Memorandum

To:	Karen Landry, Township of Puslinch
cc:	James Su, Ontario Clean Water Agency
From:	Sandra Rodriguez, CIMA+ Stuart Winchester, CIMA+
Subject:	**Municipal Servicing Questionnaire Results**
Project Name:	Feasibility Study for Municipal Water and Sewage Servicing in the Township of Puslinch
Date:	March 1, 2018

1. Introduction

The Township of Puslinch (Township) is undertaking a Feasibility Study to assess the viability of implementing municipal water and sewage services within key areas of the Township. As part of the Feasibility Study, a Municipal Servicing Questionnaire was prepared and distributed to all residents/property owners within the limits of the project Study Area. The purpose of the questionnaire was to gauge public interest for a municipal water and sewage system. A copy of the Municipal Servicing Questionnaire is attached to this memorandum.

2. Municipal Servicing Questionnaire – Summary Results

In total, the Township distributed approximately 1,000 copies of the questionnaire, which included residential, industrial, commercial and institutional (ICI) users within the study area.

A total of 361 completed questionnaires were received, which represent a response rate of 36%. Pie charts, depicting graphically the responses obtained, are attached to this memorandum for reference. The following summarizes the questionnaire results:

- Residential Users
  - 321 Questionnaires were received from residential users
  - 27% in favour of municipal water servicing
  - 33% in favour of municipal sewage servicing
- ICI Users
  - 40 Questionnaires were received from residential users
  - 63% in favour of municipal water servicing
  - 68% in favour of municipal sewage servicing

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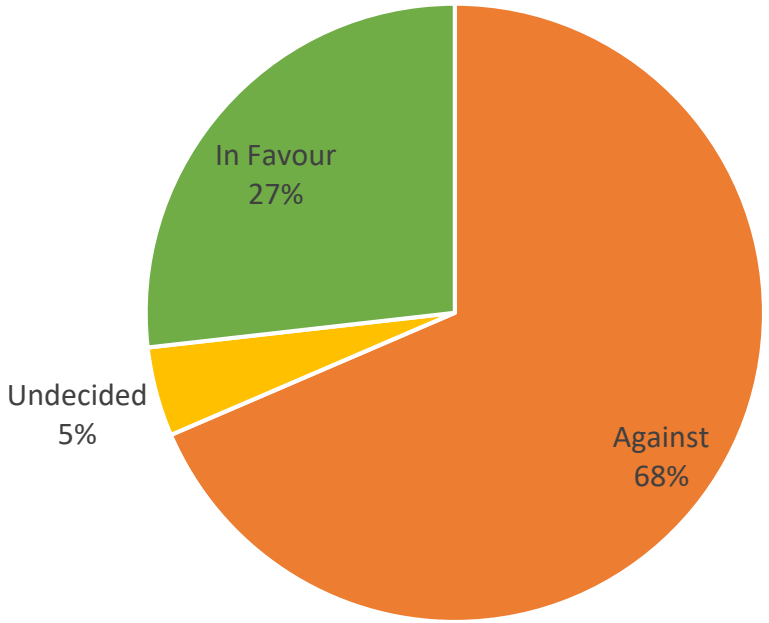
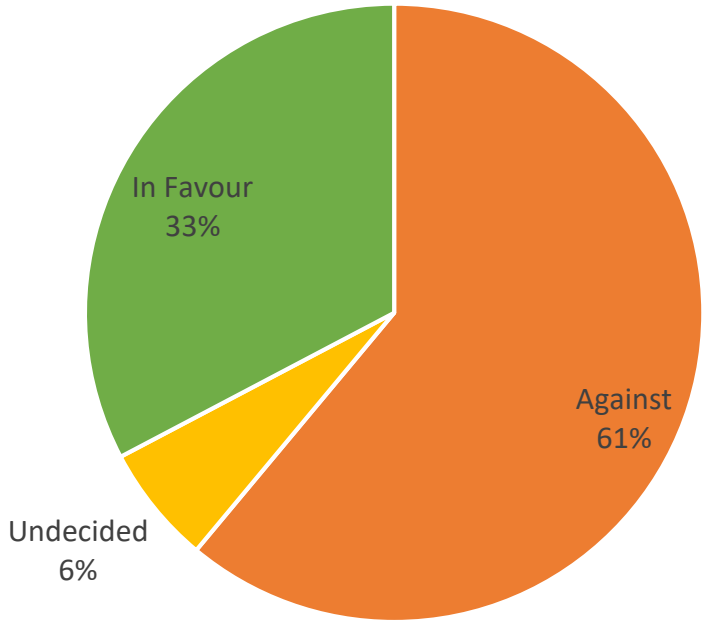
- Total
  - 361 Questionnaires were received from residential and ICI users
  - 31% in favour of municipal water servicing
  - 36% in favour of municipal sewage servicing

Township of Puslinch Municipal Water and Sewage Feasibility Study – Residential Interest

Municipal Water Servicing



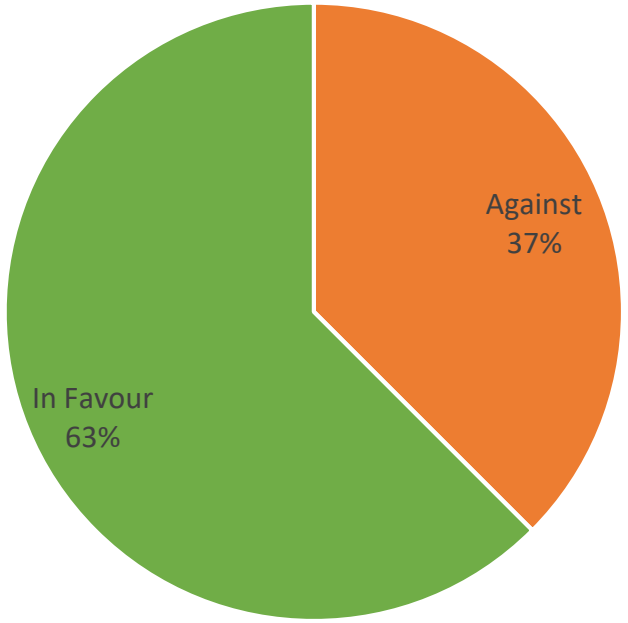
Municipal Sewage Servicing



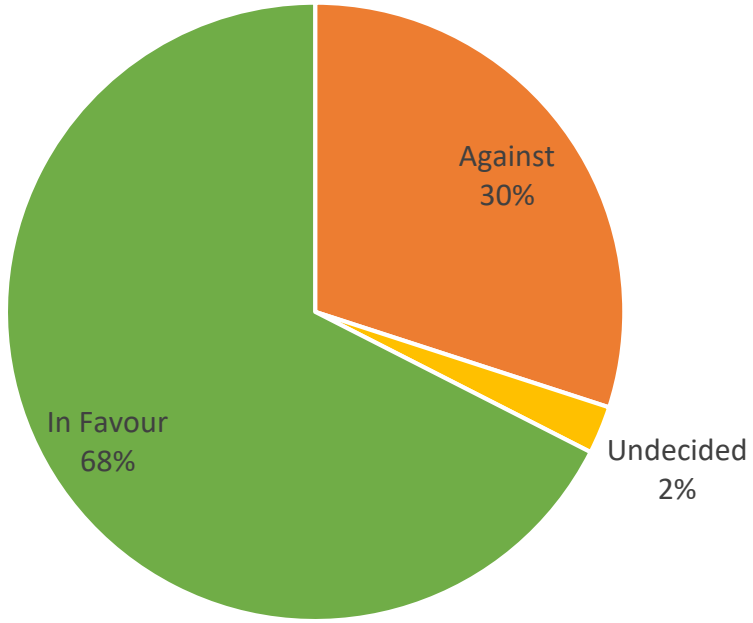
Number of Surveys: 321

Township of Puslinch Municipal Water and Sewage Feasibility Study – ICI Interest

Municipal Water Servicing



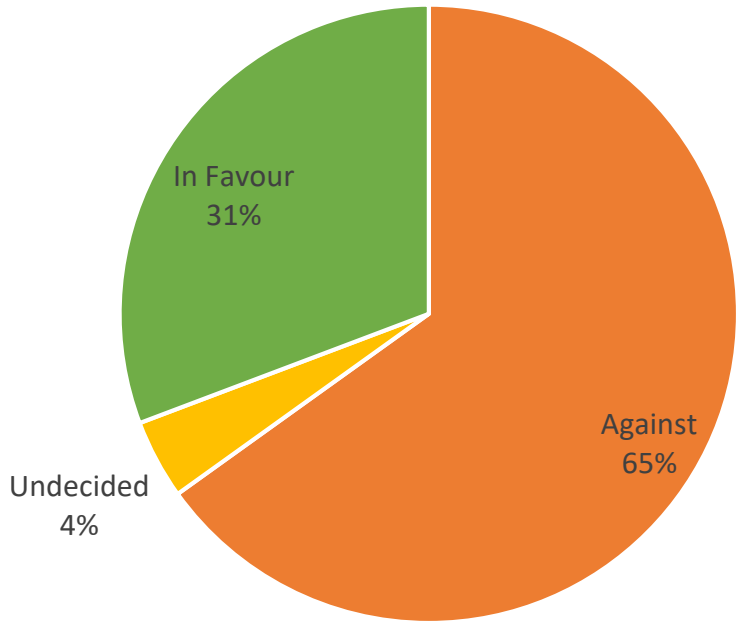
Municipal Sewage Servicing



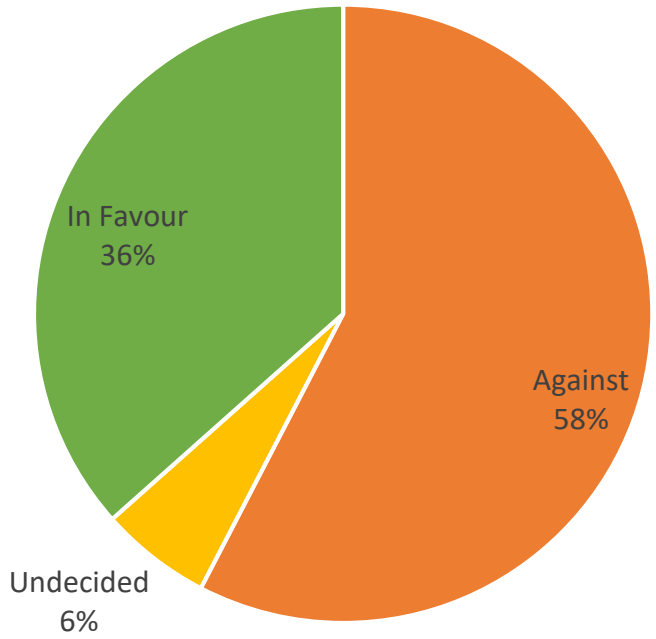
Number of Surveys: 40

Township of Puslinch Municipal Water and Sewage Feasibility Study – Combined Interest (Residential + ICI)

Municipal Water Servicing



Municipal Sewage Servicing



Total Number of Surveys: 361

THE TOWNSHIP OF Puslinch

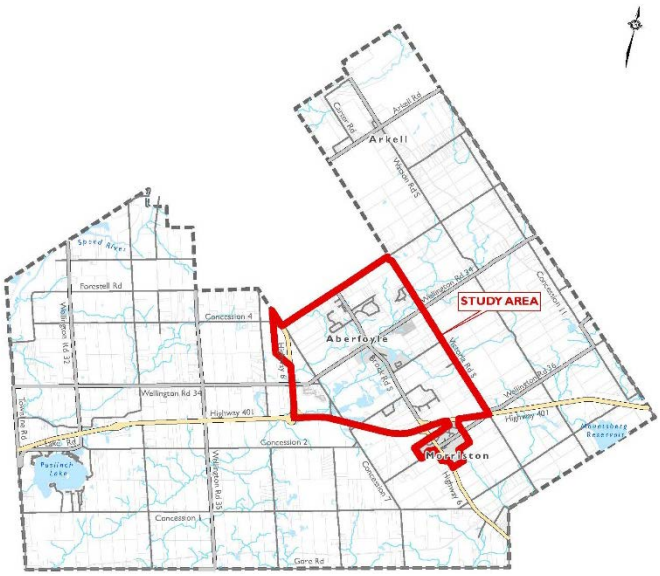
Municipal Servicing Questionnaire
For
Feasibility Study for Municipal Water and Sewage Servicing in the Township of Puslinch

Why are you getting this Questionnaire?

The Township of Puslinch is initiating a ***Feasibility Study*** to assess the viability of implementing municipal water and sewage services within key areas of the Township.

The adjacent map shows the Study Area for this project, which encompasses the key areas to be considered in the Feasibility Study for municipal servicing.

As a resident/property owner within the limits of project Study Area, the Township is interested in gauging your feedback and desire to potentially connect your property to a municipal water and sewage system, should they become available in the area.



Why are we doing a Feasibility Study?

The Township of Puslinch is surrounded by growing urban centres on all four sides with increasing demands for resources and land. The Township has been fiscally responsible on all fronts and has been operated in a very lean fashion, while keeping its rural character, protecting the agricultural land base and supporting local economic growth. The strong and established commercial and industrial base in the Township provides an opportunity to better support commercial activities and expansion through focused economic development.

Water and sewage services in Puslinch currently consist of individual on-site wells, septic systems and a few on-site small and private communal water and sewage systems. The Township has an active role in monitoring the operation and efficiency of these private systems; however, all aspects of operation, monitoring, maintenance and repairs associated with private systems, are ultimately, the responsibility of the systems' owner.

To balance commercial and residential growth and considering the importance of adequate infrastructure to economic well-being, public health and water quality protection, the Township has identified the need to conduct a ***Feasibility Study*** to investigate servicing alternatives for the provision of water and sewage services in key areas of the Township, and to explore available financial tools in preparation for the future.

THE TOWNSHIP OF Puslinch

Municipal Servicing Questionnaire
For
Feasibility Study for Municipal Water and Sewage Servicing in the Township of Puslinch

What is a Feasibility Study?

A Feasibility Study is an assessment of the viability of a proposed project or idea. The purpose of this Feasibility Study is to complete a planning level assessment of the potential for providing municipal water and sewage servicing for key areas within the Township of Puslinch. The assessment of servicing strategies will consider existing servicing schemes, current and future servicing needs, financial implications of water and sewage servicing alternatives and public interest in municipal servicing.

A Public Information Centre (PIC) will be held as part of this study to discuss the servicing alternatives under consideration and gather your feedback. The PIC is planned for Fall 2017. A separate invitation to the PIC will be sent out ahead of the meeting with details on date, time and location of the meeting.

Please be aware that if the Feasibility Study determines that municipal water and sewage servicing is feasible, a ***Municipal Class Environmental Assessment (Class EA) Study*** will need to be completed before the Township can proceed with implementation of any works. Additional public communication and consultation will be carried out during the Class EA study to inform the public and provide additional opportunities for public participation in the study.

Why is your opinion important?

The Township appreciates that not everyone may want to connect to municipal systems. To confirm future servicing needs for the study area, the Township would like to get a sense of how many private property/system owners desire to be provided with municipal servicing. Your opinion will also allow the project team to evaluate the potential for project support and assess the implications of the servicing alternatives from a socio-cultural and economic perspective.

Your response to the enclosed questionnaire is very valuable to the project team undertaking the Feasibility Study. Your response to the questionnaire does not commit you in any way for or against municipal water and sewage services. The information collected will be used solely for the purposes of this study. All personal information will remain confidential.

Contact Information

Please contact either of the project team members if you have any questions about the enclosed '***Municipal Water and Sewage Servicing Questionnaire***' or wish to obtain more information on the project:

Karen M. Landry
CAO/Clerk
Township of Puslinch
7404 Wellington Rd 34
Puslinch, ON N0B 2J0
P: 519.763.1226 ext. 214
Email: klandry@puslinch.ca

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Project Manager
CIMA+
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Kitchener, ON N2H 6R2
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Email: stuart.winchester@cima.ca

THE TOWNSHIP OF Puslinch

Municipal Servicing Questionnaire

For

Feasibility Study for Municipal Water and Sewage Servicing in the Township of Puslinch

Please take a moment to complete the enclosed questionnaire and return it in the enclosed envelope to the attention of the Township's CAO/Clerk, Karen M. Landry, by September 22, 2017. Alternatively, you can complete the Questionnaire online at www.puslinch.ca.

Even if you are not interested in a future connection to the municipal system, your information and comments are valuable to the Township.

THE TOWNSHIP OF Puslinch

Municipal Servicing Questionnaire
For
Feasibility Study for Municipal Water and Sewage Servicing in the Township of Puslinch

Property Address: _____

Property Owner: _____ Phone: _____

Contact Person: _____ Phone: _____

Billing Address: _____

General

1. What is Your Property Type?

Residential ☐ Commercial ☐ Industrial ☐

Water Services

2. What is your ***Existing Drinking Water Source***?

Private Well ☐ Communal System ☐ Other ☐

Explain if **Other**: _____

3. If you have a private well, has the well ever gone dry or provided insufficient ***Water Quantity***?

Yes: ☐ No: ☐

Explain if **Yes**: _____

4. Has there ever been a problem with the ***Water Quality*** from your well or water service?

Yes: ☐ No:

Explain if **Yes**: _____

5. Will you be interested in a future ***Municipal Water Service Connection***?

Yes: ☐ No: ☐

Explain if **No**: _____

THE TOWNSHIP OF Puslinch

Municipal Servicing Questionnaire
For
Feasibility Study for Municipal Water and Sewage Servicing in the Township of Puslinch

Wastewater Services

6. What is your ***Existing Sewage System***?

Septic Tank / Leaching Bed ☐ Holding Tank / Hauled Sewage ☐ Other ☐

Explain if **Other**: _____

7. Have you had any problems with your septic system in the past?

Yes: ☐ No: ☐ N/A ☐

Explain if **YES**: _____

8. Has your septic tank/holding tank undergone inspection on a regular basis?

Yes: ☐ No: ☐ N/A ☐

Explain if either **YES or NO**: _____

9. If you have a leaching bed, are there any shrubs and/or trees planted over this area?

Yes: ☐ No: ☐

Explain if **YES**: _____

10. Will you be interested in a future ***Municipal Sewage Service Connection***?

Yes: ☐ No: ☐

Explain if **No**: _____

Additional Comments:

_____

_____

_____

_____

_____

THE TOWNSHIP OF Puslinch

Municipal Servicing Questionnaire
For
Feasibility Study for Municipal Water and Sewage Servicing in the Township of Puslinch

Please return your complete Questionnaire by September 22, 2017 in the enclosed envelope or complete it on-line at www.puslinch.ca.

Personal information on this form is collected under the authority of the Municipal Act. The information is used for the purpose of conducting a feasibility study for municipal water and sewage servicing and is maintained in accordance with the Municipal Freedom of Information and Protection of Privacy Act. Questions regarding the collection of this information may be directed to the Township Clerk's office.

The Township of Puslinch is committed to providing accessible formats and communication supports for people with a disability. If another format would work better for you, please contact the Township Clerk's office for assistance.

Township of Puslinch

TECHNICAL MEMORANDUM NO.1
STUDY AREA CHARACTERIZATION AND WATER AND WASTEWATER DEMAND ANALYSIS

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FINAL
January 26, 2018

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1. Introduction

1.1 Background

The Township of Puslinch (Township) is undertaking a Feasibility Study to assess the viability 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 wastewater services for key areas within the Township was identified.

1.2 Purpose of this Technical Memorandum

The purpose of Technical Memorandum No.1 (TM-1) is to provide a general description of the study area; to summarize information obtained from the Township and the key users on current water demands; to identify current land use designations and plans for future growth and development; and to estimate future water demands and wastewater flows for use in assessing the feasibility of providing municipal water and wastewater services. The information presented in this TM-1 will provide the foundation for the development of water and sewage servicing options. TM-1 is not intended to be a design document.

2. Study Area

2.1 Overview

The Township of Puslinch is located in south-central Ontario in Wellington County, generally southeast of the City of Guelph. The Township, along with six other lower tier municipalities, make up the County of Wellington.

A study area has been delineated to comprise key growth areas within the Township. The project Study Area is generally bounded by Maltby Road to the north, Victoria Road South to the east, Highway 401 to the south, and Highway 6 to the west, plus the settlement area of Morriston south of Highway 401, as shown below in Figure 1. Two major urban centres, Aberfoyle and Morriston, are found within the limits of the study area. The City of Guelph abuts the northern most limits of the study area.

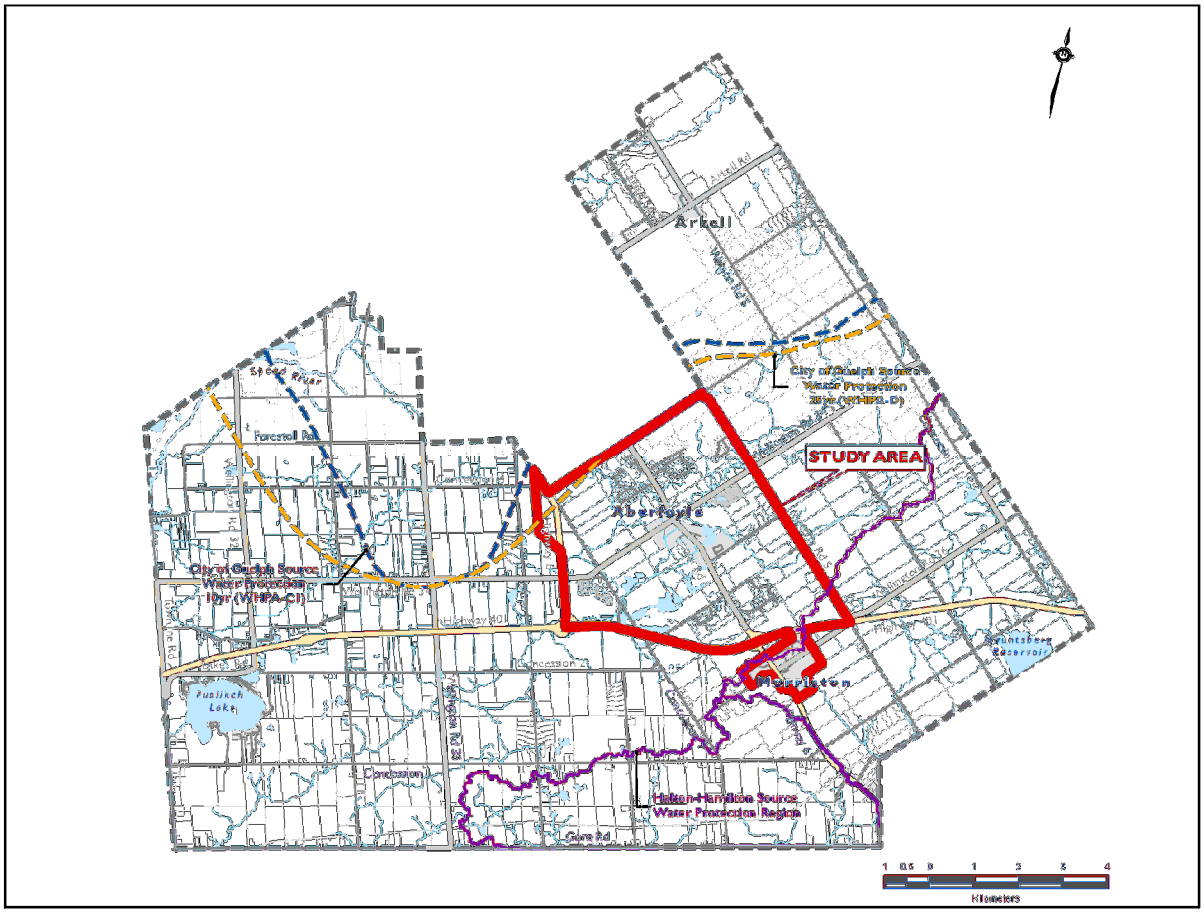

Figure 1 Study Area Map

2.2 Land Uses

The County of Wellington provides Planning Services for all growth and development related issues for the Township of Puslinch. The County, on behalf of the Township, has developed the Township's Official Plan (OP), which is used to guide all land use, growth strategies and servicing decisions for

the Township. Existing land use designations within the study area are graphically presented in Figure 2.

The predominant Land Use designation within the Study Area is Secondary Agricultural lands. A small pocket of lands considered to be Prime Agricultural areas is found in the southeast corner of the study area. Portions of the greenland system are generally identified running northwest throughout the study area. Two pockets of rural employment areas are located near the highway exits off of Highway 401 and Highway 6, which corresponds to the locations of the major business area in the study boundary. Country residential lands are generally located in the north portion of the study area, with Aberfoyle and Morriston identified as urban centres.

The community of Aberfoyle has a designated central business district along Brock Road South, and residential areas generally located adjacent to the business areas. Industrial lands are designated within Aberfoyle on the Township Municipal Office and County Works Yard lands on the north side of Wellington Road 34. Recreational designated lands are located in the centre of Aberfoyle, on the northwest corner of Brock Road and Maple Leaf Lane, where the Puslinch Community Centre, ORC, library and sports fields are located. A highway commercial area is designated in the north portion of the community. Watercourses and ponds located within the Aberfoyle Urban Centre are considered Core Greenlands.

The central area of the Aberfoyle Urban Centre is within the floodplain of Mill Creek and its tributary streams. The Official Plan also recognizes the role that Aberfoyle plays as the Township centre of rural residential, commercial and other community land uses. As such, limited development within the lands designated as “Special Policy Area PA7-7” is permitted. An area designated as Future Development area is found south of Wellington Road 34 and west of Brock Road South.

The Morriston Urban Centre is primarily designated as residential land, with Greenlands located at the east portion of the community and a Core Greenland system surrounding a watercourse. A central business district is designated along Queen Street.

2.3 Source Water Protection Areas

The City of Guelph and Hamilton Region Source Protection Areas extend into the study area (see Figure 1). The City of Guelph Wellhead Protection Areas (WHPA), WHPA-D, corresponding to the 25 year time of travel, extend into the northwest portions of the study area. Enhanced development potential within source water protection areas could result from implementation of municipal servicing in the area.

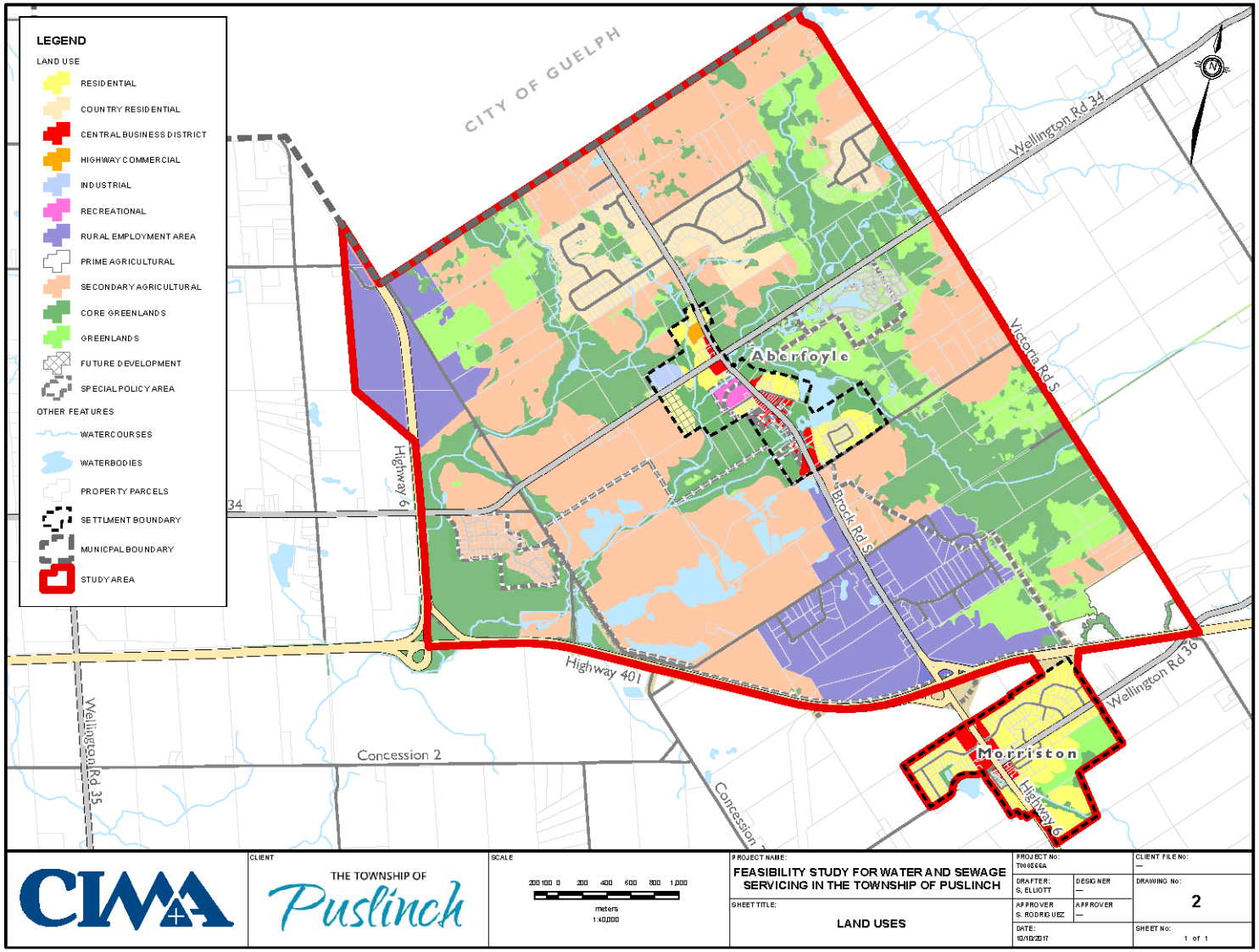

Figure 2 Existing Land Use Designations within Study Area

2.4 Population and Planning Projections

Projected growth within the study area has been set out in the County's OP. According to the OP, the majority of growth will be directed to urban centres that offer municipal water and sewer servicing and, to a limited extent, to those urban centres and hamlets that offer partial, private communal or individual on-site services. For the Study Area, the majority of the anticipated growth will be directed to the Aberfoyle and Morriston Urban Centres. Growth will also be directed, to a lesser extent, to secondary agricultural areas, provided that the planning policies for these areas are met.

2.4.1 Residential Projections

As per conversations with staff from the County of Wellington, the majority of the residential growth in the Township is expected to occur outside of the study area. Projected residential growth for the study area on the other hand, has been assumed to occur primarily within Aberfoyle and Morriston Urban Centres. The residential forecasts for these areas, as per the County's OP are shown in Table 1. Residential forecasts established in the County's OP are based on current available servicing.

Table 1 Projected Residential Growth – Aberfoyle and Morriston

Urban Centre	Projected Growth / Planning Period		
	2016	2036	2041
Aberfoyle[1]	325	345	335
Morriston[1]	480	590	620

Notes :

1. Projected Residential Growth as per Wellington County Official Plan May 6, 1999 (Last Revision September 1, 2016). Includes the net undercount adjustment which is estimated at approximately 4.1%.

Municipal infrastructure projects are normally planned for a 20-25 year planning horizon. Extended design periods are sometimes used for projects of difficult nature and high capital expenditures. For the purpose of this feasibility study, a 25 year design period corresponding to a design year 2041 has been considered adequate. As such, and consistent with the County's OP population projections, a residential population increase of 10 people in Aberfoyle and 140 people in Morriston has been used.

2.4.2 Employment Projections

Employment forecasts for the Township, as per the County's OP are shown in Table 2.

Table 2 Projected Employment Growth – Township of Puslinch

Urban Centre	Projected Growth / Planning Period		
	2016	2036	2041
Total Employment	4,017	5,161	5,632

Notes :

1. Projected Employment Growth as per Wellington County Official Plan May 6, 1999 (Last Revision September 1, 2016). Includes 'no fixed place of work' employment.

Based on a breakdown for employment forecasts for the Township, provided by the County of Wellington, it is known that a total employment population of 2,224 was considered of industrial type in 2016, representing approximately 55% of the total 4,020 employment count in 2016. For the purpose of this Feasibility Study and based on discussions with staff from the County of Wellington, the following assumptions have been made:

- All 2,224 employment recorded in 2016 have occurred within the study area, and most specifically, within the major large users known to exist in the study area. As such, water demands exerted from this employment population in 2016, have already been captured in the water demands provided by the large users.
- An employment growth of approximately 1,610 jobs will occur between 2016 and 2041 within the study area. This assumed growth includes primary, work at home, industrial, commercial, institutional and no-fixed-place-of-work job types.

The assumptions noted above are considered conservative but adequate for the level of detail required in a feasibility study. Actual employment numbers within the existing large users need to be verified if the project proceeds to the next stages (i.e. Class Environmental Assessment Study).

2.5 Existing Water and Sewage Services

Municipal servicing is currently not available in the Township. Water and sewage services in the study area currently consist of individual on-site wells, septic systems and a few on-site small and private communal water and sewage systems. The Township has an active role in monitoring the operation and efficiency of these private systems; however, all aspects of operation, monitoring, maintenance and repairs associated with private systems, are ultimately, the responsibility of the systems' owner.

Permits to Take Water (PTTW) issued by the Ontario Ministry of Environment and Climate Change (MOECC) require that each permit holder measure and record volumes and rates of water taken each day. Such records shall be submitted every year to the Ministry's Water Taking Reporting System (WTRS).

As part of this Feasibility Study, all major users within the study area were contacted directly and requested to provide the most up-to-date water and wastewater usage data, including the latest water volumes reported to the Ministry's WTRS. The following sections present a summary of water usage/consumption for each of the major large users within the study area, as per available operating records and data provided to CIMA+ for 2015 and/or 2016. Large users are not required to monitor or measure wastewater flows, and thus this information was not readily available. Wastewater information that was provided to CIMA+, when measured and recorded by the user, has been included in the corresponding section for each major user.

2.5.1 Residential Uses

Existing residential properties within the study area are generally serviced by individual on-site well and septic systems. A few major community facilities have a dedicated on-site water system which include the Puslinch Community Centre, Optimist Recreational Centre, and municipal offices. There

are also a few residential development communities that operate their own private communal water and sewage systems, including:

- Meadows of Aberfoyle,
- Mini Lakes, and;
- Millcreek Camping and Country Club.

Additional information for each of the above residential communities is provided as follows:

Meadows of Aberfoyle Communal Well Supply System

The Meadows of Aberfoyle is a single family residential development, located in the southeast area of Aberfoyle, north of Gilmour Road and east of Brock Road. It comprises 55 building lots and has been considered fully occupied since May 2011. This community is served by a communal water supply system, which consists of two wells serving the residents, as well as groundwater and surface water monitoring stations. Available water usage related data for this system is summarized in Table 3 below.

Table 3 Meadows of Aberfoyle – Water Servicing Data

Source ID	Usage Type	Max. Taking as per PTTW[1] (L/s)	Average Taking (L/s)[2]	Max. Taking (L/s)[3]	% of Permitted Max. Taking[4]
PW7	Water Supply	9.1	0.32	1.26	14%
PW6	Water Supply	9.1	0.28	1.92	21%
PW5[5]	Irrigation	0.78	-	-	-
PW2[5]	Irrigation	1.59	-	-	-
Total System Average Demand (L/s) =			**0.61**		
Unit per Capita Consumption Rate (L/cap/day)[6] =			**353**		

Notes :

1. Maximum taken as per existing PTWW #5626-7WLQ3W.
2. Two year average demands based on 2015 and 2016 data reported in the MOECC WTRS.
3. Two year average maximum demands based on 2015 and 2016 data reported in the MOECC WTRS.
4. % ratio between actual maximum taking and PTTW permitted max. taking
5. No water reported taken from well.
6. Unit per capita consumption rate calculated based on average system demands for PW7 and PW6 and a total service population of 149 people. Assumed a 2.7 PPU which is consistent with PPU for Aberfoyle for 2016 as per County's OP.

As per the 2016 Monitoring Report for this system, wells PW6 and PW7 were the only wells pumped. Wells PW5 and PW2 only serve as observation wells. In addition, water pumping and distribution system is controlled in a manner that wells PW6 and PW7 cannot be pumped simultaneously.

Meadows of Aberfoyle uses individual private septic systems for wastewater treatment and disposal.

Mini Lakes Communal Well Supply System

The Mini Lakes Mobile Home Community is a private community located just outside of Aberfoyle off of Wellington County Road 34. The drinking water system is classified as a Non-Municipal Year Round Residential System under O. Reg. 170/03. There are approximately 260 service connections to the drinking water system servicing approximately 450 people. An additional 31 services are in place for the remaining development lots.

The drinking water system consists of three production wells and three corresponding pump houses, all connected to the distribution system that consists of 50 mm to 70 mm diameter polyethylene piping. Each pump house has a dedicated treatment system. Raw water is disinfected with sodium hypochlorite prior to entering the distribution system. Water is filtered using a multi-media filtration system and passed through a series of pressure retention tanks prior to being discharged into the distribution system. The water distribution system consists of three separate pressure zones, fully interconnected and isolated by valves. Available water usage related data for this system is summarized in Table 4 below.

Table 4 Mini Lakes – Water Servicing Data

Source ID	Usage Type	Max. Taking as per PTTW[1] (L/s)	Average Taking (L/s)[2]	Max. Taking (L/s)[3]	% of Permitted Max. Taking[4]
PW1	Water Supply	1.7	0.29	0.81	48%
PW2	Water Supply	2.3	0.43	0.94	41%
PW3	Water Supply	3.7	0.81	1.56	42%
PW4[5]	-	3.4	-	-	-
Total System Average Demand (L/s) =			**1.53**		
Unit per Capita Consumption Rate (L/cap/day)[6] =			**294**		

Notes :

1. Maximum taken as per existing PTWW #7137-AG7SV2.
2. Two year average demands based on 2015 and 2016 data reported in the MOECC WTRS.
3. Two year average maximum demands based on 2015 and 2016 data reported in the MOECC WTRS.
4. % ratio between actual maximum taking and PTTW permitted maximum taking.
5. No water reported taken from well. Well decommissioned in 2015.
6. Unit per capita consumption rate calculated based on average system demands for the 3 existing wells and a total service population of 450 people.

Available wastewater flows related data for this system is summarized in Table 5 below.

Table 5 Mini Lakes – Wastewater Servicing Data

Criteria	Value
Total Average Wastewater Flows (L/s)[1] =	1.1
Total Average Wastewater Flows (m3/d) =	98.8
Unit per Capita Production Rate (L/cap/day)[2] =	219
Notes :	

1. Two year wastewater flows based on 2015 and 2016 data
2. Unit per capita consumption rate calculated based on average wastewater flows and a total service population of 450 people.

Mini Lakes is allowed under the Amended Environmental Compliance Approval (ECA) #8154-AR4J2T to treat and dispose of 158 m^3/d of treated wastewater from a maximum of 292 residential units. The wastewater treatment system consists of three pumping stations that discharge to a wastewater treatment plant. Treatment consists of a primary settling tank, rotating biological contactors (RBCs), an intermediate clarifier, a denitrification tank, and a final clarifier. The effluent pump discharges the treated wastewater for subsurface disposal to one of the five shallow buried trench absorption cells.

Millcreek Camping and Country Club

Millcreek is a manufactured home community (also known as a land leased community). A PTTW is not required for the community since the water taking is less than 50 m^3/d. Available water usage related data for this system is summarized in Table 6 below.

Table 6 Millcreek Camping and Country Club – Water Servicing Data

Source ID	Usage Type	Max. Taking as per PTTW (L/s)	Average Taking (L/s)[1]	Max. Taking (L/s)	% of Permitted Max. Taking
N/A	N/A	N/A	0.36	-	N/A
Total System Average Demand (L/s) =			**0.36**		
Unit per Capita Consumption Rate (L/cap/day)[6] =			**N/A**		

Notes :

1. Two year average demands based on 2015 and 2016 data.
N/A = Not Applicable

Millcreek uses individual private septic systems for wastewater treatment.

2.5.2 Industrial and Commercial Uses

The major industrial and commercial large water users within the study area, along with their permitted water takings, are listed below in Table 7. A brief overview of each of the large users and their reported water demands/consumptions are summarized in the following sections.

Table 7 Major Industrial and Commercial Users

ID	User Name	Usage Type	PTTW #	Max. Taking as per PTTW (L/s)	
				L/s	m3/d
1	Royal Canin Canada Company	Food processing	3782-AB6MMX	2.8	240
2	Con-Cast Pipe Inc.	Concrete pipe manufacturer	8724-9GFPQE	5.2	450
3	Maple Leaf Foods – Morguard Brock McLean Limited	Distribution centre	7431-96LRQ6	7.6	654

4	Nestle Canada Inc.	Water Bottling	1381-95ATPY	41.7	3,600
5	Dufferin Aggregates – CRH Canada Group Inc.	Aggregate extraction	7510-A34KZH	94.7	8,183
6	Capital Paving Inc.	Aggregate producers	4373-8TXQK3	212.6	18,371
7	CBM Aggregates – St. Mary's Cement	Aggregate extraction	5550-9V7HXS	272.8	23,568
			7028-7LTNV9	272.8	23,568
	Total Industrial and Commercial Max. Permitted Taking =			**910**	**78,634**

Royal Canin Canada Company

Royal Canin is a pet food manufacturer located within the rural employment designated area, north of Highway 401 and east of Brock Road South. This facility uses water and generates both process and sanitary wastewater. Their reported water usage is summarized in Table 8 below.

Table 8 Royal Canin Canada – Water Usage

Water Source	Reported Average Water Taking[1]		Max. PTTW Taking	Actual Taken / PTTW
	m3/d	L/s	L/s	%
Well PW-1	93.8	1.1	2.8	39%

Notes :

1. Two year average usage based on reported 2015 and 2016 data.

Royal Canin uses separate wastewater treatment systems for its process and domestic wastewater. They are allowed under Amended ECA #1042-A3QQRY to discharge 30 m^3/d of treated process and domestic flows for subsurface disposal. The process wastewater treatment system consists of a 40 m^3 equalization tank and a dissolved air flotation unit. A membrane bioreactor (rated treatment capacity of 75 m^3/d) is approved to be incorporated into the existing process wastewater treatment system, as well as a UV disinfection unit and osmosis unit for reuse of water for operations. The domestic wastewater treatment system consists of a pump station, a sequencing batch reactor (SBR) (rated treatment capacity of 30 m^3/d), and a sand filter (the filter is approved to be replaced with a drum filter). Both treated process and domestic wastewater discharges to a shallow buried trench system that is laid out in two beds.

The average process and domestic wastewater discharged for subsurface disposal by this facility are summarized in Table 9 below.

Table 9 Royal Canin – Wastewater Generation

Sewage Source	Reported Average Wastewater Generation[1]		System Rated Capacity	Actual Generation / Rated Capacity
	m3/d	L/s	m3/d	%
Process and domestic wastewater to buried trench	42	0.54	30	140%

Notes :

1. One year average wastewater generation based on 2016 data.

Con-Cast Pipe Inc.

Con-Cast Pipe Inc. is a precast concrete products manufacturer. The manufacturing facility is located within the rural employment designated area, north of Highway 401 and west of Brock Road South. Their footprint comprises a dry cast facility of approximately 120,000 square foot and a wet cast facility of approximately 30,000 square foot. Their reported water usage is summarized in Table 10 below.

Table 10 Con-cast Pipe Inc. – Water Usage

Water Source	Reported Average Water Taking[1]		Max. PTTW Taking	Actual Taken / PTTW
	m3/d	L/s	L/s	%
Well WSW 1	245.3	2.8	5.2	55%
Well WSW 2				

Notes :

1. Two year average usage based on reported 2015 and 2016 data.

Con-Cast Pipes is allowed under Amended ECA #3621-6HRKGC to treat and dispose of process wastewater at an average flow of 5.66 m^3/d from its pre-cast concrete manufacturing facility. The treated process wastewater is discharged to one of two on-site infiltration ponds. Based on information provided by Con-Cast Pipe Inc., process wastewater flows are not monitored.

Maple Leaf Foods – Morguard Brock McLean Limited

Maple Leaf Foods has a distribution centre within the Township that distributes the company's prepared meats throughout central and eastern Ontario. Schenker Canada operates the distribution centre on behalf of Maple Leaf Foods. Based on information received from Schenker Canada, the water is used for the cooling tower/condenser and the sprinkler; however, their water use is restricted based on the capacity of their septic bed. Their reported water usage is summarized in Table 11 below.

Table 11 Maple Leaf Foods – Water Usage

Water Source	Reported Average Water Taking[1]		Max. PTTW Taking	Actual Taken / PTTW
	m3/d	L/s	L/s	%
TW1	21.6	0.2	7.6	3%
TW2				

Notes :

1. Two year average usage based on reported 2015 and 2016 data.

In terms of wastewater generation, Maple Leaf Foods is allowed under Amended ECA #7567-94EK2F to treat and dispose of 17 m^3/d of treated domestic wastewater. The wastewater treatment system consists of two septic tanks (total capacity of 25 m^3), a tertiary treatment septic tank (rated treatment capacity of 17 m^3/d), and a polisher tank. The treated wastewater is discharged to a raised stone and sand bed for subsurface disposal. The average domestic wastewater generated by this facility are summarized in Table 12 below. Process wastewater is not produced on-site as part of their operations.

Table 12 Maple Leaf Foods – Wastewater Generation

Sewage Source	Reported Average Wastewater Generation[1]		System Rated Capacity	Actual Generation / Rated Capacity
	m3/d	L/s	m3/d	%
Domestic wastewater to septic system	14.3	0.17	17	90%

Notes :

1. Two year average wastewater generation based on 2015 and 2016 data.

Nestle Canada Inc.

Nestle Canada Inc. operates a water bottling facility, located within the rural employment designated area, south of Aberfoyle. Their reported water usage is summarized in Table 13.

Table 13 Nestle Canada Inc. – Water Usage

Water Source	Reported Average Water Taking[1]		Max. PTTW Taking[2]	Actual Taken / PTTW
	m3/d	L/s	L/s	%
TW3-80	2,117.7	24.5	41.7	59%
TW2-11[3]	-	-	-	-

Notes :

1. Two year average usage based on reported 2015 and 2016 data.
2. As per PTTW, the total taking of 3,600 m3/d must not be exceeded for the combination of the water sources.
3. Well TW2-11 is to be used for miscellaneous purposes only (such as supplying water for firefighting purposes). As per information provided, no water was taken from Well TW2-11 in 2015 or 2016. Nestle Canada Inc. has recommended that the well be decommissioned.

Nestle Waters operates under two separate approvals for its process and domestic wastewater. Amended ECA #2766-8Z6QHV allows Nestle Waters to treat and dispose process wastewater and stormwater at an approximate peak flow of 1,444 m^3/week. The process wastewater treatment system consists of a wet well/pump station, two aerated ponds, and six storage ponds. The treated process wastewater discharges to Aberfoyle Creek, which is a tributary of Mill Creek and part of the Grand River watershed. Certificate of Approval (C of A) #3152-55LQ59 permits the treatment and disposal of 15.9 m^3/d of domestic wastewater. The approved domestic wastewater treatment system consists of pumping chambers, three septic tanks (total capacity of 41 m^3), four tertiary treatment septic tanks

(total rated treatment capacity of 20 m^3/d), and a dosing chamber. The treated domestic wastewater is approved to discharge to a leaching bed and a shallow buried trench.

Based on information provided by Nestle Waters, process and domestic wastewater flows are not monitored.

Dufferin Aggregates – CRH Canada Group Inc.

Dufferin Aggregate (a division of CRH Canada Group Inc.) is an aggregate extraction business and operates three extraction pits within the Township of Puslinch. Out of the three pits, only one (Aberfoyle Pit No.1) is within the rural employment designated area, at 125 Brock Road. Their washing operation consists of a closed-loop washing system where the wash water from the wash plant is re-circulated through a settling pond system. Make-up water is periodically taken from the source pond to top-up the amount of water entering the wash plant to compensate from any loss water due to evaporation, infiltration or water adhering to aggregate products.

PTTW #5153-A49MT9 was also registered for this site as per MOECC online records. In communication with CRH Canada Group Inc., it was clarified that this PTTW was for a concrete plant that was on the same site; however, the plant is no longer onsite and water has not been taken from this source since 2010. Their reported water usage for the active wells is summarized in Table 14 below.

Table 14 Dufferin Aggregates – Water Usage

Water Source	Reported Average Water Taking[1]		Max. PTTW Taking[2]	Actual Taken / PTTW
	m3/d	L/s	L/s	%
Pond 5	8.64	0.10	94.7	0.1%
Make Up Pond 6	126.1	1.46	94.7	2%
Total	134.8	1.56	94.7	2%

Notes :

1. Average usage based on reported 2016 data.
2. As per PTTW, the total taking amount may increase from 8,182 m3/d (94.7 L/s) to 12,274 m3/d (142 L/s) for any four months between April and November, and no water shall be taken in January and December. Water must also not be taken from one of the ponds for more than 10 consecutive days in February and March. At all times, water is not permitted to be taken from both ponds simultaneously.

Capital Paving

Capital Paving is a civil construction company specializing in transportation. The head office location in Puslinch has an asphalt and concrete plant, and an aggregate pit on-site. They have four sources for water taking to supply their plant operations, aggregate washing, and office use. According to communication with Capital Paving, there are plans to build a full wash plant on site in the near future, which will increase the water demands for aggregate washing. Their reported water usage is summarized in Table 15 below.

Table 15 Capital Paving – Water Usage

Water Source	Reported Average Water Taking[1]		Max. PTTW Taking[2]	Actual Taken / PTTW
	m3/d	L/s	L/s	%
Pond B – Aggregate washing	166.1	1.92	196	1%
Well A – Office Use	2.4	0.03	1.3	2%
Well B – Asphalt Plant	51.7	0.60	6.0	10%
Well C – Concrete Plant	60.6	0.70	0.70	10%
Total	280.9	3.3	213	2%

Notes :

1. Average usage based on reported 2015 and 2016 data.

CBM Aggregates – St. Mary's Cement

CBM Aggregates (a division of St. Mary's Cement) is an aggregate extraction business and operates multiple extraction pits within the Township. The pits that have a wash plant on-site are the Aberfoyle and McNally pits, which operate under separate PTTWs to authorize aggregate washing in a closed loop system. Their reported water usage is summarized in Table 16 below.

Table 16 CBM Aggregates – Water Usage

Water Source	Reported Average Water Taking[1]		Max. PTTW Taking[2]	Actual Taken / PTTW
	m3/d	L/s	L/s	%
Aberfoyle Main (North) Pit Pond	14,411	166.8	272.8	61%
McNally Supply Pond	13,726	158.9	272.8	58%
Total	28,137	325.7	545.6	60%

Notes :

1. Average usage based on reported 2015 and 2016 data.

2.6 Summary of Large Users Demands and Flows

2.6.1 Existing Water Demands

A summary of the water demands/usage that have been established for the large users based on 2015-2016 operating / recorded data provided is presented in Table 17. It is noted that water demands for all other single residential units/dwellings within the study area are not included in Table 17. These additional demands have been calculated separately and are presented in the following sections of this memorandum.

Table 17 Summary of Existing Water Usage – Large Users

Large User Name	Average Water Taking[1]		Max. PTTW Taking	Actual Taken / PTTW
	m3/d	L/s	L/s	%
Residential Users				
Meadows of Aberfoyle	52.6	0.6	18.2	3%
Mini Lakes	132.5	1.5	7.7	19%
Millcreek Camping and Country Club	31.2	0.4	N/A	-
Total Large Residential Users =	**216.3**	**2.5**		
Large Industrial / Commercial Users				
Royal Canin Canada Company	93.8	1.1	2.8	39%
Con-Cast Pipe Inc.	245.3	2.8	5.2	55%
Maple Leaf Foods – Morguard Brock McLean Limited	21.6	0.2	7.6	3%
Nestle Canada Inc.	2,117.7	24.5	41.7	59%
Dufferin Aggregates – CRH Canada Group Inc.	134.8	1.56	94.7	2%
Capital Paving Inc.	280.9	3.3	213	2%
CBM Aggregates – St. Mary's Cement	28,137	325.7	545.6	60%
Total Large Industrial / Commercial Users =	**31,030**	**359.1**	**910.1**	**39%**

As shown in Table 17, the majority of all large users including residential and industrial and commercial, have current water demands in their systems below 60% of their permitted maximum water taking. A more representative assessment would involve a comparison between the maximum demands experienced by each system against the maximum permitted taking; however, in the absence of maximum day demand data, the average recorded flows have been compared relative to the maximum allowable water takings to provide a general indication of the current water demands for each user.

As per Table 17, Con-Cast Pipe Inc., Nestle Canada and CBM Aggregates – St. Mary's Cement, are the users with the largest volumes of water usage, relative to their existing permitted water taking capacity. Although Con-Cast Pipe Inc. uses in average approximately 55% of their permitted maximum taking capacity, the water demands for this system are very small compared to the amount of water used on an average daily basis by Nestle Canada and CBM Aggregates – St. Mary's Cement.

2.6.2 Existing Wastewater Flows

Based on information received directly from the majority of the large users, tracking of wastewater generation is not required and thus, this information is generally not available. Wastewater flow data was received from two users within the study area, but considering the different nature of the activities that occur onsite, these data are considered specific to each user and is not deemed to be

representative of the current wastewater generation for the majority of the users in the Study Area. As such, this data has been omitted from further review.

For the purpose of the feasibility study, wastewater flow generation will be calculated with consideration to the nature of the business and design guidelines provided by the MOECC. Calculated wastewater flows for the study area are presented in the following section.

3. Water and Wastewater Demand Analysis

Establishing water distribution, wastewater collection, and supply and treatment capacity design flows are integral to capital planning and are key drivers for establishing future needs and timelines for project implementation. This section describes the proposed preliminary design parameters, in terms of water demands and wastewater flows, for municipal water and wastewater servicing in the Study Area and the rationale for its development.

3.1 Water System

There are two major components to development of a new Municipal Water System; namely, the Water Supply System and the Water Distribution System.

3.1.1 Water Supply Design Basis

Water treatment systems are generally designed on the basis of projected flows for a 20-year period. A larger design period may be selected for larger systems, in cases where construction cost is an overriding factor or to satisfy the ultimate requirements of the official plan.

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. As such, establishing the design average and maximum day demands for the system is a critical step in the planning of water systems.

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. Projected water demands have been calculated assuming the residential projected growth in Aberfoyle and Morriston, as established in the County's Official Plan. In addition, it is presumed that no additional growth will occur within the existing residential communities currently serviced by private communal water systems, with the exception of the Mini Lakes Community, which has reported to have an additional 31 future service connections. In terms of industrial and commercial water demands, maximum day demands for the service area have been projected based on current water usages for each of the large users and a design maximum day factor representative of the mix of industrial and commercial users in the study area.

The basis for calculating the design average and maximum day water demands for the study area are tabulated in Table 18.

Table 18 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.

3.1.2 Water Distribution Design Basis

The Water Distribution system should be designed to meet the MOECC Design Guidelines. In particular, the system shall;

- Be capable of maintaining system pressures between 350 to 480 kPa (50 to 70 psi) under normal operating conditions.
- The maximum system pressure in the distribution system should not exceed 700 kPa (100 psi). Where local areas may experience higher system pressures, pressure reducing devices should be provided to avoid damage to household plumbing and unnecessary energy consumption.
- System pressures shall not drop below 140 kPa (20 psi) under Maximum Day plus Fire Flow conditions.
- Provision of Fire Protection through the Municipal water distribution system is a Municipal decision. If 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.

3.1.3 Preliminary Projected Water Demands

Preliminary projected water demands for the study area, based on the information available to-date, including residential, employment, and industrial and commercial uses are summarized in Tables 19, 20, and 21 respectively. Existing water demands for each user are also included in the tables, where available, for comparative purposes.

Table 19 Preliminary Projected Residential Water Demands

Residential Area	Population		2016 Existing Average Day Demands	2041 Future Average Day Demands[4]	2041 Future Max. Day Demands[5]
	2016	2041	L/s	L/s	L/s
Meadows of Aberfoyle	149	149	0.6	0.6	1.2
Mini Lakes[1]	450	504	1.5	2.1	4.2
Millcreek Camping and Country Club	87	87	0.4	0.4	0.7
Aberfoyle[2]	176	186	0.7	0.8	1.6
Morriston	480	620	2.0	2.6	5.2
Other Areas[3]	731	731	3.1	3.1	6.1
Total =	**2,073**	**2,277**	**8.3**	**9.5**	**19.0**

Notes :

1. Future population for Mini Lakes assumes 31 future service connections and a PPU of 1.7 (based on reported current population of 450 people and 260 service connections in 2016).

2. Aberfoyle existing population is calculated based on the reported 325 people in 2016 as per County's Official Plan minus existing population of 149 people currenlty serviced in the Meadows of Aberfoyle community which is located within the limits of Aberfoyle. Projected growth in Aberfoyle is consistent with the County's OP projections.
3. A total of 270 residential units/dwellings have been identified outside of Aberfoyle and Morriston but within the study area boundaries. A PPU of 2.7, as reported for Aberfoyle in the County's OP, has been used to calculate the total residential population for these additional units.
4. Future average day demands assume a unit consumption rate of 360 L/cap/day.
5. Future max. day demands assume a max. day factor of 2.0.

Table 20 Preliminary Projected Employment Water Demands[1]

Area	Employment[1]		2016 Existing Average Day Demands	2041 Future Average Day Demands[2]	2041 Future Max. Day Demands[3]
	2016	2041	L/s	L/s	L/s
Study Area	1,793	3,408	7.5	14.2	28.4

Notes :

1. Preliminary projected employment water demands shown in Table 20 reflect total employment count for the study area with the exception of industrial employment count records for 2016. Water demands for 2016 industrial employment have been captured and accounted for in the water demands received from the large users. For example; total 2016 employment as per OP is 4,017, out of which 2,224 corresponds to industrial employment. Since demands for industrial employment has been assumed under demands gathered from existing users, total 2016 employment numbers for study area is 1.793 (4,017 – 2,224). Total forecasted 2041 employment as per OP is 5,632, under the same assumption of industrial employment demands already captured, total 2041 employment numbers for study area is 3,408 (5,632 – 2,224).
2. Future average day demands assume a unit consumption rate of 360 L/employment/day.
3. Future max. day demands assume a max. day factor of 2.0.

Table 21 Preliminary Projected Industrial and Commercial Water Demands

Industrial / Commercial User	PTTW Capacity		2041 Future Average Day Demands[1]	2041 Future Max. Day Demands[2]
	m3/d	L/s	L/s	L/s
Royal Canin Canada Company	240	2.8	1.1	2.8
Con-Cast Pipe Inc.	450	5.2	2.8	5.2
Maple Leaf Foods – Morguard Brock McLean Limited	654	7.6	0.2	0.7
Nestle Canada Inc.	3,600	41.7	24.5	41.7
Dufferin Aggregates – CRH Canada Group Inc.	8,183	94.7	1.6	4.7
Capital Paving Inc.	18,371	212.6	3.3	9.8
CBM Aggregates – St. Mary's Cement	47,136	545.6	325.7	545.6
Total Existing Large Users =	**78,634**	**910.1**	**359.1**	**610.4**
Total Large Users (excluding Nestle Canada Inc. and St. Mary's Cement) =	**27,898**	**323**	**9.0**	**23.2**

Notes :

1. Future average day demands for large users assume the current water usages reported for 2015 and 2016.
2. Future maximum day demands assume a maximum day factor of 3.0. However, if the calculated maximum day demands for a user would exceed their existing PTTW taking capacity, the current PTTW rate would prevail and is shown in the table.

3.1.4 Preliminary Proposed System 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:

- Some large industrial users may not want to use municipal chlorinated water as it may affect their operations.
- Based on the nature and the character of the business of some of the large users, it won't be viable to provide municipal services, especially potable water services, to some of these users (e.g., Nestle Canada Inc. and St. Mary's Cement) that are currently permitted and currently use significant amounts of water.
- Provision of municipal water services should account for projected residential, employment and most ICI uses within the study area. Municipal water servicing should not account for provision of municipal potable water to Nestle Canada Inc. or St. Mary's Cement for purposes other than domestic. In other words, any water required by these companies for any industrial or process related activities should be provided directly through their own private water system.
- All other existing large users, outlined in this report as such, 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 the current PTTW rate, the smaller of the two.

Proposed system water demands are summarized in Table 22. Detailed calculations are provided in Appendix A for further reference.

Table 22 Preliminary Proposed System Water Demands

Service Type	Design Average Day Demand		Design Maximum Day Demand	
	m3/d	L/s	m3/d	L/s
Residential	820	9.5	1,639	19.0
Employment (outside of large users)	1,227	14.2	2,454	28.4
Industrial / Commercial / Recreational (large users excluding Nestle Canada Inc. and St. Mary's Cement)	776	9.0	2,001	23.2
Allowance for Domestic Use at Nestle Canada Inc. and St. Mary's Cement	51	0.6	152	1.8
Total Proposed System Demands =	**2,873**	**33.3**	**6,246**	**72.3**

Notes :

1. An allowance for domestic uses at Nestle Canada Inc. and St. Mary's Cement has been included in the calculations. The allowance is approximately 1% of their existing PTTW rate.

Key considerations for sizing the different water system components include:

- The supply source, either lake-based or groundwater sources, for the new system should be able to meet the projected maximum design day demands. From a groundwater perspective, multiple groundwater supply wells may be required to satisfy the projected max. day demands.
- From a treatment perspective, treatment processes should also be able to meet the projected maximum design day demands, with Peak Hour Demands and/or Fire and Emergency demands provided from storage.
- In terms of distribution system capacity, watermain sizing would have a direct impact on the cost of the system, operation and maintenance requirements in addition to water quality considerations.

3.2 Wastewater 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 23.

Table 23 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 30m3/ha/d (low end of MOECC Guideline) and 360 L/cap/d.
Peak Factor	varies	-	Calculated for each drainage area based on Harmon Formula

3.2.1 Projected Wastewater Flows

Projected wastewater flows for the study area for all residential users as well as industrial and commercial users are summarized in Tables 24 and 25, respectively.

Table 24 Projected Residential Wastewater Flows

Residential Area	2041 Population	2041 Future Average Day Flows[4] (for Treatment) L/s	2041 Future Peak Day Flows[5] (for Sewer Capacity) L/s
Meadows of Aberfoyle	149	0.62	3.9
Mini Lakes[1]	504	2.10	12.3
Millcreek Camping and Country Club	87	0.36	2.4
Aberfoyle[2]	186	0.78	7.2
Morriston	620	2.58	23.5
Other Areas[3]	731	3.05	28.7
Total =	**2,277**	**9.5**	**78.1**

Notes :

1. Future population for Mini Lakes assumes 31 future service connections and a PPU of 1.7 (based on reported current population of 450 people and 260 service connections in 2016).
2. Aberfoyle existing population is calculated based on the reported 325 people in 2016 as per County's Official Plan minus existing population of 149 people currently serviced in the Meadows of Aberfoyle community which is located within the limits of Aberfoyle. Projected growth in Aberfoyle is consistent with the County's OP projections.
3. A total of 270 residential units/dwellings have been identified outside of Aberfoyle and Morriston but within the study area boundaries. A PPU of 2.7, as reported for Aberfoyle in the County's OP, has been used to calculate the total residential population for these additional units.
4. Future average day flows assume a unit generation rate of 360 L/cap/cay.
5. Peak day flows assume an I&I rate of 10,110 L/ha/d and peak factor calculated based on Harmon Formula.

Table 25 Projected Industrial and Commercial Wastewater Flows

Industrial / Commercial Areas	Drainage Area ha	Equivalent ICI Population People	2041 Future Average Day Flows[1] (for Treatment) L/s	2041 Future Peak Day Flows[2] (for Sewer Capacity) L/s
Within Aberfoyle	26	2,128	8.9	34.6
Within Morriston	9.7	809	3.4	14.1
Within other areas in Study Area	250.8	20,897	87.1	258.6
Total =	**286**	**23,835**	**99.3**	**307.4**

Notes :

1. Future average day flows for large users assume a unit generation rate of 360 L/cap/cay.
2. Future peak day flows assume an I&I rate of 10,110 L/ha/d and peak factor calculated based on Harmon Formula.

3.2.2 Preliminary Proposed Wastewater Design Flows

Wastewater design flows for the study area is summarized in Table 26. The design flows noted in Table 26 do not account for process wastewater generated by the large industries. Detailed calculations are provided in Appendix A for further reference.

Table 26 Proposed Wastewater Design Flows

Servicing Category	Design Average Day Flow (for Treatment)		Design Peak Day Flow (for Sewer Capacity)	
	m3/d	L/s	m3/d	L/s
Residential	819.6	9.5	6,746.3	78.1
Industrial / Commercial / Recreational	8,580	99.3	26,557	307.4
Total Proposed System Flows =	**9,400**	**108.8**	**33,303**	**385.5**

4. Conclusion

To assess the viability of implementing municipal water and sewage services in the study area, plans for future growth and development were identified, and current water demands and wastewater flows were requested from the key users. The information provided by the Township and key users formed the basis of the water and wastewater demand analysis. Table 27 consolidates the preliminary proposed future water demands and wastewater flows for municipal servicing in the study area.

Table 27 Summary of preliminary proposed water demands and wastewater flows

Water	Proposed Average Day Demands		Proposed Max. Day Demands	
	m3/d	L/s	m3/d	L/s
Proposed Preliminary System Water Demands	2,873	33.3	6,246	72.3
Wastewater	**Proposed Average Day Flows (for Treatment)**		**Proposed Peak Day Flows (for Sewer Capacity)**	
	m3/d	L/s	m3/d	L/s
Proposed Preliminary System Wastewater Flows	9,400	108.8	33,303	385.5

TM-1 is not meant to be a design document. This memo is preliminary in nature and is a summary of the information obtained as of the date of issuance of TM-1.

APPENDIX A - Detailed Calculations

Project Title:	**Puslinch Water and Sewage Feasibility Study**		
Client:	Township of Puslinch		
Project No.:	T000866A		
Task:	Criteria Development - Water Demands		
Prepared By:	Sandra Rodriguez	**Date:**	5-Oct-17
Reviewed by:	Stuart Winchester	**Date:**	6-Oct-17
Revision No. :	4	**Revision Date:**	3-Jan-18

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.

Employment Forecast[1]

Employment Breakdown	2016	2041	Comments
Primary	116	114	
Work at Home	476	560	
Industrial	2224	3361	55% of the Total employment in 2016
Commercial / Population Related	651	867	
Institutional	138	182	
NFPOW	412	548	
Total =	**4017**	**5632**	Total employment projections consistent with County's OP numbers.

Notes:
1. As per breakwdown provided by County of Wellington. Source: Watson & Associates Economists Ltd. Wellington County 2014 Growth Analysis Final Report.

Residential Water Demands - Existing and Future

	Population Numbers		Existing (2016) Residential Water Demands		Future (2041) Residential Water Demands			
Residential Population within Study Area	Year		Ave.		Ave.		Max.	
	2016	2041	m^3/d	L/s	m^3/d	L/s	m^3/d	L/s
Meadows of Aberfoyle	149	149	52.6	0.61	53.6	0.62	107.3	1.24
Mini Lakes	450	504	132.5	1.53	181.3	2.10	362.6	4.20
Millcreek Camping and Country Club	87	87	31.2	0.4	31.2	0.4	62.4	0.7
Aberfoyle	176	186	63.4	0.73	67.0	0.78	134.0	1.55
Morriston	480	620	172.8	2.00	223.2	2.58	446.4	5.17
Other Areas	731	731	263.3	3.05	263.3	3.05	526.5	6.09
Total for Study Area =	**2,073**	**2,277**	**715.7**	**8.3**	**819.6**	**9.5**	**1,639**	**19.0**
Total Population Increase =	**204**							

Project Title:	**Puslinch Water and Sewage Feasibility Study**		
Client:	Township of Puslinch		
Project No.:	T000866A		
Task:	Criteria Development - Water Demands		
Prepared By:	Sandra Rodriguez	**Date:**	5-Oct-17
Reviewed by:	Stuart Winchester	**Date:**	6-Oct-17
Revision No. :	4	**Revision Date:**	3-Jan-18

Employment Water Demands - Existing and Future (Assumes all employment except for industrial employment numbers)

			Existing (2016) Employment Water Demands		Future (2041) Employment Water Demands			
Employment Population within Study Area	**Year**		**Ave.**		**Ave.**		**Max.**	
	2016	**2041**	**m^3/d**	**L/s**	**m^3/d**	**L/s**	**m^3/d**	**L/s**
Employment[1]	1793	3408	645.5	7.47	1226.9	14.20	2453.8	28.40
Total for Study Area =	**1,793**	**3,408**	**645.5**	**7.5**	**1226.9**	**14.2**	**2,454**	**28.4**
Total Employment Population Increase =	**1,615**							

Notes:

1. It has been assumed that the existing 2224 employment numbers in 2016 have been captured within the water demands receieved from ex. large users.

Employment Water Demands - Existing and Future (Assumes all employment including industrial employment numbers)

			Existing (2016) Employment Water Demands		Future (2041) Employment Water Demands			
Employment Population within Study Area	**Year**		**Ave.**		**Ave.**		**Max.**	
	2016	**2041**	**m^3/d**	**L/s**	**m^3/d**	**L/s**	**m^3/d**	**L/s**
Employment[1]	4017	5632	1446.1	16.74	2027.5	23.47	4055.0	46.93
Total for Study Area =	**4,017**	**5,632**	**1446.1**	**16.7**	**2027.5**	**23.5**	**4,055**	**46.9**
Total Employment Population Increase =	**1,615**							

Notes:

1. Assumes all employment categories including industrial

Industrial and Commercial Water Demands - Existing and Future

				Existing (2016) ICI Water Demands[1]		Future (2041) ICI Water Demands[2]				Ex. Ave. Usage / PTTW
Large Industrial/Commercial Users	**PTTW Capacity**			**Ave.**		**Ave.**		**Max.**		
	L/d	**m^3/d**	**L/s**	**m^3/d**	**L/s**	**m^3/d**	**L/s**	**m^3/d**	**L/s**	**%**
Royal Canin Canada Company	240,000	240	2.8	93.8	1.1	93.8	1.1	240.0	2.8	39%
Con-Cast Pipe Inc.	450,000	450	5.2	245.3	2.8	245.3	2.8	450.0	5.2	55%
Morguard Brock McLean Limited - Maple Leaf Foods	653,760	654	7.6	21.6	0.2	21.6	0.2	64.8	0.7	3%
Nestle Canada Inc.	3,600,000	3,600	41.7	2,117.7	24.5	2,117.7	24.5	3,600.0	41.7	59%
CRH Canada Group Inc. - Dufferin Aggregates	8,182,800	8,183	94.7	134.6	1.6	134.6	1.6	403.8	4.7	2%
Capital Paving Inc.	18,371,400	18,371	212.6	280.9	3.3	280.9	3.3	842.6	9.8	2%
St. Marys Cement Inc. (Canada)	47,136,000	47,136	545.6	28,136.5	325.7	28,136.5	325.7	47,136.0	545.6	60%
Total for Study Area =	**78,633,960**	**78,634**	**910.1**	**31,030**	**359.1**	**31,030.3**	**359.1**	**52,737.1**	**610.4**	**39%**
Total Excluding Nestle & St. Marys	**27,897,960**	**27,898**	**323**			**776.1**	**9.0**	**2,001.1**	**23.2**	

Notes:

1. Calculated as the 2-year average between data provided from ex. large users for period between 2015 and 2016.
2. It has been assumed that future water demands from large users will remain consistent with actual demands.

Project Title:	**Puslinch Water and Sewage Feasibility Study**		
Client:	Township of Puslinch		
Project No.:	T000866A		
Task:	Criteria Development - Water Demands		
Prepared By:	Sandra Rodriguez	**Date:**	5-Oct-17
Reviewed by:	Stuart Winchester	**Date:**	6-Oct-17
Revision No. :	4	**Revision Date:**	3-Jan-18

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:	Criteria Development - Wastewater Flows		
Prepared By:	Sandra Rodriguez	**Date:**	5-Oct-17
Reviewed by:	Stuart Winchester	**Date:**	6-Oct-17
Revision No. :	4	**Revision Date:**	3-Jan-18

ESTIMATE WASTEWATER FLOWS 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	219.4	L/cap/day	Calculated for Mini Lakes
Water Unit Consumption Rate	360.0	L/cap/day	Assumed
Wastewater Flow Rate	360.0	L/cap/day	Assumed to be consistent with water consumption - Very conservative
Peak Infiltration / Inflow Rate for Industrial / Commercial Areas	10,110.0	L/ha/day	Low end of MOECC Guidelines, new system should have low I&I contribution
Peak Infiltration / Inflow Rate for Residential Areas	10,110.0	L/ha/day	Low end of MOECC Guidelines, new system should have low I&I contribution
Population densities for Industrial / Commercial	83	person/ha	Assuming 30 m3/ha/d (low end of MOECC Guideline) and 360 L/cap/d, this would equeate to approx. 83 ppha.
Peak Factor	varies	-	Calculated for each area based on Harmon Formula

Residential Wastewater Flows - Existing and Future

Residential Population within Study Area	Population Numbers		Drainage Area (ha)[1]		Existing (2016) Residential Wastewater Flows		Calculated Peak Factor for Future Population	Future (2041) Residential Wastewater Flows			
	Year				Ave.			Avg. (for Treatment)		Peak (for Sewer Capacity)	
	2016	2041	2016	2041	m^3/d	L/s		m^3/d	L/s	m^3/d	L/s
Meadows of Aberfoyle	149	149	10	10	53.6	0.6	4.41	53.6	0.62	337.3	3.9
Mini Lakes	450	504	24	27	98.8	1.1	4.36	181.3	2.10	1066.2	12.3
Millcreek Camping and Country Club	87	87	7	7	31.2	0.4	4.43	31.2	0.36	208.9	2.4
Aberfoyle	176	186	31	33	63.4	0.7	4.35	67.0	0.78	625.6	7.2
Morriston	480	620	83.2	107.5	172.8	2.0	4.23	223.2	2.58	2031.6	23.5
Other Areas	731	731	135	135	263.3	3.0	4.21	263.3	3.05	2476.7	28.7
Total for Study Area =	**2,073**	**2,277**	**291**	**320**	**683.0**	**7.9**		**819.6**	**9.5**	**6,746.3**	**78.1**
Total Population Increase =	**204**										

Notes:

1. Drainage Areas calculated in Google

Industrial and Commercial Wastewater Flows - Existing (2016)

Large Industrial/Commercial/Recreational Users	Drainage Areas	Equivalent ICI Population	Calculated Peak Factor	Existing ICI Wastewater Flows			
				Average Flow (for Treatment)		Peak Flows (for Sewer Capacity)	
	Ha	people		m^3/d	L/s	m^3/d	L/s
Aberfoyle	26	2,128	3.56	766.2	8.87	2,989.4	34.6
Morriston	9.7	809	3.86	291.3	3.37	1,221.8	14.1
Other areas within Study Area[1]	197.3	16,445	2.74	5,920.2	68.5	18,204.6	210.7
Total for Study Area =	**233**	**19,383**		**6,978**	**81**	**22,415.9**	**259.4**
		83					

Notes:

1. Drainage Areas calculated in Google. It represents the built up areas north of Highway 401 currently occupied by industries and around Highway 6 (concast). See adjacent figures

Project Title:	**Puslinch Water and Sewage Feasibility Study**		
Client:	Township of Puslinch		
Project No.:	T000866A		
Task:	Criteria Development - Wastewater Flows		
Prepared By:	Sandra Rodriguez	**Date:**	5-Oct-17
Reviewed by:	Stuart Winchester	**Date:**	6-Oct-17
Revision No. :	4	**Revision Date:**	3-Jan-18

Industrial and Commercial Wastewater Flows - Future (2041)

				Future ICI Wastewater Flows			
Large Industrial/Commercial/Recreational Users	**Drainage Areas**	**Equivalent ICI Population**	**Calculated Peak Factor**	**Average Flow (for Treatment)**		**Peak Flows (for Sewer Capacity)**	
	Ha	**people**		**m^3/d**	**L/s**	**m^3/d**	**L/s**
Aberfoyle	26	2,128	3.56	766.2	8.87	2,989.4	34.6
Morriston	9.7	809	3.86	291.3	3.37	1,221.8	14.1
Other areas within Study Area[1]	250.8	20,897	2.63	7,523.0	87.1	22,345.8	258.6
Total for Study Area =	**286**	**23,835**		**8,580**	**99.3**	**26,557.1**	**307.4**

Notes:

1. Includes existing developed ICI areas plus the rural employment area around Hwy 6. Assumes only 50% of the total area to be occupied by infrastructure.

DOMESTIC & ICI FLOWS SUMMARY - 2041

Service Area	**Average Flow (for Treatment)**		**Peak Flows (for Sewer Capacity)**	
	m^3/d	**L/s**	**m^3/d**	**L/s**
Residential	819.6	9.49	6,746.3	78.08
Industrial / Commercial / Recreational	8,580	99.31	26,557	307.37
Total =	**9,400.0**	**108.8**	**33,303.4**	**385.5**

Project Title:	**Puslinch Water and Sewage Feasibility Study**		
Client:	Township of Puslinch		
Project No.:	T000866A		
Task:	Water Demand Criteria Development - Water Usages		
Prepared By:	S. Rodriguez	**Date:**	5-Oct-17
Reviewed by:	S. Winchester	**Date:**	6-Oct-17
Revision No. :	0	**Revision Date:**	

ESTIMATE EXISTING RESIDENTIAL WATER DEMANDS FOR WHOLE STUDY AREA

Existing Residential Information

1. ABERFOYLE EXISTING & FUTURE

EXISTING (2016)

Criteria	Value	Units	Comments
Total 2016 Population	325	people	As per Wellington County OP, Revision September 2016. Table 8
2016 Households	120	units	
Calculated ex. PPU	2.7	person/unit	Calculated

FUTURE (2041)

Description	Value	Units	Comments
Total 2041 Population	335	people	As per Wellington County OP, Revision September 2016. Table 8
2016 Households	130	units	
Calculated ex. PPU	2.6	person/unit	Calculated

2. MORRISTON EXISTING & FUTURE

EXISTING (2016)

Description	Value	Units	Comments
Total 2016 Population	480	people	As per Wellington County OP, Revision September 2016. Table 8
2016 Households	185	units	
Calculated ex. PPU	2.6	person/unit	Calculated

FUTURE (2041)

Description	Value	Units	Comments
Total 2041 Population	620	people	As per Wellington County OP, Revision September 2016. Table 8
2016 Households	235	units	
Calculated ex. PPU	2.6	person/unit	Calculated

3. MEADOWS OF ABERFOYLE (Communal Water System)

EXISTING (2016)

Description	Value	Units	Comments
Total 2016 Population	149	people	As per Wellington County OP, Revision September 2016.
2016 Building Lots	55	units	As per 2016 Annual Monitoring Report provided by Greg Cook on Sept 13, 2017
Assumed ex. PPU	2.7	person/unit	Assumed based on 2016 numbers for Aberfoyle. Communal system is closer to Aberfoyle.
Ave. System Water Demands	0.6	L/s	2-year Average demands as per 2015 and 2016 reported flows in MOECC WTRS
	52.6	m3/d	
Max. Day Factor	137175.0	-	Calculated based on 2015 & 2016 data
Max. System Water Demands	83479.9	L/s	Calculated
	7212661.5	m3/d	
Calculated Unit Consumption Rate	353.0	L/cap/d	Calculated

4. MINI LAKES (Communal Water System)

EXISTING (2016)

Description	Value	Units	Comments
Total 2016 Population	450	people	As per 2016 O&M Report Mini Lakes, Burnside April 2017
2016 Service Connections	260	units	
Future Service Connections	31	units	
2016 Calculated PPU	1.7	person/unit	Calculated
Water			
Ave. System Water Demands	1.5	L/s	2-year Average demands as per 2015 and 2016 in Mini Lakes Report by American Water Canada
	132.5	m3/d	
Max. Day Factor	95166.7	-	Calculated based on 2015 & 2016 data
Max. System Water Demands	145946.5	L/s	Calculated
	12609778.9	m3/d	
Calculated Unit Consumption Rate	**294.4**	**L/cap/d**	**Calculated**
Wastewater			
Ave. Wastewater Flows	98.8	m3/d	2-year Average demands as per 2015 and 2016 in Mini Lakes Report by American Water Canada
	1.1	L/s	
Max. Wastewater Flows	177.4	m3/d	Max. Flows between 2015 and 2016 as per Mini Lakes Reports
	2.1	L/s	
Calculated Unit Production Rate	**219.4**	**L/cap/d**	**Calculated**

5. OTHER RESIDENTIAL AREAS (Within the Study Area)

EXISTING (2016)

Description	Value	Units	Comments
Total 2016 Population	731	people	Calculated
2016 Service Connections	270	units	Counted number of lots already developed within the study area - Google
2016 Assumed PPU	2.7	person/unit	Assumed based on 2016 numbers for Aberfoyle. Areas closer to Aberfoyle

Township of Puslinch

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

Partners in excellence

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DRAFT
February 28, 2018

T000866A

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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	
	m3/d	L/s	m3/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 30m3/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)	
	m3/d	L/s	m3/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 2 – 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 m3/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 m3.
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.

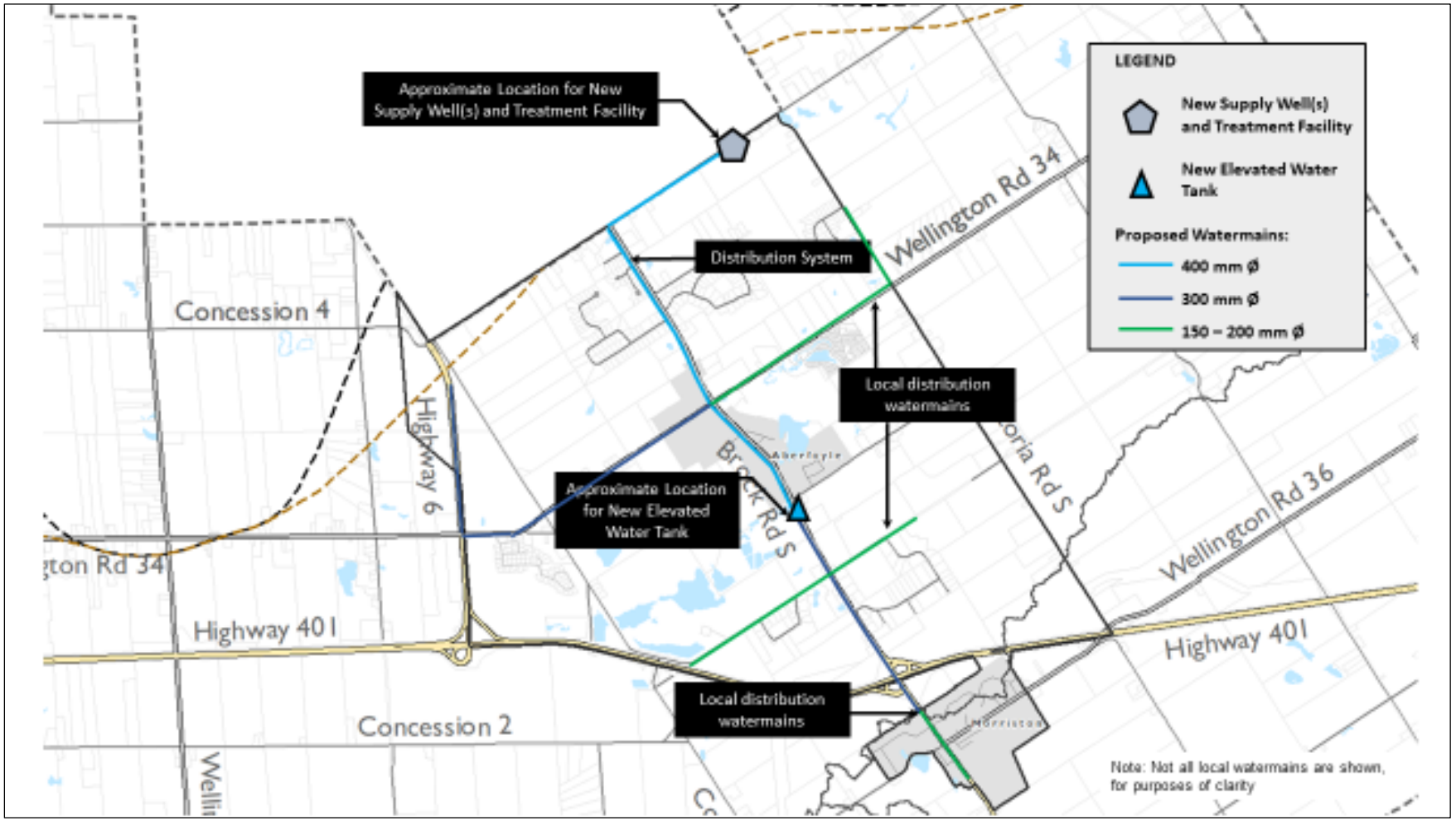

Figure 1 General Schematic – Option 1: Intra-Municipal Water Servicing

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. 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 m3/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 m3/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 m3
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.

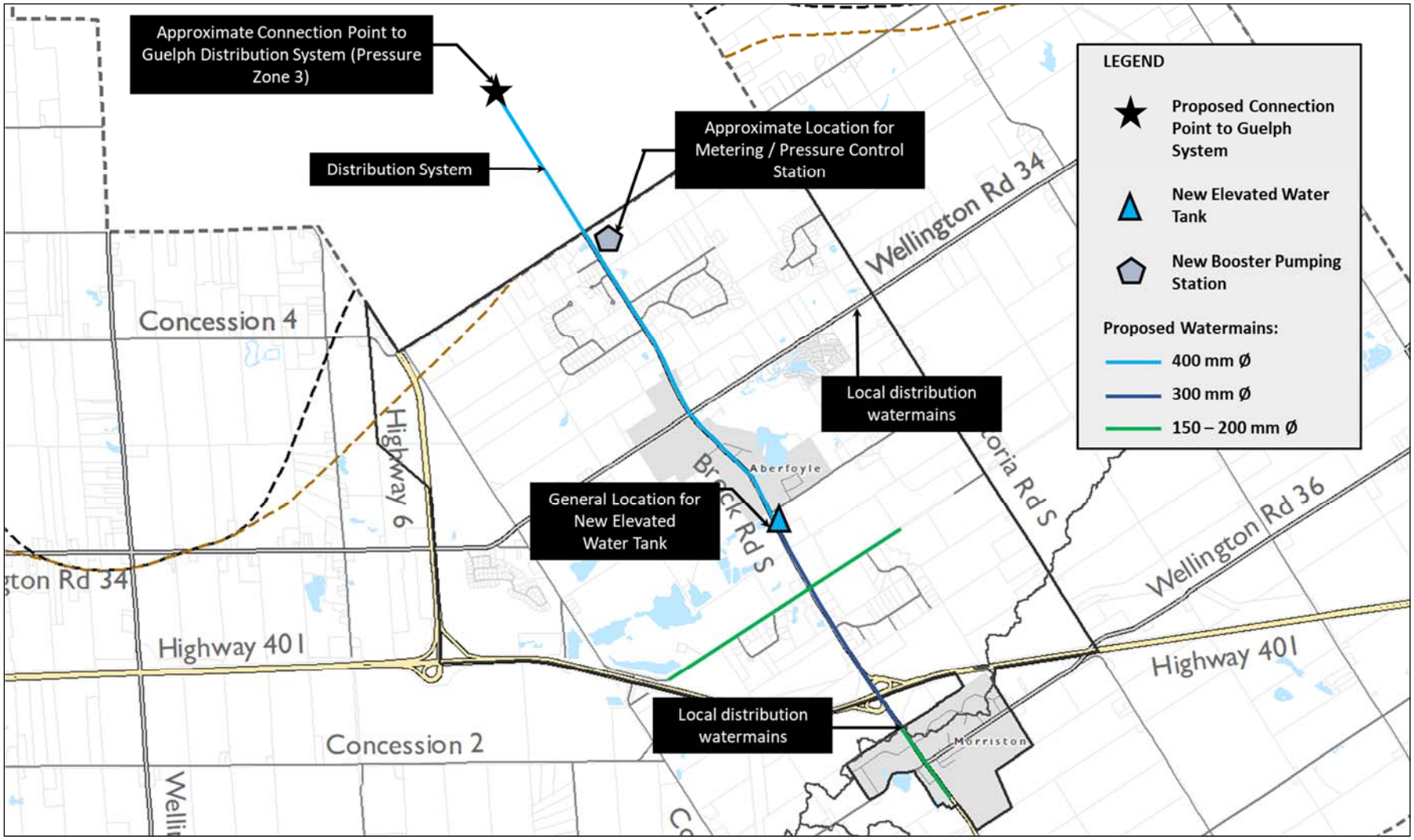

Figure 2 General Schematic – Option 2: Inter-Municipal Water Servicing

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.

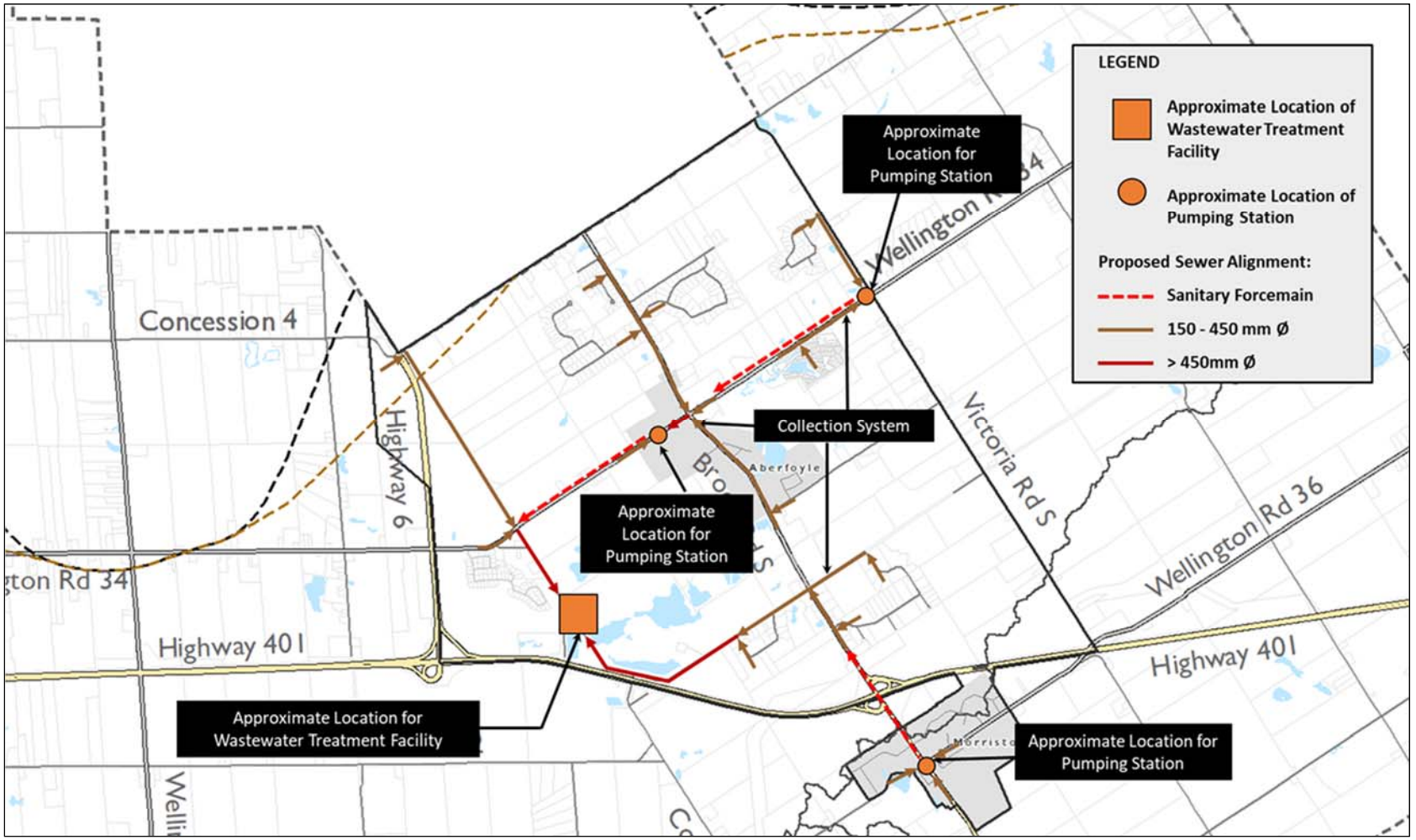

Figure 3 General Schematic – Option 1: Intra-Municipal Sewage Servicing

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. The Township Council would need to submit a formal request to the City of Guelph to initiate formal consideration of this Option.

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.

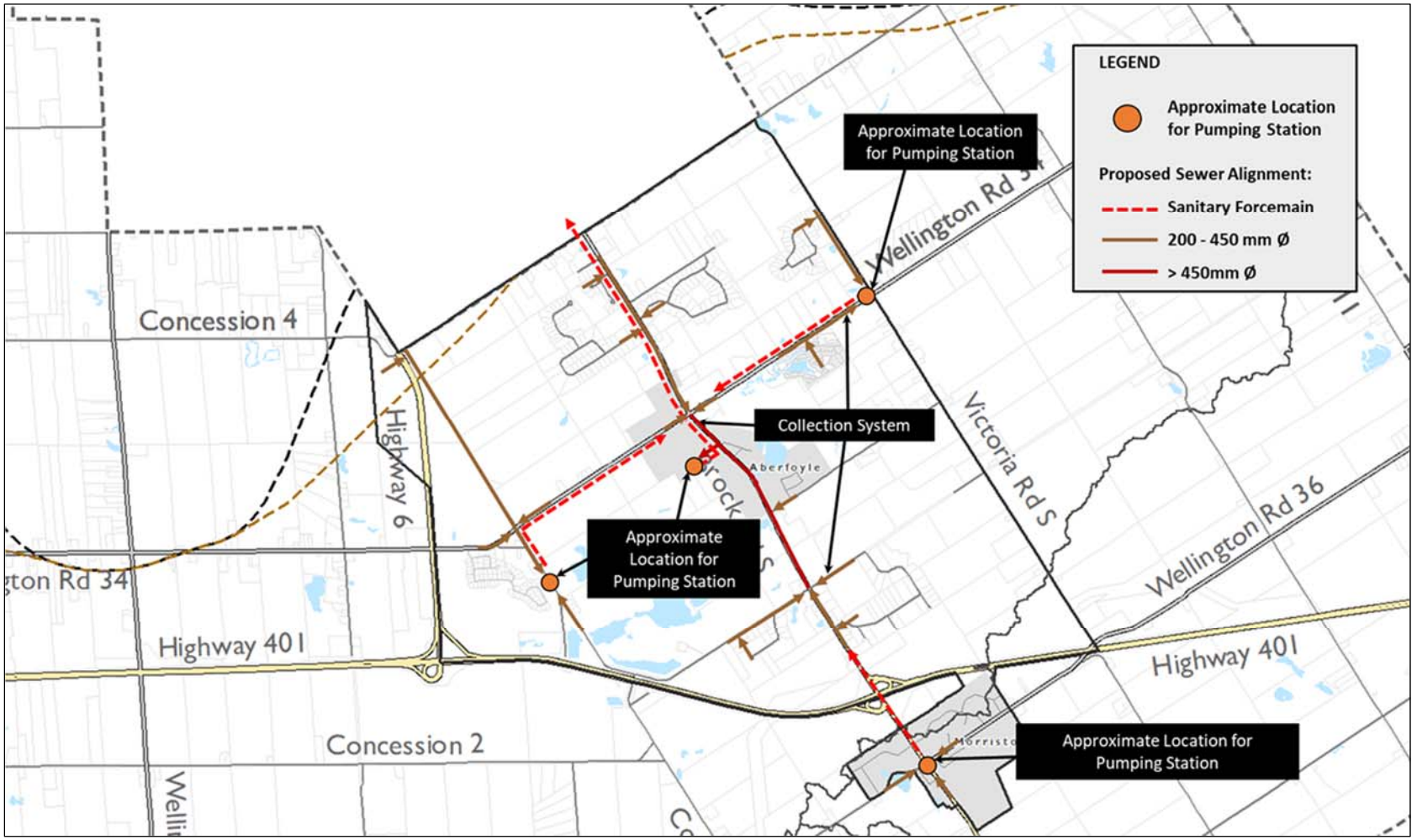

Figure 4 General Schematic – Option 2: Inter-Municipal Sewage Servicing

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.

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
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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

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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		