



WATER QUALITY RESEARCH PROGRAM

Green Infrastructure Approaches to Urban Stormwater Management

Issue

Stormwater runoff is a major cause of water pollution. In an undeveloped environment, pervious ground surfaces filter and absorb stormwater from rain events as the runoff flows into nearby waters. In an urban setting with large amounts of impervious surfaces, much more of the rainwater is directly routed into engineered stormwater collection systems.

In many older cities, the water collection systems combine stormwater with wastewater in combined sewer overflows (CSOs) before carrying it to wastewater management systems for treatment. Heavy-volume rain or snow events can overburden the collection and treatment systems, resulting in overflows of untreated wastewater (including chemical and microbial pollutants) into nearby receiving waters. This can result in unsafe recreational and drinking water, as well as potential harm to vegetation, fish, and other aquatic life.

Research is needed to provide information, methods, and tools that will enable states and communities to

make more informed decisions on cost-effective and more sustainable ways to control stormwater runoff.

Application and Impact

EPA provides scientific and engineering expertise to evaluate stormwater control measures and to develop new tools for decision making. EPA stormwater management research efforts focus on best management practices (BMPs) to reduce the volume of runoff and prevent discharge of pollutants.

Traditionally, most BMPs for stormwater control consist of “grey” infrastructure (e.g., grate inlets) that channel water through constructed networks of drains and pipes. More recently, “green” infrastructure approaches (e.g., rain gardens, wet ponds, swales, green roofs, porous pavements, and constructed wetlands) are being incorporated to restore more natural water cycles to urban environments. Onsite, green approaches to stormwater management are becoming more preferred as they can be more cost effective and provide additional

benefits such as pollutant removal and ecosystem restoration.

Research Highlights

Modeling Tools

Storm Water Management Model (SWMM)

The EPA SWMM model simulates the quantity and quality of runoff generated during rain or snowfall events. SWMM is being used in hundreds of projects throughout the world to manage the impacts of stormwater on wastewater treatment facilities.

Current SWMM extensions are under development to explicitly model green infrastructure controls along with traditional infrastructure approaches such as stormwater collection systems. The updated SWMM model will allow engineers and planners to accurately represent a combination of green infrastructure controls within a study area to determine their effectiveness in managing stormwater and combined sewer overflows.

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System for Urban Stormwater Treatment and Analysis INTEGRATION (SUSTAIN)

SUSTAIN is a decision support system designed to facilitate the selection and placement of optimal green infrastructure techniques at strategic locations in urban watersheds.

SUSTAIN is currently being applied to various case studies to demonstrate how the tool can identify the cost effectiveness and hydrologic response of various stormwater management solutions.

Permeable Parking Lot and Rain Garden Studies

In 2009, EPA completed construction of an experimental, stormwater management parking lot at its research facility in Edison, N.J. Researchers are using the parking lot to demonstrate and document the effectiveness of three permeable pavement surfaces: porous asphalt, porous concrete, and interlocking concrete pavers. EPA will study the performance capabilities of the parking lot under various conditions, and will evaluate water quality.

An experimental rain garden has been created alongside the parking lot, which will allow EPA to measure the ability of the rain garden to reduce stormwater runoff from nearby roof tops and the impermeable surfaces of the lot.

Andrew W. Breidenbach (AWBERC) Environmental Research Center Green Infrastructure Demonstration

In collaboration with the University of Cincinnati, and the Cincinnati Metropolitan Sewer District (MSD), EPA researchers will select and implement green infrastructure best management practices to manage wet weather flow on the Cincinnati AWBERC campus. Modeling will be used to estimate the potential



effectiveness of various green infrastructures to manage urban stormwater.

Community-Scale Studies

EPA is conducting case studies in several communities to evaluate the effectiveness of green infrastructure in managing stormwater and protecting water quality.

Researchers are investigating the impacts and benefits of best management practices on runoff volume, occurrence of overflows from combined sewer treatment systems, water quality, ecological integrity, nutrient management, community revitalization, and economic incentives and benefits.

Study locations include communities in:

- Cincinnati, Ohio
- Cleveland, Ohio
- Baltimore, Maryland
- Louisville, Kentucky
- Kansas City, Missouri

These research projects will contribute to a better understanding of how to manage stormwater runoff and control combined sewer overflows in urban communities. They also demonstrate how to enhance monitoring programs for watershed management and restoration efforts.

Resources:

Urban Watershed Management
<http://www.epa.gov/ednrmrl/>

Aging Water Infrastructure Research
http://www.epa.gov/awires_concepts.html

SWMM (Version 5) and SUSTAIN
<http://www.epa.gov/nrmrl/wswrd/mmd.html>

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