Assessment of Life Cycle Costs for Low Impact Development Stormwater Management Practices

Prepared by: Toronto and Region Conservation
University of Toronto

Final Report 2013

ASSESSMENT OF LIFE CYCLE COSTS FOR LOW IMPACT DEVELOPMENT STORMWATER MANAGEMENT PRACTICES

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PUBLICATION INFORMATION

This research was undertaken collaboratively between the Toronto and Region Conservation Authority's (TRCA) Sustainable Technologies Evaluation Program (project leads: Tim Van Seters, Lisa Rocha, Christy Graham) and the University of Toronto, Civil Engineering Department (project leads: Mariko Uda and Chris Kennedy).

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THE SUSTAINABLE TECHNOLOGIES EVALUATION PROGRAM

The Sustainable Technologies Evaluation Program (STEP) is a multi-agency program, led by the Toronto and Region Conservation Authority (TRCA). The program helps to provide the data and analytical tools necessary to support broader implementation of sustainable technologies and practices within a Canadian context. The main program objectives are to:

- monitor and evaluate clean water, air and energy technologies;
- assess barriers and opportunities for implementing technologies;
- develop supporting tools, guidelines and policies; and
- promote broader use of effective technologies through research, education and advocacy.

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

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EXECUTIVE SUMMARY

This project evaluates the capital and life cycle costs of Low Impact Development (LID) practices over a 50 year time horizon based on a detailed assessment of local input costs, maintenance requirements, rehabilitation costs and design scenarios relevant to Canadian climates. The LID practices evaluated include bioretention cells, permeable pavement, infiltration trenches and chambers, enhanced swales, rainwater harvesting and green roofs. Dry swales and perforated pipe systems were considered to be similar to bioretention and infiltration trenches, respectively, and therefore were not evaluated as separate practices. The savings from LID approaches associated with improved aesthetics, air quality, community livability and other public benefits were not assessed, as these savings are best evaluated in relation to specific case study examples.

A robust and replicable methodology was used to compile capital and life cycle costs for the LID practices evaluated in this project. Model designs were developed for up to 3 typical variations of each LID practice assuming a 2000 m^2 paved and/or roof drainage area. An RSMeans database, widely used for construction and maintenance cost estimation, was used as the basis for most of the costing. Where RSMeans cost data were not available, costs were derived from other sources (e.g. supplier quotes, experienced construction managers). Maintenance and rehabilitation schedules for each practice were assessed based on local guidance manuals and literature sources.

Model LID practice design costs evaluated in this study indicated that bioretention, infiltration chambers, infiltration trenches and enhanced swales are some of the least expensive practices to implement when only the practice cost itself is considered. The practice of rainwater harvesting provides additional savings by reducing the cost of potable water supplies. Permeable pavements are comparably more expensive than most other practices, but in many instances these costs would be offset to some extent by a reduction in the need to pave the drainage area, since the pavements serve both as a parking surface and stormwater treatment practice. The practice also does not require as much land as some other practices, making it particularly well suited to retrofit contexts. Green roofs are the most expensive practice as they are installed in less accessible locations and need to be carefully engineered to protect the integrity of the building envelope. This practice is often selected because of its aesthetic, biodiversity and energy saving benefits, as well as its overall contribution to green building rating schemes, the value of which were not considered in the cost assessment provided in this study.

An analysis of different treatment scenarios for an asphalt parking lot revealed that LID practices had comparable life cycle costs to conventional treatment using an oil grit separator (OGS). Incorporating the stormwater treatment benefits of the practices into the analysis showed that LID practice life cycle costs were between 35 and 77% less than conventional OGS treatment.

A spreadsheet decision support tool based on the cost calculations gathered during this study was developed to assist industry professionals calculate the initial capital and life cycle costs of site specific LID practice designs. 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. The tool is available free of charge on the Toronto and Region Conservation's Sustainable Technologies Evaluation Program website.