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Staff Report

Infrastructure & Public Works

Report To: **Special Meeting of Council**
Meeting Date: February 21, 2017
Report Number: CSPW.17.029
Subject: Wastewater Servicing Means and Methodologies
Prepared by: Reg Russwurm, Director of Infrastructure and Public Works

A. Recommendations

THAT Council receive Staff Report CSPW.17.029 entitled "Wastewater Servicing Means and Methodologies";

AND THAT Council direct Staff to proceed to obtain public input on the concept that the determination of the wastewater system to be installed for a servicing extension project will be evaluated primarily on a life cycle cost basis;

AND THAT Council direct Staff to proceed with obtaining public input on whether the Town or the property owner is to be responsibility for the on-site operation and maintenance costs of grinder pumps.

B. Overview

The collection and treatment of wastewater is one of the core services provided by the Town to enable economic development, provide for the highest value use of lands and protect the natural environment from detrimental wastewater discharges. New development within designated urban areas are required to installed municipal wastewater collection systems; however, there are older and rural areas of the Town that are serviced by privately owned on-site systems where by municipal servicing is provided by extending the existing wastewater collection system. The Town, through its Official Plan and several studies, has stated its intention to over time extend municipal wastewater collection to the un-serviced areas in the urban areas.

This report discusses the various means and methodologies that wastewater servicing extensions can be accomplished. The affordability of a servicing extension will be discussed under a separate Staff Report prepared by Finance and Information Services Department.

Staff have reviewed various alternatives including:

1. Open Gravity Sewer System;
2. Low Pressure Sanitary System, both privately and publically owned; and,

3. Modified Gravity System.

Staff feel that a preferred servicing solution should be determined on a life cycle cost basis being sensitive to extraneous factors such as environmental factors and preference of the benefiting property owners who pay the cost of construction. Staff expect that open gravity sewers systems will generally have the lowest life cycle costs. Where the cost of open gravity sewers are abnormally high, a Low Pressure Sanitary (LPS) System will likely be the next most favorable. Other servicing solution however, such as modified gravity, may be preferred in unique project situations.

Staff considered various models for the provision of Low Pressure Sanitary Systems and whether compensation is warranted for the property owner to assume the ongoing operating and maintenance costs related to a grinder pump. On balance, Staff felt that the Town should not directly own or operate on-site grinder pumps and that since the choice of servicing methodologies (gravity vs LPS) is evaluated on a life cycle basis, the ongoing operation and maintenance cost for an LPS system should remain with the property owner.

Staff recommend that Council direct Staff to proceed with obtaining public input on the wastewater servicing alternatives and the ownership models including the responsibility for the on-site operation and maintenance costs for grinder pumps for Council's further consideration.

C. Background

Wastewater is generated at each residence in the Town and must be treated. That treatment can be accomplished onsite or at a centralized wastewater treatment plant (WWTP).

On site treatment usually consists of a septic tank for the disposition of solids and an absorption field for the disposal of liquids (Figure 1). More sophisticated systems are available however typically a simple septic tank with absorption is the extent of treatment provided. The concern with this level of treatment is that quite often the end treatment quality is unknown and over time environmental degradation may occur particularly along the Georgian Bay shoreline. In some instances, holding tanks are used that have to be pumped out on a regular basis. Wastewater in a holding tank is not treated on site but is hauled to an approved treatment location.

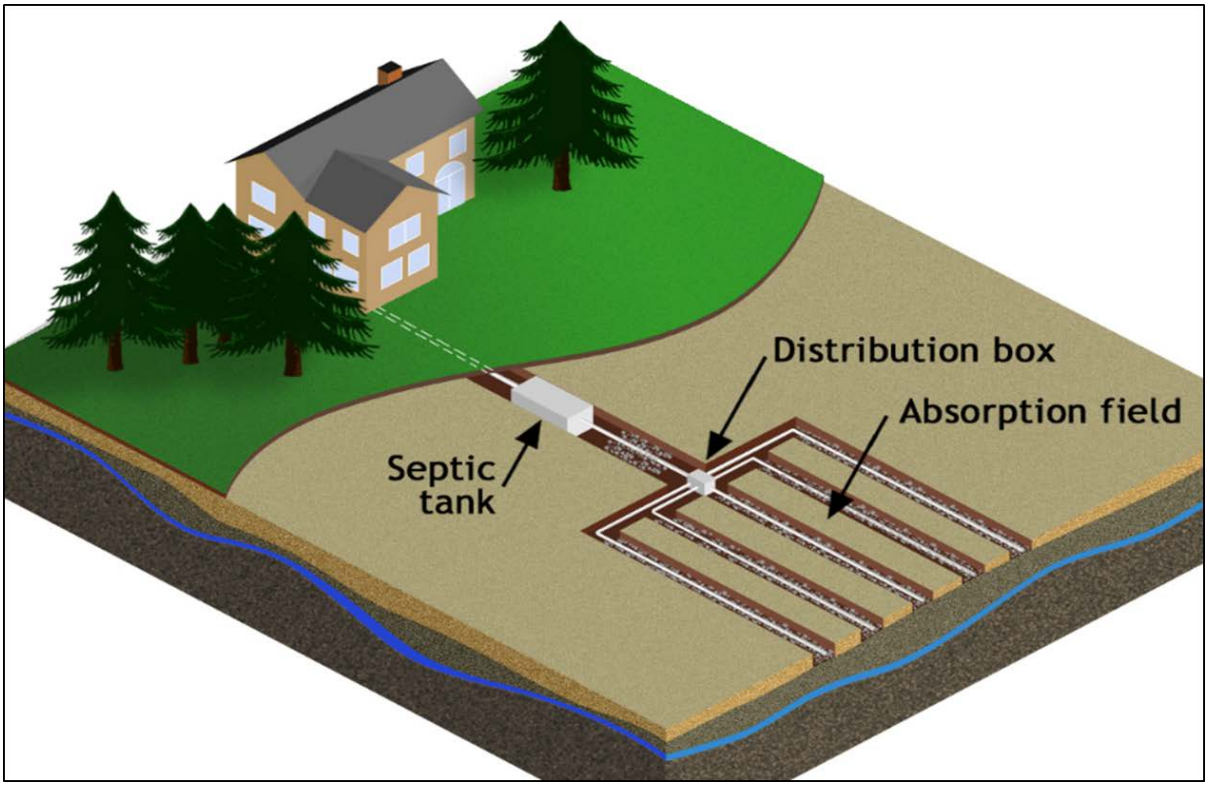
The municipal wastewater system consists of two WWTP's and a trunk collection system throughout the Town that gathers wastewater from serviced areas, transports it to a treatment plant and discharges effluent to Georgian Bay meeting all provincial regulations. The Town's treatment plants will be able to accept the Town's un-serviced areas which are designated to be serviced in time. The trunk collection system is for the most part in place. The remaining infrastructure to be installed is that local to the street(s) to be serviced.

The Town routinely schedules wastewater servicing projects depending on potential natural environment improvements, property owner requests and as opportunities become available. Regarding cost recovery, the Town's practice, as permitted under the Municipal Act, is to assess the cost of the servicing (treatment and collection) to the benefiting property owners. The

assessment of costs is often the major point of discussion with property owners involved in a servicing project. The initial capital cost and future operating cost of servicing is highly dependent on the means by which the servicing extension is accomplished.

The main methods by which municipal wastewater collection can occur are: i) open gravity; and, ii) low pressure sewage forcemain; and, iii) modified gravity. The alternatives are outlined and discussed below. On-site private systems such as a septic tile bed or holding tanks will not be discussed since the report considers that the decision to undertake servicing has been made.

Figure 1 – Typical Onsite Septic System



Alternative Servicing Concepts

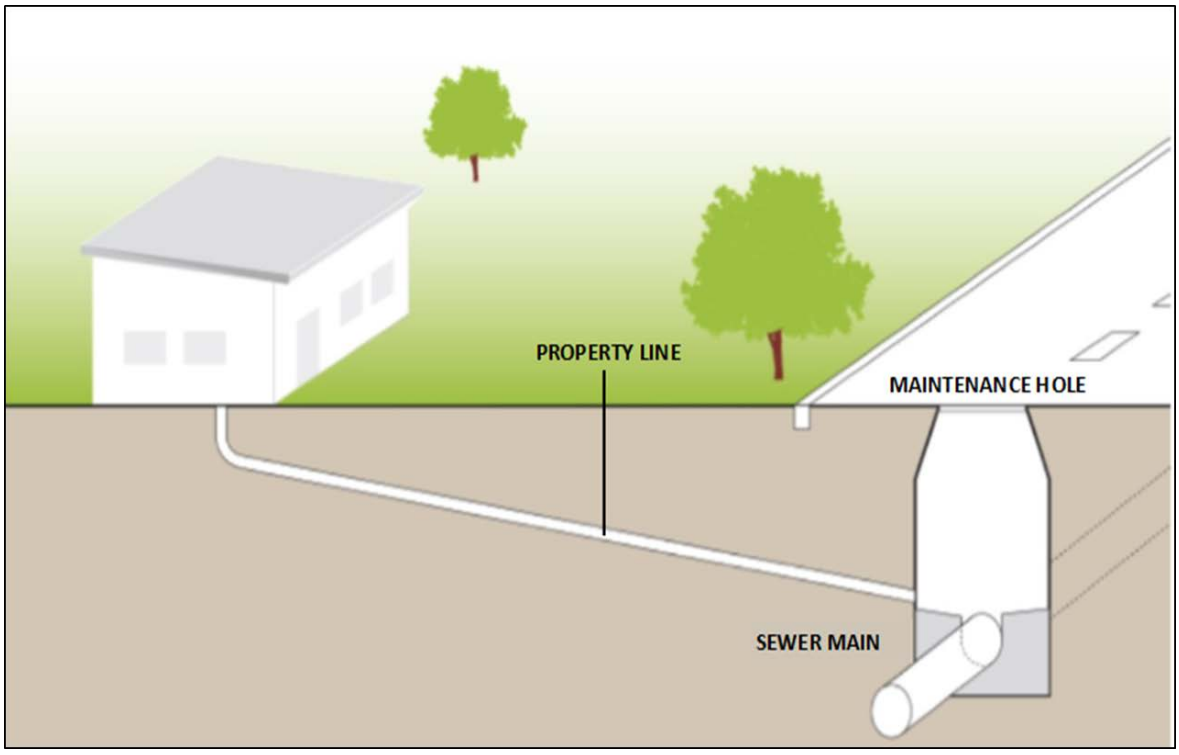
<u>Alternative 1 – Open Gravity Sewer System</u>

The traditionally preferred method of providing sanitary servicing to new or existing development is by gravity sewer due to the simplicity of construction, lower cost of operation and maintenance (O&M), and reliability (Figure 2). A gravity sewer system is defined as one that collects wastewater from properties through a free draining lateral connection. The sewer is usually 200mm or larger and is buried preferably 1.0m below the basement elevation. The goal is to provide a wastewater lateral to the property line that accommodates the waste flow from fixtures in the basement of an existing or proposed building by gravity. If the basement is very low or there are topographic challenges, the property owner may have to pump their wastewater from the building to their service connection, however the key point is the connection from the property to the municipal system line is via gravity.

The primary advantage of a gravity sewer system is that there are few pumps to install, operate or maintain. The system is robust and operates well under most all conditions except blockage by foreign materials. The primary disadvantage is the initial construction cost which is highly dependent on the depth of burial and whether rock removal is involved. A means to mitigate the construction cost of gravity sewers is to install centralized pumping stations at optimal locations.

A central pumping station permits the gravity sewer depth to be reduced and thereby reducing installation costs. Pumping stations are a significant investment in operation and maintenance (life cycle) costs because they contain sophisticated mechanical equipment. Along with the pumping equipment, a standby power generator or offline storage with 24-48 hours of capacity is required to ensure continued service when there is a power interruption. Land acquisition is often necessary.

Figure 2 – Open Gravity Sewer System



The capital cost of the system is shared amongst the benefiting property owners. All future operation and maintenance costs of a gravity system including central pumping stations are borne by the Town and recovered through the Wastewater User Rates charged to all those connected to the town-wide system.

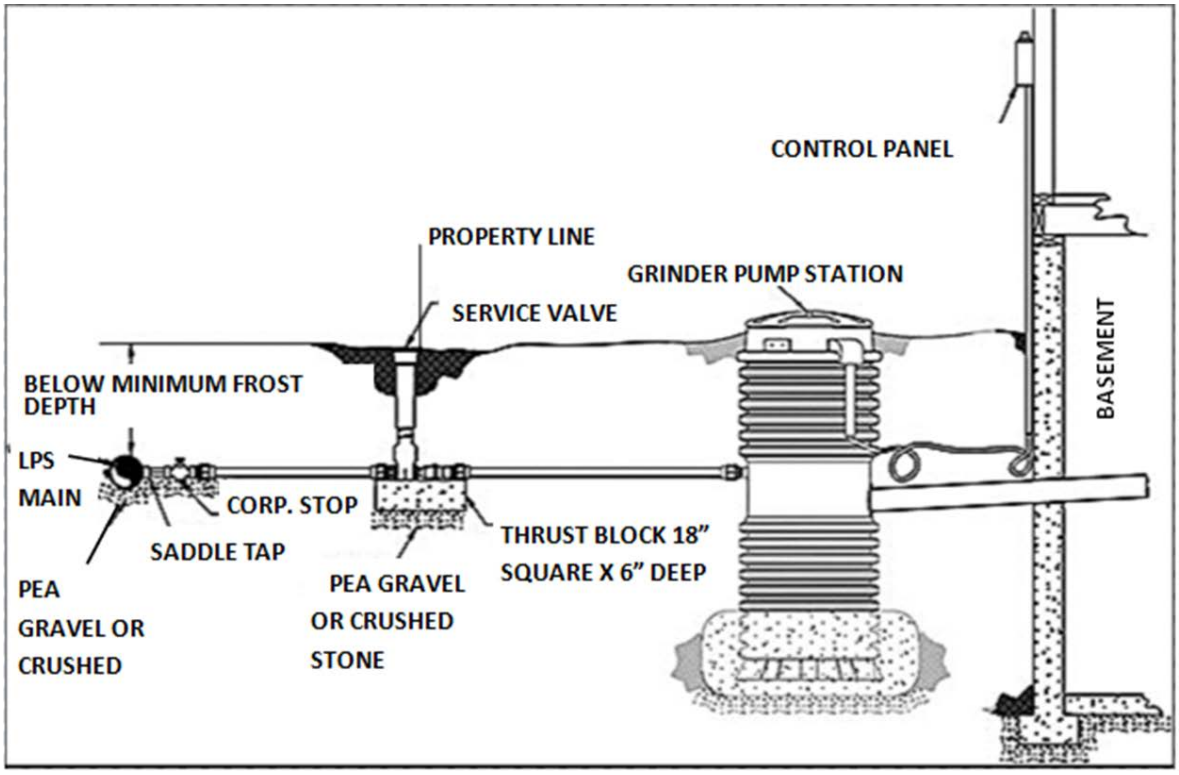
The delineation of the Town and private system is at the property line. The property owner is responsible for all costs on their property to connect the on-site system to their new service lateral. This includes decommissioning their septic systems in accordance with relevant regulations. Staff suggest the property owners pump out septic tanks, remove the lid and fill with it with sand or similar. The on-site costs for an average residential property to connect is

estimated to be $5,000. The Town doesn't undertake this work for liability and coordination reasons. Some efficiencies are found when several neighbours group together to hire the same contractor.

Alternative 2 – Low Pressure Sanitary System

When the cost of a gravity system is high, a viable alternative is to install a low pressure sanitary (LPS) system. A LPS system consists of on-site pumps that grind wastewater from the property and discharge it to a small diameter forcemain (Figure 3). The system is built in a branched tree-like configuration where the stem is the connection point to the Town's trunk collection system.

Figure 3 – Low Pressure Sanitary System



A grinder pump is a pre-fabricated unit that includes a small tank to store wastewater between pump outs. A service valve is installed at the property line to disconnect the service from the LPS system and acts to delineate the private from the public system. A back pressure check valve is installed to avoid sewage from other connected properties flowing back into the grinder pump.

The lower cost of installation is the primary advantage of LPS systems because the forcemain need only be buried deep enough to avoid freezing – generally 1.7m, utilizes lower diameter piping (50 – 100mm) and has more flexible layout requirements. The main disadvantage is the grinder pump connected to each house has ongoing O&M costs. There is also the concern that during power outages that the grinder pump tank will fill to capacity. This concern is mitigated somewhat in that the tank has around 24 hours of storage for a typical house. During a power

outage as well, the amount of wastewater generated is dramatically reduced because appliances like dishwashers, clothes washers and hot water heaters don't function. The Town has not been notified of a grinder pump backup as a result of a power outage. The property owner will have a responsibility to be aware that during a power outage they need to moderate their wastewater generation or take actions to avoid a backup.

The nature of the LPS system design is there is a limited system capacity. The forcemain design has to be carefully designed such that there is adequate velocity to ensure flushing while at the same time not creating excessive pressures. The topography and configuration of the project specific installation will dictate the ultimate capacity of the system. There may be limited opportunity to expand the system once constructed. Phasing of the system can also be challenging if there are not enough connections to ensure flushing velocities which may lead to blockages or inefficient pump operation.

Similar to a gravity system, the cost of the installation of the Town-owned portion of the LPS System is shared amongst the benefiting property owners. The Town becomes responsible for all O&M costs of the LPS system within the road allowance. The works on private property, including the grinder pump, are privately owned and operated. A model not used previously in the Town is where the grinder pump is owned and operated by the Town. Both of these concepts are discussed in more detail below.

Sub-Alternative 2A - Privately Owned Grinder Pumps

The on-site costs include the purchase of the grinder pump, installation of piping, and the on-going O&M costs such electrical costs and pump repairs. The cost of a grinder pump is in the range of $6000 and on-site servicing can be in the $4000 range for a total of $10,000 typically. This cost can vary depending on the size of the grinder unit, length of private servicing and restoration required. Ongoing O&M costs are estimated to be in the range of $150 - $200 annually including an annualized allowance for incidental repairs. The grinder pump will typically require replacing or major overhaul after 15 - 20 years of service.

Sub-Alternative 2B – Town Owned Grinder Pumps

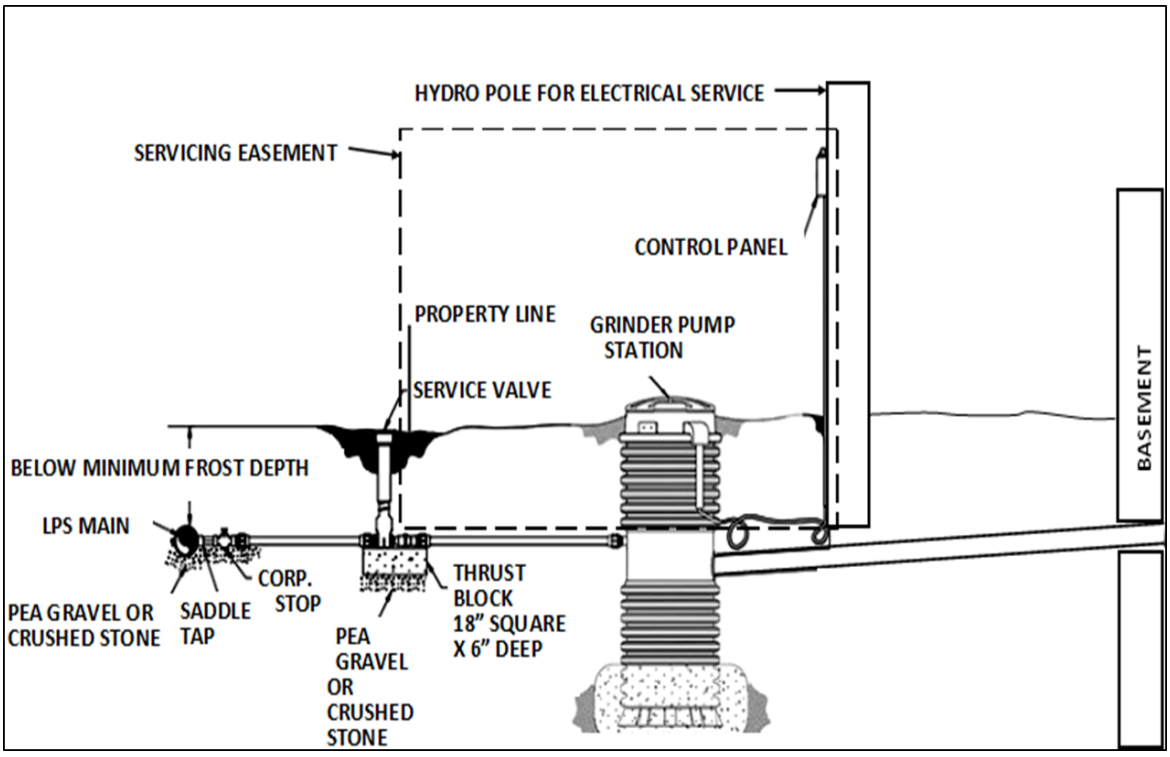
This sub-alternative considers the Town owning the on-site grinder pump and servicing from the grinder pump to the on-road LPS system (Figure 4). In this concept, the Town would provide the electrical service to the grinder pumps as well. Each grinder pump would require its own electrical service complete with a meter base and 60 Amp electrical panel. There may be opportunities for variations to this arrangement, however for the purposes of this initial evaluation, the Town would own, operate and maintain the entire on-site grinder pump system including the electrical service. Based on benchmark and rule-of-thumb pricing, the additional capital cost is at least $2000 per grinder pump for an overhead electrical feed. Underground servicing would be more expensive plus there will be additional restoration costs.

The placement of the grinder pump will ideally be placed near or on the road allowance to minimize the amount of Town infrastructure on private lands. Placing the grinder pump within the road allowance may be possible but there will be challenges given restricted boulevard

space, open ditch drainage, snow storage, and road salt damaging electrical equipment. The best location for the grinder pump is expected to be 2m or so on to privately owned lands. For the Town to own, access and undertake works on private property, either a defined easement must be created, a blanket easement provided or some sort of responsibility agreement registered on title. The cost to put an easement in place include land survey and legal costs and is estimated to be in the range of $1,000 - $1,500 per lot typically. Complicating factors may include the lands being encumbered with a mortgage, estate issues or unique legal status. As well, Staff feel that there may be resistance from those opposed to the servicing project to cooperate with easement or agreement registration.

A consideration for this model is the additional staffing or contracted resources that will be necessary to manage the on-site grinder pumps. In the short term, Staff foresee the need to retain a mechanical contractor who will can independently respond to alarms or service calls. In time, the need for additional staff may be triggered if the number of Town-owned grinder pumps grow.

Figure 4 – Town Owned LPS System Grinder Pump



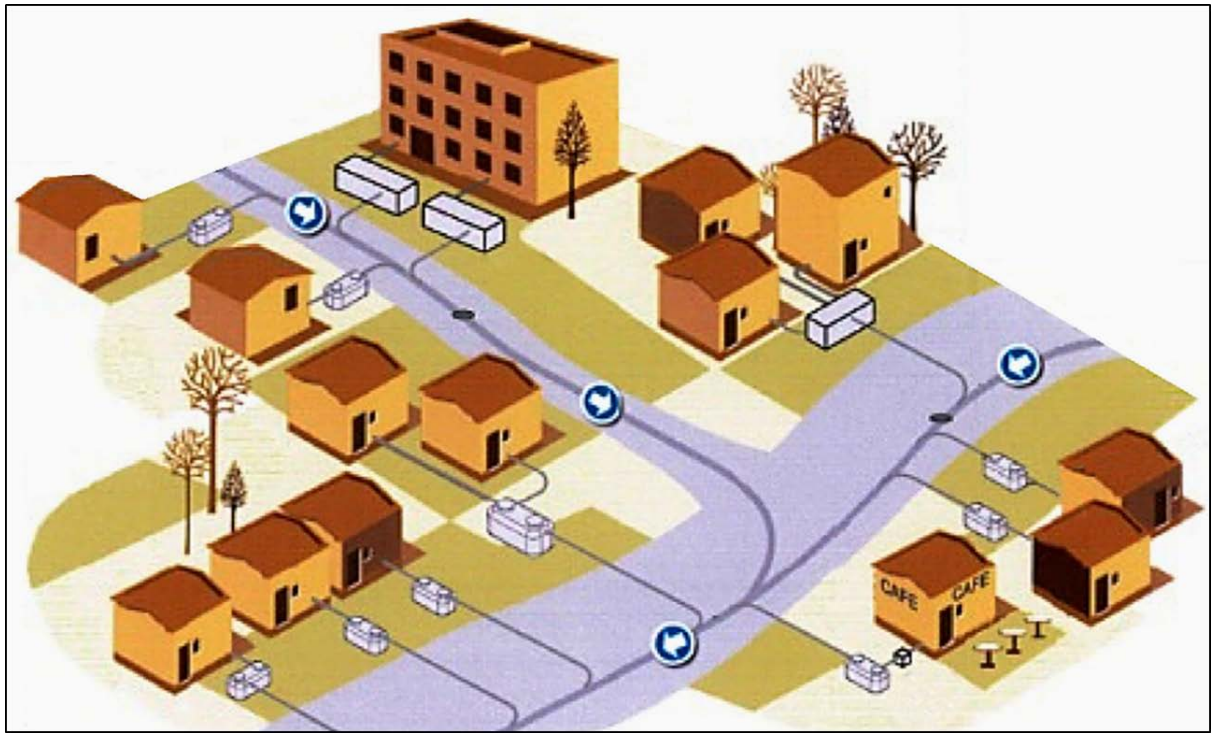
The capital costs of the onsite grinder pump and associates works is expected to be in the range of $9,500 (including, construction, electrical, legal) for the Town and $4,000 for the property owner. The annual O&M costs for the Town may be in the range of $200 - $250 while near zero for the property owner.

Town ownership of grinder pumps is not considered to extend to condominiums because the designers of condominiums have flexibility in the manner in which individual servicing is provided within the development.

Alternative 3 – Modified Gravity System

The modified gravity wastewater collection system utilizes a tank that removes solids at the source to perform primary and partial secondary treatment before discharging liquid effluent to a network of pipes to carry the liquids to a self-contained treatment facility or municipal collection system (Figure 5).

Figure 5 – Modified Gravity System



A modified gravity collection system has shallower excavation than gravity sewers but is typically deeper than LPS systems to maintain gravity flow. Like a LPS system, it uses High Density Polyethylene (HDPE) pipes that have fused joints, which essentially eliminates infiltration, and has fewer maintenance hole structures than a gravity system. This system utilizes smaller diameter piping than open gravity sewer systems because there isn't a need to convey solids. Since this system relies on gravity flow for the most part, there will be a need to install centralized pumping stations if gravity flow is not achievable. Fewer pumping stations are typically required since the piping can be installed flatter or even anti-grade because solids transportation is not a significant concern. The design must be careful though to avoid backflow from one property to another.

The on-site costs include the provision of a service connection and a solids settling tank. If a gravity connection is not available, a pump will be required. The capital costs are expected to be in the range of $10,000 unless the existing septic tank can be reconfigured for a savings around $5,000. Every three to four years, the tank will require a pump out at a cost of $300 - $400 to dispose of the accumulated solids. This is much like a traditional septic tank.

Advantages and Disadvantages

The following is a summary outline of the advantages and disadvantages of the various alternatives described above.

Alternative 1 – Open Gravity Sewer System

Advantages	- Reliable system due to few mechanical parts - Lowest ongoing O&M costs - No additional O&M costs to property owner above wastewater user rates - Easily extendable and expandable to accept new users not originally contemplated
Disadvantages	- Highest construction cost especially where significant depth or rock removal is involved, or a centralized pumping station is necessary

Alternative 2A – LPS with Privately Owned Grinder Pumps

Advantages	- Lower capital costs than open gravity collection system
Disadvantages	- Property owner must provide electrical service to grinder pump and pay electrical rates - Property owner has ongoing maintenance costs for grinder pump - Higher risk of system backups due to pump failure or power outage - Limited phasing and expansion capacity beyond initial design

Alternative 2B – LPS with Town Owned Grinder Pumps

Advantages	- Lower capital costs than open gravity collection system - No additional O&M costs to property owner
Disadvantages	- Higher construction costs than privately owned grinder pump configuration because a separate electrical and metering system is required to power the pumps - Alarm system required to notify Town of service interruptions and pump failure - Legal costs to obtain and register easements - Higher Town paid O&M costs than for open gravity collection system resulting in higher wastewater user rates for all those connected to the municipal system - Higher risk of system backups due to pump failure or power outage - Limited phasing and expansion capacity beyond initial design

Alternative 3 – Modified Gravity System

Advantages	-	Lower capital costs than open gravity collection system
Disadvantages	-	Higher construction cost than LPS
	-	Higher O&M costs than open gravity collection system for property owners to clean settling tank
	-	Removal of organic material (solids) may cause operational challenges at WWTP if system use is widespread since treatment process relies on a continuous biological material source (solids)
	-	Higher local truck traffic since septic haulage of solids necessary on regular basis
	-	Limited expansion capacity beyond initial design

D. Analysis

Wastewater Servicing Method

The choice of wastewater servicing means and methodologies is very much project dependent. The evaluation of options should consider the life-cycle costs over at least 20 years to appraise both the construction and on-going O&M costs. Although a lower construction cost alternative may exist, higher O&M costs may more than offset the initial savings. The lowest overall life-cycle cost generally becomes the preferred alternative unless there are extenuating circumstances. The exception may be when there are project specific factors, such as the protection of natural environment features that impose other constraints or input by the property owners is they would prefer to pay a higher capital cost to avoid the on-going O&M costs.

In most instances, a traditional gravity sewer system (Alternative 1) will have the lowest life cycle costs unless there are abnormally high costs such as a pumping station or construction costs (i.e. rock removal). When there are exceptional costs, other available methodologies may become viable. In general, LPS Systems (Alternative 2) are expected to have a lower life cycle cost than modified gravity systems (Alternative 3) when open gravity systems are not economical.

A 20 year life cycle is generally a reasonable period over which to conduct such a life cycle analysis because it considers the purchase, operation and maintenance, and replacement of a grinder pump. There may be instances where the evaluation should be, or is wished to be, taken over a longer time frame. The result would be to increase the cost of the LPS making the gravity system more attractive. Beyond 20 years however the accuracy of the calculations becomes suspect.

<u>Recommendation</u>

Since each servicing extension project will have its unique challenges, a default system is not being recommended for wastewater servicing. Instead, Staff recommend Council endorse proceeding to obtain public input on the concept that the determination of the wastewater

system to be installed for servicing extensions will be primarily evaluated on project specific basis to find the lowest life cycle cost alternative.

Responsibility for LPS Onsite Costs

The model as implemented by the Town on LPS systems several projects is the on-going O&M costs are the responsibility of the property owner. Given concerns raised on recent projects, a review of this model is warranted.

The reduction in capital cost realized by constructing a LPS system over a gravity system is offset primarily by higher O&M costs for on-site grinder pumps. That a LPS system is installed to reduce the construction cost may not be seen by some to be reason enough to shift the onsite O&M cost burden onto the property owners. There are two options to consider regarding who should pay the onsite costs: i) the property owner; or, ii) the Town.

The Town can assume ownership and the ongoing grinder pump O&M costs as outlined in Alternative 2B but there are several key points that should be considered.

i. The property owners would have had the benefit of a lower construction cost assessment because the LPS system was found to have the lowest life cycle cost;
ii. The construction cost of the LPS system will be higher than with Town owned grinder pumps given the additional infrastructure for electrical services and legal costs;
iii. The Town will incur additional O&M costs to maintain on-site grinder pumps which are transferred to the other wastewater users though their user-rates; and,
iv. There are approximately 180 existing LPS system connections who may expect the Town should assume ownership of their systems as well.

Given the above implications and challenges, Staff feels the Town should not own or operate on-site grinder pumps. That said, the owner's O&M burden for grinder pumps can be offset by either through a lump sum compensation or a credit at each billing cycle. The calculation of the allowance or credit would be based on life-cycle analysis. A very rough estimate is a $9,500[1] lump sum or $75[2] at each bi-monthly billing cycle. Should this model be considered, a fulsome evaluation of costs will need to be undertaken to set the amounts.

A lump sum allowance will help defer the property owner's up-front capital cost of installation and O&M over a set period of time (say 20 years) and a lower administrative burden for the Town than a billing credit. On the other hand, a one-time allowance doesn't permit flexibility to address changes in electrical costs, compensation beyond 20 years, or other unknowns that may arise. As well, it will be difficult to pro-rate existing users who may come forward to gain the same benefit.

A billing credit has the flexibility to reflect changes in electrical costs, be somewhat tied to the wastewater production rate (higher usage could get higher credit for operating costs), isn't a

[1] $6,000 construction plus 20 years of $175 annually
[2] $9,500 (see previous note) divided into bi-monthly credits over 20 years

large financial outlay for the Town, directly benefits the user (not a past owner) and is easily expanded to include existing LPS system users.

Although owners of grinder pumps will look on a compensation scheme favorability, those who pay the wastewater user rates that will subsidize grinder pump O&M costs may not. The reason a grinder pump was installed is because a LPS system had the lowest life cycle cost evaluation including the on-site O&M costs.

Recommendation

Staff feel that the Town should not directly own or operate on-site grinder pumps due the additional capital costs and the complications of undertaking work on private lands.

Staff also feel that since the property owners benefited from a lower construction costs, the O&M costs for a grinder pump should not be subsidized by the general wastewater user.

Staff recommend that Council direct Staff to proceed with obtaining public input on the ownership models and the responsibility for the on-site operation and maintenance costs for grinder pumps for Council's further consideration.

E. The Blue Mountains Strategic Plan

Goal #4: Promote a Culture of Organizational & Operational Excellence

Goal #5: Ensure Our Infrastructure is Sustainable

F. Environmental Impacts

Effective and efficient wastewater collection, especially from properties next to vulnerable water courses or bodies, provides an improvement to the natural environment over time by centralizing treatment to a facility which is constructed, operated, maintained and regulated to only discharge compliant effluent.

G. Financial Impact

The cost of construction of the wastewater servicing extension will be assigned to the Town, future development and current property owners as decided upon by Town Council based on the circumstances of the servicing project and costs. The basis of the cost assignment is those that benefit from the servicing pay for the service improvement. The affordability and cost recovery for servicing projects is being considered within Staff Report FAF.17.08 prepared by the Finance and IT Services Department.

The cost of on-going operation and maintenance, and ultimate replacement of the Town's wastewater collection system, is assigned to the current wastewater users connected to the Town's system.

H. In consultation with

Senior Management Team

John Caswell, Manager of Water and Wastewater Services

I. Attached

None

Respectfully submitted,

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