Sustainable Technologies
EVALUATION PROGRAM

www.sustainabletechnologies.ca

# Water Projects Overview

The Sustainable Technologies Evaluation Program (STEP) is multi-agency initiative developed to support broader implementation of sustainable technologies and practices within a Canadian context. STEP works to achieve this overarching objective by:

- Carrying out research, monitoring and evaluation of clean water and low carbon technologies;
- Assessing technology implementation barriers and opportunities;
- Developing supporting tools, guidelines and policies;
- Delivering education and training programs;
- Advocating for effective sustainable technologies; and
- Collaborating with academic and industry partners through our Living City Labs and other initiatives.

Technologies evaluated under STEP are not limited to physical devices or products; they may also include preventative measures, implementation protocols, alternative urban site designs, and other innovative practices that help create more sustainable and livable communities.

As part of the Canadian Environmental Technology Verification Program, STEP also conducts third party verification and testing of sustainable technologies.

*The water component of STEP is operated in partnership between Toronto and Region Conservation, Credit Valley Conservation and Lake Simcoe Region Conservation Authority.*

Clean water is an important component of a healthy watershed ecosystem. It helps support diverse aquatic habitat, vibrant recreational areas, good quality drinking water, and adds to our aesthetic appreciation of the natural environment.

The primary goal of the water component of STEP is to advance the knowledge and practice of urban runoff management through monitoring and evaluation of new and innovative water technologies and strategies. Our key areas of focus are green infrastructure and low impact development, erosion and sediment control, healthy soils, preservation of natural features, and road salt management.

# TECHNOLOGY EVALUATIONS

### Permeable Pavement

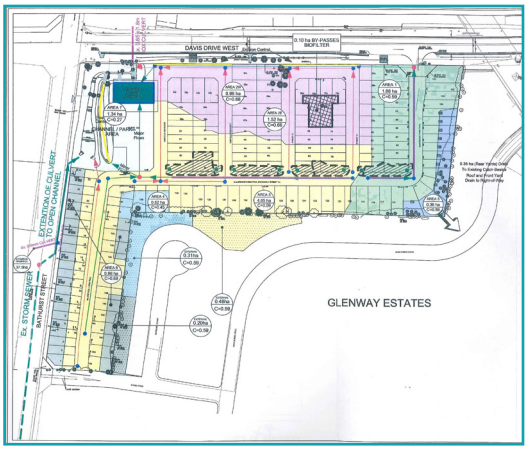
The use of permeable pavement in parking lots, driveways and roads protects downstream aquatic habitat by promoting infiltration, filtration and retention of polluted urban stormwater runoff. STEP first evaluated permeable pavements in 2005 at Seneca College's King campus, examining soil and water quality, year-round stormwater management performance and the effects of infiltration on groundwater quality. In 2008, a second Living Lab was constructed at the Kortright Centre for Conservation in Vaughan. This long-term project evaluated and compared different permeable pavements relative to a conventional asphalt surface. Research topics included performance on tight soils, winter effectiveness, changes in infiltration capacity over time, long term performance, and the effectiveness of pavement cleaning techniques.

### Bioretention

Bioretention is a storwmater infiltration practice that treats runoff from paved surfaces. Within a bioretention area, the natural properties of soil and vegetation remove pollutants through microbial activity and plant uptake. They also reduce runoff volumes through evapotranspiration and infiltration, the latter also resulting in enhanced groundwater recharge. STEP has conducted several bioretention studies involving both new and retrofit installations, and evaluating both proprietary and generic types. Key research topics to date have included pollutant removal and runoff reduction capacity, winter performance, road salt impacts, durability, maintenance needs, long term performance, cost-effectiveness, and phosphorus removal techniques.

### Low Impact Development (LID) Treatment Trains

With the widespread implementation of LID stormwater management practices, more sites are being designed to include LID treatment trains (TT). The TT approach involves the application of lot level, conveyance, and end-of pipe practices, often in series. TTs help maximize a site's capacity to achieve LID water management objectives, including maintaining the hydrologic cycle, protecting water quality, and preventing erosion and flooding. STEP is currently carrying out a monitoring evaluation of a multi-LID site – Mosaik Homes Glenway Subdivision in Newmarket - to assess the individual and combined effectiveness of the LIDs and their financial and technical feasibility from a construction and maintenance perspective. The project is one of the first in Ontario to demonstrate and evaluate widespread application of LID on the scale of a medium density residential subdivision.




### Salt Management

During Canadian winters, vast quantities of road salt are applied to driving surfaces to facilitate safe and efficient transportation conditions. The environmental impact of road salt use has been documented in several studies, including a comprehensive 5-year scientific assessment completed in 2001 by Environment Canada. Elevated concentrations of chloride salts have been shown to cause adverse effects to aquatic life, terrestrial vegetation, soil structure, and drinking water. Road salt also has economic impacts due to its capacity to corrode motor vehicles and road infrastructure. STEP has been involved in several salt management studies, including the Salt Application Verified Equipment (SAVE) program, an evaluation of organic anti-icing materials, and the development of procurement guidance for parking lot snow and ice management.

# GUIDELINES

### Low Impact Development

Over the last decade the practice of stormwater management has shifted towards the LID approach, which utilizes decentralized practices to promote surface runoff retention and volume reduction, water quality improvement, infiltration, groundwater recharge, and evapotranspiration. To support this evolution of water management in Ontario, STEP has produced two LID Guides - the LID Stormwater Management Planning and Design Guide (CVC and TRCA, 2010) and the LID Stormwater Management Practice Inspection and Maintenance Guide (TRCA, 2016). Additionally, the LID Construction Guide (CVC, 2012) provides guidance to facilitate the ongoing success of LIDs. These guides were produced so as to complement one another and provide up-to-date, clear and consistent direction to industry professionals. An update to the CVC and TRCA (2010) guide is currently underway, and will reflect the rapid evolution of LID design since 2010, as well as upcoming changes to existing provincial stormwater criteria.

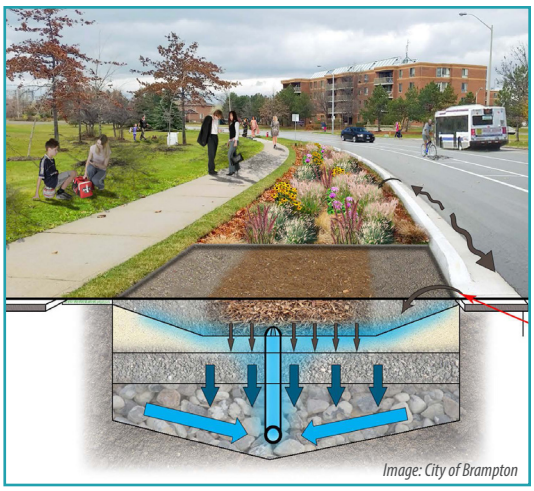


*Image: City of Brampton*

### Polymers

The use of polymer-based products for water clarification and erosion control on construction sites has become increasingly popular in recent years. They are able to enhance coagulation and/or flocculation of fine particles, allowing for more rapid settling in downstream detention practices and making soil surfaces resistant to erosive forces. Anionic polyacrylamide (PAM) is a common polymer currently on the market, and has shown promising performance and low toxicity in studies completed to date. Largely informed by a 2009 STEP study on anionic PAM, the Anionic Polyacrylamide Application Guide for Urban Construction in Ontario (TRCA, 2013) provides guidance on three different types of applications of anionic PAM – erosion control, clarification of sediment-laden runoff, and consolidation of wet sediment during pond clean-outs.

### Soil Management

The way in which landscaped portions of urban environments are constructed and managed affects how absorbent they are to stormwater and how well they facilitate vegetation growth and success. Without best practices to preserve or restore healthy functioning soils in these areas, changes to soil structure, biology and organic matter content and the effects of compaction can cause them to function more like impervious surfaces, while the use of fertilizers and irrigation as compensation measures impair the quality and quantity of runoff they produce. The Preserving and Restoring Healthy Soil: Best Practices for Urban Construction Guide (TRCA, 2013) provides recommendations on best practices and minimum standards for preserving, establishing and restoring healthy landscaped areas during construction.

### Stormwater Management Facility Maintenance

Municipalities in Ontario first began implementing wet ponds as part of their stormwater infrastructure in the late 1980's and today, there are over 1000 stormwater ponds and wetlands within the Greater Toronto Area alone. Like other municipal infrastructure such as sewers and treatment plants, the effective long-term operation of these facilities relies on effective inspection and maintenance practices. The largest and most costly maintenance task involves the removal, hauling and safe disposal of potentially contaminated sediment. Several municipalities are only now recognizing the magnitude of this effort, and designating funds to address the problem. STEP's Inspection and Maintenance Guide for Stormwater Management Ponds and Constructed Wetlands, released in 2016, details current and economical best practices for inspecting, maintaining and cleaning stormwater management facilities.

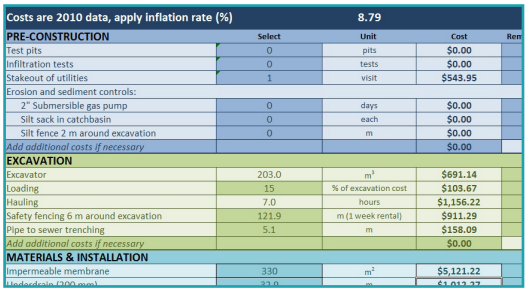
## DECISION SUPPORT TOOLS

### LID Treatment Train Tool (TTT) for Ontario

Developed in partnership between Toronto and Region Conservation, Credit Valley Conservation and Lake Simcoe Region Conservation Authority, the LID TTT is a cloud-based conceptual tool using the Environmental Protection Agency's SWMM5 modelling engine for computations. It is designed to support practitioners with a preliminary assessment of the effectiveness of LID SWM features in helping to achieve objectives for volume reductions and both total phosphorus and total suspended solids load reductions. The tool allows for computation of outcomes for individual events or on an annual basis, and can be used to determine the amount of runoff volume that will be reduced through infiltration, evapotranspiration or re-use, based on site conditions, BMP design, drainage area treated by LID, and other site specific factors.


### LID Life Cycle Costing Tool

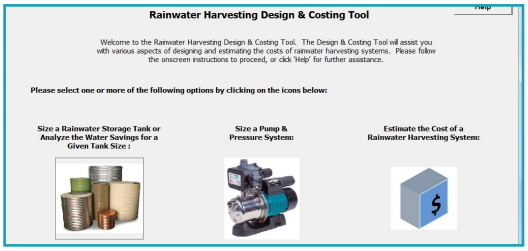
This spreadsheet-based tool was developed to assist industry professionals estimate the capital and life cycle costs of site specific LID practice designs. It includes seven LID practices – bioretention, enhanced grass swales, green roofs, infiltration chambers, infiltration trenches, permeable interlocking concrete pavers and rainwater harvesting. The tool provides users with a more comprehensive understanding of all relevant costs, facilitates cost comparisons, and allows users to optimize proposed designs based on both performance and cost.



| Costs are 2010 data, apply inflation rate (%) | | 8.79 | | |
|---|---|---|---|---|
| **PRE-CONSTRUCTION** | **Select** | **Unit** | **Cost** | **Rem** |
| Test pits | 0 | pits | $0.00 | |
| Infiltration tests | 0 | tests | $0.00 | |
| Stakeout of utilities | 1 | visit | $543.95 | |
| Erosion and sediment controls: | | | | |
| 2" Submersible gas pump | 0 | days | $0.00 | |
| Silt sack in catchbasin | 0 | each | $0.00 | |
| Silt fence 2 m around excavation | 0 | m | $0.00 | |
| *Add additional costs if necessary* | | | $0.00 | |
| **EXCAVATION** | | | | |
| Excavator | 203.0 | $m^3$ | $691.14 | |
| Loading | 15 | % of excavation cost | $103.67 | |
| Hauling | 7.0 | hours | $1,156.22 | |
| Safety fencing 6 m around excavation | 121.9 | m (1 week rental) | $911.29 | |
| Pipe to sewer trenching | 5.1 | m | $158.09 | |
| *Add additional costs if necessary* | | | $0.00 | |
| **MATERIALS & INSTALLATION** | | | | |
| Impermeable membrane | 330 | $m^2$ | $5,121.22 | |

### Rainwater Harvesting (RWH) Design and Costing Tool

This tool was developed to assist with the design, sizing and costing of residential and commercial scale RWH systems. The user is required to input data about their project, such as roof area, number of building occupants, and anticipated rainwater use. The tool calculates the optimum size of the rainwater storage tank and system components, and provides an estimate of the rainwater harvesting system cost.




## TRAINING AND OUTREACH

Research conducted by STEP provides the data and analytical tools that enable knowledge transfer to industry professionals and the public. Professional training in the form of in-class or in-the-field workshops, online courses, and both ondemand and live webinars are delivered by industry professionals with extensive practical experiences in designing, constructing, maintaining and monitoring technologies. These training education opportunities help professionals learn proper techniques and procedures for implementing sustainable technologies. Course topics include Certified Inspector of Erosion and Sediment Control (CISEC), various topics surrounding the design, construction and maintenance of LIDs, polyacrylamides for erosion and sediment control, maintaining stormwater management facilities and many more.

*The water component of STEP is operated as a partnership between Toronto and Region Conservation, Credit Valley Conservation and Lake Simcoe Region Conservation Authority.*

**www.sustainabletechnologies.ca**

The website provides information about STEP projects and highlights the great work that our partners and others are doing in related areas. Full reports, technical briefs and case studies on all STEP water and energy projects are available for download through the online resource library.

For more information about the program email us at STEP@trca.on.ca