
TO: GENERAL COMMITTEE

SUBJECT: ADVANCED NUTRIENT REMOVAL AT WASTEWATER TREATMENT FACILITY - UPDATE

WARD: ALL

PREPARED BY AND KEY CONTACT: W. REID, P. ENG. *W.R. Rk.*
PROJECT ENGINEER - ENVIRONMENTAL (Ext. 5116)

SUBMITTED BY: J. WESTON, M.A.SC., P.ENG., PMP *J. Weston*
DIRECTOR OF ENGINEERING

GENERAL MANAGER APPROVAL: K. BRADLEY, B.A., M.L.A. *K. Bradley*
GENERAL MANAGER OF INFRASTRUCTURE & GROWTH MANAGEMENT (ACTING)

CHIEF ADMINISTRATIVE OFFICER APPROVAL: C. LADD *C. Ladd*
CHIEF ADMINISTRATIVE OFFICER

RECOMMENDED MOTION

1. That staff not proceed with the planned project "Advanced Nutrient Removal at WwTF - Interim Solution" and that the resulting excess funding be returned to the Wastewater Reserve Fund (12-05-0575) through the next Capital Status Report.

PURPOSE & BACKGROUND

2. The purpose of this report is to seek Council's approval to not proceed with the planned "Advanced Nutrient Removal at WwTF - Interim Solution" project and to return the excess funding to the Wastewater Reserve Fund. The recommended motion does not affect the "Advanced Nutrient Removal at WwTF - Ultimate Solution" project, for which pre-design work will continue as per the Business Plan.
3. The recommended motion is based on a letter from the Ministry of Environment (MOE) (refer to Appendix "A") advising the City to contact the Barrie District Office to address any Phosphorus compliance concerns in the interim until the ultimate solution is operational. This letter was the result of a series of meetings and correspondence between the City and the MOE in the first quarter of 2014.
4. The MOE issued a new Environmental Compliance Approval on June 28, 2012 which required the City to achieve an annual average effluent compliance concentration of 0.1 mg/L Total Phosphorus by June 2, 2015. It should be noted the current ECA Total Phosphorus monthly average effluent compliance concentration is 0.18 mg/L.
5. On July 13, 2012, the City appealed the new Environmental Compliance Approval. The portion of the appeal relating to Total Phosphorus limits was ultimately withdrawn as per Council Motion 13-G-049 for reasons stated within confidential staff report ENG009-13.
6. The City undertook a conceptual study and a pilot project in 2010 which identified a proposed end of pipe membrane technology solution capable of achieving 0.1 mg/L Total Phosphorus, with an estimated capital cost of \$100 million.

7. In August 2013, City staff engaged a panel of experts to evaluate options and identify a preferred technology solution, to achieve the new compliance limit of 0.1 mg/L Total Phosphorus. The expert panel concluded that the preferred solution is to retrofit existing process tankage with membrane bioreactor (MBR) equipment with an estimated capital cost of \$60 million. Due to project scale and complexities, the expert panel identified that it would take approximately 7 years to design and construct the ultimate solution and therefore, it would not be possible for the City to implement the ultimate solution by the June 2, 2015 deadline. Therefore, an interim solution was required to bridge the gap between June 2, 2015 and 2021, at which time the ultimate solution would be operational. The interim solution was estimated to cost \$7.6 million. Funding for both the interim solution (relating to design, capital purchases, and construction) and the ultimate solution (relating to design) was approved in the 2014 Business Plan.
8. On January 28, 2014 the Mayor and City Staff met with the MOE and Minister Bradley to discuss options for the City of Barrie in reducing phosphorus discharges to Lake Simcoe and to discuss extending the deadline to achieve a Total Phosphorus concentration of 0.1 mg/L at the Wastewater Treatment Facility from 2015 to 2021. As a follow-up to this meeting, on February 12, 2014, the City issued a letter to the MOE (see Appendix B) to re-iterate the City's commitment to protecting the health of Lake Simcoe, including focusing investment on implementing the ultimate MBR retrofit solution before 2021 and implementing stormwater management projects.
9. The MOE responded to the City's February 12, 2014 letter in their April 11, 2014 correspondence. They advised that if at any time during the implementation of the ultimate solution, the City experiences concerns about their ability to achieve compliance with the Total Phosphorus concentration limits or any other issues of concern with the plant operation, then the City is to contact the ministry's Barrie District Office to discuss the nature of the issue and any and all actions that will be taken to address the concern.

ANALYSIS

10. The City of Barrie has demonstrated a commitment to the health of Lake Simcoe through investments made in recent years and ongoing capital projects and initiatives. Barrie has achieved significant reductions in phosphorus loadings that are reflected in the declining trends in phosphorus concentrations in Kempenfelt Bay over this period.
11. The City intends to begin design work on the ultimate phosphorus reduction solution at the wastewater treatment facility in 2014 such that the ultimate solution is operational by 2021.
12. The 2014 Business Plan includes funding for construction of retrofits to three existing stormwater ponds, LV4, LV5, and LV6 that will result in improved phosphorus removal. Funding for other stormwater pond retrofits will be considered in the development of future Business Plans. There are many other initiatives that the City is undertaking to reduce phosphorus discharges to Lake Simcoe such as a Comprehensive Storm Water Management Plan, regular stormwater pond maintenance, removal of homes and business from septic systems, inflow and infiltration studies and water quality monitoring.
13. The Wastewater Treatment Facility has in recent history regularly achieved low levels of Total Phosphorus; typically achieving an annual average of 0.07 - 0.08 mg/L Total Phosphorus. Although biological treatment processes can occasionally become upset, based on past performance of the facility, there is a low risk of not meeting the new annual average compliance limit of 0.1 mg/L Total Phosphorus. For example, the plant experienced an upset for a five month period from October 2012 through April 2013 during which time the monthly averages were 0.1 mg/L or greater, however overall the annual average Total Phosphorus concentrations for 2012 and 2013 were 0.07 mg/L and 0.08 mg/L respectively.

14. Since September 2013, the wastewater treatment facility has demonstrated that they have been able to achieve average monthly Total Phosphorus concentrations of 0.03 mg/L through process optimization. The risk to compliance will increase as the City of Barrie's population continues to grow, however, it is expected that the Wastewater Treatment Facility will be able to meet the compliance limit for phosphorus until the year 2021 when the ultimate solution is expected to be operational.
15. In the event that the City experiences concerns about their ability to achieve compliance with the phosphorus concentration limits or any other issues of concern with plant operation, the City will contact the Ministry's Barrie District Office as per the MOE's letter in Appendix 'A' to discuss the nature of the issue and any and all actions that will be taken to address the concern.
16. For example, actions could include past and planned phosphorus discharge reductions through the City's stormwater management pond retrofit projects and other stormwater system improvements. In order to be proactive in using these projects as part of the contingency plan and to help quantify the net benefit to Lake Simcoe, the City intends to begin monitoring and tracking the phosphorus reduction values for stormwater projects.
17. The 2014 Business Plan includes approximately \$7.6 million for the proposed interim solution for phosphorus removal at the wastewater treatment facility. If implemented, the proposed interim solution for phosphorus removal would also incur operating and maintenance costs estimated at \$170,000 per year. The interim solution would result in a small net improvement in phosphorus reduction and would be essentially a throw away solution once the ultimate wastewater solution is in service.
18. Therefore, it is recommended that the City not proceed with the proposed interim solution and that the project be removed from the 2014 Business Plan through the next Capital Status Report.

ENVIRONMENTAL MATTERS

19. The City of Barrie has demonstrated its commitment to the health of Lake Simcoe through investments made in recent years and ongoing capital projects and initiatives. Barrie has achieved significant reductions in phosphorus loadings that are reflected in the declining trend in phosphorus concentrations in Kempenfelt Bay over this period.

ALTERNATIVES

20. There is one Alternative available for consideration by General Committee:

Alternative #1

General Committee could choose to not follow the recommended motion and proceed with the interim phosphorus reduction solution at the wastewater treatment facility.

This alternative is not recommended because the MOE in their letter to the City dated April 11, 2014 (Appendix 'A') is committed to working with the City in the event the City experiences concerns about its ability to achieve the new phosphorus limit in the ECA. This alternative would mean that the city would incur throw away costs, both capital and operating, that would be better applied towards stormwater projects which are effective in reducing phosphorus discharge to Lake Simcoe.

FINANCIAL

21. The budgeted amount for the Advanced Nutrient Removal at WwTF Interim Solution project of \$7,634,000 includes \$4,322,000 in 2014 and \$3,312,000 in 2015. Total expenditures on this project, should the recommended motion be adopted, are estimated to be approximately \$100,000. Therefore, it is expected that funding in the order of \$7.5 million (\$4.2M in 2014 and \$3.3M in 2015) would be returned through the next Capital Status Report.

LINKAGE TO 2010 – 2014 COUNCIL STRATEGIC PLAN

22. The recommendation included in this Staff Report support the following goals identified in the 2010-2014 City Council Strategic Plan:
- Manage Growth and Protect the Environment
 - Strengthen Barrie's Financial Condition
23. The elimination of the interim solution, in view of other phosphorus reduction strategies, is consistent with proper fiscal management of environmental issues.

APPENDIX A

Ministry of the Environment
Central Region Office
5775 Yonge Street
8th Floor
North York ON M2M 4J1
Tel.: 416 326-6700
Fax: 416-325-5345

Ministère de l'Environnement
Région Central
5775, rue Yonge
8^{ème} étage
North York (Ontario) M2M 4J1
Tél: (416) 326-6700
Télé: (416) 326-6345



April 11, 2014

Richard Forward
General Manager, Infrastructure and Growth Management
City of Barrie
70 Collier Street, Box 400
Barrie, ON L4M 4T5

Dear Mr. Forward:

Thank you for your letter of February 12, 2014 to Nancy Matthews, Assistant Deputy Minister of Operations Division, Ministry of the Environment regarding the City of Barrie's Wastewater Treatment Facility's ability to meet its phosphorus concentration limit and the considerable efficiencies realized through optimization. I would also like to thank you for taking the time to meet with myself and Cindy Hood, Barrie District Manager, on March 26, 2014.

I understand that since September 2013 the Waste Water Treatment Facility (plant) has been able to achieve monthly phosphorus concentrations of 0.03 milligrams per litre (mg/L), a ~99% reduction rate, through process optimization. This progress is to be commended given that it exceeds the performance standards established by the manufacturer. I also am aware of your concerns about the unpredictability of the influent quality received by your plant, as well as the increased volume that will be experienced as Barrie grows.

Given the improvements through optimization, it appears that the issue regarding the plant's ability to maintain compliance with the limit will be pushed out several years. We are also encouraged to hear that the City is embarking on project initiation in 2014 to put in place a permanent membrane filtration solution by 2020.

If at any time during the implementation of the permanent solution, the City experiences concerns about their ability to achieve compliance with the phosphorus concentration limits or any other issues of concern with the plant operation, please contact the ministry's Barrie District office to discuss the nature of the issue and any and all actions that will be taken to address the concern.

I also want to commend you for the actions the City has proposed to address stormwater management pond retrofits and the projections of significant phosphorus loading reductions to Lake Simcoe. As you move to implement these projects it would be beneficial to know the actual pre- and post-retrofit reduction values, to quantify the net benefit to the lake.

Again, thank you and please feel free to contact Cindy Hood, Barrie District Manager of the Ministry of the Environment at 705-739-6436.

Sincerely,

A handwritten signature in black ink, appearing to read "Dolly Goyette".

Dolly Goyette
Director, Central Region

APPENDIX "B"

CITY HALL
70 COLLIER STREET
TEL. (705) 739-4220



P.O. BOX 400
BARRIE, ONTARIO
L4M 4T5

THE CORPORATION OF THE CITY OF BARRIE
Infrastructure & Growth Management Division
"Committed to Service Excellence"

February 12, 2014

File: A19-ADV

Ministry of the Environment
135 St. Clair Avenue West, 8th Floor
Toronto, Ontario M4V 1P5

Attention: **Nancy Matthews, Assistant Deputy Minister**

Dear Ms. Matthews:

Re: **Phosphorus Discharges to Lake Simcoe**

Thank you for the opportunity to meet with you and Minister Bradley on January 28, 2014 to discuss options for the City of Barrie in reducing phosphorus discharges to Lake Simcoe. The health of Lake Simcoe is extremely important to the City of Barrie and we will continue to take proactive steps to protect our natural environment.

As discussed at the meeting, we are requesting an extension of the deadline to achieve a phosphorus concentration of 0.1 mg/L at our Wastewater Treatment Facility from 2015 to 2021, in order to allow time to design and construct a permanent \$60 million membrane technology solution. Through the City's 2014 Budget and Business Plan, Council approved the funds required to start the design of this innovative solution so that it can be constructed and in-service before 2021 to ensure that the Wastewater Treatment Facility will continue to operate well below the phosphorus loading limit of 2774 kg/y.

Currently, our Environmental Compliance Approval requires us to achieve 0.1 mg/L phosphorus by June 2, 2015. Unfortunately, it is not possible for us to design and construct the permanent \$60 million membrane technology solution by June 2, 2015. We have consulted with industry experts and have identified an interim solution that would allow us to meet the June 2, 2015 deadline, but at a "throw-away" capital cost of approximately \$7 million plus additional annual operating costs of approximately \$1.1 million per year. The interim solution involves the purchase of three membrane treatment units that will provide additional phosphorus removal in the interim period while the City is designing and constructing the permanent solution, but these interim membrane treatment units are not part of the permanent solution.

Therefore, if the City is provided with the extension, then we will avoid spending approximately \$7 million in "throw-away" capital cost on an interim solution, and we would be able to focus on implementing the permanent membrane technology solution before 2021. There is an urgency to our request for an extension because the City must make the financial commitment to purchase the interim membrane treatment units by April 2014 in order to ensure that they are in-service by June 2, 2015.

While we are designing and constructing the permanent solution at the Wastewater Treatment Facility, the City will also continue to implement planned stormwater pond retrofit projects which will provide a long term reduction in phosphorus discharges to Lake Simcoe at a lower cost. For example, the City has recently filed a Drainage & Stormwater Master Plan that identifies 28 stormwater ponds that can be retrofit to increase phosphorus removal by a minimum of 129 kg/y at a total cost of \$14 million. To provide context, with no additional treatment at our Wastewater Treatment Facility, the loading to Lake Simcoe by the year 2021 would be approximately 2803 kg/y (64 MLD x 0.12 mg/L phosphorus x 365 days/year), which is only 29 kg/y more than the loading limit of 2774 kg/y.

Infrastructure & Growth Management

- 2 -

File: A19-ADV

Letter to MOE

February 12, 2014

In support of our request for an extension to the phosphorus concentration deadline in our current ECA, we are pleased to provide you with the attached information regarding the phosphorus reduction initiatives that we are currently undertaking to improve the health of Lake Simcoe:

- **Wastewater Treatment Facility Optimization Program:** The City of Barrie's Wastewater Operations Branch is committed to process optimization and to reducing the phosphorus discharges to Lake Simcoe to the maximum extent possible using existing treatment technology. To that end, the City has developed an optimization strategy that has been reviewed with the Ministry of the Environment staff to ensure we are doing everything possible to optimize our facility. The City has recently established a new "Optimization Analyst" position at the Wastewater Treatment Facility to ensure operations staff remain focused on this priority. Please refer to Attachment #1.
- **Wastewater Treatment Facility Innovative Technology Workshop Summary:** The original conceptual engineering cost estimate to implement membrane technology to achieve 0.1 mg/L phosphorus at the City's Wastewater Treatment Facility was \$100 million. In the summer of 2013, the City brought together a panel of industry experts to complete a value engineering study of alternatives and the panel identified an innovative solution using membrane bioreactors in existing tanks that reduced the estimated cost to \$60 million. Please refer to Attachment #2.
- **Wastewater Treatment Facility Phosphorus Reduction Project Work Plan:** Following the value engineering study, the City developed a detailed work plan for implementing the membrane bioreactor solution with an estimated timeframe of approximately six years including design, construction and commissioning. However, since the City cannot guarantee achieving 0.1 mg/L phosphorus with current technology, there would be a risk of non-compliance with our ECA until the new membrane bioreactors are commissioned. The City then assessed available options and identified an interim solution that would allow us to achieve the ECA compliance limit of 0.1 mg/L phosphorus by June 2, 2015 by purchasing three membrane treatment units at a cost of approximately \$7 million. The interim membrane treatment units must be purchased by April 2014, in order to have them built, delivered to site, installed and commissioned in time to meet the June 2, 2015 deadline. Please refer to Attachment #3.
- **Phosphorus Reduction Through Stormwater Management:** In 2013, the City of Barrie won the Federal Gas Tax Capacity Building Award for our Stormwater Facility Asset Management Plan, which is aimed at reducing phosphorus discharges to Lake Simcoe by ensuring our stormwater treatment facilities are properly maintained through a sustainable, full life cycle asset management plan. The City has also recently completed a Stormwater & Drainage Master Plan that addresses growth to the year 2031. The Master Plan requires Low Impact Development (LID) for all future development in the City and also includes an assessment of all existing ponds for retrofit opportunity to improve phosphorus removal. In addition, the City is currently undertaking a Comprehensive Stormwater Management Master Plan that will provide further information on opportunities to reduce phosphorus discharges to Lake Simcoe. The City's 2014 Budget and Business Plan includes funding for construction of retrofits to three existing stormwater ponds, LV4, LV5 and LV6 that will result in improved phosphorus removal. There are many other initiatives that the City is undertaking to reduce phosphorus discharges to Lake Simcoe such as implementation of our Stormwater Facility Asset Management Plan, regular stormwater pond maintenance, removal of homes and businesses from septic systems, inflow and infiltration studies and water quality monitoring. Please refer to Attachment #4.

The City of Barrie has demonstrated our commitment to the health of Lake Simcoe through investments we have made in recent years and our ongoing capital projects and initiatives. While tripling in size over the last 20 years, Barrie has achieved significant reductions in phosphorus loadings that are reflected in the declining trend in phosphorus concentrations in Kempenfelt Bay over this period. We are proud of this achievement and want to continue to work with the Ministry of the Environment towards our common goal of protecting Lake Simcoe.

Infrastructure & Growth Management

- 3 -

File: A19-ADV

Letter to MOE

February 12, 2014

In summary, we respectfully request an extension of the deadline to achieve a phosphorus concentration of 0.1 mg/L at our Wastewater Treatment Facility from 2015 to 2021, in order to allow time to design and construct a permanent \$80 million membrane technology solution. We would appreciate receiving a response to our proposal by the end of March 2014.

Please contact me at (705) 739-4220 ext. 4302 or by email at Richard.Forward@barrie.ca if you have any questions or require additional information.

Sincerely yours,



R. J. Forward, MBA, M.Sc., P. Eng.
General Manager of Infrastructure & Growth Management

Attachments