Clause 7 in Report No. 1 of Committee of the Whole was adopted, without amendment, by the Council of The Regional Municipality of York at its meeting held on January 25, 2018.

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Duffin Creek Plant Outfall Class Environmental Assessment Status Update

Committee of the Whole recommends adoption of the following recommendation contained in the report dated December 8, 2017 from the Commissioner of Environmental Services:

1. The Regional Clerk circulate this report to the Regional Municipality of Durham, the Ministry of the Environment and Climate Change and the Toronto and Region Conservation Authority.

Report dated December 8, 2017 from the Commissioner of Environmental Services now follows:

1. Recommendation

It is recommended that:

1. The Regional Clerk circulate this report to the Regional Municipality of Durham, the Ministry of the Environment and Climate Change and the Toronto and Region Conservation Authority.

2. Purpose

This report updates Council on the status of the Duffin Creek Plant Class Outfall Environmental Assessment and the Minister of the Environment and Climate Change's April 4, 2016 Order to complete a Phosphorus Reduction Action Plan for the Duffin Creek Plant.

3. Background

Duffin Creek Plant has been successfully expanded to accommodate future growth

In 2006, York Region and Durham Region completed a Stage 3 Class Environmental Assessment to increase the capacity of the Duffin Creek Plant from 420 megalitres per day to 630 megalitres per day. The expansion was undertaken to accommodate planned growth in both communities to 2031 and beyond. In 2007, the Ministry of the Environment and Climate Change (the Ministry) approved the Environmental Assessment for the expansion of capacity at the Duffin Creek Plant to a total of 630 megalitres per day.

The Ministry's approval of the expansion also included a condition that the Duffin Creek Plant liquid rated capacity be limited to 520 megalitres per day until such time as the Regions completed a Class Environmental Assessment to address the hydraulic limitations in the plant outfall. The Ministry requires that outfalls operate with sufficient hydraulic capacity to achieve a mixing ratio of 20 to 1 with the surrounding lake water. Over $850 million has been invested to expand the plant to its current treatment capacity and a Class Environmental Assessment to address the hydraulic capacity in the outfall began in 2010.

In 2013, York and Durham Regions jointly completed a Class Environmental Assessment study on the Duffin Creek Plant outfall

York and Durham Regions jointly completed a Class Environmental Assessment study to identify a preferred solution to address capacity limitations in the existing Duffin Creek Plant outfall. The Environmental Assessment was filed for public review on November 19, 2013. The Environmental Assessment determined the following recommended solution to use the full 630 megalitres per day of plant-rated liquid capacity that has already been built and approved:

- Modify the existing outfall diffusers with variable port technology to achieve a 20 to 1 mixing ratio
- Optimize the operation of the existing Duffin Creek Plant (Stages 1, 2 and 3) to achieve optimal total phosphorus removal

Part II Order Requests allege Duffin Creek Plant is the primary cause of algae growth

The *Environmental Assessment Act* provides opponents of a Class Environmental Assessment process the opportunity to request a Part II Order for the Regions to undertake an Individual Environmental Assessment. There were 90 responses sent to the Minister of which 75 were Part II Order Requests. The most notable requests were from the Town of Ajax, Lake Ontario Waterkeeper, Pickering and Ajax Citizens Together to Protect Our Water (PACT POW) and Environmental Defence alleging that the Duffin Creek Plant is responsible for a resurgence of algae (*Cladophora*) growth, odour problems and loss of waterfront enjoyment along the Ajax waterfront.

The Town of Ajax's Part II Order Requests made several misleading claims suggesting that the Duffin Creek Plant contributes as much as 85 per cent of the total phosphorus load to the nearshore water adjacent to the Ajax waterfront. Further, the town claimed that the loading from the Duffin Creek Plant will triple as the influent increases to 630 megalitres per day. Many of the remaining Part II Order Requests were a duplication of these issues, which PACT POW organized with the use of a form letter to the Minister. A detailed response was provided to the Ministry and public to correct these statements and other misleading information contained in the Part II Order submissions.

Duffin Creek Plant is a relatively minor contributor of phosphorus to Lake Ontario

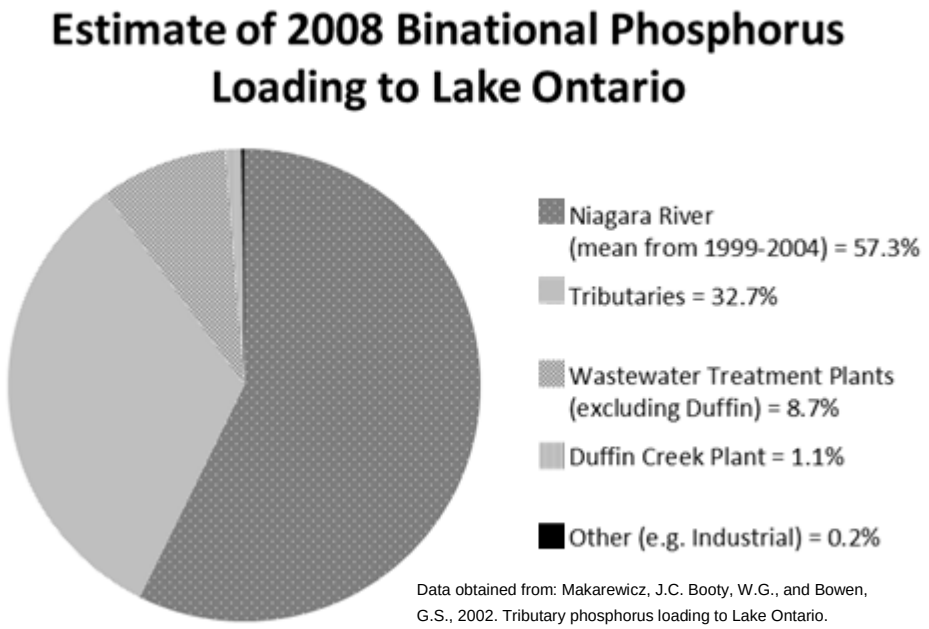
The Regions' response included credible third-party references that the Duffin Creek Plant is a minor contributor of total phosphorus to the Ajax/Pickering nearshore water (approximately 16 per cent) and the recent amount of soluble phosphorus discharging to the lake will be approximately 3.5 times lower when compared to historic limits. These significant reductions in phosphorus loading are directly linked to new facilities installed as part of the Duffin Creek Plant Stage 3 upgrades. The Minister has advised they are continuing to review the Regions' September 30, 2014 response as part of the information required for making a decision on the Part II Order Requests.

Lake scientists are focusing on the proliferation of mussels and surface runoff as the major cause of algae resurgence in the Great Lakes

Most experts agree that the resurgence of algae (*Cladophora*) over the past decade is a lake-wide problem linked to many factors including the presence of dreissenid mussels, increased sunlight penetration caused by the filtering action of mussels, warmer lake water temperatures and available food supply from a variety of phosphorus sources entering the lake.

Most studies are concluding that surface runoff from rivers, streams and storm sewers are the major contributor of phosphorus to the lake. This is consistent with the recent Environmental Commissioner of Ontario's October 2017 report "Good Choices, Bad Choices" that notes wastewater treatment plants as a minor contributor to phosphorus levels and identifies runoff from rural, agricultural and urban lands as the dominant source of phosphorus. Similar conclusions were reached in a 2012 article published in the *Journal of Great Lakes Research* that estimated the Niagara River, combined with other rivers and tributaries from the State of New York and Ontario, accounts for approximately 90 per cent of the phosphorus entering Lake Ontario (see Figure 1 below).

Figure 1
Sources of Phosphorus Output to Lake Ontario



Data obtained from: Makarewicz, J.C. Booty, W.G., and Bowen, G.S., 2002. Tributary phosphorus loading to Lake Ontario. Journal of Great Lakes Research, 38:14-20.

Lake Erie and Lake Ontario studies found that wastewater treatment plants contribute only 10 per cent of the phosphorus load

The 49 Ontario and United States wastewater treatment plants discharging to Lake Ontario are estimated to contribute only 10 per cent of the total phosphorus load with the remaining 90 per cent coming from rivers, tributaries and other sources such as storm sewers and air deposition. This finding is supported by a May 2017 Draft Action Plan for Lake Erie Phosphorus Reduction, which is a report prepared by a study team under Annex 4 of the Great Lakes Water Quality Agreement. This study estimated that 85 per cent of the phosphorus loading to Lake Erie originates from the agricultural sector and urban runoff. Only 10 to 15 per cent is attributed to all point sources. A phosphorus study is planned for Lake Ontario in the future and it is expected that similar results will be determined.

A study completed by University of Waterloo in 2009 on the Ajax/Pickering section of shoreline concluded that even without the Duffin Creek Plant, *Cladophora* growth would still occur:

> "Non-local and/or in-lake processes as key to development of nuisance Cladophora in the study area. Restriction of the dominant local sources would not eliminate (*Cladophora*) problems."

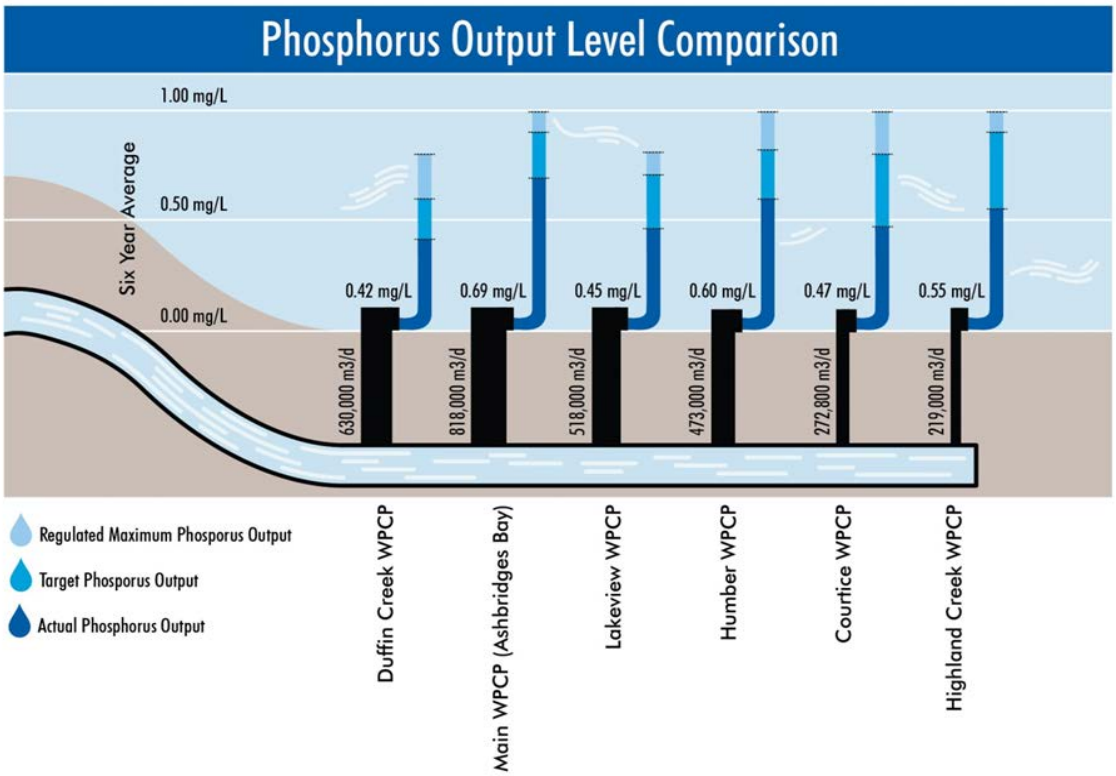
The Ministry has acknowledged that the Duffin Creek Plant is not the primary cause of phosphorus loading

In 2006, the Minister of the Environment, also agreed with the scientific evidence provided at the time of the Stage 3 Plant expansion and noted:

> "It is my understanding that there is no evidence to suggest that the Duffin Creek WPCP discharge is the primary cause, either directly or indirectly, of elevated phosphorus concentrations and E. coli presence observed at the Ajax waterfront"

The Duffin Creek Plant has an exemplary performance record with the lowest phosphorus limits of all large plants discharging to the open waters of Lake Ontario (see Figure 2). It is considered to be an environmental leader and unlike most other large plants, it has the capacity to treat all flows that occur during peak wet weather events without overflows or bypasses. The high quality of treatment provided by the Duffin Creek Plant has been verified by a 10-year detailed nearshore water quality sampling program undertaken by the Toronto and Region Conservation Authority.

Figure 2
Phosphorus Output Level Comparison



The Minister issued an order to the Regions in 2016 for a Phosphorus Reduction Action Plan to be completed before a decision on the Part II Orders is issued

In order to make an informed decision on the Part II Order Requests, the Minister issued an order on April 4, 2016 for the Regions to undertake a Phosphorus Reduction Action Plan study to address the following key issues:

- A desktop optimization study of methods to reduce phosphorus effluent limits to the lowest achievable level.
- Assess operating implications including costs to achieve such reductions.
- Determine the feasibility of achieving a permanent (ongoing) annual average total phosphorus concentration of 0.35 milligrams per litre and a total phosphorus load of 190 kilograms per day annual average.
- Meet with Ministry staff throughout the Phosphorus Reduction Action Plan study and post the results of the study for a 45-day public review period.

Durham Region Council requested collaboration with the Town of Ajax on the Phosphorus Reduction Action Plan study

Durham Region Council, at its meeting of June 8, 2016, adopted a motion by the Mayor of Ajax to engage the Town of Ajax in the Phosphorus Reduction Action Plan study process. Work began on the Phosphorus Reduction Action Plan study in June, 2016. The Ministry granted an extension on the completion date of the Phosphorus Reduction Action Plan study to March 31, 2018 to accommodate the additional consultation process with the Town of Ajax.

Phosphorus Reduction Action Plan study will be filed for a 45-day review period commencing January 8, 2018

Eight meetings have been held with Town of Ajax staff and their consultants. The collaboration has been constructive and technical issues concerning the plant optimization and tertiary treatment options have generally been resolved. There are, however, major differences of opinion concerning the town's claim that the Duffin Creek Plant is the principal cause for the resurgence of *Cladophora* growth impacting the Ajax shoreline. The areas of consensus and areas where the town and Regions differ will be recorded as part of the Phosphorus Reduction Action Plan Study Report. Town staff has advised that they will be reporting to their council on the outcome of the Phosphorus Reduction Action Plan study during the 45-day public review period expected to commence the week of January 8, 2018.

4. Analysis and Implications

Leading experts in phosphorus removal strategies were assembled to complete the Phosphorus Reduction Action Plan study

The Regions retained a team of leading experts with international expertise to evaluate optimization strategies and tertiary treatment technologies to determine achievable phosphorus reductions in the plant's discharge. The Phosphorus Reduction Action Plan study was undertaken using a proven wastewater process model calibrated to represent specific process conditions at the Duffin Creek Plant under varying flow conditions up to the 630 megalitres-per-day plant capacity limit. The modelling scenarios and the type of model used were reviewed by the Ministry of the Environment and Climate Change and Ajax and were found to be acceptable.

Areas of the plant were isolated as test sections to analyze various chemicals and dosing rates to achieve the best combinations for optimal phosphorus removal. Flow rates and operating conditions in these test sections were varied to simulate long-term plant operating conditions typical of the remaining life of the plant.

Plant field testing confirmed model predictions

Plant field test results provided a higher level of confidence in the model predictions and allowed a more appropriate assessment of risk due to stresses on plant performance that occur from unplanned events such as high, wet-weather flows or equipment downtime. Plant testing was not required as part of the Phosphorus Reduction Action Plan study; however, the Ministry and Ajax have both agreed that plant field testing was a useful approach to confirm model predictions. Results of the plant field testing have been incorporated into the Phosphorus Reduction Action Plan.

The Phosphorus Reduction Action Plan study confirmed plant process optimization can achieve lower phosphorus discharge at a reasonable cost and effort over tertiary treatment

The current Environmental Compliance Approval limits the plant total phosphorus discharge to an annual average of 311 kilograms per day at a peak plant flow of 630 megalitres per day. This current limit is lower than the 425 kilograms per day limit previously in effect. The current limit of 311 kilograms per day was applied as part of the approval of the Stage 3 Plant expansion. On average, 94 per cent of the phosphorus entering the plant is removed prior to treated water being discharged to the lake.

Options for phosphorus reduction were identified in the study and evaluated using the key factors of treatment effectiveness, implementation effort and cost. For all treatment alternatives, the study considered important factors such as the amount of greenhouse gas emissions generated, life-cycle costs, funding strategies and an assessment of operating risks associated with lower phosphorus discharge. A combined 25-year net present value capital and operating cost was used to compare the options. Results of the study found:

- The total phosphorus effluent target of 190 kilograms per day proposed in the Minister's April 2016 order can be achieved with plant optimization up to approximately the year 2034. Thereafter, the phosphorus loading would increase marginally to approximately 221 kilograms per day as peak influent flows reach 630 megalitres per day. These improvements can be achieved at an approximate $40 million combined net present value capital and operating cost. Achieving these new levels represents about a

50 per cent reduction from those permitted levels in effect prior to Stage 3 implementation.

- Tertiary treatment at the Duffin Creek Plant can reduce the annual phosphorus loading to the lake to approximately 61 kilograms per day. Alternative tertiary treatment technologies were considered with costs ranging from $240 million to $600 million combined net present value capital and operating cost.

- It is feasible to install and operate tertiary treatment during the *Cladophora* growing season (4.5 months) at a cost of approximately $210 million combined net present value capital and operating cost.

Based on this assessment, tertiary treatment is not a reasonable solution to reduce phosphorus given the significant cost increase for no improvement to algae reduction in the lake. Broader lake-wide strategies relating to phosphorus reduction are required to create a significant impact on algae levels.

Ministry staff has advised that the Phosphorus Reduction Action Plan addresses the requirements of the Minister's April 14, 2016 order. A decision on the Phosphorus Reduction Action Plan and the Part II Order Requests will be made following submission of the final report and the outcome of the 45-day public review period.

Implementing achievable phosphorus discharge levels from optimization study would be most stringent on Lake Ontario

The Phosphorus Reduction Action Plan and plant field testing was successful in identifying the optimal type of chemicals and dosing rates needed to achieve the lowest sustainable phosphorus reduction levels over the remaining life of the plant. Operational variances were simulated in the study for unforeseen occurrences associated with equipment malfunctions and extreme peak flow events from intense rainfall events. A detailed assessment of total phosphorus and soluble reactive phosphorus removal effectiveness was undertaken at each stage of treatment process using the expertise of the Regions' accredited laboratory. In all, analysis of over 12,000 samples supported treatment plant effectiveness under a range of operating conditions. The optimal solution for phosphorus removal has involved a rigorous statistical review of these test results including a peer review by leading wastewater experts.

Achievable levels for phosphorus discharge from the Duffin Creek Plant are described as follows:

- Achievable annual average effluent total phosphorus load of 221 kilograms per day. This is based on a design annual average flowrate of 630 megalitres per day.
- Achievable annual average effluent total phosphorus concentration of 0.45 milligrams per litre. This was determined to be a reasonable and achievable annual average discharge concentration based on the plant modelling and field study results. An annual average concentration of 0.35 milligrams per litre could be addressed as an operating objective.
- Achievable seasonal average (April 1 to August 31) effluent total phosphorus concentration of 0.35 milligrams per litre. This was determined to be a reasonable and achievable seasonal average discharge concentration based on the plant modelling and field study results. The seasonal period of April 1 to August 31 is the window in which *Cladophora* growth is most prevalent in Lake Ontario.

Recommended action results in discharge quality meeting the most stringent open water discharge standards in the Great Lakes

The achievable concentrations and loadings are below the guidelines established by the *Great Lakes Water Quality Agreement* as well as below the proposed guidelines for wastewater treatment plants that discharge to Lake Erie (both are 0.5 milligrams per litre). Committing to a treated water discharge quality better than the objectives outlined by the *Great Lakes Water Quality Agreement* demonstrates the Regions' environmental stewardship. In addition, a seasonal total phosphorus discharge concentration during the *Cladophora* growth window demonstrates the Regions' commitment to reach an amenable solution with the Town of Ajax and their Phosphorus Reduction Action Plan study peer reviewers.

Phosphorus Reduction Action Plan implementation comes with risks and benefits

Implementation of the recommended optimization solution identified in the Phosphorus Reduction Action Plan will provide additional phosphorus reduction. Risks associated with this recommended solution can be mitigated by a suitable time frame to implement required additional capital upgrades, changes to operating protocols and operator training.

- Based on the annual average flow projections for the Duffin Creek Plant, meeting the achievable effluent concentrations will result in a decrease of approximately 40 per cent in effluent total phosphorus loading over the next 25 years compared to meeting the plant's current Environmental Compliance Approval.

- Lowering total phosphorus concentrations below the current Environmental Compliance Approval will reduce the plant's current operational flexibility and introduce operational challenges and risks when dealing with peak rainfall occurrences, equipment malfunctions and operational upsets all of which are events with a high probability for future occurrence. To mitigate these risks, an implementation plan will be developed with a three- to five-year time frame required to complete capital upgrades and provide the equipment, resources and training necessary to sustain the new total phosphorus levels over the remaining life of the plant.

- The achievable optimization solution can be operated with seasonally adjusted phosphorus discharge values to address concerns raised by the Town of Ajax.

- The plant's greenhouse gas emissions remain virtually unchanged with the optimized solution, whereas considerable new energy consumption would be required for each of the tertiary treatment solutions due to the need for additional pumping equipment. The optimization solution will support the projected water and wastewater process emissions identified in York Region's Energy Conservation and Demand Management Plan (2016).

- The recommended optimization solution aligns with the Environmental Commissioner of Ontario's comments in the *2016/2017 Annual Energy Conservation Progress Report* that "Good public policy would focus on the cheapest available phosphorus reductions, not the most expensive ones. The province does our lakes no favours when it forces municipalities to increase their greenhouse gas emissions, which contribute to the warming that will harm those very lakes."

- The annual and seasonal phosphorus concentrations from the Phosphorus Reduction Action Plan study are lower than the 0.5 milligrams per litre phosphorus loading targets identified in the *Draft Action Plan for Lake Erie Phosphorus Reduction* and lower than the target phosphorus limits identified in the *Great Lakes Water Quality Agreement*. This supports the Region's role as environmental leaders in wastewater treatment in all of Ontario.

The expected decision on the Outfall Class Environmental Assessment and Part II Orders will provide wastewater treatment capacity to 2031 and beyond.

The Duffin Creek Plant Outfall Environmental Assessment supports York Region's long-term priorities

York Region supports growth as demonstrated through critical planning documents including *York Region Official Plan 2010*. A favourable decision on the Duffin Creek Plant Outfall Class Environmental Assessment would also support the *2006 Growth Plan for the Greater Golden Horseshoe*, including the growth targets for the Town of Ajax and City of Pickering as approved in the *2006 Durham Region Official Plan*. The Outfall Class Environmental Assessment supports the Region's Strategic Plan in the following strategy priority areas:

- Strengthen the Region's economy by fostering an environment that attracts, grows and maintains business
- Support community health and well-being by increasing the range of available and affordable housing
- Manage environmentally sustainable growth by optimizing critical infrastructure systems and capacity

The Outfall Environmental Assessment supports York Region's long-term *Vision 2051* goals by helping residents to live sustainably and supporting a resilient natural environment and agricultural system as well as supporting appropriate housing for all ages and stages.

5. Financial Considerations

Plant optimization upgrades are included in the current approved capital plan and new treatment process can be accommodated in operating budgets

The plant optimization upgrades are captured in the current approved 10 Year Capital Plan. Future annual operating budgets could accommodate funding for costs associated with the new chemicals and resources needed for optimized treatment processes. The 2018 10 Year Capital Plan also includes an allowance for the potential rollout of a reasonable range of conditions of approval that may be issued as part of the Minister's decision. The optimization solution would require no change to the current projected wastewater rates planned for both Regions. Conversely, tertiary treatment has not been planned for and could potentially incur an additional expenditure ranging from $240 million to $600 million depending upon the specific treatment technology used. Tertiary treatment is not recommended based on the analysis in this report and the little benefit it would bring to Lake Ontario.

6. Local Municipal Impact

The recommended Duffin Creek Plant Outfall Class Environmental Assessment will release additional hydraulic capacity allocation at the Duffin Creek Plant and accommodate planned growth and employment opportunities up to 2031 and beyond. The *York Region Official Plan* allocates growth targets to each of the local municipalities. A lengthy delay by the Ministry in approving additional capacity at the Duffin Creek Plant may have an impact on timing of the planned growth in one or more of the local municipalities.

7. Conclusion

The Phosphorus Reduction Action Plan study and an optimization solution was submitted to the Ministry and posted for a 45-day public comment period on January 10, 2018. The Regions believe that all necessary and requested information has been provided for the Ministry to make a decision on the Part II Order Requests and the Outfall Environmental Assessment. Implementing changes resulting from the Phosphorus Reduction Action Plan will maintain Duffin Creek Plant's status as an environmental leader with the lowest discharge limits on the lake and lower than those recommended in the *Great Lakes Water Quality Agreement* and lower than those recommended in the *2017 Draft Action Plan for Lake Erie Phosphorus Reduction*.

The Region of Durham has considered a report with similar content at their January 10, 2018 Committee of the Whole.

For more information on this report, please contact Mike Rabeau, Director, Capital Planning and Delivery at 1-877-464-9675 ext. 75157.

The Senior Management Group has reviewed this report.

December 8, 2017

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Accessible formats or communication supports are available upon request