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LRRB
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$51,748

Underground treatment devices such as sump catch basins do not require much land area, but require frequent maintenance to be effective.

MINNESOTA DEPARTMENT OF TRANSPORTATION

RESEARCH SERVICES
OFFICE OF POLICY ANALYSIS, RESEARCH & INNOVATION

Putting Research into Practice: Selecting Optimal Stormwater Treatment Strategies

What Was the Need?

One common cause of water pollution is stormwater runoff, which occurs when water from rain and thawing snow flows across paved surfaces or soils that are too saturated to allow more water to pass through them. As runoff flows over the surface, it can accumulate pollutants and carry them into waterways.

The decision tree tool developed in this project will help city and county public works employees more efficiently select stormwater BMPs appropriate to their projects to protect the environment with the most cost-effective available methods.

To manage stormwater, engineers use a number of treatment strategies, typically referred to as best management practices. As state and federal regulations for stormwater management have become more stringent, the number of available BMPs has increased significantly. However, not all BMPs perform the same treatment functions or remove pollutants with the same efficiency. They also vary in cost of construction and maintenance. Consequently, choosing between BMPs can be a complex task, and research was needed to develop a tool that would assist stormwater managers in selecting BMPs to meet the needs of specific projects.

What Was Our Goal?

The goal of this project was to create a tool to assist city and county public works employees in selecting stormwater BMPs appropriate to their projects.

What Did We Implement?

This tool implements and is intended to work in conjunction with Report 2009RIC12, "Stormwater Maintenance BMP Resource Guide," and the 2005 "Minnesota Stormwater Manual." The resource guide describes the five most commonly used stormwater facilities in Minnesota and details the best inspection and management practices for each.

How Did We Do It?

Investigators created a planning-level decision tree tool to assist practitioners in selecting BMPs for stormwater management. The decision tree incorporates a cost-benefit analysis using whole-life costs as determined by the Water Environment Research Foundation and covers methods commonly or increasingly used in Minnesota, including:

- Stormwater ponds, which capture runoff to mitigate its effects on downstream water quality or quantity.
- Bioretention basins, such as bioswales, rain gardens and filtration basins, which are landscaped depressions that remove pollutants from runoff using plants, soils and naturally occurring microbes found in the soil.
- Underground treatment devices, which remove pollutants and debris from underground drainage systems. They are typically used as pretreatment systems with other BMPs.
- Underground detention systems, which store runoff temporarily and regulate its flow. These can be used in conjunction with underground treatment devices to provide additional water quality treatment.
- Infiltration systems, which temporarily trap runoff and allow it to seep into the soil. These can be surface sand filters or underground pipe galleries.

continued

"We wanted to create a tool to help engineers quickly zero in on the relevant part of BMP manuals—which can be large or difficult to navigate—based on the circumstances of their particular project."

—Mel Odens
State Aid Engineer,
MnDOT District 8

"This guide simplifies the task of deciding between the large number of available stormwater BMPs by presenting a series of questions that can be answered in a step-by-step fashion to narrow the options."

—Michael Marti
Principal, SRF Consulting Group Inc.

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Stormwater ponds are a commonly used BMP in Minnesota and have the benefits of effectively reducing many pollutant loads and controlling runoff rates. However, because they require a large amount of space, they are not a feasible BMP in all situations.

- Porous/pervious/permeable pavements, which reduce runoff pollution by allowing water to filter through pavements into the underlying soil or underdrain system.
- Tree or planter boxes, which consist of containers filled with a soil mixture, mulch layer, underdrain system and a shrub or tree. These boxes can be used to temporarily store and filter runoff in urban areas.

What Was the Impact?

This tool is a five-step BMP selection process that narrows BMP choices according to physical constraints, the regulatory environment, capital costs and other factors. It is especially intended for projects where there is no regional stormwater facility downstream designed to provide treatment. The five steps are:

1. **Select Your Project Type** by determining how much space will be available for BMPs after a project is completed and whether the project is a site project (involving residential, commercial or other development) or roadway/linear project.
2. **Describe Your Project** according to location, receiving waters, soil types, setting and special site considerations.
3. **Determine the Regulatory Environment for Your Project** by determining which of the state, local and federal agencies might have jurisdiction over the project, with the intent to identify the most stringent design criteria.
4. **Create a Preliminary BMP Toolbox** by using information from previous steps to help narrow a matrix of seven BMPs to two or three that are most appropriate for the project.
5. **Refine BMP Selection/Select the Right Tool** by comparing factors such as maintenance, life-cycle costs and aesthetics.

Appendices to this tool contain a list of further resources as well as the cost-benefit analysis on which it is based.

What's Next?

Investigators are presenting this tool at numerous conferences and are monitoring its reception among practitioners. As stormwater management practices continue to evolve, the decision tree will be updated so that it continues to help practitioners select the most effective measures for managing stormwater runoff.

This Technical Summary pertains to the LRRB-produced Report 2011RIC01, "Decision Tree for Stormwater BMPs," published March 2011. The full report can be accessed at http://www.lrrb.org/PDF/2011RIC01.pdf.

The research being implemented via this project can be found mainly in the LRRB-produced Report 2009RIC12, "Stormwater Maintenance BMP Resource Guide," published January 2009. This report can be accessed at http://www.lrrb.org/PDF/2009RIC12.pdf.