The Great Lakes Sewage Report Card

[2013]

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ACKNOWLEDGEMENTS

August 2013

This report was written by Liat Podolsky, with invaluable assistance from Dr. Elaine MacDonald.

The author thanks Penelope Ma and Michele Charles for managing correspondence with officials and handling the extensive data collection and findings presented in this report.

Thanks to Steve Gurman and Myranda O'Shea for their research and contributions to the report.

Pierre Hamilton provided invaluable assistance in reviewing drafts and providing corrections.

Tunaheart Creative managed the design and layout of this report.

This report was made possible through the generous support of the Charles Stewart Mott Foundation, Sisters of St. Joseph, Bulrush Foundation, Eden Conservation Trust, Schad Foundation, and the ongoing support of Ecojustice donors.

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executive summary

In 2006, Ecojustice (then Sierra Legal Defence Fund) published the *Great Lakes Sewage Report Card* — the first ecosystem-based survey and analysis of municipal sewage treatment and sewage discharges into the Great Lakes Basin. That analysis identified combined sewer overflows (CSOs) as a significant source of pollution in the Great Lakes. The report was based on a survey of American and Canadian cities in the Great Lakes Basin and found that 92 billion litres of raw sewage, mixed with stormwater, was released into the Great Lakes in one year via CSOs.

Billions of litres of sewage are dumped into the Great Lakes and Ontario's waterways each year. This occurs when sewage bypasses municipal sewage treatment plants or is directly released into the environment from antiquated combined sewer systems, which carry sewage and stormwater in the same pipes and are prone to overflowing during wet weather.

Ecojustice has drawn attention to this critical issue by surveying municipalities on their sewage management practices, the results of which have been published in several previous Ecojustice reports: the *Great Lakes Sewage Report Card* (2006), *Green Cities, Great Lakes* (2008) and *Flushing out the Truth* (2009).

This report is an update to our 2006 analysis. It examines the current state of sewage management in the Great Lakes, including any changes and improvements made in the past seven years, and builds on our work to reduce pollutants entering the Great Lakes through recommendations to improve sewage treatment. We looked at Ontario cities in the Great Lakes Basin and graded them based on how well they manage their sewage — including treatment, sewage discharges, green infrastructure, and each city's ability to meet new federal standards. This report also provides an updated analysis and comparison of the patchwork of Canadian and provincial laws and policies related to sewage treatment in the Great Lakes Basin. While some things have changed, municipal sewage is still a major source of pollution in the Great Lakes Basin. Adequate resources and efforts at federal, provincial and municipal levels of government must be better invested in order to see significant improvement in sewage management and the health of the Great Lakes.

introduction

The Great Lakes include Lake Superior, Lake Michigan, Lake Huron, Lake Erie and Lake Ontario and are interconnected by rivers, channels and smaller lakes.

The Great Lakes Basin ecosystem is one of the most ecologically diverse ecosystems on earth, and the largest freshwater ecosystem, holding 20 per cent of the world's fresh surface water. The Great Lakes Basin is also home to thousands of native species of plants, fish and wildlife, many of which are unique to the region.

The Great Lakes Basin has seen tremendous economic and industrial growth in the past century. Currently, 105 million people live in the region, including 98 per cent of Ontarians. Three out of every four Ontarians get their drinking water from the Great Lakes.[1] Sprawling cities and major industries, including mining and manufacturing, all place heavy burdens on the Great Lakes' delicate ecosystems. Serious threats to the health of the Great Lakes include toxic contamination from various sources, invasion of alien, non-native species, shoreline development, loss of natural habitat and climate change.

Pollution enters the Great Lakes via different routes: point source effluent discharges like sewage treatment plants and industrial wastewater; non-point sources like stormwater runoff from urban and agricultural land; and air pollution deposition from cars and pesticides. Although each of these sources deserves detailed study and analysis, this report is focused on one of the leading sources of pollution impacting the Great Lakes — municipal sewage.

This report examines the current state of sewage management on the Canadian side of the Great Lakes, including an assessment of changes and improvements made since 2006.

sewage pollution

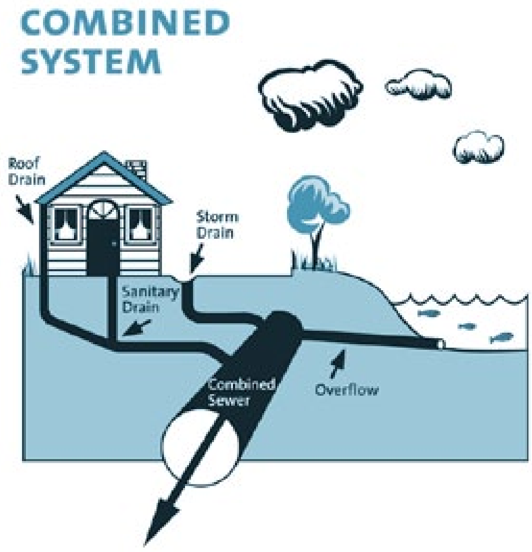
Municipal wastewater effluent is one of the largest sources of pollution, by volume, discharged to water bodies in Canada.[2] Despite multi-billion dollar investments over the past few decades, including over $653 million committed by Ontario since 2007 to municipal wastewater infrastructure upgrades in the Great Lakes Basin[3], untreated or partially treated sewage is still being dumped directly into local waters, resulting in beach closures, impacts on biodiversity, excessive algae and weed growth, and increased costs to treat drinking water.

Typical municipal sewage is a foul cocktail of biological and chemical pollutants, including human waste, micro-organisms, disease-causing pathogens such as viruses and bacteria, and hundreds of toxic chemicals and heavy metals. Pollutants found in sewage include oxygen depleting substances (referred to as Biological Oxygen Demand or BOD), and suspended solids and nutrients, such as phosphorus and nitrogen-based compounds — each of which carries a heavy ecological toll when released into a fragile ecosystem. Large concentrations of toxic chemicals, such as oil, tend to wash from the urban environment into the sewer system when it rains or the snow melts. Toxic metals and synthetic organic chemicals — such as cadmium, lead, mercury, silver, zinc and PCBs — are commonly found in sewage and pose serious dangers to human health and the environment. This sewage pollution affects biodiversity, water treatment costs, and our ability to enjoy our beaches as a result of closures from high levels of contamination. In addition, pharmaceuticals, personal care products, household cleaning chemicals and antibiotics are entering water resources through wastewater, and are a growing cause for concern.[4] Existing Ontario permit requirements are based on provincial water quality laws that are developed according to pollutants anticipated to exist in the community, so the existence of new potentially toxic substances can be overlooked.[5]

Combined Sewer Overflows

The antiquated sewer systems found in many of Ontario's cities continue to regularly release huge quantities of partially treated or untreated sewage directly into the lakes and rivers through sewage bypasses and CSOs.

There are two types of municipal wastewater collection systems: combined sewer systems and separate sewer systems. Separate sanitary sewers have separate pipes for household waste (sanitary pipes) and stormwater runoff (storm pipes). Combined sewers are an antiquated system that transports both sanitary sewage and stormwater in the same pipe. During wet weather events like rainstorms, the volume of flow often exceeds the capacity of the sewer system. When this happens, untreated raw sewage and stormwater are released directly into the local water bodies from outfalls referred to as combined sewer outfalls. The release of sewage from such outfalls is referred to as a combined sewer overflow (CSO).



Bypasses: Wet Weather and Maintenance/Malfunction

During heavy rainstorms or spring snowmelt, sewage treatment plants commonly have sewage bypasses and spills. Bypasses occur when the treatment facility is overloaded. Instead of allowing sewage to back up into basements and onto streets, the flow is deliberately redirected and discharged into receiving waters with little or no treatment. Bypasses may also occur during routine maintenance activities, such as when the treatment plant is temporarily out of operation, and power failures.

It is not overtly illegal to dump sewage via a bypass or overflow under Ontario law, particularly if it is done during wet weather to alleviate high flow volumes.[6] There are provincial government guidelines[7] that municipalities can follow, however, the guidelines are not enforceable and encourage, but do not require, reductions in sewage dumping.

Without further mitigation, CSOs and bypasses will worsen as population density continues to increase in older neighbourhoods that have combined sewers. Climate change will increase the frequency of storms and heavy precipitation, posing serious risks for environmental and human health.

sewage treatment

Sewage treatment is the process of removing contaminants from wastewater that will be released into the local environment. Treatment generally involves three stages, described as primary, secondary and tertiary. Primary and secondary treatment removes biodegradable organics and solid particles suspended in the wastewater. Tertiary treatment is an advanced treatment level that includes the removal of additional contaminants such as phosphorus and nitrogen. The percentage of the population that receives secondary treatment or higher has increased in the Great Lakes Basin, from 90 per cent in 2004 to 99 per cent in 2009.[8] Most municipal wastewater currently produced in the Great Lakes Basin portion of Ontario is treated at a secondary level or higher, with only several municipalities, accounting for just over 100,000 people, still using only primary treatment.[9] Common descriptions for each sewage treatment level are given below, although technologies used may vary.

Preliminary Screening

This initial step removes grit and larger materials that can be easily collected from sewage. Screening makes sewage less offensive to the eye, but no less dangerous to the environment or human health.

Primary Treatment

Primary treatment screens matter from wastewater in settling tanks or sewage lagoons. Heavy materials sink to the bottom and form sludge. Fats and oils rise to the top and are skimmed off the surface. Both top and bottom materials are usually taken to a solid waste processing plant. Conventional primary treatment generally removes up to 50 per cent of BOD and 90 per cent of total suspended solids.

The settling process also reduces fecal coliform levels by up to 55 per cent. In advanced primary treatment, chemicals are added to the wastewater to help particles stick together to expedite the process.

Secondary Treatment

Secondary treatment is also referred to as biological treatment because it uses micro-organisms to break down dissolved organic material that escaped primary treatment. Enhanced (or advanced) secondary treatment refers to secondary treatment with phosphorus and/or nitrogen removal. Secondary treatment reduces BOD and suspended solids by 85 to 90 per cent and removes 90 to 99 per cent of coliform bacteria and can also remove significant amounts of other pollutants. The wastewater is also put in a holding tank to further separate material.

Tertiary Treatment

Tertiary treatment involves an additional treatment stage that reduces potentially harmful substances such as nitrogen, ammonia, phosphorous, heavy metals and toxic pollutants. Technologies used in tertiary treatment depend on specific characteristics of the sewage. The most common methods of tertiary treatment include filtration with sand or activated carbon and chemical oxidation. It is important to note that tertiary treatment is unable to remove or treat all harmful compounds. There is no treatment method for a significant number of compounds, namely pharmaceuticals.[10] These compounds continue to be released into receiving waters.

Chlorine Disinfection

Municipal sewage treatment systems often use a synthetic disinfection process to eliminate many of the micro-organisms and disease-causing pathogens in sewage. While disinfection is intended to protect human health, downstream municipal water supplies and recreational waters, certain methods of disinfection can cause serious environmental harm. Chlorination is a common disinfection method due to its low cost and history of effectiveness. This process uses chlorine to kill bacteria and micro-organisms, such as fecal coliform. However, chlorine and some chlorine byproducts are highly toxic to aquatic organisms, even in small amounts, and chlorinated wastewater effluent was officially designated as "toxic" under the *Canadian Environmental Protection Act (CEPA) 1999.* In 2006, we reported that many facilities in Canada and Ontario were still using chlorination as a disinfection method. The new federal Wastewater System Effluent Regulations (to be discussed later in this report) do impose a limit on the amount of total residual chlorine that can be discharged in wastewater treatment plant effluent and, previous to the regulations, Environment Canada had implemented pollution planning to reduce the amount of chlorine in wastewater effluents.[11] As of July 2012, Environment Canada reported that 80 per cent of wastewater systems had implemented plans that considered actions to reduce total residual chlorine in wastewater effluent, most using dechlorination and ultraviolet disinfection.[12]

Ultraviolet Disinfection and Dechlorination

Of the alternative disinfection methods available, dechlorination and ultraviolet (UV) disinfection are most widely used. Dechlorination is the process of removing residual chlorine from disinfected wastewater prior to discharge into the environment, commonly using sulphur dioxide.[13] Downsides of chlorination/dechlorination include systems that are not adequately designed or operated to consistently meet target chlorine residual levels[14] and equipment that is complex. For this reason, Environment Canada encourages the use of non-chlorine-based disinfection technologies such as ultraviolet (UV) irradiation.[15]

UV disinfection uses the energy of ultraviolet rays to deactivate pathogenic organisms and has no known negative impacts on the aquatic environment. But the wastewater must be exceptionally clear for UV to be effective. Ozone can also be used to disinfect wastewater, but is a generally more complex and costly technology. However, ozone disinfection raises dissolved oxygen levels in the wastewater effluent, which provides potential benefits for aquatic life.

Other Treatment Processes

There are various ways sewage can be treated other than by conventional physical-chemical or biological treatment processes. One innovative alternative to tertiary treatment is the use of constructed wetlands. Natural wetlands act as a bio-filter, with micro-organisms, plants and insects removing pollutants and toxic constituents from water. Constructed wetlands can act in a similar fashion, reproducing the natural biological processes of marshes in a treatment facility. The constructed wetland concept can be taken a step further and compacted into a series of greenhouses where sewage effluent moves through a series of tanks while plants and insects process the waste. The result can be as good as conventional treatment.

Green Infrastructure

Comprised of trees, vegetation and wetlands, as well as engineered systems that mimic natural landscapes such as green roofs and rain gardens, green infrastructure manages stormwater at the source by capturing runoff and retaining it before it can reach the sewer system.[16] Once runoff reaches the soil, vegetation and microbes naturally filter and break down pollutants, allowing the cleansed water to be re-used, evapotranspirated, or allowed to recharge groundwater or surface water. On a larger scale, forests protect watersheds by filtering rain and buffering water bodies from pollution. Using green infrastructure instead of, or in combination with, hard infrastructure solutions, such as pipes and storage tunnels, reduces stormwater runoff volumes. This in turn reduces CSOs and mitigates the amount of pollution entering local water bodies.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renewable energy

Sewage has a negative connotation in the public eye, for obvious reasons, and sewage management places a financial burden on municipalities that will only increase with population growth, increased urbanization and climate change. However, we as the saying goes, “one man’s waste is another man’s treasure.” The output of municipal sewage treatment facilities contains a wealth of potentially recoverable renewable resources. With the proper technology, treatment plants can reduce their greenhouse gas emissions and improve their energy efficiency and financial self-sufficiency.

Sewage Energy Recovery and Heat Collection

Sewage pipes contain a mixture of sewage and water from showers, dishwashers, washing machines, etc. The temperature of this mixture is always greater than that of the ground in which the pipes are laid. During the winter, it is about 14 to 15 degrees warmer and during the summer it is about 20 degrees warmer.[17] This heat energy can be collected and reused through sewage energy recovery. This process operates on the same basic principle as geothermal heating. For example, the sewage can be piped into a district heating plant, where heat pumps recover the heat from the waste stream and transfer it to the incoming fluid (such as potable water or other fluid), for use in hydronic heating systems, faucets, washing machines, etc. The system is closed so sewage never comes into contact with the incoming fluid. Sewage energy recovery has been implemented in several locations across North America and was used to heat the Olympic Village during the 2010 Vancouver Olympics.[18]

Methane Gas as Fuel

Sewage treatment plants use bacteria to digest organic material. When they do this in the absence of oxygen, the bacteria produce methane gas (also referred to as biogas or digestion gas). The amount of methane produced by any one treatment plant depends on the treatment process of the facility. If the amount of methane produced is large enough, it can be converted into fuel for electricity and heat. Combined heat and power (CHP) can be generated using micro turbines, fuel cells or reciprocating engines.[19] Combined systems are efficient and require less fuel than separate systems, which reduces greenhouse gas emissions and lowers energy costs. Another advantage of CHP is that it is reliable and independent of the power grid.[20] If a sewage treatment facility can generate its own power, the number of sewage bypasses that result from power outages (originating on the national grid) would be reduced.

CHP is not the only means in which methane can be used as fuel. Methane can also be piped to a boiler and used to heat facility buildings. It can be treated and sold as natural gas, sold to a power producer or used to fuel fleet vehicles. Additionally, CHP can be used to generate fuel from sewage sludge incineration. [21]

Reducing Energy Needs by Reusing Wastewater

Reducing the demand on a sewage treatment system at its source, i.e. by decreasing the volume of waste being produced at home or at work, will result in a reduction of the energy needed to treat the waste. While we cannot do much about the solid waste that we produce, there are a number of ways in which the volume of liquid waste (grey water) coming from our sinks, showers and washing machines could be reduced. These methods include treating grey water so that it can be reused for toilet flushing, laundry or bathing. Many of these technologies are already in use around the world.[22]

Although source control or pollution prevention is not a treatment process, it is a preventative approach to wastewater management — similar to green infrastructure — that reduces discharge of specific substances to the environment. Source control activities are not a substitute for treatment of municipal wastewater effluent, but can help to protect sewer or collection system infrastructure, sewer workers, private property and the general public from hazardous substances released into sewers.

law and policy

The following section reviews the state of sewage policy in Ontario since the 2006 *Great Lakes Sewage Report Card* was published. The legislative authority for the Ontario Ministry of the Environment (MOE) continues to come from the *Environmental Protection Act* and the *Ontario Water Resources Act*. However, law and policy in Ontario have undergone some change. The Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystems was signed in 2007, but has since expired. The Protocol Amending the Great Lakes Water Quality Agreement and the Ontario Great Lakes Strategy were finalized or released in 2012. The *Open for Business Act, 2010*, and the *Water Opportunities Act, 2010*, were also enacted. The Ontario government has proposed legislation to protect the Great Lakes twice, but no law has been enacted. In June 2012, the provincial government introduced the Great Lakes Protection Act (Bill 100), but that legislation died on the order paper when the government prorogued the Ontario legislature. In February 2013, the Government of Ontario re-introduced

the Great Lakes Protection Act (Bill 6). The bill is still under consideration by the Legislature at the time of this publication. As well, the federal government enacted the *Wastewater Systems Effluent Regulations, 2012,* which set national wastewater treatment standards for the first time. The following is a brief overview of important legislation and agreements concerning Ontario's sewage policy.

INTERNATIONAL/INTERJURISDICTIONAL AGREEMENTS

Protocol Amending the Great Lakes Water Quality Agreement (2012)

The Great Lakes Water Quality Agreement (GLWQA) is a long-standing agreement between Canada and the United States to restore and protect the Great Lakes. The updated Protocol establishes new measures to protect the Great Lakes. For example, it commits the parties to review and update phosphorus loading targets for each of the Great Lakes and develop load reduction targets for priority watersheds. In addition to a number of innovative approaches, it is anticipated that programs to achieve targets will address phosphorus loadings

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from urban sources through the optimization of existing wastewater facilities and standards set for construction/operation of wastewater treatment facilities that discharge more than one million liquid gallons per day.

To enable the federal government to implement the GLQWA, Canada negotiates an agreement with Ontario to coordinate their respective efforts to restore and protect the Great Lakes. This agreement is referred to as the Canada-Ontario Agreement (COA), and is described below.

The Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystems

The Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA) is a three-year agreement that was signed in 2007. It was extended twice and has since expired. Negotiations for the new COA are ongoing. The COA is a collaborative effort between the federal and provincial governments. It recognizes the ecological importance and human dependence on the Great Lakes, and seeks to reduce the amount of municipal sewage and stormwater pollution entering the Great Lakes via CSOs and stormwater runoff.[23] It is also intended to improve sewage treatment standards and upgrade treatment methods. A Memorandum of Cooperation between the existing parties and the Great Lakes and St. Lawrence Cities Initiative[24] was set in place to continue to work under the COA until 2014.[25] However, no draft agreement associated with the negotiation has been released, so all that stands currently are the old commitments.

CANADA

Under Canada's *Constitution Act*, the federal and provincial governments both have jurisdiction to pass laws with respect to water management issues. Given that the *Constitution Act* does not specify which level of government has jurisdiction over the environment or water, the jurisdiction has been shared, with Ontario taking the lead in regulating water quality and quantity management within provincial geographic boundaries. In addition, Ontario has enacted legislation that authorizes municipalities to administer aspects of water management.

Canadian Federal Laws

Under federal law, Environment Canada administers two acts concerning environmental protection of surface waters: the *Canadian Environmental Protection Act, 1999* (CEPA) and the *Fisheries Act.* CEPA is a comprehensive piece of legislation that governs the release of toxic substances and nutrients into the environment from several different sectors. The *Fisheries Act* protects Canadian waters against the deposit of deleterious substances into waters "frequented by fish" and the destruction of fish habitat.[26] The *Fisheries Act*'s protection against certain types of water pollution can be modified by a regulation, as is discussed below.

Federal Wastewater Systems Effluent Regulations

The federal *Wastewater Systems Effluent Regulations*, released in 2012 under the authority of the *Fisheries Act*, set national wastewater treatment standards achievable through secondary treatment or its equivalent. This is the first time the federal government has enacted a national sewage treatment standard. By contrast, secondary treatment has been the minimum acceptable technology in the United States since the enactment of the *Clean Water Act* in 1972[27], and comparable jurisdictions in Europe have had national wastewater treatment standards in place for decades.

The regulations set a final effluent standard that must be met by January 1, 2015, unless an extension is granted. The regulation has a point system that rates sewage treatment plants by risk — high-risk plants can get an extension to meet the new final effluent quality standards by 2020, medium-risk plants by 2030 and low-risk plants by 2040. This will permit municipalities to delay upgrades for up to 28 years, a length of time never before seen for the implementation of new standards. More than 136 treatment plants are considered high risk and require upgrades by 2020, while other plants considered medium or low risk would not have to comply until 2030 or 2040, respectively.

In addition, a regulatory loophole can let a high or medium-risk municipality, which has CSOs that are deemed to be a greater risk than the final effluent from the treatment plant, delay their overall compliance date until 2041. The intent is to allow the municipality time to focus on the CSO problem by delaying treatment plant upgrades. However, the regulations do not set any reduction targets or standards for CSOs. The concern is that this will allow cities to delay much-needed treatment plant upgrades while not resulting in any tangible progress on CSOs.

In Ontario, it is doubtful the national standards will result in change, as many of the province's wastewater plants are already operating under effluent guidelines that are the same or similar to the federal standards.[28] This is a major issue, as the results presented later in this report will demonstrate, and indicates that the federal regulations will do little to improve the current state of sewage pollution in the Great Lakes Basin. These gaps need to be further addressed at a provincial level.

ONTARIO

The legislative authority of the Ontario Ministry of the Environment (MOE) to manage water comes primarily from two acts: the *Environmental Protection Act* (EPA) and the *Ontario Water Resources Act* (OWRA).

Ontario Environmental Protection Act

The *Environmental Protection Act* (EPA) is the province's key piece of environmental legislation. It bans the discharge of contaminants into the natural environment that are or could be detrimental to environmental health, except where specifically permitted by an Environmental Compliance Approval or Environmental Activity Sector Registry. Certain contaminants can be discharged, but must not exceed regulatory standards.[29] The EPA also requires that contaminant spills be reported and promptly remediated. The EPA can also determine if a party is liable for environmental contamination. The EPA is applied in conjunction with the *Ontario Water Resources Act* when issues of water contamination and pollution arise.

Ontario Water Resources Act

The *Ontario Water Resources Act* (OWRA) is the most important piece of legislation concerning the conservation, protection and management of Ontario's groundwater and surface water.[30] It regulates both sewage disposal and sewage works.[31] In general, the OWRA prohibits the discharge of contaminants that may compromise water quality. It regulates water supply, sewage discharge, oversees the approval of sewage treatment facilities, and allows the Ontario Clean Water Agency to maintain or manage municipal sewage works.[32]

Under the OWRA, the MOE issues Environmental Compliance Approvals to sewage treatment facilities. Environmental Compliance Approvals do not need to be renewed, but the ministry can choose to revise the approval. Under the *Environmental Bill of Rights, 1993*, Ontario citizens can request that a facility be reviewed.[33]

Open for Business Act

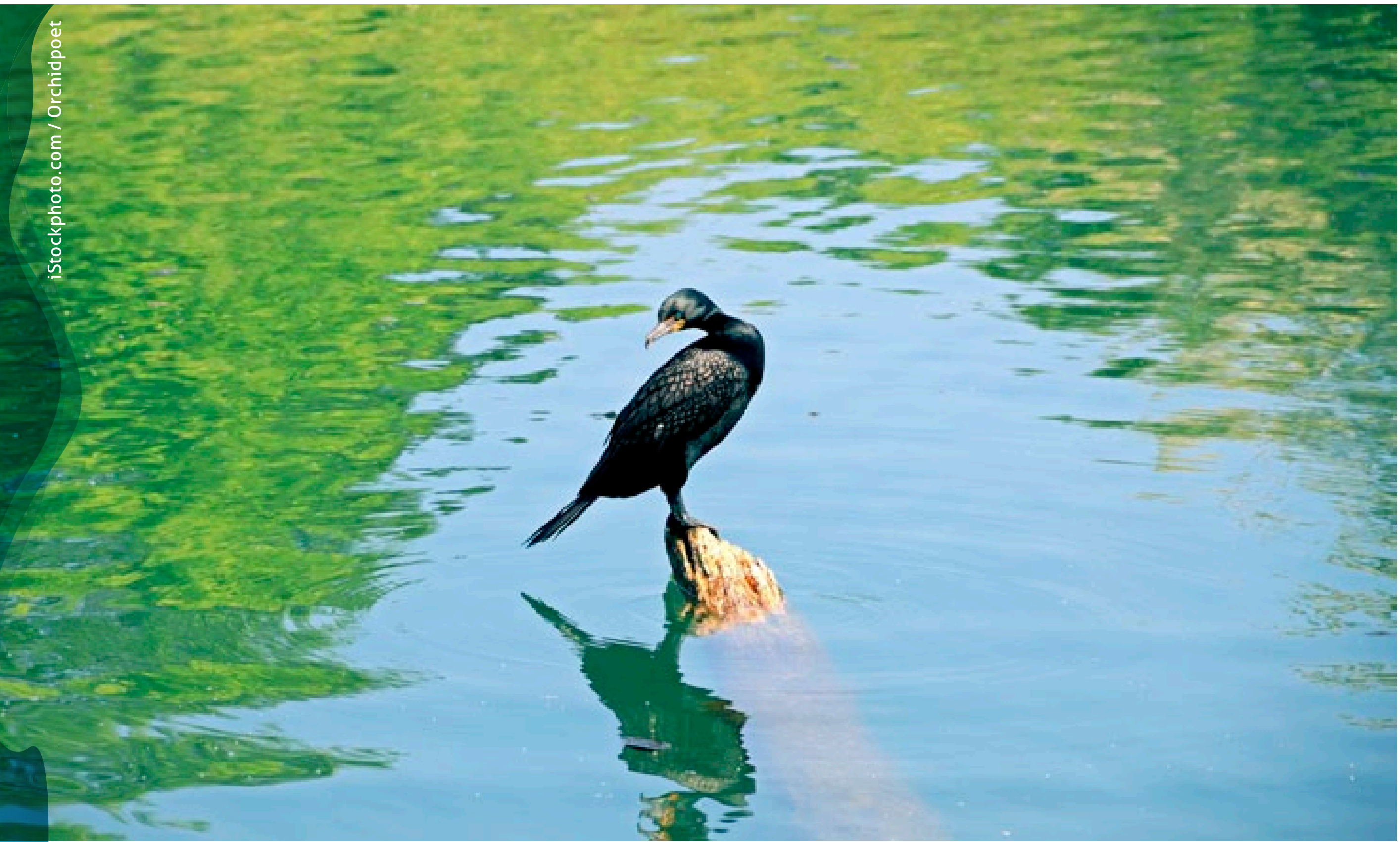
The *Open for Business Act, 2010*, amends various Ontario statutes, including the *Environmental Protection Act* and the *Ontario Water Resources Act*, to enable a modern, risk-based approach for environmental approvals. The changes include a replacement of the requirement to obtain a certificate of approval for sewage works with a requirement to obtain an "environmental compliance approval," which requires a specific project-based assessment.

Water Opportunities Act

The *Water Opportunities Act, 2010*, promotes water conservation that would reduce pressure on sewage treatment infrastructure, and enables comprehensive municipal water services planning through municipal water sustainability plans. These plans, though yet to be implemented, would require asset management plans.

Municipal Sewer-Use Bylaws

Ontario's *Municipal Act* allows municipalities to pass bylaws prohibiting or regulating the discharge of any matter into a sewage system. Many municipalities have sewer-use bylaws in place, though some are considerably more comprehensive than others. While many chemicals and pollutants are regulated through municipal sewer-use bylaws, emerging con-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taminants such as pharmaceuticals and personal care products are not regulated through sewer bylaws.[34]

OTHER GREAT LAKES POLICIES

The MOE has made recent strides to improve sewage policy in Ontario.

Proposed Great Lakes Protection Act and the Great Lakes Strategy

The MOE re-introduced the proposed Great Lakes Protection Act (GLPA) in February 2013. Among a number of environmental regulations, it would oversee requirements for better planning and development of wastewater and stormwater infrastructure.[35] The *Great Lakes Strategy* was released in December 2012. It outlines a continued effort to improve wastewater infrastructure, emphasize green technology, reduce the incidence of sewage bypasses and overflows, better report and monitor such contamination events, minimize the amount of untreatable chemicals that enter the system and improve upon nutrient recycling.[36]

CSOs and bypasses: management guidelines in ontario

The MOE publishes numerous sewage related guidelines in Ontario. The most relevant to this issue are Procedures F-5-5[37] and F-5-1[38]. These procedures set out requirements and protocols for managing combined sewer systems and sewage bypasses. Though not enforceable, applications for permits for municipal sewage treatment plants are assessed according to the requirements in the guidelines.

MOE Procedure F-5-5 provides objectives for the treatment of wet weather flows and effluent quality targets for CSOs. The guidelines require the equivalent of primary treatment for at least 90 per cent of all wet weather flow during an average runoff season. Primary treatment is defined as the removal of a minimum of 50 per cent of total suspended solids (TSS) and 30 per cent of five-day Biochemical Oxygen Demand (BOD5), prior to discharge. Procedure F-5-5 also outlines minimum control strategies, including: no dry weather overflows except under emergency conditions; an operation and maintenance program; a pollution prevention program; control of floatables; maximize use of collection system for storage of wet weather flows; and maximize use of sewage treatment plant for wet weather.

Ontario policy F-5-1, also not enforceable, permits bypasses only in emergency situations, and requires that the incident be recorded and the appropriate agencies notified. Unless allowed by permit, the OWRA has a general prohibition on the discharge of any material that may impair the quality of water[39] and that applies to sewage treatment plant bypasses and spills. Some approvals may have conditions that allow for bypasses under certain conditions.

public reporting requirements

There are no federal or provincial public reporting requirements nor are there any summaries of CSOs released to Ontarians. This leaves most Ontarians in the dark about the extent of this massive problem and their local community's contribution. Although municipalities are required to report any such events to the provincial government, that information is not provided to the public except occasionally on a discretionary basis.

report card research methodology

A 22-question survey was sent to 25 municipalities within the Great Lakes Basin in Ontario in June 2012. A copy of the survey questions can be found in the city summaries in Appendix A. The survey included questions such as the treatment level, number and volume of CSOs and bypasses, relevant sewer-use bylaws, current and future plans for sewage management, use of green infrastructure, and expectations for compliance with the federal regulations. Our 2006 report looked at cities in the U.S. and Canada. For this report, we decided to focus on Canadian cities to get a clearer picture of how well Ontario is performing with respect to sewage management in the Great Lakes Basin.

Numerous cities and regions did not respond to our request for information. Of the cities assessed in 2006, the following did not participate this time: Thunder Bay, Sault Ste Marie and Kingston confirmed they received our survey but they did not complete or return it to us. In Hamilton, we attempted to find the correct contact person to send the survey, but were unable to get a reply to this request and did not send the survey. Niagara Region refused to participate due to time constraints. Welland, which was not previously assessed in our 2006 report, told us that we would need to submit a Freedom of Information request to obtain their sewage treatment information. Other cities and regions not assessed in 2006 that did not provide us with information were: Barrie, Halton Region, Marathon, Owen Sound, Wawa, Oshawa, Cornwall and Belleville. These cities were not included in the report as we were unable to obtain enough information to provide the needed analysis. We did however research publicly available information for those that were included in our 2006 report to attempt to get a sense of whether these cities have made any improvements or changes.

Before the publication of this report, the information we obtained was sent to each city for verification in March 2013. Sudbury, Collingwood, Kitchener-Waterloo, Windsor, and York and Durham Region did not respond, so these five municipalities have not verified this information as accurate.

In total, we are reporting on 12 cities or regions in Ontario. The following information was surveyed and researched with respect to each city or region assessed:

- Population served by sewage treatment plants
- Receiving water
- Percentage of combined sewers
- Level of sewage treatment, treatment description
- Sewage sludge disposal
- Bypass and CSO releases—volume and number of events
- Final effluent testing
- Sewer-use bylaw
- Current and future sewage management plans
- Use of green infrastructure and renewable energy
- Public reporting
- Certificates of Approval
- Expectation for compliance with the Wastewater Systems Effluent Regulations
- Contact Information

Grading Methodology

We followed the same grading methodology as was used for our 2006 report. The grading methodology is based on a weighted average of the grades assigned to results of individual questions. Grades were assigned based on the following categories: level of treatment, bypasses and combined sewer overflow frequency and volumes, final effluent testing, sewer-use bylaws, current and future sewage management plans, use of green infrastructure and renewable energy, and expected compliance with the federal regulations. Greater weight was given to questions that directly relate to surface water quality, such as the level of sewage treatment provided and the quantity or volume of combined sewer overflows and bypasses. Some questions were considered informational and were not include in the grading. The final grades were averaged and presented as a letter grade for easy comparison. A summary of the grading methodology is provided in Appendix B.

For the purposes of this report, the ideal city would have tertiary treatment to remove contaminants such as phosphorus and nitrogen. It would also use non-chlorine based disinfection. In addition, it would have no CSOs or bypasses, comprehensive final effluent testing, a recently updated sewer-use bylaw, innovative sewage management plans that include the use of green infrastructure, and expect to meet the new federal standards without the need for extra time.

discussion of results

Of all the cities and regions included in this report, Windsor received the worst grade, followed by London and Toronto. The best overall grade went to Peel Region, followed by York and Durham and Kitchener-Waterloo. See Table 1 for each city or region's overall ranking and Table 2 for a summary of each city or region's grades in each category.

It is important to note that while the results of this investigation are revealing, this report fails to give a complete picture because it is based on a small sample of municipalities in the Great Lakes Basin that volunteered their information. Five municipalities that were assessed in our 2006 report are not included in this analysis, making it difficult to draw direct conclusions about changes over the past seven years.

Sewage Treatment

All the surveyed cities had secondary treatment as a minimum level of treatment except for Collingwood, which has primary as well as secondary. (At the time of our 2006 report, the cities of Kingston, Sault Ste Marie and Windsor had primary treatment at one of their sewage treatment plants. Since 2006, those cities have upgraded to secondary treatment.) London, Peel, Sarnia and Kitchener-Waterloo have said that they have at least one tertiary treatment plant or lagoon. Collingwood and Sarnia reported using UV disinfection and Toronto reported that it uses phosphorus removal and effluent disinfection. York Region reported that it uses phosphorus removal and chlorine disinfection and dechlorination.

Table 1: Ranking of cities/regions based on the grade point average calculations

City	Rank	Grade
Peel Region	1st	A-
York & Durham	2nd	B+
Collingwood	3rd	B+
Kitchener-Waterloo	4th	B+
Midland	5th	B
Brockville	6th	B
Sarnia	7th	C+
Sudbury	8th	C
St. Catharines	9th	C
Toronto	10th	C
London	11th	C-
Windsor	12th	C-

Wet-Weather Bypasses and Combined Sewer Overflows (CSOs)

Wet-weather bypasses and CSOs were the most distinguishing issue between the cities surveyed. The grade for these discharges is based on the percentage of the annual sewage flow that is released via bypass and CSO events, as well as the number of times per year these events occur each year. Based on our analysis of available information, it is clear that sewage dumping is still a problem that is unlikely to improve without serious investment, particularly as climate change leads to more frequent storms that overwhelm combined sewers systems. Some municipalities have more frequent sewage dumping incidents and larger amounts of sewage dumped via bypasses and CSOs. It is important to note that cities facing major CSO problems are generally older and larger, and have old combined sewer

Table 2:
Summary of city/region grades for each question

	Weight	St Catharines	York & Durham	Collingwood	Kitchener-Waterloo	Midland	Sudbury	Sarnia	Windsor	Peel	Toronto	London	Brockville
Treatment level	2	N/A	B	C-	B	C	C	B-	C	B	B-	B	C
Wet-weather bypasses	2	N/A	A	A	B	A	C	D	F	B	F	F	B
Wet-weather bypass % of total flow	2	N/A	A	A	A-	A-	D	D	F	A-	D	F	C
CSO event(s)	2	F	N/A	A	N/A	C	N/A	A	D	N/A	F	D	N/A
CSO % of total flow	2	N/A	N/A	A	N/A	A-	N/A	A	D	N/A	D	D	N/A
Up to date sewer-use bylaw	1	D	A	A	D	D	A	C	D	A	A	A	C
Expected compliance with federal regulations	1	A	A	A	X	A	B	X	B	A	B	C	A
Final effluent quality – # of different parameters tested	1	N/A	C	C	C+	B	B	C	A+	A	A	C	C+
Current and future sewage management plans	1	B	B	C	A	C	C	D	B-	B	A	B+	B
Green infrastructure	1	A	N/A	N/A	N/A	C	N/A	C-	A-	N/A	A+	D	N/A
Renewable energy	1	N/A	A	B-	B	B	D	D	C+	B+	B	B	B
Final Grade		C	B+	B+	B+	B	C	C+	C-	A-	C	C-	B

X – did not answer


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systems that become inundated with storm water during wet weather. This causes greater amounts of raw sewage to flow out at CSO outfalls. Surveyed cities with major CSO and bypass problems include Windsor, Toronto and London. We note that London and Windsor do not measure their CSO events and thus do not know the extent of events or volumes. Toronto estimates the number of events, but does not measure the volumes. Midland had five CSO events. St. Catharines had the highest number of CSOs, based on a hydraulic model of the sewer system. However, it was difficult to get a full picture of how bad their sewage management practices are since Niagara Region manages most of their operations and refused to participate in our survey due to time constraints.

Peel Region, Brockville, Sudbury, Kitchener-Waterloo, and York and Durham do not have combined sewers and thus do not have CSO events. These cities were not graded on this question.

For wet-weather bypass volumes, Windsor received an "F" for having a high number of bypasses with volumes reaching 4.4 per cent of their total sewage volume treated. London's bypass volumes reached almost 2.5 per cent of their total sewage volume treated and they also received an "F", followed by Toronto, Sarnia and Sudbury, all with more than 1 per cent of partially treated discharges resulting in grades of "D". Because cities with aging infrastructure and combined sewer systems are more susceptible to CSO events, it is important to note that the degree of wet-weather bypasses are also dependent of the amount of rainfall and wet-weather events in any particular year. However, this is something that municipalities need to manage for by incorporating source control and alternative measures to keep as much stormwater out of the drain as possible.

Of the cities we surveyed in our 2006 report, and which are not included in this analysis, we were able to ascertain from publicly available information that they are still experiencing sewage discharge problems on the same scale as when last assessed. For example, Kingston, with over 20 combined sewer outfalls, publicly reported 16 bypasses in 2011 in the city's combined sewer system with a total volume of 518,411 m^3.[40] In 2011, Hamilton appears to have had 67 CSO events with a total volume of 5,403,914 m^3, as well as 23 bypasses of 1,855,000 m^3.[41]

Sudbury and Kitchener-Waterloo also reported maintenance or malfunction-related bypasses such as power failure during a storm event, partial loss of air supply within a plant or filter maintenance. But we did not factor those events into the grades.

We also included public reporting within this section's grade, allowing each municipality an additional half grade if they indicated that they reported bypass and CSO events to the public in an accessible way and in a timely fashion. No city received this half grade addition. London reports to a Citizens Advisory Committee on a monthly basis but even this does not qualify as accessible public reporting.

Final Effluent Testing and Sewer-Use Bylaws

Windsor and Toronto have the most comprehensive final effluent testing programs, conducting more than 1,000 analyses per year on many parameters and pollutants. In contrast, some cities had minimal testing programs of only a few dozen tests per month, including some with less than 10 different parameters.

With respect to sewer-use bylaws, they were not analyzed for comprehensiveness or content. Instead, the city's grade was based on two factors: did they have a bylaw and how recently had the bylaw been reviewed and updated? London, Toronto, Peel, Sudbury, York and Durham, and Collingwood have recently updated or reviewed their sewer-use bylaws and received top marks on this question.

Current and Future Sewage Management Plans

Some cities have significant capital works underway or are planning significant upgrades. We highlight Toronto's leading efforts and investments to upgrade and replace aging infrastructure and optimize operations at all of their treatment plants. Kitchener-Waterloo also gets top marks for major investments in plant expansions and upgrades.

Green Infrastructure

Green infrastructure (such as trees, vegetation, wetlands, or engineered systems that mimic natural landscapes) offers an innovative and sustainable approach to stormwater management source control by capturing stormwater runoff and retaining it before it reaches the sewer system. This limits the frequency of CSOs and reduces the amount of polluted stormwater runoff entering local water bodies. Green infrastructure measures can be a cost effective means of reducing CSOs, and integrating green infrastructure techniques into traditional sewage management plans is an economically viable option for municipalities struggling with aging infrastructure and CSO problems.

We received a range of replies from cities about their use of green infrastructure to complement their sewage management plans and operations. Top honours go to the city of Toronto for their extensive programs and policies related to green infrastructure, many of them specifically devised to manage stormwater and their CSO problems, and officially set out in bylaws, standards and policies. We note that Toronto was the only city to receive a grade of "A+" and encourage other cities to follow Toronto's lead in establishing programs and policies of comparative calibre.

Other cities indicated some use of green infrastructure, although few provided specifics. London indicated that they have a downspout disconnection program, but they do not believe that green infrastructure makes a noticeable difference in CSOs. If a city does not have any combined sewers, we did not grade them on this question.

Wastewater Systems Effluent Regulations Compliance

Some cities and regions indicated that they already are, or expect to be, in compliance with the new federal regulations. Those cities and regions include Brockville, Peel, Windsor, Sudbury, Midland, Collingwood, York and Durham and St. Catharines. Toronto is striving to meet the new requirements and London has said that their main concern is de-nitrification. London is also considering how to optimize treatment plants. Kitchener-Waterloo and Sarnia did not answer this question.

recommendations

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The recommendations range from reduction targets for CSOs and bypasses to green infrastructure to the need for all levels of government to fund major infrastructure improvements. Further recommendations include the enacting of enforceable, comprehensive legislation and strong regulatory and policy reform.

Regulatory and Policy Reform

The standards set in the new federal regulations require some sewage treatment plants to improve treatment, but does little to prevent sewage dumping through CSOs and bypasses. In Ontario, there are guidelines pertaining to CSOs and bypasses, but no specific regulations or legally binding requirements. Further, despite being a serious pollution source, information from municipalities on CSOs is scarce, as the volume and frequency of CSO events are not routinely measured, estimated or consistently reported. There are CSO reporting requirements in the federal regulations, and Ontario should supplement the federal regulation with strong provincial requirements regarding CSOs and bypasses that set out reporting requirements as well as reduction targets. There should also be a municipal wastewater regulation that exceeds the federal regulation, which is minimal and only regulates a few pollutants at the end-of-pipe that affect fish. Additional monitoring for emerging pollutants of concern and corresponding protection and regulation measures are also needed. Upper levels of government need to provide adequate funding and guidance to help municipalities take the steps necessary to control CSOs and bypasses.

Wastewater Treatment Infrastructure Funding

The release of sewage into the Great Lakes is an enormous problem that is not going to improve unless urgently needed investment is made from all levels of government in sewage infrastructure — including green infrastructure — to improve how we manage our sewage and reduce the amount of stormwater that enters the sewage system and causes CSOs and bypasses. Challenges to providing adequate levels of wastewater treatment in the Great Lakes include ag-

ing facilities and population growth that stresses the capabilities of existing plants and creates the need for more facilities.[42] The escalating costs associated with addressing these challenges are obvious problems for Canadian municipalities. Billions of dollars are needed to mitigate CSOs and stormwater pollution. Both the federal and provincial governments must make available sufficient funds to local governments to ensure proper treatment facilities and sewer infrastructures are built in all Great Lakes communities. In addition, we must encourage the development and the implementation of alternative technologies for sewage treatment that may prove to be more cost effective or efficient than conventional physical-chemical treatment plants.

The federal government estimates roughly 75 per cent of municipalities are already in compliance with the new federal regulations.[43] The Federation of Canadian Municipalities has said it welcomes the new regulations, and called on Ottawa to create a national funding program to pay for the wastewater upgrades.[44]

In its latest budget, the Conservative government provided Canadian cities with funding by renewing an infrastructure deal for a full decade and increasing the amount of money it transfers to municipalities through the federal Gas Tax Fund.[45] The budget commits to indexing the Gas Tax Fund, currently set at $2 billion annually, at two per cent per year starting in fiscal 2014-15, increasing the municipal transfer in increments of $100 million. This is infrastructure funding that could be allocated entirely towards wastewater treatment improvements. A renewed Building Canada Fund — worth $14 billion over 10 years — will replace the existing seven-year deal, worth $8.8 billion, which is set to expire next year. It will give provincial and municipal governments time to plan projects and figure out a way to match the fund-

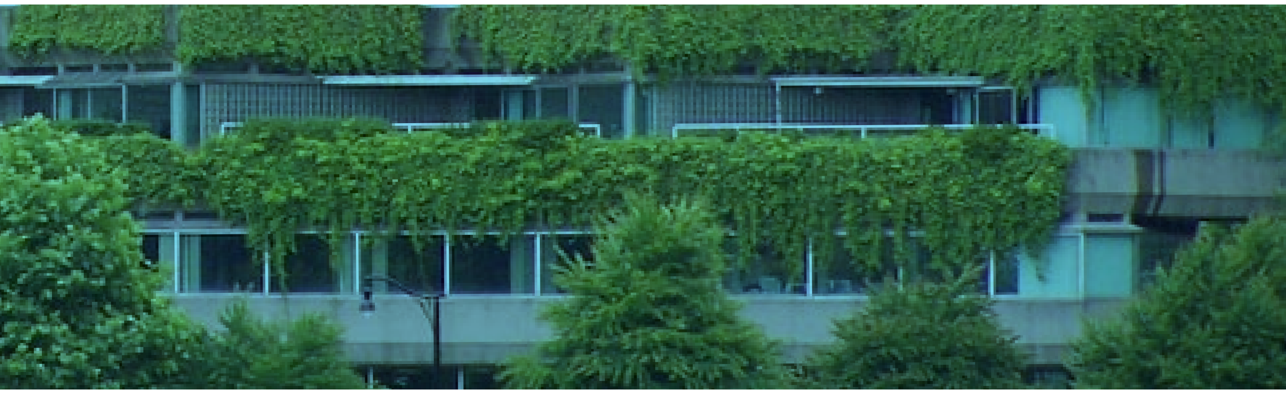
ing. Of the Building Canada Fund's $14 billion, $10 billion will go to a wide range of infrastructure projects of "national, regional and local significance," including wastewater.[46] However, the federal government estimates upgrades associated with the regulations will cost municipalities about $5 billion nationwide. The Federation of Canadian Municipalities estimates the cost will total $20-40 billion.[47]

Municipalities maintain that funding for the new regulations must be added to the federal government's new Long-Term Infrastructure Plan (LTIP) to pay for the once-in-a generation costs of meeting the new requirements.[48] The new costs are above and beyond what municipalities already need to maintain and expand core infrastructure, let alone invest towards source control and green infrastructure. The LTIP is being developed by Infrastructure Canada and will be in place before current federal funding programs expire in 2014.[49]

Municipalities need to prioritize federal funding to wastewater treatment upgrades in order to meet the new federal standards. However, as there are gaps in the new federal standards that fail to address CSOs, additional funding at federal and provincial levels is required to tackle this critical issue. As one example, Ontario should create a fund specifically targeted to reduce the massive amounts of raw and partially treated sewage that are released into the Great Lakes each year. The only new source of funding specific to the Great Lakes in the 2013 Ontario budget is the allocation of $13.5 million over three years to work in partnership with small municipalities to protect the quality and quantity of drinking water supply sources in the Great Lakes.[50]

Green Infrastructure

The use of green infrastructure should be a priority for stormwater and CSO



management programs and policies, and green infrastructure technologies and approaches should be brought into mainstream stormwater management. Green techniques should be incorporated into plans for infrastructure repairs and upgrades and into long-term control plans for managing CSOs. Provincial and local development and planning policies should be revised to prioritize the use of green infrastructure. Local stormwater management policies should be revised to encourage green infrastructure though requirements such as: minimizing and reducing impervious surfaces, maintaining predevelopment runoff volume and infiltration rates, and providing water quality improvements. Further, adequate funding is critical for successful stormwater and CSO management programs. Dedicated funding should be established for stormwater management that rewards green design. To encourage its use, dedicated stormwater funding sources could identify a preference for green infrastructure or establish a funding scale based upon the relative use of green management techniques.

Public Reporting and Community Right to Know

Until the Ministry of the Environment increases transparency and public engagement, Ontarians will know little about the performance of municipal wastewater facilities. Municipalities and sewage treatment system operators should report all releases of inadequately treated sewage to the public as they occur so Ontarians can take steps to ensure that their health and the health of their community are protected from potential exposure to sewage contaminated water. Improving transparency with respect to CSOs and bypasses, along with mandatory timely public reporting of these discharges, will ensure that this issue is given the attention and investment it needs.

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conclusions

The Great Lakes are a treasure trove of biological diversity, with significance to wildlife species and humans. However, sewage treatment in the Great Lakes Basin has undergone little change since our last assessment in 2006. The basic infrastructure and treatment methods are well established and have been so for many years, yet we continue to see massive amounts of raw or partially treated sewage being dumped into our local waterways. The same environmental concerns persist and climate change will likely strain an already imperfect system.

Sewage dumping through CSOs and bypasses, without further mitigation, is expected to increase as climate change causes increased wet weather and storm events in Ontario. In order to mitigate these impacts and adapt to climate change, immediate and adequate investment in sewage infrastructure is needed to improve treatment and increase the capacity of Ontario's sewage systems. Decreasing the frequency and volume of CSO and bypass events must also become a priority. Resources and energy must be invested now in order to conserve and protect the Great Lakes, for present and future generations, before it is too late.

appendix a
city summaries

Brockville [B]

Population serviced by the wastewater treatment plant(s): 21,560.

Percentage sewer system combined (storm and sanitary):
0%. There are no combined sewers, but combined manholes – about 20%. The sanitary and storm sewer remain separate systems as they pass through a shared manhole. In a large rain event, the storm sewer can surcharge and pass over into the sanitary sewer over a dividing wall in the manhole. The only way the sanitary sewer could surcharge over into the storm sewer is if there was a blockage in the sanitary sewer.

Combined sewer outfalls: None.

Receiving water body:
St. Lawrence River.

Sewage sludge disposal:
Landfill and Land Application.

Total sewage volume treated in 2011:
6,852,013 m^3.

Treatment level:
Secondary Treatment (as of July 2012).

Sewage treatment description:
Conventional Activated Sludge.

Number of wet-weather related bypasses (2011): 2 [Note: 0 in 2012].

Wet-weather related bypass volume (2011): 41,726 m^3 [Note: 0 in 2012].

Maintenance / malfunction-related bypasses (2011): 0.

Maintenance / malfunction-related bypass volume (2011): 0.

CSO event(s) (2011): 0.

CSO volume (2011): 0.

Type and frequency of tests conducted on final effluent quality:
Typically:
CBOD – 2/week, TP – 2/week, TSS – 2/week, Total ammonia nitrogen – 1/week, Temperature – grab 1/week & online continuous, pH – grab 1/week & online continuous, E. coli – 1/week, unionized ammonia – 1/week, toxicity – 4/year, Sewer Use bylaw parameters – once/year (for NPRI and trending purposes).

Municipal sewer-use bylaw:
Adopted in 1991 and currently undergoing review and production of an updated version.

Current sewage management projects:
Upgrade to Secondary Treatment was completed July 23, 2012 – Conventional Activated Sludge.

Future plans for sewage management:
Upgrades to Main Pumping Station and twinning the force main. The city also has a 20-year capital work program in place for upgrading equipment and infrastructure.

Use of green infrastructure:
Brockville encourages private industry to implement green infrastructure techniques on their projects.

Sewage energy recovery, heat collection, or use and management of methane gas as a fuel:
The wastewater treatment plant uses methane gas to heat digesters and buildings. Solar panels were installed on new Operation Control Building as part of upgrade and will supplement heating the building.

Public reporting of CSOs and bypasses:
Bypasses are reported immediately to SAC and the MOE. Bypasses are reported to city council through quarterly and annual reports.

Environmental Compliance Approvals Numbers / Certificates of Approval:
WWTP C o A – 5526-7SGL3D.

Expectations for compliance with federal Wastewater Systems Effluent Regulations under the Fisheries Act:
Compliance has been achieved upon completion of Secondary Treatment upgrade on July 23, 2012.

For more information, contact:
Ed Malcomnson, Supervisor – Wastewater Systems, Environmental Services, 613-342-8772 Ext 8301.

Collingwood [B+]

Population serviced by the wastewater treatment plant(s):
Approximately 20,000.

Percentage sewer system combined:
Sanitary and combined is approximately 50 miles of various sizes and materials.

Combined sewer outfalls:
Maybe five. These would be emergency overflow connections from sewage pumping station wet wells to a storm outfall that would allow sewage to flow out should the station not be able to maintain flow in the system. All stations have standby power so the chance of this happening is remote.

Receiving water body:
Collingwood Harbor (situated in Georgian Bay on the south shore of Nottawasaga Bay).

Sewage sludge disposal:
Land applied on licensed agricultural land.

Total sewage volume treated in 2011:
7,220,280 m^3.

Sewage treatment description:
Primary and Secondary. Conventional activated sludge plant, with sludge thickening. Alum (Aluminum Sulfate) addition for phosphorous removal. UV disinfection year round. Sludge stabilization by anaerobic digestion.

Number of wet-weather related bypasses (2011): None.

Wet-weather related bypass volume (2011): 0.

Maintenance / malfunction-related bypasses (2011): None.

Maintenance / malfunction-related bypass volume (2011): 0.

CSO event(s) (2011): 0.

CSO volume (2011): 0.

Type and frequency of tests conducted on final effluent quality:
CBOD5, SS, TP, E-coli, NH3, TKN by accredited lab, pH and temp at time of sampling. Frequency is weekly as per Certificate of Approval. (Daily Monday to Friday in-house for same parameters except E-coli).

Municipal sewer-use bylaw:
Town of Collingwood sewer use bylaw 2009-118.

Current sewage management projects:
EA complete.

Future plans for sewage management:
As per EA as design flow is approached.

Use of green infrastructure:
Did not answer.

Sewage energy recovery, heat collection, or the use and management of methane gas as a fuel:
Methane produced in digestion process used a fuel for boiler.

Public reporting of CSOs and bypasses:
Any bypass would be reported to MOE and SAC as required.

Environmental Compliance Approvals Numbers / Certificates of Approval:
C of A for Wastewater treatment plant is 2639-5TLQB2.

Expectations for compliance with federal Wastewater Systems Effluent Regulations under the Fisheries Act:
Yes.

For more information, contact:
Don Green, Town of Collingwood WWTP, 705 445-1631, dgreen@collus.com.

Kitchener-Waterloo [B+]

Population serviced by the wastewater treatment plant(s):
Region-wide: 509,774.
Kitchener, 226,106; Galt, 82,321;
Waterloo, 126,029 (2010 numbers).

Percentage sewer system combined (storm and sanitary): 0%.

Combined sewer outfalls: 0.

Receiving water body:
Grand River, Nith River, and Speed River.

Sewage sludge disposal:
Currently, anaerobic sludge is dewatered and hauled to landfill. Starting January 2013, the region is moving to a dewatered solid land application program. Aerobic sludge is a liquid land application program.

Total sewage volume treated in 2011:
Total Region: 60,882 ML
(Kitchener: 25,711,650 m^3, Waterloo: 16,622,140 m^3, Galt: 12,895,262 m^3).

Sewage treatment description:
Kitchener: Conventional – Secondary,
Waterloo: Conventional – Secondary,
Galt: Conventional – Tertiary.
All plants within the Region are a minimum of Secondary Plants with most having tertiary treatment.

Number of wet-weather related bypasses (2011):
Kitchener: 1, secondary bypass
Waterloo: 1, partial secondary treatment
Galt: 3, all tertiary.

Wet-weather related bypass volume (2011): Kitchener: 15,700 m^3,
Waterloo: 32,317 m^3, Galt: 4,391 m^3.

Number of maintenance / malfunction-related bypasses (2011):
Not clearly tracked.

Maintenance / malfunction-related bypass volume (2011):
Total: 326,813 m^3. (*Kitchener:* 4,730 m^3 received partial secondary treatment due to power failure during a storm event. 10,350 m^3 did not receive full secondary treatment due to partial loss of air supply within plant 1. *Waterloo:* 9,000 m^3 did not receive full secondary treatment due to power loss. *Galt:* 302,733 m^3 did not receive tertiary treatment due to filter maintenance).

CSO event(s) (2011):
N/A. no combined sewers in the region.

CSO volume (2011):
N/A. no combined sewers in the region.

Type and frequency of tests conducted on final effluent quality:
Kitchener: CBOD, BOD, Suspended Solids, Nitrite-Nitrate, Alkalinity, pH, Chloride, Total Phosphorous, Total Kjeldahl Nitrogen (TKN), Ammonia and E-Coli. *Galt:* CBOD, BOD, Suspended Solids, Nitrite-Nitrate, Alkalinity, pH, Chloride, Total Phosphorous, Filter Phosphorous, TKN, Ammonia and E-Coli. *Waterloo:* CBOD, BOD, Suspended solids, Nitrate-Nitrite, Alkalinity, pH, Total phosphorous, Ammonia, TKN, E-Coli.
All tests are performed on a weekly basis.

Municipal sewer-use bylaw:
Bylaw number 1-90, enacted in 1990. This was amended by bylaw 92-050 in 1992.

Current sewage management projects:
Elmira WWTP: Biosolids dewatering and minor process upgrades. Kitchener WWTP: Plant 2 Aeration and UV disinfection Upgrades. Currently starting into a $300M capital program to upgrade the facility that extends out to 2020. Waterloo WWTP: Headworks, Biosolids dewatering, Aeration Upgrades. Currently halfway through a $100 million capital upgrade at the facility. Preston WWTP: Digester upgrades.

Future Plans for sewage management:
New Hamburg: Plant capacity expansion. Waterloo WWTP: Plant capacity expansion by 2024. Hespeler WWTP: Process upgrades. Small rural WWTPs: Full SCADA upgrades. Centralized Biosolids Heat Drying Facility to be constructed (2018).

Use of green infrastructure:
Did not answer.

Sewage energy recovery, heat collection, or the use and management of methane gas as a fuel:
Digester methane is used to fuel the boilers at Kitchener, Galt and Waterloo. As part of our capital program, co-generation facilities to be incorporated at these treatment plants.

Public reporting of CSOs and bypasses:
Did not answer.

Environmental Compliance Approvals Numbers / Certificates of Approval:
Did not answer.

Expectations for compliance with federal Wastewater Systems Effluent Regulations under the Fisheries Act:
Did not answer.

For more information, contact:
Water Services,
General Contact, 7/F,
150 Frederick Street,
Kitchener, Ontario N2G 4J3,
Phone: 519-575-4426,
TTY: 519-575-4608,
Fax: 519-575-4452.

London [c-]

Population serviced by the wastewater treatment plant(s): 352,395 (2006 Census).

Percentage of city's sewer system combined:
2% (25.474 km combined / 1,255.3 km sanitary). Combined Sewer: sanitary sewer with catch basin(s) directly connected.

Combined sewer outfalls:
42(37 overflow 'influence' outfalls, i.e. storm outfalls with at least one confirmed overflow upstream and five direct sanitary overflow outfalls).

Receiving water body: Thames River.

Sewage sludge disposal:
Incineration. Landfill for incinerator shut downs/repairs and contingency.

Total sewage volume treated in 2011:
84,793 megalitres (ML).

Sewage treatment description:
Secondary: Adelaide Plant, Greenway Plant; Pottersburg Plant, Vauxhall Plant.
Tertiary: Oxford Plant, Southland Plant.

Number of wet-weather related bypasses (2011):
125 (94 raw bypasses and 31 secondary bypasses).

Wet-weather related bypass volume (2011): 2,005 ML (375 ML raw bypasses and 1,630 ML secondary bypasses).

Number of maintenance / malfunction-related bypasses (2011): None.

Maintenance / malfunction-related bypass volume (2011): None.

CSO event(s) (2011):
Not currently measured but the City is trying to find the best method to do this in a cost effective way as part of the Pollution Prevention Control Plan.

CSO volume (2011):
Not currently measured.

Type and frequency of tests conducted on final effluent quality:
BOD 5, Suspended solids,
Total ammonia, Total Phosphorus,
Dissolved Oxygen, E. coli, pH.

Sewer-use bylaw:
First enacted in the 1960s. Waste Discharge bylaw WM-16 – consolidated 2010.

Current sewage management projects:
London has an extensive list of projects; the following are some examples. The Infrastructure Lifecycle Renewal Program is an annual program intended to maintain the life of London's infrastructure at an acceptable performance level. Typically, about 10 Capital Works Projects are awarded each year and include projects such as water main and sewer replacement/ repairs. The Greenway Pollution Control Centre is undergoing upgrades and expansion to include wet weather control and treatment as well as dewatering

capacity upgrades. Finally, the Pollution Prevention and Control Plan will be a multi-year project designed to provide a long term solution for CSOs and bypasses in an effort to meet system wide conformance with MOE Procedure F-5-5 and mitigate impacts to the Thames River.

Future plans for sewage management:
The Thames Clear Water Revival is finally underway since work began in 2008.

Use of green infrastructure:
In London's opinion and experience, green infrastructure does not make a noticeable difference in CSOs. London's CSO situation is exacerbated by homes that were constructed prior to 1985 with weeping tiles and foundation drains that are connected to the sanitary private drain connections and therefore the sanitary sewer system. This is the major cause of CSOs and basement floodings. The latest strategy to mitigate this is an inflow and infiltration reduction strategy that includes targeted, mandatory foundation drain disconnections for homes located in areas prone to basement flooding.

Sewage energy recovery, heat collection, or the use and management of methane gas as a fuel:
Methane recovery is done at London's landfill, and the city is working on improvements to biosolids management and some potential for electricity through waste heat recovery.

Public reporting of CSOs and bypasses:
Plant and pumping station bypasses are reported to MOE, as required, and to a citizen's advisory committee, the Advisory Committee of the Environment, on a monthly basis.

Environmental Compliance Approvals Numbers / Certificates of Approval:
C of A #s: 5270-6CKJ92; 2300-8JJHXH; 3434-7J6HHY; 7562-8N2MM7; 7972-86BHVK; 3-0214-99-006.

Expectations for compliance with federal Wastewater Systems Effluent Regulations under the Fisheries Act:
As per discussions with the Canadian Council of Ministers of the Environment, the city's main concern is de-nitrification, and they are considering how to optimize treatment plants via: *Federation of Canadian Municipalities. National Guide to Sustainable Municipal Infrastructure. Wastewater Treatment Plant Optimization. November 2003.*

For more information, contact:
Tom Copeland, P.Eng. Division Manager, Wastewater and Drainage Engineering, City of London, 519-661-2500, x4662.

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Midland [B]

Percentage of population serviced by the wastewater treatment plant(s): 16,500.

Percentage of city's sewer system combined: 7.2%.

Combined sewer outfalls: 2.

Receiving water body: Georgian Bay.

Sewage sludge disposal: Farmland.

Total sewage volume treated in 2011: 3,337,074 m^3.

Sewage treatment description:
Secondary. The Conventional Activated Sludge Plant was built in 1965 as a Primary plant. In 1980, the plant expanded adding Secondary treatment. In 1995, it expanded to its current capacity of 15,665 m^3 per day.

Number of wet-weather related bypasses (2011): 0.

Wet-weather related bypass volume in 2011: 0.

Number of maintenance / malfunction-related bypasses (2011): 0.

Maintenance / malfunction-related bypass volume (2011): 0.

CSO event(s) (2011): 5.

CSO volume (2011): 1200 m^3.

Type and frequency of tests conducted on final effluent quality: BOD, Temperature, TSS, pH, TP, Conductivity, ECOLI, Total Chlorine Residual, Total Ammonia & Ammonia Nitrogen. All conducted weekly except Total Chlorine Residual which is daily.

Municipal sewer-use bylaw:
Enacted in 1994.

Current sewage management projects:
Bay St – Twin sewage force main project to reduce bypasses at chamber B.

Future Plans for sewage management:
Did not answer.

Use of green infrastructure: Yes.

Sewage energy recovery, heat collection, or the use and management of methane gas as a fuel:
All buildings on site heated with methane and ESD heating.

Public reporting of CSOs and bypasses:
Monthly to MOE.

Environmental Compliance Approvals Numbers / Certificates of Approval:
5708 – 7UZK93 – Amended C of A.

Expectations for compliance with federal Wastewater Systems Effluent Regulations under the Fisheries Act:
Yes, we are well below their limits now.

For more information, contact:
Patrick LeClair, pleclair@midland.ca.

Region of Peel [A-]

Population serviced by the wastewater treatment plant(s): 1,296,814.

Percentage sewer system combined (storm and sanitary): 0%.

Combined sewer outfalls: 0.

Receiving water:
Lake Ontario (G.E. Booth & Clarkson WWTPs) and Credit River (Inglewood Communal Plant).

Sewage sludge disposal:
Hot Wind Box Fluidized Incineration.

Total sewage volume treated in 2011:
G.E Booth WWTP: 161405.61 x1000 m^3
Clarkson WWTP: 58492.56 x1000 m^3
Inglewood Communal Plant: 33567.68 m^3.

Sewage treatment description:
G.E. Booth WWTP: Secondary,
Clarkson WWTP: Secondary,
Inglewood WWTP: Tertiary.

Number of wet-weather related bypasses (2011):
G.E. Booth WWTP: 2; Clarkson WWTP: 0; Inglewood WWTP: 0.

Wet-weather related bypass volume in 2011: 57.7 x1000 m^3.

Maintenance / malfunction-related bypasses (2011): 0.

Maintenance / malfunction-related bypass volume (2011): 0.

CSO event(s) (2011): 0.

CSO volume (2011): 0.

Type and frequency of tests conducted on final effluent quality:
G.E.Booth and Clarkson WWTPs:
Total Ammonia Nitrogen – Weekly, CBOD – Daily, TKN – Weekly, Total Phosphorus – Daily, TSS – Daily, Nitrite – Weekly, Nitrate – Weekly, pH – Daily, E.Coli – Weekly, Unionized Ammonia (calculated analysis) – Weekly, Temperature – Daily, Residual Bisulphite – Continuous, Residual Chlorine – Continuous
Inglewood WWTP:
Total Ammonia Nitrogen - 3x per week, CBOD – Weekly, Total Phosphorus - 3x per week, TSS – Weekly, pH - 3x per week, E. coli – Weekly, Temperature - 3x per week.

Municipal sewer-use bylaw:
Revised bylaw was enacted in 2010.

Current sewage management projects:
Expansion of the Clarkson WWTP, demolition of older buildings/equipment at G.E. Booth WWTP to improve safety & efficiency, and completion of Mercury Reduction System at G.E Booth WWTP (incineration).

Future plans for sewage management:
Clarkson Generator project and upgrades to the Inglewood WWTP.

Use of green infrastructure:

N/A. We do not have CSOs.

Sewage energy recovery, heat collection, or the use and management of methane gas as a fuel:
Digester gas recovery is used as fuel for hot water boiler and the cogeneration unit. Incineration heat recovery: heat exchanger pre-heats fluidizing air. Combustion process is autogenous – no supplementary fuel is required.

Public reporting of CSOs and bypasses:
MOE Spills Action Centre and Peel Public Health are immediately notified of bypasses or spills.

Environmental Compliance Approvals Numbers / Certificates of Approval:
Sewage works CofAs: 3202-8KFNHJ, 1043-7QNR8L, 7646-5PJKVE.

Expectations for compliance with federal Wastewater Systems Effluent Regulations under the Fisheries Act:
Yes, our facilities will comply.

For more information, contact:
Cindy Kambeitz,
(905) 274-9616 ext. 135.

Sarnia [c+]

Population serviced by the wastewater treatment plant(s): 72,000 (5,800 of this is Bright's Grove).

Percentage sewer system combined (storm and sanitary): 4%.

Combined sewer outfalls:
3 (Ferry Dock Hill, Rainbow Park, WPCC).

Receiving water body:
Sarnia – St. Clair River
Bright's Grove – Cow Creek to Lake Huron.

Sewage sludge disposal:
City of Sarnia WPCC sludge is processed into a soil amendment (N-Rich©) and is sold under the product label as regulated by The Canadian Food Inspection Agency (CFIA) under *The Fertilizer Act.* All Sarnia N-Rich© sold in 2011 was used as a soil amendment for agriculture purposes.

Total sewage volume treated in 2011:
Sarnia: 10403.825 10^3m^3
Bright's Grove: 647.462 10^3m^3.

Sewage treatment description:
Sarnia WPCC: Secondary. Treatment consists of screening, aerated grit removal, primary settling followed by biological treatment, secondary settling and UV disinfection with lime stabilization (Nviro) sludge treatment.
Bright's Grove Lagoons: Facultative Lagoons with New Hamburg Tertiary Sand Filters.

Number of wet-weather related bypasses (2011):
Partially treated 28 Secondary Bypass – Primary and U.V. treated. Untreated effluent out of the 28 – 6 were total Plant Bypass – no treatment.

Wet-weather related bypass volume (2011):
Secondary: 130.080 10^3m^3
Total: 12.791 10^3m^3.

Number of maintenance / malfunction-related bypasses (2011): 0.

Maintenance / malfunction-related bypass volume (2011): 0.

CSO event(s) (2011): 0.

CSO volume (2011): 0.

Type and frequency of tests conducted on final effluent quality:
$CBOD^5$, Total Suspended Solids, Total Phosphorus, Total Ammonia Nitrogen, Dissolved Oxygen, E. coli, PH, Temperature, and Unionized Ammonia are analyzed weekly.

Municipal sewer-use bylaw:
Enacted in 1993. Working on an update of the sewer use bylaw for 2013.

Current sewage management projects:
Sewer Master Plan.
EA of Bright's Grove Lagoons scheduled to be completed by 2013.

Future plans for sewage management:
None.

Use of green infrastructure:
Sarnia's newest subdivision has been designed with an E-Filtration Trench System to control storm water runoff.

Sewage energy recovery, heat collection, or the use and management of methane gas as a fuel in your city:
None.

Public reporting of CSOs and bypasses:
At the time of bypasses, they are reported to SAC (Spills Action Centre), Sarnia MOE and Lambton Health Unit.

Environmental Compliance Approvals Numbers / Certificates of Approval:
WPCC:
C of A – 0741-8JQP9P,
C of A – 2261-4NBQC4,
C of A – 8-1191-99-006
Bright's Grove Lagoons:
C of A – 5099-84WKY4
CSO Facility:
C of A – 6529-86RQAH.

Expectations for compliance with federal Wastewater Systems Effluent Regulations under the Fisheries Act:
Did not answer.

For more information, contact:
Bryan Prouse, Operations Manager.

St. Catharines [c]

Population serviced by the wastewater treatment plant(s): 130,000.

Percentage sewer system combined (storm and sanitary): Approximately 15%.

Combined sewer outfalls: 68.

Receiving water body: Lake Ontario.

Sewage sludge disposal:
N/A. Niagara Region owns and operates wastewater treatment facilities.

Total sewage volume treated in 2011:
N/A. Niagara Region owns and operates wastewater treatment facilities.

Sewage treatment description:
N/A. Niagara Region owns and operates wastewater treatment facilities.

Number of wet-weather related bypasses (2011):
N/A. Niagara Region owns and operates wastewater treatment facilities.

Wet-weather related bypass volume (2011):
N/A. Niagara Region owns and operates wastewater treatment facilities.

Maintenance / malfunction-related bypasses (2011):
N/A. Niagara Region owns and operates wastewater treatment facilities.

Maintenance / malfunction-related bypass volume (2011):
N/A. Niagara Region owns and operates wastewater treatment facilities.

CSO event(s) (2011):
There were an estimated 47 storm events where at least one CSO outfall was active. (Note: the number of storm events is not tracked in real-time; the City uses a hydraulic model of the sewer system to estimate the frequency of overflows.) In 2012, there were an estimated 22 events.

CSO volume (2011): 134,724 m^3 (based on model simulation for the F-5-5 Reporting Period Apr–Nov). [In 2012, the volume was 108,173 m^3).

Type and frequency of tests conducted on final effluent quality:
N/A. Niagara Region owns and operates wastewater treatment facilities.

Municipal sewer-use bylaw:
Bylaw 91-364.

Current sewage management projects:
The Rain Barrel Program offers subsidized rain barrels during an annual sale. The Flood Alleviation Program (FLAP) offers funding to a number of homes that are then required to remove foundation drain connections from the sanitary sewer lateral of the home and redirect them to a sump pump, and disconnect their downspouts as per City of St. Catharines bylaw 91-364. The city owns and operates eight combined sewage storage facilities

that alleviate overflows during wet weather events, and conducts routine inspections of combined sewers. The city also continued the Westchester and Old Welland Canal CSO Catchment Study and Update to the Environmental Assessment to address discharges from a CSO outfall. In 2012, 1,573 m^3 of storm separation projects were completed by the City.

Future plans for sewage management:
The city will continue with the Rain Barrel and Flood Alleviation Programs, and undertake Pollution Control Studies. Specifically, the *Merritton Master Plan and Class Environmental Assessment* will assess CSO outfalls in the catchment area and look at alternatives to address these flows. For 2013, 1,486 m^3 of storm sewer separation projects are planned.

Use of green infrastructure:
The Lake Street Service Centre Permeable Parking Surface Pilot Project installed permeable asphalt, concrete and interlocking brick, to measure water quality improvement and operational / maintenance costs over time. The Carlisle St. Parking Garage features rooftop gardens, as well as grey water collection for garden maintenance and waste transport in the washrooms. The Kiwanis Aquatics Centre and St. Catharines Public Library – Grantham Branch will feature similar water collection systems. In 2008, the city constructed the Pelham/Louth Stormwater Retention Wetland (retention volume 2,242 m^3) to provide additional stormwater handling capacity to reduce surface flooding and treat stormwater prior to discharging into 12 Mile Creek. In 2011, Council approved the Urban Forest Management Plan, an objective of which is to increase total tree canopy cover.

Sewage energy recovery, heat collection, or the use and management of methane gas as a fuel:
N/A. Niagara Region owns and operates wastewater treatment facilities.

Public reporting of CSOs and bypasses:
No.

Environmental Compliance Approvals Numbers / Certificates of Approval:
N/A. Niagara Region owns and operates wastewater treatment facilities.

Expectations for compliance with federal Wastewater Systems Effluent Regulations under the Fisheries Act:
The city is expected to comply with all applicable requirements of the Wastewater Systems Effluent Regulations.

For more information, contact:
Mark Green, Manager of Environmental Services, City of St. Catharines, 905-688-5601 x 2193, mgreen@stcatharines.ca.

Sudbury [c]

Population serviced by the wastewater treatment plant(s):
143,277 (2011 Census for water users).

Percentage sewer system combined (storm and sanitary): Unknown.

Combined sewer outfalls: 0.

Receiving water body: Georgian Bay.

Sewage sludge disposal: Mixed with mine tailings and land filled at tailings site.

Total sewage volume treated in 2011:
Azilda WWTP - 604,680 m^3
Chelmsford WWTP – 1,419,180 m^3
Lively WWTP – 374,090 m^3
Coniston WWTP – 358,114 m^3
Sudbury WWTP – 21,245,600 m^3
Dowling WWTP – 673,610 m^3
Valley East WWTP – 1,798,670 m^3
Falconbridge WWTP – 96,270 m^3
Walden WWTP – 814,900 m^3
Levack WWTP – 291,660 m^3

Sewage treatment description:
Secondary.

Number of wet-weather related bypasses (2011): 6.

Wet-weather related bypass volume (2011): 318,258 m^3 (primary bypasses).

Number of maintenance / malfunction-related bypasses (2011): 10.

Maintenance / malfunction-related bypass volume (2011):
122.5 m^3 (sanitary sewer overflows).

CSO event(s) (2011): 0.

CSO volume (2011): 0.

Type and frequency of tests conducted on final effluent quality:
BOD_5, $CBOD_5$, Suspended Solids, Total Phosphorous, Total Ammonium, Total Kjeldahl Nitrogen, Nitrate, Nitrite, pH, Alkalinity, E. Coli. By plant C of A, weekly to monthly, dependant on WWTP.

Municipal sewer-use bylaw:
Bylaw 2010-188 was enacted in 2010.

Current sewage management projects:
Sudbury Plant Head House Upgrade. Biosolids. Several Lift Station Upgrades.

Future plans for sewage management:
Various plant and lift station upgrades as required.

Use of green infrastructure:
None.

Sewage energy recovery, heat collection, or the use and management of methane gas as a fuel:
None.

Public reporting of CSOs and bypasses:
Bypasses immediately reported to MOE SAC, local MOE office & local Health Unit.

Environmental Compliance Approvals Numbers / Certificates of Approval:
Azilda WWTP – 8852-7W6J93
Chelmsford WWTP – 4370-7QPMGZ
Lively WWTP – 6339-7W6JAJ
Coniston WWTP – 3-0215-86-007
Sudbury WWTP – 8970-8J3R79
Dowling WWTP – 3-0897-98-006
Valley East WWTP – 5864-7E5RLV
Falconbridge WWTP – N/A
Walden WWTP – 5318-7W6J9Y
Levack WWTP – 6279-5KKLQA.

Expectations for compliance with federal Wastewater Systems Effluent Regulations under the Fisheries Act:
Yes, by December 2013.

For more information, contact:
Waste Water Plants Supervisor,
705-675-2622 Ext. 250.

Toronto [c]

Population serviced by the wastewater treatment plant(s): 2.7 million (in 2013).

Percentage sewer system combined (storm and sanitary): 15% (based on sewer length), 25% (based on sewer shed area), 25% of city serviced by combined sewers.

Combined sewer outfalls: 80.

Receiving water body:
97% Lake Ontario; 3% Don River.

Sewage sludge disposal:
Wet Tonnes:
Agricultural land application: 48,290;
Soil Amendment: 3,167;
Pelletization: 45,722; Landfill: 32,034;
Incineration: 38,825.

Total sewage volume treated in 2011:
Ashbridges Bay Treatment Plant (ABTP): 227,355 ML; Humber Treatment Plant (HTP): 137,971 ML; Highland Creek Treatment Plant (HCTP): 62,753 ML; North Toronto Treatment Plant (NTTP): 11,037 ML.

Sewage treatment description:
Secondary treatment. Major treatment processes include screening and grit removal, primary treatment, secondary treatment, chemical addition for phosphorus removal, and effluent disinfection.

Number of wet-weather related bypasses (2011): ABTP - 15 events; HTP - 48 events.

Wet-weather related bypass volume (2011): No total plant bypasses. The events noted above are secondary treatment bypasses (discharges of disinfected primary treatment effluent) of 4,650 ML for ABTP and 1,138 ML at HTP.

Maintenance / malfunction-related bypasses (2011): 0.

Maintenance / malfunction-related bypass volume (2011): 0.

CSO event(s) (2011):
Toronto does not monitor CSO events. Between April and October of a typical year, there would be about 42 CSO events of varying degrees in the Don River and Central Waterfront watershed, depending on weather conditions (e.g. rainfall events).

CSO volume (2011): Unknown.

Type and frequency of tests conducted on final effluent quality: Final effluent undergoes about 1,800 analyses/yr at ABTP, HTP and HCTP: Daily: Total Suspended Solids, Carbonaceous Biochemical Oxygen Demand, Total Phosphorus, Orthophosphate, Residual chlorine, pH. Weekly: Ammonia, Total Kjeldahl Nitrogen, Nitrate, Nitrite, E. Coli. Monthly: Metals (arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel & zinc). NTTP has reduced frequency of analysis (parameters shown as "daily' are done weekly, except Total Phosphorus which is analyzed 3x/week).

Municipal sewer use bylaw:
Toronto's Sewers bylaw — bylaw 467-2000, found in Chapter 681 of the Municipal Code — was enacted on July 6, 2000.

Current sewage management projects:
Significant capital upgrades at all plants to replace and upgrade aging infrastructure. Optimization projects underway to make plant operations more reliable, reduce energy usage, and optimize chemical usage. A few CSO storage / treatment facilities have been built to reduce CSO frequency and volume. EA studies completed or underway to address remaining outfalls. e.g., 2007 Class EA in Coatsworth Cut sewershed recommended new underground storage tanks and sewer upgrades (completed), and a constructed wetland south of the ABTP (to be completed).

Future plans for sewage management:
Class EA completed in 2012 for Don River and Central Waterfront Project to address CSOs and stormwater discharges from 50 combined sewer outfalls along lower Don River, Taylor Massey Creek and the Inner Harbour. Recommended solutions include three integrated tunnels, linked to equivalent of 15 underground storage shafts, offline storage tanks at remote outfall locations, and a new high-rate wet weather flow treatment facility. Preliminary design to commence 2013. Completion of two Class EAs to address CSO discharges to Humber River and Black Creek expected in 2014.

Use of green infrastructure:
Many programs (see city websites). Downspout Disconnection bylaw adopted in 2007 and being phased in across the city. The Wet Weather Flow Management Policy provides direction to manage flows on a watershed basis. Policies are incorporated in the Toronto Green Standard, with performance measures to minimize stormwater leaving a site, including green roofs, rainwater harvesting, permeable pavers, and greening of impervious areas. 2009 Green Roof Bylaw makes Toronto the first North American city to require green roofs on new development.

Sewage energy recovery, heat collection, or the use and management of methane gas as a fuel:
Digester gas is used where possible in plant boilers to produce heat for use by in-plant processes. Capital works underway to make operational existing co-generation facilities at HTP. Cogeneration facilities at ABTP are being planned by Toronto Hydro.

Public reporting of CSOs and bypasses:
Not currently reported.
(Secondary treatment bypasses reported annually as part of Wastewater Treatment Plant Annual Reports.)

Environmental Compliance Approvals Numbers / Certificates of Approval:
ABTP: 8319-7TTR62. HTP: 4927-733KWH.
HCTP: 0158-88NJ35. NTTP: 7665-7NWMH2.

Expectations for compliance with federal Wastewater Systems Effluent Regulations under the Fisheries Act:
Working to meet new requirements, with initiatives related to new monitoring reports, additional testing of plant effluents, identification of CSO locations and volumes, and dechlorination of wastewater plant effluents.

For more information, contact:
Toronto 311. Dial 3-1-1 or visit the City of Toronto's website at www.toronto.ca/water.

Windsor [c-]

Percentage of population serviced by the wastewater treatment plant(s): 268,349 (City of Windsor, 216,473; Town of LaSalle, 27,652; Town of Tecumseh, 24,224).

Percentage sewer system combined (storm and sanitary): 13%.

Combined sewer outfalls: 26.

Receiving water body:
Lou Romano Water Reclamation Plant: Detroit River.
Little River Pollution Control Plant: Little River.

Sewage sludge disposal:
Heat dry, pelletize, land application.

Total sewage volume treated in 2011:
86,171.5 ML (Lou Romano Water Reclamation Plant: 67,180.7 ML. Little River Pollution Control Plant: 18,990.8 ML).

Sewage treatment description:
Secondary for both plants.

Number of wet-weather related bypasses (2011): Lou Romano Water Reclamation Plant: 53 events (received primary treatment & disinfection). Little River Pollution Control Plant: 49 events (received disinfection).

Wet-weather related bypass volume (2011): Lou Romano Water Reclamation Plant: 1,672 ML. Little River Pollution Control Plant: 2,113 ML.

Number of maintenance / malfunction-related bypasses (2011): 0

Maintenance / malfunction-related bypass volume (2011): 0.

CSO event(s) (2011): Unknown.

CSO volume (2011): Unknown.

Type and frequency of tests conducted on final effluent quality:
For each wastewater treatment plant: pH – daily, Total Suspended Solids – daily, Total Solids – monthly, Total Phosphorous – daily, Soluble Phosphorous – 3 times a week, BOD_5 – 20 samples a month, Alkalinity – weekly, Ammonia – 3 times a week, Total Kjeldahl Nitrogen – three times a week, Nitrate/Nitrite – three times a week, Mercury – monthly, Metals (Al, Cd, Cr, Co, Cu, Pb, Mo, Ni, Zn, Sb, As, Se, Ba, Be, B, Ca, Li, Mg, Mn, K, Ag, Na, Sr, Tl, V, Fe) – monthly, E. Coli – weekly.
Lou Romano Water Reclamation Plant: Toxicity – Daphnia Magna & Rainbow Trout – Monthly, Hexachlorobenzene, aldrin, dieldrin, chlordane, PCB, lindane, benzo(a)pyrene – quarterly.

Municipal sewer-use bylaw: Yes, 2002.

Current sewage management projects:
CSO Retention Treatment Basin performance evaluation and optimization; Energy management projects; Compressive citywide collection system flow monitoring; Comprehensive citywide precipitation data collection; Basement flooding mitigation.

Future plans for sewage management:
Riverfront trunk sewer CSO treatment/control west of CMH Woods Pumping Station. Wastewater/stormwater master plan.

Use of green infrastructure:
Green roofs, bioswales, exploring pervious pavements / rain gardens, rain barrel program, downspout disconnect program, dry and wet stormwater management ponds and natural garden planting.

Sewage energy recovery, heat collection, or the use and management of methane gas as a fuel:
Biogas projects are presently in the capital budget planning stages.

Public reporting of CSOs and bypasses:
Yes, in real time and in monthly reports to the MOE. Bypasses are reported to: MOE Spills Action Centre, MOE Local Office, Windsor Essex Medical Officer of Health, OCWA Amherstburg Water Treatment Plant.

Environmental Compliance Approvals Numbers / Certificates of Approval:
Lou Romano Water Reclamation Plant 3658-83ZPP8; Little River Pollution Control Plant 8532-8JBLBT; CSO RTB 3730-85LRWM.

Expectations for compliance with federal Wastewater Systems Effluent Regulations under the Fisheries Act:
Ability to comply is expected.

For more information, contact:
Paul Drca, Manager Environmental Quality, City of Windsor, 519-253-7217.

York & Durham Regions [B+]

Percentage of population serviced by the wastewater treatment plant(s): Nearly 1 million within York and Durham Regions' service areas.

Percentage sewer system combined (storm and sanitary): 0% for York and Durham.

Combined sewer outfalls: 0.

Receiving water body: Lake Ontario.

Sewage sludge disposal: Sewage sludge is dewatered and incinerated and the ash is shipped to a manufacturer and used to produce cement.

(Note: information provided only for Duffin Creek Water Pollution Control Plant, the largest Great Lakes based plant owned by York and Durham Regions.)

Total sewage volume treated in 2011: 123,041,802 m^3.

Treatment level: Primary and secondary. The secondary treatment process at Duffin Creek includes nitrification/dentrification and biological nutrient removal.

Sewage treatment description: The Duffin Creek plant is a Class 4 conventional activated sludge process to treat the wastewater. This process includes: mechanical screening, grit removal, primary sedimentation, aerated bioreactor, secondary clarification - nitrification/ denitification, disinfection (chlorination), dechlorination, and phosphorus removal.

Number of wet-weather related bypasses (2011): N/A. There is no mechanism for bypassing untreated wastewater at the Duffin Creek WPCP.

Wet-weather related bypass volume (2011): N/A. There is no mechanism for bypassing untreated wastewater at the Duffin Creek WPCP.

Maintenance / malfunction-related bypasses (2011): N/A. There is no mechanism for bypassing untreated wastewater at the Duffin Creek WPCP.

Maintenance / malfunction-related bypass volume (2011): N/A. There is no mechanism for bypassing untreated wastewater at the Duffin Creek WPCP.

CSO event(s) (2011): N/A. There is no mechanism for bypassing untreated wastewater at the Duffin Creek WPCP and there are no combined sewers in the York Durham Sewage System service area.

CSO volume (2011): N/A. There is no mechanism for by-passing untreated wastewater at the Duffin Creek WPCP and there are no combined sewers in the York Durham Sewage System service area.

Type and frequency of tests conducted on final effluent quality:
The analysis meets the regulatory requirements set by the MOE: $CBOD_5$, Total Suspended Solids, Total Phosphorus, Total Ammonia Nitrogen, Un-ionized Ammonia, Total Chlorine Residual, E. coli, and pH. All are tested weekly.

Municipal sewer-use bylaw:
In 2011, York Region updated their bylaw to sewer use bylaw No. 2011-56, which was amended and strengthened in 2012. Durham Region is currently updating its bylaw No. 43-2004.

Current sewage management projects:
Undertakings to update and improve plant treatment processes include: Stage 3 biosolids process expansion (biosolids dewatering and incineration, heat recovery systems and ash dewatering); Stage 3 influent pumping station; Stages 1 and 2 new electrical substation, new preliminary treatment facility, new disinfection facility, and upgrades and refurbishment to existing liquids process.

Future plans for sewage management:
Currently undertaking an environmental assessment to address future capacity of the existing outfall in Lake Ontario.

Use of green infrastructure:
York Region has an inflow and infiltration reduction program which has identified areas in the collection system with high wet weather flows and has implemented programs to identify and reduce the volume of inflow and infiltration into the sewer system. Durham Region has planned inflow and infiltration control works to reduce basement flooding in the Ajax and Pickering service areas.

Sewage energy recovery, heat collection, or use and management of methane gas as a fuel: All the digester gas (methane) generated from the Duffin Creek plant is used to heat the anaerobic digestion process. The biosolid disposal process utilizes a full waste heat recovery system.

Public reporting of CSOs and bypasses:
N/A.

Environmental Compliance Approvals Numbers / Certificates of Approval:
Environmental Compliance Approval No: 0823-6Z9LF7, Wastewater Treatment Facility Certificate of Classification No: 9 (Class 4), Trunk Wastewater Collection Facility Certificate of Classification No: 3676 (Class 1).

Expectations for compliance with federal Wastewater Systems Effluent Regulations under the Fisheries Act:
The Duffin Creek plant is designed and operated to produce effluent that exceeds the current regulated requirements.

For more information, contact:
John Presta, P. Eng.,
Director, Environmental Services,
905-668-7711, ext. 3520,
John.presta@durham.ca.

appendix b: grading methodology

The following section describes how each question was graded and how the final grades were determined. The same methodology was used for each city in the report card. We used the same methodology as was used for the 2006 report for the questions that were asked then, and developed similar methodology for new questions that were not asked in 2006.

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
4	3.7	3.3	3	2.7	2.3	2	1.7	1.3	1	0.3	0

APPROACH

The methodology design was based on the following considerations:

Inter-city Comparison: The cities are compared with each other. Those featuring the best practices amongst the group receive higher grades than cities that have inadequate practices.

Ideal Standards: An "A" grade is assigned to the ideal standard or best practice for each question.

Grade: The grade is assigned (Ranging from A to F) according to the methodology established for each question as described below.

Weight: Each question was assigned a weight reflecting the importance of that particular indicator. Greater weight was given to questions that directly relate to surface water quality, such as the level of sewage treatment provided or the quantity or volume of combined sewer overflows or bypasses. For example, the total volume of combined sewer overflows as a percentage of the total sewage has a higher weight than the response regarding final effluent testing because it is considered to be one of the most critical indicators affecting the water quality of the Great Lakes.

Overall Grade Calculation: The grade and weighting factor were multiplied for each question, and the results summed and averaged to get the overall city grade (similar to a grade point average calculation). The overall grade was calculated by taking the weight for each question and multiplying it by the grade point equivalent to the letter grade received. The overall grade was determined by converting the grade point average back into a letter grade using the following conversion between grade point average and letter grade.

INDICATORS

The following questions were graded as follows:

Frequency (Overflow events per year)	Grade
0	A
<5	B
5-10	C
10-20	D
Does not monitor overflow events	D
>20	F
Reports CSOs publicly	Increase grade by +

Overflow Volume as Percentage of Total Flow	Grade
0	A
<0.5%	A-
<1%	B
<2%	C
<5%	D
>5%	F
Reports bypasses publicly	Increase grade by +

Weight 2 Questions (more important determinant of water quality):

Combined Sewage Overflow Frequency. A high overflow frequency indicates that the system capacity cannot meet the flow demand on a more frequent basis. A greater frequency of overflows also results in more frequent impacts on the receiving environment. An "A" is best and indicates no overflows. A city that does not monitor overflow events received a D, and a city with no combined sewers would not be graded on this question. We also included public reporting of CSOs in this section. Cities would get a half grade higher if report CSOs directly to the public, and not just to government offices or local health units.

Combined Sewage Overflow Volume. Calculated as percentage of total sewage volume treated. An "A" indicates zero CSO volume as a percentage of total flow.

Wet-weather Related Bypass Frequency. Similarly, a high bypass frequency indicates that the system capacity cannot meet the flow demand on a more frequent basis. A greater frequency of bypasses also results in more frequent impacts on the receiving environment. An "A" is best and indicates no bypasses. We also included public reporting of bypasses in this section. Cities would get a half grade higher if they reported bypasses directly to the public, and not just to government offices or local health units.

Wet-weather related bypass volume. Calculated as percentage of total sewage volume treated. An "A" indicates zero bypass volume as a percentage of total flow. Partially treated bypasses were taken into account.

Sewage Treatment Type. With the resources available to North American cities, and considering the effects of pollution that still exists in effluent after secondary treatment, for the purposes of this report, secondary treatment is considered to be merely satisfactory. Tertiary treatment that includes additional BOD and SS removal is considered to be the ideal level of treatment. In addition, the grade was increased if the city reported to use non-chlorine based disinfection such as UV, dechlorination of final effluent and/or the removal of nutrients such as phosphorus.

Frequency (Bypass events per year)	Grade
0	A
<5	B
5-10	C
10-20	D
>20	F

Bypass Volume as Percentage of Total Flow	Grade
0	A
< 0.1%	A-
< 0.5%	B
>0.5%	C
>1% partially treated	D
>1% raw	D-
>2%	F

Treatment	Grade
Tertiary	A
Advanced Secondary to Secondary	B to C
Primary	F

Sewer-use bylaw	Grade
City has a recently updated sewer-use bylaw	A
Yes, but not updated in last 5 years	B
Yes, but not updated in last 10 years	C
Yes, but not updated in last 15 years	D
Yes, but not recently updated but under review	C
City does not have a sewer-use bylaw	F

Weight 1 Questions (less important determinant of water quality):

Final Effluent Testing. The key factors with respect to final effluent testing are the frequency of testing and the number of different parameters tested. Cities that received high grades tested many different parameters on a more frequent basis than those that received lesser grades. The grade range reflects minimal to comprehensive testing in terms of the number of different parameters tested and frequency of testing (F to A).

Sewer-use bylaws. We did not analyze the bylaws themselves. A city was graded on how recently their bylaw had been reviewed and/or updated. Sewer-use bylaws or ordinances control the discharge of toxic substances into sewer systems and a city that has recently reviewed its bylaw is more likely to have a comprehensive bylaw that sets standards for emerging toxic pollutants.

Expectations for compliance with federal Wastewater Systems Effluent Regulations under the Fisheries Act. A municipality that is already in compliance or expects to fully comply would receive an A, those that do not, and have no plans to mitigate the situation, would receive an F, and those who expect to comply with some improvements would receive somewhere in between, depending on the amount of work needed to be done and timelines.

Current and Future Sewage Management Projects. Sustainability depends upon current and future planning. Cities with good plans and investments would be given a high mark. The fact that a city has plans indicates they value the environment, have taken stock of the current situation, and are willing to invest towards a better environment.

Current and Future Projects	Grade
Treatment plant and collection infrastructure upgrades	A/B
Treatment plant and / or collection infrastructure upgrade	B/C
Improved or expended effluent testing only or plans for improvements	C/D
If already a well performing city making just minor investments	B
If already a well performing city making major investments	A

Use of green infrastructure. Green infrastructure can lessen the degree of CSO and wet-weather related bypass events using natural systems such as trees, vegetation, and wetlands, or engineered systems such as green roofs, which mimic natural landscapes, to reduce stormwater runoff and divert it to areas where it can be absorbed, evapotranspirated or re-used. Cities that actively encourage and implement green infrastructure would be given a high mark. Cities with no combined sewers would not be graded on this question.

Use of Green Infrastructure	Grade
Extensive use and active investment in projects	A
Moderate use of green infrastructure	B
Plans to implement programs or projects	C
No use or intent to implement green infrastructure	D

Sewage energy recovery, heat collection, or use and management of methane gas as a fuel. The output of sewage treatment facilities contains a wealth of potentially recoverable renewable resources. With the proper technology, treatment plants can improve their energy efficiency and financial self-sufficiency. Cities that are using alternative energy strategies would receive a high mark.

The following questions were considered informational and not included in the grading:

Population serviced by the wastewater treatment plant(s). This was asked just to provide background information.

Percentage of Sewer System Combined and Number of Combined Sewer Outfalls. Ideally storm and sanitary systems should be separate. However, most old cities have some combination sewer systems. Rather than opt for expensive sewer separation some cities manage combined sewer overflows by installing control or capture structures at overflow points or within the sewer infrastructure. We decided not to grade the response to this question given the different ways cities manage CSOs. The real issues to grade CSOs are the frequency of overflows and volume of overflows as a percentage of the total sewage volume. We do not want to penalize a city that has found other ways of managing CSOs that does not include separation of combined sewers.

Receiving Water. This is included in the narrative but does not relate to sewage management.

Sludge Disposal. This is a highly controversial issue and at present there are environmental impacts associated with many of the disposal methods currently in use. We did not grade the response but provide the results in the narrative.

Maintenance / malfunction-related bypasses and volume: This is often beyond the control of the wastewater treatment cooperators and municipalities and therefore this information was included in the narrative but not graded.

Environmental Compliance Approvals Numbers / Certificates of Approval. This was requested for reference. No analysis was conducted of the parameters of each Certificate of Approval and this was therefore not assigned a grade.

Contact Information. This would have no bearing on the grade but is included in the city information sheet.

endnotes

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2 Canadian Council of Ministers of the Environment. Municipal Wastewater Effluent Development Committee. December 2006. Municipal Wastewater Effluent in Canada. Available at: http://www.ccme.ca/assets/pdf/mwwe_general_backgrounder_e.pdf

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5 State of the Lakes Ecosystem Conference. October 26 & 27, 2011. State of the Great Lakes 2012 Draft for Discussion. Available at: http://www.solecregistration.ca/documents/Treating%20Wastewater%20DRAFT%20Oct2011.pdf

6 Procedure F-5-5 Determination of Treatment Requirements for Municipal and Private Combined and Partially Separated Sewer Systems. Available at: http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079341.pdf

7 There are several sewage related guidelines. The most relevant to this issue are Procedure F5-5. Determination of Treatment Requirements for Municipal and Private Combined and Partially Separated Sewage Systems. Available at: http://www.ene.gov.on.ca/envision/gp/F5-5.pdf, and Procedure F5-1. Determination of Treatment Requirements for Municipal and Private Sewage Treatment Works Discharging to Surface Waters. Available at: http://www.ene.gov.on.ca/envision/gp/F5-1.pdf

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11 Environment Canada. 2012. Inorganic Chloramines and Chlorinated Wastewater Effluents Performance Report – Pollution Prevention Planning for Chlorine in Wastewater Effluents. Available at: http://www.ec.gc.ca/planp2-p2plan/default.asp?lang=En&n=73B726F7

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16 Natural Resources Defense Council. 2006. Rooftops to Rivers: Green Strategies for Controlling Stormwater and Combined Sewer Overflows. Available at: www.nrdc.org/water/pollution/rooftops/contents.asp

17 Frances Bula. July 10, 2012. Sewage as Energy: An essentially unlimited renewable resource. The Globe and Mail. Available at: http://www.theglobeandmail.com/news/british-columbia/sewage-as-energy-an-essentially-unlimited-renewable-resource/article4404628/

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21 Ibid.

22 Andrew Hellebust. 2009. Making the Most of the Water We Have: The Soft Path Approach to Water Management. Earthscan. 190-193.

23 The Canadian/Ontario Agreement Respecting the Great Lakes Basin Ecosystems. 2007. Pg. 12.

24 The Great Lakes and St. Lawrence Cities Initiative is a binational coalition of mayors that work together and with federal, state, and provincial governments to advance the protection and restoration of the Great Lakes and the St. Lawrence River.

25 Memorandum of Cooperation. 2008. Available at: http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_097431.pdf

26 With respect to habitat protections, the law has been changed and it is anticipated that those changes will be brought into force and, if Cabinet so orders, those changes will provide for a much changed fisheries and fish habitat regime. In any event, the issue of sewage and deleterious substances is substantially unaffected.

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