



Environmental Services Department

MEMORANDUM

TO: Committee of the Whole

FROM: Erin Mahoney, Commissioner Environmental Services

DATE: March 3, 2016

RE: **Update on Water and Wastewater Research Partnerships**

This memo provides an update to Council on water and wastewater research activities undertaken in partnership with academic and other organizations as communicated to Regional Council October 2012 and November 2013.

Environmental Services has an active research program

To stay ahead of regulatory changes and in step with advances in treatment technology, the Environmental Services Department has engaged in a research program since 2008 spanning both water and wastewater disciplines. The program supports protection of public health and the environment by:

- understanding emerging challenges;
- optimizing facility operations to reduce chemical consumption and improve treatment quality; and
- aligning with a complex and changing regulatory framework.

This research program is enabled through strategic partnerships with the University of Toronto Drinking Water Research Group, the Water Research Foundation and collaboration with various industry experts, universities and the Ministry of Environment and Climate Change (the Ministry).

York Region facilities demonstrate innovation to the water industry

During a recent visit by the Ontario Deputy Minister of the Environment and Climate Change and the Director of the Safe Drinking Water Branch, Region staff showcased leading edge technologies used for treatment of water at the Georgina Water Treatment Plant and Keswick Water Resource Recovery Facility. Participation at WaterTAP and Southern Ontario Water Consortium events enable Regional staff to engage over 900 water technology companies. Together researchers and entrepreneurs connect our needs with industry technology hubs to help address emerging challenges.

City of Toronto, Peel Region and Durham Region also partner with the University of Toronto Drinking Water Research Group

The City of Toronto and Regions of Peel and Durham also partner with the University of Toronto Drinking Water Research Group; enabling greater collaboration and communication with our key service partners. With this shared knowledge, we optimize service delivery across the Greater Toronto Area through collective planning for operational changes to address common emerging challenges. The University of Toronto Drinking Water Research Group partnership with York Region is a funding arrangement that was renewed for a five year period in April 2012. Staff will be bringing a report forward in June 2016 for the upcoming renewal in 2017.

Leveraging partnerships with research and industry leaders has led to many successful projects and programs

Research initiatives have improved plant operations and informed capital upgrade proposals to include new advanced technology and practices. Staff engagement with these industry experts has created opportunities to modify practices to meet treatment challenges in York Region. Some highlights from recent and ongoing projects covering water and wastewater research partnerships include:

Biologically active filtration: In partnership with the University of Toronto Drinking Water Research Group, a pilot is ongoing at the Georgina Water Treatment Plant to better understand granular activated carbon biofilters with the goal of optimizing operations, further reducing disinfection by-products and increasing chlorine residual stability in the distribution system. The concentration of disinfection by-products and chlorine residual is regulated by the Province.

Nutrient recovery from wastewater: Cutting edge research with University of Waterloo and Wilfred Laurier University is currently underway to investigate potential cost savings and effluent quality improvements by harvesting nutrients (phosphorus and nitrogen) from wastewater. Nutrient recovery is a relatively new area of wastewater research driven by recent regulatory advances by way of the *Great Lakes Protection Act, 2015* and *Lake Simcoe Protection Act, 2008*. Strategically, this work will help the Region better understand the cost implication and technical ability to recover these nutrients resulting from low effluent limits imposed by these regulatory frameworks.

Mussel Deterrence and Control: Working with the Lake Simcoe Region Conservation Authority and the University of Toronto Drinking Water Research Group, it was determined that the mussel population in Lake Simcoe has shifted from zebra mussels to predominantly quagga mussels. Given the different mussel biology, new approaches will need to be investigated and implemented to prevent mussel growth in the Lake Simcoe water treatment plant intakes and treatment processes. As an alternative mussel deterrent, the Drinking Water Research Group investigated the use of ferrate. Ferrate is a chemical, which would have the ability to deter the mussels and provide coagulation benefits reducing raw water disinfection by-product formation.

Keswick Water Resource Recovery Facility membrane optimization: Partnering with GE Power and Water, Region staff have increased membrane life and improved performance, resulting in significant operational and long term asset cost savings.

Monitoring impacts of Toronto's corrosion control plan on the York Water System: In partnership with the City of Toronto, Environmental Services Department staff monitor total phosphorus throughout the York Water System in response to the Toronto corrosion control plan. This supports the *Sewer Use By-Law* and enables Operations to understand impacts to regional and local distribution system assets. Results are regularly reported to the local municipalities and Public Health.

Emerging contaminant research and monitoring: Operations, Maintenance and Monitoring staff have worked with Ministry staff on a number of projects including research into antibiotics in drinking water, pharmaceutical removal by wastewater plants, emerging contaminant impacts to Lake Simcoe and the development of new biological test methods. In addition, the Sewer Use team is working with the Ministry of Environment and Climate Change on monitoring discharge sources for specific industries. In order to better forecast trends and respond to emerging contaminant concerns, the Environmental Services Department is also leading an internal Emerging Contaminants Working Committee with Public Health.

Quantitative Microbial Risk Analysis: Working with the Drinking Water Research Group, a Quantitative Microbial Risk Analysis evaluation as outlined by Health Canada was completed in 2014 for the Georgina Water Treatment Plant. The Health Canada model evaluates effectiveness of the treatment process against measured pathogens in the raw water source. Results indicate the Georgina Water Treatment Plant has very robust treatment for pathogens with low levels of risk to public health. The Regions of Durham and Peel, as well as the Cities of Toronto and Ottawa have also completed these evaluations.

Chloramine Secondary Disinfection Studies: To answer questions pertaining to secondary residual loss in the distribution system, staff engaged the Drinking Water Research Group to investigate potential impacts of water age, source blending, nitrification, optimum treatment and residual stability. Additional work was completed looking at sediments collected from the distribution system to better understand in-pipe sedimentation and biological activity. This work continues to inform ongoing improvements with operations, capital projects and water quality management efforts with local municipal partners.

Lake Simcoe Wastewater Effluent Monitoring: In partnership with Trent University and the Ministry, York Region participated in a wastewater emerging contaminants survey. Samples were taken at the influent and effluent of three York Region facilities and showed excellent removal rates. Staff continue to pursue opportunities to better understand emerging contaminants and effluent quality.

Future research projects include:

Cyanotoxin Removal and Detection: In partnership with four other Ontario municipalities and the Drinking Water Research Group, a project proposal is pending federal funding approval. The project will look at determining treatability and early detection of cyanotoxins produced by blue-green algae. Recently Toledo, Ohio was the first Great Lake city to experience a cyanotoxin outbreak in their source water, whereby more than 400,000 residents were not able to use their drinking water due to unsafe conditions.

Membrane Optimization and Lifespan Evaluation: Building on the work done at the Keswick Water Resource Recovery Facility, consistent practices will be employed to monitor and analyze data to enhance maintenance of membranes including cleaning, and staged membrane replacement at the Georgina Water Treatment Plant. Through the partnership with the Drinking Water Research Group, research is commencing with the University of British Columbia to develop membrane life expectancy evaluation tools. This study is in collaboration with 15 other utilities across Canada. Similar work is currently being carried out by Peel Region. A study to review the potential benefits of pre-coagulation for the membranes has been planned for completion in 2016 with the Drinking Water Research Group. Pre-coagulation can reduce membrane cleaning, improve performance and increase service life.

York Region continues to promote shared knowledge with the industry

York Region continues to have a strong presence at industry events and technical committees; promoting the Region's leadership in water and wastewater innovation and research. As part of the partnership with the Drinking Water Research Group, staff attends the annual 'Technology Transfer Day' where keynote speakers highlight new industry trends or challenges and project work outcomes. The event also provides networking opportunities with partners throughout the day. In addition, the Drinking Water Research Group professors have presented at several Region sponsored events including a leadership event, the Water Summit and a Water Re-Use seminar. The industry insight, knowledge shared and promotion of Region projects at these events are valuable parts of the partnership with the Drinking Water Research Group.

Collectively, our improved knowledge better positions Regional staff to advocate and respond to proposed advancements in regulatory governance. These ongoing efforts demonstrate the Region's commitment to continuous improvement, leadership, and operational excellence in water and wastewater service delivery.

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Commissioner of Environmental Services