

SUSTAINABLE MUNICIPAL WATER MANAGEMENT: Measuring Progress and Reporting Publicly



A Green CiTTS Report

June 2012

**The Great Lakes and St. Lawrence
Cities Initiative**



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1. INTRODUCTION

The Green CiTTS program

The Cities Initiative's Green CiTTS program adopts a comprehensive approach to protecting our shared water resources, involving a broad range of municipal operations and responsibilities (www.glslcities.org/initiatives/greencities.cfm). The Green CiTTS program showcases municipal leadership and provides support to municipalities to further expand these activities. It is through the promotion and expansion of best practices that our member cities are setting the course for a sustainable future in the Great Lakes and St. Lawrence region.

This report, *Sustainable Municipal Water Management: Measuring Progress and Reporting Publicly* is the second report released under the Green CiTTS program.

In this report, you will find:

- ◆ A framework for Sustainable Municipal Water Management (SMWM)
- ◆ A description of milestones to work towards
- ◆ Indicators to measure progress towards milestones
- ◆ Best practices that illustrate how Cities Initiative member municipalities have put SMWM into practice
- ◆ A guide to preparing a SMWM Public Evaluation Report (SPER)

The Move Towards Sustainable Municipal Water Management

In the face of accumulating impacts including urbanization and climate change, municipalities are increasingly embracing an integrated approach to water management that captures the full spectrum of a community's impact on water. This approach cuts across traditional municipal delivery areas, to include infrastructure design and operations, land use planning and approvals, public education and participation, emergency planning and response, pollution prevention, and habitat and shoreline restoration.

This shift in water management, from a narrower operational focus on water service delivery and wastewater treatment, to a broader notion of 'sustainable water management' marks a change for municipalities, one that takes time to adopt and involves continuous innovation, improvement and evaluation.

To help its members along this path, the Great Lakes and St. Lawrence Cities Initiative has developed a framework to reflect this new integrated approach. The framework was prepared under the guidance of the Cities Initiative Green CiTTS advisory committee, with representation from large, medium and small municipalities across the Great Lakes and St. Lawrence basin. It also benefitted from an external review by experts in the water management field.

This framework was adopted as a Declaration of Sustainable Municipal Water Management by the mayors of the Cities Initiative at its annual conference in June 2012 in Québec City.



View of Chicago, from Lake Michigan
Photo Credit: City of Chicago

Putting the Declaration into Practice

To put this declaration into practice, the Cities Initiative is encouraging its members, on a voluntary basis, to evaluate and report publicly on their progress towards the principles and milestones outlined in the Declaration on Sustainable Municipal Water Management. Evaluating and public reporting on progress are integral aspects of sustainable water management, which relies on transparency, continuous improvement, and public participation.

Over time, it is intended that the municipalities that evaluate and publicly report on their SMWM performance will be able to demonstrate the shift towards a more integrated approach to water management.

To this end, the Cities Initiative has prepared this guide for member municipalities.

This guide :

- ◆ explains the six principles of Sustainable Municipal Water Management, and twenty-five milestones;
- ◆ provides examples of best practices from members of the GLSLCI in each area of activity;

- ◆ proposes indicators with which to evaluate a municipality's progress against each milestone and
- ◆ offers an At-a-Glance reporting template using color-coded symbols to represent a municipality's evaluation of its performance in each of the 25 areas of activity.

It should be noted that identifying a limited number of milestones and indicators that encompass the diversity of municipalities within the Cities Initiative and beyond is a challenge. While it is important to maintain scientific rigor and consistency in the application of the indicators, it is equally important not to impose a 'cookie cutter' approach to measuring progress that does not reflect the reality on the ground. In the end, this evaluation is not meant to compare one municipality's performance against another but rather to chart the progress within each municipality towards sustainable municipal water management.

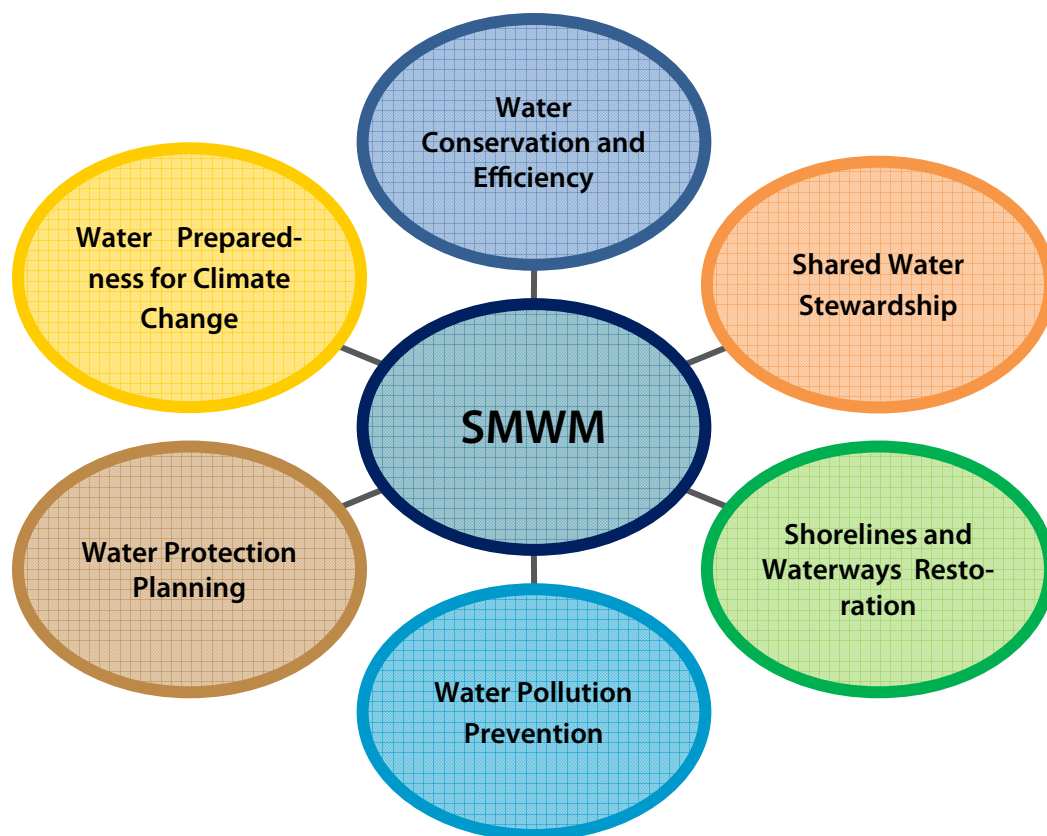


View of the Chateau Frontenac from the St. Lawrence River, Québec City, Québec
Photo Credit: City of Québec

2. A SUSTAINABLE MUNICIPAL WATER MANAGEMENT FRAMEWORK

The Cities Initiative Declaration on Sustainable Municipal Water Management includes six principles and twenty-five milestones, which are described in this report. Each milestone is associated with an indicator that may be used by a municipality to evaluate and report publicly on its progress.

Six Principles of Sustainable Municipal Water Management



Principle 1: Water Conservation and Efficiency

Milestones

- 1.1. Promote water conservation
- 1.2. Install water meters
- 1.3. Set the right price
- 1.4. Minimize water loss
- 1.5. Water reuse and recycling

This first principle of sustainable municipal water management underscores the importance of conserving water, through greater efficiency and a reduction in water loss. This effort involves municipal water providers, residents, and businesses.

Members of the Cities Initiative are already actively involved in supporting these principles, through its Water Conservation Framework. Under this initiative, thirty-three participating municipalities report annually on their water conservation progress towards reducing by their water use by fifteen percent over fifteen years. For more information, and to view best practices from Cities Initiative members, see www.glsclcities.org/initiatives/water-conservation.cfm.

Milestone 1.1: Promote water conservation

The Great Lakes contain six quadrillion gallons of water (one thousand million millions of liters)¹, but only 1 % of this is renewed each year. Although less than one percent is consumed each year, about 620 billion liters (164 billion gallons) of water are used each day².

Water conservation leads to multiple benefits. Firstly, climatic modeling predicts that water levels in the Great Lakes will lower due to the effects of elevated temperatures in the basin, which will cause more rapid and extended evaporation (see Principle 6). To minimize these reductions and their impacts on communities, it is wise to adopt measures immediately that reduce water consumption and increases water efficiency. Secondly, reducing water consumption contributes to reduced energy consumption, and associated greenhouse gas emissions and the amount of chemicals used in the production of safe drinking water. In the United States, the urban water cycle (pumping, distribution, treatment) accounts for 13 % of energy consumption, or 520 million megawatt hours annually³. This does not include energy consumed to heat water.

Indicator 1.1

This milestone can be measured by means of one of two indicators. Please choose the indicator that is most appropriate for your municipality. You may also use another indicator that is already being applied in your municipal operations to track water conservation.

A. 'Change in the total volume of water produced annually'.

Tip: This indicator serves to compare total annual water withdrawals by a municipality, and shows a change over time as a result of the water conservation strategy. This indicator does not isolate variations in water consumption due to changes in economic activity or changing demographics. As there is a difference in the amount of water taken and the amount of water distributed, the volume of water taken at source should be measured.

B. 'Volume of water consumed per household per day'.

Tip: This measure better isolates progress towards water conservation from fluctuations due to other factors such as economic activity or demographics. The same metric may be applied to the commercial, industrial and institutional sectors.

Good Practice

Through its participation in the Great Lakes and St. Lawrence Cities Initiative Water Conservation Framework, the City of **Grand Rapids**, Michigan, has reduced its water consumption by 8.5 billion liters per year (2,25 billion gallons). This exceeds the objective of a 15 % reduction before 2015, compared to the city's water consumption in 2000. This water conservation was achieved through the implementation of a series of best practices.

For more information: <http://grcity.us/enterprise-services/officeofenergyandsustainability/Documents/Year1ProgressReport.pdf>

Milestone 1.2: Install water meters

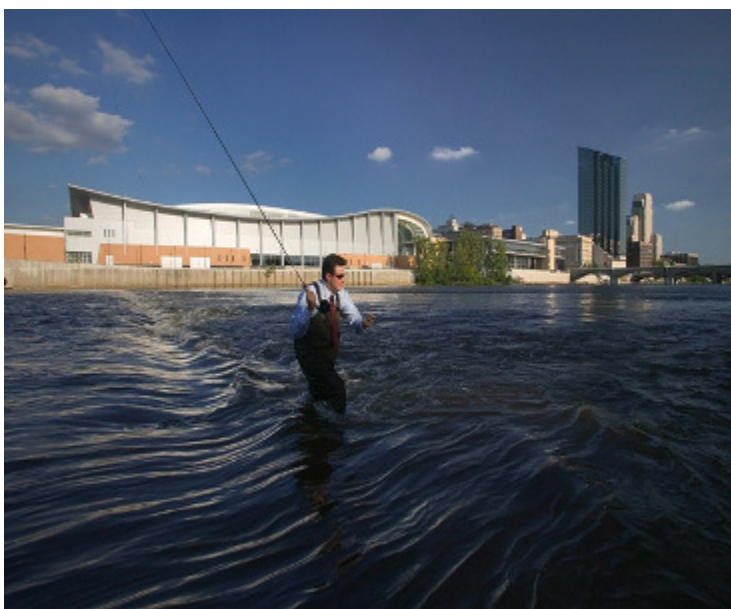
The second milestone underlines the importance of highlighting the value of drinking water in efforts to conserve water. Installing water meters is one way that municipalities and water utilities encourage more efficient use of water based on the user pay principle. For example, in Canada, households with a fixed rate for water consume on average 467 liters (123 gallons) of water per person per day, while households with a volumetric rate consume only 266 liters (70 gallons)⁴. The installation of water meters is often complemented with incentives to promote the use of water-efficient appliances and water-wise household habits.

Indicator 1.2

This indicator demonstrates the annual progress in installing water meters and the application of the user-pay principle in a municipality.

‘Percentage of users on water meters’.

Tip: If only large industrial consumers are metered the percentage of users that are metered may appear low, even if the ratio of metered water/distributed water is high. This could be noted in the narrative section of the SMWM Public Report (see Section 3).



City of Grand Rapids, Michigan
Photo Credit: City of Grand Rapids

Good Practice

The City of **Chicago**'s Department of Water Management (CDWM) established a residential water metering installation program called MeterSave. It is a voluntary program that allows homeowners to have water meters installed at no cost. The CDWM guarantees program participants that their water bill will not increase for the first seven years of the program. It also provides tools to reduce domestic water consumption, such as a small magnetic digital display that can be put on the refrigerator, that shows a household's water consumption rate.

For more information: www.metersave.org.

Milestone 1.3: Set the right price

This milestone relates to efforts to account for the full cost of water treatment and distribution, to put safe drinking water services on a more sustainable financial footing and to encourage water conservation. Full cost includes all fixed and variable costs incurred by the municipality or utility, including replacement costs.

While reduction in water consumption can result in savings in the cost of water purification and treatment, and the need for investment to expand capacity, municipalities and utilities must also contend with a reduction in water revenues as a result of water conservation. This should be taken into consideration when setting water rates. Rates may have to rise as a result of a successful water conservation program. Where water rate increases have been necessary, some municipalities have demonstrated how proactive public communication can help to promote public acceptance by showing how higher rates will be used to protect water resources and improve the quality of water service.

In working towards full cost accounting and recovery, municipalities may need the financial support of provincial, state and federal governments. As municipalities face a historical infrastructure deficit, some financial assistance to bridge the gap on the way to full cost recovery will likely be necessary.

Indicator 1.3

This indicator can be measured in two ways. Please use the most appropriate indicator for your municipality.

A. 'Progress towards full cost accounting and recovery'.

Tip: By referring to 'progress towards', we recognize that calculating the full cost of water infrastructure and services can be complex, particularly where historical data of the existing infrastructure is not available. The measurement of progress should be based on the best available knowledge and estimates where information is lacking.

B. 'Total costs / Total water rate revenues'.

This indicator is used by the European Benchmarking Co-operation (www.waterbenchmark.org) to evaluate the financial sustainability of water service providers.

A ratio > 1 indicates a system that is dependent on revenue sources above and beyond what is raised through the water rate. A ratio of < 1 indicates a system that is financially sustainable without external financing. Reasons for changes in this ratio from year to year may be explained in the narrative of the SMWM public report (see section 3).

Good Practice

The City of **Evanston**, north of Chicago, issues an annual report of activities, which includes information on its drinking water and wastewater systems. Included in the report is information on the annual volume of water taken from Lake Michigan, annual revenues from the sale of water, and the cost of operations. The annual report explains the rate and fees structure and their historical trends.

For more information: www.cityofevanston.org/utilities/plans-reports-brochures/

Milestone 1.4: Minimize water loss

Unauthorized and unaccounted for losses of drinking water in the distribution system represent both a loss in revenues and a loss in terms of water conservation. Leaks in the distribution system also contribute to wasted energy used to maintain pressure in the system. These water losses are most often associated with aging infrastructure.

Indicator 1.4

This indicator can be measured in two ways. Please use the most appropriate indicator for your municipality.

A. 'Percentage of water loss in distribution system'.

Indicator 1.4 A applies to municipalities where water metering is not widespread. It could be based on an estimate using the best information available.

Tip: There are several ways to detect water leaks and measure water losses. One consists of evaluating variations in pressure in the system and using fixed access points to make repairs. Other methods detect sounds that indicate water losses in the distribution system. Finally, tracers, such as color powders, can be used to follow the path of water in a system.

B. 'Non-revenue water / water produced (Percentage)'.

Indicator 1.4 B applies to municipalities that have complete water meter coverage.

Tip: Note that 'non-revenue water' is equal to total water produced minus total water billed.

Non-revenue water equals water that is not billed but is authorized, such as water for firefighting, street cleaning, and flushing of the distribution system. It can also include errors in water metering.



Infrastructure replacement
Photo Credit: City of Evanston

Good Practice

The Québec Government requires that municipalities reduce water production by 20 % by 2017 and that they reduce their water losses to less than 20% of water produced. To meet these new requirements, the City of **Trois-Rivières**, Québec, began a program to evaluate the rate of water loss in their water distribution system. Nearly 950 kilometers of piping will be tested by the Department of Public Works through the summer 2012.

For more information: www.radio-canada.ca/regions/mauricie/2012/03/12/005-eau-potable-trois-rivieres.shtml



City of Trois-Rivières, Québec
Photo Credit: City of Trois-Rivières

Milestone 1.5: Increase water reuse and recycling

There are a number of innovative water reuse and recycling techniques which reduce the demand on surface and groundwater resources.

Water recycling and reuse offers alternative sources of water that may be used for different purposes. Rainwater harvesting is the most common of these, used for watering gardens and lawns. Other more advanced techniques allow for the reuse at-source of lightly used wastewater (commonly known as grey water), or the recapturing of nutrients in wastewater at source⁵.

Indicator 1.5

‘Estimate of total reused or recycled water through municipal initiatives ‘.

Tip: This indicator serves to estimate the impact of measures taken by the municipality or utility to encourage recycling or reuse of water by residences or businesses. It could involve an estimate of the amount of water harvested as a result of the distribution of rain barrels, or the result of approved household grey water recycling projects.

Good Practice

The City of **Windsor**, Ontario, has a number of initiatives to encourage the reuse of water. The City offers an eaves trough disconnection subsidy, whereby the city will disconnect the downspouts from eaves troughs and the sanitary sewer system at no cost to the homeowners, and instead direct the drains to the front or rear yards for irrigation. In previous years, the city has also distributed rain barrels to harvest water.

In its own operations, the City of Windsor also minimizes the use of treated water where possible, including the installation of soil moisture sensors on 80% of its irrigation systems, as well as self-watering planters, each with a water sump that wicks water into the soil from below. The City uses untreated water to irrigate the large riverfront parkland and the entire riverfront with Detroit River water.

For more information: <http://www.citywindsor.ca/residents/environment/Environmental-Services/Pages/Water-Resources.aspx>



Bert Weeks Memorial, Windsor, Ontario
Photo Credit: City of Windsor

Principle 2: Shared Water Stewardship

Milestones

2.1. Raise public awareness

2.2. Engage the public

This second principle is focused on the transition towards a shared management of water. The involvement of all water users is an essential aspect of an integrated, decentralized approach to water management, and has the added benefits of increasing social acceptance of measures taken to protect water resources while reflecting local needs.

The milestones for this principle emphasize the responsibility of citizens and water users in the protection of water resources and the direct engagement of citizens in water management at the local level.

Milestone 2.1: Raise public awareness

While municipalities are formally responsible for a significant portion of overall water management in a community, important aspects of water management are shared with residents and businesses. Developing a culture of shared water stewardship at the community level is an essential element of an integrated municipal water management strategy.

To foster a water-wise ethic in municipalities, public engagement between water providers and water users is the key. These exchanges seek to develop a shared vision of water stewardship in the community. The information gathered for the purposes of reporting on sustainable municipal water management, as outlined in the report, may be used to help expand this dialogue.

Indicator 2.1

‘SMWM public awareness campaign currently in place (static indicator)’.

Tip: For more details on static indicators see chapter 3.

Good Practice

With the assistance of a grant from the RBC Blue Water Project, the Town of **Goderich**, Ontario, launched a public awareness campaign focused on reducing pollution from wastewater. Using catchy advertising, the campaign highlighted the link between daily habits such as car maintenance or walking dogs, and the protection of Lake Huron. Making people conscious of the impact of their daily practices as it relates to substances that are poured down the drain and enter into the sanitary or stormwater system, and ultimately into the Great Lakes or St. Lawrence is an important aspect of shared water stewardship. The Town of Goderich also released a publication on best practices with respect to stormwater management.

For more information: www.goderich.ca/en/townhall/resources/StormwaterGuide.pdf.

WHEN YOU'RE WASHING
YOUR CAR IN THE DRIVEWAY,
YOU'RE NOT
JUST WASHING YOUR CAR
IN THE DRIVEWAY



Storm drains run directly in lakes and rivers. When you wash your car in your driveway, the soap can go down the storm drain and pollute our waters. Use a car wash instead where the wastewater is sent to the sanitary sewer for treatment.

Don't feed soap to the storm drain.
Wash your car right.



Milestone 2.2: Engage the public

Over and above adopting more water-wise habits at home and at work, a better informed public is also more likely to participate actively in the municipality's sustainable water management strategy. This collaboration between the municipality and the public has multiple benefits, including engaging people in community activities, accelerating progress on water-related projects like shoreline restoration, and can add to the sense of shared community and identity amongst residents.

Indicator 2.2

This indicator can be measured in one of two ways. Please apply the indicator that is most appropriate for your municipality.

A. 'Active citizens committee or volunteer program sponsored by the municipality in support of an aspect of sustainable municipal water management' (static indicator).

B. 'Number of citizens involved in municipally-supported events or activities related to water protection (e.g. watershed committees, shoreline clean-up days, public gardens, water festivals)'.

Tip: Although the event(s) may be organized by a community group, the municipality should play an active role in the event(s). The 'number of citizens' should be the sum of citizens involved in the total number of events or activities. The most significant events may be highlighted in the narrative section of the public report.



Good Practice:

The Niagara Children's Water Festival is celebrating its 10th anniversary in September, 2012. The event, hosted by the Region of **Niagara**, Ontario, in collaboration with the City of **St. Catharines**, Ontario, the Niagara Region Conservation Authority and corporate sponsor Ontario Power Generation, is part of the Region's comprehensive public awareness campaign called WaterSmart. The annual event involves 5,000 students, teachers and parents on a journey of discovery and learning, through 27 interactive Water Discovery Centres. One of these centres, the Bog Squad, teaches students about the Wainfleet Bog, one of the few acidic bogs left in southern Ontario. Many rare plant and animal species, including the massasauga rattlesnake, inhabit the bog. The Wainfleet bog also aids in flood control. Students learn how human impacts have drastically altered the Wainfleet bog area and how they can preserve it.

For more information:

www.niagarachildrenswaterfestival.com



Photo Credit: Niagara Children Festival

Principle 3: Shoreline and Waterways Restoration

Milestones

- 3.1. Protect and restore shorelines and riparian corridors, and control erosion
- 3.2. Increase public access to shorelines, riverbanks, and waterfronts
- 3.3. Protect habitats

This third principle recognizes the importance of protecting, restoring and valuing naturalized areas. Urbanization and human settlements generally, have had an enormous impact on the disappearance of natural areas in the Great Lakes and St. Lawrence region. For example, in the St. Lawrence valley, more than eighty percent of wetlands have disappeared, a trend that continues today with the regulation of water levels that inhibits natural seasonal fluctuations and the unusually low water levels of recent years⁶.

In addition to the essential role of supporting local flora and fauna, the protection and restoration of natural areas plays an integral role in the municipal water cycle. Among other functions, natural areas retain and filter stormwater, protect shorelines from erosion, reduce the risk of flooding and contribute to carbon sequestration and air filtration.

Milestone 3.1: Protect and restore shorelines and riparian corridors and control erosion

Naturalized shorelines and river or riparian corridors play an important role in the protection of waterways, particularly in reducing erosion. A number of actions may be taken, including the replacement of concrete waterfront structures with naturalized shoreline rich in trees and other vegetation.

Urban rivers and streams can also play a significant role in an integrated stormwater management strategy. While they have been seriously affected by erosion and polluted urban runoff, their restoration can allow increased flow capacity, reduce erosion, increased bio filtration and increased overall biological richness.⁷



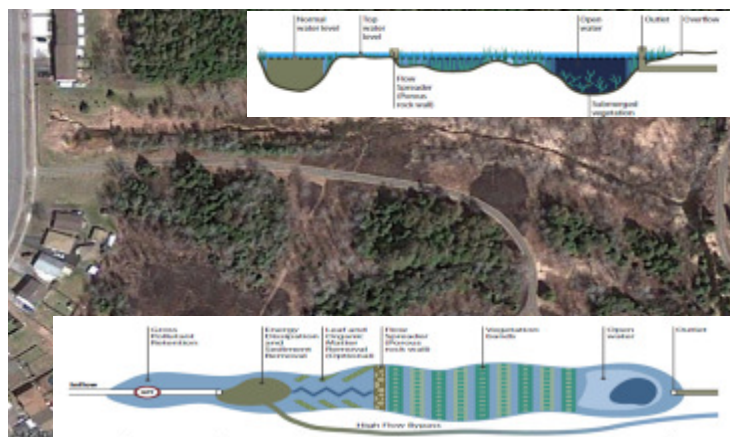
Erosion on the St. Lawrence Photo Credit: Environment Canada

Indicator 3.1

'Length of shoreline or riparian corridor that is protected or restored'.

Tip: Only 'green' or naturalized protection and restoration measures should be included under this indicator.

It is particularly important that a base year be referenced.



Design for the restoration of the McVickers stream, Thunder Bay, Ontario

Photo Credit: City of Thunder Bay

Good Practice

The environmental policy and Pollution Prevention and Control Plan of the City of **Thunder Bay**, Ontario,, provides a framework for a number of measures focused on the reduction of pollution reaching receiving waters. Among these measures, the City has undertaken the restoration of the urban subwatershed of the McVickers stream. A study of the biophysical characteristics of the river was completed, as well as an inventory of sources of pollutants. Forty non-point source pollutants were identified, of which six exceeded provincial water quality standards. This study allowed for the identification of priority action zones for the gradual restoration of the subwatershed basin. The illustration above shows the restoration concept developed by the City. This will allow for the integration of sections of the stream into the city's stormwater management, allowing for the natural filtration of the stormwater.

Milestone 3.2: Increase public access to shorelines, riverbanks, and waterfronts

Access to natural areas is a valued aspect of a person's quality of life in an urban or rural setting. For example, it has been shown that access to parks and green spaces increases the time people devote to physical activity by twenty-five percent⁸, and consequently reduces the incidence of obesity, a condition recognized by the World Health Organization as having reached epidemic levels⁹. Access to shorelines and waterfronts that emphasizes ecosystem protection provides added benefits in terms of protecting the natural and historical heritage of the area at the same time as encouraging recreational activity and offering another opportunity to educate the public of the value of local waterways protection.

Indicator 3.2

'Length of shoreline and/or river bank with public access'.

Tip : This indicator includes naturalized access, rather than artificial, hardened surfaces.

Reference to a management plan or a conservation plan of the public access or park can be included in the narrative section of the public evaluation report .

Good Practice

In collaboration with the National Oceanic and Atmospheric Administration, the West Michigan Shoreline Regional Development Commission and the Great Lakes Commission, the City of **Muskegon**, Michigan, is nearing completion of a shoreline restoration and improvement project. This project aims to increase public access, including a cycling path, and to restore degraded shorelines, in part by implementing an invasive species eradication strategy. This project is part of a larger project that aims to have Lake Muskegon delisted as an 'Area of Concern'.

For more information: www.glc.org/announce/11/pdf/Muskegon-Lake-ARRA-econ-fact-sheet_Final_May2011.pdf



Restoration along Muskegon Lake shoreline, City of Muskegon, MI
Photo Credit: Dave Alexander, Muskegon Chronicle

Milestone 3.3: Protect habitats

In the U.S., one third of terrestrial and aquatic indigenous species are at risk of extinction, due to the encroachment of urban settlements on natural areas¹⁰. As a consequence, reconciling urbanization and habitat protection has become a concern and a number of municipalities have adopted a natural areas conservation plan which include a biological inventory of natural areas (documenting types of habitat, flora and fauna species, vulnerable or at-risk species), designation of sites of ecological interest, and a management plan for these sites.

River aquatic habitats are of ecological interest in the Great Lakes and St. Lawrence Region. In a number of cases, their protection involves the restoration of portions of the river that have become inaccessible to fish due to artificial barriers, such as hydroelectric dams or water level regulation barriers. Two thirds of fish species, including the yellow sturgeon, the walleye and the American eel depend on tributaries for spawning¹¹.

To maximize the benefits of terrestrial natural area protection and restoration, connectivity of adjacent natural areas is needed to facilitate the migration of certain species.

Indicator 3.3

‘Area of protected ‘site of ecological interest’.

Tip: We use the term ‘site of ecological interest’ to signify natural area protection measures that prioritize the protection of local biodiversity.

A sub indicator ‘length of tributaries where ecological connectivity is restored’ could also be used as a measurement for this indicator.



Improving access to protected habitats

Photo Credit : sustainablesites.org

Good Practice

The land use and development master plan of the Metropolitan Community of **Montreal**, Québec seeks to optimize connectivity between agricultural activity, recreational and tourism activity, and the value of protected natural areas. To do so, the concept of a Blue and Green Belt is being promoted and an objective to protect seventeen percent of natural areas within the metropolitan Montreal area has been instituted.

For more information: <http://pmad.ca/orientations/environnement/objectifs/proteger-17-du-territoire-du-grand-montreal/>



A variety of habitats and a variety of species to protect.
Photo Credit: MMSD

Principle 4: Water Pollution Prevention

Milestones

- 4.1. Prevent pollutants from entering the sewage collection system
- 4.2. Remove pollutants from wastewater treatment plant effluent
- 4.3. Reduce stormwater entering waterways
- 4.4. Monitor and respond to sources of pollution
- 4.5. Improve beach quality
- 4.6. Reduce sodium chloride entering waterways

The fourth sustainable municipal water management principle is focused on municipal efforts to prevent pollution from entering waterways, with six milestones to measure progress. Sources of pollution have changed over the last decades, as the most important industrial point sources have largely been regulated effectively. With these regulations, the more ‘traditional’ pollutants have seen a decline in the basin¹². Unfortunately, the Great Lakes and St. Lawrence are still feeling the impact of pollution, and in some areas, these impacts are acute, such as the impact of nutrients on the growth of algal blooms in Lake Erie¹³ that have created so called ‘dead zones’ in the lake.

According to the International Joint Commission, the most significant sources of contaminants in the basin are from urban, rural and agricultural runoff. Amongst those contaminants, a number are found in products that find their way into sewage or stormwater collection systems. These include flame retardants, pesticides, pharmaceutical products, phosphorus, and sodium chloride used in road de-icing products. In the U.S., a large scale study on ecosystems contamination showed that half of the gathered samples of surface waters, sediments and fish tissue contained at least one contaminant in excess of established standards for protection of aquatic fauna¹⁴.

Milestone 4.1: Prevent pollutants from entering the sewage collection system

Many types of contaminants enter the wastewater collection system and a number of these cannot be completely removed during the treatment process. This is why the first step to reducing pollution from wastewater is to eliminate it at the source. Pollution prevention activities undertaken by municipalities can include raising public awareness on the contents of certain household products, and guidance on

what should and should not be discharged into the sewage system.

Information is also distributed on environmentally-friendly alternatives that may be used and product certification programs to look out for. Household hazardous waste collection days can also contribute to directing more products to appropriate disposal. Reducing contaminants on roads, such as used oil, can also improve the quality of stormwater that runs over urban surfaces and into waterways¹⁵. Many municipalities have also introduced their own ordinances or by-laws that prescribe limits or prohibitions on the discharge of certain contaminants into the sewage collection system.

Indicator 4.1

‘Change in concentration of contaminants in wastewater’.

Tip: The measurement of changes in contaminant concentration should be based on water samples taken before the wastewater enters the treatment system, at a frequency that reflects temporal variations. Particular attention should be given to emerging contaminants of concern, especially those that are not effectively removed from the wastewater by the treatment technology. Using a base year, the measurements should track changes in concentrations of key contaminants. A descriptive analysis of the measures taken to reduce contaminants, and the reduction in concentrations may be added to the narrative section of the municipality’s SMWM public report.

Good Practice

The Region of **Durham**, Ontario, on the north shore of Lake Ontario, offers residents a household hazardous waste collection system that allows for the recycling of certain household hazardous waste products, such as paint, and safe disposal of other products that would otherwise end up contaminating the water or soil. The Region has a number of waste collection facilities and also collaborates with local pharmacies to collect leftover pharmaceutical products. The Region also participates in 'Orange Drop', a program organized by Stewardship Ontario, an industry-led organization that promotes recycling and collection of hazardous waste. It is fully funded by the companies that make the products. These companies must contribute to a fund in proportion to the amount of products sold in Ontario. Lastly, the Region of Durham's Works Department raises public awareness over alternatives to replace more hazardous products with less harmful ones.

For more information:

- ♦ <http://www.makethedrop.ca>
- ♦ <http://www.durham.ca/works.asp?nr=/departments/works/waste/hazardouswaste.htm#hhw>



Region of Durham, Ontario
Photo Credit: Region of Durham



Household hazardous waste Photo
Credit: Region of Durham

Milestone 4.2: Remove pollutants from wastewater treatment plant effluent

This milestone focuses on the effectiveness of removing pollutants through the wastewater treatment process. Increasing the effectiveness of wastewater treatment and improving the quality of wastewater effluent discharged into receiving waters is an important aspect of a municipality's sustainable water management. This is an end-of-pipe solution to deal with all the pollutants that make their way into the sewage treatment process. Treatment technology is becoming increasingly sophisticated, but it is a very costly means to reduce pollution into the waters of the Great Lakes and St. Lawrence. The cost of treatment should always be weighed against the cost of preventing pollutants from entering the treatment system in the first place. Whatever the choices made, the treatment technology must be approved by provincial, state or federal regulators.

Indicator 4.2

'Improvements to the quality of treated wastewater effluent, including contaminants of emerging concern'.

Tip: The samples should be taken at a frequency that reflects temporal or seasonal variations. A descriptive analysis to elaborate on the actions taken to improve wastewater treatment may be included in the narrative section of a municipality's public report.

Good Practice

From 2002-2003, the municipalities of **Racine**, Mont Pleasant, Caledonia, Wind Point and Sturtevant, Wisconsin, reached an intergovernmental agreement on the joint management and the sharing of revenues for a wastewater treatment system. This agreement allowed the City of Racine to modernize its wastewater treatment and to increase its capacity. Since 2008, the Racine Water Utility has run a program to improve the efficiency of its wastewater treatment plant, which has resulted in a significant reduction in operational costs. This modernization includes the addition of a pre-sedimentation basin and a process for dewatering solids. As a result of this practice, more than US \$200,000 were saved in 2011. The modernized plant allows for the production of wastewater of better quality and an increased capacity to manage precipitation during intense storm events. It also includes a system of methane gas collection from an anaerobic digester and the recovery of heat produced through the treatment process.

For more information: <http://www.cityofracine.org/Wastewater.aspx>



City of Racine, Wisconsin

Photo Credit: City of Racine

Milestone 4.3: Reduce stormwater entering waterways

Effective and comprehensive stormwater management is recognized as a major element of a local strategy to improve water quality in the Great Lakes and St. Lawrence. In 2001, Environment Canada estimated that the combined non-point discharges of Canadian stormwater into the Great Lakes contributed 90,000 tons per year of sediment, oil, grease, heavy metals, and other contaminants¹⁶.

The Cities Initiative conducted a survey in 2011 on municipal stormwater management and produced a report on best practices across the basin as well as ten recommendations on improving stormwater management. The report can be found at <http://www.glslcities.org/fr/initiatives/greencities/stormwater.cfm>

The Cities Initiative survey found that American cities were comparatively more advanced than Canadian cities in their stormwater management, likely as a result of regulatory requirements to develop and implement comprehensive stormwater management plans.

As municipalities have primary jurisdiction over stormwater management, it is one of the principal areas where municipal action can make a profound difference in preventing pollutants from entering the Great Lakes and St. Lawrence. Improvements in stormwater management have recently included the application of green infrastructure to complement existing grey infrastructure. More information can be found in the Cities Initiative report cited above.

Indicator 4.3

This indicator may be measured in two ways, depending on whether your municipality has a combined or separated sewage collection system.

A. 'Separated System: Reduction in the quantity of stormwater entering receiving waters/ or improvement in the quality of stormwater effluent'.

Tip : In measuring stormwater quality, you may measure the following variables- Ecoli/mL, BOD5 (biological oxygen demand), and suspended solids. These variables are used by many cities as an estimate of the overall reduction in contaminants as trace metals and pesticides attach themselves to the suspended solid particle¹⁷.

B. 'Combined System: Reduction in the number and/or volume of non-treated sewage (i.e. combined sewer overflow) entering receiving waters'.

Good Practice

Part of **Lambton** County, the township of St. Clair, Ontario, has made significant investments to protect water resources along their shoreline by building sewage collection and treatment systems in ten critical areas along the shoreline, at a total cost of CDN \$40 million. Based on a study conducted by the municipality, properties that used aging septic systems to collect their wastewater were found to be a significant source of pollution along the near shore waters of the St. Clair River. The River is a tributary that drains from Lake Huron into Lake St. Clair, part of the international boundary waters between Ontario and Michigan, and a major shipping channel. Shoreline properties were required to connect to the new gravity-fed sewage collection and treatment system. In taking this action, Lambton County and the Township of St. Clair not only improved the quality of receiving waters; they also significantly reduced the impact on the drinking water sources of several downstream communities, including their First Nations and American neighbors. The surrounding aquatic environment was also improved.



City of Superior, Wisconsin

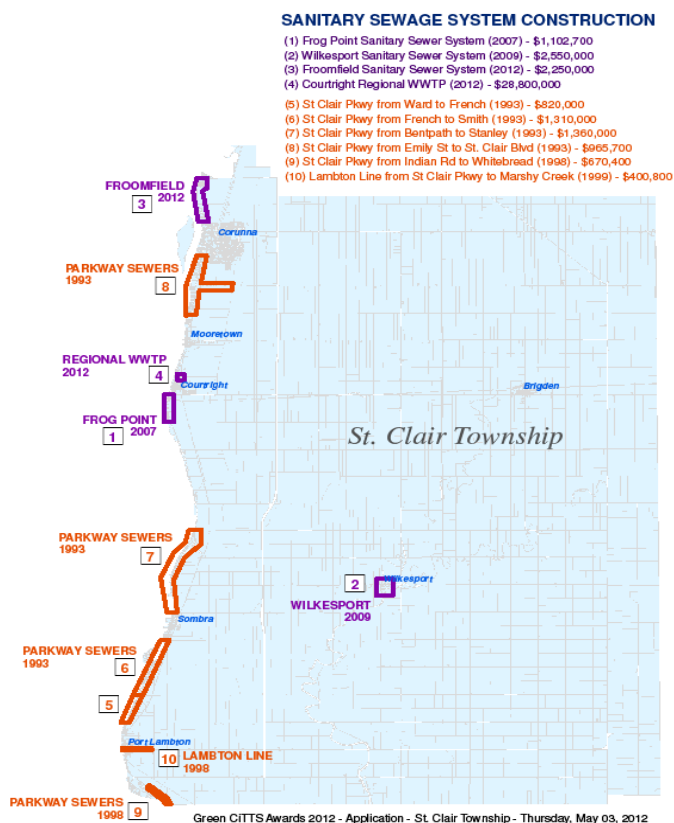
Photo Credit: City of Superior

Good Practice

The City of **Superior**, Wisconsin, at the western end of the Great Lakes basin, on Lake Superior, put in place a program called 'Slow the Flow', whose objective is to reduce shoreline erosion from urban stormwater runoff and flooding during intense storm events. The program is based on a decentralized approach to stormwater management to maximize the absorption of water on the land. To encourage businesses to participate in the program, the municipality offers a reduction in their stormwater charges for those interested in increasing the capacity of their stormwater retention ponds. Prior to the program, most retention ponds were designed with a 2-year storm capacity. To receive a reduction in stormwater charges, the ponds needed to be expanded to handle precipitation from a 100-year storm. The incentive had the desired effect. Almost all private retention ponds have increased their capacity. The City of Superior considers this a good example of the public and private sectors working together towards a joint solution to protect water quality.

For more information:

◆ <http://www.ci.superior.wi.us/index.aspx?nid=578>



Sanitary systems installed in St. Clair Township, Ontario

Photo Credit: Lambton County



Retention pond

Photo Credit: City of Superior

Milestone 4.4: Monitor and respond to sources of pollution

Notwithstanding the primary role of state, provincial and federal environmental protection departments in monitoring and responding to water pollution incidents, it is now recognized that there is a complementary role to play for municipalities, particularly in areas of municipal jurisdiction. These include, for example, the inspection of septic tanks, construction and post-construction inspections of developments that have received municipal building permits, the monitoring of sodium chloride associated with the application of road salt, and the evaluation of green infrastructure performance such as swales. Monitoring for impacts on sources of drinking water is also becoming a more common municipal responsibility. A number of municipalities have adopted monitoring programs to assist in identifying sources of pollution along their shorelines, sometimes in collaboration with other orders of government, to determine the best course of action to improve their beaches and near shore water quality.

Indicator 4.4

‘Adoption of a regular monitoring system for common water quality parameters in sources of drinking water and/or surface waterways, and a response protocol in the event of a detected pollution event’. (static indicator).



Town of Ajax, Ontario
Photo Credit: Town of Ajax

Good Practice

For a number of years, the near shore waters bordering the Town of **Ajax**, Ontario, were of poor quality, affecting access and enjoyment of the beautiful public shoreline and beaches. To find a solution to this chronic problem, the Town, in association with the Ontario Ministry of the Environment, the University of Waterloo, and Ontario Power Generation, undertook a study of sources of pollution affecting the near shore waters and shoreline of the town. The Study characterized fourteen urban sub-watersheds that contributed to sewage overflows. Results also showed that six of the fourteen sub-watersheds were responsible for ninety percent of the total pollution. In calculating the costs associated with putting in place conventional grey infrastructure to treat the stormwater, the Town also considered installing green infrastructure, including the construction of wetlands. Runoff from each of the six urban sub watersheds is now reduced to the point that the water quality now meets provincial water quality guidelines.

For more information: http://www.ajax.ca/en/doingbusinessinajax/PDENG_D_StormwaterQualityRetrofitStudyEA.asp

Milestone 4.5: Improve beach quality

Beaches are one of the best links between people and the Great Lakes and St. Lawrence River. Maintaining a clean beach and good water quality is therefore a particularly important means to influence a person's perception of the lakes and river. Unfortunately, a number of beaches experience poor water quality, which results in them being posted as unsafe for swimming by public health authorities on many summer days. Contributing causes of these closures include the presence of toxic algae and bacteria, that are best explained by the eutrophication of the lakes, sewage overflows and the presence of invasive species such as zebra mussels and quagga mussels.

There are a number of measures that municipalities have taken to improve the quality of beaches and reduce the number of summer days that they are posted as unsafe. For example, some members of the Cities Initiative have improved the quality of their beaches by improving their grooming practices and taking measures to reduce the number of seagulls on the beach.

Indicator 4.5

'Increase in the number of days a municipal beach is open or declared safe for swimming during the summer season'.

Tip: The monitoring data should specify the parameters for which sampling was taken. The length of the 'open beach' season should also be noted.



Dunes trap surface runoff from the parking lots adjacent to North Beach

Photo Credit: City of Racine

Good Practice

In 1999, the City of **Racine**, Wisconsin set out to improve the quality of its beaches by identifying and preventing the introduction of harmful substances in and around North Beach on Lake Michigan. North Beach had water quality advisories or closures, on average, in excess of 25% of available swim days prior to 2005. Over a seven year period, the City identified the sources of pollution contributing to the beach advisories and closures and undertook on-site remediation measures to control these sources. The assessment of surface water quality was accomplished through routine monitoring, use of the US EPA beach sanitary survey tool, and microbial source tracking.

By 2005, the City of Racine was able to permanently reduce and maintain beach advisories and closures at less than 5% of available swim days. The city worked closely with local businesses such as S. C. Johnson and citizen groups such as KOBO, Boy Scouts of America, the Volunteer Center of Racine County, Young Business Professional, Leadership Racine, the Root-Pike Watershed Initiative Network, the Sierra Club, and others. Through these partnerships, the City generated a spirit of volunteerism which was vital to the success of the project. In 2010 the City of Racine made North Beach accessible to the mobility challenged with a special pathway.

For more information: <http://cityofracine.org/depts/health/beach.aspx>.

Milestone 4.6: Reduce sodium chloride entering waterways

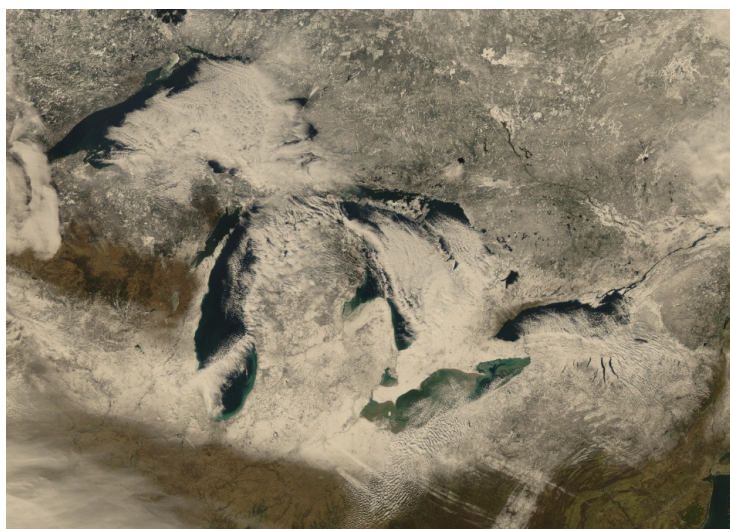
To ensure safe winter road conditions, municipalities use deicing products, most of which are salt-based. In Quebec alone, over 1.5 million tons of salt is applied to roads per year¹⁷. While necessary to keep the roads safe, the use of salt has an impact on waterways, soil and vegetation, and can also accelerate corrosion within water pipelines¹⁸. Most municipalities have put in place a salt management plan and have adopted a salt reduction objective, applying best practices in procurement, storage and application.

Salt and other contaminants like greases, debris and oils can also accumulate in snow removed from roads. Municipalities are becoming mindful of the location of their snow storage sites to ensure that the spring snow melt does not discharge into waterways or sensitive habitats.

Indicator 4.6

'Adoption of a road salt management plan that protects soil and waterways (static indicator)'.

Tip: Include road salt reduction objectives and progress towards the objectives in the narrative section of the SMWM public report.



The Great Lakes in winter

Photo Credit: NASA Goddard Space Flight Center ¹⁹

Good Practice

The City of **Toronto**, Ontario, adopted a road salt management plan that ensures that the city transports, applies and stores road salt in a way that reduces the impact on natural areas and waterways. The plan includes an annual evaluation of de-icing operations, annual inspections of snow storage sites, application tools, the installation of infrared sensors on vehicles that allow for the monitoring of road temperatures, a fleet modernization program, and a training program for staff responsible for de-icing. The program will also include real-time monitoring through a network of meteorological stations to better predict road conditions and improve the effectiveness of de-icing operations. Lastly, the City's Transportation Department will work with the Water and Wastewater Departments to determine the concentration of sodium chloride in Toronto's near shore waters in Lake Ontario.

For more information: <http://www.toronto.ca/transportation/snow/salt.htm>



De-icing and snow removal Photo Credit: City of Toronto

Principle 5: Water Protection Planning

Milestones

- 5.1. Adopt council-endorsed commitment to sustainable water management
- 5.2. Integrate water policies into land use plan
- 5.3. Collaborate on watershed-scale
- 5.4. Adopt green infrastructure
- 5.5. Value ecological functions

As highlighted under Principle 4, non-point sources, such as urban and agricultural stormwater runoff, are now recognized as major sources of pollutants into waterways. As a result, land use planning and management is increasingly seen as an integral part of a municipal water protection strategy. Land use planning has not traditionally been focused on protection of water, and a reorientation requires integration with public works and environmental services, as well other departments such as finance, parks and recreation, among others. This process of integration is most effective when directed by a commitment to sustainable water management from council.

Based on council's direction, a municipality's land use plan may then adopt principles, objectives and policies consistent with sustainable water management. These policies may be implemented, by means, for example, of applying the policies when issuing subdivision or building permits, or in preparing a stormwater management strategy or a habitat protection strategy.

Milestone 5.1: Adopt council-endorsed commitment to sustainable water management

The transition towards sustainable municipal water management is brought into effect through the integration of a vision adopted by council into the corporate culture of a

municipality, its departments and by its residents and businesses. This vision clarifies how the city will make a shift from the traditional model that saw water management as the sole responsibility of the water and wastewater department.

Indicator 5.1

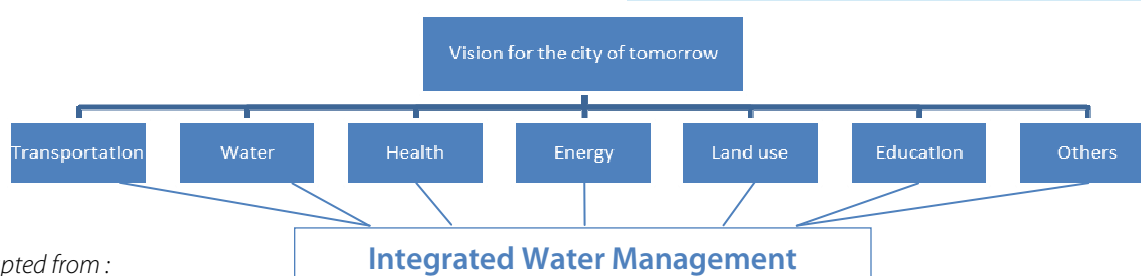
'Adoption of a vision for sustainable municipal water management by municipal council (static indicator)'.

Tip: The details of the vision for SMWM may be provided in the narrative section of the SMWM public report.

Good Practice

In 2010, the City of **Salaberry-de-Valleyfield**, Québec, adopted a Sustainable Development Action Plan, following a process of public input. Protection of the environment and water resources are central to the Action Plan. It is based on a state of the environment report prepared in 2009. The Action Plan defines specific actions, with indicators to measure progress and results. Lastly, each year the mayor of Salaberry-de-Valleyfield holds a public forum in order to take stock of progress through the year. In 2012, 87% of actions identified in the Action Plan were completed or en route to being achieved.

For more information: www.ville.valleyfield.qc.ca/fr/service.prtscid=SV_PAGE_GENERIQUE_CATEGORIES130&idoc=151495



This scheme is adapted from :
Water Services Association Australia ²⁰

Milestone 5.2: Integrate water policies into land use plan

As sustainable municipal water management involves multiple municipal departments, and in some cases regional utilities, the integration of SMWM objectives within a municipality's land use plan is one of the more effective means to bring it about. Urban intensification, policies applying to subdivision developments, the preservation of urban parklands, the clean-up of contaminated sites, and the use of green infrastructure in stormwater management are some examples of the measures that may be integrated into land use planning to further protect water resources.



Progression towards smart neighborhood building
Image Credit : US Green Building Council

Indicator 5.2

'Integration of sustainable water management objectives into a municipality's land use plan (static indicator)'.

Tip: In addition to indicating whether a municipality has integrated SMWM into its land use plan, a municipality may provide details on the policies included in the land use plan in the narrative section of the SMWM public report.

Good Practice

The City of Québec, Québec, part of the **Metropolitan Community of Québec**, is creating an entire model neighborhood based on sustainable development and best practices in architecture. While the project for a green neighborhood is still in the planning stage, the plan and vision developed by the City of Québec includes best practices in the rehabilitation of a contaminated site, situated next to the St. Charles River, use of alternative energy sources, and waste management based on best practices in recycling and composting. The project will also include best practices in rainwater harvesting and retention, using green roofs, retention ponds and wetlands. A portion of the harvested rainwater will be used to irrigate urban gardens and green spaces.

For more information: www.ville.quebec.qc.ca/EN/environnement/urbanisation/ecoquartiers/docs/PointeAuxLievre%20ANG-final.pdf

Eco-efficient and water-friendly buildings:

Some existing tools may be of assistance to municipalities embarking on the integration of SMWM in their land use plans. For example, LEED certification and guidelines apply to green buildings, and LEED-ND certification and guidelines apply to neighborhoods.

More information is available at www.usgbc.org



Vision of a 'green' neighborhood planned on the St. Charles River in Québec City
Photo Credit: City of Québec

Milestone 5.3: Collaborate on a watershed-scale

A sustainable municipal water management approach should also consider how it fits into a broader watershed water management strategy, with consideration for the interconnections between and amongst urban areas, suburban areas, and rural and agricultural areas. Consideration of watershed effects is particularly important for Great Lakes and St. Lawrence protection, given that the Lakes and the River are 'downstream', or at the receiving end of runoff that accumulates pollutants as it crosses through watersheds. Addressing activities that contribute to this 'downstream' effect is an essential aspect of a water protection strategy for the entire basin.

There are a number of examples of watershed management plans affecting the Great Lakes and St. Lawrence, including the St. Lawrence Plan 2011-2026²¹ and Ontario's watershed-based Drinking Water Source Protection Plans²².

Indicator 5.3

- A. Adoption of a watershed-scale approach within the sustainable municipal water management strategy (static indicator)'.
- B. The municipality currently participates in the development or implementation of a watershed-scale water management plan (static indicator)'.

Milestone 5.4: Adopt green infrastructure

Green infrastructure is increasingly seen as an effective complement to grey infrastructure to manage stormwater and to contribute to the quality of life in towns and cities. Green infrastructure has been shown to be effective in retaining water on land, reducing runoff, providing a natural filtration process to remove pollutants from stormwater, and even reducing the risk of flooding. Low impact development and green infrastructure can also contribute to the revitalization of neighborhoods, the reduction of air pollution, and lowering the 'heat island' effect in urban areas²³.

Indicator 5.4

- A. 'Objective or policy adopted by a municipality to encourage the use of green infrastructures (static indicator)'.
- B. 'Percentage of permeable surfaces within serviced urban boundary'.

Tip: The serviced urban boundary includes those areas that are serviced by a public water/wastewater system.



City of Milwaukee, Wisconsin
Photo Credit: City of Milwaukee

Good Practice

In 2006, the Ontario Government passed the Clean Water Act, establishing a locally-driven, watershed-based program to assess and develop policies to address significant threats, or to prevent future threats, to sources of drinking water, be they groundwater or surface water. The assessment process includes identification and characterization of significant threats to drinking water sources, a water budget to determine the vulnerability of water supply (i.e. groundwater), and the designation of vulnerability zones around public water intakes. Given that eighty percent of public drinking water is drawn from the Great Lakes in Ontario, this process of assessing threats at a watershed-scale has given municipalities unparalleled information on the activities that are contributing to pollutants that eventually find their way into the Great Lakes. Many Cities Initiative members participated on watershed-scale source water protection committees to assist in preparing policies that, once approved by the Provincial Minister of the Environment, will be required to be implemented at the local level.

For more information: <http://www.waterprotection.ca/DPSPP/dpspp.htm>

Good Practice

Greenseams is a voluntary program for private property owners, run by the **Milwaukee** Metropolitan Sewerage District (MMSD), the utility that serves Milwaukee, Wisconsin, and surrounding communities. It has protected natural areas with high water retention potential that are being encroached by urban development, as well as lakefronts, forests, meadows, and riverbanks. MMSD recognized that the loss of these natural spaces would have a significant impact on fulfilling its responsibilities for the collection of wastewater and stormwater management.

As a result of the Greenseams program, 1.3 billion gallons of water are retained rather than running off into Lake Michigan. A portion of the protected space has also been made accessible to the public and has been used to raise public awareness about our collective responsibility to protect water resources. For property owners, the program also offers an excellent opportunity to protect their lands and to contribute to the quality of life in the Milwaukee region.

For more information: <http://v3.mmsd.com/Greenseams.aspx>



Protection of water retention capacity through Greenseams Program - This aerial photograph shows orange zones that are protected properties under the Greenseams program. Wooded agricultural lands adjacent to these orange zones are also included in the program. The drainage system of these lands is modified to maximize water retention.

Photo Credit: MMSD²⁴

Milestone 5.5: Value ecological functions

Ecological services refer to the benefits associated with natural processes or features within the surrounding ecosystem that provide a quantifiable benefit to communities²⁵. Ecological services include, for example, the creation of fertile soil, reduction of discharges, the storing or natural filtration and removal of pollutants, the maintenance of biodiversity and genetic diversity and the aesthetic and recreational value of natural areas.

Typically, the value of ecological services does not figure into decision making because they are not quantified in advance. An important way to influence decision making to support sustainable municipal water management is to formally require the consideration of the value of ecological services that may be affected by a decision. The integration of the calculated value of ecological services that are not usually accounted for allows decision makers to take the best informed decisions, particularly in land use decisions²⁶.

Indicator 5.5

'Consideration of the value of ecological services in land use decision making affecting sustainable municipal water management (static indicator)'

Tip : The methodology behind the calculation of the value of ecological services continues to evolve. Therefore, the above indicator can be based on estimates and best available information on the value of ecological services. Details of the method of calculation may be included in the narrative section of the SMWM public report.



City of Chicago, Illinois
Photo Credit: City of Chicago

Good Practice

In 2001, the City of **Chicago**, Illinois, renewed its commitment to natural areas and ecosystems with the adoption of the Nature and Wildlife Plan 2011-2016. In addition to defining objectives and strategies for the protection of natural spaces and the improvement of urban ecosystems, the plan recognizes the role that these natural spaces play in the vitality and quality of life of the city, as well as the public's perception of their city. It also recognizes that the value of ecological services is an important element of the protection of natural spaces and ecosystems. For example, a study of the benefits of the urban forest in Chicago has quantified that the city's 3.6 million trees are worth \$22 million, which represents an economic calculation of their ecological value for their contribution to carbon sequestration, air pollution removal, among other ecological functions²⁷. The estimated value of the beaches in Chicago to its users was calculated at US\$1 billion.

For more information: www.cityofchicago.org/city/en/depts/dcd/supp_info/chicago_nature_andwildlifeplan.html

The value of ecosystem services as a decision-making tool:

A 2007 report entitled America's North Coast : A Benefit-Cost Analysis of a Program to Protect and Restore the Great Lakes , reached some interesting conclusions with respect to the potential returns on investments in Great Lakes restoration. Based on the recommended investments in water quality and environmental protection contained in the USEPA's Great Lakes Regional Collaboration Strategy to Restore and Protect the Great Lakes, a plan that called for twenty six billion dollars in restoration work in the region, the study calculated that the investments would realize a fifty billion dollar return, or a 2:1 return on investment. For example, in the drinking water sector, the study found that investments would result in savings of between fifty and one hundred and twenty five million dollars as a result of a reduction of 10-25% in sedimentation by controlling erosion. The study also concluded that in the absence of such investments, in the short term, the region could suffer losses. Improvements in the environmental quality of the Great Lakes region are a major incentive in attracting and maintaining skilled workers and dynamic industries.

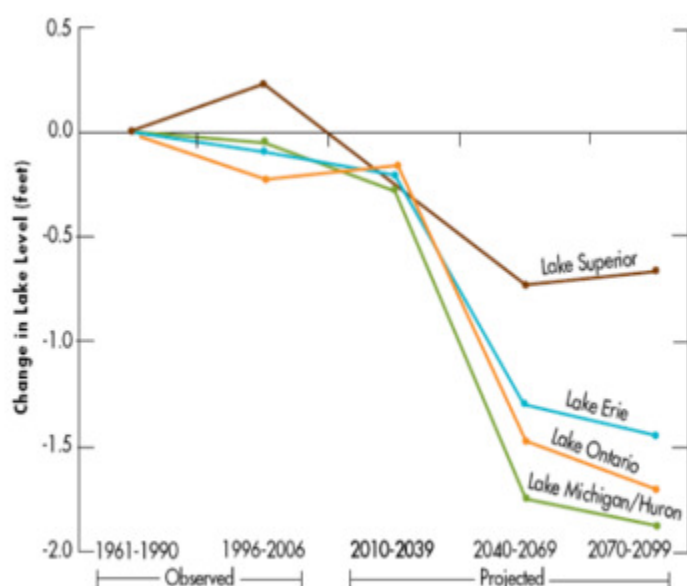
For more information: [http://www.snre.umich.edu/scavia/wp-content/uploads/2009/11/America s North Coast Report 07.pdf](http://www.snre.umich.edu/scavia/wp-content/uploads/2009/11/America_s_North_Coast_Report_07.pdf)

Principle 6: Water Preparedness for Climate Change

Milestones

- 6.1. Conduct a vulnerability assessment
- 6.2. Address vulnerability
- 6.3. Adapt emergency response plan
- 6.4. Mitigate contribution to climate change

The Intergovernmental Panel on Climate Change (IPCC) has concluded that the climate of the next several decades will be different from the one that our communities have enjoyed in past years²⁸. Within the Great Lakes region, predictive modeling by the National Oceanic and Atmospheric Administration (NOAA) suggest that temperatures will be higher than the current norm. Winters will become warmer, particularly in the northern end of the basin, and summers will be particularly hot in the southern end. A slight increase in average precipitation is anticipated, but a more significant increase in the frequency of heavy rainfalls and extreme weather events, such as droughts or tornados, is also expected. Lastly, the higher atmospheric temperatures and the reduction in ice coverage on the lakes are expected to accelerate evaporation, causing a decline in lake levels to historic lows. According to predictions by Ouranos, a Québec-based climate change research consortium, similar climatic patterns and impacts are expected in the St. Lawrence region²⁹.



Predicted changes in Great Lakes water levels

Image Credit: NWF³⁰

A 2011 survey conducted by the Cities Initiative showed that the impacts of climate change are already being observed on the ground, such as the increase in the frequency of storm and heavier rainfalls as well as early and rapid spring snow melts and resulting stormwater runoff.

This is why understanding and adapting to these climate change impacts is becoming a priority for many local governments, and are being integrated into comprehensive action plans over the short, medium and long term.

Milestone 6.1: Conduct a vulnerability assessment

The impacts of climate change will not be consistent across all regions. Microclimates could result in dramatically different conditions, from prolonged drought in some areas to extreme flooding in others. The first step to adaptation is a better understanding of these local conditions, and an assessment of the likely impacts of climate change.

A municipality's vulnerability to changes in weather will depend, among other characteristics, on the local geography that influences precipitation levels and stormwater conveyance, the age and capacity of infrastructure, including bridges and underground pipes, and the settlement patterns in relation to possible flooding scenarios. There is also a strong equity component to a vulnerability assessment, as some groups of people will be more vulnerable than others, given differences in income, lack of access to municipal services, or social isolation³¹.

Indicator 6.1

'Assessment of municipal vulnerability associated with climate change completed (static indicator)'.

Good Practice

The City of **Welland**, Ontario, in cooperation with the Cities Initiative, the Ontario Ministry of the Environment and Engineers of Canada, completed a climate change impact assessment study of its water, wastewater and stormwater infrastructure. Like a number of other cities, Welland is preparing an infrastructure maintenance and replacement strategy to complete the separation of its combined sewer system. The city recognized that it needed to include consideration of climate change impacts in the design of its new sewage infrastructure. The study also assessed the need to update its Intensity Duration Frequency (IDF) curve that informs future infrastructure design criteria based on anticipate precipitation events, as well as the current capacity of its water system. Lastly, the study makes a series of recommendations with respect to minimizing risks, including raising public awareness and applying green infrastructure.

For more information: <http://www.glslcities.org/news/news/Welland.pdf>



Sept-Îles, Québec

Photo Credit: City of Sept-Îles

Milestone 6.2: Address vulnerability

With knowledge of current and anticipated climate change impacts and associated risks, and the lead time required for adaptation, many municipalities are already embarking on measures to adapt to anticipated climatic changes. The adaptation strategy typically would include adaptation measures that touch on a range of municipal activities and services, encourage decentralized measures that respond to very local conditions, and where information is lacking, embrace the precautionary principle and a 'no regrets' philosophy that brings benefits regardless of outcomes. In addition, given limited financial resources, prioritization of measures is essential.

Consideration of public safety and the protection of property and goods may require a revision of settlement patterns based on the vulnerability assessment, for example for flood-prone or land-slide-prone neighborhoods. Similarly, infrastructure construction standards, such as design criteria and building standards, including stormwater conveyance away from properties may also need to be adapted to climate change predictions.

Indicator 6.2

'Climate Change adaptation plan associated with water resources and operations approved and implementation under way (static indicator)'.



Ellesmere Road flooded during a heavy rainfall in 2005, Toronto, Ontario

Photo Credit: City of Toronto

Good Practice

Like a number of municipalities that border the St. Lawrence River, **Sept-Îles**, Québec, is facing serious challenges from erosion. From 2005 to 2008, Sept-Îles, the Québec Ministry of Public Safety, Ouranos (a climate change research consortium), the University of Québec in Rimouski and the municipalities of Percé and Îles-de-la-Madeleine collaborated on a research study aimed at better understanding the impacts of climate change on erosion and strategies to manage and adapt to these changes. The problem of coastal erosion in Sept-Îles is expected to worsen as a result of climate change, in part because the protection of coastlines by ice cover will be diminished as winters become warmer and shorter. As a result of the study, Sept-Îles undertook land use zoning changes to better control shoreline activities and conducted a cost-benefit analysis of different solutions to protect at-risk buildings due to coastal erosion.

For more information: http://www.ouranos.ca/media/publication/20_Rapport_Savard_maritime_2008.pdf



Shoreline erosion on residential properties, Sept-Îles, Québec

Photo Credit: La Presse³²

Milestone 6.3: Adapt emergency response plan

Flooding in the Richelieu Valley in Québec last spring, and the increased frequency and movement north of tornados and hurricanes in the US, are reminders that climate change impacts are real, and can create immediate and dire public safety risks. Municipalities are beginning to adapt their emergency response plans to the possible public safety scenarios that may result from a range of climate-induced emergencies. For instance, these may include more effective alert systems, support for vulnerable populations such as the elderly, and even the relocation of emergency service centers if necessary. Emergency power sources, financial reserves, and rescue equipment may also need to be improved depending on the climatic event anticipated³³.

While emergency response strategies are essential to effectively respond in a crisis situation, some water –related measures such as maintaining minimum supply during a prolonged emergency can also benefit from early adaptation of systems and infrastructure that may avert or reduce the risk during an emergency. These could include proactively reducing water losses, or reusing or recycling water³⁴.

Indicator 6.3

‘Adaptation of municipal emergency plan based on climate change vulnerability assessment (static indicator)’.

Good Practice

Racine County, Wisconsin, has adapted its emergency plan to reduce the public's vulnerability to severe weather events, which are predicted to increase in frequency. In December 2011, the National Weather Service (NWS) recognized Racine County as a 'StormReady' community. Racine County is Wisconsin's 10th StormReady community and one of only about 1,000 nationwide.

'StormReady', a national community preparedness program under the direction of the National Oceanic and Atmospheric Administration (NOAA), uses a grassroots approach to help communities develop plans for handling all types of severe weather. The designation is reserved for communities that have solid communication networks and multi-hazard emergency operations plans. Specifically, in order to become StormReady, the community must have: established a 24-hour warning point and emergency operations center, multiple methods to receive and disseminate severe weather warnings and information for their community, various methods to monitor weather conditions locally, promote the importance of public readiness, and develop a formal hazardous weather action plan (including severe weather spotter training and drills). Racine County (including the City of Racine) has fully met all these requirements with, for example, extensive public outreach campaigns, annual storm spotter training, and placement of weather radios in all Racine County schools and municipal buildings. For more information: www.crh.noaa.gov/mkx/?n=racinestormready.



Flooding in Racine, Wisconsin
Photo Credit: City of Racine

Milestone 6.4: Mitigate contribution to climate change

While the reduction of greenhouse gases (GHGs) can involve a whole range of municipal activities, given the focus of the sustainable municipal water management framework, it is proposed that for reporting purposes, only those activities to reduce GHGs that are water-related should be included. The energy consumption and greenhouse gas emissions associated with the production and use of water in a municipality can be reduced in three ways: by reducing the consumption of water, and hence the amount of wastewater generated; by recovering the energy value contained in organic material in wastewater; and lastly by using alternative sources of energy with lower or zero carbon content to power the water and wastewater systems.

A number of wastewater plants have already put in place technology that harnesses the energy value of organic material in sewage sludge, either by collecting gas from anaerobic digestion or transforming nutrients into fertilizer. These technologies also generate additional revenues for the municipality and can reduce the system's dependence on carbon-based energy³⁵. Greenhouse gas reductions associated with water use can also be made in the residential sector, through the installation eco-efficient appliances and fixtures like solar-powered or tankless water heaters.

Indicator 6.4

'Increase in energy savings in the operation of the water and wastewater systems as a result of energy efficiency measures or co-generation'.



City of Duluth, Minnesota
Photo Credit: City of Duluth

Good Practice

The City of **Duluth**, Minnesota, has adopted an Energy Action Plan to increase energy efficiency, reduce greenhouse gas emissions, and to reduce energy-related operational costs. Its 2011-2015 Action Plan includes a 20% target by 2020, based on 2001, for greenhouse gas emission reductions and a monitoring program to track progress. The 2008 emissions inventory showed that the wastewater treatment sector and the water distribution sector were responsible for 13% of total GHGs, and activities related to water accounted for 50% of the total annual municipal electricity consumption. As a result, the municipality has taken measures to reduce the maximum temperature of heated water, replace high flow toilets, showers, carwashes, and has planted vegetation that needs less irrigation.

For more information: http://www.duluthmn.gov/downloads/Duluth%20CITY%20OPERATION%20Energy%20Action%20Plan_FINAL_May%2010%202011.pdf

CONCLUSION

By using the SMWM framework's principles, milestones and indicators described in this report, municipalities across the Great Lakes and St. Lawrence basin will be able to track their progress towards sustainable water management in an easy-to-communicate and comprehensive way.

Chapter 3 provides guidance and advice on preparing a Sustainable Municipal Water Management Public Evaluation Report (SPER), based on the framework described above.

3. Guidance for Preparing a Sustainable Municipal Water Management Public Evaluation Report

This chapter serves as a guide for municipalities that choose to prepare a SMWM Public Evaluation Report (SPER). The SPER is a tool to assist municipalities in evaluating and publicly reporting on their progress towards the principles and milestones in the Cities Initiative's Sustainable Water Management Framework, using the indicators described in chapter 2 of this report.

It is important to note that the SMWM Public Evaluation Report (SPER) does not aim to compare municipalities against each other. Rather the objective is to track over time an individual municipality's progress towards meeting the twenty-five milestones in the SMWM framework. In this way, it is hoped that this evaluation and public reporting function will serve to keep the public informed, and to encourage municipalities to go even further in their progress towards sustainable water management.

What's in a SPER?

A SMWM Public Evaluation Report (SPER) may be prepared every 1-2 years, in any format that serves the purposes of the municipality. What is most important is that it serves as a useful tool for the mayor, council, and other senior decision makers in communicating with the public about the municipality's SMWM performance.

It may be combined with an existing water-related public report, such as an annual drinking water quality report that is required in some jurisdictions. At a minimum, the Cities Initiative recommends that the SPER include:

1. Monitoring and evaluating progress towards the SMWM principles and milestones over a fixed period of time, using the indicators described in chapter 2, or similar indicators that capture the same intent of the milestone.
2. An At-a Glance performance evaluation table that uses indicators and a color-coded system to indicate performance across the twenty-five milestones.
3. A narrative section that provides more detailed explanation of the evaluation of activities undertaken under each milestone, such as monitoring methodologies, best practices, and additional sources of information.

Monitoring and Evaluating Performance using the SMWM Indicators

The first step in preparing a SPER is to identify what monitoring is already underway in the municipality that can serve to measure progress towards the SMWM milestones, and what additional monitoring is required.

As some municipalities may have limited resources to commit to monitoring across such a wide range of activities, the evaluation system proposed below allows for a municipality to indicate that information is not available to determine progress. As this information does become available, it can be added to the SPER year over year.

The evaluation indicators described in chapter 2 strive to strike a balance between consistency and flexibility. The set of twenty-five outcome-oriented indicators allows a municipality to evaluate its performance towards each of the milestones in the SMWM framework. These indicators have been developed with the diversity and range in capacity amongst our broad membership in mind.

Note that in chapter 2, some milestones provide an option of choosing one of two indicators that best suits local circumstances. To match its local circumstances, a municipality may use a different indicator to measure its progress towards the same milestone. What is most important is that the same measurement is used by the municipality over a number of years to track progress consistently.

Two Types of Indicators

There are two types of indicators described in chapter 2 to evaluate performance. Tips are provided throughout chapter 2 to explain how these indicators should be applied.

The first type, **trend indicators**, show changes over time, using quantitative measurements. This type of indicator is applied where the milestone calls for improvement over time, such as Milestone 4.2 'Remove pollutants from wastewater treatment plant effluent'. Evaluating a municipality's performance using this type of indicator involves comparing monitoring data over a fixed period of time.

In the first reporting year, the fixed period of time for reporting purposes can be chosen at the discretion of the municipality. It is recommended that this period of time be within the last 1-5 years. If municipal investments were made more than five years ago that resulted in a significant improvement, for example in sewage effluent quality, this information may be documented in the narrative section of the report. If there is no data, then 2012 can serve as 'year zero', and progress can be measured in subsequent years.

The second type, **status indicators**, indicate whether a milestone that cannot be quantitatively measured has been achieved. For example, for Milestone 5.2, 'Integrate water policies into land use plan', the evaluation is simply a yes/no response to the question, "Have you integrated water policies within your land use plan?"






Preparing the At-a-Glance Table of the SPER

The At-a-Glance section is intended to offer the public an easy-to-understand overview and evaluation of a municipality's progress towards the SMWM milestones. It would appear as a two-page spread sheet near the beginning of the SPER (see template, Appendix 1). The template may be downloaded from the Cities Initiative website at www.glsicities.org/initiatives/greencities/smwm.cfm.

The At-a-Glance evaluation table consists of three columns (see example, below).

1. **Milestone:** The first column indicates the milestone against which progress is being measured.
2. **Trend/Status:** The second column provides a very brief explanation of the nature of the progress, be it based on a measured trend over time or status indicator.
3. **Evaluation:** The third column provides the color coded evaluation of the progress described in column 2. As seen below, the shape of the color code will depend on whether the indicator measures a trend or status.

Example of an At-a-Glance evaluation table for Milestones under Principle #5, Water Protection Planning, prepared by the Town of Ajax (ON)

#	Indicator	Description of Progress	Evaluation of Progress
5.1	Corporate water management statement	2000: Town Council motion to adopt Environment-Oriented Official Plan for Ajax, with principles, goals & policies for protecting water quality in Lake Ontario and other waterways, and protecting environmental features & functions.	
5.2	Integrate water management into land use plan	2010: Ajax Council adopted OPA 38 (Environment Policies), with focus on Lake Ontario Waterfront, Water Quality and Stormwater Management.	
5.3	Watershed-scale collaboration	2003: Watershed Plan policies for Duffins and Carruthers Creek incorporated into Ajax Official Plan. Continuous collaboration on projects with local watershed agency.	
5.4	Green Infrastructure	Insufficient resources to determine extent of pervious surfaces, or adoption of green infrastructure	
5.5	Ecological services	Approved OPA 38 to the Ajax Official Plan established policies to protect the ecological features and functions	

Note: The SPER At-a-Glance table includes all 25 milestones

How to Describe Progress in the Trend/ Status Column

Using the above **trend** indicator example, Milestone 4.2 'Remove pollutants from wastewater treatment plant effluent', depending on the evaluation of performance, the entry in the Trend/Status column could read:

- ◆ 'BOD5, total suspended solids, phosphorus levels and total nitrogen all show downward trend' (this describes 'progress')
- ◆ 'no significant change in pollutant levels over the last year' (this describes 'stability')
- ◆ 'gradual increase in BOD5, total suspended solids, phosphorus levels and total nitrogen over last three years' (this describes 'improvement needed')
- ◆ 'not responsible for wastewater treatment, upper tier responsibility' (this describes 'not applicable')

Using the above **status** indicator example, Milestone 5.2 'Integrate water policies into land use plan', depending on the evaluation of performance, the entry in the Status column could read:

- ◆ 'water sensitive policies integrated into land use plan in 2010', ('achieved or adopted')
- ◆ 'water sensitive policies to be integrated into land use plan in 2013', ('in process of being adopted')
- ◆ 'Specific water-sensitive policies not integrated into land use plan', ('not adopted')









Based on the municipality's own quantitative measurements, as reflected in the Trend/Status column, it is up to the municipality to determine whether a trend should be characterized as a) progress, b) stability, c) needs improvement or d) undetermined. As described in the table below;

- ◆ A green rectangle may be used where a municipality's quantitative measurement shows moderate or significant progress has been made of the chosen period of time.
- ◆ A yellow rectangle may be used to show slight improvement or lack of improvement, or no change towards the milestone.
- ◆ A red rectangle may be used to show a deteriorating trend in the municipality's quantitative measurement towards the milestone.
- ◆ A grey rectangle may be used where no quantitative measurement is available, or the milestone in question is not the responsibility of the municipality.

Likewise, the status of achieving a particular milestone should be characterized as:

- ◆ A green diamond for 'achieved or adopted'
- ◆ A yellow diamond for 'in process of being achieved/ adopted'
- ◆ A red diamond for 'not adopted/not planned'
- ◆ A grey diamond for 'not applicable'

How to fill in the Evaluation Column and Choose the Right Color Code System of Evaluation

Evaluation of Trend Indicator		Evaluation of Status Indicator	
	Progress: The indicator is clearly showing improvements in this milestone.		Milestone achieved or adopted
	Stability: The indicator is showing slight improvements or little change		Milestone in process of being adopted/ planned
	Needs improvement: The indicator is showing a reversal or deterioration in performance		Milestone not adopted, not planned
	Data not available, or not applicable		Milestone not applicable

Preparing the Narrative Section of the SPER

The At-a-Glance table and indicators are used to illustrate the status and trend of SMWM milestones. More detailed information may be needed to grasp the full scope and complexity of municipal activity and the full meaning of the indicators.

To supplement the At-a-Glance section of the SPER, a narrative section provides evidence and/ or an explanation of the evaluation of each milestone from the At-a-Glance evaluation table. This section may be as long or as short as a municipality sees fit. Throughout the first section of this report, tips are provided where it is felt that elaboration in the narrative section to describe the story behind the indicators would be helpful.

Suggested Elements of the Narrative Section

For each milestone, it is suggested that details be provided in the narrative section of the SPER, including:

- ◆ Further explanation of progress that has occurred in the 25 areas of activity;
- ◆ Description of programs, policies or investments that resulted in improved performance, including best practices;
- ◆ Description of the data gathering activities and monitoring methodology (e.g. sampling frequency, sources of information, extrapolations);
- ◆ Information on how the municipality intends to continue to maintain/improve its performance;
- ◆ Long term goals or objectives;
- ◆ Documents or links to relevant documents (e.g. Water quality reports, land use plan, specific project website , etc.) and photographs that show the results of a municipality's efforts.

CONCLUSION

The purpose of the SMWM Framework and the SPER reporting tool is to provide municipalities with a vision of sustainable water management towards which to work, and to assist municipalities in evaluating and publicly reporting on their progress towards this vision.

Each municipality will be at a different point on the journey. The first round of reporting may prove challenging for some, if data is lacking to evaluate performance in some areas, or indicators described in chapter 2 do not reflect a municipality's situation on the ground. Whatever the circumstances it is important to note that the departure point is not as important as the destination, and the progress made year over year. By documenting this progress, Cities Initiative members will once again demonstrate that they are leaders, individually and collectively, in charting a path towards a more sustainable future in the Great Lakes and St. Lawrence basin.

The Cities Initiative encourages its members to send their completed SPER to the Cities Initiative at pam.kaput@glslcities.org. It will be posted on our website along with the SPERs of other members. It will also be eligible for an award at next year's Cities Initiative Annual Conference.

The Cities Initiative welcomes members' feedback on preparing this first report. Please send any comments to the email above. With this feedback, the Cities Initiative will continue to improve it, with a goal of building an internationally-recognized, credible method of evaluating a municipality's SMWM performance.

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APPENDIX 1: At-a-Glance Performance Evaluation Template

#	Milestone	Trend/Status	Performance Evaluation
1.1	Promote water conservation		
1.2	Install water meters		
1.3	Set the price right		
1.4	Minimize water loss		
1.5	Increase water reuse/recycling		
2.1	Raise public awareness		
2.2	Engage the public		
3.1	Protect and restore shorelines and riparian corridors, and control erosion		
3.2	Increase access to shoreline, river banks, and waterfronts		
3.3	Protect habitat		
4.1	Prevent pollutants from entering the sewage collection system		
4.2	Remove pollutants from wastewater treatment plant effluents		
4.3	Reduce stormwater entering waterways		
4.4	Monitor and respond to sources of pollution		
4.5	Improve beach quality		
4.6	Reduce sodium chloride entering waterways		
5.1	Adopt council-endorsed commitment to integrated water management		
5.2	Integrate water policies into land use plan		
5.3	Collaborate on a watershed-scale		
5.4	Adopt green Infrastructure		
5.5	Value ecological functions		
6.1	Conduct a vulnerability assessment		
6.2	Address vulnerability		
6.3	Adapt emergency response plan		
6.4	Mitigate contribution to climate change		