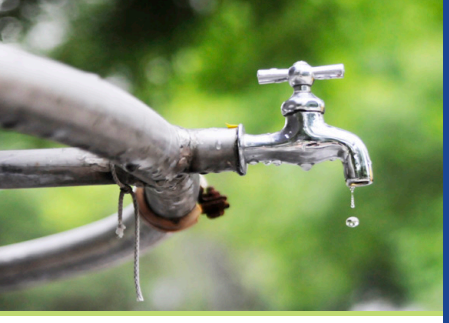
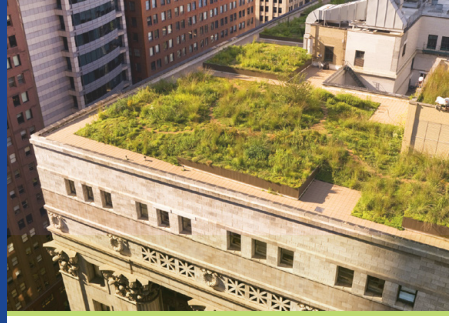


GREATER LAKES

Reconnecting the Great Lakes Water Cycle



Making Cents from Integrated Water Management: Financial Considerations for Municipalities Related to Water Conservation and Green Infrastructure

Greater Lakes Project | May 2016

In this summary report, the financial implications of implementing water conservation/efficiency and green infrastructure methods are evaluated for their impact on municipalities and their ratepayers.

All across the Great Lakes basin, the natural water cycle has been fractured as a result of development practices whose consequences were not fully understood. Our built environment inhibits infiltration and increases runoff, washing pollution into nearby lakes and streams. The impacts are not only economically and socially damaging, but also ecologically destructive and unsustainable.

Greater Lakes: Reconnecting the Great Lakes Water Cycle[1] aims to help heal these fractures. This requires shifting from a paradigm where water is used and discarded to one where water is valued, and returned to the water cycle. An Integrated Water Management (IWM) approach, which embraces water conservation and efficiency, and green infrastructure, is a smart choice for both the environment and municipal budgets. IWM enhances the environment by mitigating problems like flash floods and water scarcity, thus reducing government costs. This summary examines additional financial questions and demonstrates that properly implemented IWM, incorporating water conservation/efficiency and green infrastructure, is a wise investment.

Municipalities are uniquely positioned to benefit from investing in water conservation/efficiency and green infrastructure. Although some municipalities across the Great Lakes basin are making such investments, two key barriers remain. First is the perception that water efficiency/conservation and green infrastructure are not as effective as the traditional "pipes and pumps" at dealing with water supply, wastewater conveyance, and stormwater management needs. The Greater Lakes project helps demonstrates that moving beyond the "pipes and pumps" is an effective option for municipalities and even produces additional benefits.[2] The second barrier is the belief that the IWM approach focusing on water conservation and green infrastructure is too expensive for the municipalities and their water users.

1 The *Greater Lakes* project was led by the Great Lakes Commission with funding from the Great Lakes Protection Fund. Between 2013 and 2016 the Greater Lakes project team worked with communities in the United States and Canada to identify and test the ecological and financial rationales for pursuing water conservation and green infrastructure practices, and piloted the use of this information to drive better water management throughout the Great Lakes region. More information is available at http://glc.org/projects/water-resources/greater-lakes/

2 See materials on website in foot note 1 for our reports and educational events addressing this perception.

Financial Costs and Savings Delivered by Water Efficiency and Conservation Programs[3]

Costs: Water conservation programs cost municipalities money. However, savings usually outweigh those costs. Costs may result from implementation of mandatory conservation programs or providing incentives to change customer behavior.

Municipalities must pay for staff time to administer water conservation programs whether the drivers are mandatory or incentive-based. This involves time for staff to conduct inspections, process rebates, etc.

The financial incentives to encourage water users to adopt a water efficiency/conservation activity are the most common cost for municipalities engaged in water conservation and efficiency. Popular examples include rebates on the purchase of water efficient toilets and washing machines. Other examples are rebates on irrigation controllers and rebates for placing water efficient pre-spray valves on dishwashing systems in restaurants.

Another critically important municipal cost involves public education, marketing and outreach programs that lead to behavior changes by customers. For example, the City of Guelph offers its water customers free consultations to learn how to improve garden and landscape water efficiencies. Each site visit costs the City approximately $70 (Can.).

Savings: What is the upside of investments in water conservation? Savings! Conservation activities and changed customer behaviors result in lower conveyance and treatment costs for municipalities and delay or reduce costs associated with the expansion of service. Reduced consumption also sustains the available water supply.

Some of these savings occur immediately. For example, less water consumed means less water is pumped and treated by the municipality, resulting in lower energy costs for pumping and treating water, delivering it to the user, and for pumping and treating the resulting wastewater produced. These energy savings can be significant for a municipality.

> "Toronto Water, the municipal operation responsible for water distribution [and treatment] in Toronto, uses more electricity than the Toronto Transit Commission [which runs an extensive network of subways and streetcars primarily on electricity] and five times the energy consumed by all of the city's streetlights and traffic signals."
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> *- Carol Maas, Water Sustainability Project, H2O Ontario: A Blueprint for a Comprehensive Water Conservation Strategy, p. 8 (2009) based on information in IndEco Strategic Consulting Inc. Report on the Development of the Energy Plan for Toronto (2006).*

The Alliance for Water Efficiency (AWE) calculated that by 2025, the Region of Waterloo will save over half a million dollars each year in energy costs alone as a result of its water efficiency and conservation programs. A substantial portion of this is achieved as a result of strengthened Ontario codes requiring use of water efficient appliances. Reduced energy use also means reduced energy generation, and thus reduced greenhouse gas emissions. Municipalities spend substantial sums purchasing electricity to treat and move water. For example, the reduced demand for water also reduces treatment cost for the purification of the water supply because of reduced purchase of treatment chemicals.

Other savings from water conservation and efficiency may not be felt until a future date. As a result of reduced water demand, capital expenditures for new or expanded water supply and wastewater treatment facilities can be deferred, downsized, or even completely dropped. These savings can be dramatic. As an example, the Region of Waterloo's water conservation measures have been so successful that they dropped plans to build a 100 kilometre (62 mile) pipeline to Lake Erie for a new water supply to service this rapidly growing inland community. The resultant savings are estimated to be one billion dollars (Can.) in avoided capital expenditures.

3 Most of the information in this section is taken from a report the Alliance for Water Efficiency prepared for the Greater Lakes Project. The report entitled *Improving Water Conservation and Efficiency in Six Great Lakes Communities* is available at http://glc.org/projects/water-resources/greater-lakes/. It provides much more detail than is in this summary report.

Making Choices to Balance Costs and Savings:

One of the most effective ways to achieve rapid reduction in water use is through installation of **water efficient appliances** in residences and institutional, commercial and industrial operations. Increasingly, senior levels of government are setting standards that ban or restrict the sale or use of non-low flow toilets and washing machines. As a result, new construction will automatically have water efficient appliances and municipalities can focus their efforts on the replacement of less efficient appliances already in use.

A prime driver behind costly municipal water supply system expansion is **peak demand**. Peak demand usually occurs in the summer because of activities like lawn and landscape watering, vehicle washing, etc. For example, in the three municipalities in Oakland County, Michigan analyzed for the Greater Lakes project, the daily water use is between two and three times higher in the summer than the rest of the year. Reducing peak demand is much less expensive and faster than undertaking expensive upgrades or expansions of the water supply system. These reductions can be achieved through the adoption of by-laws or ordinances that limit certain residential, commercial, institutional and industrial outdoor water use in the summer months. "Smart" irrigation systems that deliver water only when it is needed, combined with drought tolerant landscaping, results in water savings at little investment. It was primarily because of by-laws and incentives that addressed peak demand that Waterloo Region ultimately did not need to build the expensive pipeline to Lake Erie.

> The Cost of Water: Municipalities regularly receive complaints that people don't see their water rates go down when they conserve water. The other side of this is the complaint from municipal water managers that they don't sell enough water to cover their costs if people do too good of a job of conserving water. The City of Westminster in Colorado carried out a study of water rate changes over a 30-year period to test this water rate impact question. They concluded that, "Conserve water or don't conserve water – your rates will go up – but if conservation is the lowest cost source of new supply (and it almost always is) then your rates will go up less than they would have without conservation."
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> *- Alliance for Water Efficiency, Conservation Limits Rate Increases for a Colorado Utility: Demand Reductions over 30 Years have Dramatically reduced Capital Costs, November 2013, p. 8.*

Municipalities are all under financial pressure so the need to prioritize investments is important to the municipality and their ratepayers. This requires municipal officials to address critical short-term projects, but also **prepare for long-term needs**. For example, in two of the Oakland County townships that we examined, the cost-benefit analyses for water efficiency and conservation programs did not justify some of the standard water efficiency investments because their water was supplied from a relatively inexpensive groundwater supply. However, while the short-term need may be low, there are indications that groundwater levels are falling. It may be imprudent to rely on this source in the long-term. With that perspective in mind, it makes financial sense to start instituting aggressive water conservation and efficiency programs to delay or avoid the need for substantial future water supply investments.

Innovative programs such as water reuse may not currently make financial sense. Nevertheless, some municipalities are investing in such programs now at a pilot scale in order to build credibility for these innovative programs. Early adoption allows the community to refine such programs and make it easier to implement them at a large scale in the future.

Financial Costs and Savings with Green Infrastructure Programs[4]

Municipalities continue to seek cost effective ways of managing stormwater in a manner that complies with regulatory requirements, prevents flooding, improves the environment and is cost effective. Green infrastructure should be part of the solution.

Costs and Savings: A recurring question around green infrastructure is whether it costs more or less than grey infrastructure. The American Society of Landscape Architects completed a survey in 2015 of 465 case studies related to stormwater management across Canada and the U.S. The study concluded that in three quarters of the cases green infrastructure was not more expensive than grey infrastructure . Their overall conclusion: when carefully selected, designed, implemented and maintained, green infrastructure is less costly than a comparable grey infrastructure solution.

Storm Water Case Studies Cost Analysis

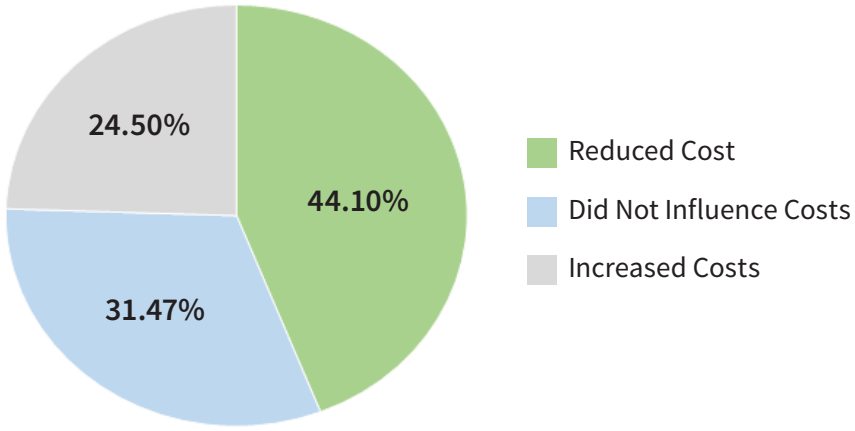

Figure 1. Pie chart prepared by ECT based on information at www.asla.org/stormwateroverview.aspx.

Figure 2 provides some examples of savings from green infrastructure projects from Great Lakes states. For a broader list of projects and relative savings as reported by the American Society of Landscape Architects, see ECT's report for the Greater Lakes Project.[5]

A Comparison of Green Infrastructure Cost Savings (ASLA 2015)

State	Project type	Cost savings with Green Infrastructure
Ohio	Bioretention, green roof, bioswales, permeable pavers, CSO avoidance and compliance instrument	Over 50% reduction in cost
Minnesota	Bioretention, green roof, bioswales, permeable pavers	Construction and site development restrictions made green infrastructure the only option.
Illinois	Pervious pavers	Green significantly cheaper thanks to avoided infrastructure installations
Indiana	Biorentention facility and bioswales	Green capital costs higher, long term costs less, so there is a payoff period
Indiana	Rain Gardens, Porous Pavers, Curb Cuts	10% cost savings over installing grey infrastructure
Indiana	Biorentention facility and bioswales	Savings in maintenance and site redevelopment

Figure 2.

4 The information in this section is based on a report prepared for the Greater Lakes project by Environmental Consulting & Technology, Inc. The report, entitled *A Practical Guide to Implementing Integrated Water Resources Management and the Role of Green Infrastructure*, April 2016, is available at http://glc.org/files/projects/greaterlakes/GreaterLakes-ECT-IWM-How-To-Guide-Final-20160510.pdf.

5 See Table 6-1 in *A Practical Guide to Implementing Integrated Water Resources Management & the Role of Green Infrastructure* on the Greater Lakes website.

Usually the least-cost and most effective solution to a stormwater issue will be a mix of green and grey infrastructure. With this approach, a community receives the best financial solution while also enjoying the multiple ancillary benefits of green infrastructure that are often difficult to quantify.

Figure 3 shows the "least cost mix" relied upon by the City of Portland, Oregon (2005) for reducing stormwater that contributes to combined sewer overflows. The green infrastructure elements are in bold. It shows, for example, that to reduce Portland's CSO's by approximately 18 million gallons, the least cost method would be to use a combination of green infrastructure methods of downspout disconnection, school and church disconnections from the sewage system, and curb extensions. This would also involve some use of grey infrastructure to separate storm and sanitary sewers. If the goal to reduce combined sewer overflows was doubled, more sewer separations (grey infrastructure) and requirements for parking lot infiltration (a green infrastructure method) would be required.

Making Choices to Balance Costs and Savings: A major challenge when comparing costs of green infrastructure is how best to **take into account the full range of benefits of green infrastructure**. Stormwater management – drainage, flood prevention, road safety - is frequently the prime objective when talking about green infrastructure. These will remain primary drivers, but other benefits can be realized through a well crafted "green" drainage program. In addition to avoiding floods, green infrastructure can reduce pollutant runoff, increase groundwater recharge, protect the drinking water supply, enhance habitat and support wildlife. Additionally, green infrastructure increases green space, increases beauty and fosters citizen enjoyment of their community. These benefits can be hard to assign cost savings to, so they are often undervalued by decision-makers.

Costs and Cumulative Volume of Stormwater Removed from the CSO System in Portland, Oregon through Various Gray and Green Strategies (Green in Bold)

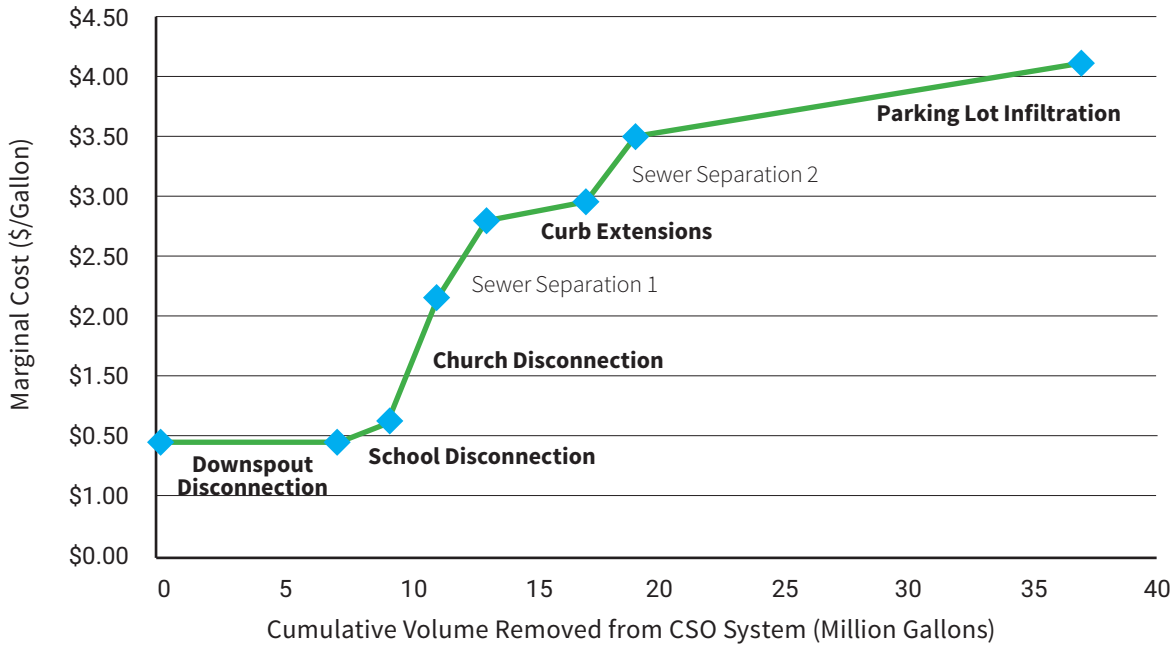

Figure 3. Odefey, 2012

The benefits of green roofs can't all be financially quantified and therefore, green roofs are often not given fair consideration. Additional benefits of green roofs that should be considered include: the valuable use of space in a dense urban setting for stormwater management, providing habitat value, providing space to grow food, and the high insulation effect on buildings.

Stormwater **peak flow rate** – the need to manage and treat stormwater during major rain events - is a major issue facing municipalities. The vast majority of sewer and stormwater sewer pipes are not large enough to accommodate the increased water flow during a severe storm. The results? Flooded (and sometimes impassable) roads, flooded basements, and polluted and eroded streams cause distressing issues for residents and for municipalities. Flood damage also results in major cleanup costs for residents and municipalities. Building sewer pipes large enough to meet peak, yet infrequent storms is extremely expensive. This approach continues to perpetuate a fractured water management approach and ignores the financial, economic and environmental benefits of IWM.

Successful integrated water management methods employ a broad perspective recognizing that:

1. Some benefits are intangible and can't be quantified financially;
2. Savings may not be realized until 10 to 20 years down the road;
3. Changes such as climate change may have a substantial impact on future municipal challenges.

Not unlike the water supply discussion where the cheapest way to meet peak demand water conservation and efficiency is to reduce demand, the least costly and quickest way to address peak stormwater flow is to install green infrastructure. In this case, green infrastructure will increase infiltration rates and slow the sudden rush of water into sewers during a major storm. Credit Valley Conservation Authority reports that green infrastructure installations have reduced flooding during major storms. Bioretention planters at the Peel District School Board's Adult Education Centre South school capture 90% of rainfall events with only 3 to 6 events entering storm sewers each year. These features also helped manage the extreme rainfall on July 8, 2013 – no water left the site for the first 40 minutes of the storm. This relieved the pressure on the sewer system, reduced stream erosion, protected water quality and lessened property damage.[6] With climate change, these peak flow events are becoming larger and much more frequent.

Risks and liabilities for municipalities need to be taken into account when examining the financial aspects of green and grey infrastructure. Money can be saved through cost avoidance measures. Clean-up costs and other damages as a result of floods can be major burdens for both the municipality and property owners. Class action lawsuits against municipalities for damages caused by flooding are increasingly being used by residents. The City of Stratford, Ontario came to a $7.7 million settlement payment to local residents in a class action lawsuit after a flooding event.[7] Green infrastructure techniques with proven performance may relieve municipalities from these liabilities.

Municipalities Taking Action

Municipalities can reduce their operating costs and improve the local environment by using an IWM approach. Moving toward this approach, it may be helpful to think about what can be done within existing management frameworks.

- **Water Use –** Utilizing appliance rebates and incentives for grey water recycling programs, which can decrease municipal operating costs as well as capital needs. Using less water, particularly during peak periods, recycling water, and discharging treated effluent close to the original source water are improvements both for the environment and a municipality's financial situation.
- **Sanitary Sewage –** Costly sewage collection and treatment should be reserved for sanitary sewage only. To accomplish this, infrastructure repair and replacement should reduce extra water entering the sewage collection system by restricting flow from households, institutions, commercial operations and industries to only sanitary sewage while allowing remaining grey water to be recycled on-site. Maximizing the use of existing "in-system storage" will moderate flows to the wastewater treatment facilities. These efforts save money as well as being better for the environment.

6 Credit Valley Conservation, *Grey to Green Public Lands Retrofits*, p. 6.

7 Credit Valley Conservation, *Advancing Low Impact Development as a Smart Solution for Stormwater Management*, p. 7.

- **Stormwater Management –** Green infrastructure should be an important and low-cost component of stormwater management programs. Drainage systems and flood control systems are costly and typically oversized to rapidly move water during peak flows (sending the problem downstream). To minimize these costs – and reap environmental benefits –municipalities should explore IWM to minimize stormwater runoff by storing peak flows and maximizing infiltration.

Financial considerations for Municipalities Contemplating an Integrated Water Management Approach

1. When considering water conservation and green infrastructure methods, look beyond direct financial costs as there are many additional intangible, yet valuable benefits.
2. There are both immediate and longer term cost savings from water conservation and green infrastructure methods.
3. Peak water demand and peak stormwater flow rate can be addressed with less costly water conservation/efficiency and green infrastructure measures, rather than traditional grey infrastructure expansions and upgrades.
4. Long term needs around water supply and demand may be achievable at lower cost through water conservation and efficiency measures
5. Water conservation education and outreach is vital to helping people maintain water conscious behaviors
6. Water rates can be held in check through water conservation efforts.
7. Green infrastructure can be cost effective, even when compared to traditional grey approaches
8. Municipalities must face the reality of risk and liability around flooding and water damage; green infrastructure can help avoid public safety issues, costly litigation, and property destruction.

This publication was authored by John Jackson (Greater Lakes project manager). It is based on work carried out for the Greater Lakes project by Bill Christiansen (Alliance for Water Efficiency) and Jim Ridgway (Environmental Consulting & Technology, Inc.). It was edited by Melissa Soline (Great Lakes and St. Lawrence Cities Initiative) and Victoria Pebbles (Great Lakes Commission). Input was also received from Steve Gombos (Region of Waterloo) and Emily Stahl (City of Guelph). Laura Andrews at the Great Lakes Commission formatted the report for publication.