water demands and sewage flows for the study area are also documented in TM-1.

The next step in the process consists of developing potential servicing options for both water and sewage servicing, based on the general criteria developed in TM-1, and completing a high-level assessment of the servicing options in terms of key advantages, disadvantages and estimated probable costs.

1.2 Purpose of this Technical Memorandum

The purpose of this Technical Memorandum No.2 (TM-2) is to provide a general description of the available high-level water and sewage servicing options, the major infrastructure requirements and probable cost estimates associated with each option, as well as the results of the high-level assessment.

2. Water and Wastewater Design Basis

This section summarizes the proposed preliminary design basis, in terms of water demands and wastewater flows, for municipal water and sewage servicing in the Study Area. Additional details on the establishment of the design basis can be found in CIMA's *TM-1 Study Area Characterization & Water and Wastewater Demand Analysis*, January 2018.

2.1 Water System – Design Basis

The drinking water system, including water supply sources, water treatment plant and treated water storage are typically designed to satisfy the projected maximum day water demand of the service area.

Key considerations for sizing the different water system components include:

+ Water supply may be from either a surface water or groundwater source. However, given the lack of a significant surface water source within the Study Area, and given the evidence of significant groundwater resources in the area, it is anticipated that a groundwater supply system would be proposed for any water servicing solution within the Township.

+ The supply source for the new system should be able to meet the projected maximum design day demands. Multiple groundwater supply wells may be required to satisfy the projected maximum day demands.

+ Treatment processes should be able to meet the projected maximum design day demands, with Peak Hour Demands, with Emergency and/or Fire demands provided from storage.

+ Provision of Fire Protection through the Municipal water distribution system is a Municipal decision. Should the Township decides to provide fire protection via the municipal water system, the minimum fire flows should be established with consideration given to the latest Fire Underwriter's Survey document "Water Supply for Public Fire Protection" and/or the MOECC's fire flows guidelines, whichever is judged more appropriate.

+ The distribution system should be designed to maintain system pressures between 40 psi and 100 psi for a full range of demand scenarios. If the Township decides to provide Fire protection through the municipal system, the system should be sized to convey Maximum Day Demands plus Fire Flows while maintaining a minimum pressure of 20 psi throughout the system. The system should also be designed to minimize dead-end mains and excessive residence times which may lead to water quality issues. Watermain sizing would have a direct impact on the cost of the system, operation and maintenance requirements in addition to water quality considerations.

In order to establish the water demands for the study area, a 25-year planning period which corresponds to the year 2041, has been assumed. The basis for calculating the design average and maximum day water demands for the study area are summarized in Table 1.

Table 1 Water Design Basis

Criteria	Value	Units	Comments
Unit per Capita Consumption Rate	360	L/cap/d	Assumed as the mid-point from MOECC range of 270-450 L/cap/day and marginally above the Meadows of Aberfoyle rate of 353 L/cap/d.
Residential Max. Day Factor	2.0	-	Based on MOECC Guidelines and expected future total residential and employment population of 7,900 for the study area.
Industrial/Commercial Max. Day Factor	3.0	-	Based on MOECC suggested range between 2 and 4 for industrial uses.

2.1.1 Preliminary Projected Water Demands

Considering the financial stability of the Township for the provision of municipal services and the implementation feasibility of a municipal water system for the study area, the following was considered:

+ Based on the nature and the character of their businesses, it won't be viable to provide municipal water services to Nestle Canada Inc. for bottling purposes, or to St. Mary's Cement for process and cooling water. It is assumed that these two large users will continue to use the sources that are currently permitted.

+ Provision of municipal water services should account for all projected residential, employment and most ICI uses within the study area. Municipal water servicing should also account for provision of municipal potable water to Nestle Canada Inc. and St. Mary's Cement for domestic purposes for the staff at these facilities.

+ All other existing large users, considered in this study, would connect to the municipal system. Existing average day water demands recorded for the period 2015-2016 from large users will be maintained to the 2041 planning period. Maximum day demands will increase based on the assumed max. day factor of 3.0, or to the current Permit to Take Water (PTTW) rate, whichever rate is lower.

Subject to the above noted consideration, the preliminary projected water demands for the study area are summarized in Table 2.

Table 2 Preliminary Projected Water Demands

Water	Proposed Average Day Demands		Proposed Max. Day Demands	
	m^3/d	L/s	m^3/d	L/s
Proposed Preliminary System Water Demands	2,873	33.3	6,246	72.3

2.2 Wastewater System – Design Basis

Wastewater treatment facilities are typically designed for average day flows, while wastewater conveyance systems are designed and rated to deliver peak wastewater flows to the treatment facilities. Similar to the rationale used to develop the water design basis, a 25-year planning period which corresponds to the year 2041, has been assumed to calculate wastewater generation in the study area.

The basis for calculating the design average and peak wastewater flows for the study area is summarized in Table 3.

Table 3 Wastewater Design Basis

Criteria	Value	Units	Comments
Unit per Capita Wastewater Generation Rate	360	L/cap/d	Consistent with unit water consumption rate.
Peak Infiltration / Inflow Rate for Industrial / Commercial Areas	10,110	L/ha/day	Assumed based on the low end of MOECC Guidelines as new system should have low I&I contribution.
Peak Infiltration / Inflow Rate for Residential Areas	10,110	L/ha/day	Assumed based on the low end of MOECC Guidelines as new system should have low I&I contribution.
Population densities for Industrial / Commercial	85	person/ha	Assumed based on $30m^3$/ha/d (low end of MOECC Guideline) and 360 L/cap/d.
Peak Factor	varies	-	Calculated for each drainage area based on Harmon Formula

2.2.1 Projected Wastewater Flows

Preliminary projected wastewater flows for the study area for all residential users as well as industrial and commercial users are summarized in Table 4.

Table 4 Preliminary Projected Wastewater Flows

Wastewater	Proposed Average Day Flows (for Treatment)		Proposed Peak Day Flows (for Sewer Capacity)	
	m^3/d	L/s	m^3/d	L/s
Proposed Preliminary System Wastewater Flows	9,400	108.8	33,303	385.5

3. High-level Water Servicing Options – Development and Assessment

This section provides a description of the high-level water servicing options considered in this study. Major infrastructure / process requirements, general schematics and preliminary capital, operating and life cycle costs for each option are also presented.

3.1 General Description

3.1.1 Option 1 – Intra-Municipal Water Servicing

The Intra-Municipal Water Servicing alternative consists on providing the required water supply and treatment capacity through a new water supply system owned and operated by the Township. The new water supply system will be built within or in close proximity to one of the future well supply field identified in the City of Guelph Water and Wastewater Master Plan.

As part of Option 1, it is assumed that all existing individual on-site wells and existing small private communal water systems within the study area are expected to be decommissioned. Further consideration can be given to maintaining existing small private communal water systems during the Class EA stage; however, for the purpose of establishing high-level servicing options, it has been assumed that existing systems would no longer be in service. All small users and large users within the study area, with the exception of Nestle Canada Inc. and St. Mary's Cement, will be supplied by the new Municipal Water System. Nestle Canada Inc. and St. Mary's Cement will be provided with municipal water services for domestic uses only.

A hydrogeological investigation, including well drilling, well and aquifer testing, water quality characterization and groundwater modelling would be necessary to confirm the location and the production capacity of the new groundwater supply well(s) and any potential effects on existing natural heritage features within the area.

A new treatment facility would be required to provide the necessary treatment. A complete water quality characterization would be needed to confirm treatment requirements; however, for the purpose of option development and estimation of probable cost, it has been assumed that the water is of good quality, necessitating only treatment for disinfection.

A new storage facility will be provided as part of Option 1 in order to meet the required storage requirements for equalization, emergency and fire flows. The storage facility may take the form of an in-ground reservoir, an elevated tank, or a combination of the two. For the purposes of this Study, we have assumed that the necessary storage will be provided by a new elevated tank.

A description of the main infrastructure and process requirements for Option 1 – Intra-Municipal Water Servicing is provided in Table 5. A general schematic of the major components of Option 1 is shown in Figure 1.

Land acquisition would be anticipated for construction of the new treatment facility and the new elevated tank. All other linear infrastructure associated with Option 1 is expected to be constructed within existing road rights-of-way.

Table 5 Water Servicing Option 1 – Infrastructure / Process Requirements

Area	Option Requirements
Supply	• A new groundwater supply source will be developed to provide a maximum day demand of 72.3 L/s (6,250 m^3/d).
Treatment	• A new water treatment facility will be built to provide the required treatment requirements. It is assumed that the water is of good water quality and treatment will consist of only disinfection through chlorination. • The new treatment system would be designed to provide a treatment capacity of 72.3 L/s.
Pumping	• The new supply well(s) will be equipped with well pumps with enough capacity to overcome system pressure and pump to the new elevated tower.
Storage	• A new elevated water tank will be built to provide for required storage requirements. The new tank will have a capacity of 3,500 m^3.
Distribution	• Approximately 5.1 km of 400 mm diameter watermain connecting the new supply wells/treatment facility to the new elevated water tank. • Approximately 27.1km of distribution system consisting of watermains ranging in diameter from 150 to 300 mm.

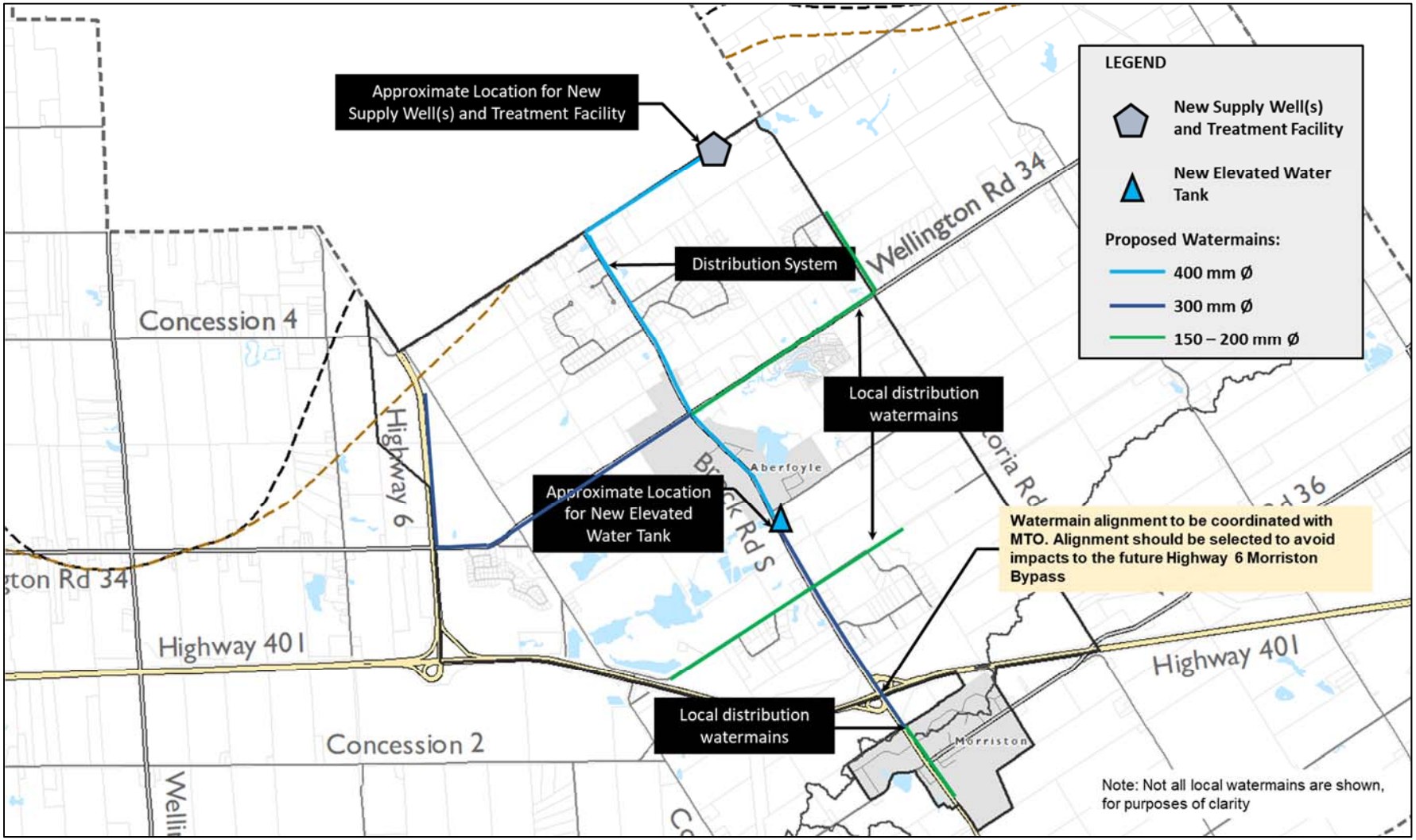

Figure 1 General Schematic – Option 1: Intra-Municipal Water Servicing

3.1.2 Option 2 – Inter-Municipal Water Servicing

The Inter-Municipal Water Servicing alternative consists of securing the required water supply and treatment capacity through the existing water supply system in the City of Guelph. Preliminary discussions with staff from the City of Guelph have indicated that the City would be open to negotiations for establishing an Inter-Municipal Servicing arrangement. Through further consultation with the City, the City indicated that they do not have excess water supply capacity to support external servicing requests. The Township acknowledged that the City may not have available capacity to allocate to the Township of Puslinch, and further recognized that if capacity was available, allocation of that capacity would not be without cost.

The Township Council would need to submit a formal request to the City of Guelph to initiate formal consideration of this Option. All water supply, treatment and distribution systems in the City of Guelph would remain under the City's ownership.

Similar to Option 1, all existing individual on-site wells and existing small and private communal water systems within the study area are expected to be decommissioned. All small users and large users within the study area, with the exception of Nestle Canada Inc. and St. Mary's Cement, will be supplied by the new Intra-Municipal Water System. Nestle Canada Inc. and St. Mary's Cement will be provided municipal water services for domestic uses only.

A new elevated water tank will be provided as part of Option 2 in order to meet the required storage requirements for equalization, emergency and fire flows. A new metering facility will be required at the boundary between the City of Guelph System and the Township system. The metering facility may be combined with a pressure control station/re-chlorination system (either boosting or reduction) and may be required to control system pressures from the City of Guelph distribution system to meet the Township system requirements.

A description of the main infrastructure and process requirements for Option 2 – Inter-Municipal Water Servicing is provided in Table 6. A general schematic of the major components of Option 2 is shown in Figure 2.

Land acquisition would be anticipated for construction of the new pressure control station and the new elevated water tank. All other linear infrastructure associated with Option 2 is expected to occur with the existing road right-of-ways.

Table 6 Water Servicing Option 2 – Infrastructure / Process Requirements

Area	Option Requirements
Supply	• A direct connection to the City of Guelph distribution system, Pressure Zone 3. City of Guelph Water System should be able to provide a maximum day demand of 72.3 L/s (6,250 m^3/d).
Treatment	• Not required within the Township.
Facilities	• A new metering facility with a potential pressure control station will be required to accommodate maximum day flows of 72.3 L/s (6,250 m^3/d) to the new elevated tower in the Township. A new pressure control station may be required to control system pressures in the Township.
Storage	• A new elevated water tank will be built to provide for required storage requirements. The new tank will have a capacity of 3,500 m^3.
Distribution	• Approximately 2.0 km of 400 mm diameter watermain extension in Guelph to the Puslinch border, and a metering facility at the municipal boundary. • Approximately 3.3 km of 400 mm diameter watermain from the metering facility to the new to the new elevated water tank. • Approximately 27.1 km of local distribution system consisting of watermains ranging in diameter from 150 to 300 mm.

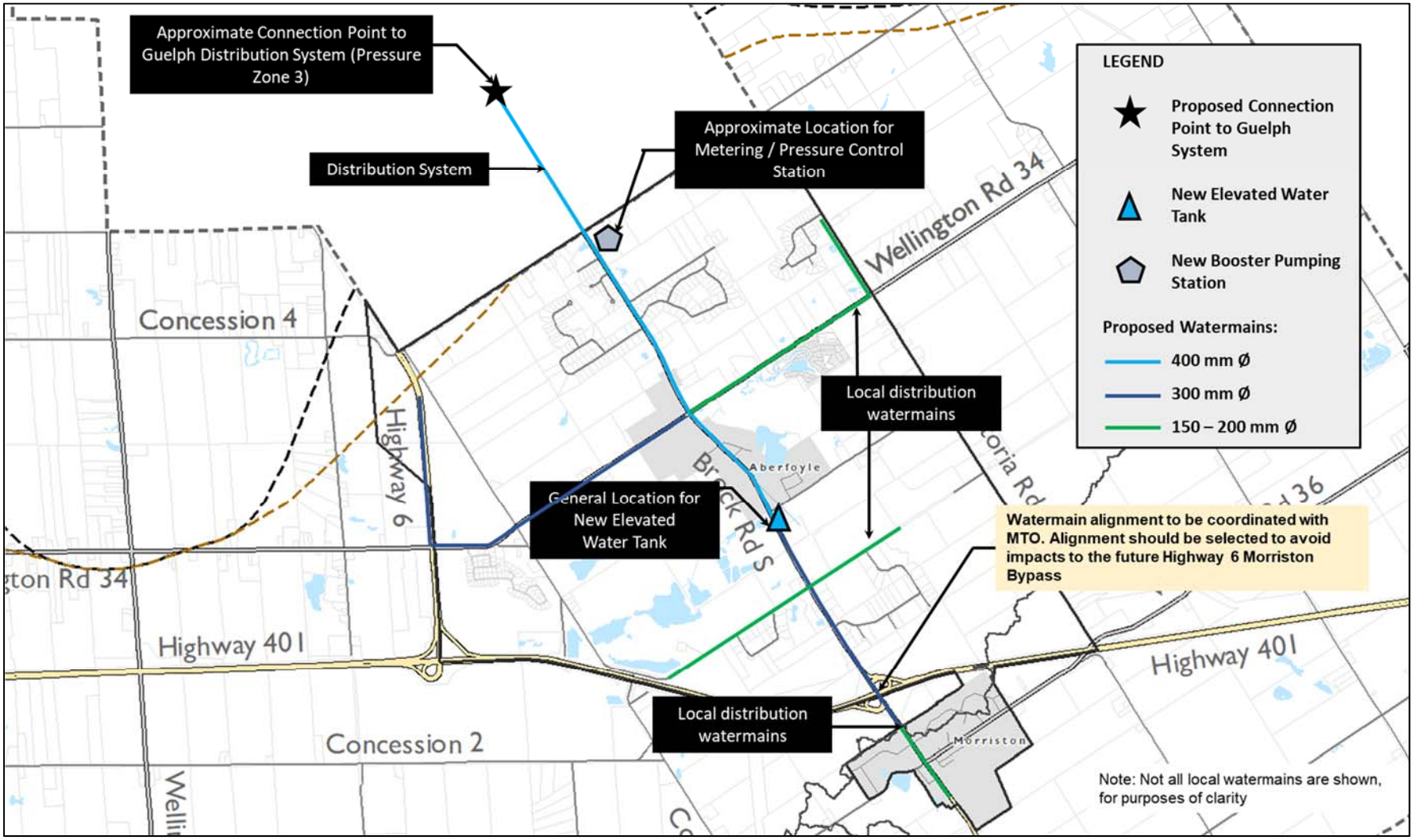

Figure 2 General Schematic – Option 2: Inter-Municipal Water Servicing

3.2 Estimates of Probable Cost

Estimates of probable capital, operating and maintenance costs and life cycle costs have been developed. Capital costs include development of new supply, treatment and storage facilities, major process and treatment equipment such as pumps, piping and valves, instrumentation, treatment equipment, standby power supply and watermain installation. Operating and maintenance costs accounted for include power, chemical usage, regulatory requirements and other replacement and labour costs. Life cycle costs have been calculated based on a 20-year life expectancy.

The following general assumptions were made when developing the costs for the servicing options:

+ Cost estimates are based on 2018 construction costs. Inflation and escalation to account for actual expected prices at the time of construction cannot be accounted for at this time.

+ Estimates of probable capital costs have been developed on a conceptual level and based on prices and data in CIMA's possession, as well as previous experience from projects of similar nature and scope. The accuracy of conceptual estimates developed at this point, are assumed to be around +/- 30%.

+ There is capital expenditure associated with the replacement of major pumping and treatment equipment every 30 years for water facilities.

+ All taxes (including the 13% HST) have been excluded.

+ The cost to decommission existing private groundwater wells and small communal water systems within the study area has not been accounted for in Water Servicing Options 1 and 2. Should this project proceed to the next phases (i.e., completion of a Class Environmental Assessment Study), an inventory of existing groundwater wells within the study area should be completed and the cost for decommissioning existing wells and private communal water systems should be added to CIMA's preliminary estimates.

+ Capital costs associated with any required upgrades needed in the City of Guelph Water System to accommodate the inter-municipal connection and servicing, or any Capital Contributions to secure Supply capacity from Guelph are unknown at this point and have not been accounted for in the estimate for Option 2. The required capital costs would need to be identified through further negotiations between the Township and the City, as well as the mechanisms to pay for these upgrades. Similarly, a portion of the operation and maintenance (O&M) costs for Option 2 should be covered under a Bulk Water Rate that the Township would pay to the City, also to be established through further negotiations between the two parties.

+ Completion of Class Environmental Assessment (Class EA) studies as well as additional amendments to existing master plans, servicing studies, secondary plans, approved draft plans, etc., have not been accounted for and should be included in the Capital Upgrade Costs, through consultation and negotiations between the Township and the City.

Life cycle costs have been estimated based on:

+ A 20 year amortization period

+ An inflation rate of 2% and an interest rate of 6% to give a market/discount rate of 4%

Estimates for probable capital, operating and life cycle costs for the water servicing options are summarized Table 7. Detailed costs calculations are included in Appendix A.

Table 7 Water Servicing Options – Cost Estimates

Servicing Alternative	Capital Cost ($ millions)	Annual Operating & Maintenance Cost	NPV 20-Year Life Cycle Cost [1] ($ millions)
Option 1 – Intra-Municipal Water Servicing	$ 34.3	$ 504,000	$ 39.4
Option 2 – Inter-Municipal Water Servicing	$ 29.6	$ 95,400	$ 29.3

Notes:
1. Net Present Value (NPV) represents the value of the project in today's dollars. Calculated NPV for Option 2 gets reduced over time as a result of the lower O&M costs which represent cash outflows. Higher cash outflows, as in Option 1, results in a higher NPV.

3.3 High-level Assessment

This section presents the results of the high-level assessment completed for the water servicing options presented in Section 3.1. Key advantages and disadvantages are summarized in Table 8.

Table 8 Water Servicing Options – High-Level Assessment Results

Servicing Option	Advantages	Disadvantages
Option 1 – Intra-Municipal Servicing	• Option provides the Township with complete control of the operation and maintenance of the water supply system. • Complete independent system from supply, to treatment and distribution. Township can provide desired level of robustness and flexibility to the system. • Provision of municipal water servicing (coupled with wastewater servicing) in the area will provide an invitation for developers to invest in the Township and promote growth in accordance with	• Option results in highest capital, O&M and life cycle costs. • Option requires the largest amount of new infrastructure. • Majority of residents who currently rely on private groundwater wells and communal systems may object to a connection to a municipal system. • Residential connections to municipal systems to be born by residents.

Servicing Option	Advantages	Disadvantages
	the County Official Plan – population and employment.	
Option 2 – Inter-Municipal Servicing	• Option results in lower capital, O&M and life cycle costs when compared to Option 1. • Option provides the Township with some control of the operation and maintenance of the water supply system – through a servicing agreement between the Township and the City. • Option is able to optimize the use of some of the existing infrastructure (in City of Guelph) and reduces the need for new infrastructure. • Water supply is dependant on City of Guelph supply but provision of an elevated tower in the Township would provide adequate level of robustness and flexibility to the system. • City of Guelph has a proven track record of providing adequate level of water servicing to its residents, which create trust to potential future serviced areas in the Township. • Option supports affordable and sustainable development between two municipalities. • It may provide an opportunity for the two municipalities (City of Guelph and Township) to partner for funding opportunities and share existing resources. • This coordinated approach to service delivery can result in efficiencies in infrastructure costs, water conservation, and allow for additional funds to be allocated to improved treatment and program delivery. • Provision of municipal water servicing (coupled with wastewater servicing) will provide an invitation for developers to invest in the areas and promote growth in accordance with the County Official Plan – population and employment.	• Majority of residents who currently rely on private groundwater wells and communal systems may object to a connection to a municipal system. • It most likely require an amendment the City of Guelph Official Plan to allow the extension of the City's urban services for areas outside of the City's urban boundaries. This process may be long. • Amendments to existing Secondary Plans, and approve Draft Plans may be required. • City of Guelph Water Servicing Master Plan would need to integrate servicing to the area in Township. • Upgrades to existing water servicing infrastructure in Guelph Pressure Zone 3 may be required, directly or indirectly, to accommodate the inter-municipal transfer. • An inter-municipal agreement will be required to establish an inter-municipal services scheme. • The cost of any Capital Contribution and/or Capital Upgrades to secure supply from the City of Guelph is unknown at this time, and may represent a significant impact to the overall project cost.

4. High-level Sewage Servicing Options – Development and Assessment

This section provides a description of the high-level sewage servicing options considered in this study. Two alternative options have been reviewed to determine the potential cost implications of each. The options selected consist of Option 1 – Intra-Municipal Sewage Servicing, and Option 2 – Inter-Municipal Sewage Servicing. Major infrastructure / process requirements, general schematics and preliminary capital, operating and life cycle costs for each option are also presented.

4.1 General Description

4.1.1 Option 1 – Intra-Municipal Sewage Servicing

The Intra-Municipal Sewage Servicing alternative considers the development of a stand-alone system for wastewater collection, treatment and disposal. The system would be owned and operated by the Township.

On a preliminary basis, the system would consist of a conventional gravity collection system with pumping stations and forcemains as required to accommodate ground elevation variations. A new treatment facility would be required, with discharge to a surface water course. For the purpose of this Study, a site in the vicinity of Mill Creek was selected.

This system would allow stand alone collection and treatment for the study area operated and maintained by the Township. This option includes sanitary sewer installed at standard depths of three (3) metres to five (5) below existing ground surface. However, in order to service small pockets of residential, or mixed use land, pumping stations and forcemain would be required to convey the wastewater to the treatment facility.

As shown in Figure 3 below, a pumping station would be required to service Morriston, with a forcemain installed under the Ministry of Transportation (MTO) Highway 401. A small pumping station would be required to service the Audrey Meadows and the Mini Lakes communities which would pump by forcemain to a gravity sewer at Wellington Road 34 and Brock Road. An additional pumping station would be required for the collection and conveyance for Aberfoyle and surrounding area. The existing industrial/commercial lands north of Highway 401, and the areas east of Highway 6 could be serviced by gravity sewer to a waste water treatment facility generally located near Concession Road 7 and Mill Creek area. The assimilative capacity of Mill Creek would need to be reviewed to ensure a suitable outfall location.

A description of the main infrastructure is summarized for Option 1 – Intra-Municipal Sewage Servicing in Table 9 below. A general schematic of the major components of Option 1 is shown in Figure 3.

Table 9 Sewage Servicing Option 1 – Infrastructure / Process Requirements

Area	Option Requirements
Collection	• A new conventional gravity collection system would be required throughout the Township in order to collect wastewater from the individual properties. The sewer system would range in size from 200 mm diameter up to 525 mm diameter.
Pumping	• Three pumping stations would be required to convey the wastewater from pockets that cannot, at this stage, be conveyed through a gravity system. The pumping stations would range in size from small (18 L/s) to medium sized (90 L/s) stations. • Provision of stand-by power and overflow storage would need to be considered during detailed design.
Treatment	• A wastewater treatment facility would need to be constructed to provide the required treatment capacity. It is anticipated that construction of the facility would be staged to accommodate current populations plus anticipated growth over the design period, with provisions for expansion beyond the current planning horizon. A new treatment plant would need to be designed for a capacity of 9,400 m3/day.
Effluent Discharge	• For the purpose of this study, it has been assumed that treated effluent may be discharged to Mill Creek. An Assimilative Capacity Study will be required to determine if Mill Creek can be used for this disposal of treated effluent, and to establish design parameters and effluent criteria and loading limits from this facility.

As part of Option 1, all existing individual on-site septic tanks, communal wastewater systems within the study area are expected to be decommissioned, and costs for decommissioning will be the responsibility of the private property owners.

Land acquisition would be anticipated for construction of the new treatment facility and the pumping stations. All other linear infrastructure associated with Option 1 is expected to occur with existing road rights-of-way.

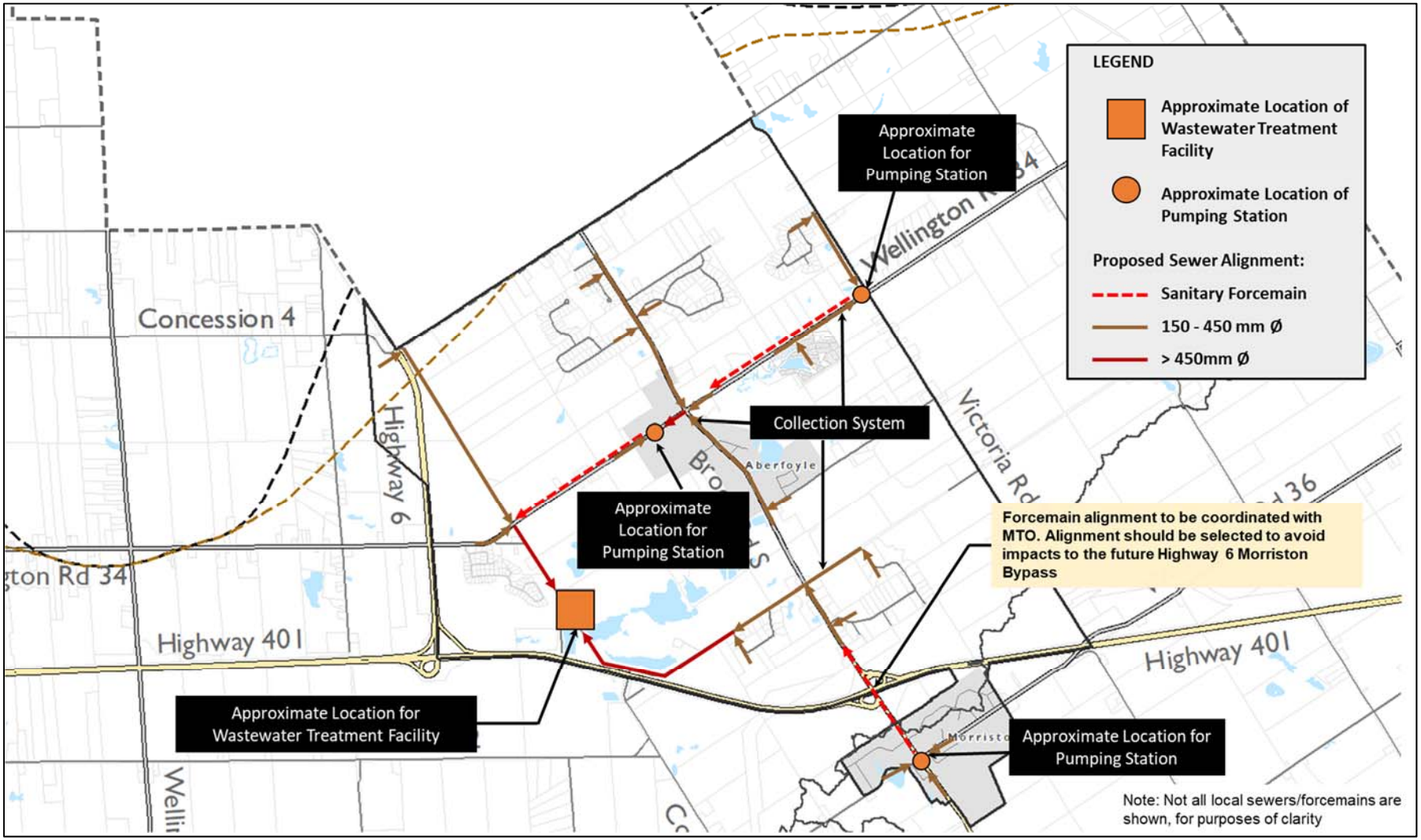

Figure 3 General Schematic – Option 1: Intra-Municipal Sewage Servicing

4.1.2 Option 2 – Inter-Municipal Sewage Servicing

The Inter-Municipal Sewage Servicing alternative consists of collection and conveyance of wastewater through a sanitary sewer network, pumping stations and forcemain, with an outlet to the Guelph collection system for ultimate treatment and disposal.

Option 2 will rely on the Guelph system for treatment, and therefore will require an inter-municipal servicing agreement. Preliminary discussions with staff from the City of Guelph have indicated that the City would be open to discussions necessary to establish an inter-municipal servicing agreement; however, no terms and/or conditions have been identified.

Through further consultation with the City, the City indicated that they do not have excess wastewater treatment capacity to support external servicing requests. The Township acknowledged that the City may not have available treatment capacity to allocate to the Township of Puslinch, and further recognized that if capacity was available, allocation of that capacity would not be without cost.

The Township Council would need to submit a formal request to the City of Guelph to initiate formal consideration of this Option. All water supply, treatment and distribution systems in the City of Guelph would remain under the City's ownership.

The preliminary sewer alignment and location of pumping stations is similar to Option 1; however, an additional pumping station would be required to convey the wastewater generated from the lands east of Highway 6 to a larger pumping station that would convey the wastewater flows to the Guelph system. In addition, a flow monitoring facility would be required at the discharge location to measure flows for billing purposes.

As with Option 1 this system includes sanitary sewer installed at standard depths of three (3) to five (5) metres below existing surface. Figure 4 below provides an approximate location for a pumping station to service Morriston, Audrey Meadows, the Mini Lakes communities, Aberfoyle and surrounding area. Each pumping station will have an associated forcemain which will discharge to the gravity system prior to being pumped into Guelph.

A description of the main infrastructure is summarized for Option 2 – Inter-Municipal Sewage Servicing in Table 10 below. A general schematic of the major components of Option 2 is shown in Figure 4.

Table 10 Sewage Servicing Option 2 – Infrastructure / Process Requirements

Area	Option Requirements
Collection	• A new gravity sewer system would be required throughout the Township in order to collect the wastewater. The sewer system would range in size from 150 mm diameter up to 525 mm diameter.
Pumping	• Four pumping stations would be required to convey the wastewater from pockets that cannot, at this stage, be conveyed through a gravity system. The pumping stations would range in size from small (18 L/s) to medium sized (385.5 L/s) stations.

As part of Option 2, all existing individual on-site septic tanks, and communal wastewater systems within the study area are expected to be decommissioned, and costs for decommissioning will be the responsibility of the private owner.

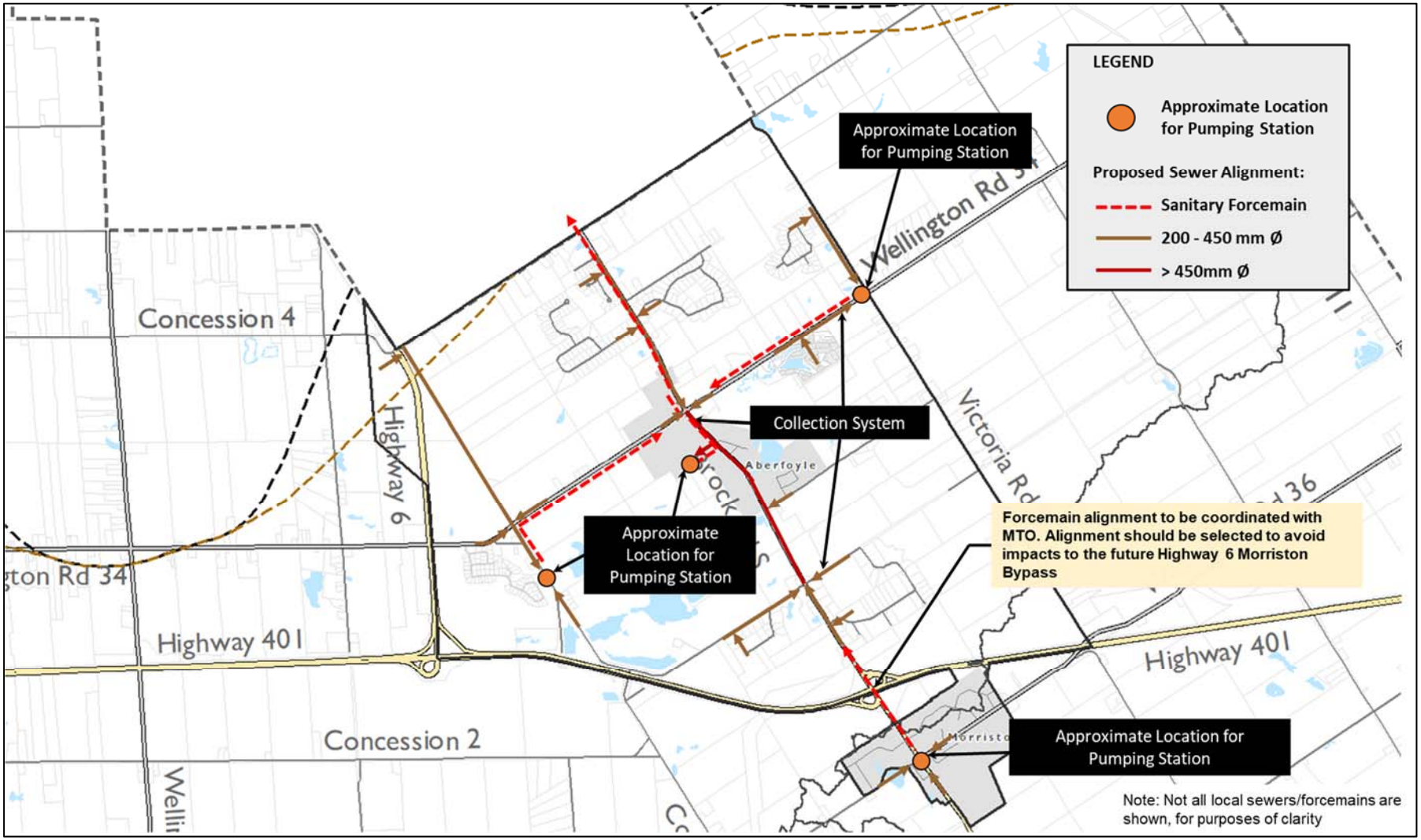

Figure 4 General Schematic – Option 2: Inter-Municipal Sewage Servicing

4.2 Estimates of Probable Cost

Estimates of probable capital, operating and maintenance costs and life cycle costs have been developed. Capital costs include an allowance for property acquisition, for pumping stations and for Option 1, a treatment facility. Major process and treatment equipment such as pumps, piping and valves, instrumentation, treatment equipment, standby power supply are assumed to be included. Operating and maintenance costs accounted for include power, chemical usage, regulatory requirements and other replacement and labour costs. Life cycle costs have been calculated based on a 20-year life expectancy.

The following general assumptions were made when developing the costs for the servicing options:

+ Cost estimates are based on 2018 construction costs. Inflation and escalation to account for actual expected prices at the time of construction cannot be accounted for at this time.
+ Estimates of probable capital costs have been developed on a conceptual level and based on prices and data in CIMA's possession, as well as previous experience from projects of similar nature and scope. The accuracy of conceptual estimates developed at this point, are assumed to be +/- 30%.
+ There is capital expenditure associated with the replacement of major pumping and treatment equipment every 30 years for wastewater facilities.
+ The cost to decommission existing private septic systems within the study area has not been accounted for in Sewage Servicing Options 1 and 2.
+ Capital costs associated with any required upgrades needed in the City of Guelph collection and treatment system to accommodate the inter-municipal Option, are unknown at this point and have not been accounted for. The required capital costs would need to be identified through further negotiations between the Township and the City, as well as the mechanisms to pay for these upgrades. Similarly, a portion of the City of Guelph's operation and maintenance (O&M) costs would need to be reviewed and negotiated for Option 2.
+ Completion of a Class Environmental Assessment (Class EA) study as well as additional amendments to existing master plans, servicing studies, secondary plans, approved draft plans, etc., have not been accounted for and should be included in the Capital Upgrade Costs, through consultation and negotiation between the Township and the City.

Life cycle costs have been estimated based on:

+ A 20 year amortization period
+ An inflation rate of 2% and an interest rate of 6% to give a market/discount rate of 4%

Estimates for probable capital, operating and life cycle costs for the sewage servicing options are summarized Table 11.

Table 11 Sewage Servicing Options – Cost Estimates

Servicing Alternative	Capital Cost ($ millions)	Annual Operating & Maintenance Cost	NPV - 20-Year Life Cycle Costs ($ millions)
Option 1 – Intra-Municipal Sewage Servicing	$ 66.6	$ 814,000	$ 73.0
Option 2 – Inter-Municipal Sewage Servicing	$ 43.5	$ 289,000	$ 44.5

Notes:
1. Net Present Value (NPV) represents the value of the project in today's dollars. Higher cash outflows, as in Option 1, results in a higher NPV.

4.3 High-level Assessment

This section presents the results of the high-level assessment completed for the water servicing options presented in Section 4.1. Key advantages and disadvantages are summarized in Table 12.

Table 12 Sewage Servicing Options – High-Level Assessment Results

Servicing Option	Advantages	Disadvantages
Option 1 – Intra-Municipal Servicing	• Provides the Township with complete control of the operation and maintenance of the wastewater collection and treatment system. • Complete independent system from collection, treatment and discharge/disposal. Township can provide desired level of robustness and flexibility to the system. • Provision of municipal sewage servicing (coupled with water servicing) in the area will provide an invitation for developers to invest in the Township and promote growth in accordance with the County Official Plan – population and employment.	• Results in highest capital, O&M and life cycle costs. • Option requires the largest amount of new infrastructure. • Majority of residents who currently rely on private septic systems and communal systems may object to connecting to a municipal system. • Residential connections to municipal systems to be borne by residents. • Assimilative capacity of Mill Creek may limit capacity of treatment plant. • An alternative effluent discharge location or method of disposal may be required.
Option 2 – Inter-Municipal Servicing	• Option results in lowest capital, O&M and life cycle costs.	• Majority of residents who currently rely on private septic and communal

Servicing Option	Advantages	Disadvantages
	• Option provides the Township with control of the collection system and operation and maintenance, which is a lower complexity operations requirement. • Operations costs for wastewater treatment will be fixed by Agreement with the City of Guelph, and funded through rates established in the Agreement. • May be able to optimize the existing infrastructure (in City of Guelph) and reduce the need for new infrastructure. • It may provide an opportunity for the two municipalities (City of Guelph and Township) to partner for funding opportunities and share existing resources. • The coordinated approach to service delivery can result in efficiencies in infrastructure costs, water conservation, and allow for additional funds to be allocated to improved treatment and program delivery. • Provision of municipal sewage servicing (coupled with water servicing) will provide an invitation for developers to invest in the areas and promote growth in accordance with the County Official Plan – population and employment.	systems may object to a connection to a municipal system. • It most likely require an amendment the City of Guelph Official Plan to allow the extension of the City's services for areas outside of the City's urban boundaries. • City of Guelph Wastewater Servicing Master Plan would need to integrate servicing to the area in Township. • Upgrades to existing wastewater infrastructure in Guelph may be required, directly or indirectly, to accommodate the inter-municipal servicing. • An inter-municipal agreement will be required to establish an inter-municipal services scheme, and to document Capital Contributions, cost sharing for Capital upgrades, and for user rates. • The cost of any Capital Contribution and/or Capital Upgrades to secure treatment from the City of Guelph is unknown at this time, and may represent a significant impact to the overall project cost.

5. Closing

The above sections have described the potential high-level water and sewage servicing options for the study area within the Township. It should be noted that there are more servicing design options that may be considered (i.e. alternative locations and routing for facilities); however, the basic options and assessments would remain.

On a preliminary basis, from a capital cost perspective, it appears that the Inter-Municipal servicing options for both water and sewage servicing would be preferred. However, this assessment would have to be re-visited once formal discussions and negotiations proceed with the City of Guelph, and once the impacts of any Capital Contributions, Capital Upgrades, and user rates are established.

APPENDIX A - Detailed Calculations

Project Title:	**Puslinch Water and Sewage Feasibility Study**		
Client:	Township of Puslinch		
Project No.:	T000866A		
Task:	Option Development - Water		
Prepared By:	Sandra Rodriguez	**Date:**	9-Jan-18
Reviewed by:	Stuart Winchester	**Date:**	
Revision No. :		**Revision Date:**	

SOURCE: WATER DEMANDS HAVE BEEN CALCULATED PREVIOUSLY IN A SEPARATE SPREADSHEET. THIS IS A COPY OF THE WATER DEMANDS CALCULATIONS. PROVIDED HERE FOR REFERENCE AND USED IN THE DEVELEOPMENT OF OPTIONS.

ESTIMATE WATER DEMANDS FOR WHOLE STUDY AREA

Design Criteria

Description	Value	Units	Comments
MOECC Residential Unit Rate	270-450	L/cap/day	MOECC suggested range
Calculated for Ex. Communual Systems	353.0	L/cap/day	Calculated for Meadows of Aberfoyle
	294.4	L/cap/day	Calculated for Mini Lakes
Recommended Design Rate	360.0	L/cap/day	Assumed (mid point from MOECC range, marginally above Meadows of Aberfoyle rate)
Residential Max. Day Factor	2.00	-	Based on future residential and employment population of 7,909 as per adjacent numbers and MOECC Guidelines
Safety factor for ICI future conditions	1.00		Assumed
Industrial/Commercial Max. Day Factor	3.00	-	Assumed based on MOECC range between 2 and 4 for industrial uses.

RECOMMENDED SCENARIO:

Provide servicing to entire service area for domestic and ICI purposes. Nestle and St. Mary's Cement to be excluded; however, a 1% allocation of total PTTW flows have been assumed for domestic purposes in both Nestle and St. Marys.

Industry Name	PTTW Capacity		1% Allocation for Domestic	
	m3/d	L/s	m3/d	L/s
Nestle Canada Inc.	3,600	41.7	3.60	0.04
St. Marys Cement Inc. (Canada)	47,136	545.6	47.14	0.55

Service Type	Scenario V (Domestic and Industrial Uses - Excluding Nestle and St. Marys Cement)					
	Ave. Day Demands		Max. Day Demands		Peak Hour Demands	
	m^3/d	L/s	m^3/d	L/s	m^3/d	L/s
Residential	819.6	9.5	1,639.1	19.0	2,458.7	28.5
Industrial / Commercial / Recreational (outside large users)	1,226.9	14.2	2,453.8	28.4	3,680.6	42.6
Industrial / Commercial / Recreational (large users excluding Nestle and St. Marys)	776.1	9.0	2,001.1	23.2	2,328.3	26.9
Allowance for Domestic Use at Nestle and St. Marys	50.7	0.6	152.2	1.8	152.2	1.8
Total =	**2,873**	**33.3**	**6,246**	**72.3**	**8,620**	**99.8**

Project Title:	**Puslinch Water and Sewage Feasibility Study**		
Client:	Township of Puslinch		
Project No.:	T000866A		
Task:	Option Development - Water Option 1A - Intra-Municipal Servicing		
Prepared By:	Sandra Rodriguez	**Date:**	30-Jan-18
Reviewed by:	Stuart Winchester	**Date:**	27-Feb-18
Revision No. :		**Revision Date:**	

Option 1A - Intra-Municipal Servicing

Key Components:

Water supply - Assumes one new groundwater well

One common treatment facility providing treatment for well water. Assume good water quality requiring treament for disinfection only.

Storage facility - assumes one elevated water tower. To be located south of Aberfoyle and close to ex. industrial/employment area.

Distribution system - Assumes connection to Guelph distribution system around southern boundary for pressure Zone 3.

1. System Design Demands

Design Demands	Units		Comments
	m3/d	L/s	
Average Day Demands	2,873.3	33.3	
Max. Day Demands	6,246.2	72.3	
Peak Hour Demands	8,619.9	99.8	
Calculated Max. Day Factor	2.2		
Peak Hour Factor	3.0		

2. Well Supply

Criteria	Value	Units	Comments
Required Supply Demand (System Max. Day Demands)	72.3	L/s	
No. wells (assumed)	1.0		Assumes two wells, based on capacity
Well Capacity (each)	72.3	L/s	
No. of well pumps	1.0		
Capacity of well pump (each)	72.3	L/s	

2. Treatment Facility - Provision of disinfection only assumed

Criteria	Value	Units	Comments
Required Treatment Demand (System Max. Day Demands)	72.3	L/s	
No. chlorine contact chambers (assumed)	1.0		Assumes only one contact chamber providing full treatment capacity
Tratment capacity of contact chamber	72.3	L/s	

3. Storage Facility - Storage through an Elevated Water Tower

3.a Storage Calculations based on Risk Analysis for Emergency Storage (no fire protection)

Criteria	Value	Units	Comments
Emergency Storage Volume			Emergency storage volume equivalent to 2 x full day's demand
System Ave. Day Demands	33	L/s	
	2,873	m3/d	
Calculated Emergency Volume	5,747	m3	

3.b Storage Calculations based on MOECC Guidelines (fire protection provided)

Criteria	Value	Units	Comments
Minimum Required Storage Volume			Fire Storage + Equalization Storage (25% of Max. Day) + Emergency Storage (25% of Fire + Equalization Storage)
System Max . Day Demands	6,246	m3/d	
Fire Storage	1,253	m3	Fire storage based on ultimate euiqvalent population of 7700 people. Based on fire flow of 174 L/s for 3 hours as per MOE guidelines Table 8-1 (value interpolated)
Equalization Storage	1,562	m3	
Emergency Storage	703.6	m3	
Minimum Required Storage Volume as per MOECC	3,518	m3	Separate chlorine contact chambers will provide the required disinfection requirements
	3.5	ML	

4. Distribution System					
From Guelph/treatment facility to New Elevated Tower in Aberfyole					
Criteria	**Value**		**Units**		**Comments**
Set watermain diameter of	mm	400	300	200	Note that future watermains in south Guelph expected to be 400 mm diameter
	m	0.40	0.30	0.20	
Length of distribution watermain	m	5,500	5,500	5,500	Approx. distance from current upper boundary of Guelph Zone 3 @ Clair Road West to proposed location of new tower in Aberfoyle.
Pipeline Area	m2	0.126	0.071	0.031	
Pipeline Volume	m3	691.2	388.8	172.8	
System Ultimate Average Daily Flow	L/s	33.3	33.3	33.3	
System Ultimate Max. Daily Flow	L/s	72.3	72.3	72.3	
System Ultimate Peak Hour Flow	L/s	99.8	99.8	99.8	
System Max. day + Fire Flow	L/s	246.3	246.3	246.3	
Velocity under Average Flows	m/s	0.3	0.5	1.1	
Velocity under Max. Flows	m/s	0.6	1.0	2.3	Chose 400 mm mainly to be consistent with future watermains in Guelph
Velocity under Peak Hour Flows	m/s	0.8	1.4	3.2	
Velocity under Max. day + Fire flows	m/s	1.96	3.48	7.84	
Retention Time under Ultimate Average Flows	hrs	5.8	3.2	1.4	
Retention Time under Max. Flows	hrs	2.7	1.5	0.7	
From New Elevated Tower in Aberfyole to Industrial and Commercial areas					
Criteria	**Value**	**Units**			**Comments**
Set watermain diameter of	mm	500	400	300	
	m	0.50	0.40	0.30	
Length of distribution watermain	m	1,800	1,800	1,800	Approx. length for major industrial/employment area south of Aberfoyle
Pipeline Area	m2	0.196	0.126	0.071	
Pipeline Volume	m3	353.4	226.2	127.2	
System Ultimate Average Daily Flow	L/s	33.3	33.3	33.3	
System Ultimate Max. Daily Flow	L/s	72.3	72.3	72.3	
System Ultimate Peak Hour Flow	L/s	99.8	99.8	99.8	
System Max. day + Fire Flow	L/s	246.3	246.3	246.3	
Velocity under Average Flows	m/s	0.17	0.26	0.47	
Velocity under Max. Flows	m/s	0.37	0.58	1.02	
Velocity under Peak Hour Flows	m/s	0.51	0.79	1.41	
Velocity under Max. day + Fire flows	m/s	1.3	2.0	3.5	Chose 400 mm to satisfy max. day + fire flow conditions in major industrial/employment area
Retention Time under Ultimate Average Flows	hrs	3.0	1.9	1.1	
Retention Time under Max. Flows	hrs	1.4	0.9	0.5	
From New Elevated Tower in Aberfyole to Morriston					
Criteria	**Value**	**Units**			**Comments**
Set watermain diameter of	mm	300	200	150	
	m	0.30	0.20	0.15	
Length of distribution watermain	m	1,500	1,500	1,500	Approx. length for major industrial/employment area to Morriston
Pipeline Area	m2	0.071	0.031	0.018	
Pipeline Volume	m3	106.0	47.1	26.5	
System Ultimate Average Daily Flow for MORRISTON only	L/s	2.6	2.6	2.6	
System Ultimate Max. Daily Flow for MORRISTON only	L/s	5.2	5.2	5.2	
System Ultimate Peak Hour Flow for MORRISTON only	L/s	7.8	7.8	7.8	
System Max. day + Fire Flow	L/s	43.2	43.2	43.2	2041 Projected population for Morriston is 620 people. As per MOE Guidelines suggested fireflows for this population is 38 L/s for 2 hours
Velocity under Average Flows	m/s	0.04	0.08	0.15	
Velocity under Max. Flows	m/s	0.07	0.16	0.29	
Velocity under Peak Hour Flows	m/s	0.11	0.25	0.44	
Velocity under Max. day + Fire flows	m/s	0.6	1.4	2.4	Chose 200 mm to satisfy max. day + fire flow conditions
Retention Time under Ultimate Average Flows	hrs	11.4	5.1	2.9	
Retention Time under Max. Flows	hrs	5.7	2.5	1.4	

Project Title:	**Puslinch Water and Sewage Feasibility Study**		
Client:	Township of Puslinch		
Project No.:	T000866A		
Task:	Water Servcing Option Development - Option 1 Probable Cost		
Prepared By:	Sandra Rodriguez	**Date:**	30-Jan-18
Reviewed by:	S. Winchester	**Date:**	27-Feb-18
Revision No. :	1	**Revision Date:**	27-Feb-18

CAPITAL AND OPERATION & MAINTENANCE COST

Option 1A - Intra-Municipal System

System Description	Quantity	Unit	Material		Labour		Total Material & Labour	Sub Total Cost	Comments
			Unit Cost	Total Material Cost	% of Material	Total Labour Cost			
Supply and Treatment									
Preliminary Studies and Approvals - hydrogeological study and testing	1	LS	$ 500,000	$ 500,000	50%	$ 250,000	$ 750,000		
Construction of new production wells (assumed 2), equipped with well pumps	1	LS	$ 150,000	$ 150,000	50%	$ 75,000	$ 225,000		
New treatment facility (assumes 15mx10m footprint)	150	m2	$ 2,000	$ 300,000	50%	$ 150,000	$ 450,000		
Piping, valves and fittings	1	LS	$ 50,000	$ 50,000	50%	$ 25,000	$ 75,000		
Instrumentation	1	LS	$ 35,000	$ 35,000	30%	$ 10,500	$ 45,500		
Sodium Hypoclorite System - disinfection	1	each	$ 50,000	$ 50,000	30%	$ 15,000	$ 65,000		
Electrical (standby diesel generator, service entrance, control panels motor starters, controls and automation)	1	LS	$ 450,000	$ 450,000	50%	$ 225,000	$ 675,000		
Mechanical (HVAC system, lighting)	1	LS	$ 75,000	$ 75,000	50%	$ 37,500	$ 112,500		
Site Works (includes site grading, excavation, trenching, backfilling)	1	LS	$ 250,000	$ 250,000	50%	$ 125,000	$ 375,000		
Contact Chambers for disinfection	1	LS	$ 250,000	$ 250,000	50%	$ 125,000	$ 375,000		
Other site works (watermains, driveway, fences, gates, sodding, etc.)	1	LS	$ 100,000	$ 100,000	50%	$ 50,000	$ 150,000		
Power upgrades to 3 phase	1	LS	$ 75,000	$ 75,000	50%	$ 37,500	$ 112,500		
Property acquisition - treatment facility	1.0	acres	$ 300,000	$ 300,000		$ -	$ 300,000		*Assumed $300,000/acre as per info provide by real state agent in Puslinch.*
Property acquisition - storage facility	1.00	acres	$ 300,000	$ 300,000		$ -	$ 300,000		*Assumed $300,000/acre as per info provide by real state agent in Puslinch.*
Sub-total Capital Cost for New Well Pump =								**$ 4,010,500**	
Storage and Distribution System									
New Elevated water tower (3,500 m3)	1	LS	$ 4,000,000	$ 4,000,000	incl		$ 4,000,000		*Provided by M. Elliott*
400 mm diameter watermain	5,100	m	$ 870	$ 4,437,000	incl		$ 4,437,000		*Assumes installation in shoulder of road*
300 mm diameter watermain	7,700	m	$ 520	$ 4,004,000	incl		$ 4,004,000		*Assumes installation in shoulder of road*
200 mm diameter watermain	20,100	m	$ 360	$ 7,236,000	incl		$ 7,236,000		*Assumes installation in shoulder of road*
Sub-total Capital Cost for Connecting Watermain =								**$ 19,677,000**	
SUB-TOTAL CAPITAL COST IN CURRENT YEAR (2018) =								**$ 23,687,500**	
Contingency (20%) =								**$ 4,737,500**	
Engineering and Construction (15%) =								**$ 3,553,200**	
Contractor Overhead (10%) =								**$ 2,368,800**	
TOTAL CAPITAL COST IN CURRENT YEAR (2018) =								**$ 34,347,000**	

OPERATION AND MAINTENANCE COST

Area	Item	QTY	Unit	Unit Cost ($)	Annual Cost	Subtotal	Comments
Pumping Cost	Well Pumps Annual Electrical Cost	$ 1	LS	$ 15,000	$ 10,000		
	Sub-Total Well Pumps =					**$ 10,000**	
Chemical Systems	NaOCl at new well pump facility for primary disinfection	$ 1	LS	$ 5,000	$ 5,000		
	Sub-Total Chemical Systems =					**$ 5,000**	
Miscellaneous O&M	Equipment maintenance, contracts and agreements	1	LS	$ 30,000	$ 30,000		
	Pumps parts and replacement, materials, for new facility	1	LS	$ 15,000	$ 15,000		
	Sub-Total Regulatory Requirements =					**$ 45,000**	
Labour	Labour	1	LS	$ 350,000	$ 350,000		Assumed that Town will retain an Operating Agency to operate the system on their behalf. High-level cost provided by OCWA in email on February 20, 2018.
	Sub-Total Regulatory Requirements =					**$ 350,000**	
Regulatory Requirements	Lab and reporting	1	LS	$ 10,000	$ 10,000		
	Sub-Total Regulatory Requirements =					**$ 10,000**	
TOTAL O&M COST IN CURRENT YEAR (2018) =						**$ 420,000**	
Contingency (20%) =						**$ 84,000**	
TOTAL O&M COST IN CURRENT YEAR (2018) =						**$ 504,000**	

Project Title:	**Puslinch Water and Sewage Feasibility Study**		
Client:	Township of Puslinch		
Project No.:	T000866A		
Task:	Water Servcing Option Development - Option 1 Probable Cost		
Prepared By:	Sandra Rodriguez	**Date:**	8-Feb-18
Reviewed by:	S. Winchester	**Date:**	27-Feb-18
Revision No. :	2	**Revision Date:**	28-Feb-18

LIFE CYCLE COST

Option 1A - Intra-Municipal System

Economic Factors

Interest rate (%)	6%
Inflation rate (%)	2.0%
Project Start Year (Year n)	2020
Planning Period (yrs)	20

Cost in Year n = Cost in Current Year x (1+inflation Rate)^(Year n - Current Year)

Present Value = Cost /((1+Interest Rate)^(Year n - Current Year))

20-Year NPV

Year	Capital Cost	NPV Capital Cost	Operating Cost	NPV Operating Cost	Capital and Operating NPV
2018	$34,347,000		$504,000		
2019	$0		$0		
2020	$35,734,619	$31,803,684	$524,362	$466,680	$32,270,363
2021	$0	$0	$534,849	$449,069	$449,069
2022	$0	$0	$545,546	$432,123	$432,123
2023	$0	$0	$556,457	$415,817	$415,817
2024	$0	$0	$567,586	$400,126	$400,126
2025	$0	$0	$578,938	$385,027	$385,027
2026	$0	$0	$590,516	$370,497	$370,497
2027	$0	$0	$602,327	$356,516	$356,516
2028	$0	$0	$614,373	$343,063	$343,063
2029	$0	$0	$626,661	$330,117	$330,117
2030	$862,404	$428,589	$639,194	$317,660	$746,248
2031	$0	$0	$651,978	$305,673	$305,673
2032	$0	$0	$665,017	$294,138	$294,138
2033	$0	$0	$678,318	$283,038	$283,038
2034	$0	$0	$691,884	$272,358	$272,358
2035	$0	$0	$705,722	$262,080	$262,080
2036	$0	$0	$719,836	$252,190	$252,190
2037	$0	$0	$734,233	$242,674	$242,674
2038	$0	$0	$748,917	$233,516	$233,516
2039	$0	$0	$763,896	$224,704	$224,704
2040	$1,051,266	$291,732	$779,174	$216,225	$507,956
	Sub-Total NPV value =	$32,524,004		$6,853,289	
	Total NPV value (20 years) =	**$39,377,300**			**$39,377,300**

Capital Cost Breakdown Every 10 Years :

Well Pump House	Cost every 10 years	Comments
Building envelope, disinfection system, media regeneration, equipment =	$100,000	Assumed
Well rehabilitation (2 wells) =	$80,000	Assumed
Elevated Tank (inspection, coating, etc.) =	$500,000	
Total Capital Cost New Well Pump House / 10 years	**$680,000**	

Total Additional Capital Cost / 10 years = $680,000

Project Title:	**Puslinch Water and Sewage Feasibility Study**		
Client:	Township of Puslinch		
Project No.:	T000866A		
Task:	Water Servcing Option Development - Option 2 Probable Cost		
Prepared By:	Sandra Rodriguez	**Date:**	30-Jan-18
Reviewed by:	S. Winchester	**Date:**	27-Feb-18
Revision No. :	1	**Revision Date:**	27-Feb-18

CAPITAL AND OPERATION & MAINTENANCE COST

Option 1B - Inter-Municipal System

System Description	Quantity	Unit	Material		Labour		Total Material & Labour	Sub Total Cost	Comments
			Unit Cost	Total Material Cost	% of Material	Total Labour Cost			
Supply									
Connection to ex. Guelph distribution system, including metering facility	1	LS	$ 250,000	$ 250,000	50%	$ 125,000	$ 375,000		
Pressure Control Station	1	LS	$ 1,000,000	$ 1,000,000	50%	$ 500,000	$ 1,500,000		*Assumed by S.Rodriguez*
Property acquisition - Pressure Control station	0.5	acres	$ 300,000	$ 150,000		$ -	$ 150,000		*Assumed $300,000/acre as per info provide by real state agent in Puslinch.*
Property acquisition - storage facility	1.0	acres	$ 300,000	$ 300,000		$ -	$ 300,000		*Assumed $300,000/acre as per info provide by real state agent in Puslinch.*
Sub-total Capital Cost for New Well Pump =								**$ 2,325,000**	
Storage and Distribution									
New Elevated water tower (3,500 m3)	1	LS	$ 4,000,000	$ 4,000,000	incl		$ 4,000,000		*Provided by M. Elliott*
400 mm diameter watermain	3,300	m	$ 870	$ 2,871,000	incl		$ 2,871,000		*Assumes installation in shoulder of road*
300 mm diameter watermain	7,700	m	$ 520	$ 4,004,000	incl		$ 4,004,000		*Assumes installation in shoulder of road*
150mm - 200 mm diameter watermain	20,100	m	$ 360	$ 7,236,000	incl		$ 7,236,000		*Assumes installation in shoulder of road*
Sub-total Capital Cost for Connecting Watermain =								**$ 18,111,000**	
SUB-TOTAL CAPITAL COST IN CURRENT YEAR (2018) = $ 20,436,000									
Contingency (20%) = $ 4,087,200									
Engineering and Construction (15%) = $ 3,065,400									
Contractor Overhead (10%) = $ 2,043,600									
TOTAL CAPITAL COST IN CURRENT YEAR (2018) = $ 29,632,200									

OPERATION AND MAINTENANCE COST

Area	Item	QTY	Unit	Unit Cost ($)	Annual Cost	Subtotal	Comments
Pumping Cost	Well Pumps Annual Electrical Cost	$ 1	LS	$ 15,000	$ 10,000		
	Sub-Total Well Pumps =					**$ 10,000**	
Chemical Systems	NaOCl at new well pump facility for primary disinfection	$ 1	LS	$ 2,000	$ 2,000		In case they want to do re-chlorination at the storage facility
	Sub-Total Chemical Systems =					**$ 2,000**	
Miscellaneous O&M	Equipment maintenance, contracts and agreements	1	LS	$ 10,000	$ 10,000		
	Pumps parts and replacement, materials, for new facility	1	LS	$ 5,000	$ 5,000		
	Sub-Total Regulatory Requirements =					**$ 15,000**	
Labour	Labour	1	LS		$ 50,000		Assumed
	Sub-Total Regulatory Requirements =					**$ 50,000**	
Regulatory Requirements	Lab and reporting	1	LS	$ 2,500	$ 2,500		
	Sub-Total Regulatory Requirements =					**$ 2,500**	
TOTAL O&M COST IN CURRENT YEAR (2018) = $						**79,500**	
Contingency (20%) = $						**15,900**	
TOTAL O&M COST IN CURRENT YEAR (2018) = $						**95,400**	

Project Title:	**Puslinch Water and Sewage Feasibility Study**		
Client:	Township of Puslinch		
Project No.:	T000866A		
Task:	Water Servcing Option Development - Option 2 Probable Cost		
Prepared By:	Sandra Rodriguez	**Date:**	8-Feb-18
Reviewed by:	S. Winchester	**Date:**	27-Feb-18
Revision No. :	2	**Revision Date:**	28-Feb-18

LIFE CYCLE COST

Option 1B - Inter-Municipal System

Economic Factors

Interest rate (%)	6%
Inflation rate (%)	2.0%
Project Start Year (Year n)	2020
Planning Period (yrs)	20

Cost in Year n = Cost in Current Year x (1+inflation Rate)^(Year n - Current Year)

Present Value = Cost /((1+Interest Rate)^(Year n - Current Year))

20-Year NPV

Year	Capital Cost	NPV Capital Cost	Operating Cost	NPV Operating Cost	Capital and Operating NPV
2018	$29,632,200		$95,400		
2019	$0		$0		
2020	$30,829,341	$27,438,004	$99,254	$88,336	$27,526,339
2021	$0	$0	$101,239	$85,002	$85,002
2022	$0	$0	$103,264	$81,795	$81,795
2023	$0	$0	$105,329	$78,708	$78,708
2024	$0	$0	$107,436	$75,738	$75,738
2025	$0	$0	$109,585	$72,880	$72,880
2026	$0	$0	$111,776	$70,130	$70,130
2027	$0	$0	$114,012	$67,483	$67,483
2028	$0	$0	$116,292	$64,937	$64,937
2029	$0	$0	$118,618	$62,486	$62,486
2030	$697,533	$346,653	$120,990	$60,128	$406,781
2031	$0	$0	$123,410	$57,859	$57,859
2032	$0	$0	$125,878	$55,676	$55,676
2033	$0	$0	$128,396	$53,575	$53,575
2034	$0	$0	$130,964	$51,553	$51,553
2035	$0	$0	$133,583	$49,608	$49,608
2036	$0	$0	$136,255	$47,736	$47,736
2037	$0	$0	$138,980	$45,935	$45,935
2038	$0	$0	$141,759	$44,201	$44,201
2039	$0	$0	$144,595	$42,533	$42,533
2040	$850,289	$235,959	$147,486	$40,928	$276,888
	Sub-Total NPV value =	$28,020,616		$1,297,230	
	Total NPV value (20 years) =	**$29,317,900**			**$29,317,900**

Capital Cost Breakdown Every 10 Years :		
Well Pump House	Cost every 10 years	Comments
PS building envelope, equipment =	$50,000	Assumed
Elevated Tank (inspection, coating, etc.) =	$500,000	
Total Capital Cost New Well Pump House / 10 years	**$550,000**	

Total Additional Capital Cost / 10 years = $550,000

WATER SERVICING INFRASTRUCTURE AVERAGE UNIT PRICES (2018 - Southwestern Region)

A) Watermain Installation with Minimum Restoration (Top Soil and Seed only) (FOR INSTALLATION IN DITCHES)

	Nom. Pipe Size	Outer Diameter	Depth to Invert	Minimum Trench Width	Excavation		Bedding		Pipe		Backfill		Restoration Allowance	**Subtotal Unit Cost**	Appurtenance Allowance	**Subtotal Unit Cost**	Dewatering Allowance	**Subtotal Unit Cost**	Conting @20%	Eng. @15%	**TOTAL (excl. HST)**
					Vol.	Cost	Vol.	Cost	Cost	Installation	Vol.	Cost									
	(mm)	(m)	(m)	(m)	(m^3)	($/m)	(m^3)	($/m)	($/m)	($/m)	(m^3)	($/m)	($/m)	**($/m)**	($/m)	**($/m)**	($/m)	**($/m)**	($/m)	($/m)	**($/m)**
PVC	100	0.14	2.4	0.74	2.8	16.80	0.44	19.70	24.80	2.48	2.80	14.00	40.00	**117.78**	59.00	**176.78**	10	**186.78**	37.40	33.60	**260.00**
	150	0.20	2.4	0.80	3.10	18.60	0.52	23.40	38.25	3.83	2.85	14.30	40.00	**138.38**	59.00	**197.38**	10	**207.38**	41.50	31.11	**280.00**
	200	0.26	2.4	0.86	3.4	20.40	0.61	27.50	63.00	6.30	2.90	14.50	40.00	**171.70**	64.00	**235.70**	10	**245.70**	49.10	36.86	**340.00**
	250	0.33	2.4	0.93	3.7	22.20	0.73	32.70	91.00	9.10	2.95	14.80	40.00	**209.80**	67.00	**276.80**	10	**286.80**	57.40	43.02	**390.00**
	300	0.38	2.4	0.98	4.0	24.00	0.81	36.70	124.50	12.45	3.00	15.00	40.00	**252.65**	80.00	**332.65**	15	**347.65**	69.50	52.15	**470.00**
	350	0.45	2.4	1.05	4.4	26.40	0.94	42.60	279.00	27.90	3.00	15.00	40.00	**430.90**	85.00	**515.90**	15	**530.90**	106.20	79.64	**720.00**
	400	0.50	2.4	1.10	4.5	27.00	1.04	47.10	312.00	31.20	3.05	15.30	40.00	**472.60**	103.00	**575.60**	15	**590.60**	118.10	88.59	**800.00**
	450	0.55	2.4	1.15	4.6	27.60	1.15	51.80	385.00	38.50	3.05	15.30	40.00	**558.20**	123.00	**681.20**	15	**696.20**	139.20	104.43	**940.00**
	500	0.60	2.4	1.20	4.9	29.40	1.26	56.70	450.00	45.00	3.05	15.30	40.00	**636.40**	134.00	**770.40**	20	**790.40**	158.10	118.56	**1,070.00**
	600	0.73	2.4	1.33	5.8	34.80	1.57	70.70	719.00	71.90	3.05	15.30	40.00	**951.70**	174.00	**1,125.70**	20	**1,145.70**	229.10	171.86	**1,550.00**
CPP	750	0.90	2.4	1.50	7.0	42.00	2.02	91.20	850.00	85.00	3.00	15.00	40.00	**1,123.20**	150.00	**1,273.20**	20	**1,293.20**	258.60	193.98	**1,750.00**
	900	1.10	3.0	1.70	8.7	52.20	2.63	118.60	1,000.00	100.00	3.35	16.80	40.00	**1,327.60**	180.00	**1,507.60**	20	**1,527.60**	305.50	229.14	**2,070.00**

B) Watermain Installation with Granular Road Restoration

	Nom. Pipe Size	Outer Diameter	Depth to Invert	Minimum Trench Width	Excavation		Bedding		Pipe		Backfill		Restoration Allowance	**Subtotal Unit Cost**	Appurtenance Allowance	**Subtotal Unit Cost**	Dewatering Allowance	**Subtotal Unit Cost**	Conting @20%	Eng. @15%	**TOTAL (excl. HST)**
					Vol.	Cost	Vol.	Cost	Cost	Installation	Vol.	Cost									
	(mm)	(m)	(m)	(m)	(m^3)	($/m)	(m^3)	($/m)	($/m)	($/m)	(m^3)	($/m)	($/m)	**($/m)**	($/m)	**($/m)**	($/m)	**($/m)**	($/m)	($/m)	**($/m)**
PVC	100	0.14	2.4	0.74	2.8	16.80	0.44	19.70	24.80	2.48	2.80	14.00	72.00	**149.78**	59.00	**208.78**	10	**218.78**	43.80	39.40	**310.00**
	150	0.20	2.4	0.80	3.10	18.60	0.52	23.40	38.25	3.83	2.85	14.30	72.00	**170.38**	59.00	**229.38**	10	**239.38**	47.90	35.91	**330.00**
	200	0.26	2.4	0.86	3.4	20.40	0.61	27.50	63.00	6.30	2.90	14.50	72.00	**203.70**	64.00	**267.70**	10	**277.70**	55.50	41.66	**380.00**
	250	0.33	2.4	0.93	3.7	22.20	0.73	32.70	91.00	9.10	2.95	14.80	72.00	**241.80**	67.00	**308.80**	10	**318.80**	63.80	47.82	**440.00**
	300	0.38	2.4	0.98	4.0	24.00	0.81	36.70	124.50	12.45	3.00	15.00	72.00	**284.65**	80.00	**364.65**	15	**379.65**	75.90	56.95	**520.00**
	350	0.45	2.4	1.05	4.4	26.40	0.94	42.60	279.00	27.90	3.00	15.00	72.00	**462.90**	105.00	**567.90**	15	**582.90**	116.60	87.44	**790.00**
	400	0.50	2.4	1.10	4.5	27.00	1.04	47.10	312.00	31.20	3.05	15.30	72.00	**504.60**	123.00	**627.60**	15	**642.60**	128.50	96.39	**870.00**
	450	0.55	2.4	1.15	4.6	27.60	1.15	51.80	385.00	38.50	3.05	15.30	72.00	**590.20**	153.00	**743.20**	15	**758.20**	151.60	113.73	**1,030.00**
	500	0.60	2.4	1.20	4.9	29.40	1.26	56.70	450.00	45.00	3.05	15.30	72.00	**668.40**	164.00	**832.40**	20	**852.40**	170.50	127.86	**1,160.00**
	600	0.73	2.4	1.33	5.8	34.80	1.57	70.70	719.00	71.90	3.05	15.30	72.00	**983.70**	194.00	**1,177.70**	20	**1,197.70**	239.50	179.66	**1,620.00**
CPP	750	0.90	2.4	1.50	7.0	42.00	2.02	91.20	850.00	85.00	3.00	15.00	72.00	**1,155.20**	150.00	**1,305.20**	20	**1,325.20**	265.00	198.78	**1,790.00**
	900	1.10	3.0	1.70	8.7	52.20	2.63	118.60	1,000.00	100.00	3.35	16.80	72.00	**1,359.60**	180.00	**1,539.60**	20	**1,559.60**	311.90	233.94	**2,110.00**

C) Watermain Installation with with Road Restoration (Assumes 1 Lane restored, along with Curb & Gutter, and Sidewalk one side)

	Nom. Pipe Size	Outer Diameter	Depth to Invert	Minimum Trench Width	Excavation		Bedding		Pipe		Backfill		Restoration Allowance	**Subtotal Unit Cost**	Appurtenance Allowance	**Subtotal Unit Cost**	Dewatering Allowance	**Subtotal Unit Cost**	Conting @20%	Eng. @15%	**TOTAL (excl. HST)**
					Vol.	Cost	Vol.	Cost	Cost	Installation	Vol.	Cost									
	(mm)	(m)	(m)	(m)	(m^3)	($/m)	(m^3)	($/m)	($/m)	($/m)	(m^3)	($/m)	($/m)	**($/m)**	($/m)	**($/m)**	($/m)	**($/m)**	($/m)	($/m)	**($/m)**
PVC	100	0.14	2.4	0.74	2.8	16.80	0.44	19.70	24.80	2.48	2.80	14.00	214.12	**291.90**	59.00	**350.90**	10	**360.90**	72.20	65.00	**500.00**
	150	0.20	2.4	0.80	3.1	18.60	0.52	23.40	38.25	3.83	2.85	14.30	214.12	**312.50**	59.00	**371.50**	10	**381.50**	76.30	57.22	**520.00**
	200	0.26	2.4	0.86	3.4	20.40	0.61	27.50	63.00	6.30	2.90	14.50	214.12	**345.82**	64.00	**409.82**	10	**419.82**	84.00	62.97	**570.00**
	250	0.33	2.4	0.93	3.7	22.20	0.73	32.70	91.00	9.10	2.95	14.80	214.12	**383.92**	67.00	**450.92**	10	**460.92**	92.20	69.14	**630.00**
	300	0.38	2.4	0.98	4.0	24.00	0.81	36.70	124.50	12.45	3.00	15.00	214.12	**426.77**	80.00	**506.77**	15	**521.77**	104.40	78.27	**710.00**
	350	0.45	2.4	1.05	4.4	26.40	0.94	42.60	279.00	27.90	3.00	15.00	214.12	**605.02**	105.00	**710.02**	15	**725.02**	145.00	108.75	**980.00**
	400	0.50	2.4	1.10	4.5	27.00	1.04	47.10	312.00	31.20	3.05	15.30	214.12	**646.72**	123.00	**769.72**	15	**784.72**	156.90	117.71	**1,060.00**
	450	0.55	2.4	1.15	4.6	27.60	1.15	51.80	385.00	38.50	3.05	15.30	214.12	**732.32**	153.00	**885.32**	15	**900.32**	180.10	135.05	**1,220.00**
	500	0.60	2.4	1.20	4.9	29.40	1.26	56.70	450.00	45.00	3.05	15.30	214.12	**810.52**	164.00	**974.52**	20	**994.52**	198.90	149.18	**1,350.00**
	600	0.73	2.4	1.33	5.8	34.80	1.57	70.70	719.00	71.90	3.05	15.30	214.12	**1,125.82**	194.00	**1,319.82**	20	**1,339.82**	268.00	200.97	**1,810.00**
CPP	750	0.90	2.4	1.50	7	42.00	2.02	91.20	850.00	85.00	3.00	15.00	214.12	**1,297.32**	150.00	**1,447.32**	20	**1,467.32**	293.50	220.10	**1,990.00**
	900	1.10	3.0	1.70	8.7	52.20	2.63	118.60	1,000.00	100.00	3.35	16.80	214.12	**1,501.72**	180.00	**1,681.72**	20	**1,701.72**	340.30	255.26	**2,300.00**

Notes

1) Cost of excavation: $6/m3
2) Cost of bedding/pipe surrounding: $45/m3 includes supply and place
3) PVC Pipe (up to 600 mm) Cost provided by IPEX on 30 Oct 17
4) Pipe Installation Allowance based on 10% of pipe cost
5) Backfill trench $5/m3 based on replacement of native material and compaction
6) Includes costs for mainline valves and hydrant sets. No hydrants connected to 750mm and larger mains. Service connections and special appurtenances excluded
7) Restoration for route along existing road allowance (Cost varies with type of restoration). Minimum 4.0m width of restoration (2.0m trench plus 1.0 m each side)
8) Includes allowance for dewatering
9) PVC DR18 (100mm to 600mm)

Prepared By: D. Prashad Date:
Checked By: S. Winchester Date: 30-Nov-17

CIMA
Partners in excellence

WASTEWATER SERVICING INFRASTRUCTURE - Average Unit Prices (Southwestern Ontarion Region) for 2018

Nom. Pipe Size	Depth to Invert	Shoring System Cost	Outer pipe Diameter	Excavation		Granular Bed. Surr.		Backfill		Pipe		MH Allowance	**Subtotal**	Dewatering Allowance	**TOTAL (excluding restoration)**	Road Restoration	**TOTAL (including restoration)**
				Vol.	Cost	Vol.	Cost	Vol.	Cost	Cost	Installation Allowance						
(mm)	(m)	($/m)	(m)	(m3)	($/m)	(m3)	($/m)	(m3)	($/m)	($/m)	($/m)	($/m)	**($/m)**	($/m)	**($/m)**	($/m)	**($/m)**
200	5	10.00	0.213	6.2	37.20	0.6	27.00	5.6	28.00	55.65	5.57	94.00	**257.42**	20.00	**280**	214	**494**
250	5	10.00	0.267	6.2	37.2	0.7	31.5	5.5	27.5	85.30	8.53	94.00	**294.03**	20.00	**320**	214	**534**
300	5	10.00	0.318	6.2	37.20	0.8	36.00	5.4	27.00	120.25	12.03	94.00	**336.48**	20.00	**360**	214	**574**
375	5	10.00	0.389	6.2	37.20	0.9	40.50	5.3	26.50	162.45	16.25	94.00	**386.90**	20.00	**410**	214	**624**
450	5	10.00	0.622	7.3	43.80	1.2	54.00	6.1	30.50	101.30	30.39	94.00	**363.99**	20.00	**390**	214	**604**
525	5	10.00	0.711	7.8	46.80	1.4	63.00	6.4	32.00	129.00	38.70	135.00	**454.50**	20.00	**480**	214	**694**
600	5	10.00	0.800	8.2	49.20	1.5	67.50	6.7	33.50	170.90	51.27	135.00	**517.37**	20.00	**540**	214	**754**
675	5	15.00	0.889	8.7	52.20	1.6	72.00	7.1	35.50	259.60	77.88	135.00	**647.18**	20.00	**670**	271	**941**
750	5	15.00	0.978	9.2	55.20	1.8	81.00	7.4	37.00	343.50	103.05	135.00	**769.75**	20.00	**790**	271	**1,061**
825	5	15.00	1.067	9.6	57.60	1.9	85.50	7.7	38.50	443.40	133.02	172.00	**945.02**	20.00	**970**	271	**1,241**
900	5	15.00	1.156	10.4	62.40	2.1	94.50	8.3	41.50	478.40	143.52	172.00	**1,007.32**	20.00	**1,030**	271	**1,301**
975	5	20.00	1.245	10.8	64.80	2.2	99.00	8.6	43.00	549.70	164.91	172.00	**1,113.41**	20.00	**1,140**	271	**1,411**
1050	5	20.00	1.334	11.3	67.80	2.4	108.00	8.9	44.50	632.00	189.60	303.00	**1,364.90**	20.00	**1,390**	271	**1,661**
1200	5	20.00	1.511	12.2	73.20	2.7	121.50	9.5	47.50	791.50	237.45	303.00	**1,594.15**	20.00	**1,620**	271	**1,891**
200	7	10.00	0.213	8.6	51.60	0.6	27.00	8.0	40.00	55.65	5.57	150.00	**339.82**	20.00	**360**	214	**574**
250	7	10.00	0.267	8.6	51.60	0.7	31.5	7.9	39.50	85.30	8.53	150.00	**376.43**	20.00	**400.00**	214	614
300	7	15.00	0.318	8.6	51.60	0.8	36.00	7.8	39.00	120.25	12.03	150.00	**423.88**	20.00	**450**	214	**664**
375	7	15.00	0.389	8.6	51.60	0.9	40.50	7.7	38.50	162.45	16.25	150.00	**474.30**	20.00	**500**	214	**714**
450	7	15.00	0.622	10.2	61.20	1.2	54.00	9.0	45.00	101.30	30.39	150.00	**456.89**	20.00	**480**	214	**694**
525	7	15.00	0.711	10.8	64.80	1.4	63.00	9.4	47.00	129.00	38.70	189.00	**546.50**	20.00	**570**	214	**784**
600	7	20.00	0.800	11.4	68.40	1.5	67.50	9.9	49.50	170.90	51.27	189.00	**616.57**	20.00	**640**	214	**854**
675	7	20.00	0.889	12.1	72.60	1.6	72.00	10.5	52.50	259.60	77.88	189.00	**743.58**	20.00	**770**	271	**1,041**
750	7	20.00	0.978	12.7	76.20	1.8	81.00	10.9	54.50	343.50	103.05	189.00	**867.25**	20.00	**890**	271	**1,161**
825	7	20.00	1.067	13.3	79.80	1.9	85.50	11.4	57.00	443.40	133.02	226.00	**1,044.72**	20.00	**1,070**	271	**1,341**
900	7	30.00	1.156	14.3	85.80	2.1	94.50	12.2	61.00	478.40	143.52	226.00	**1,119.22**	20.00	**1,140**	271	**1,411**
975	7	30.00	1.245	14.9	89.40	2.2	99.00	12.7	63.50	549.70	164.91	226.00	**1,222.51**	20.00	**1,250**	271	**1,521**
1050	7	40.00	1.334	15.6	93.60	2.4	108.00	13.2	66.00	632.00	189.60	356.00	**1,485.20**	20.00	**1,510**	271	**1,781**
1200	7	40.00	1.511	16.9	101.40	2.7	121.50	14.2	71.00	791.50	237.45	356.00	**1,718.85**	20.00	**1,740**	271	**2,011**

Notes

1) Cost of excavation $6/m^3
2) For 200mm to 375 mm sewer pipe, supply cost taken from Royal Pipe Products (PVC) 2018 Price Installation Cost 10% of pipe supply cost
3) For sewer pipe 450mm dia and larger, supply cost taken from M-Con Products 2017 Price list for Installation Cost 30% of pipe cost for concrete pipe
4) Backfill trench $5/m3 based on replacement of native material and compaction
5) Cost of granular bedding $45/m^3
6) Manhole Spacing 100 m
7) Service Laterals excluded from this estimate,
8) Restoration cost for sewers 600mm dia and smaller includes 300mm subbase, 150mm base, 60mm binder, and 40mm binder
9) Restoration cost for sewers larger than 600mm dia includes 450mm subbase, 150mm base, 100mm binder, and 40mm surface
10) Engineering and HST not included

Prepared By: S. Mayirou Date: 9/1/2018
Checked By: S. Winchester Date: 15/01/18

MH	Dia	Depth	List Price[1]	Additional Items[2]	Sub-Total _ Supply Cost	Installation @ 100%	Total Cost per Installed	Cost per m
	1200	5	$3,834.00	$862.80	$4,696.80	$4,696.80	$9,400.00	$94.00
	1500	5	$5,630.00	$1,112.80	$6,742.80	$6,742.80	$13,500.00	$135.00
	1800	5	$7,128.00	$1,462.80	$8,590.80	$8,590.80	$17,200.00	$172.00
	2400	5	$13,265.00	$1,862.80	$15,127.80	$15,127.80	$30,300.00	$303.00
	1200	7	$6,593.00	$862.80	$7,455.80	$7,455.80	$15,000.00	$150.00
	1500	7	$8,293.00	$1,112.80	$9,405.80	$9,405.80	$18,900.00	$189.00
	1800	7	$9,791.00	$1,462.80	$11,253.80	$11,253.80	$22,600.00	$226.00
	2400	7	$15,927.00	$1,862.80	$17,789.80	$17,789.80	$35,600.00	$356.00

Note:

1 Based on 2017 List Price from M-Con Products. Safety Landing included for MH depths > 5.0 m

2 Allowance for castings, grade rings, benching, flexible connectors

Flexible Connectors

300	$312.30
375	$375.30
450	$474.80
525	$560.50
600	$664.40
675	Not listed
750	Not listed
825	Not listed
900	Not listed
975	Not listed
1050	Not listed
1200	Not listed

Excavation Quantities for Sewers laid at Different Depths

For Depth to Invert = 5.0 m

Nom. Pipe Size	Outer Pipe Dia.	Depth To Invert	Bottom Trench			Middle Trench			Top Trench				Total Area
			Width	Depth	Area	Width	Depth	Area	Bottom Width	Top Width	Depth	Area	
mm	m	m	m	m	m2	m	m	m2	m	m	m	m2	m2
200	0.260	5	1.010	1	1.0	1.510	3	4.5	1.510	3.510	1	2.5	**8.1**
250	0.318	5	1.068	1	1.1	1.568	3	4.7	1.568	3.568	1	2.6	**8.3**
300	0.445	5	1.195	1	1.2	1.695	3	5.1	1.695	3.695	1	2.7	**9.0**
375	0.520	5	1.270	1	1.3	1.770	3	5.3	1.770	3.770	1	2.8	**9.4**
450	0.580	5	1.330	1	1.3	1.830	3	5.5	1.830	3.830	1	2.8	**9.7**
525	0.665	5	1.415	1	1.4	1.915	3	5.7	1.915	3.915	1	2.9	**10.1**
600	0.755	5	1.505	1	1.5	2.005	3	6.0	2.005	4.005	1	3.0	**10.5**
675	0.880	5	1.630	1	1.6	2.130	3	6.4	2.130	4.130	1	3.1	**11.2**
750	0.970	5	1.720	1	1.7	2.220	3	6.7	2.220	4.220	1	3.2	**11.6**
825	1.055	5	1.805	1	1.8	2.305	3	6.9	2.305	4.305	1	3.3	**12.0**

For Depth to Invert = 7.0 m

Nom. Pipe Size	Outer Pipe Dia.	Depth To Invert	Bottom Trench			Middle Trench			Top Trench				Total Area
			Width	Depth	Area	Width	Depth	Area	Bottom Width	Top Width	Depth	Area	
mm	m	m	m	m	m2	m	m	m2	m	m	m	m2	m2
250	0.318	7	1.068	1	1.1	1.568	5	7.8	1.568	3.568	1	2.6	**11.5**
300	0.445	7	1.195	1	1.2	1.695	5	8.5	1.695	3.695	1	2.7	**12.4**
375	0.520	7	1.270	1	1.3	1.770	5	8.9	1.770	3.770	1	2.8	**12.9**
450	0.580	7	1.330	1	1.3	1.830	5	9.2	1.830	3.830	1	2.8	**13.3**
525	0.665	7	1.415	1	1.4	1.915	5	9.6	1.915	3.915	1	2.9	**13.9**
600	0.755	7	1.505	1	1.5	2.005	5	10.0	2.005	4.005	1	3.0	**14.5**
675	0.880	7	1.630	1	1.6	2.130	5	10.7	2.130	4.130	1	3.1	**15.4**
750	0.970	7	1.720	1	1.7	2.220	5	11.1	2.220	4.220	1	3.2	**16.0**
825	1.055	7	1.805	1	1.8	2.305	5	11.5	2.305	4.305	1	3.3	**16.6**

For Depth to Invert = 9.0 m

Nom. Pipe Size	Outer Pipe Dia.	Depth To Invert	Bottom Trench			Middle Trench			Top Trench				Total Area
			Width	Depth	Area	Width	Depth	Area	Bottom Width	Top Width	Depth	Area	
mm	m	m	m	m	m2	m	m	m2	m	m	m	m2	m2
250	0.318	9	1.068	1	1.1	1.568	6	9.4	1.568	5.568	2	7.1	**17.6**
300	0.445	9	1.195	1	1.2	1.695	6	10.2	1.695	5.695	2	7.4	**18.8**
375	0.520	9	1.270	1	1.3	1.770	6	10.6	1.770	5.770	2	7.5	**19.4**
450	0.580	9	1.330	1	1.3	1.830	6	11.0	1.830	5.830	2	7.7	**20.0**
525	0.665	9	1.415	1	1.4	1.915	6	11.5	1.915	5.915	2	7.8	**20.7**
600	0.755	9	1.505	1	1.5	2.005	6	12.0	2.005	6.005	2	8.0	**21.5**
675	0.880	9	1.630	1	1.6	2.130	6	12.8	2.130	6.130	2	8.3	**22.7**
750	0.970	9	1.720	1	1.7	2.220	6	13.3	2.220	6.220	2	8.4	**23.5**
825	1.055	9	1.805	1	1.8	2.305	6	13.8	2.305	6.305	2	8.6	**24.2**

RESTORATION UNIT COST FOR SEWERS

Nom. Pipe Size	Outer Pipe Dia.	Depth To Invert	Surface Area of Trench	Topsoil+ Seed Cost @ $7.5/m^2	Topsoil+ Sod Cost @ $10.00/m^2	Granular Restoration Base & Sub-base		Asphalt including Granular Base	
						Local Street @ $18.0/m^2	Collector Street @ $23.4/m^2	Local Street @ $41.0/m^2	Collector Street @ $55.3/m^2
mm	m	m	m^2/m	$/m	$/m	$/m	$/m	$/m	$/m
300	0.445	5	4.0	30.2	40.0	72.0	93.6	214.1	271.0
375	0.533	5	4.0	30.2	40.0	72.0	93.6	214.1	271.0
450	0.622	5	4.0	30.2	40.0	72.0	93.6	214.1	271.0
525	0.711	5	4.0	30.2	40.0	72.0	93.6	214.1	271.0
600	0.800	5	4.0	30.2	40.0	72.0	93.6	214.1	271.0
675	0.889	5	4.0	30.2	40.0	72.0	93.6	214.1	271.0
750	0.978	5	4.0	30.2	40.0	72.0	93.6	214.1	271.0
825	1.067	5	4.0	30.2	40.0	72.0	93.6	214.1	271.0
900	1.156	5	4.0	30.2	40.0	72.0	93.6	214.1	271.0
975	1.245	5	4.0	30.2	40.0	72.0	93.6	214.1	271.0
105	1.334	5	4.0	30.2	40.0	72.0	93.6	214.1	271.0
1200	1.511	5	4.0	30.2	40.0	72.0	93.6	214.1	271.0

UNIT COST FOR DIFFERENT LAYERS

Item	Local Street		Collector Street		Remarks	
		$/m^2		$/m^2		
Subbase	300 mm "B"	10.8	450 mm "B"	16.2	"B" @ $15/tonne (2.4 t/m^3)	
Base	150 mm "A"	7.2	150 mm "A"	7.2	"A" @ $20/tonne (2.4 t/m^3)	
Subtotal		**18.0**		**23.4**		
Binder	60 HL4	13.2	100 HL4	22.1	"HL4" @ $90/tonne (2.45 t/m^3)	
Surface	40 HL3	9.8	40 HL3	9.8	"HL3" @ $100/tonne (2.45 t/m^3)	
Total		**41.0**		**55.3**		
Curb (one side)		50.0		50.0		