



Office of the Commissioner
Environmental Services Department

MEMORANDUM

To: Members of Committee of the Whole

From: Erin Mahoney, M. Eng.
Commissioner of Environmental Services

Date: February 27, 2020

Re: Update on Water and Wastewater Research and Innovation

This memo provides an update to Regional Council on water and wastewater research activities and innovations in 2019.

Research programs increase staff knowledge and produce innovative solutions that assist in meeting and anticipating emerging regulatory and treatment challenges.

Since 2008, Environmental Services staff have been engaged in research and innovation that support protection of public health and the environment through:

- Increased understanding of emerging challenges and potential impacts
- Leveraging and implementing the latest technologies
- Mitigating risk in operations of water and wastewater facilities
- Optimizing processes to reduce chemical consumption and improve treatment quality
- Aligning with a complex and changing regulatory framework
- Advocacy for changes to legislation based on sound science

Partnerships and collaborative work with regulators and agencies, industry experts, consultants, public utilities and universities allow for the development and implementation of innovative solutions to complex challenges in the water and wastewater industry. These partnerships, outlined in Attachment 1, enable Environmental Services to more effectively manage risk and continue to deliver value for money.

Research programs allow for more informed decisions through use of new technologies and approaches

Environmental Services staff engage in research partnerships to assist in anticipating challenges and undertake initiatives to remain engaged and current with advances in technology. Research has resulted in more informed decisions regarding water and wastewater operations through use of new technologies and approaches.

Benefits realized by York Region as a direct result of research programs and partnerships include:

- Increased understanding of membrane performance, lifespan and maintenance in both water and wastewater treatment applications
- Optimized operation of water filtration processes for water treatment applications
- Improved understanding of disinfection by-products and public health impacts
- Monitoring tools and techniques for biomass growth in filters and distribution pipes
- Multi-barrier approach to mussel control and continuous mussel monitoring system
- Reductions in energy costs and greenhouse gas emissions from heat recovery projects and optimizing treatment processes
- Adoption of the One Water approach considering the water cycle as an integrated system to mitigate risks and promote excellent water quality source to tap and back again
- Improved collection system point source mitigation to protect wastewater infrastructure and receiving water bodies

Highlights from ongoing and future projects include:

Research enhances system understanding and anticipates future challenges

Assessment and Evaluation of Harmful Algal Blooms and Detection and Treatment of Blue-Green Algae Toxins

Led by the Drinking Water Research Group, this research will provide utilities with knowledge and tools for early detection and mitigation of algae impacts to drinking water treatment. Results have fed into development of the Ministry of Environment, Conservation and Parks (MECP) required Harmful Algal Bloom Response planning. York Region is also participating in a Water Research Foundation study to create guidance for utilities in the event harmful algal blooms threaten source water quality. This project is expected to deliver a guidance document, decision trees, and recommendations for early warning systems, source control strategies, and

technology applications. Early results have characterized lake sediment algae, enabling the Region to understand the potential effects from off-season storm taste and odour impacts.

Anticipated Completion: Q2 and Q4 2020

Mussel Control at Drinking Water Intakes

Environmental Services staff have developed new monitoring techniques and are working towards trialing alternate chemical control strategies to reduce the impacts of invasive mussels (Quagga) on drinking water intakes and water treatment plants. This work builds on research done by the Drinking Water Research Group and lake monitoring by Lake Simcoe Region Conservation Authority. The multi-barrier approach implemented is a combination of physical and chemical control strategies when monitoring indicates a mussel threat. Copper sulfate and periacetic acid will be trialled as alternatives to chlorine for mussel suppression. Using a deterrent other than chlorine has potential to reduce disinfection by-products and taste and odour compounds in drinking water. Results will be relevant to all southern Ontario utilities with surface water plants as these invasive mussels are prevalent in most freshwater systems. This research has informed recent capital upgrades ensuring this facility meets future treatment requirements.

Anticipated Completion: Ongoing

Microplastics source impacts and treatment capacities

Microplastics have emerged as a contaminant of concern for drinking water. York Region is participating in microplastics sampling and treatment evaluation projects with the Drinking Water Research Group, MECP and Health Canada. The projects will look at the type (size and source) of plastic in the raw water and how it changes through plant treatment processes as well as point sources of microplastics to wastewater and stormwater. Work will also be done to evaluate potential health impacts. This industry leading research will help regulators and utilities to determine if this contaminant of concern poses a threat to drinking water and what can be done to mitigate that risk.

Anticipated Completion: 2021

Biofiltration Project to Address Schomberg Water Quality

In 2019 the Region retained AECOM to complete the Schomberg Biofiltration Pilot project. Groundwater treatment by biofiltration is used extensively in Europe but is only now gaining traction in North America. Raw water from the Schomberg aquifer has naturally occurring elevated levels of ammonia, methane, iron and manganese. Given distribution quality challenges, a cost-benefit feasibility study was completed to select the best technology for

ammonia removal. Biofiltration was the top ranked solution. The pilot project is testing multiple configurations of biofilters along with traditional oxidation-filtration technology to determine the best possible drinking water quality.

Anticipated Completion: 2022

Distribution System Best Practices

Through the Groundwater Treatment Strategy Project, the Region and local municipalities evaluated current groundwater system distribution system practices. As part of this project current practices were compared against industry standards and areas for improvement highlighted. These recommendations were well received when presented at the Local Municipal-Regional Water Quality Committee. Next steps to inform and engage our local partners are planned for 2020.

Anticipated Completion: Ongoing

Understanding Biostability in Distribution Systems - Implications for Maintenance and Treatment Practices

The Region is collaborating with researchers at Queen's University to develop a tool for understanding and evaluating biostability in distribution systems. Health Canada will be introducing a Biostability in Distribution Systems Guideline and therefore, this research is timely on multiple fronts: to support selection of treatment options at groundwater sites, to improve distribution system practices and asset management, as well as reduce public health risk.

Anticipated Completion: 2021

Emerging Contaminants Passive Sampling Program

York Region's Emerging Contaminants Committee has partnered with Trent University to develop and implement an emerging contaminants passive sampling program at select drinking water and wastewater facilities within the Region. The program has been designed to establish a baseline understanding of possible emerging contaminants including pharmaceuticals and personal care products within York Region. Emerging contaminant sampling is not a regulatory requirement. Staff are awaiting the final report, which will guide development and implementation of future sampling programs.

Anticipated Completion: Q2 2020

Organochloramines Research

York Region, through participation on an American Water Works Association subcommittee, will be engaging in research to enhance understanding of organochloramines, a disinfection by-product associated with distribution systems. This work will advance our understanding of

disinfection capacity, formation pathways and how to accurately measure organochloramines. Results will assist with improving water quality in distribution systems.

Anticipated Completion: Q4 2021

Adenosine Triphosphate and Coliform Analysis as Risk Assessment Tool for New Infrastructure

This preliminary study, being led through the American Water Works Association, will determine if adenosine triphosphate analysis is a suitable risk assessment tool that may be used as an alternate method for releasing newly installed or rehabilitated water infrastructure. Staff are on the project steering team. This project complements Health Canada's anticipated guideline on biostability in distribution systems and the province's recognition of adenosine triphosphate for biological monitoring.

Anticipated Completion: Q3 2020

Multi-Residential Food Waste Grinder Impacts Study

In late 2017 Council directed staff to examine the possible use and impacts of food waste grinders in a multi-residential setting. Staff have partnered with the charitable organization Markham Inter-Church Committee for Affordable Housing to install food waste grinders in each unit of their new affordable housing building. This building is scheduled to be constructed by April 2020. The Region has also partnered with the University of Waterloo to plan and oversee the study and the City of Markham to provide expertise and water use data. The study will examine organic waste disposal behaviours of tenants, the chemistry of wastewater from grinders and the water and electricity use of the building. This information will be compared to results of a similar building without food waste grinders. This comparison should provide insight into how under-sink food waste grinders are used and how they might impact wastewater quality, solid waste diversion and water and electricity use. Findings from this study will guide future Regional policies on food waste grinders and diversion.

Anticipated Completion: Q3 2021

Research initiatives enable advanced process and energy optimization

Optimization of Biological Filtration

In partnership with the Drinking Water Research Group, a pilot is ongoing at the Georgina Water Treatment Plant to better understand biological filtration in the granular activated carbon filters (GAC). Recent work focused on the upstream use of an alternative, biocide (copper sulfate) to deter mussel growth. Testing was done to ensure that the application of this upstream biocide would have no impacts to the biofilters. In parallel to this pilot work, full-scale monitoring efforts have confirmed the conversion of the recently installed GAC 2 filter to biological mode.

Understanding how the filters work enables operations to improve biofilter performance and produce water with lower disinfection by-products and greater distribution water stability.

Anticipated Completion: Ongoing

Monitoring Toronto's Corrosion Control Plan in the York Water System

The City of Toronto uses phosphates to prevent lead corrosion within old service line piping as part of a Corrosion Control Plan. Phosphates are added to prevent lead from dissolving into drinking water. To better understand impacts, York Region actively monitors phosphorus throughout the York Water System. Results are regularly reported to the City, local municipalities and Public Health. Health Canada released a new guideline for lead in 2019 reducing the health based maximum from 10 ppb to 5 ppb. It is anticipated that the Ministry of Environment, Conservation and Parks will follow suit. Given current and anticipated lead regulatory levels, phosphate addition by the City of Toronto will continue into the future.

Anticipated Completion: Ongoing

Optimization of Membrane Performance during Cold Weather Conditions

York Region is currently completing a federally funded research partnership with Suez (membrane manufacturer) and the Universities of British Columbia and Waterloo to optimize biological processes and membrane treatment at the Keswick Water Resource Recovery Facility. This partnership with internationally recognized experts in wastewater treatment will provide a strategy to better address cold water challenges. It has the potential to increase membrane life, advance operations and assist in improving the quality of water returned to Lake Simcoe. This inaugural project sets out the framework for industry leading wastewater research and better understanding of membrane performance in the Canadian climate.

Anticipated completion: Q4 2020

Leadership initiatives support excellence in inflow and infiltration and water reuse

Inflow and Infiltration Building Code Gap Analysis

On behalf of Canadian Water Wastewater Association, Regional staff are leading the review of the Ontario Building Code, National Building Code and provincial regulations regarding private-side plumbing to identify gaps and areas for improvement. This review will lead to multiple Code Change Requests through the Ministry of Municipal Affairs and Housing. Areas identified for improvement include lateral installation practices and monitoring techniques. Provincially inflow and infiltration has become a major concern; closing these gaps will alleviate stresses to collection systems during major storm events.

Anticipated completion: Q2 2020

Water Reuse Research Demonstration Project

In 2019, Environmental Services completed the second phase of the Water Reuse Research Demonstration Project. Reclaimed water from the Mount Albert Water Resource Recovery Facility was used to irrigate a test plot of sod at an operating farm in Georgina for the 2018 and 2019 growing seasons. The project is implemented by Black and Veatch Canada and an academic research team lead by Soil Resource Group with the University of Waterloo and Agriculture and Agri-Food Canada.

The team sampled throughout both growing seasons to evaluate the effects of reclaimed water on plant health, soil properties and water quality. The Ministry of Environment, Conservation and Parks also provided in-kind support of lab analysis of emerging contaminants for both growing seasons. Preliminary results from the 2018 growing season indicate that the soil and plant health are good without any noticeable difference in crop quality between the test and control plots.

Environmental Services received \$73,000 in funding from the Canadian Agriculture Partnership (provided by both Federal and Provincial governments) to conduct the second phase of the project. In addition the Region will receive up to \$191,000 for phases 2 and 3 of this project from the Federation of Canadian Municipalities Green Municipal Fund. The third phase of the project began in early 2020 and includes detailed analysis of results and recommendations. Final results will be shared with stakeholders including provincial government and local conservation authorities. Results will help York Region better understand the technical, regulatory and environmental implications of water reuse.

Anticipated Completion: Q4 2020

York Region continues to promote shared knowledge and showcase excellence

Research and innovation initiatives have and will continue to improve plant operations, asset management programs and inform capital projects. Staff engagement with industry experts has created opportunities to modify practices to meet regulatory requirements as well as develop new programs and tools to anticipate the needs and challenges the industry faces.

Articles pertaining to research projects led by York Region have been published in numerous manuals and journals, including American Water Works Association manuals, Water Research Foundation, and Water Environment Federation publications. In 2019 York Region research projects were also published in the peer-reviewed science journals: Science of the Total Environment and Environmental Pollution.

York Region staff have conducted presentations at various technical conferences of American Water Works Association, Ontario Water Works Association, Water Environment Association of Ontario, Canadian Ecotoxicity Workshop and the Water Environment Federation. York Region staff also participate in industry leadership programs such as the Water Environment Federation's Water Leadership Institute and are active members of local and international technical committees.

Our improved knowledge better positions York Region to advocate and respond to proposed advancements in regulatory requirements. These ongoing efforts demonstrate York Region's commitment to continuous improvement, leadership and operational excellence in the highly regulated delivery of water and wastewater services.

Erin Mahoney, M. Eng.
Commissioner of Environmental Services

Bruce Macgregor
Chief Administrative Officer

Attachments (1)
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