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REPORT TO GANGES SEWER LOCAL SERVICE COMMISSION
MEETING OF MONDAY, DECEMBER 12, 2016

Item 5.1

SUBJECT **GANGES WASTEWATER INFRASTRUCTURE RENEWAL PROJECT – PROGRESS REPORT UPDATE**

ISSUE

To provide an update on the Wastewater Infrastructure Renewal Project and seek approval from the Ganges Sewer Commission (Commission) and Capital Regional District (CRD) Board on the next steps.

BACKGROUND

On July 25, 2015, Ganges electors voted in favour of borrowing up to $3,900,000 to fund the Ganges Wastewater Infrastructure Renewal Project. Subsequently, Loan Authorization Bylaw No. 4007 was adopted by the CRD Board and the Commission approved the Project Plan Overview and Preliminary Project Schedule at their January 12, 2016 meeting.

The Renewal Project was broken down into four key work areas based on the best and most cost effective means to execute the work. These work areas and their respective budgets are:

Work Area/Project Description	Estimated Budget
1. Ganges Wastewater Treatment Plant (WWTP) Upgrades	$2,337,700
2. Small Equipment Replacement at Ganges WWTP	$322,300
3. Inflow and Infiltration Assessment and Initial Remediation	$298,000
4. Harbour House and Manson Road Pump Station Upgrades	$942,000
TOTAL	**$3,900,000**

Since the January 12, 2016 commission meeting, progress has been made on all four work areas, but the primary focus has been on the Ganges WWTP Upgrades. A summary of the status for each work area follows:

1. Ganges Wastewater Treatment Plant Upgrades

A Request for Proposals to retain an engineering consultant to design the Wastewater Treatment Plant (WWTP) upgrades was issued in April, evaluated in May, presented to the Commission on June 14 and approved by the CRD Board on July 13, 2016. The consultant, Amec Foster Wheeler (Amec), signed the contract in August and commenced with gathering background information, contacting equipment vendors, conducting an odour and noise baseline study, and preparing a draft Design Basis report for the WWTP upgrades. A draft executive summary of Amec's report is attached (**Attachment 1**) and Amec will be presenting the initial findings of their work at the December 12, 2016 Commission meeting.

Based on the initial work completed by Amec, it has been confirmed that the following items need to be completed at the WWTP:

- upgrade the influent pump station,
- replace the fine screen,
- re-purpose the old RBC tank,
- replace the membrane bioreactor (MBR) cassettes and frames,
- upgrade the effluent pumps,
- upgrade the sludge thickening equipment,
- replace various pipe runs and valves, and
- upgrade some electrical and instrumentation controls.

The rehabilitation of the WWTP can be accomplished by various treatment processes and equipment. Therefore, it is important to confirm a particular liquid treatment process prior to undertaking a sludge thickening option analysis as different process technologies will produce different types of sludge. Amec will provide information on the different liquid treatment equipment options for the Commission's consideration. Should the Commission direct Amec to proceed with a recommended liquid treatment process at the December 12 meeting, Amec can then proceed with providing an options analysis for the sludge thickening process to the Commission in early 2017.

In order to maintain the project schedule for WWTP upgrades and to establish cost certainty early on in the process, it is suggested that major equipment be pre-purchased (including the sludge thickening equipment when approved by the Commission). This will enable suppliers to start manufacturing the equipment that have a long lead time, allows Amec to complete the design based on known equipment specifications/dimensions and avoids having to pay mark-up costs to a general contractor to supply the equipment.

Therefore, as noted in Alternative 1 below, staff are seeking direction from the Commission on confirming the treatment process as well as the procurement approach for this project. The major equipment to be pre-purchased includes: MBR cassettes, inlet screen, influent pumps, effluent pumps, and sludge processing equipment all at an estimated cost of $1,050,000 including 30% contingency. The subsequent installation tender is estimated to be within the total remaining budget for this project. Contingency allowances are for unforeseen conditions such as market conditions, the Canadian dollar exchange rate, final selection variations, etc.

2. Small Equipment Replacement at Ganges WWTP

There are a number of smaller equipment items (such as meters, valves, instruments, etc.) that also need to be replaced at the WWTP which will preferably be performed by CRD Operations staff to ensure that the plant remains in operation while the small equipment is replaced. Meetings have been held with operations staff to plan out the most effective method for executing this work. Some of the small equipment work (like certain instrument replacement) are dependent on the WWTP treatment process. Therefore, once the WWTP process is confirmed, staff will complete the project plan and work to deliver the small equipment replacement project in tandem with the WWTP upgrades.

3. Inflow & Infiltration Assessment and Initial Remediation

A project plan is being developed to determine how this work will be completed. Generally, the scope will include gathering background information, undertaking flow monitoring to measure how much groundwater is leaking into the system, completing CCTV inspection of sewer pipe to identify where defects are located, effecting repairs on the worst defects, and flow monitoring again to quantify if there has been any I&I reduction. If necessary, a hydraulic model can also be prepared for the collection system, along with updated set of as-built drawings so that future modelling and long-term planning of the system can be completed. A similar program is also underway for the Magic Lake Estates Sewer Area on Pender Island, so there is a potential to combine both programs for better efficiency and economy of scale.

4. Harbour House and Manson Road Pump Station Upgrades

Both of these pumps stations have reached the end of their service life and need to be replaced. A project plan will be prepared to guide the execution of this project. Staff are also evaluating two project delivery options (i.e. design-bid-build vs design-build) to determine the most effective delivery method for this project.

ALTERNATIVES

Alternative 1

That the Ganges Sewer Local Services Commission:

1) direct staff to proceed with upgrades to the Ganges Wastewater Treatment Plant with a membrane bioreactor (MBR) process;
2) direct staff to proceed with the sludge handling options analysis based on the sludge produced from a MBR treatment process and present the options to the Commission for their consideration; and
3) recommend to the Electoral Area Services Committee to recommend to the CRD Board that staff be authorized to issue a Request for Proposal (RFP) to pre-purchase major equipment for Ganges WWTP upgrades and issue an Invitation to Tender (ITT) for the installation of equipment and associated works when the design is completed.

Alternative 2

That the Ganges Sewer Local Service Commission request additional information to be provided at a subsequent meeting.

IMPLICATIONS

Alternative 1 - The pre-purchase of major equipment is necessary to enable the equipment to be manufactured and delivered to the site in a timely manner. Pre-purchasing of the major equipment by the CRD also avoids paying significant mark-up costs to a general contractor (if the contactor were to order the equipment). Knowing the exact specifications of the pre-purchased equipment also enables the consultant to complete his design with more certainty and less potential for changes during construction.

However, pre-purchasing equipment does require more staff effort to administer the pre-purchase contract and there is some risk in contract interface between the supplier and the general contractor, but that risk can be mitigated by utilizing good contract language. The benefits of saving time, saving mark-up costs, and having design certainty outweigh the slight risk associated with pre-purchasing the equipment.

Once the RFP and ITT are reviewed and a recommended supplier/contractor are identified, reports will be brought back to the Commission and CRD Board for approval to award the contracts.

Alternative 2 – Staff can provide additional information at a subsequent meeting, but this will delay the advancement of the project, extend the overall project timeline and potentially increase the overall cost.

CONCLUSION

Many components of the Ganges wastewater system have reached the end of their service life and are in need of renewal to avoid system failures, increasing operational effort to keep the system running and to prevent non-compliance with the Discharge Permit. The Renewal Project was broken down into four key work areas based on the best and most cost effective means to execute the work. The total cost of the renewal project, as approved by the electors in a referendum, is $3,900,000. The work proposed in this report is in accordance with the approved project plan and is the first step in making necessary improvements to the Ganges wastewater system.

RECOMMENDATION(S)

That the Ganges Sewer Local Services Commission:

1) direct staff to proceed with upgrades to the Ganges Wastewater Treatment Plant with a membrane bioreactor (MBR) process;
2) direct staff to proceed with the sludge handling options analysis based on the sludge produced from a MBR treatment process and present the options to the Commission for their consideration; and
3) recommend to the Electoral Area Services Committee to recommend to the CRD Board that staff be authorized to issue a Request for Proposal (RFP) to pre-purchase major equipment for Ganges WWTP upgrades and issue an Invitation to Tender (ITT) for the installation of equipment and associated works when the design is completed.

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DP/MC:ls

Attachments: 1

Amec Foster Wheeler

amec
foster
wheeler

DRAFT Executive Summary

Ganges WWTP Infrastructure Renewal Project Liquid Stream Design Basis

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Background

The Ganges wastewater treatment plant was initially constructed in 1983 as a Rotating Biological Contactor (RBC) secondary wastewater treatment facility with a design capacity of 400 m^3/d, capable of serving a population of about 2000. The plant also included influent screens and grit removal, treated effluent storage and a pump station to discharge treated effluent through a marine outfall terminating near the mouth of Ganges Harbour. To accommodate anticipated wet weather flows, the design also included a bypass around the treatment plant for wastewater flows greater than 680 m^3/d.

In 1998 the RBC process was replaced by a Membrane Bioreactor (MBR) tertiary treatment process. This was achieved by converting the East and West effluent storage tanks into bioreactors, and installing hollow-fiber ultrafiltration membranes into the East tank, and to accommodate wet weather flows, the design capacity of the treatment plant was increased 800 m^3/d. Figure 1 illustrates the existing process flow diagram.

After seven years of service the MBR ultrafiltration membranes required replacement in 2005, and now, after a total of 18 years of service, number of mechanical and electrical components have reached the end of their service life and require replacement. This includes the membranes, membrane cassettes, influent pump station, fine screens, effluent pumps, piping, and electrical controls.

The discharge Registration for the Ganges plant requires the effluent to have an average biochemical oxygen demand (BOD) and total suspended solids (TSS) concentration of no greater than 25 parts per million (ppm). However, the MBR process can reduce the concentrations to less than 2 ppm. While this water quality is not required to meet the outfall discharge requirements, the low BOD and TSS concentrations supports the direction of the community to use reclaimed water for non-potable applications such as screen washing or irrigation. However, before the effluent can be reused for non-potable applications there are a number of additional regulatory requirements that will have to be met, and are outside the scope of the current equipment replacement process engineering work reported here.

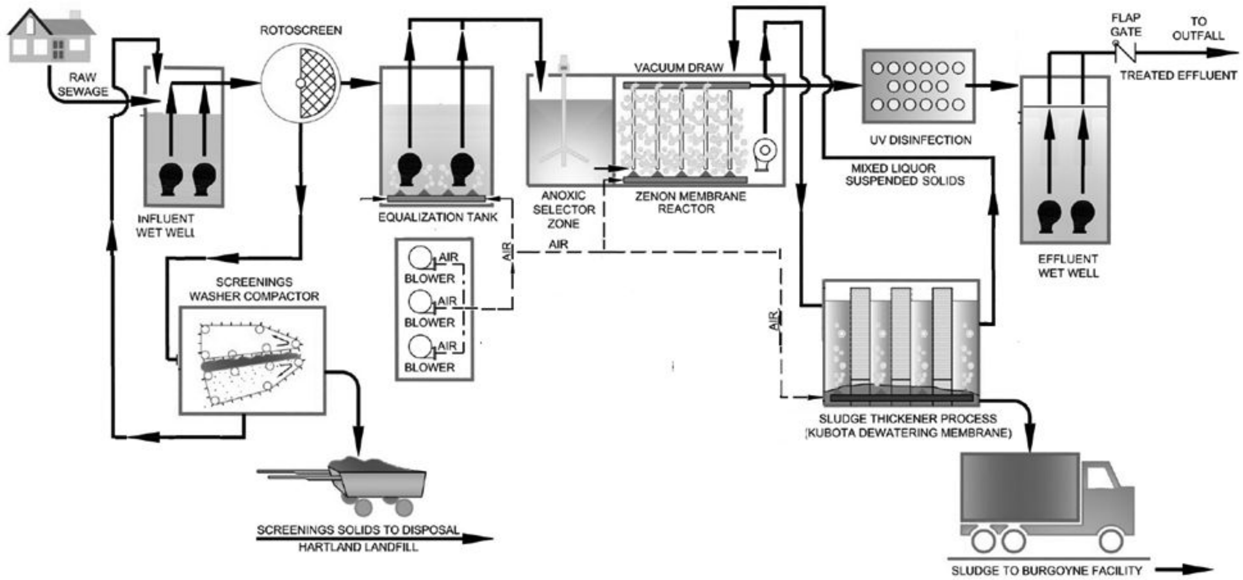

Figure 1 Simplified Existing Process Flow Diagram (Courtesy CRD)

Wastewater Flows

The historical wastewater flows and contaminant characteristics at Ganges were reviewed and analyzed. As illustrated in Table 1, there has been little if any increase in the average annual or dry weather flows, or sewage strength, over the last five years. A model was developed during the study that is able to predict the wastewater flows based solely on precipitation information, as illustrated in Figure 2, confirming that wastewater flows are affected by precipitation, and that it takes two to three days for wastewater flows to increase following a major rain event. This lag in response to rainfall events indicates the water is infiltrating into the sewer system through ground water, rather than through much faster surface drainage.

Table 1 - Ganges WWTP Influent Flow Summary

YEAR	ANNUAL			ADWF [JUL-AUG] (m3/d)	AWWF [DEC-JAN] (m3/d)	RATIO MAX:AVG
	AVG DAY (1) (m3/d)	MAX DAY (m3/d)	MIN DAY (m3/d)			
2006	500	855	-	-	-	1.71
2007	482	1,039	-	-	-	2.16
2008	475	756	-	-	-	1.59
2009	466	806	-	-	-	1.73
2010	448	792	-	-	-	1.77
2011	396	598	261	-	540	1.51
2012	456	1022	336	448	380	2.24
2013	424	1040	275	446	457	2.45
2014	447	797	315	452	457	3.31
2015	440	838	253	416	-	1.91
REPRESENTATIVE	**450**	**1100**	**300**	**440**	**460**	**2.4**

1 Based on 365 days/year except for 2011 (Sept – Dec)

To reduce the effects of rainwater on wastewater flows in the sewer and on treatment plant hydraulics, previous studies proposed that additional equalization storage be provided. However, the plant has been able to accommodate peak day flows during wet weather with the current equalization storage. This is because the infiltration flow from precipitation is being spread out over several days. Consequently, the equalization storage required to achieve uniform flows during dry weather and wet weather conditions is essentially the same, and the existing equalization storage capacity should continue to be sufficient. However, converting the unused RBC tank and clarifier into additional equalization storage would provide an additional hydraulic buffer and could provide operational benefit by holding back flow to allow more time for the repair of downstream equipment.

The following design flows are recommended based on the analysis of the historical flow data:

- Average Daily Flow: 450 m^3/day (population equivalent 2,250)
- Maximum Daily Flow: 1,500 m^3/day

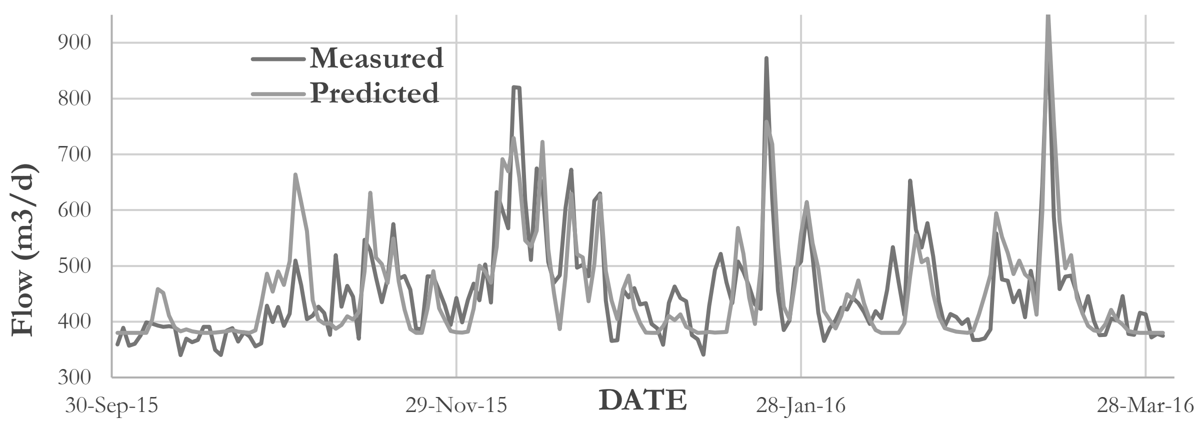

Figure 2 - Wastewater Flows Recorded for October 2015 through March 2016 Compared with Modeling Results Based on Precipitation Data Alone

Process Technology Option Analysis

The need to replace the majority of the mechanical and electrical components in the Ganges MBR treatment plant offered an opportunity to consider alternative wastewater treatment technologies that may have lower operating costs, improved waste biosolids thickening and dewatering characteristics, and can be readily retrofitted into the existing tanks. Amec Foster Wheeler, reviewed an alternate treatment process called Moving Bed Biofilm Reactor (MBBR), and alternative membrane technologies were also investigated for Ganges WWTP as well.

Moving Bed Biofilm Reactor (MBBR)

The MBBR process technology is comparable to the existing MBR process technology in footprint and is commonly used during the upgrade of the existing wastewater treatment plants. The MBBR does have a lower operating cost depending on the effluent quality that is desired, and it can create a biosolid that can be more easily dewatered. The conversion to a MBBR process generally involves removing the existing MBR membranes, adding plastic floating media to one of the existing bioreactor tanks, and installing a dissolved air flotation (DAF) solids separation device to collect the waste biomass. The MBBR process can accommodate more extreme increases in wastewater flows due to precipitation because wastewater can flow through the media whereas a MBR provides a physical barrier. The MBBR process also uses less energy than a MBR process, requires less cleaning, and can produce waste biosolids that are easier to dewater without requiring polymer addition. Key disadvantages of this technology over the existing MBR process are: 1) higher capital cost due to the need to install new solids/liquid separation equipment; and 2) while it will meet the outfall discharge water quality requirements, it cannot achieve the MBR effluent water quality without adding additional media and filtration equipment – further increasing the capital and operating costs.

Membrane Bioreactor (MBR)

Although the MBR processes can achieve a very high quality effluent, they typically have higher capital and operating costs than non-membrane technologies, and they need to be oversized to be able to filter peak wet-weather flows. The membranes require vigorous aeration to keep them from becoming clogged (fouled) which adds to energy costs, and require periodic chemical cleaning. MBR waste biosolids are also typically more difficult to thicken and dewater than biosolids from non-membrane technologies, and often require polymers to be added to improve sludge dewatering and thickening. Biosolids management and disposal will be analyzed further in a subsequent report.

However, because the MBR process is already in-place, replacing the components, including the membranes, is relatively easy and inherently expected to be more cost-effective than installing new infrastructure to convert the plant to a completely new process. Further, the higher operating cost for the MBR process could be offset by the higher water quality and potential for reuse including washing screens, pump station maintenance, irrigation and other non-potable uses.

Another MBR alternative considered in this document is the substitution of the GE/Zenon hollow-fiber membranes with equivalent ultrafiltration membranes supplied by other membrane manufacturers. As an example, the use of Fibercast FiberPlate hybrid membranes was considered. This technology combines hollow-fiber and flat-sheet characteristics to improve membrane robustness, increase flux rates and potentially reduce energy costs. The FiberPlate membranes also come supplied in their own tank, which can improve the plant operation by making it easier to chemically clean the membranes in comparison with the existing membranes that have to be lifted and placed into a separate dip tank for cleaning. However, providing a new membrane tank enclosure increases the capital cost. Provision for alternative membrane manufacturers will be considered further in the detailed design for Ganges WWTP upgrade, so that competing membrane suppliers can potentially incorporate their equipment into the upgrade plant and enable the ability to receive competitive proposals.

Cost Comparison

A cost comparison was conducted on the various process options and shows that the replacement of the existing equipment with like-kind, MBR membranes is the lowest overall capital cost alternative, with an estimated cost of about \$1.8 million versus \$3.1 - \$3.5 million for the MBBR process (depending on the effluent quality objectives). The life cycle cost analyses shows the MBR to be comparable with the MBBR option, with \$8.8M estimated over 20 years for both processes. Although the lifecycle costs are similar for both the MBR and MBBR processes, the higher water quality achieved with the MBR process provides opportunities for reclaimed water reuse, whereas the MBBR process meets the regulatory standard for the outfall discharge, but would require additional capital costs for additional media and filtration to meet the regulatory reclaimed water quality standard.

Recommendations

Based on the foregoing, the following is a summary of the recommended improvements:

- Upgrade the influent pump system with new duplex submersible pumps. All valves will be installed above grade with fiberglass enclosure for better access (without confined space entry).
- Install a new fine screen to remove solids larger than 2mm to improve membrane operation;
- Upgrade the return activated sludge piping system;
- Install new MBR membrane systems (GE/Zenon or equivalent) complete with chemical-clean system upgrades;
- Install a new flowmeter to measure the discharge flow through the permeate pumps and a new turbidity meter to monitor the integrity of the membranes;
- Install new effluent pumps to improve discharge flow capacity;
- Replace the existing 208V Motor Control Center (MCC) with a new 600V MCC. All new equipment installed as part of the upgrade will be 600V three phase. A more modest 208V MCC or distribution will be provided for a legacy 208V equipment remaining; and
- Upgrade various piping, valves, instruments and controls.

It is also recommended that the major equipment noted above be pre-purchased in order to enable suppliers to start manufacturing the equipment that have a long lead time. In addition, the pre-purchasing of equipment avoids the Owner of having to pay significant mark-up costs that a general contractor would include.

Once the liquid process equipment has been confirmed, sludge handling options can then be presented in a subsequent report.

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REPORT TO GANGES SEWER LOCAL SERVICES COMMISSION
MEETING OF DECEMBER 12, 2016

Item 5.2

SUBJECT **GANGES WASTEWATER TREATMENT PLANT - EMERGENCY STANDBY GENERATOR REPLACEMENT**

ISSUE

To request funding for the replacement of the standby generator at the Ganges Wastewater Treatment Plant.

BACKGROUND

The emergency standby generator (genset) and automatic transfer switch (ATS) at the Ganges Wastewater Treatment Plant (GWWTP) provides emergency power for the wastewater treatment process during power outages. The existing genset, was originally purchased as a used unit and has been in operation for nearly 20 years. The actual age of the equipment is not completely clear however, based on maintenance records and discussions with industry equipment suppliers we suspect the genset is approaching 35 years old.

In 2011, a condition assessment and engineering study of the Ganges Wastewater collection and treatment system was performed by Stantec Consulting. The condition assessment included the review of all the equipment at the GWWTP including the electrical systems and more specifically the genset and ATS. At the time, the study concluded the genset and ATS to be in good condition and that no upgrades or replacement were required. As a result this equipment was not included in the scope of the current wastewater infrastructure replacement project.

Currently, the genset and ATS are functioning however, during recent repair work it was discovered that spare parts are no longer available for this equipment. As a result, the diesel engine water pump had to be custom rebuilt in the CRD machine shop which is more expensive than replacement in kind and takes staff away from completing other planned work. Without having the ability to order spare parts for this genset, we are at risk of it being out of service for a prolonged period of time, and should there be a power failure while it is out of service the wastewater treatment plant would not operate and sewage could back-up and spill over into the adjacent creek creating significant environmental and public health impacts.

In order to address this risk it is proposed that the emergency standby generator and automatic transfer switch be replaced as soon as possible.

Preliminary reviews of the standby power requirements for the upgraded GWWTP have been assessed and it is estimated that the genset size will be near equivalent to its current capacity. A final review of the electrical load requirement will be completed prior to ordering a new genset.

The estimated cost to design, procure and install the standby power generator system is $165,000. The cost breakdown is as follows:

Table A

ITEM	ESTIMATE
Standby Generator	$ 60,000
Electrical Transfer Switch	$ 15,000
Ancillary Equipment	$ 10,000
Labour	$ 40,000
Administration/Engineering (~15% of above))	*$ 18,500*
Subtotal	**$ 143,500**
Contingency (~15%)	*$ 21,525*
Total Cost	**$ 165,025**

Procurement of the genset could commence early in 2017 when the specification and tender documents are complete. Manufacturing of the genset is estimated to be approximately four to five months and should be ready for installation and commissioning by the summer of 2017. This work will be coordinated with the other Ganges WWTP Renewal project upgrade work.

ALTERNATIVES

Alternative 1: That the Ganges Sewer Local Services Commission:

a) direct staff to proceed with preparing specifications and tender documents for the replacement of the emergency standby generator and automatic transfer switch at the Ganges Wastewater Treatment Plant;
b) authorize staff to issue a tender for the replacement generator when the tender documents are complete; and
c) approve up to $165,000 from the Ganges Sewer Capital Reserve Fund to replace the standby generator and automatic transfer switch.

Alternative 2: That the Ganges Sewer Local Services Commission not approve the works.

IMPLICATIONS

Alternative 1 - The works would proceed immediately to ensure the GWWTP has a new and reliable standby generator to operate the facility during BC Hydro power outages in order to treat wastewater at all times and prevent potential overflows and protect public health.

The estimated cost to replace the emergency standby generator and automatic transfer switch is $165,000. It is proposed that funding for this work be from the capital reserve fund (CRF) which has a projected balance at the end of 2016 of approximately $431,350.

Prior to procurement the genset capacity (power size) will be confirmed to ensure it meets the requirements of the planned capital improvements presently being considered for the GWWTP.

Alternative 2 – More effort will be required to monitor the genset and any repairs will require custom shop work. However, some parts may not be easily repairable and could take considerable time and cost to get repaired. The Ganges WWTP will not be able to operate during a BC Hydro power failure should the back-up generator be out of service. If the WWTP is not able to operate, sewage could back-up and overflow into the nearby creek creating an environmental impact and public health risks.

CONCLUSION

The emergency standby generator and automatic transfer switch at the GWWTP is approaching 35 years old. Some spare parts are no longer available and as a result maintenance costs, public health risks and environment risks have increased. Failure of this equipment could have significant implications.

RECOMMENDATION

That the Ganges Sewer Local Services Commission

a) direct staff to proceed with preparing specifications and tender documents for the replacement of the emergency standby generator and automatic transfer switch at the Ganges Wastewater Treatment Plant;
b) authorize staff to issue a tender for the replacement generator when the tender documents are complete; and
c) approve up to $165,000 from the Ganges Sewer Capital Reserve Fund to replace the standby generator and automatic transfer switch.

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Comparison of Ganges Sewer Rates in 2015 and 2016

	$/Sq Ft			$			
	Business	Institutions	Residential	Business	Institutions	Residential	Total
2015	$0.2417	-	-	104,737	-	-	104,737
Increase due to:							
Operating Expenses	$0.0018	-	-	801	-	-	801
Transfer to Capital Reserve	$0.0227	-	-	9,820	-	-	9,820
Reduction in Surplus from previous year	$0.0200	-	-	8,677	-	-	8,677
Debt Servicing Costs	$0.0223	-	-	9,666	-	-	9,666
Increase/(decrease) due to increase in Residential share of gallons	-$0.0054	-	-	(2,318)	-	-	(2,318)
2016	**$0.3032**	**$0.0000**	**$0.0000**	**131,384**	**-**	**-**	**131,384**

	$/Gallon			$			
	Business	Institutions	Residential	Business	Institutions	Residential	Total
2015	$0.0128	$0.0255	$0.0160	104,737	113,548	146,467	364,752
Increase due to:							
Operating Expenses	$0.0001	$0.0002	$0.0002	801	869	1,789	3,459
Transfer to Capital Reserve	$0.0012	$0.0024	$0.0024	9,820	10,647	21,933	42,400
Reduction in Surplus from previous year	$0.0011	$0.0021	$0.0021	8,677	9,407	19,379	37,463
Debt Servicing Costs	$0.0012	$0.0024	$0.0024	9,666	10,480	21,588	41,735
Increase/(decrease) due to increase in Residential share of gallons	-	-	-	(2,318)	(934)	5,570	2,318
2016	$0.0163	$0.0326	$0.0230	**131,384**	**144,017**	**216,726**	**492,126**
Fixed Cost per Unit	-	-	$150.00	-	-	87,450	87,450
				262,768	**144,017**	**304,176**	**710,960**

	Business	Institutions	Residential
Square Feet			
2015	433,311	-	-
2016	433,311	-	-
Gallons			
2015	8,200,635	4,445,257	9,175,335
2016	7,079,347	3,879,980	8,194,905
Residential Units			
2015	-	-	87,450
2016	-	-	87,450

Comparison of Ganges Sewer Rates in 2016 and 2017

	$/Sq Ft			$			
	Business	Institutions	Residential	Business	Institutions	Residential	Total
2016	$0.3057	-	-	130,592	-	-	130,592
Increase due to:							
Operating Expenses	$0.0033	-	-	1,429	-	-	1,429
Transfer to Capital Reserve	-$0.0065	-	-	(2,802)	-	-	(2,802)
Debt Servicing Costs	$0.0505	-	-	21,870	-	-	21,870
2017	**$0.3530**	**$0.0000**	**$0.0000**	**151,090**	**-**	**-**	**151,090**

	$/Gallon			$			
	Business	Institutions	Residential	Business	Institutions	Residential	Total
2016	$0.0186	$0.0371	$0.0265	130,592	144,016	218,310	492,918
Increase due to:							
Operating Expenses	$0.0002	$0.0003	$0.0003	1,429	1,549	3,192	6,171
Transfer to Capital Reserve	-$0.0003	-$0.0007	-$0.0007	(2,802)	(3,038)	(6,258)	(12,098)
Debt Servicing Costs	$0.0027	$0.0053	$0.0053	21,871	23,712	48,846	94,430
2017	$0.0214	$0.0428	$0.0321	**151,091**	**166,240**	**264,090**	**581,420**
Fixed Cost per Unit	-	-	$150.00	-	-	87,450	87,450
				302,180	**166,240**	**351,540**	**819,960**

	Business	Institutions	Residential
Square Feet			
2016	433,311	-	-
2017	433,311	-	-
Gallons			
2016	7,079,347	3,879,980	8,194,905
2017	7,079,347	3,879,980	8,194,905
Residential Units			
2016	-	-	87,450
2017	-	-	87,450