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# A Green Sector Overview

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## Green Infrastructure and Municipal Services

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Traditional (or *grey*) infrastructure development activities tend to cover large areas with impermeable surfaces like roads, buildings, and other physical structures. These developments place greater pressure on municipal services like stormwater and wastewater management because rainwater cannot infiltrate into the ground. This has caused a need for innovation in stormwater management practices and has created a push for what is known as *green infrastructure*.

In general, green infrastructure can be applied to more activities than just stormwater management, as it encompasses any form of physical infrastructure that exhibits positive environmental attributes. This can include green energy infrastructure such as solar panels and smart grid transmission systems, bike lanes, and living vegetative technologies like constructed wetlands, stormwater ponds, and rain gardens. This last form of green infrastructure, developing networks of open spaces and natural areas, is becoming a more common way to naturally manage stormwater, reduce flooding risk, and improve municipal water quality.

**Bioswales**<sup>1</sup> are vegetated open channels specifically designed to treat stormwater runoff. They have several advantages over conventional stormwater management practices, including reduction of peak flows, removal of pollutants, promotion of runoff infiltration, and also have lower capital costs.



**Green Roofs** can absorb anywhere from 15% to 90% of stormwater runoff, which reduces potential pollutants compared to impervious roofing surfaces. The natural thermal insulation of a green roof – structures are cooler in the summer and warmer in the winter – can also reduce a building's overall energy usage.



**Permeable Pavement** allows rainwater to infiltrate to an underlying reservoir base, which helps to remove pollutants, reduce runoff volumes, and recharge groundwater. Permeable pavement can be a partial alternative to standard asphalt or concrete in sidewalks, parking lots, and roads, but should be used as part of a comprehensive stormwater management plan for the site.

**Rain Gardens** are landscaping tools aimed at improving water quality and reducing the risk of flooding. A bioretention area is created, which collects and stores water runoff and allows the water to be absorbed by the underlying soil. This process naturally recharges groundwater sources and costs less than many conventional stormwater management practices.



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<sup>1</sup> Green Infrastructure images courtesy Centre for Neighborhood Technology and Capital Region District.

**Restored Wetlands and Stormwater Ponds** are areas where water is present at or near the surface of the soil. These areas capture and slow stormwater runoff, while also naturally improving water quality and providing valuable wildlife habitats.



Another key municipal service that will be transformed by the transition to a green economy is waste management and remediation services. A major component of this transition will be the ability of municipalities to move beyond landfills for waste management and adopt greater waste recovery and recycling practices.

## The Market

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Municipal governments are recognizing the need to adapt to the unavoidable impacts of climate change – increased occurrence of prolonged heat waves, torrential rain storms, windstorms, and droughts. The effects of these changes will put greater pressure on municipalities’ physical infrastructure. Already, several large urban centres (including Chicago and New York) have begun to invest heavily in green infrastructure.



The Ontario government released an *Adaptation Action Plan* that addressed many of these issues. Three key areas that may be impacted greatly by the effects of climate change are physical, water, and transportation infrastructure. Physical and transportation infrastructure are particularly vulnerable to damage caused by extreme weather events and temperature-related damage. Water infrastructure, however, may be forced into myriad changes in order to effectively treat wastewater (new bacteria and viruses could thrive in changing temperatures), manage stormwater, regulate water levels, and

supply safe drinking water. Standards for water infrastructure have been based on historical weather patterns, but new infrastructure standards may need to be based on projections of future patterns.

The value of green infrastructure will need to be measured by its ability to help municipalities adapt to and mitigate the effects of climate change. Some key areas for measuring the impact of green infrastructure include water runoff, energy demand, air quality, greenhouse gas (GHG) emissions, and habitat improvement. Quantifying and valuing the social and environmental benefits of green infrastructure is a task that businesses and municipalities need to undertake.

The *Ontario Adaptation Action Plan* makes several recommendations for municipal governments to invest in green infrastructure to deal with these changes. Green infrastructure should be a key part of a low-impact development approach in order to manage storm and waste water in business and industrial parks. As more municipalities develop sustainability plans and include sustainability in their water and infrastructure planning, the market for the development and installation of green infrastructure will grow.

Another important green economy trend for municipalities is brownfield remediation. Brownfield sites are abandoned, idled, or underused industrial or commercial properties that have real or perceived environmental contamination, building deterioration, and/or inadequate infrastructure. Brownfield sites can offer significant opportunities for green infrastructure development. Research suggests that this

trend will provide future business opportunities in soil remediation, ecosystem restoration, and green infrastructure development.

The federal government introduced a **Green Infrastructure Fund** that focuses on green priorities such as building transmission lines for green energy or upgrading wastewater treatment systems. Eligible projects must contribute to cleaner water or air or reduce GHG emissions and fall into the following categories:

- Wastewater infrastructure
- Green energy generation infrastructure
- Green energy transmission infrastructure
- Carbon transmission and storage infrastructure
- Solid waste infrastructure

While the fund focuses on a few, large-scale, strategic infrastructure projects, a comprehensive green infrastructure plan that includes several of the living vegetative systems described above as well as tree planting and green spaces could fit under the wastewater, carbon storage, and solid waste infrastructure categories. There is no application deadline for the fund, but projects must be completed by March 31, 2014.

The Federation of Canadian Municipalities (FCM) also administers the Green Municipal Fund that supports municipal and other projects in under the following categories:

- Brownfields
- Energy
- Transportation
- Waste
- Water

Information on new applications for projects will be made available after July 31, 2011: [www.gmf.fcm.ca](http://www.gmf.fcm.ca)

## **Participants**

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Municipalities will lead the development of green infrastructure in Midwestern Ontario. With the potential impacts of climate change a real threat, municipalities will have to incorporate green infrastructure into their development planning and reform stormwater and wastewater policies. Several large cities in Ontario have begun to implement some green infrastructure projects, including green roofs, permeable pavement, and rainwater harvesting. Two urban centres in Midwestern Ontario, London and Waterloo, have implemented green roof and stormwater pond projects respectively.

In rural Ontario, Conservation Authorities, municipalities and community groups are working together on watershed-based ecosystem restoration projects that engage landowners in the process of restoring green infrastructure on their properties to help in reducing erosion, improving water quality and creating outdoor recreation opportunities. The Pine River Watershed Initiative is an example of this kind of activity: [www.pineriverwatershed.com](http://www.pineriverwatershed.com).

The Lake Huron-Georgian Bay Watershed's *Canadian Framework for Community Action* initiative supports the Pine River project and others. It is a collaborative approach including environmental and local community groups, businesses, municipal, provincial, federal, and aboriginal governments.

Participants in this initiative have committed to the Lake Huron Charter which states: “We commit to working together to restore and protect the lands and waters of the Lake Huron Watershed for today and for all generations”: [www.lakehuroncommunityaction.ca](http://www.lakehuroncommunityaction.ca).

The Region of Waterloo has embraced a number of environmental initiatives related to green infrastructure and municipal services. A summary of these initiatives can be found online at [www.regionofwaterloo.ca/en/abouttheenvironment/abouttheenvironment.asp](http://www.regionofwaterloo.ca/en/abouttheenvironment/abouttheenvironment.asp).

The **Ontario Green Infrastructure Coalition** is made up of a variety of organizations that share a vision for a healthy, green Ontario. The coalition aims to identify opportunities and gaps in current legislation related to green infrastructure, develop a green infrastructure evaluation framework, conduct stakeholder workshops, and release a Green Infrastructure Strategy for Ontario. More information about green infrastructure can be found on their website: [www.greeninfrastructureontario.org](http://www.greeninfrastructureontario.org).

The **Sustainable Technologies Evaluation Program (STEP)** was developed to provide the tools necessary to support the implementation of green infrastructure technologies and practices in Canada. The main objectives of the program are to monitor and evaluate clean air, water, and energy technologies, identify barriers to implementation, develop guidelines and policies, and promote broader adoption of green infrastructure. For more information about STEP visit [www.sustainabletechnologies.ca](http://www.sustainabletechnologies.ca).

## **Environmental Benefits**

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Adding or restoring the green infrastructure of a community has a positive impact on air quality by increasing the CO<sub>2</sub> absorption and production of oxygen through the carbon cycle in plants, as well as the reduction of chemical and particulate pollution through the use green technologies, including energy efficiency and renewable energy supplies.

Biodiversity and habitat improvement occurs when there is an increase in the amount of forest cover in an area, as well as other natural area restoration projects. Creating “green belts” between communities also supports healthy wildlife communities.

Energy efficiency and renewable energy generation projects also fall within the realm of green infrastructure. Energy efficiency upgrades to municipal buildings and water treatment and pumping facilities represent huge opportunities for financial savings.

GHG emissions, the major cause of climate change, can be partially offset by the carbon sequestering function of the various examples of green infrastructure. Energy efficiency upgrades and renewable energy generation contribute to reducing GHG emissions by lessening the demand for non-renewable energy sources. Municipalities are often challenged by the need for capital expenditures to pay for upgrades that have longer term payback schedule. The additional paperwork required to secure financial assistance for these upgrades is often beyond the capacity of staff.

Water quality and quantity both benefit from the use of green infrastructure. Creating a landscape that is able to absorb or store water so that it leaves the land more slowly provides moisture to both the flora and fauna that exists in the ecosystem. Water that is allowed to filter through the natural infrastructure as it returns to the subsurface storage systems (aquifers) is cleaned of unwanted chemicals, including those used in commercial agriculture.

## Labour Market

The development of green infrastructure to replace and complement traditional grey infrastructure and the adoption of greener waste management practices will create employment opportunities in these industries as these green activities tend to have higher employment to capital ratios. There is already a growing need for workers with intermediate experience in wastewater treatment. The in demand occupations include Facility Managers, Laboratory Supervisors, and Experienced Operators. Further research suggests that water and waste management activities will grow over the next few years, with 80% of new positions being labourers and operators.

Other examples of green activities in the green infrastructure and waste management and remediation services industries include:

- Pollution mitigation, control, and remediation
- Waste management, reduction, and recycling
- Environmental consulting
- Energy efficient landscaping
- Ecosystem restoration and other environmental services

Each of the above green activities offers opportunities for business expansion and attraction, as well as job creation. There are a number of green jobs specific to green infrastructure development, including:

- Compost Operations
- Green Landscaping/Landscape Architecture
- Green Roof Professional
- Grey Water Systems Design and Installation
- LEED Accredited Professional
- Pervious Concrete Contractor
- Stormwater Management Technician
- Water Conservation Technician
- Wetlands Management

Transferability of a traditional occupation in these industries to a green job often requires the completion of a degree, diploma, or certification program. Programs that relate specifically to green infrastructure and green municipal services include Civil Engineering, Chemical Engineering Technology, Environmental Technology, and Water and Wastewater Technology. The follow table lists related programs at Ontario colleges.

Job Title	Institution	Program
<b>Air Monitoring Technician</b>	Niagara College (Welland)	Environmental Technician – Field and Laboratory
<b>Green City Planner</b>	Nipissing University (North Bay)	B.A. Environmental Geography
	George Brown College (Toronto)	Bachelor of Applied Technology – Construction and Environment Regulations Compliance

<b>Environmental Conservationist</b>	Queens University (Kingston)	Environmental Science
<b>Environmental Consultant</b>	Carleton University (Ottawa)	Environmental Science
	St. Clair College (Windsor)	Energy Systems Design Technology
	University of Guelph (Guelph)	Environmental Management
	University of Ontario Institute of Technology (Oshawa)	Energy Systems Engineering
	University of Western Ontario (London)	Environmental Science Environmental Studies
	York University (Toronto)	Environmental Studies
	Niagara College (Welland)	Environmental Technician – Field and Laboratory
<b>Environmental Engineer</b>	University of Toronto (Toronto)	Environmental Engineering
<b>Environmental Field Technician</b>	Niagara College (Welland)	Ecosystem Restoration Environmental Management and Assessment Geographic Information Systems – Geospatial Management
<b>Environmental Impact Assessor</b>	Carleton University (Ottawa)	Environmental Science Sustainable and Renewable Energy Engineering
	York University (Toronto)	Environmental Studies
<b>Environmental Lab Technicians</b>	Niagara College (Welland)	Environmental Technician – Field and Laboratory
<b>Environmental Protection Specialist</b>	Trent University (Peterborough)	Indigenous Environmental Studies Environmental Studies
	Wilfrid Laurier University (Waterloo)	Environmental Science

<b>Environmental Site Assessor</b>	Seneca College (Toronto)	Environment and Site Remediation
<b>Environmental Technician</b> <i>Groundwater Technician</i> <i>Soil/Terrain Specialist</i> <i>Water Quality Technician</i> <i>Watershed Technician</i>	Fleming College (Peterborough)	Environment Technician and Technologist
	Georgian College (Barrie)	Environmental Technology
	Mohawk College of Applied Arts and Technology (Hamilton)	Environmental Technician
<b>Field Engineer</b>	McMaster University (Hamilton)	Environmental and Earth Sciences
<b>Green Roof Designer/Installer</b>	Green Roofs for Health Cities	Green Roof Professional Certification
<b>Natural Resources Management</b>	Queens University (Kingston)	Environmental Studies
<b>Remediation Technologies/Specialist</b>	Seneca College (Toronto)	Environment and Site Remediation
<b>Solid Waste Management</b>	Northern College	Environmental Technician – Water and Wastewater Systems Operations Program
<b>Sustainable Designer</b>	Conestoga College (Cambridge)	Civil Engineering Technology
	Fanshawe College (London)	Bachelor of Applied Arts (Integrated Land Planning Technologies)
	Seneca College (Toronto)	Environmental Landscape Management
<b>Wastewater Management</b>	Queens University (Kingston)	Environmental Science
	Algonquin College (Ottawa)	Water and Wastewater Technician
<b>Water Quality Inspector</b>	Sault College (Sault Ste. Marie)	Environmental Technician - Water

## Industry Outlook

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Infrastructure replacement for roads, sewers, water mains, treatment plants, buildings, arenas, parks, and other municipal services represent a large portion of municipal spending (One kilometre of highway can cost as much as \$1,000,000). The movement from “grey” to “green” infrastructure will need to make economic sense to be successful. As with any shift of thinking it will take innovators to demonstrate the value of such a shift. Usually the shift requires a financial incentive beyond the simple payback based on energy savings.

Grey County, in Midwestern Ontario, proudly displays a sign along a stretch of county highway promoting the process of adding old rubber tires to their asphalt mix with sustainable results. Many municipalities have upgraded heating and cooling systems in their arenas and are tracking the financial benefits they are recovering.

As fossil fuel prices continue to rise and adaptation to the impacts of climate change (including stormwater management) becomes a more accepted requirement in municipal thinking, money will be spent on either reacting to problems or dealing with some of the sources of the problems. Provincial and Federal agencies are searching out creative solutions to the issues facing local municipalities and are willing to support pilot projects to demonstrate what needs to be done creating opportunities in the green economy.

## Sources

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