



EXCELLENCE IN
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TECHNICAL MEMORANDUM No. 2
ASSESSMENT OF ALTERNATIVE SOLUTIONS
VICTORIA HARBOUR WWTP CLASS EA

Prepared for:

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1. INTRODUCTION

1.1 Background

The Victoria Harbour Wastewater Treatment Plant (WWTP), constructed in 1982, services the community of Victoria Harbour in the Township of Tay (the Township). The WWTP is an extended aeration plant with tertiary filtration, with final effluent discharging to Sturgeon Bay of Georgian Bay. The rated average day flow capacity of the works is 2,364 m³/d. The plant was constructed with provision for future expansion to an average day flow capacity of 4,728 m³/d utilizing the conventional activated sludge process.

The Victoria Harbour WWTP is currently operating at approximately 75 percent of its rated average day flow capacity. To meet the servicing requirements of future growth in the service area, the Victoria Harbour WWTP may have to be expanded beyond its existing rated capacity. As such, this project is a “Schedule C” activity under the Municipal Class Environmental Assessment (Class EA) process. XCG Consultants Ltd. and R.J. Burnside & Associates Ltd. have been retained by the Township to provide engineering services for the Class EA of the Victoria Harbour WWTP.

This Technical Memorandum (TM) presents the identification and preliminary evaluation of Alternative Solutions.

1.2 Objectives

The objectives of this TM are to:

1. Identify Alternative Solutions for wastewater servicing for the community of Victoria Harbour; and
2. Complete a preliminary evaluation of the Alternative Solutions and identify a recommended preferred Alternative Solution.

2. PROBLEM STATEMENT**2.1 Study Objectives**

A Class Environmental Assessment (EA) of the Victoria Harbour Wastewater Treatment Plant (WWTP) was initiated by the Township of Tay (Township) with the objective of identifying the most cost-effective, environmentally sound, and sustainable approach to provide:

1. Wastewater servicing for future growth in the community of Victoria Harbour, including an assessment of various potential outfall locations;
2. Biosolids and septage management for the Township of Tay; and
3. Effluent disinfection that produces non-toxic effluent.

2.2 Justification and Need for the Project

Table 2.1 presents the future service population and wastewater flows based the Township's Official Growth Plan.

As can be seen in Table 2.1, the projected 2031 and Build-Out average wastewater flows exceed the existing Victoria Harbour WWTP ADF capacity of 2,364 m³/d. As a result, additional wastewater servicing capacity must be provided to accommodate planned growth in the community.

Table 2.1 Design Flows to the Victoria Harbour WWTP

Parameter	Current	Projected ⁽²⁾	
	2008	2031	Build-Out
Service Population	3,530	5,022	7,357
Average Wastewater Flows	1,800 m ³ /d	2,824 m ³ /d	4,155 m ³ /d
Existing Average Flow Capacity ⁽¹⁾	2,364 m ³ /d		
Notes:			
1. ADF capacity from CofA No. 1-797-82-006.			
2. For details regarding projected population and wastewater flows, refer to Technical Memorandum No. 1 (XCG, 2008).			

DEVELOPMENT AND EVALUATION OF ALTERNATIVE SOLUTIONS

3. DEVELOPMENT AND EVALUATION OF ALTERNATIVE SOLUTIONS

A number of planning alternatives exist to address the wastewater servicing issues for the community of Victoria Harbour:

1. the “Do Nothing” option;
2. the “Limit Community Growth” option;
3. modify and optimize operational practices at existing treatment system to accommodate future flows and loads;
4. reduce wastewater flows through water conservation programs and sewer rehabilitation;
5. expansion and upgrading of the existing treatment system to treat future flows and loads;
6. decommissioning of the existing plant construction of a new plant on the existing site;
7. decommissioning of the existing plant and construction of a new plant at a new site;
8. pump wastewater to a nearby treatment facility; and
9. upgrading the existing treatment system to its existing capacity, and construction of a new plant on a new site to treat new growth.

A description of the above servicing alternatives is provided below.

3.1 Do Nothing

The “Do Nothing” alternative would not provide any expansion or upgrades to the existing wastewater treatment system. No servicing would be available for the planned future development. Under the Township’s Official Growth Plan, there is planned growth in the community of Victoria Harbour.

In addition, under this alternative no upgrades would be completed to ensure ability to meet requirements for biosolids storage and non-toxic effluent with respect to chlorine.

3.2 Limit Community Growth

This alternative would involve limiting growth in the community such that the capacity of the WWTP is not exceeded. Based on historic flows, there is capacity remaining at the WWTP to service an additional 1,025 persons, or approximately 390 residential units.

Based on current planning information for the community of Victoria Harbour, there are currently 234 residential units that are registered but not yet built, and draft plans for 408 residential units that have been approved. Thus, there is a total approved growth of 642 residential units within the community of Victoria Harbour, which exceeds the reserve capacity at the WWTP.

In addition, under this alternative no upgrades would be completed to ensure ability to meet requirements for biosolids storage and non-toxic effluent with respect to chlorine.

DEVELOPMENT AND EVALUATION OF ALTERNATIVE SOLUTIONS

3.3 Optimize Existing Treatment Process

This alternative would involve modifying and optimizing operational practices at existing treatment system to accommodate future flows and loads.

Optimization of the existing treatment process may allow for an increase in the existing average day flow capacity of the biological portion of the treatment system without the need for the construction of additional tankage. Equipment upgrades to the aeration and RAS pumping systems may be required. Previously identified operational changes and minor design upgrades would be reviewed and updated as required (XCG, 2007).

The hydraulic capacity of components of the existing infrastructure, such as the tertiary filters and secondary clarifiers, will be exceeded due to the projected increase in peak flows to the WWTP. Optimization alone would not be sufficient to provide adequate hydraulic treatment capacity at future design flows (XCG, 2007).

In addition, under this alternative no upgrades would be completed to ensure ability to meet requirements for biosolids storage and non-toxic effluent with respect to chlorine.

3.4 Reduce Wastewater Flows through Water Efficiency and Sewer Rehabilitation

This alternative would include the implementation of programs to reduce wastewater flows through water efficiency and sewer rehabilitation.

Expanded water conservation programs, including water metering and public education, would be used to maintain and possibly reduce future water consumption. A reduction in sewage flow could be accomplished by water conservation measures such as the installation of plumbing fixture retrofit kits, and the replacement of high water use fixtures. An education program and public awareness campaign could be implemented by the Township of Tay to educate residents on means available to conserve water.

Extraneous flow includes the following components:

- Groundwater infiltration through cracked sewer pipes;
- Rainfall-derived inflow through foundation drain connections, roof leader connections, manhole lids, etc;
- Rainfall-derived infiltration through cracked sewer pipes and manholes.

The amount of extraneous flow that could be eliminated through sewer rehabilitation and the costs associated with such work are uncertain at this stage of the evaluation.

Although a reduction in wastewater flows can be achieved through water efficiency and sewer rehabilitation programs, at this stage of the evaluation the flow reduction cannot be quantified. As such, there is still the possibility that increased growth will result in flows exceeding the existing rated capacity of the plant.

In addition, under this alternative no upgrades would be completed to ensure ability to meet requirements for biosolids storage and non-toxic effluent with respect to chlorine.

DEVELOPMENT AND EVALUATION OF ALTERNATIVE SOLUTIONS

3.5 Expand and Upgrade the Existing Plant

This alternative would expand the existing WWTP to provide capacity for the existing community and any forecasted growth. The expanded plant would be sized to accommodate the increased wastewater flows associated with growth in the community, and would utilize an activated sludge process providing treatment including nitrification, non-toxic disinfection, and tertiary effluent polishing. Expanded biosolids storage capability would also be provided. Existing plant infrastructure would be re-used where possible.

This alternative would also involve an assessment of potential outfall locations, including utilizing and/or modifying the existing outfall or constructing a new outfall discharging into Severn Sound. An assessment of the Township's sludge digestion, biosolids storage, and septage receiving requirements would also be undertaken to ensure the expanded facility is capable of meeting those needs.

3.6 Construction of a New Plant on the Existing Site

This alternative would involve the construction of a new tertiary mechanical WWTP on the existing site to service the existing community and any forecasted growth. A new activated sludge plant would be sized to accommodate the increased wastewater flows associated with growth in the community, and would provide treatment including nitrification, non-toxic disinfection, and tertiary effluent polishing. The existing WWTP would be decommissioned.

This alternative would also involve an assessment of potential outfall locations, including utilizing and/or modifying the existing outfall or constructing a new outfall discharging into Severn Sound. An assessment of the Township's sludge digestion, biosolids storage, and septage receiving requirements would also be undertaken to ensure the new WWTP is capable of meeting those needs.

3.7 Construction of a New Plant on a New Site

This alternative would involve the construction of a new tertiary mechanical WWTP on a new site to service the existing community and any forecasted growth. A new activated sludge plant would be sized to accommodate the increased wastewater flows associated with growth in the community, and would provide treatment including nitrification, non-toxic disinfection, and tertiary effluent polishing. The existing WWTP would be decommissioned.

A site for the new WWTP would need to be selected based on available land within the community, as well as based on access to the collection system infrastructure and suitable effluent discharge locations. The collection system would need to be modified to convey the wastewater to the new WWTP.

This alternative would also involve an assessment of potential outfall locations, including utilizing and/or modifying the existing outfall or constructing a new outfall discharging into Severn Sound. Utilizing the existing outfall would require effluent pumping to convey the treated effluent from the new site to the existing outfall. An assessment of the Township's sludge digestion, biosolids storage, and septage receiving requirements would also be undertaken to ensure the new WWTP is capable of meeting those needs.

DEVELOPMENT AND EVALUATION OF ALTERNATIVE SOLUTIONS

3.8 Pump Wastewater to Nearby Existing Treatment Facility

This alternative would involve the construction of a centralized Pumping Station (PS) on the existing WWTP site, and a new forcemain to convey the wastewater from the community of Victoria Harbour to the Port McNicoll WWTP. The existing Victoria Harbour WWTP would be decommissioned.

The existing Port McNicoll WWTP would need to be expanded to handle the projected growth in the community of Victoria Harbour, as well as the growth in the existing service area. The Port McNicoll WWTP is currently operating at approximately 58 percent of its rated average day capacity of 1,900 m³/d. Based on projected growth within Victoria Harbour and Port McNicoll, the Port McNicoll WWTP would need to be expanded above its existing rated capacity. For the purposes of this study, it was assumed that the capacity of the Port McNicoll WWTP would be increased by expanding the existing membrane bioreactor (MBR) treatment process.

The hydraulic capacity of the existing Port McNicoll WWTP outfall would be evaluated to determine if a new outfall would be required. An assessment of the Township's sludge digestion, biosolids storage, and septage receiving requirements would also be undertaken to ensure the expanded facility is capable of meeting those needs.

3.9 Upgrade Existing Plant and Construct a New Plant for New Growth

This alternative would upgrade the existing WWTP to meet future effluent requirements at its existing rated capacity of 2,364 m³/d. The upgraded plant would utilize an activated sludge process providing treatment including nitrification, non-toxic disinfection, and tertiary effluent polishing. Existing plant infrastructure would be re-used where possible.

In addition, this alternative would involve the construction of a new tertiary mechanical WWTP on a new site to service the forecasted growth in the community. A new activated sludge plant providing treatment including nitrification, non-toxic disinfection, and tertiary effluent polishing would be constructed to accommodate additional wastewater flows.

A site for the new WWTP would need to be selected based on available land within the community, as well as based on access to the collection system infrastructure and suitable effluent discharge locations. The collection system would need to be modified to convey a portion of the wastewater to the new WWTP

This alternative would also involve an assessment of potential outfall locations, including utilizing and/or modifying the existing outfall or constructing a new outfall discharging into Severn Sound. An assessment of the Township's sludge digestion, biosolids storage, and septage receiving requirements would also be undertaken to ensure the upgraded plant and new plant are capable of meeting those needs.

4. EVALUATION OF ALTERNATIVE SOLUTIONS

4.1 Preliminary Evaluation

A preliminary evaluation was conducted to determine if the alternative solutions presented in Section 3 are capable of meeting the study objectives. Only those alternatives that satisfy the project objectives were considered for further evaluation.

Alternative 1 (Do Nothing) and Alternative 2 (Limit Growth in the Community) would not provide servicing capacity for planned growth in the community. In addition, neither Alternatives 1 or 2 allow for upgrades to ensure the ability to meet requirements for biosolids storage and non-toxic effluent with respect to chlorine. As a result, these alternatives do not satisfy the study objectives and were not considered further.

Alternative 3 (Optimize Existing Treatment Process) may provide additional servicing capacity for a portion of the planned growth in the community, however the increase in peak flows would exceed the hydraulic capacity of components of the existing infrastructure. Optimization alone would not be sufficient to provide adequate treatment capacity at future design flows, however it may reduce the scale of required upgrades to the existing plant. In addition, under this alternative no upgrades would be completed to ensure ability to meet requirements for biosolids storage and non-toxic effluent with respect to chlorine. Therefore, this alternative would not satisfy the study objectives and was not considered further as a stand-alone solution. However, optimization of the existing treatment process should be considered for implementation in conjunction with Alternative 5 to potentially reduce the capital costs associated with expanding the existing plant.

Alternative 4 (Reduce Wastewater Flows) would be able to achieve a reduction in wastewater flows through water efficiency and sewer rehabilitation programs, however there is still the possibility that increased growth will result in flows exceeding the existing rated capacity of the plant. In addition, under this alternative no upgrades would be completed to ensure ability to meet requirements for biosolids storage and non-toxic effluent with respect to chlorine. Therefore, this alternative would not satisfy the study objectives and was not considered further as a stand-alone solution. However, water efficiency and extraneous flow reduction should be considered for implementation in conjunction with the preferred alternative.

Alternative 5 (Expand and Upgrade the Existing Plant), Alternative 6 (Construction of a New Plant on Existing Site), Alternative 7 (Construction of a New Plant on a New Site), Alternative 8 (Pump Wastewater to Nearby Treatment Facility), and Alternative 9 (Upgrade Existing Plant and Construct New Plant for Growth) would satisfy all of the study objectives. Therefore, these alternatives were considered in further detail in Section 4.2.

A summary of the preliminary evaluation of alternative solutions is presented in Table 4.1.

EVALUATION OF ALTERNATIVE SOLUTIONS**Table 4.1 Preliminary Evaluation of Alternative Solutions**

Alternative	Will Alternative Satisfy All Project Objectives?		Could Alternative be Part of Solution?
	Yes	No	
1. Do Nothing		X	
2. Limit Community Growth		X	
3. Optimize Existing Treatment Process		X	X
4. Reduce Wastewater Flows		X	X
5. Expand and Upgrade the Existing Plant	X		
6. Construction of a New Plant on Existing Site	X		
7. Construction of a New Plant on a New Site	X		
8. Pump Wastewater to Nearby Existing Treatment Facility	X		
9. Upgrade Existing Plant and Construction of a New Plant for New Growth	X		

4.2 Evaluation of Feasible Alternatives

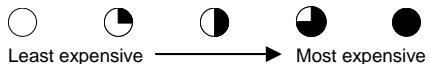
An evaluation of the feasible alternatives identified in Section 4.1 was conducted based on their impacts on the natural environment, social environment, and economic environment.

4.2.1 Cost Estimates

A conceptual level cost evaluation was conducted to determine relative costs of the feasible alternatives. The estimated relative capital costs, annual operation and maintenance (O&M) costs, and overall life cycle costs for each feasible option are shown in Table 4.2.

EVALUATION OF ALTERNATIVE SOLUTIONS

Table 4.2 Relative Costs of Feasible Alternatives


Alternative	Capital Cost	Annual O&M Cost	25-Yr Life Cycle Cost
5. Expand and Upgrade the Existing Plant	○	○	○
6. Construction of a New Plant on Existing Site	◐	○	◐
7. Construction of a New Plant on a New Site	◑	◐	◑
8. Pump Wastewater to Nearby Existing Treatment Facility	●	●	●
9. Upgrade Existing Plant and Construction of a New Plant for Growth	◒	◑	◒
Notes: 			

4.2.2 Comparison of Alternative Solutions

The advantages and disadvantages for each feasible alternative, based on impacts on the natural, technical, social, and economic environment, are summarized in Table 4.3.

Table 4.3 Comparison of Feasible Alternative Solutions

Alternative	Natural Environment		Technical Environment		Social Environment		Economic Environment		Relative 25-Year Life Cycle Cost
	Advantages	Disadvantages	Advantages	Disadvantages	Advantages	Disadvantages	Advantages	Disadvantages	
5. Expand and Upgrade the Existing Plant	- Construction limited to existing site. - Minimum disturbance to existing site due to construction.		- Existing site removed from residential area.	- Expansion options may be limited by ability to retrofit existing infrastructure.	- Minimum amount of construction activity on existing site.		- Maximum use of existing treatment plant infrastructure, minimizing capital costs.		○
6. Construction of a New Plant on Existing Site	- Construction limited to existing site.		- Flexibility with respect to selecting treatment technologies. - Existing site removed from residential area.			- Significant construction activity on existing site.		- No use of existing treatment plant infrastructure, increasing capital costs.	◐
7. Construction of a New Plant on a New Site	- Portion of existing site could be recovered.	- Land required for new treatment plant. - Construction at multiple sites within the community.	- Flexibility with respect to selecting treatment technologies.	- Additional collection system components requiring maintenance.		- Significant construction activity at multiple sites within the community.		- No use of existing treatment plant infrastructure, increasing capital costs. - Land acquisition costs.	◑
8. Pump Wastewater to Nearby Existing Treatment Facility	- Portion of existing site could be recovered.	- Required construction of forcemain from Victoria Harbour to Port McNicoll. - Construction required at the existing site, as well as at the Port McNicoll WWTP. - Higher energy requirements associated with pumping wastewater over a long distance.	- Only one WWTP to operate to service both Victoria Harbour and Port McNicoll.	- Additional collection system components requiring maintenance. - Significant increase in capacity at the Port McNicoll WWTP required. - Potential for septic and corrosive conditions at discharge of forcemain to the Port McNicoll WWTP.		- Significant construction activity at multiple sites within the communities of Victoria Harbour and Port McNicoll. - Potential for odours at the Port McNicoll WWTP.		- No use of existing treatment plant infrastructure, increasing capital costs. - Relatively high O&M costs associated with energy requirements to pump wastewater over a long distance.	●
9. Upgrade Existing Plant and Construction of New Plant for Growth		- Land required for new treatment plant. - Construction at multiple sites within the community.	- Flexibility with respect to selecting treatment technologies for the new WWTP.	- Additional collection system components requiring maintenance. - Two WWTP's to operate to service the community of Victoria Harbour		- Significant construction activity at multiple sites within the community.	- Continued use of existing treatment plant infrastructure.	- Two WWTP's to operate, resulting in relatively high O&M costs.	◒

Notes:

 ○ ◐ ◑ ◒ ●
 Least expensive → Most expensive

4.3 Selection of the Recommended Preferred Solution

The preferred alternative solution to meet the study objectives is Alternative 5 – Expand and Upgrade the Existing Plant. The preferred solution includes the following components.

- Expansion and upgrading of the existing plant to provide wastewater servicing capacity for growth in the community. The expanded plant to utilize an activated sludge process including nitrification, non-toxic disinfection, and tertiary effluent polishing.
- An assessment of sludge digestion and biosolids storage requirements for the Township, and provision of expanded sludge digestion and biosolids storage at the expanded plant.
- An assessment of septage receiving requirements for the Township, and provision of a septage receiving station at the expanded plant.
- An assessment of potential outfall locations, including utilizing and/or modifying the existing outfall or constructing a new outfall discharging into Severn Sound.

In addition to having the lowest relative 25-year life cycle cost, this option offers the following advantages relative to the other alternatives.

Expand and Upgrade Existing Plant vs. Constructing a New Plant

- Treatment at the existing Victoria Harbour WWTP would allow for the continued use of existing infrastructure, which results in capital cost savings.
- Utilizing existing tankage and buildings will result in less impact on the natural and social environment during construction due to a smaller construction footprint, a shorter construction period, and less truck traffic within the community.

Maintaining Treatment Facilities at the Existing Site vs. Servicing at a New Site

- No land acquisition is required, resulting in capital cost savings.
- Less impact on environment during construction as only one site will be disturbed, as opposed to two separate sites. In addition, there is no need to construct a forcemain through the community, as in Alternatives 7 and 8, resulting in less impact on the natural and social environment during construction.

Maintaining Separate Treatment Facilities at Victoria Harbour and Port McNicoll vs. Pumping Wastewater to the Port McNicoll WWTP

- Pumping wastewater to the Port McNicoll WWTP results in increased energy requirements, and the potential for odours at the Port McNicoll WWTP. By retaining a treatment facility within the community of Victoria Harbour, energy savings can be realized.

5. REFERENCES

MOE (1985). Guidelines for the Design of Sanitary Sewage Systems.

XCG (2007). Victoria Harbour WWTP Process Review (Final Draft).

XCG (2008). Technical Memorandum No. 1 – Projected Future Service Population and Average Day Wastewater Flows – Victoria Harbour WWTP Class EA.