



GREEN INFRASTRUCTURE IN THE MILWAUKEE REGION

MMSD has a long history of environmental stewardship and has implemented holistic approaches to improve water quality and protect residents from the effects of flooding. With a changing climate, it has never been more important to manage stormwater flow to improve drainage and water quality. MMSD has put additional focus on using green infrastructure as a cost-effective means to protect the region's property and water resources. Green infrastructure reduces the volume of stormwater entering the sewer systems and complements the Private Property Inflow and Infiltration Reduction Program. MMSD continues its leadership role to mitigate climate change and its effects through innovative and sustainable projects, but recognizes that participation by everyone is crucial for success.

INTRODUCTION

MMSD's grey infrastructure, such as sewer pipes, storage tunnels, and reclamation facilities, has been and will continue to be the backbone for meeting water quality goals and flood management protection for the region. Grey infrastructure is expensive and building bigger pipes will not solve all water quality problems. Capturing the first 0.5 inch of rainfall in green infrastructure on impervious surfaces is an essential and cost-effective component to meeting the 2035 Vision of zero overflows and zero basement backups.

In 2009, MMSD published "Fresh Coast Green Solutions" (Figure 9) to educate the public and municipalities on 10 key green infrastructure strategies and their benefits (see next page). The Regional Green Infrastructure Plan (Plan) presents broad implementation strategies for both the short and long term and emphasizes capturing stormwater runoff with permeable surfaces to mimic natural processes. Such strategies take advantage of infiltration and evaporation to reduce stormwater runoff. This section explains these strategies and the existing programs that will be expanded in order to meet the goals of the 2035 Vision.

SUCCESSFUL STRATEGIES AND PROGRAMS

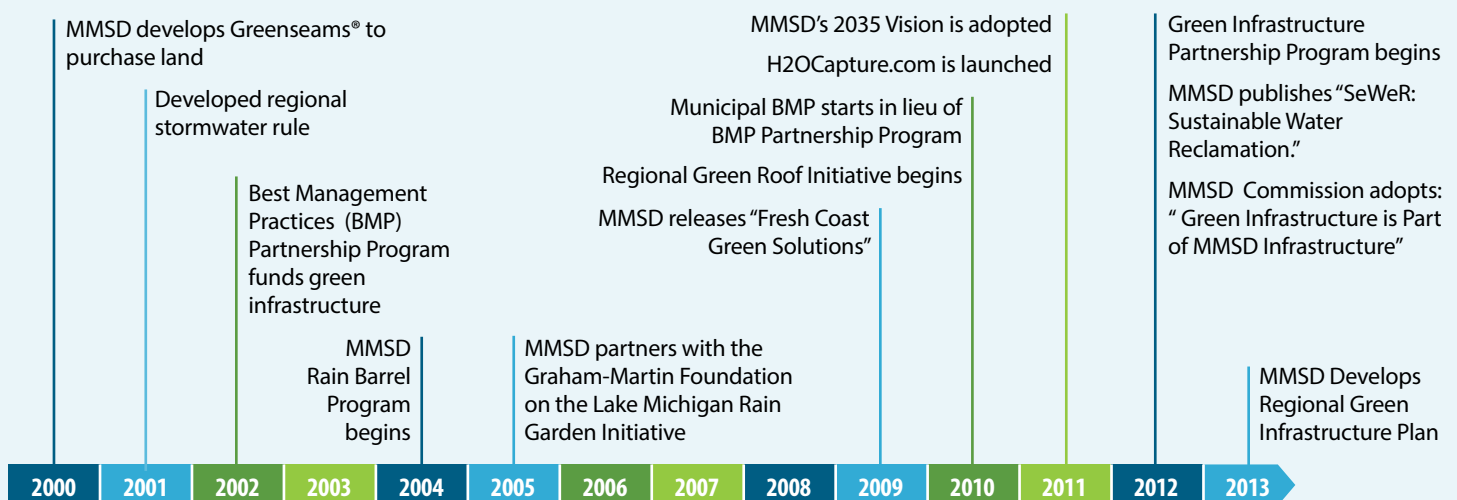
Since the 1990s, MMSD has implemented green infrastructure strategies (Figure 10) because they either hold or slow down the natural flow of water to discharge points and because they complement grey infrastructure by adding capacity. Green strategies also clean and reduce the amount of stormwater runoff volume and pollution carried into creeks, rivers, and Lake Michigan. Using this holistic approach to watershed management provides natural stormwater and flood management features and helps meet existing and pending water quality regulations, while preserving aquatic species, protecting wildlife habitat, and beautifying neighborhoods.

MMSD leads several programs that have been a great success and that will be expanded over the next several years, including the following:

- + Rain Barrel Program
- + Lake Michigan Rain Garden Initiative
- + Regional Green Roof Initiative
- + Green Infrastructure Partnership Program
- + Greenseams®

FIGURE 9

MMSD's Green Infrastructure Leadership



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FIGURE 10

REGIONAL GREEN INFRASTRUCTURE STRATEGIES

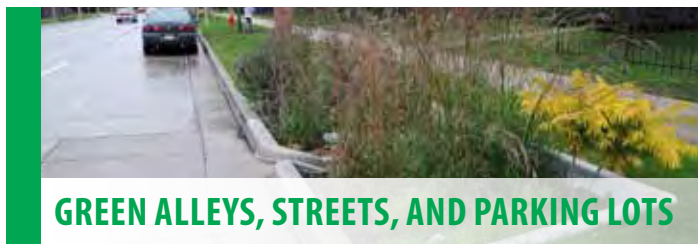
Green infrastructure strategies capture stormwater, provide natural flood management, and bring a multitude of benefits to municipalities and residents. Each strategy shown below has already been implemented throughout the region, and much more is needed to achieve the 2035 Vision goals. The Plan focuses heavily on the strategies that would treat impervious surfaces and turf grass areas to provide economic, social, and environmental benefits to the region.



Business owners and public property owners with large flat roofs were mapped in the Plan and are encouraged to participate in the Regional Green Roof Initiative Program.



The Plan recommends use of porous materials for public and private streets and parking lots.



The Plan calls for green alleys, streets, and parking lots that include several green infrastructure strategies, offering multiple economic, social, and environmental benefits.



The Plan encourages residents to plant rain gardens to prevent stormwater from entering the sewer system too quickly. The Plan includes soil amendments to increase water holding capacity in lawns and improve grass growth when native landscaping is not preferred.



Wetlands (not quantified in this Plan) also known as bogs, marshes, and swamps allow rainwater to pool and slowly infiltrate into the ground.



The Plan encourages residents and business owners to harvest rainwater. Doing so reduces energy costs and reduces unwanted stormwater from entering the sewer system.



The Plan encourages the public, business owners, and municipalities to replace turf grass with native landscaping to reduce runoff and save money through reduced landscape maintenance.



Bioretention and bioswales can be used along transportation corridors and parking lots.



The Plan encourages municipalities to plant trees. They hold rainwater on their leaves and branches, infiltrate it into the ground, absorb it through root systems and evapotranspire it to the atmosphere.



Greenways (not quantified in this Plan) include riparian and non-riparian buffer zones and strips that store and drain stormwater runoff into the ground naturally.

An MMSD rain barrel stores 55 gallons of water, preventing that water from carrying pollution into area waterways. Residents reduce their water bill when rainwater is used to irrigate lawns, gardens, and plants.

- ◆ 17,900 barrels sold through 2012
- ◆ Target number in the Plan: 152,000 barrels



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Rain Barrel Program

In 2004, MMSD started a comprehensive rain barrel program. MMSD's rain barrel program includes reusing 55-gallon food-grade drums, retrofitting them for stormwater collection, and managing their distribution. MMSD partnered with the Milwaukee Community Service Corps—a non-profit organization that helps young adults learn job skills and make positive community impacts—to build and deliver the barrels. Eventually the program grew and several other organizations and retailers were brought on to meet demands and offer a variety of barrels to consumers. All orders can be placed on MMSD's website (mmsd.com). To meet the 2035 Vision, many more barrels need to be installed across the region.

Lake Michigan Rain Garden Initiative

According to the Wisconsin Department of Natural Resources (WDNR), rain gardens can absorb 30 percent more water than a conventional, well-manicured lawn. The Lake Michigan Rain Garden Initiative (a partnership between the Graham-Martin Foundation and MMSD) promotes replacing grass with rain gardens, especially near downspouts, so that rainwater will infiltrate/absorb into the ground. MMSD's website offers how-to guides and grant application instructions. Homeowners can apply for a grant, and each year plants are provided at a reduced price, typically at a 50 percent discount compared to retail prices.

Neighborhoods have climbed on the bandwagon and implemented native plantings to manage stormwater, increase their property values, and to be good environmental stewards.

Increased Participation in Rain Garden Initiative Planned

Residents formed the Walnut Way Conservation Corp and planted rain gardens to help reduce sewer overflows and to revitalize their neighborhood.

Photo Source: Greater Milwaukee Water Quality Connections, a joint publication by MMSD, the Joyce Foundation, and 1000 Friends of Wisconsin.

- ◆ Over 29,000 plants sold since 2006
- ◆ Regional Green Infrastructure Plan recommends ramping up plant sales to meet rain garden implementation goals





Golda Meir Library, University of Wisconsin—Milwaukee

Rockwell Automation



Silver City Townhomes

Mequon Nature Preserve

Regional Green Roofs

Millions of gallons of stormwater are absorbed by green roofs throughout the region each year. They provide energy cost savings and more green space.

Regional Green Roof Initiative

Green roofs can hold millions of gallons of stormwater each year. Private, public, and non-governmental institutions in the region can reap the benefits of installing green roofs because they capture stormwater, reduce heating and cooling costs, and extend the life of the roof. Since 2003, MMSD has awarded grants to encourage building owners to install them. To date, 9 acres of green roofs have been funded by MMSD throughout the region, such as on Milwaukee’s Central Public Library, the Mitchell Park Domes, the University of Wisconsin-Milwaukee campus, and a variety of public and privately-owned businesses.

Currently, MMSD is providing incentive funding to increase green roof coverage within the region. The Regional Green Roof Initiative currently provides money for an approved green roof project. An example of a local green roof installation’s ability to store stormwater is Rockwell Automation’s global headquarters on South 2nd Street. There are two dozen varieties of sedum, native wildflowers, and perennials growing in custom-blended growing media engineered to be lightweight, retain water, and promote growth that collect 40,000 gallons of rainwater or more each storm. It was completed in 2010 and is the largest single-level green roof in Wisconsin. According to a story in the Milwaukee Journal Sentinel Newspaper on July 22, 2012, the project collects more than 70 percent of all the rain that falls on it. Between June 2010 and June 2012, Rockwell’s plantings absorbed 500,000 gallons of water.

The next step is increased investments and participation in green roofs, particularly in urban areas. For this Plan, the consultant team mapped all large flat roofs in each watershed and cataloged whether buildings are privately or publicly owned. This will help MMSD and others incorporate green roofs into long-range capital improvement plans and identify best candidates. For more information on green roof benefits, installations, maintenance, or funding, visit www.h2ocapture.com.



Green Infrastructure Partnership Program

The Green Infrastructure Partnership Program was launched in 2012; it was the transformation of a green infrastructure program that began in 2003. Through this program, MMSD provides funding support for projects to demonstrate the importance of green infrastructure as a sustainable practice in managing the volume, rate, and quality of stormwater runoff. These projects may also catalyze more widespread green infrastructure that can benefit municipal storm and sanitary sewers, as well as the MMSD system. All projects must include education and outreach, and maintenance must be committed to.

Since 2011, MMSD invited applicants to propose green improvements and or redevelopment projects incorporating green infrastructure. In 2012, there were 20 applications and MMSD funded 13 of these projects. Two of the more significant projects are in the final stages of construction:

- + MMSD awarded \$100,000 to the City of Milwaukee Housing Authority's Westlawn development for the installation of bioswales as part of the redevelopment.
- + MMSD awarded \$125,208 to American Rivers for the South 6th Street Community Space redevelopment that will be part of Milwaukee's "Green Corridor." It uses a combination of green infrastructure strategies, such as porous pavement, Aqua-blocks™, native landscaping, and bioswales.

Greenseams®

MMSD created the Greenseams® program to purchase and preserve land, particularly in flood-prone areas to prevent future flood damages. All land acquired remains undeveloped, providing recreational opportunities and protecting properties by providing the ability to store rain and melting snow. Wetlands restoration at these sites can provide further water storage and habitat benefits. This program will continue to be part of MMSD's overall watershed management strategy, but it is not dealt with extensively in the Plan. The Plan focuses on treating impervious areas and turf grass. To learn more about the program visit mmsd.com.

Greenseams®

To date, MMSD has preserved over 2,500 acres of land through Greenseams® and its goal is to acquire another 10,000 acres by 2035 to provide more flood management and wildlife habitat protection throughout the region.



Deep Tunnel

Grey infrastructure, such as MMSD's Inline Storage System or Deep Tunnel, is critical to the region's growth and to eliminating overflows and basement backups. Capturing stormwater through green infrastructure will reduce stormwater runoff in both the combined sewer and sanitary sewer service areas, making it an important part of the 2035 Vision.

EXISTING REGIONAL EFFORTS

Green infrastructure complements grey infrastructure and existing watershed programs to provide a holistic approach to water management. MMSD will look for ways to incentivize its use and allocate funds towards projects that incorporate these proven strategies. Green infrastructure strategies help:

- + Provide storage to reduce regional flooding
- + Provide storage to lessen the burden on the combined sewer system and Deep Tunnel
- + Reduce inflow and infiltration (stormwater entering the sanitary sewer system)
- + Reduce stormwater pollution from entering rivers and Lake Michigan, thereby improving water quality

MMSD owns and operates about 300 miles of regional sewers that collect wastewater from 28 municipalities. All of the municipalities own and operate their own sewers—that's collectively about 3,000 miles of pipes. In addition, private sewer laterals from homes and businesses account for about another 3,000 miles of pipes. Sewer pipes, the Inline Storage System or Deep Tunnel, and water reclamation facilities are known as "grey infrastructure". Green infrastructure can improve the function of the grey infrastructure storage and sewer system. When planning capital improvement projects like street repairs or sewer replacement, municipalities can stretch their spending dollars by investing in cost-effective green infrastructure at the same time. These investments benefit residents because water captured and stored during extreme storms will help reduce basement backups and sewer overflows, protecting homes and Lake Michigan.

When planning capital improvement projects to repair or replace streets and sewers, municipalities can stretch their spending dollars by investing in cost-effective green infrastructure.



Lateral Replacement

Workers inspect a sewer lateral as part of MMSD's Private Property Inflow and Infiltration Reduction Program. Funding is set aside for the next 10 years and includes incentives for incorporating green infrastructure into the work, such as re-routing stormwater to a rain garden that would have flowed to the sanitary sewer, similar to the Shorewood Disconnects Program.

Private Property Inflow and Infiltration Reduction Program Reduces Flooding in Hard-Hit Areas

Ninety-four percent of the MMSD planning area is a separate sewer service area, while only 6 percent is a combined sewer service area. As a result, the Plan is designed to reduce combined sewer overflows, but also complement the MMSD's Private Property Inflow and Infiltration Reduction Program.

In April 2011, the MMSD Commission approved the policy and formally established the MMSD Private Property Inflow and Infiltration Reduction Program and has committed funding towards the program. Under the program, not only are sewer lateral rehabilitation and foundation drain disconnects eligible costs to be reimbursed, but site grading and green infrastructure solutions are also encouraged to remediate problems. For example, disconnecting foundation drains and installing sump pumps that direct water to soak into rain gardens is an excellent solution to reduce basement backups.

The Plan complements the Private Property Inflow and Infiltration Reduction Program by reducing the amount of excess clear water that enters privately-owned sanitary sewer laterals, a common source of the problem. Several green infrastructure strategies retain and infiltrate stormwater, and when properly located, they direct stormwater away from sanitary and combined sewers.

What is Inflow and Infiltration?

Excess water that flows into sanitary sewer pipes from groundwater and stormwater is called inflow and infiltration. Infiltration (from groundwater) seeps into sewer pipes through holes, cracks, joint failures, and broken connections. Inflow (from stormwater) rapidly flows into sewers via roof downspouts connected to the sewer, building foundation drains in homes without a sump pump, unintended storm drain cross-connections, and through holes in manhole covers.

Watershed Restoration Plans

MMSD, SEWRPC, and the Southeastern Wisconsin Watersheds Trust (SWWT) recently developed watershed restoration plans for the Kinnickinnic, Menomonee, and Root River watersheds that includes a long list of partners and green infrastructure projects aimed at solving water quality problems. Based on watershed pollution mapping, the plans identified priority areas for improvements. The plans also noted that education and outreach will be particularly important to garner residential participation in private property improvements.

The Plan supports these efforts by providing additional information to help every watershed identify priority implementation locations and key strategies based on the unique characteristics of each watershed. As part of the Plan's mapping and data gathering, locations were identified with the highest pollutant loadings (meaning significant opportunities where green infrastructure can improve water quality).

“With over 60 percent of the pollutants now coming from stormwater, there is no simple end-of-pipe solution. The solution necessitates the engagement of the citizens throughout communities who assume the responsibility for stormwater generated on their own property and act to reduce its impact.”

Source: Implementation Plan and Priority Project List for the Kinnickinnic River Watershed (summary of Milwaukee Area Household Survey conducted by the Southeastern Wisconsin Watersheds Trust)

Shorewood Addresses Flooding with Grey and Green Infrastructure

Shorewood has an aging sewer system with almost half the village connected to a combined sewer system. Widespread flooding in 1997 and 1999 raised public concern and spurred action. A Wet Weather Management Plan was implemented to withhold stormwater from the system, reducing both volume and peak flow. The central component of the plan was the disconnection of residential downspouts in parts of the village's combined sewer area. Rain barrels, rain gardens, and simple infiltration over lawns (away from sewer laterals) better manages the rainwater in those neighborhoods. In addition, inlet restrictors and street storage slows the flow from streets to pipes. In some areas sewer lines were upgraded, redirecting rain water to nearby storm sewers.

The work progressed through five targeted project areas over 5 years. The goal of removing 50 percent of the roof area from the combined sewer area was surpassed with over 240 roofs and 985 downspouts disconnected—an equivalent of 11 acres of impervious surface. In addition, 61 rain gardens and 268 rain barrels were installed.

Source: Greater Milwaukee Water Quality Connections, a joint publication by MMSD, the Joyce Foundation, and 1000 Friends of Wisconsin



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Our region's green infrastructure
 Our Greenseams program captures a significant amount of stormwater every time it rains. Besides Greenseams, 10 other green infrastructure strategies help protect basements, sewers and area waterways every time it rains.
[Learn More](#)

GREENSEAMS
1,445,199,371 gals.

Strategy	Count
GREENSEAMS	1,445,199,371 gals.
POROUS PAVEMENT	2,233,730
PERMEABLE CURBS	13,600
BIOSWALES	142,508
RAIN BARRELS	982,000
RAIN GARDENS	17,895
GREEN ALLEYS	37,400
CONSTRUCTED WETLANDS	8,468
NATIVE LANDSCAPING	1,179

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Alterra Flushing Station - Milwaukee, WI

Learn How To Capture Stormwater
 Do you want to reduce stormwater pollution, conserve water and save money?
 Green infrastructure allows us to collect and infiltrate stormwater by keeping it out of sewers and waterways, reducing flooding and basement back-ups. It can be as simple as connecting a rain barrel to your home or planting native vegetation.
 Read more in our **Learn** section about how you can use green infrastructure to capture stormwater.

The Brewery - MMSD Signature Projects | **Milwaukee Co. Zoo - MMSD Signature Projects** | **Walnut Way Neighborhood - MMSD Signature Projects**

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Interactive Green Infrastructure Website

H2OCapture.com informs the public and tracks regional successes in green infrastructure installation.

TRACKING SUCCESS: H2OCAPTURE.COM

Measuring performance and providing green infrastructure information to the public is an important way to ensure metrics are met and people are educated. In 2011, MMSD developed H2OCapture.com to track and map green infrastructure implementation in the region and has maintained it ever since. Essentially, the region's success is summarized here. With the click of a mouse, a user can see how many rain barrels, bioswales, Greenseams® projects, or green roofs have been implemented in the region. It is also a repository for a multitude of information on green infrastructure best practices. Visit h2ocapture.com to view green infrastructure initiatives throughout the region. There are active discussions with other interested parties to evolve the website to become a regional resource.

A new discharge permit condition requires that MMSD add 1 million gallons of new, constructed green infrastructure capacity to the region annually. This is the first permit in the country with a green infrastructure requirement in the body of the permit.