Municipal Wastewater and Stormwater Management in Ontario Discussion Paper

Minister's Introduction

As Ontario's Minister of Environment, Conservation and Parks, and MPP for Northumberland-Peterborough South, I know how critical water is to each of us, and I want to ensure Ontario is ready for the years ahead. Ontario is home to thousands of lakes and rivers, from four of the five Great Lakes to rivers like the Ganaraska and Thames, to places like Rice Lake and Lake Nipissing. Keeping our lakes and rivers healthy supports healthy people and a healthy economy, and relies on good management of water resources.

Today, Ontario communities invest billions of dollars building and operating their water, wastewater and stormwater infrastructure to minimize any negative impacts on waterways and groundwater. Population growth, urban intensification, climate change and new contaminants are going to continue to increase pressure on water resources, so I am seeking feedback on what proactive steps, new approaches and technologies are needed to respond to the challenges we face. I know that we all want world-class management of wastewater and stormwater systems, so this needs to be a priority for Ontario.

Many of Ontario's rules and policies for wastewater are over 30 years old and there is no comprehensive environmental protection policy for stormwater or framework for water reuse. Updating our rules and policies and enabling new and innovative approaches including improved climate change adaptation practices and ways to address cumulative effects of multiple discharges will make it easier for Ontario communities to improve how wastewater and stormwater is managed and make better use of taxpayer dollars through better overall financing. Cleaner wastewater and stormwater discharges from Ontario's urban areas will help protect and improve Ontario's water bodies to support a healthy and prosperous Ontario into the future.

I have asked for this discussion paper to set out the challenges and opportunities for improving wastewater and stormwater management and water conservation in Ontario. I want to hear your ideas and solutions for improving the management of municipal wastewater and stormwater management so we can all improve Ontario together. You'll find this paper builds on our government's commitments to improving municipal wastewater and stormwater

management and reporting, ensuring sustainable water use, and restoring and protecting our waterways and groundwater.

This discussion paper is organized into sections that set out the background, challenges, and opportunities for a variety of wastewater and stormwater topics, with each topic-specific chapter including a set of discussion questions. I look forward to your input.

The Honourable David Piccini
Minister of the Environment, Conservation and Parks

Recent Progress

The Government of Ontario has made progress on keeping our water safe and clean. Highlights include:

- Signed the 9th Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health, which includes a new Wastewater and Stormwater Annex.
- Invested $80.5 M in March 2021, together with Canada, in wastewater and stormwater projects through the Investing in Canada Infrastructure Program Green Stream.
- Made progress on the Canada-Ontario Lake Erie Action Plan through establishing an implementation team and working with municipalities to better manage wastewater and stormwater impacts.
- Released the Minister's 10-Year Report on Lake Simcoe, which outlines improvements in the health of the lake after a decade of actions and programs under the Lake Simcoe Protection Plan.
- Benchmarked water quality and nutrient levels in over 60 kilometres of the heavily urbanized Lake Ontario shoreline from the cities of Toronto, Mississauga and beyond.
- Launched an on-line platform (Bypass and Overflow Portal) as a pilot with several municipalities to enable faster, more reliable reporting on wastewater to the ministry.
- Implemented enhancements to Ontario's water taking framework, including new measures to help manage water takings in areas affected by water shortages and drought.

1. Overview of Wastewater and Stormwater

Overview of Wastewater and Stormwater Management in Ontario

Smart management of wastewater and stormwater is key to the protection of our water resources. In Ontario, oversight of wastewater and stormwater management is based on environmental compliance approvals (ECAs) required under the Ontario Water Resources Act (OWRA) for the establishment, alteration and operation of sewage works, including wastewater and stormwater facilities and systems. The terms and conditions of individual ECAs are based on Ontario's water management and wastewater policies.

Provincial water management policies set the water quality objectives for Ontario's waters, including rules for setting site-specific effluent quality and quantity limits for wastewater discharges. The wastewater policies set the minimum level of treatment, and monitoring and reporting requirements for all municipal and private wastewater systems. However, at this time

there is no formal environmental protection policy related to stormwater management systems to inform decision making by staff at the Ministry of the Environment, Conservation and Parks (MECP) with respect to the approval of stormwater management systems, including the consideration of use of green infrastructure, the minimum level of treatment, and the requirements for monitoring and reporting.

Municipalities, as owners of many of these wastewater and stormwater systems, are responsible for building and operating their systems in compliance with provincial requirements.

Typically, municipal wastewater is collected into one system of pipes (sanitary sewers) conveying all flow to one or more centralized wastewater treatment plants. Older systems collect municipal wastewater and stormwater in the same pipes (combined sewers), leading to overflows of untreated sewage (wastewater) into our waterways during and following heavy rains and snowmelt. Stormwater management is usually decentralized and occurs on private properties, streets and other common areas within local communities. Municipal stormwater infrastructure normally includes pipes for collection and conveyance of stormwater runoff and ponds for flow control and treatment, and increasingly includes green infrastructure which aims to absorb stormwater directly into the ground at the location it is generated. The practice of wastewater and stormwater reuse is relatively limited in Ontario, but it could reduce wastewater and stormwater management costs and conserve the fresh water supply by allowing for less water to be withdrawn from its natural source.

Good management of wastewater and stormwater is key to ensuring Ontario has clean water for drinking, swimming, fishing and other recreational activities now and into the future.

What is municipal wastewater? – municipal wastewater is primarily the sanitary sewage from homes and businesses and often some industrial wastewater discharged into municipal sanitary or combined sewers and conveyed for treatment at municipal wastewater treatment plants.

- Municipal wastewater also includes some inflow and infiltration of stormwater and groundwater entering sewers through imperfect pipe joints, and often also through illegal connections from roof leaders and foundation drains.
- In combined sewer systems, municipal wastewater also includes stormwater collected through catch basins connected to the combined sewers.
- Under the *Ontario Water Resources Act*, both wastewater and stormwater is considered “sewage,” and all facilities for the collection, conveyance, treatment and/or disposal of wastewater and or stormwater are “sewage works.”

What is stormwater? – rainwater or melted snow/ice that runs off along the surface of the ground or soaks into the ground.

What is a sewage overflow? – raw (untreated) sewage (wastewater) discharged from a wastewater collection system or wastewater treatment plant to the environment.

What is a sewage bypass? – partially treated sewage (wastewater) discharged from a wastewater treatment plant to the environment, resulting from diversion of sewage (wastewater) flow around one or more treatment processes within a wastewater treatment plant.

What is basement flooding? – sewage (wastewater) backup from sanitary or combined sewers into basements, or stormwater runoff that flows into basements during severe wet weather events.

What is urban flooding? – excess stormwater runoff flowing over urbanized areas, impacting homes (basement flooding), infrastructure, roads, underpasses and transportation routes.

What is water reuse? – the practice of reclaiming water from a variety of sources, treating it, and reusing it for beneficial purposes, which can provide alternative supplies for non-potable uses to enhance water supply sustainability and resilience.

What is water conservation? – means a reduction in the use, loss or waste of water or an increase in the efficiency of water use.

Pressures on Water Resources and Challenges Managing Wastewater and Stormwater

Population growth, rapid and expanded urban development, and aging infrastructure are threatening Ontario's lakes, rivers and other waterbodies through pollution and loss of natural heritage. Ontario's population is projected to grow by 30.3 percent over the next two decades, to approximately 18.2 million people by 2041. While western Lake Ontario is affected by population growth the most, many other communities across the province are also experiencing growth. The Provincial Policy Statement, 2020 is the consolidated statement of the Province's priorities concerning land use planning. It provides policy direction on matters of provincial interest in land use planning and development, including policy direction for municipalities and other planning authorities to ensure water and sewage (wastewater) servicing and stormwater management are appropriately planned.

Inadequate wastewater and stormwater management pose risks to people and ecosystems. Untreated or partially treated wastewater and inadequately treated stormwater can contain elevated levels of bacteria and other pathogens as well as emerging contaminants such as microplastics. Flooding is also a risk for municipalities both in existing flood prone areas, and as

a result of increasing urbanization, outside of flood plains. Over the last several years, we have seen increases in property damage, insurance costs and disruptions to communities and businesses due to extreme weather events.

Many areas within the Great Lakes basin, including Lake Erie, Lake Ontario and Lake Simcoe, are facing pressures from the increase in harmful algal blooms and nuisance algae as a result of excess phosphorus. Severe storms are washing soils and nutrients from the land into our waters. The runoff of nutrients such as phosphorus from agricultural land, particularly in spring, is contributing to severe algal blooms.

The changing climate is compounding these stresses. There is a trend toward more precipitation falling as rain and less as snow, as well as more freeze-thaw cycles. More intense and frequent rainfalls and snowmelt overwhelm sewer systems and wastewater treatment plans, which then overflow untreated or discharge partially treated wastewater into waterbodies, flood basements and urban areas, and damage infrastructure - costing billions of dollars.

Also, drought and seasonal water shortages can occur in some Ontario watersheds despite our abundant water resources. There are a few watersheds in Ontario that experience high water use in the summer from irrigation and other uses, which makes them susceptible to lower summer stream flows and drought. Some communities that rely on shallow groundwater sources are also vulnerable to drought.

Although Ontario's lakes and rivers have responded well to past protection efforts, current science indicates that they are again exhibiting symptoms of stress. For example, MECP's recent review of water quantity management in Ontario found that climate change, combined with population growth and land use changes, create uncertainty regarding the long-term sustainability of groundwater and surface water in some areas of the province.

2. Reducing Sewage Overflows and Bypasses, and Public Reporting

As explained above, a sewage overflow is a situation in which raw sewage (wastewater) is discharged from a wastewater collection system or treatment plant to the environment, and a sewage bypass is a situation when partially treated sewage (wastewater) is discharged from a wastewater treatment plant.

Sewage overflows and bypasses most often happen when it rains heavily or snow melts because excess water gets into, and may overwhelm wastewater collection and treatment systems. This occurs frequently in older municipal systems that have combined sewers, which collect sanitary sewage and stormwater in the same pipe. Where there are combined sewers,

discharges into our waterways can occur from overflow structures within the sewer system designed to prevent sewer backups, or at downstream treatment facilities. Even in newer systems, which collect sanitary sewage and stormwater in separate pipes, inflow and infiltration of groundwater and surface runoff into the sanitary sewer can result in overflows and bypasses at the downstream wastewater treatment plants. Overflows and bypasses can also occur during system technical failures or scheduled maintenance and repairs.

Combined sewer systems collect and convey storm water runoff and sanitary sewage in shared piping, designed to overflow during and following heavy rains and snowmelt as the associated wastewater treatment plants were not designed to handle the excess flow caused by the inflow of stormwater. For example, in fiscal year 2019-2020, there were 1,413 combined municipal sewer overflows and treatment plant bypasses reported to MECP.

Construction of new combined sewers is no longer permitted in Ontario but separating existing combined sewers or mitigating their negative impact is a costly and time-consuming process.

Investments to separate combined sewers into sanitary and storm sewers, as well as building large holding tanks to contain the excess combined sewer flows during storms can help mitigate overflows and bypasses. Good maintenance programs and effective inspections of the construction of sewer systems can also reduce overflows and bypasses. However, such traditional infrastructure solutions are usually quite expensive.

Innovative stormwater management approaches such as low impact development (LID) or green stormwater infrastructure that manage rain where it falls also help reduce stormwater in combined sewers, resulting in reduced volume of combined sewage, and reduced volume and frequency of untreated and partially treated sewage discharge to Ontario's waterways. Some U.S. jurisdictions (e.g., Philadelphia and Lancaster) use green stormwater infrastructure, such as rain gardens and green roofs, to better manage combined sewage volumes or as an integral part of large sewer separation projects (see Section 3).

Public Reporting

The public has little information on sewage risks, especially those associated with the release of untreated or partially treated sewage into local waterbodies. Municipalities are currently not required to inform the public at the time of a sewage overflow from their collection system, nor are they required to undertake real time monitoring of these sewage overflows. However, some municipalities, like the City of Kingston, have taken the initiative to notify the public of sewage overflows from their wastewater systems. This is why Ontario has committed $10 million to improve monitoring and public reporting of these events in municipalities with lots of these events, but further action is likely needed.

Real Time Reporting – City of Kingston, Ontario

Kingston Utilities and the City of Kingston have implemented real-time monitoring and public reporting of sewage overflows. The public can view the location of sewage overflows through an online real-time map. There are cautions to residents to avoid swimming or other recreational water use in these areas.

Several U.S. states have laws requiring near real-time public reporting of sewage overflows and bypasses so the public can avoid exposure to the health risks from sewage pollution. While costs of approaches to monitor and publicly report these events have decreased with technology improvements in recent years, significant investments would still be required for municipalities to implement them.

Advances in Sensor Technology

Opportunities may exist with new advances in sensor technology that enable more cost-effective monitoring/modelling of sewage overflows. These approaches allow municipalities to be alerted to sewage overflows, other stormwater related impacts or spill events from their wastewater and stormwater systems.

Discussion Questions

1. Should municipalities be required (e.g., through a regulation) to provide near real-time monitoring/modelling and public reporting of sewage overflows and bypasses, or should the decision be left to individual municipalities based on guidance material that would be developed by Ontario?

2. If it is to be a requirement, should it be province-wide or focused on problem areas (i.e., those areas with many sewage overflow and bypass events or high discharge volumes)?

3. What information should be reported to the public by municipalities when a sewage overflow or bypass occurs, how quickly would you want to know, and how should this information be made publicly available?

3. Changing the Way Stormwater is Managed in Urban Areas

Need for Change

In Ontario, municipalities are responsible for land use and infrastructure planning, and stormwater management for their communities (e.g., planning, design, establishment, operation and maintenance). The property owners (homeowners and businesses) have responsibility for the management of stormwater on their respective land prior to it flowing onto municipal road rights-of-way, into municipal stormwater infrastructure, onto other lands or directly into our waterways. Many provincial ministries and other entities provide oversight for various aspects of stormwater management and surface drainage.

The Provincial Policy Statement, led by the Ministry of Municipal Affairs and Housing, provides policy direction to municipalities and other land use planning authorities on planning for stormwater management, including using green infrastructure to help minimize erosion and changes in the water balance, and to prepare for the impacts of a changing climate.

However, there is currently no comprehensive environmental protection policy (led by the Ministry of the Environment, Conservation and Parks) to provide clear guidance for stormwater management or to encourage the use of innovative approaches such as green stormwater infrastructure.

Current stormwater management practices have not been effective in mitigating the impacts of urban development. The significant impacts of this 'business as usual' approach to stormwater management has led to many management challenges, including:

- Rapid conveyance of stormwater away from the site of its generation only pushes water pollution and flooding risk to downstream locations.
- High cost of building greater capacity stormwater conveyance and storage infrastructure in an attempt to address growth and climate change, which can be less effective than innovative technologies.
- Municipal investments in stormwater management infrastructure, including ongoing operation, maintenance and monitoring, may be inadequate due to competing priorities.
- Some municipalities do not have a complete stormwater management infrastructure inventory or locations of storm sewer outfalls to waterways.
- Cumulative impacts to the water quality of our lakes and streams are difficult to understand and address.

The insurance industry provides a general perspective on economic impacts. It indicates that water damage is the key factor behind growing insurance costs associated with extreme weather events.[1] These losses across Canada averaged $405 million per year between 1983 and 2008, and $1.8 billion between 2009 and 2017.

Overview of Green Stormwater Infrastructure and Low Impact Development

Green stormwater infrastructure, which includes low impact development practices, mimics the natural water cycle by managing stormwater close to where rain falls and where snow melts to reduce runoff volume and release of contaminants to waterways. Green infrastructure, such as rain gardens, green roofs, trees, permeable pavement, and rainwater harvesting and reuse systems may be built on private and public properties and on road rights-of-way (ROW). These innovative green technologies also increase infrastructure climate change resiliency, reduce energy use (reduce greenhouse gases), and may provide urban green space.

Potential Solutions for Modernizing Stormwater Management in Ontario

Modernizing stormwater management in Ontario requires discussion about potential changes, and willingness to adopt new ways of doing business. Possible solutions for modernizing stormwater management are identified below.

Performance measures could be developed that support an outcome-based approach for managing stormwater management systems and provide benchmarks for progress or performance, such as stormwater runoff volume control criteria, water quality objectives for discharge into the environment, etc. While a design-based approach (e.g., specification of stormwater pond or rain garden dimensions) can be effective at the initial time of the design of a system, the systems become outdated as new science and technology are developed over time.

Long-term planning approaches could be developed to achieve a sustainable stormwater management system. For example, a broad infrastructure planning approach, such as the use of master planning that is informed by watershed planning, combined with community engagement could identify community priorities to inform implementation. As well, there would be increased opportunity to address the cumulative impacts of stormwater on Ontario's waterways.

Innovative practices and partnerships could also be supported. Some examples of such practices in Ontario include using stormwater to flush toilets in some Toronto buildings, wash Guelph public transit buses, irrigate sports fields in Waterloo and make snow for a Toronto ski

[1] Moudrak, N., Feltmate, B., Venema, H., Osman, H. 2018. Combating Canada's Rising Flood Costs: Natural infrastructure is an underutilized option. Prepared for Insurance Bureau of Canada. Intact Centre on Climate Adaptation, University of Waterloo. http://www.ibc.ca/ab/resources/studies/natural-infrastructure-is-an-underutilized-option

hill. These practices demonstrate the management of rain where it falls; however, they are not yet common practices. Given that stormwater runoff flows across property lines and municipal boundaries, cooperative partnerships could be established for stormwater management. For example, neighbouring businesses could share the water as well as the cost of a rainwater harvesting and reuse system, or upstream and downstream municipalities could collaborate on stormwater management.

All infrastructure, including stormwater management infrastructure, require on-going operation, inspection and maintenance to ensure they are performing as intended. For example, some facilities, such as stormwater management ponds, are designed to trap sediments or contaminants and require sediment clean-out on a periodic basis. The sediment collected in stormwater ponds could have a beneficial use to build noise barrier berms or, if the quality is good enough, could be used for soil conditioning.

Managing stormwater where rain falls, such as through green stormwater infrastructure/low impact development, in combination with conventional stormwater management, would yield benefits, including enabling greater adaptation and resilience to the impacts of extreme weather, disaster mitigation, and improving community livability/public health, including a reduction in flooding risk.

MECP has developed a draft Low Impact Development Stormwater Management Guidance Manual with input from key stakeholders, including developers and municipalities. The draft guidance manual provides information and guidance on voluntary innovative stormwater management practices, including green infrastructure.

Discussion Questions

1. How can greater municipal adoption of green stormwater infrastructure/low impact development practices on public, private and commercial/industrial property be encouraged?

2. Should there be a comprehensive and province-wide environmental protection policy or guidance document to provide clear direction on stormwater management to municipalities, developers, planning authorities and others? What should be included?

3. Should there be mandatory stormwater management design or technology requirements in Ontario? If so, how can that be phased in for new development and existing development areas?

4. Updating Policies Related to the Management of Wastewater and the Quality of Ontario's Water Resources

As noted in the Overview of Wastewater and Stormwater above (Section 1), provincial water management policies set the water quality objectives for Ontario's waters, including rules for setting site-specific effluent quality and quantity limits for individual wastewater discharges, and the wastewater policies set minimum level of treatment, monitoring and reporting requirements for all municipal and private wastewater systems.

These policies date back to the 1980s and 1990s, and have not kept pace with environmental needs, technology development, and best practices in other jurisdictions. They lack clarity by not reflecting the currently available wastewater treatment technologies or current environmental protection science, and not addressing current environmental protection needs, including the cumulative effect of multiple discharges, effects of climate change and potential effects of non-conventional and emerging contaminants.

Updating these policies and enhancing their clarity and transparency would improve effluent quality from municipal wastewater facilities and promote development of new and innovative technologies which can stimulate business, reduce wastewater overflows and bypasses and their impacts, improve climate resiliency through improved adaptation efforts and support community level environmental stewardship efforts.

Some specific additional policy updates being considered include more stringent phosphorus limits for wastewater discharges within the Lake Erie watershed to conform to the commitments in the Canada-U.S. Great Lakes Water Quality Agreement and Canada-Ontario Lake Erie Action Plan, and elimination of chlorine from municipal wastewater discharges (by effluent dechlorination or use of an alternative effluent disinfection process, such as ultraviolet disinfection) to achieve equivalency with a corresponding requirement of Canada's Wastewater Systems Effluent Regulations, a federal regulation that applies to Ontario's wastewater treatment plants.

The requirement to eliminate chlorine from municipal wastewater effluent, as well as some of the requirements currently enforced through conditions of individual ECAs being issued for municipal wastewater treatment plants based on Ontario's water management and wastewater policies, could be included in a new Ontario regulation for municipal wastewater systems. To eliminate federal-provincial regulatory duplication for Ontario's municipal wastewater systems, such a new Ontario regulation could be made to match or exceed all requirements of the federal regulation, and once Ontario achieved an equivalency agreement with Canada, the federal regulation would no longer apply to Ontario's municipal wastewater systems.

In addition, new policies may be considered to provide consistency and clarity of expectations respecting proposals for new and managing existing systems for sub-surface disposal of

wastewater effluent (i.e., large and multiple septic systems) and reuse of stormwater and wastewater effluent.

Another potential new policy could address industrial contaminants in wastewater entering municipal wastewater treatment plants, where the plants are not capable of removing these contaminants from their final effluent to the level that can be assimilated by the receiving water in accordance with the provincial water management policies and water quality objectives. A potential approach to such a policy could be implementation of a short term comprehensive monitoring program for municipalities to identify industrial and other non-conventional contaminants in their treated wastewater discharges, followed by provincial development of site specific objectives for the municipalities to reduce these contaminants in their effluents, where necessary. Municipalities would then be expected to address these objectives through implementation and enforcement of municipal sewer use bylaws to control inflow of these contaminants into their sewers, and/or implement the necessary upgrades to the treatment processes at their wastewater treatment plants.

Discussion Questions

4. What feedback do you have for the potential policy updates and new policies identified above?

5. What additional issues should be addressed in the updated or new policies?

6. Considering the wide range and complexity of the potential policy updates and additions, this work will have to be undertaken in stages. Which policies should be updated/developed first?

5. Promoting Water Reuse in Ontario

Key Information about Water Reuse

Water reuse is the reclamation of stormwater or treated wastewater for a beneficial purpose. This can include agricultural and golf course irrigation, cooling water for power plants, industrial processing water, toilet flushing, dust control, construction activities, concrete mixing and other purposes that can use non-potable water. There are also water reuse projects for potable purposes such as recharging ground water aquifers and augmenting surface water reservoirs or wetlands.

The Provincial Policy Statement promotes stormwater reuse and water conservation and A Place to Grow also requires municipalities to develop and implement official plan policies and other strategies in support of water conservation objectives, including through water recycling. Although Ontario does not have specific water reuse regulations, a number of provincial rules

and standards can apply to water reuse. The Ontario Water Resources Act governs the reuse of treated wastewater or stormwater from sewage works. The Environmental Protection Act regulates off-site hauling of stormwater or wastewater, including the facilities that receive it for reuse. Also, the Ontario Building Code includes standards for the reuse of roof stormwater or greywater for non-potable uses such as flushing toilets.

Generally, water reuse can be achieved as part of a decentralized local system which may be specific to a building or a neighbourhood, or it can be achieved as part of a centralized system that is part of municipal wastewater treatment. The level of treatment is dependent on the intended application of the reused water.

Benefits of Water Reuse

Water conservation measures such as treating and reusing wastewater and stormwater for beneficial purposes enhances water sustainability by reducing the overall demand for fresh water, leaving more water for sensitive ecosystems and saving potable water for purposes such as drinking water. Water reuse can also reduce the volume of wastewater and stormwater entering infrastructure for capture, treatment and discharge into natural waterways, and in turn decrease pollutant loadings from wastewater and stormwater discharges, alleviate infrastructure capacity pressures, and reduce the energy cost to pump and treat wastewater. Water reuse may become increasingly important as climate change increases the stress on Ontario's water, wastewater and stormwater infrastructure.

Water Reuse in Other Jurisdictions

There are many jurisdictions around the world that have implemented water reuse policies and programs. Drivers for implementing a water reuse project include concerns about water scarcity and wastewater management in urban areas, and the recognition that water is a vital resource that can be recycled for new purposes. Many jurisdictions have also used innovative means to overcome barriers to water reuse.

British Columbia is the only province with regulations on water reuse, allowing water to be reused for toilet and urinal flushing, landscape, playground and green-roof irrigation, golf course irrigation, and forage crop irrigation. British Columbia also modernized their building code to allow water utility providers to distribute non-potable water and to allow non-potable distribution systems to be installed in buildings.

Governments use many methods to address public perceptions, reluctance and concerns on water reuse safety. Jurisdictions such as Washington State issue water reuse permits with safeguards designed to match water quality requirements with the proposed use application. California conducted extensive public engagement before constructing the world's largest water purification system, which purifies highly treated wastewater to drinking water standards. Israel, where more than 87% of wastewater is reused for agriculture, provides

favourable pricing to give farmers a strong incentive to use treated reclaimed wastewater for irrigation. New York City provides financial incentives in the form of grants for water reuse systems at the individual building and district levels.

Promoting Water Reuse in Ontario

In Ontario, interest in water reuse as a water conservation measure has increased but is still only practiced on a relatively small scale. Current examples include individual facilities reusing water for non-potable purposes, such as golf course and landscape irrigation and residential toilet flushing. Challenges facing water reuse in Ontario include cost, regulations and standards, and public perception. Cost is a factor because potable water is relatively low cost in Ontario and there are significant costs to building storage and distribution infrastructure for reclaimed water. Currently, Ontario lacks a comprehensive framework to guide municipalities, industries and others interested in water reuse, which makes it challenging for water reuse proponents to know how to implement water reuse systems safely and appropriately. Public perception refers to the "yuck" factor people have for using reclaimed water, which can limit uptake of water reuse. Education and outreach are needed to clearly explain how any public health and environmental risks associated with water reuse are carefully monitored and avoided.

Water Reuse in Practice

Wastewater Reuse Example Option 1: Credit Valley Conservation Blue Roof Pilot

Credit Valley Conservation (CVC) is undertaking a pilot project to construct a "blue roof" at their head office in Mississauga, Ontario. The blue roof is expected to contribute to sustainability goals by:

- reducing freshwater demand by capturing rainwater for indoor and outdoor non-potable use,
- reducing potential overflow of municipal stormwater systems during heavy rain events, and
- reducing energy demand and greenhouse gas emissions as stormwater evaporates from the roof, cooling the building.

Construction is expected to begin in 2022 and is projected to meet non-potable water demands of 8.84 m3/day, exceeding the building's current non-potable water demand of 5.68 m^3/day[2].

[2] Toronto and Region Conservation Authority, Investigating the Technical and Financial Feasibility of a Smart Blue Roof - Sustainable Technologies Evaluation Program (STEP) *and* Detailed Design and Implementation of a Smart Blue Roof - Sustainable Technologies Evaluation Program (STEP), 2019,

How it works: Blue roofs are designed to temporarily detain rainwater on flat, low-sloped roofs over an extended period of time, releasing the water gradually which reduces the potential of overflow in the municipal stormwater systems during heavy rain events. A system of sensors and real-time controls would manage the release of rainwater from the roof to CVC's rainwater harvesting tank to be treated and stored for indoor and outdoor non-potable use, such as landscape irrigation and toilet flushing.

Wastewater Reuse Example Option 2: Mountain Equipment Co-op Burlington

The Mountain Equipment Co-op (MEC) store in Burlington reduces their water footprint by capturing rainwater and stormwater in cisterns. One cistern captures rainwater from the roof and reuses it for toilet flushing. Another cistern stores water from stormwater runoff from the parking lot and reuses it for all irrigation. Both cisterns overflow to an on-site stormwater management pond. These measures have allowed the MEC to achieve indoor water savings of 82%[3] at the Burlington site, and no potable water is used for irrigation.

Discussion Questions

1. How can the Province encourage water reuse and other water conservation measures in Ontario?
2. What are the obstacles that prevent your business from using water reuse technology in your operations?
3. Are there specific operations, facilities or sectors which may benefit from water conservation / water reuse?
4. Should Ontario develop a regulatory framework or guidelines for water reuse?

6. Recovering Resources from Wastewater

Types of Resources to be Recovered and How They Can be Recovered

Wastewater also contains resources such as energy, nutrients and metals that can have value if recovered, and reusing them reduces the amount of pollutants discharged into our waterways.

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https://sustainabletechnologies.ca/home/urban-runoff-green-infrastructure/low-impact-development/blue-roofs/technical-financial-feasibility-study-smart-blue-roof

[3] Enermodal Engineering Limited, *Mountain Equipment Co-op Burlington*, https://www.canadianconsultingengineer.com/awards/pdfs/A-9_MountainEquipmentBurlington.pdf

Resource recovery from wastewater is becoming increasingly common around the world and in Ontario, highlighted by the trend toward calling wastewater treatment plants "Water Resource Recovery Facilities". Examples of resource recovery already practiced in Ontario are using biogas from wastewater treatment for heating and energy generation and using biosolids as a soil amendment on farms. Others, such as the greenhouse sector, are recycling and reusing their wastewater in their operations.

A concept in resource recovery that is gaining more attention and adoption is to upgrade wastewater treatment plants to be "net zero" in terms of energy consumption. Conventional wastewater treatment plants can use large amounts of energy to treat wastewater, but the raw wastewater has energy in the form of carbon, heat and flow. Some treatment plants are being modified to generate as much energy as they use in the treatment process or are net energy producers.

Biosolids are rich in carbon and nutrients so they can be used to improve soil. One way biosolids are used is as nutrients for agricultural land soil conditioning, which is regulated under the Nutrient Management Act to ensure biosolids are used beneficially. Some treatment plants have advanced processes for recovering value from biosolids by converting biosolids into commercial fertilizers. There are also innovative technologies that extract nutrients from the biosolids while improving wastewater treatment processes and reducing the carbon footprint of the treatment plant. In short, there are many ways to recover resources from wastewater, some of which are already being done in Ontario.

Recovering resources from wastewater does not have to occur after it is collected and taken to a point of treatment. Beneficial use of stormwater at the source was discussed above in the context of green infrastructure and water reuse. Opportunities for resource recovery at wastewater sources could be recovering heat from sewage or using water from sinks and appliances for flushing toilets. Some technologies for recovering wastewater resources at the source are well-established, while others are new technologies with limited adoption in Ontario.

There is growing interest in Ontario and around the world to recover resources from wastewater and stormwater. The initiatives can help us adapt to a changing climate and improve climate resiliency.

Discussion Questions

1. Should the Province apply a reduce, reuse and recycle model to wastewater management?

2. How could the Province encourage resource recovery at a centralized system such as a wastewater treatment plant, or at the source?

3. Do you see challenges to recovering resources from wastewater, and are there potential solutions?

4. What do you think could be done to help increase uptake of innovative technologies and practices for resource recovery?

7. Improving the Management of Hauled Sewage from Private Septic System

Hauled sewage, commonly known as septage, is untreated waste material removed from portable toilets, sewage holding tanks and septic systems. Approximately 1.2 million residents in Ontario rely on their own wastewater servicing using septic systems or holding tanks, with the majority located in rural Ontario. Hauled sewage can be taken to a wastewater treatment plant for treatment with other sewage, disposed in lagoons, applied to land following treatment or applied to land directly on approved sites. Land application of portable toilet waste is prohibited in Ontario without treatment prior to application.

Considerations for disposing hauled sewage on land include adhering to applicable laws, protecting municipal drinking water and beneficial use of treated hauled sewage. Ontario regulates the transportation and land application of hauled sewage through ECAs issued under the *Environmental Protection Act*, and operators of land disposal sites for hauled sewage must follow local requirements such as municipal official plans and zoning by-laws. Municipal drinking water sources are protected through source protection plans created under the *Clean Water Act, 2006*, which include policies to ensure that land application of hauled sewage never becomes a significant risk to municipal drinking water, such as by prohibiting this activity in areas where it is or would be a significant drinking water threat. Beneficial use of hauled sewage on land for agriculture is possible if it is treated and meets standards under the *Nutrient Management Act*.

Managing hauled sewage can be a complex issue because landowners with septic systems or holding tanks require a way of disposing of their waste safely. In some areas of Ontario alternatives to land application are not readily available as some municipalities lack wastewater treatment plant capacity to accept hauled sewage. Therefore, land application at Ontario-approved sites through a licensed waste hauler is the only practical option.

MECP considers potential impacts on the environment and neighbours when reviewing applications for approval of land disposal sites, and posts proposals and decision notices for these sites on the Environment Registry of Ontario. However, conflicts respecting land application sites can also arise after their approval. In light of these conflicts and to align MECP's policy and program on hauled sewage with other jurisdictions, MECP consulted with the public through the Environment Registry of Ontario in 2017. MECP received input that

included a range of suggested approaches from a complete phase-out of land application of untreated hauled sewage to flexible local solutions for treatment and disposal.

MECP has committed to continue considering potential changes to the hauled sewage policy and to better protect human health and the environment. Some potential options and approaches include:

- A province-wide phase-out of land application.
- Geographically based local bans based on local municipal wastewater treatment plant capacity.
- New guidelines for treatment, land application and trench disposal of treated and untreated hauled sewage (no bans).

Discussion Questions

1. What are the potential benefits and/or challenges, including cost and environmental considerations, of the options identified in this section?
2. Are there other options or changes to the approaches to managing hauled sewage that could be considered?

8. Improving Financial Sustainability

How Wastewater and Stormwater Services are Financed

Many municipalities provide services to people and businesses in their communities through centralized wastewater and stormwater systems. Most wastewater and stormwater infrastructure in Ontario was built between the 1950s and 1970s and in many places it is nearing the end of its useful life. Another example of an infrastructure challenge is the Chedoke Creek incident where the system failed to detect that a sewage overflow storage tank gate was left partially open, resulting in extremely visible and negative outcomes. This infrastructure is typically paid for by users based on a flat fee or amount of water used or wastewater disposed. Stormwater costs are paid for based on water rates or via general municipal revenues, however, some municipalities are implementing specific stormwater user fees.

Many municipalities struggle to adequately finance their wastewater and stormwater systems to ensure they can address existing and future pressures, including population growth, urbanization, and climate change. Historically, many have not invested at sustainable levels. This under-investment threatens environmental protection, increases operational costs, and hinders service enhancements and/or system growth.

Current Framework to Improve Financial Sustainability

The Ministry of Infrastructure's Asset Management Planning for Municipal Infrastructure Regulation (O. Reg. 588/17) sets out requirements for municipal asset management planning to help municipalities better understand their infrastructure needs and inform infrastructure and financial planning. This includes wastewater and stormwater infrastructure.

All municipal governments were required to have a finalized strategic asset management policy by July 2019, and their asset management plan for core assets, including wastewater and stormwater infrastructure, are to be completed and approved by July 2022. More information about the regulation can be found at www.ontario.ca/assetmanagement.

Challenges

Water rates typically do not cover the full cost needed to invest in wastewater and stormwater assets, which includes addressing the infrastructure deficit resulting from past underinvestment. Many communities have raised water rates in the recent past to try and make the necessary investments. However, some communities cannot raise rates without running into affordability issues, which are most predominant in small, rural and northern communities that lack economies of scale (i.e., large densely populated areas where cost impacts can be spread out). Stormwater charges or fees are infrequently used, resulting in stormwater infrastructure receiving very little investment after its initial construction.

Options for Improving Financial Sustainability

Affordable management of wastewater and stormwater infrastructure is critical to enabling economic growth, sustainable infrastructure and protecting Ontario's people, property and the environment. Ontario is encouraging municipalities to explore new approaches to financial sustainability and affordability of their wastewater and stormwater management systems as well as opportunities to fully and effectively use this infrastructure.

While wastewater and stormwater infrastructure is investment intensive, only a few municipalities have explored alternate governance structures which can give them flexibility to leverage borrowing opportunities and options to improve financial sustainability are available.

One option that could improve financial sustainability is achieving a regionalized economy of scale with wastewater and stormwater services. Some drinking water systems use this approach such as the Lambton Area Water Supply System, Union Water Supply System and the Lake Huron and Elgin Area Primary Water Supply Systems, where one system serves a group of municipalities. Physical interconnection of wastewater and stormwater infrastructure is not practiced amongst many groups of municipalities, but could be considered in the future to

achieve economies of scale (e.g., one large wastewater treatment plant serving many municipalities with advanced treatment improving water quality). Also, centralization of biosolids management in a municipality or sharing biosolids management resources among municipalities can occur. Municipalities could also group together to purchase chemicals or other resources through joint-procurements or other arrangements.

To help address financial sustainability, municipalities may also consider using innovative approaches such as municipal service corporations and public private partnerships (P3s).

Municipally owned corporations can provide a different way to manage municipal services such as wastewater and stormwater. Municipalities have broad powers to establish service corporations including utilities to operate their wastewater and stormwater services as long as they remain publicly owned and controlled, and include provisions for accountability and transparency. These corporations can also finance capital investments by leveraging alternative financing approaches such as through green bonds, which may not impact the municipality's borrowing capacity.

By tapping into a previously inaccessible market for capital, green bonds diversify the funding options available for municipalities, potentially creating access to cheaper sources of capital. By creating municipal service corporations, municipalities can access more debt financing for capital-intensive water, wastewater and stormwater management projects, since corporations are not subject to the same limits on borrowing that municipalities are. Municipal service corporations can also serve multiple municipalities, which opens up the possibility of realizing economies of scale and shared administration. Shifting responsibility for the financing, construction and operation of water infrastructure to a corporation led by skilled professionals can make the transition to full cost recovery on these assets more likely. While this could lead to short-term increases in rates, it can help municipalities avoid more costly rehabilitation of failed infrastructure in the longer term.

Municipal Service Corporation – Innisfil, Ontario

InnServices Utilities Inc. is a water and wastewater utility company owned by the Town of Innisfil to deliver water and wastewater services to Innisfil and other municipalities.

The Town retained a consultant to assess the Town's strategic needs and prepare a business model for the establishment of a municipal service corporation. The consultant recommended the adoption of a municipal service corporation in order to enable investment in water and wastewater assets without impacting the Town's financial position.

As a result, the Town transferred its water and wastewater assets and operations to InnServices in 2016. The Town remains the shareholder (owner) and continues to be accountable and responsible for the oversight and rate increases. InnServices is responsible for providing clean, safe drinking water to its customers and treating wastewater collected from the sewer system.

P3s can help finance wastewater and stormwater infrastructure through partnerships between the government and the private sector. P3s are an alternative form of financing which involves leveraging private sector investment through a contractual agreement that allows for private sector involvement in planning, design, construction, financing, operation and maintenance of new infrastructure, or the rehabilitation and replacement of aging infrastructure, while always maintaining public ownership and control. A wide spectrum of P3 service arrangements is available, with the allotment of responsibility between the private and public sectors varying considerably such as service contracts, management contracts, leases, and concessions. P3 models may allow public infrastructure projects to be delivered more efficiently and cost effectively than conventional procurements. P3 models can protect taxpayers from cost overruns by transferring project risks to the party with the expertise, experience and ability to handle that risk best.

Each community in Ontario has their own unique challenges, so the degree to which innovation is used may vary from one community to the next. Some may benefit from applying new and innovative approaches while others may benefit from using traditional ones. Regardless of the approach, the outcome needs to be financially sustainable municipal wastewater and stormwater systems that meet today's needs and future stresses such as climate change.

Discussion Questions

1. Are there any barriers to utilizing innovative financing approaches?

2. Are there other innovative financial approaches for wastewater and stormwater management, including water reuse that could be considered?

3. What opportunities are there for encouraging economies-of-scale for wastewater and stormwater?

4. How can municipalities improve their wastewater and stormwater management cost recovery? Should full cost recovery or life cycle costing be mandatory for municipalities?

5. With the goal of achieving full cost recovery for wastewater and stormwater services, what specific actions can different levels of government take to encourage, or better support municipalities to adopt innovative approaches to financing these services?

9. Improving Public Access to Data on Wastewater and Stormwater Discharges, and the Quality of Ontario's Waters

Publicly available data puts information in the hands of the public, which can enhance accountability of wastewater and stormwater system owners, identify knowledge gaps and support decision making. However, access to data is challenging because it is collected in many shapes and forms and by different government and non-government entities. Inconsistency in data availability limits our ability to adaptively manage complex wastewater and stormwater problems.

There is plenty of data collected by the Province, municipalities, conservation authorities, academics and ENGOs. The list below provides examples of the type of data that is publicly available.

- The Government of Ontario's Open Data Catalogue holds thousands of datasets on a wide range of topics including the environment. The following datasets are specific to wastewater and water quality in our lakes and streams:

    - *Annual Environmental Compliance Reports*: Information about wastewater discharges that exceed regulated limits.

    - Industrial Wastewater Discharges: Wastewater discharge volumes and effluent quality from wastewater facilities within several industrial sectors.

    - *Municipal Wastewater Treated Effluent* – Municipal wastewater treatment plant discharge volumes and effluent quality.

    - *Provincial (Stream) Water Quality Monitoring Network*: Measures water quality in rivers and streams across Ontario and shares the data and as an online stream water quality map.

- *Lake Partner Program*: Province-wide, volunteer-based, water quality monitoring program that collects water quality information from hundreds of lakes while promoting citizen science.

- *Inland Waters Lakes and Streams – Water Chemistry*: Includes information on water quality of lakes and streams across Ontario.

- *Lake Simcoe Monitoring:* The Lake Simcoe lake monitoring program provides measurements of chemical and physical water quality.

- *Lake Water Quality at Drinking Water Intakes:* Water chemistry data collected at 18 locations in the Great Lakes-St. Lawrence River and 4 locations in Lake Simcoe.

- *Georgian Bay Water Quality:* Water quality data for Georgian Bay collected at location from Killarney and Honey Harbour between 2003 and 2005.

- Environment and Climate Change Canada's publishes data collected through the federal Wastewater Systems Effluent Regulations (WSER), which requires wastewater systems to electronically submit data, such as flows, quality of final effluent and combined sewer overflows.

- Other examples include:

  - *City of Kingston Utilities*: Real-time public notification of CSOs through a combined sewer overflow map, including historical logs of overflows

  - *Lake Simcoe Watershed – Municipal Citywide SWM Database*: Managed by LSRCA, in collaboration with member municipalities, the database stores and tracks information about stormwater facilities and enables operations and maintenance and monitoring analysis of these assets on a watershed basis.

  - *Swim, Drink, Fish*: supports data compilation that goes into the publicly available Swim Guide that tells beach goers when and where water quality passes the local standards for swimming. Some data, such as water samples, are collected by citizen scientists across Ontario and Canada.

While a large amount of data is publicly available today, making data more accessible to the public can also be challenging. One challenge is simply making the data from provincial and other sources available. Data could be posted on a data owner's website, but that leads to the challenge of having data decentralized and located in many places, which makes it difficult to find by potential users. Another challenge is data quality and consistency. Data that is posted for public use should be verified so the user can get accurate insights from its use. Also, data collection methods may not be consistent among data sets, which can limit data usability.

These are some of the hurdles to making wastewater and stormwater data more accessible to the public and may limit the amount of data available.

Discussion Questions

1. What wastewater and stormwater data would support you and/or your organization's decision making, and how would it be used?

2. How can public access to wastewater, stormwater and water quality-related data be improved?

3. What role could sector partners contribute to improving public transparency of wastewater and stormwater data?

4. What role could community science play in the collection and/or reporting of wastewater and stormwater data?

5. How could all data on wastewater and stormwater discharges and water quality generated within Ontario by various entities be consolidated and made publicly available? Should there be an independent body charged with managing this data, and who could that be?

10. Making it Easier to Follow the Rules

The way the Province regulates municipal wastewater and stormwater has evolved over the years. An example of this is the updated Environmental Compliance Approvals (ECA) framework for approval of wastewater treatment systems that has flexibility to make pre-approved process changes.

Most recently, MECP created a consolidated linear infrastructure (CLI) ECA approach for municipalities to consolidate the existing pipe-by-pipe approvals issued for a municipality's wastewater collection system.

The current framework for sewage works approvals has resulted in the issuance of thousands of approvals to municipalities and developers with inconsistent requirements, resulting in a fragmented picture of municipal collection systems across the province. Under the new approach, a municipality will have one ECA for its sanitary collection system, and another for its stormwater management works with a set consistent terms and conditions that meet the most current standards for environmental protection. The new ECAs will also streamline the approvals process for sewage works as they will contain preauthorization conditions that will allow municipalities to make routine alterations to their collection system without an application to MECP as long as the conditions of the CLI-ECA are met. Municipalities were

invited to apply for a CLI-ECA in August 2021, and applications are due back to the ministry in early 2022. MECP is targeting July 2022 to have the new ECAs issued to municipalities.

These improvements are making it easier for municipalities to follow the rules and improve their infrastructure while ensuring environmental protection. However, more work is needed. Current challenges include inconsistent duplicative reporting requirements to provincial and federal governments, outdated approvals, and outdated, unclear or lacking policies, which makes it difficult for the regulated community and the public to be sure what the rules are. Also, there are no province-wide performance measures that inform how well municipalities are managing wastewater and stormwater in their communities.

The work the Province is doing to make it easier to follow the rules and measure how well wastewater and stormwater is managed could build on work already done such as electronic reporting and new ECAs. It could include new work such as merging federal and provincial reporting requirements, clarifying and simplifying requirements, creating key performance indicators and providing better guidance.

Solutions may include more electronic reporting, simplified factsheets on MECP requirements, continued improvements in streamlining approvals and consistency in conditions (e.g., system-wide ECAs), merging federal and provincial reporting requirements, and encouraging the development and enforcement of municipal sewer use bylaws.

Some of this work can be done within existing rules, but other work would require updated policies or new policies as set out in previous chapters.

Discussion Questions

1. What else can the Province do to streamline reporting requirements?
2. How can the Province make achieving compliance easier (e.g., improved guidance in specific areas)?
3. What province-wide performance measures can be utilized to ensure effective management of wastewater and stormwater assets?