Green Infrastructure Regional Maintenance Alliance

Research Report for Metro Blooms

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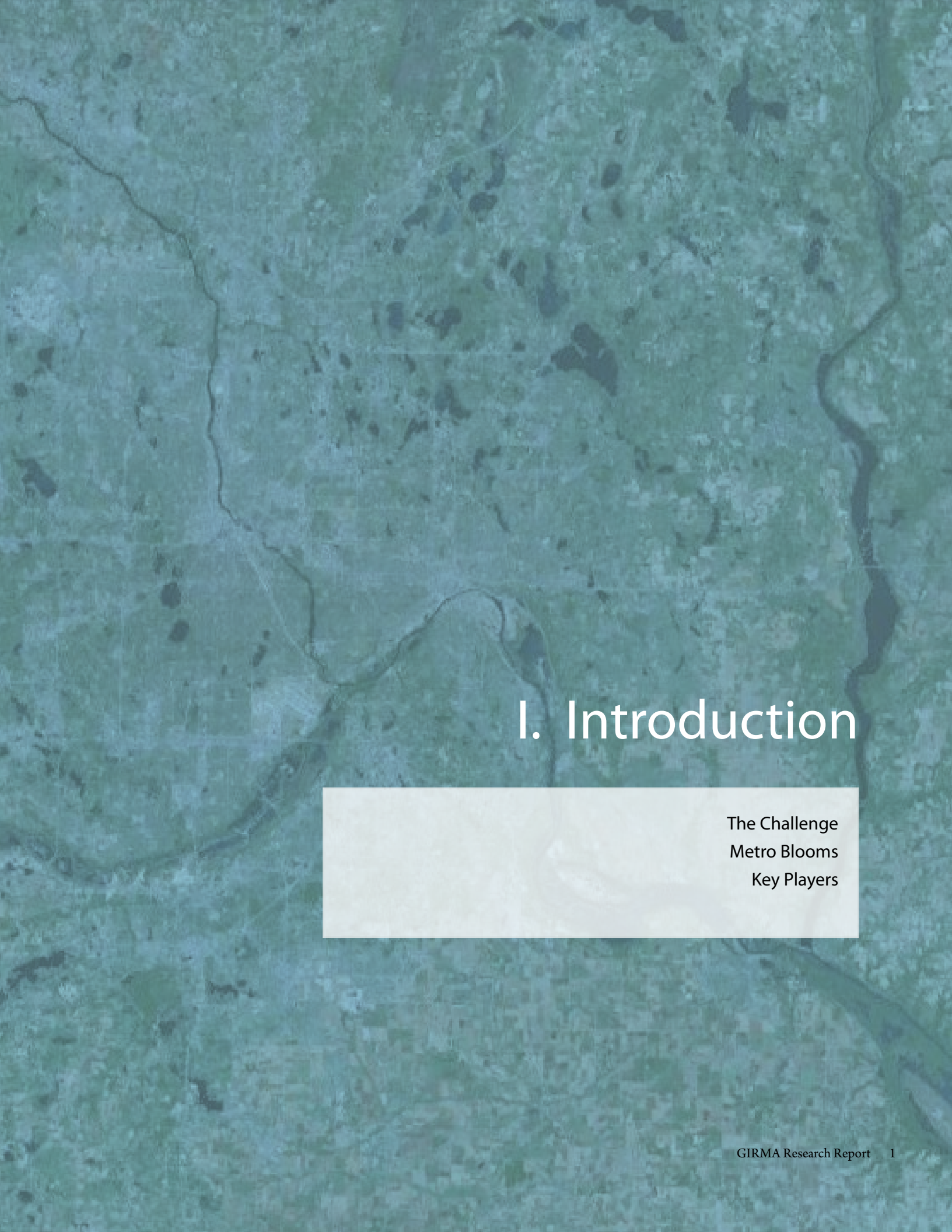

I. Introduction

The Challenge
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Introduction

The Challenge

Stormwater green infrastructure best management practices (BMPs) are increasingly being installed by cities and watershed districts to capture, filter, infiltrate, and otherwise manage stormwater runoff. Stormwater green infrastructure BMPs include but are not limited to bioretention/ bioinfiltration basins or raingardens, wet and dry stormwater ponds, vegetated swales, French drains, permeable pavers and porous asphalt, and sediment traps. Oftentimes these BMPs are installed in order to help cities meet public policy and Total Maximum Daily Load (TMDL) and Municipal Separate Storm Sewer Systems (MS4) regulatory requirements. This research report focuses primarily on maintenance of bioretention/ bioinfiltration basins or raingardens.

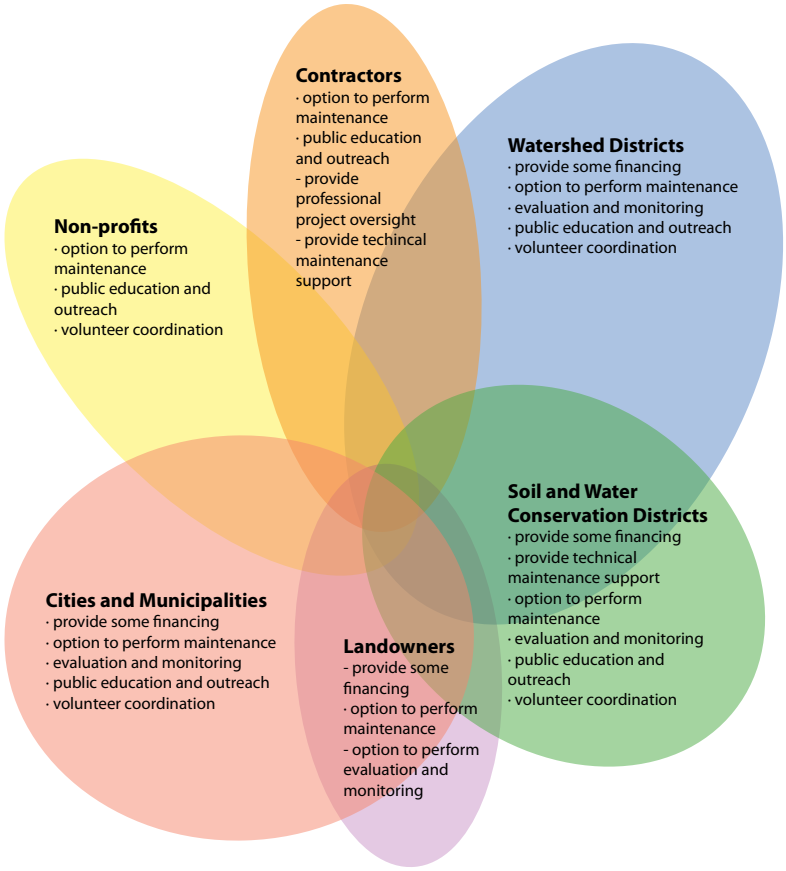


Figure 1: Key Partners.

Although funding for installation has become more available in recent years, funding for ongoing necessary maintenance of these BMPs has not kept pace. These BMPs require regular, professionally-trained maintenance to insure they function at full capacity. Unfortunately, the lack of funding, staff resources, and/or expertise for maintenance has led some cities to turn down installing additional BMPs. Vegetated BMPs that are not maintained can look weedy and unpleasant and can fail to function because of sediment loading or other issues, thereby discrediting their public and scientific value as a stormwater management tool. Therefore, regular maintenance is an essential part of any green infrastructure BMP program.

Metro Blooms

Metro Blooms' mission is to promote and celebrate gardening, to beautify our communities and help heal and protect our environment. As a non-profit, Metro Blooms forms strategic partnerships to promote and install environmentally sound gardening and landscaping practices. Metro Blooms creates urban green infrastructure that captures stormwater pollution, creates urban habitat, adds beauty, and creates educational spaces. Metro Blooms strives to reach as large an audience as possible with our educational programs and get projects into the ground cost-effectively. The organization is continuously improving the quality of its services and expanding its geographic scope.

Metro Blooms accomplishes its mission through strategic partnerships with citizens, cities, watershed districts, private businesses, non-profits, and volunteers. Metro Blooms serves the entire Twin Cities Metro as well as several other communities in rural Minnesota. The majority of the organization's work currently takes place in Minneapolis and other communities in Hennepin County. As a non-profit, Metro Blooms is positioned to cross jurisdictional boundaries, work across scales, cultivate private funding sources, and build relationships that connect people with local waterbodies through direct action. This action-oriented approach, which integrates public education and organizational collaboration, allows Metro Blooms to build projects cost-effectively and to create citizen stewards who are able to affect change.

Key Partners

In addition to Metro Blooms, other key players involved in this discussion of stormwater BMP maintenance include cities and municipalities, counties, watershed districts, soil and water conservation districts, private landowners, and landscape contractors.

Goals of this Research Project

This research report is the first step in a multi-stage project with the goal of forming a Green Infrastructure Regional Maintenance Alliance (GIRMA). GIRMA has four main goals focused on BMPs:

- regional alliance building
- exploring possible long-term maintenance funding mechanisms
- exploring levels of required or optional maintenance and standardization of monitoring, and
- providing education and outreach

Potential subsidiary outcomes of GIRMA include an increase in municipal and public support of green infrastructure (socially, politically and financially) in addition to existing "pipe and pond" structured systems, an increase in the installation of green stormwater infrastructure metro-wide, a resulting increase in the water quality of regional water bodies, and provision of job training and skills to local youth interested in conservation, horticulture, landscaping, and urban development. This report presents initial findings and ideas in these four main goal areas. In addition, this report includes case studies of several local maintenance approaches, and finishes with recommendations for additional research, activities, and partnerships to achieve the six objectives below.

Regional Alliance Building

Through the process of researching this report, using interviews and discussions, Metro Blooms has begun identifying a wider regional alliance of governmental and non-profit agencies devoted to finding long term solutions for sustaining investments in green infrastructure. Metro Blooms staff have meet with several key local experts working with BMPs to discuss the possibility of a regional alliance, and how each entity is currently managing maintenance funding. Those interviewed included watershed district staff, city engineers, water resources personnel, parks departments, and non-profits with an environmental focus. Response has been supportive and positive on the whole, with interest in varying levels of participation in a collaborative funding effort. Those cities which have many raingardens, limited staff and/or budgets expressed strong interest in collaboration, while those with a small number of raingardens, adequate staff, and/or reliable maintenance funding more often expressed interest in serving on an advisory board. Several interviewees expressed interest in continued collaboration.

Objective 1: Recruit a critical mass of representatives from different agencies; and assemble a working group to build consensus and implementation plans for each of the component goal areas described below.

Maintenance Funding Mechanisms

This report aims to provide information on the initial feasibility of different, sustainable financing options such as a dedicated endowment, legislative appropriation, or a subsidized fee-for-service approach. GIRMA's ultimate goals are to develop a reliable funding mechanism that will support long-term maintenance of vegetative and non-structural stormwater BMPs. It is Metro Blooms' assumption that economies of scale can be achieved through collaboration, thereby reducing maintenance costs. It is also possible through collaboration to construct cost-matching programs or regional labor pools that could further reduce maintenance costs. In addition, it is

Green Infrastructure

"Green infrastructure is an approach to wet weather management that is cost-effective, sustainable, and environmentally friendly. Green Infrastructure management approaches and technologies infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrologies … green infrastructure practices include rain gardens, porous pavements, green roofs, infiltration planters, trees and tree boxes, and rainwater harvesting"

– EPA website

"Basins or rain gardens eliminate or dramatically reduce stormwater flow rates and volumes. They improve water quality by settling and filtering out pollutants, they recharge groundwater, and they can provide stormwater storage capacity in a large drainage area."

– Portland, OR Stormwater Manual

important to consider collaborations with youth employment and internship programs which provide multiple benefits of jobs and skills training for youth, as well as trained, low-cost maintenance services to cities and landowners.

Objective 2: Build consensus around preferred financing approach and create refined implementation plan to accomplish that goal.

Maintenance and Monitoring

This report presents a range of approaches cities already take in regards to maintenance, and explores the costs associated with hiring contractors, utilizing interns/seasonal employees/youth job training organizations, and with mobilizing citizen volunteers. It explores what types of maintenance are needed at what times, and different ways to categorize maintenance needs. In addition, it presents the possibility for different government partners to collaborate on shared costs, and ultimately to create a shared BMP evaluation and reporting process. This goal is focused not so much on financing the costs of maintenance, as in outlining a generally agreed-upon structure of maintenance activities (type, frequency, and estimated costs) necessary for BMP functioning and aesthetics.

Objective 3: Establish pros and cons associated with each approach to maintenance and evaluation, and develop ballpark square foot cost estimates and ranges based on data from city and watershed sources.

Objective 4: Identify the scale thresholds at which it is possible to achieve economies of scale, and at what scales different approaches may work best.

Objective 5: Determine what maintenance approach or combination of approaches is most cost effective for different practices.

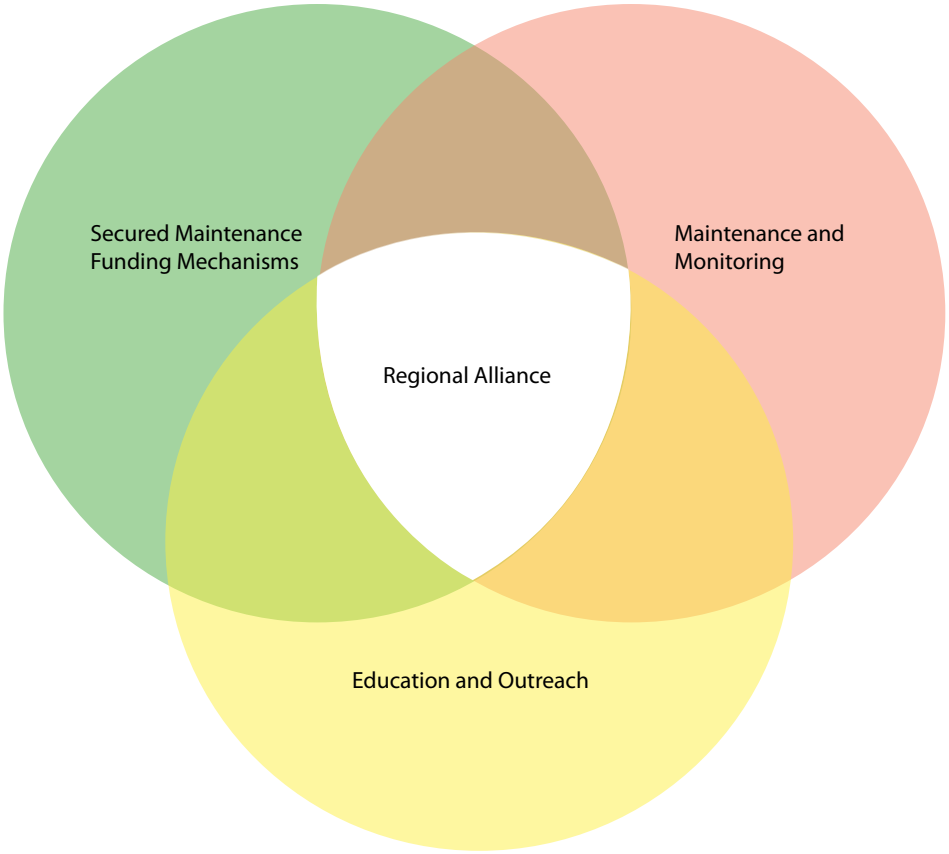
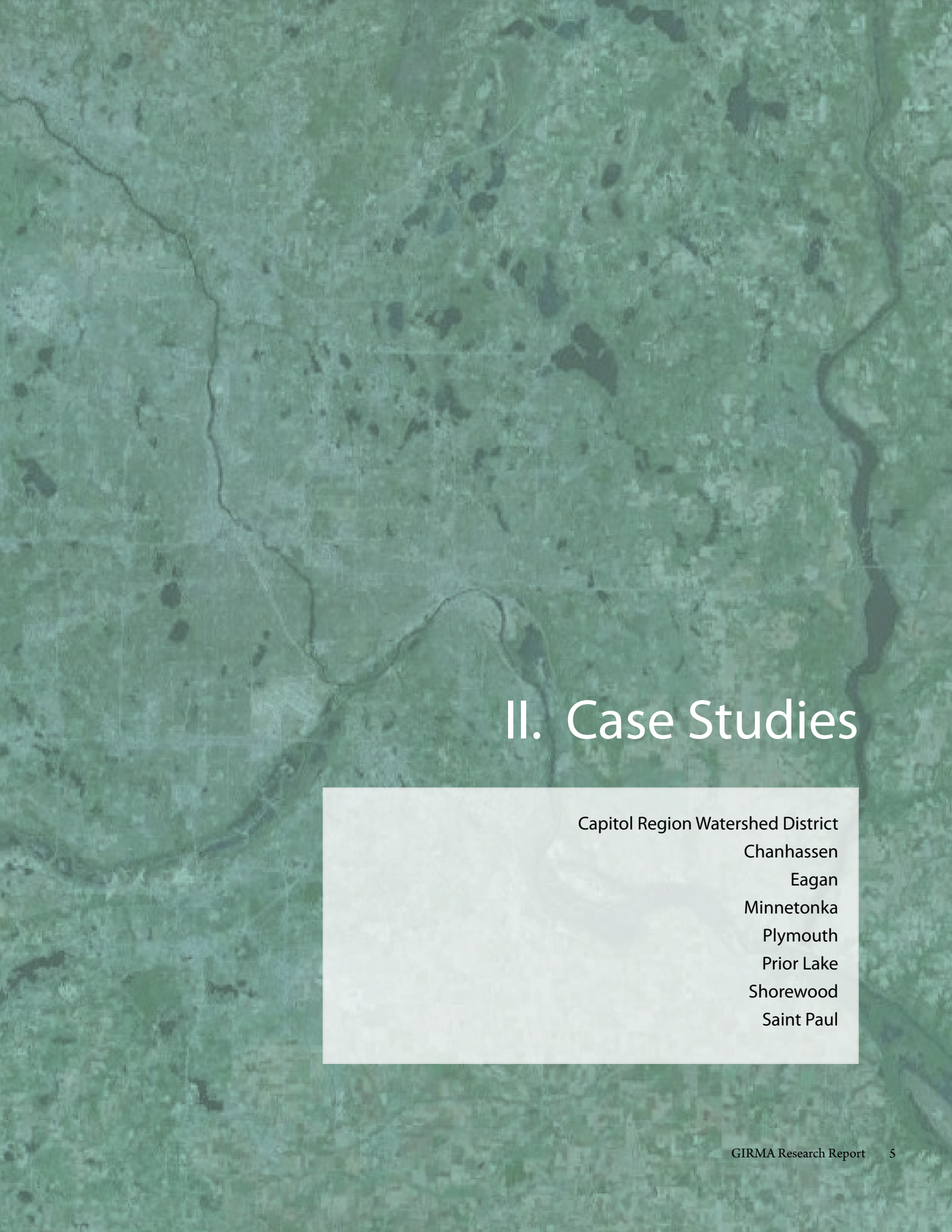


Figure 2: Project Goals.

Education and Outreach

By training landowners and promoting annual evaluation and reporting as a maintenance responsibility, it may be possible to reduce the costs associated with city staff time spent evaluating or maintaining gardens. In Metro Blooms' experience, landowners often benefit from assistance identifying plants and weeds, instructions regarding regular and seasonal maintenance, and proper strategies for controlling sediment build-up. In addition, there is an opportunity to collaborate with the Conservation Corps of Minnesota (CC of MN), interns, or other youth programs to provide both maintenance training and work to area youth, increasing their skills and interest in conservation, horticulture, landscaping, water resources, and urban development. It is also feasible that an established GIRMA program could act as a regional clearinghouse for stormwater BMP maintenance information, research, expertise, and cooperation.

- Objective 6: Gather information on what public education is already being done, what might



II. Case Studies

Capitol Region Watershed District
Chanhassen
Eagan
Minnetonka
Plymouth
Prior Lake
Shorewood
Saint Paul

Capitol Region Watershed District (CRWD)

Comparative Background Information

Location: southern Ramsey County
Population: 245,000 (6,125/sq mi density)
Stormwater green infrastructure managed by: Capitol Region Watershed District Water Resource Technicians
Size: 25,600 acres (40 sq mi)
Major waterbodies: Mississippi River, Como Lake, Crosby Lake, Loeb Lake, Lake McCarrons.
Cities covered by the Watershed District: portions of Falcon Heights, Lauderdale, Maplewood, Roseville and St. Paul.

— *Census Bureau 2010, MN Association of Watershed Districts, CRWD website*

Figure 3. Capitol Region Watershed District boundaries. Source: CRWD website.

Narrative

How many, what raingardens they have:
CRWD has installed and maintains multiple raingardens, most notably eight that were included in the Arlington Pascal Stormwater Improvement Project (APSIP) built from 2005-2006. These were built within city rights-of-way during street reconstruction projects. The Watershed District also currently does inspections for 100 raingardens.

How they perform maintenance and who does it:
The Watershed District worked together with Saint Paul Parks and Recreation and some volunteers to maintain the APSIP gardens. The District assigns three levels when inspecting raingardens, which determines the maintenance that will be done: 1) needs weeding, watering, basic care; 2) needs consultation with owner; and 3) needs serious maintenance.

How landowners are involved:
In general, landowners were not involved unless they served as volunteers doing maintenance.

How much maintenance costs:
For the two year of 2007 and 2008, CRWD spent a total of $22,394 and 1,046 staff and volunteer hours maintaining the eight raingardens in APSIP, with over 70% of those costs going towards labor. This averages to $11,197 annually in total, or $1,399 annually per garden. CRWD has found that raingarden maintenance in general can range from $1000-35000 annually.

Challenges:
CRWD feels its important to maintain current raingardens, even if they weren't originally of the best design. It is best to keep, repair and maintain what already exists.

Successes:
The District maintains their raingardens to a high level, aiming for quality performance and functioning.

Chanhassen

Comparative Background Information

Location: Northeast Carver County and southwest Hennepin County

Population: 23,179 (density 1,147/sq mi)

Stormwater green infrastructure managed by: Water Resources Coordinator

Size: 14,427 acres (24 sq mi) total

Surface Water Features: 3,975 acres, 25.8% of city

Major waterbodies: 12 lakes, approximately 400 wetlands, over 170 storm water ponds, and portions of four creeks. Bluff Creek, Riley Creek, Lotus Lake, Lake Riley, Lake Ann, Christmas Lake, Lake Minnewashta, Lake Susan, Harrison Lake, Lake Lucy, Rice Lake, Rice Marsh Lake, Silver Lake, and Lake St. Joe

Watershed Organization(s): Minnehaha Creek WD, Riley-Purgatory Bluff Creek WD, Lower Minnesota River WD, Carver County Water Management Organization.

— *Second Generation Surface Water Management Plan 2006 by City of Chanhassen, Census Bureau 2010, MN Association of Watershed Districts, City of Chanhassen website*

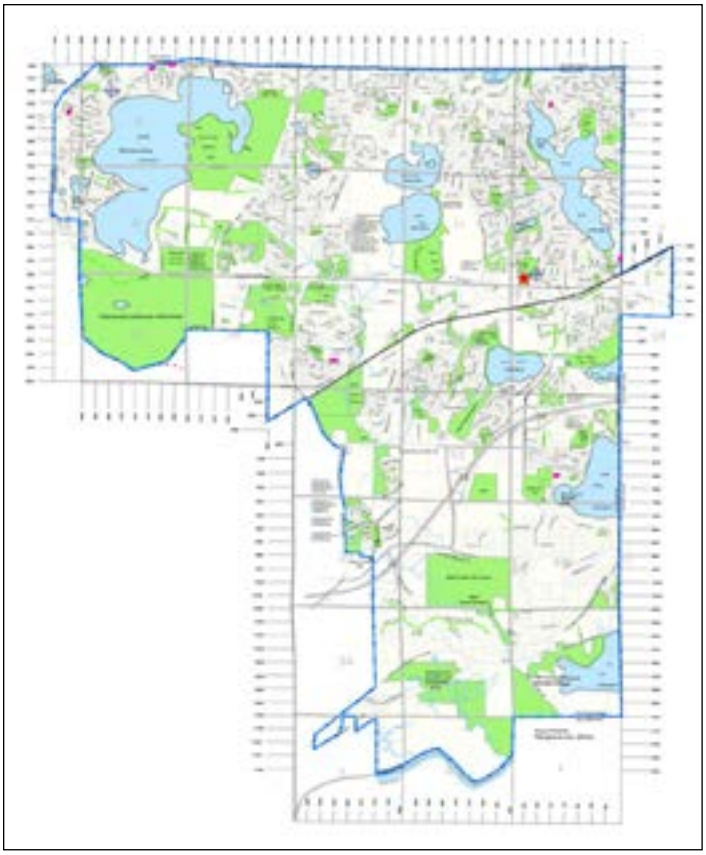


Figure 4. Chanhassen boundaries. Source: Chanhassan city website.

Narrative

How many, what raingardens they have:

The City of Chanhassen currently has 21 total raingardens installed, not including those in private development, the largest of which are Laredo, Pontiac, Foxbird, Tiberon, Deepone. Most are located in the right of way. Major public projects which often include more than one BMP include Kerber Park, Lake Anne, Cimarron, Erie/Rice Marsh Lake Park, and Lake Riley Woods. The city has a total of 97,314 sq ft of public BMPs, including 21 raingardens, 1 vegetated swale, and 1 permeable paver installation. Total water volume treated by these BMPs is estimated at 2,534,163 sq ft of watershed area, 211,179 cu ft in a 1" rain event. In 2012 the city plans to put even more raingardens on public property.

How they perform maintenance and who does it:

In the City of Chanhassen, stormwater green infrastructure is managed by a Water Resources Coordinator, with assistance from a Natural Resources technician and seasonal workers. They are often short-staffed to work on maintenance. Maintenance is done annually or biannually, and includes weeding, re-planting, mowing, and mulching. The City will often hire professional contractors to do BMP maintenance for the first 3 years, then it becomes the responsibility of landowners.

How landowners are involved:

City requires right-of-entry for first three years for maintenance, then it becomes responsibility of property owner to maintain. City has landowners sign a maintenance agreement, but there are not resources to enforce this. City would be willing to charge a fee if raingardens on private land are not maintained.

How much maintenance costs:

The city generally includes the first 2 years of maintenance in the installation cost. For one of their largest projects, Laredo Gardens, the city estimated $2500-5000 in annual maintenance costs, but have already spent $52,000 in the last 3 years due to drainage issues related to clay soils. Laredo has 3 large raingardens and 1 stormwater pond.

For Cimmaron, a project of 7 raingardens at 10,900 sq ft total, a contractor charged $2000 for a 1 year maintenance contract – this was 7.1% of the total installation & materials costs ($28,169). Installation & materials costs from Cimmaron that could also later apply to maintenance practices include:

MNDOT Type 6 shredded wood mulch ..... $50/cu yd
MNDOT 3890 Type 1 compost ..... $40/cu yd
MNDOT 3149 washed sand ..... $40/cu yd
MNDOT Category 1 Erosion Control Blanket..... $0.55/sq ft
Crushed rock ..... $20/cu yd

The city estimates that it costs $5227 annually to maintain the 21 public raingardens it currently has, which equates to an average of $249 each. With 74,119 sq ft of raingardens, that equates to $0.07/ sq ft.

Challenges:
Clay soil complicates infiltration and can create maintenance issues, as with Laredo Gardens. The skill level and oversight of work done by contractors can make a huge difference, as any issues with installation can cause failures that become maintenance issues. For example, with an installation on Lake Ann, contractors used the wrong gravel in the drain tile. This has caused ongoing maintenance issues. City has to meet MCWD, Carver County, and MS4 requirements for stormwater. Right-of-entry for city to maintain raingardens on private property is difficult to get. Property owners need more education on how to maintain the gardens, preferably hands-on education while maintenance crews are there the first 3 years.

Other notes:
The city doesn't currently claim their raingardens as BMPs.

Eagan

Comparative Background Information

Location: northwestern Dakota County
Population: 64,206 (1,966/sq mi density)

Stormwater green infrastructure managed by: Water Resource Specialist

Size: 22,080 acres (34.5 sq mi)

Surface Water Features: 704 acres, 3.2% of city

Major waterbodies: 200 natural lakes and wetlands larger than one acre, plus 1200 waterbodies. Quigley Lake, Thomas Lake, Jensen Lake, Fitz Lake, Holz Lake, Hay Lake, Schwanz Lake, Holland Lake, Bald Lake, Fish Lake, O'Leary Lake, Blackhawk Lake, Lemay Lake,

Watershed Organization(s): Gun Club Lake WMO, Lower Minnesota River Watershed District

— *Census Bureau 2010, MN Association of Watershed Districts, City of Eagan website, Gun Club Lake WMO, Lower MN River WD*

Figure 5. Eagan boundaries. Source: Googlemaps

Narrative

How many, what raingardens they have:
Eagan historically had 30 raingardens, and recently the city installed 25 additional curb cut raingardens in a 27-acre neighborhood over a 2-year period. The new gardens all have trench drain sediment collection, while 10 of the older ones have catch basins with pipe inlets modified to catch sediment, and the rest have turf strip inlets. The city plans to modify the turf strip inlet gardens, but does not currently have plans for more raingarden installations in 2012.

How they perform maintenance and who does it:
The 25 raingarden installation has been very easy to maintain, because the city had control over installation and was able to meet their design and install specifications. Homeowners have been responsible for regular vegetative maintenance from day one of installation, with city responsible for sediment removal at the curb cut trench drain. Eagan's water resources department has 3 staff members, but generally one person does all the sediment removal as well as occasional weeding. At the time of cleanout, sediment is weighed to determine an average maintenance volume. The city focused on quality design and installation to help prevent maintenance problems, and if there are any it is usually the trench drain which the city will replace in order to avert the need for a major repair later.

How landowners are involved:
The city is now transitioning so that both vegetative maintenance and curb cut trench drain sediment cleanout will be the responsibility of homeowners from day one after installation. The city plans to give homeowners a 5 gallon pail to hold sediment that the city will pick up periodically. If homeowners **haven't been maintaining their garden vegetation, the city will often take up the weeding while they are already on site for sediment removal. This has proven easier than outreach, though outreach is still done, including door knocking.**

How much maintenance costs:
Installation of the 25 gardens cost approximately $26/sq ft. City's sediment removal and occasional weeding maintenance costs are included as part of the general fund so those costs aren't tracked separately. The city expects a 20-year lifespan for their raingardens.

Minnetonka

Comparative Background Information

Location: south central Hennepin County
Population: 49,734 (1,764/sq mi density)
Stormwater green infrastructure managed by: Natural Resources Manager
Size: 18,048 acres (28.2 sq mi)
Surface Water Features: 704 acres, 3.9% of city
Major waterbodies: Lake Minnetonka, Glen Lake, Shady Oak Lake, Lake Rose, Minnehaha Creek
Watershed Organization(s): Bassett Creek, Minnehaha Creek, Riley- Purgatory Creek, Nine Mile Creek

— *Census Bureau 2010, MN Association of Watershed Districts, City of Minnetonka website*

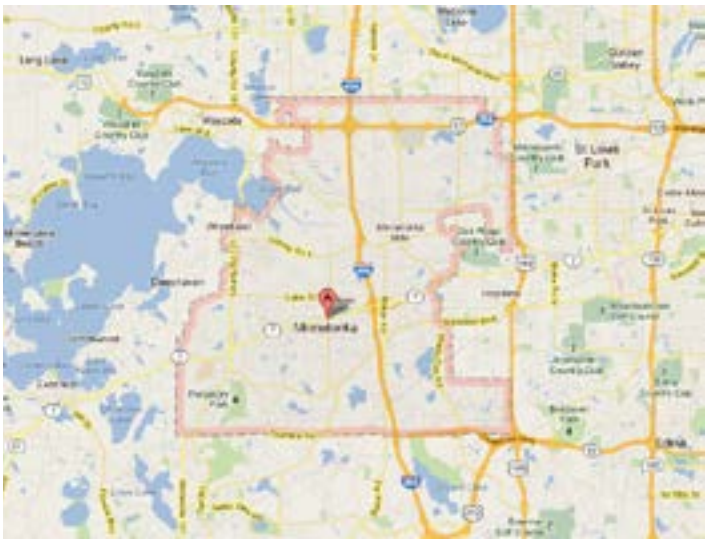


Figure 6. Minnetonka boundaries. Source: Googlemaps

Narrative

How many, what raingardens they have:
The city maintains several raingardens. The city has enough staff to do their own raingarden design, installation, and maintenance in-house.

How they perform maintenance and who does it:
The city has engineering interns that monitor the state of all raingardens, though landowners are required to do maintenance on gardens on private property. For public gardens, the city contracts with institutional work crews. The city also has a "drainage team" that takes care of stormwater ponds, located in the streets department.

How landowners are involved:
Landowners are required to sign a maintenance agreement with the city stating that they will perform maintenance on gardens on their own property. The city sets it up so that if the property is sold, the new property owners are legally agreeing to assume maintenance when they buy the property. They also take part in public education provided by the city.

How much maintenance costs:
They do their own raingarden design, installation, and maintenance in-house less expensively than if they contracted outside. For gardens on school district property, the city holds on to maintenance funds for a year to guarantee plants are maintained during the first critical year.

Challenges:
Public education and making homeowners aware when they buy into a development if the developer signed a maintenance agreement with the city. Often it is the homeowners who must assume the developer's responsibility.

Plymouth

Comparative Background Information

Location: central Hennepin County
Population: 70,576 (density 1,999/sq mi)
Stormwater green infrastructure managed by: Water Resources Engineer
Size: 22,592 acres (35.3 sq mi) total
Surface Water Features: 1536 acres, 6.7% of city
Major waterbodies: eight lakes, 800 wetlands, and 250 stormwater ponds. Medicine Lake, Hadley Lake, Lost Lake, Mooney Lake, Gleason Lake, Schmidt Lake, Pomerleau Lake, Bass Lake.
Watershed Organization(s): Bassett Creek, Elm Creek, Minnehaha Creek, and Shingle Creek.

— *Census Bureau 2010, MN Association of WDs, Plymouth website*

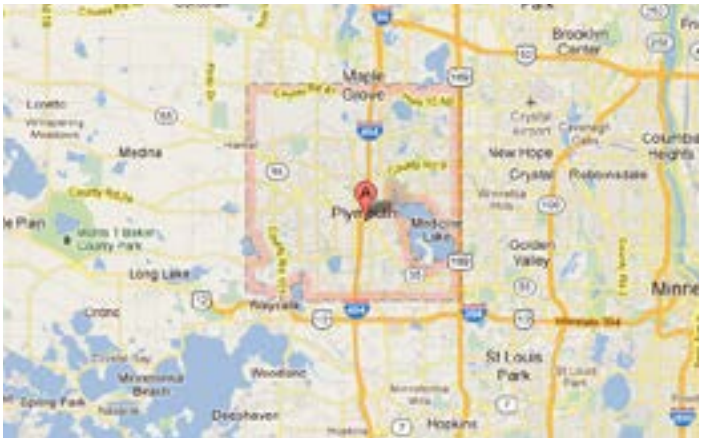


Figure 7. Plymouth boundaries. Source: Googlemaps

Narrative

How many, what raingardens they have:
The city currently has 36 raingardens they maintain, and numerous other that landowners maintain. They've been installing them since the mid-1990, offering grants at that time to landowners to incorporate native plants into the landscape. The program has since expanded in size and sophistication. Later development pressures caused some developers to install raingardens where they tended not to function properly, and require residents to maintain them yet that responsibility was not made clear to residents. Since 2000, the city has been installing curbside raingardens. These are all a minimum of 400 square feet and include retaining walls to maximize volume.

How they perform maintenance and who does it:
Early "backyard homeowner raingardens" were maintained by landowners, who signed a written agreement. Later raingardens installed by developers were to be maintained by landowners and/or residents, but often go with irregular or little-to-no maintenance performed. The most recent curbside raingardens installed after 2000 by the city are maintained by the city, though homeowners are charged a $5 stormwater utility fee to fund this maintenance. The city hires Natural Shore Technologies as contractor to perform the maintenance.

How landowners are involved:
Early "backyard homeowner raingardens" were maintained by landowners, who signed a written agreement. Landowners not involved in current raingardens expect to pay stormwater utility fee.

How much maintenance costs:
The raingardens installed since 2000 cost about $10,000 each to install, with half of that cost attributable to the retaining wall. This works out to about $25/sq ft. The city plans on 10 year lifespans for its raingardens, and invests $200 into each garden for maintenance.

Challenges:
Raingardens installed by private developers as part of residential, commercial and industrial developments tend to not function properly, and are often located in areas difficult to access for maintenance. Landowners are responsible for maintenance but enforcement is difficult.

Successes:
The city has had a good relationship with the City Council, which has been willing to try new things.

Prior Lake

Comparative Background Information

Location: northeastern Scott County

Population: 22,796 (density 1,178.4/sq mi)

Stormwater green infrastructure managed by: City Water Resources Engineer

Size: 18.3 sq mi

Area covered with water: 2.5 sq mi (15.6%)

Major waterbodies: 14 lakes. Upper and Lower Prior Lakes, Spring Lake, Howard Lake, Campbell Lake, Mystic Lake, Jeffers Pond, Pike Lake, Crystal Lake, Rice Lake, Markley Lake, Haas Lake, Arctic Lake, Blind Lake.

Watershed Organization(s): Prior Lake/ Spring Lake Watershed District

— *City of Prior Lake website, Census Bureau 2010, MN Association of Watershed Districts*

Narrative

How many, what raingardens they have:

City has about 50 raingardens, 50 other infiltration practices, and 150 storm ponds, mostly on private land.

How they perform maintenance and who does it:

In the City of Prior Lake, stormwater green infrastructure is managed by the Water Resources Engineer, with assistance from park staff and seasonal workers/interns. The city only does inlet maintenance, and the rest is the responsibility of the landowner. The City considers a raingarden optimization lifecycle of 15 years, including annual spring sediment cleanout of inlets, and replacement of mulch and plantings every 5 years. The first 3 years the city checks and replaces plants, monitors water needs. Intensity of maintenance tapers off after installation, with strongest levels in first 3 years. Major maintenance and plant replacement every 5 years is the responsibility of landowners. Monitoring is important to the city, especially measuring how much phosphorus was removed by the BMP. The maintenance schedule that landowners are asked to complete:

First Year Maintenance:

Weekly: Water garden for the first 3 months.

Monthly: Weed the garden monthly in the first year.

Figure 8. Prior Lake boundaries. Source: Googlemaps

Normal Maintenance: water the garden, weed the garden 2-3 times per season, replenish mulch material and hand till in the spring, cut back and divide plants in either the spring or fall, cut dead material out and compost, lean up sediment and debris in the bottom of the rain garden, rake the affected area and recover with mulch in the spring or summer.

How landowners are involved:

The City and landowner partner to pay for maintenance, with city handling first 3 years, and landowners taking over after that. If landowners don't perform necessary maintenance, the city asks the SWCD to encourage and educate the landowner. If it still isn't maintained, the city will pave over the inlet. The SWCD is very involved in landowner maintenance education, keeping contact with landowners and sending regular maintenance reminders. One challenge with landowners is what happens to maintenance if property is sold. Most raingardens are installed as part of street reconstruction projects. The city requires interested homeowners sign a "Resident Statement of Interest" form which includes the following statements:

- I am interested in exploring the possibility of a rain garden in the boulevard near my property.
- I understand that not all properties may be able to accommodate a rain garden.
- I would like to schedule a time to meet with City Staff to sketch a conceptual rain garden for my property.
- Name, Date, Address, Telephone, E-mail

If homeowners want to proceed, the city has them sign a "Resident Statement of Decision" form which includes the following statements:

- I would like the City to build a rain garden in the boulevard near my property.
- I understand that the City will create a rain garden depression and install edging, soil amendments and mulch.
- I understand that the City will provide plant materials and technical support but that I will be required to schedule time to plant the garden on one of three 'planting weekends,' date to be determined.
- I understand that I will be expected to maintain the rain garden in perpetuity.

How much maintenance costs:

Raingardens are often installed as part of street reconstruction, thereby sharing the public outreach and other costs. Capital funding from both the watershed district and the city is used for raingardens. In order to get most grant funding, raingardens need at least 15-year lifespans. Unfortunately, the city has found that many grants don't account for the potential failure rate of some BMPs, and so provide no contingency funds for refurbishing, repair, or maintenance of gardens. City prefers to approach costs by measuring how many lbs of phosphorus were removed by practice or dollar invested, with ultimate annual costs indicated per square foot. Many cities, including Prior Lake are structured to do more capital spending than maintenance spending, so would need reorganization internally to make the switch. City's spending focus is on simple, defined maintenance itself, not the public education that accompanies it. For public education, the city works with the Scott County SWCD.

The city estimates a maintenance cost of $55/hour or $18/year for each garden for inlet cleaning and light maintenance only, not major repairs or renovations. This includes salary for one staff member to train 2 interns, truck, fuel, labor, tools, and seed costs, spending approximately 20 minutes per garden plus driving time. The interns do light inspections and cleaning of inlets, sediment or woodchip removal. Any major issues, such as erosion or plant replacement needs are noted and given to city and SWCD staff who work with landowners to address the issues. Prior Lake has extensively analyzed the installation and maintenance costs for its raingardens, conducting cost/benefit analysis to optimize placement and sizing for greatest effect. In this way, they created a toolkit for decision makers to help them determine when and where raingarden installation is most appropriate, efficient, and effective both functionally and financially. An example analysis: a 200 sq ft raingarden that costs $1700 to install can have 15 yr lifetime maintenance costs of $1,650, bringing total cost (install and maintenance) to $3,350, or $223 per year. This is total cost incurred by city, landowner, and SWCD combined, and includes annual and 5yr major maintenance activities.

The city also estimates a cost of $450-550 per lb of phosphorous removed per life cycle of a raingarden on private land, and $250-400 on public land. Private raingarden costs are higher because of the cost of public engagement and education. The city estimates that the cost of public education on a raingarden for just one neighborhood can be around $1,000, so efficiencies of scale are necessary. A series of distributed practices is less efficient for crews to travel to without efficiencies of scale via multiple BMPs, so a regional approach would be more efficient.

From 2008-2011 the city did a research project on how to better place raingardens in the landscape for phosphorus removal, and adjust costs according to placement. They created target areas based on soils, slope, and SWCD input. Raingardens were offered to residents at a cost related to the amount of phosphorus that a particular raingarden could remove, with the city covering more of the cost for the most efficient and effective raingarden locations. First step was to size the raingarden, determine drainage area, plot how much phosphorus could be captured, then translate that to cost. Larger sized raingardens could remove more phosphorus. Some BMPs were free to residents because of their efficient locations, other less efficient locations were offered on a cost-share basis, with costs to residents between $300-$1,200, cost to Watershed District $11,750 per garden, and cumulative costs at $23,500 per garden. In addition, "curb-cut raingardens ranged from $12,000 to $44,000 per pound of new treatment capacity for phosphorus, and between $400 and $1,500 per pound of removal over the lifecycle of the practice" (City of Prior Lake Subwatershed Assessment, 2011).

Other notes:

City only claims public gardens for TMDL/MS4 credit, because claiming private gardens would require full maintenance responsibility. City would like to have another entity do maintenance, but wants city to be able to still claim TMDL/MS4 credit. City suggested county-based organizations that keep owners active and engaged in maintenance.

Shorewood

Comparative Background Information

Location: Southwest Hennepin County

Population: 7,307 (1,305/sq mi density)

Stormwater green infrastructure managed by: City Engineer

Size: 3600 acres (5.6 sq mi)

Area covered with water: 8.1 sq mi

Major waterbodies: Lake Minnetonka,

Watershed Organization(s): Minnehaha Creek Watershed District, Riley Purgatory Bluff Creek Watershed District, Lake Minnetonka Conservation District

— *Census Bureau 2010, MN Association of Watershed Districts, City of Shorewood website*

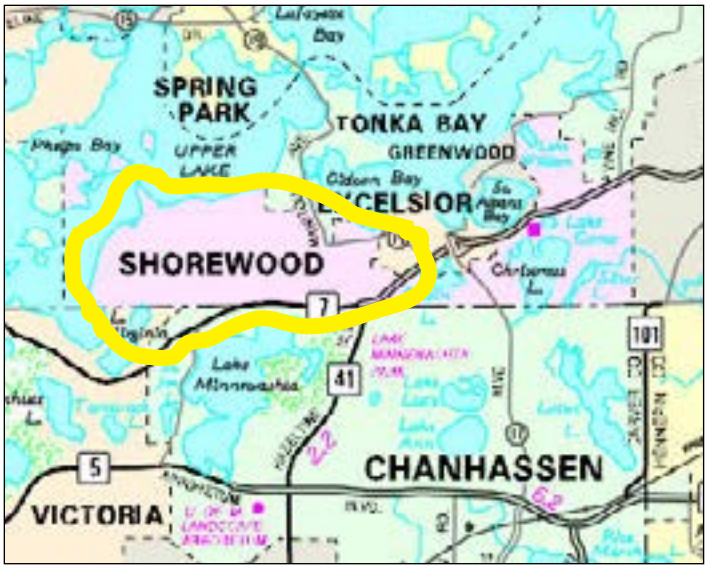


Figure 9. Shorewood boundaries. Source: Lakesnwoods.com

Narrative

How many, what raingardens they have:

The city has installed 2 public raingardens, one in cooperation with Metro Blooms. A third project – Gideon-Glen, a stormwater infrastructure demo and park trail site, is in need of erosion repair. It is a cooperative project between the city and watershed district, but the city will take it over after 5 years. In addition the city employs roadside treatment trains, vegetative swales, and curb cuts. It is highly likely that the city will install additional raingardens in the future.

How they perform maintenance and who does it:

City does not currently have staff trained in plant identification, so need to contract out for this. For Gideon-Glenn the city was considering contracting with CC of MN but they would like more professionally trained oversight, so are considering other options as well.

How landowners are involved:

Raingardens are maintained by the city, often with contractors doing the work. Homeowners are educated on general stormwater pollution prevention issues, but not expected to maintain public raingardens.

How much maintenance costs:

Stormwater project funding comes from property owners' stormwater utility fees. These fees are usually used to replace pipes and culverts over 40 years old. This funding is considered an "enterprise fund" so it won't be cut, although it could incur changes.

Challenges:

Gideon-Glen is in need of renovation, and city is short-staffed to do work themselves, so must contract out.

Successes:

City has reliable funding stream for current level of maintenance

Saint Paul Parks and Recreation

Comparative Background Information

Location: southern Ramsey County

Population: 285,068 (5,072/sq mi density)

Stormwater green infrastructure managed by: Public Works and/or Parks and Recreation

Size: 35,968 acres (56.2 sq mi)

Surface Water Features: 2,176 acres, 6% of city

Major waterbodies: Mississippi River, Como Lake, Phalen Lake, Pig's Eye Lake

Watershed Organization(s): Capitol Region Watershed District, Lower Mississippi River WMO, Mississippi River WMO, Ramsey-Washington Metro Watershed District.

— *Census Bureau 2010, MN Association of Watershed Districts, City of Saint Paul website*

Figure 10. Saint Paul boundaries. Source: City of Saint Paul website

Narrative

How many, what raingardens they have:

Most city raingardens are in the right-of-way and have been installed by public works. There are a few raingardens in parks. Existing or planned raingardens include those at Como Pool, Highland Pool, Victoria Park/school project, Police Department on Hamline, Hillcrest Knoll, and the Central Corridor green space.

How they perform maintenance and who does it:

The city uses Capitol Region Watershed District/CC of MN crews to maintain gardens in the right-of-ways. Saint Paul Parks and Recreation (SPPR) provides technical expertise and oversight when needed. In addition, a group of volunteers from the west side of the city also helps out, and SPPR has three staff who will sometimes do maintenance work, but staff time is limited.

How landowners are involved:

Landowners are generally not involved in maintenance, as the city contracts with CC of MN for that. There is public education outreach to landowners.

How much maintenance costs:

The city contracts with CC of MN crews, which Capitol Region Watershed District secures by applying for Clean Water Legacy funding.

Challenges:

Change in funding every year requires annual re-staffing and re-coordination of stormwater maintenance program.

Successes:

The city has an interdepartmental Water Resources Working Group that meets monthly.

Other notes:

The city assigns a code to all public art in the their parks system so they can track maintenance. A similar system could be set up for tracking raingarden maintenance.

III. GIRMA Funding Mechanisms

Invested Funds
Formula
Appropriation
Additional Financial Considerations
Menu of Service Options
Management and Allocation of Funds

GIRMA Funding Mechanism

The primary task of the GIRMA program is to devise sustainable long-term solutions for financing green infrastructure maintenance. Due to the variability in stakeholder attitudes towards the value of green infrastructure and maintenance, the delivery method degree of service will likely differ from partner to partner. Ideally, a single funding mechanism could support a range of maintenance programs with different structural features or options. Approaches explored in this report include:

1. Invested Funds. A designated beneficiary opportunity fund held by the Minneapolis or St. Paul Foundation initiated with a seed grant of $10,000 from Metro Blooms. Investment returns can be used to provide full or partial funding for maintenance on specific projects for the duration of their functional life. The benefit of this approach is that over time the endowment would be able to grow and attract additional philanthropic support from private parties. Alternatively, the fund could be started with a seed grant from a government entity or partnership of agencies.
2. Formula. A regionally approved formula for endowing maintenance as part of any initial capital investment in green infrastructure. Included is the idea of a "partnership" program for low-cost maintenance using subsidized labor pools together with professional oversight.
3. Appropriation. A legislative appropriation to provide long term funding via the Clean Water Fund. This funding could be used to finance CC of MN crews under staff direction, seasonal interns or contract maintenance.

Principal balance	Annual 2% ROI	Annual 4% ROI	Annual 6% ROI
$10,000	$200	$400	$600
$50,000	$1000	$2,000	$3,000
$100,000	$2,000	$4,000	$6,000
$250,000	$5,000	$10,000	$15,000
$500,000	$10,000	$20,000	$30,000
$750,000	$15,000	$30,000	$45,000
$1 million	$20,000	$40,000	$60,000
$2 million	$40,000	$80,000	$120,000

Figure 11. Return on investment rates for invested fund.

Invested Funds

In order to guarantee an ongoing funding stream for maintenance activities, one option is to invest seed money in an endowment, a designated beneficiary opportunity fund, or other financial instrument that pays annual returns. This approach would require fundraising in order to grow the principal enough to earn adequate returns (*Figure 11*). Seed money could come from grants, private donations, or money that cities, watershed districts and/or landowners would deposit as a percentage of BMP construction costs.

Metro Blooms is in a position to begin such an investment of fundss. However, it may be beneficial for a regional collaboration to initiate a fund collaborative of multiple entities including cities, counties, soil and water conservation districts, watershed districts, and landowners. Such a partnership fund would necessitate a more stringent public oversight process than if a private entity established such a fund. A preliminary review of research and trade literature did not return any previous examples of coalitions which funded maintenance in this way.

A GIRMA participant's contribution could be calculated up front as a percentage of total installation costs (ex: 10-30%), or could be pro-rated annually. If pro-rated annually, it could receive a match from watershed districts and landowners who would also be contributing part of the investment, so total returns would be greater than if the city had only made the initial investment themselves.

Example: Endowment

In general terms, an endowment is simply an account of money, managed and distributed by a board, with annual returns that are often partially withdrawn for use, and partly reinvested along with an untouchable principal to keep up with inflation. Endowments can be restricted or unrestricted in the use of their returns for specific purposes (such as maintenance). Many large colleges and universities maintain endowments to fund operations, salaries, and scholarships. There is also a quasi-endowment, which is a fund that functions as an endowment, but does allow access to the principal in certain circumstances.

Example: Minneapolis Foundation Designated Beneficiary Opportunity Fund

A designated beneficiary opportunity fund, housed at the Minneapolis Foundation, is similar to an endowment in that principal funds are invested by the Foundation and returns earned. It differs in one key aspect: an opportunity fund offers the possibility to access the original principal if needed, while an endowment's principal becomes the property of the Minneapolis Foundation. In this way, the opportunity fund can be considered a quasi-endowment.

More specifically, the Foundation legally owns the principal in both options, however, one can petition to access the original balance in an opportunity fund. Even if one petitions, it appears that the Minneapolis Foundation board could deny a withdrawl request, so refund of principal is not guaranteed even with an opportunity fund. All of these restrictions on principal can change or be re-negotiated once $1 million in principal is reached. It appears this is similar to the way most all community foundations work (e.g. Minnesota Foundation, Saint Paul Foundation, etc.).

This type of fund is considered a "public charity", so anyone can donate to it including foundations, public entities, and individuals. The fund would name Metro Blooms, GIRMA (or any entity we choose) as sole beneficiary. One benefit of housing the fund with the Minneapolis Foundation is that they have access to several private donors, who might be pursuaded to contribute to the fund. Staff indicated willingness to meet privately with key donors about our fund. The Minneapolis Foundation also has the capacity to furnish an oversight board for disbursement of the returns if we would rather relinquish that responsibility. Options for disbursement are discussed later in this report under the *Management and Allocation of Funds* section, pg 22.

For bookkeeping purposes, Metro Blooms must decide if their opportunity fund would be "agency" or "non-agency". With agency funds, donors give money to Metro Blooms and we transfer it to the funds, so the assets are kept on our books. With non-agency, donors give directly to the Minneapolis Foundation and it is not tracked on our books.

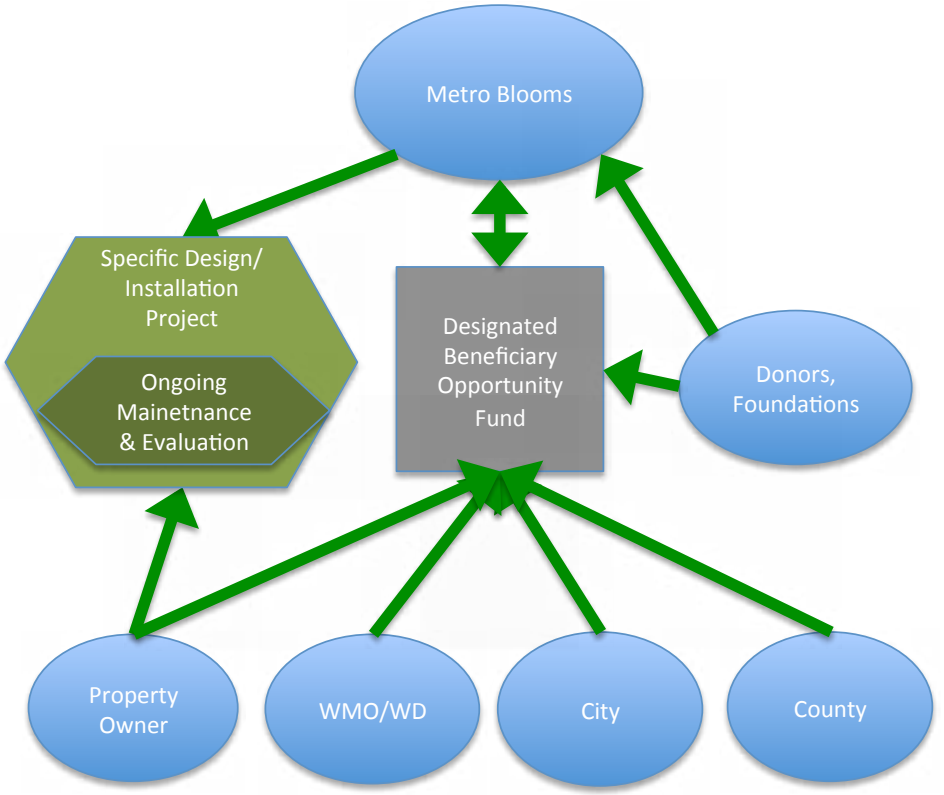


Figure 12. Potential Funding flow for invested Fund approach

The Minneapolis Foundation also offers specific purpose, legacy, and field of interest funds. Money donated to these funds goes to multiple beneficiaries under one umbrella theme such as "environment". These are not recommended for our purposes, however, because we would have absolutely no control over how these funds are dispersed.

Funds at the Minneapolis Foundation are currently returning around 4%. Costs charged are 1% of the fund annually, plus additional investment fees at a minimum of $750.

If we choose to house a fund at the Minneapolis Foundation, they can offer some limited legal advice for investments, but cannot offer advice on how to set up a program or board for disbursement of returns or grants. We may need to pay our own attorney to write documents and procedures.

Example: Brokerage Account through Capital Management

The Minnesota Land Trust currently has several brokerage accounts through Robert Shepard at Capital Management in Minnesota. They are happy with the service and are able to draw up to 5% annually to help fund stewardship conservation activities. Robert indicated that the principal of funds invested with his company can remain the property of GIRMA, with full access if desired. Robert suggested investing primarily in bonds if we want an annual draw, and bonds currently only return about 4-5%. So an initial investment of $10K

Figure 13. Chanhassen homes. Source: Homes.com

would only return $400-500 (Figure 1).

It would be important through this approach to increase the size of the principal. A money manager from Ameriprise interviewed for this project said that some organizations have bylaws that dictate where money can or cannot be invested.

Cambridge Associates, a national fund manager, suggests asking the following questions before setting up a fund:

- Does our governance structure facilitate sound, disciplined decision-making?
- Do those individuals charged with responsibility for overseeing the assets have sufficient understanding of institutional investing and sufficient information at their disposal to make informed decisions?
- Are they spending enough time to do the job right?
- Do we have explicit, written policies that describe the endowment's objectives and the means taken to achieve them?
- Do we have the knowledge, experience, and resources needed to implement those policies effectively?
- Are we monitoring and measuring the results of our decisions in ways that tell us whether we are succeeding in achieving our objectives?

Challenges and Concerns

1. Maintaining control of, and access to, any principal invested, i.e., who owns the fund?
2. Cities may have difficulty convincing city boards/councils of the value of an immediate investment with more long-term payoffs, especially if they are required to maintain zero rollover on their financial balance sheets.
3. Cities may want to see examples of this sort of financial process working successfully elsewhere, however, this research project was unable to locate comparables.
4. If installation of a BMP isn't done correctly can this fund pay the extra costs to repair it? What about major storm damage?
5. Should there be a difference in funding available (or allocation process) for maintenance or repairs of BMPs already installed vs new ones yet to be installed?
6. How big of a benefit would this be for cities? What's difference if a city just budgets $5000 a year for maintenance themselves vs. putting it into the endowment? How big does a return have to be in order to get cities on board?
7. Is Minneapolis Foundation or a private capital management firm the best location to house the fund, or could it legally be located at the city, county, or WMO/WD?
8. What sort of public oversight would be required if LGUs contribute to the fund?

Benefits

1. Cities and other entities can have a consistent, predictable annual cost for routine maintenance.
2. Cities and other entities can safeguard maintenance funding long-term from budget cuts by earmarking it via the fund at the beginning of a project.
3. Cities and other entities can invest in the cost-sharing at every step of the process, reducing their overall budget burdens for maintenance

Formula

Another funding mechanism approach could be the implementation of a regionally approved formula for endowing maintenance as part of any initial capital investment in green infrastructure. Members of GIRMA would agree upon a formula (such as including a line-item in public project budgets that up to 33% of a project's cost should go to maintenance via an endowment fund or similar approach) and commit to utilizing it. These built-in costs would thereby become more regionally standardized, allowing for fair competition in the maintenance service market, and ensuring quality installation and maintenance.

In order to institute an acceptable formula, variations in city and watershed district bookkeeping styles must be compared to find an approach that is mutually sustainable. For example, GIRMA members could agree to committing 6% of installation costs towards long-term maintenance. These funds could be due at time of installation or permitting, and could be deposited in one of the above-described funds, with annual returns paid for regular maintenance. Benefits of annual payments from cities versus a one-time up-front payment of a percentage of project costs should be considered.

Possible partners in such a formula include

cities and municipalities, counties, watershed districts, soil and water conservation districts, and landowners.

Subsidized Partnership Labor Team

An important part of such a formula, and one that would guarantee cost-savings for participants, is a consideration of who will perform maintenance. City staff, watershed district staff, SWCD staff, landowners, and contractors are fairly obvious options. Another option to consider is subsidized or otherwise reduced-cost labor, such as Conservation Corps of Minnesota crews funded through Clean Water Legacy funding, institution/community work crews (ICWCs) and work release crews, interns or volunteers. These reduced-cost labor pools could be combined with professional training and oversight crews made up of city staff or contractors to ensure quality, accurate, and reliable services. Metro Blooms already has experience working with CC of MN crews in this way, with Metro Blooms providing the professional training and oversight. Once entities join the GIRMA program and invest funds, they would have access to this reduced-cost, professionally trained "partnership" maintenance labor team on a subsidized fee-for-service basis. By combining resources into one specialized team, cities could achieve efficiencies of scale by paying for only one set of tools and equipment, one series of trainings, etc for a crew that could work continuously, moving from one city to the next.

Challenges and Concerns

1. If pitching an intangible endowment investment to a City Council might be a hard sell, consider instead a "maintenance subscription service" that asks City Council to contribute annually to a service that in turn does annual maintenance (like a magazine subscription). Similar consider are a "co-op maintenance group" or "green infrastructure conservancy".
2. Can guarantees be offered by a partnership labor team? For example – the team will maintain BMPs to a specified level, and if still doesn't make the BMP functional, who will pay to fix it? Also, if the BMP is maintained to specifications but still doesn't perform to expectation, does it get repaired, who pays, and who makes the decision?

Benefits

1. Buying into a reduced-cost partnership labor team.
2. Clear expectations of cities for their contribution amount.
3. Efficiency of scale with partnership labor team: only one crew, one vehicle, one set of tools needed for several sites.

Appropriation

Similar to the funding mechanism used for the Clean Water Legacy Fund, a state legislative appropriation could be instituted to provide ongoing funding for stormwater BMP maintenance activities. This funding could be used by cities, MCC crews under staff direction, seasonal interns or contractors with the intent of ultimately improving regional water quality. Another approach of this type would be to appeal to the Minnesota Board of Water and Soil Resources (BWSR) to dedicate an allotment of their state funding for GIRMA or a similar fund. Watershed Districts could also consider levying a special assessment or tax for this purpose. In the city of Shorewood, residents are charged a one-time sewer access charge when building new property. If an existing residence is demolished and a larger one (producing more stormwater runoff) is built, it might be possible to consider increasing the storm sewer access fee that is normally charged at this time.

This is the most complicated and long-term approach to funding included in this report. This approach could be pursued concurrently with other approaches, and would benefit from a regional consortium

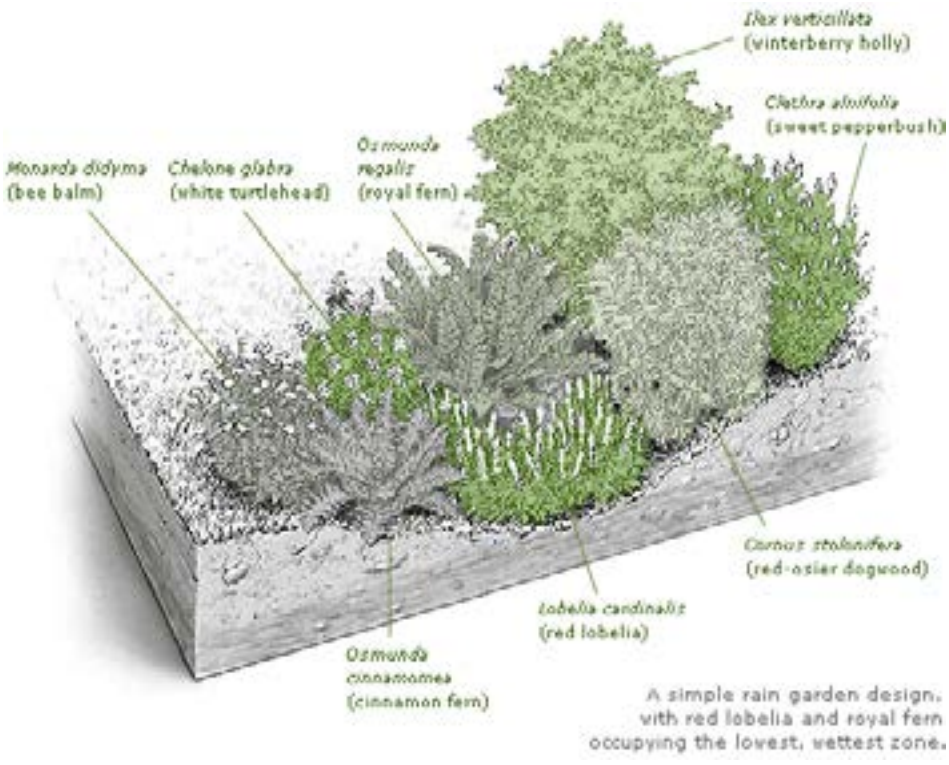


Figure 14: Raingarden. Source: Sleepy Creek Watershed Association

such as GIRMA to provide direction, staff, resources, and political influence through organized collaborative efforts.

Challenges and Concerns

1. A regulation requiring BMP maintenance and reporting might end up being another difficult to meet, unfunded mandate.

Benefits

1. Mechanism embedded in existing structure, ensuring longevity and reliability.

Figure 15. Powderhorn Park raingarden. Source: Gayla Ellis, flickr.com

Additional Financial Considerations

Public Versus Private Projects

Another consideration is how GIRMA might need to be adapted for any maintenance difference between BMPs installed primarily on public land versus those on private land or right-of-ways. Private BMPs requiring right-of-access may pose additional logistic challenges, but may also provide a considerable opportunity for hands-on landowner education, a topic discussed later in the *Public Education* section of this report (pg 33.) Private BMPs may require less maintenance if landowners are also involved.

Fundraising

Should a GIRMA funding mechanism be established, the alliance could consider allocating time or resources to fundraising activities to more rapidly increase the fund's principal balance. These efforts could be easily included with campaigns already underway by including information on GIRMA at already-planned events, in mailings, and in project planning discussions.

Shift of Cost Burden

Some cities assume responsibility of BMP maintenance from day one, others require this of the landowner from day one, and still others shift the cost burden of maintenance after the first year. If a BMP is going to fail, it is often apparent during the first year after installation. Shifting the cost burden allows plants to begin establishing themselves and for a full season of inspection and observation to determine if the BMP was designed and installed correctly. In a switch situation, the first-year cost burden is often the responsibility of the contractor who performed the installation, after which point it switches to the landowner or city.

Menu of Service Options:

It is Metro Blooms' assumption that a collaborative approach to funding BMP maintenance would produce the most benefits and cost efficiencies. Any regional approach however must take into consideration variability in what types of services different cities want or need, and how they would best be delivered. For this reason it seems important to consider a menu of service options that offer participating entities choices in how to use the funds. GIRMA can offer options for both disbursement of funds, as well as for actual maintenance activities performed. As an example of the first instance, one city may want to invest in the fund up front as a one-time deposit of a percentage of the construction costs, then draw from the fund returns annually to cover their own staff costs to maintain raingardens. Another city may want to use the funds to partially fund hiring a private contractor to do the work, while yet another city may want to draw on the funds and participate in a reduced-labor cost partnership program to provide maintenance.

Some options for how cities could use the fund disbursement:

1. Pay for city staff or seasonal interns to maintain BMPs.
2. Hire private contractors or otherwise outsource to maintain BMPs
3. Buy into a regional Partnership Labor Team program for reduced-cost maintenance labor with professional oversight. Potential partners include MCC, 3 Rivers Park District staff, or prison work programs.
4. Use funds to pay for landowner and community education, then the trained landowner or community volunteers perform maintenance duties.
5. Use funds to do major overhaul maintenance repairs on public BMP projects, to supplement the regular maintenance that the city is already doing.
6. Other approaches developed in conjunction with project partners.

Some options for what types of maintenance activities cities could choose to have done is

discussed later in the *GIRMA Maintenance Program* section (page 23).

Management and Allocation of Funds

Disbursed funds could be allocated using any of the 5 options presented earlier in the *Menu of Service Options* section (pg 21). It is also possible that it may not be best for a fund to grant directly to participants (cities, landowners, contractors, etc) because of legal issues and paperwork involved. It may be necessary instead to disperse funds directly to Metro Blooms or a GIRMA board, which then decides where to allocate funds.

Metro Blooms Board

If Metro Blooms proceeds with setting up an endowment or other funding mechanism using its own grant money, then the Metro Blooms board of directors or a board-appointed special committee is the most logical entity to manage and oversee the allocation of the funds' annual financial returns. Metro Blooms can instead ask the Minneapolis Foundation staff and board to decide allocations, but then Metro Blooms has no control over their decisions. Metro Blooms can arrange for disbursements from the fund at any time: annually, quarterly, or on a project-by-project basis. One aspect of this approach that should be explored is if it would be prudent to require that recipients work with Metro Blooms rather than other contractors.

GIRMA Board

If a GIRMA consortium initiates and contributes to an endowment or other funding mechanism, then for thorough oversight purposes, an advisory team or special committee made up of representatives of all GIRMA participants including municipalities, watershed districts and others could review and recommend spending of "grants" of investment returns. In this instance, a detailed process directive would have to be prepared indicating grant priorities, such as specific projects cities had in mind when first contributing to the fund, or a formula for allocating grants to participants based on the initial amount of investment contribution. It does not seem feasible to require that cities work with Metro Blooms if this alliance approach is used.

Funds housed at the Minneapolis Foundation, as well as most other brokerage accounts and investment mechanisms would allow disbursements at the discretion of the fund owner(s). Funds could be disbursed annually, quarterly, or on a project-by-project basis. If GIRMA wishes for funds to be available year-round, an annual disbursement may require that a "holding location" be established from which grants are made throughout the year. In this instance it may be best to utilize a project-by-project granting process. However, for ease of management, a more regular disbursement process that is annual or quarterly allows for efficiency of paperwork and other management duties.

RFP-Type Process

Regardless of the form of management, one option for allocation of grants would be to issue RFPs for maintenance activities, similar to the Clean Water Legacy process. Cities or watershed districts could apply for specific projects, providing the data needed for the board to make an informed decision on their case. In this way responsibility is shared between the city and granting organization. This delegation of responsibility is important if planning a centralized regional system, in order to streamline the process and share the work load. It is also important to establish standards for requesting, dispersing, managing, and granting funds for transparency.

Figure 16. Components of a Successful Maintenance Program

IV. GIRMA Maintenance Program

Thresholds of Service
Lifecycle and Performance Standards
Practices
Frequency and Responsibility
Costs

GIRMA Maintenance Program

As introduced in the *Menu of Services Options* section earlier (page 21), any collaborative approach to maintenance must take into consideration variability in the needs of different cities, locations, and BMPs. In order to offer and provide services in an efficient and comprehensive way however, some degree of maintenance protocol, procedures, and metrics should be considered and potentially agreed upon by all participants. In order to set up a funding mechanism for maintenance, one must first understand what maintenance is necessary, when it must be performed, and how much it can be expected to cost. This section presents information gathered in pursuit of this baseline.

Thresholds of Service

Based on our experience at Metro Blooms and additional research, it appears there are certain thresholds of maintenance needs. Presented below are a few approaches to delineating these thresholds and categorizing maintenance activities. Additional factors to consider in service provision include size of BMP and amount of water to be infiltrated, soils, expected lifespan, and locational aspects such as proximity to erosive material, and sun exposure.

Type and Complexity Matrix

The University of New Hampshire Stormwater Center divides BMP maintenance into 4 types: reactive, periodic, predictive, and proactive maintenance (Figure 1). This delineation separates activities by frequency as well as the amount of planning involved, balancing this against cost increases as both increase. Seen through this lens, most maintenance of properly installed BMPs falls in the periodic and predictive categories.

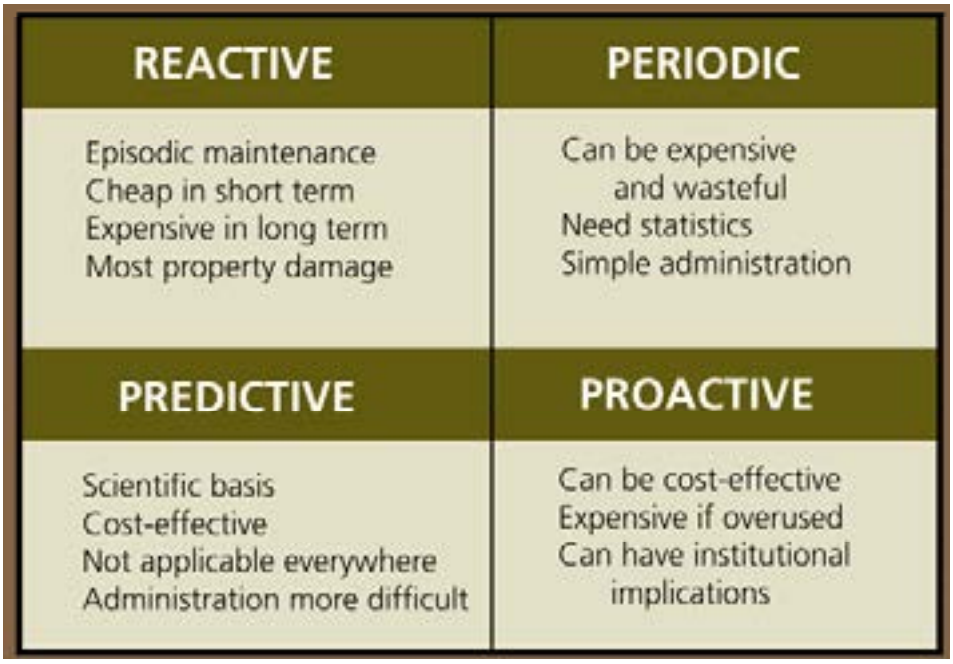


Figure 17. Source: Houle, et al., University of New Hampshire

The UNH also delineates the types activities undertaken for maintenance into 4 categories of complexity: minimal, simple, moderate, and complicated (Figure 2). Again, given properly installed BMPs, most maintenance activities could be expected to fall into the simple and moderate categories.

Given that reactive maintenance often requires complicated professional repairs, associated costs can be expected to be higher. By maintaining BMPs periodically and with a structured approach of simple to moderate activities, a maintenance program can expect to save money over an approach that ignores simple periodic activities and instead relies on reactive, complicated repairs (Figure 3)

Maintenance versus Repair

Mike Isensee of Dakota County SWCD makes a sharp distinction between two types of activities following installation of a BMP: maintenance and repair. The distinction is similar to the way in which a house is maintained. A house needs periodic upkeep such as painting and patching on a regular basis, but only needs repair if something goes badly wrong such as a tree falls on it in a storm. Likewise, BMPs need regular, simple maintenance, but only

Minimal	Simple
Stormwater Professional or Consultant is seldom needed	Stormwater Professional or Consultant is occasionally needed
Moderate	**Complicated**
Stormwater Professional or Consultant is needed half the time	Stormwater Professional or Consultant is always needed

Figure 18. Houle, et al., University of New Hampshire

need repair if something goes badly wrong. For BMPs, this usually means bad design, incorrect installation, or the influence of an unexpected factor such as a prolific source of sediment.

It is important to keep maintenance and repair distinct, because regular maintenance can be fairly accurately predicted and budgeted for in regards to frequency, labor needed, and costs. Repairs, however, are unpredictable and can vary widely in intensity and cost. Repair costs should be treated separately from regular maintenance costs, as they are often much higher and less regular. It may be best to reserve two separate sources of funding: one for maintenance that is smaller but regular and reliable; and a second for repair that is larger but only tapped on an an-needed basis, such as any contingency fund.

Separating funds into two groups will more accurately reflect the true cost of "maintenance" which is much lower and more manageable than it might otherwise seem. It will also help to identify the true source of problems in a BMP. If a raingarden is choked with maple saplings, a contractor could pull them as a "maintenance activity", but if this will become needlessly expensive if saplings will return the next year because the BMP is located under a maple tree, which is a larger repair issue that should be addressed first. Separating maintenance from repair issues and educating contractors in the distinction will narrow down the list of required activities to only what is required to maintain a robustly designed and functioning system.

Category of Maintenance	Type of Maintenance	complexity	price ($)
Reactive maintenance	Structural Repairs	complicated	135
	Partial Rehabilitation	complicated	135
	Rehabilitation	complicated	135
Periodic maintenance	Inspection	simple	95
	Mowing	minimal	75
	Vegetation Management	minimal	75
Predictive maintenance	Solids and Debris Removal	moderate	115
Proactive maintenance	Pavement Vacuuming	moderate	115
	Erosion control & bank stabi	simple	95

Figure 19. Source Houle, et al., University of New Hampshire

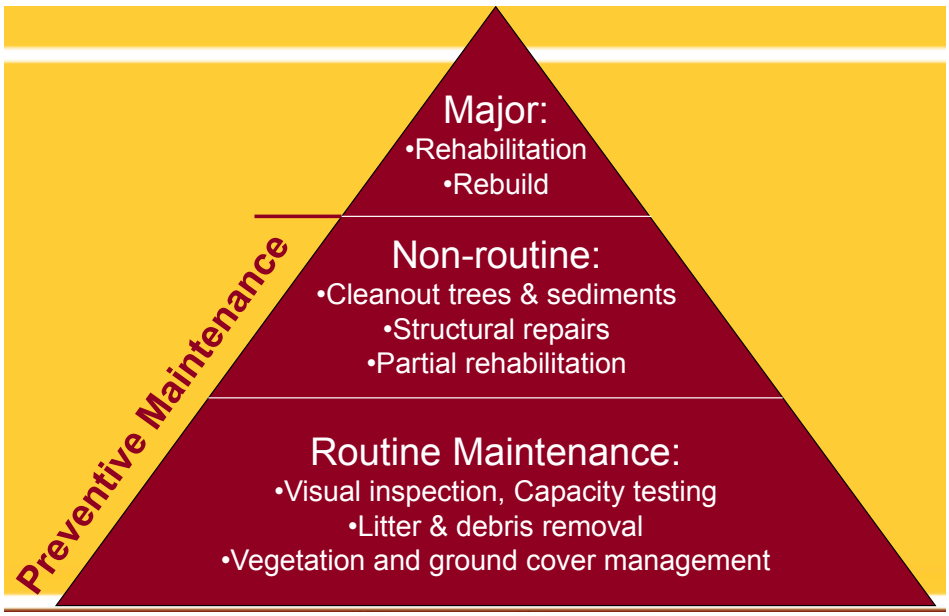


Figure 20. Source: Erickson,UofM Extension

Preventive Maintenance Pyramid

Andrew Erickson and fellow staff at the Saint Anthony Falls Laboratory (SAF) in Minneapolis have done extensive research on stormwater BMPs, including a survey of BMPs throughout Minnesota. They categorize maintenance into three types, of increasing intensity and decreasing frequency, represented by a pyramid. The most frequent forms of maintenance are routine and non-routine, and together they comprise "preventive maintenance", which is distinct from "major" maintenance and/or repair.

The Capitol Region Watershed District currently does inspections for 100 raingardens, and they also assign 3 levels for maintenance, though they are slightly different from those in the pyramid:

1. Needs weeding, watering, basic care
2. Needs consultation with owner
3. Needs serious maintenance

Pre-Maintenance Assessment

Researchers John Gulliver, Brook Asleson and their colleagues at Saint Anthony Falls Laboratory also developed a 4-level raingarden assessment methodology to assist with evaluation of performance. This

approach can be helpful when determining the level at which a raingarden is functioning in preparation for maintenance work. The four levels are visual inspection, capacity testing, synthetic runoff testing, and monitoring, with each requiring progressively more time to administer (Figure 5). Guidelines for visual inspection may prove the most useful for maintenance purposes.

	1. Visual Inspection	2. Capacity Testing	3. Synthetic Runoff Testing	4. Monitoring
Objectives	Determine if stormwater BMP is malfunctioning	Determine infiltration or sedimentation capacity and rates	Determine infiltration rates, capacity, and pollutant removal performance	Determine infiltration rates, capacity, and pollutant removal performance
Relative Effort	1	10	10-100	400
Typical Elapsed Time	1 day	1 week	1 week - 1 month	14+ months
Advantages	Quick, inexpensive	Less expensive, no equipment left in field	Controlled experiments, more accurate with fewer tests required for statistical significance as compared to monitoring, no equipment left in field	Most comprehensive, assesses stormwater BMP within watershed without modeling
Disadvantages	Limited knowledge gained	Limited to infiltration and sedimentation capacity/rates, uncertainties can be substantial	Cannot be used without sufficient water supply, limited scope	Uncertainty in results due to lack of control, equipment left in field

Figure 21. Source: Gulliver, Saint Anthony Falls Laboratory

Lifecycle and Performance Standards

Monitoring and reporting activities for MS4 requirements address a 15-year lifecycle, as do many TMDL plan requirements. Well-designed, installed, and maintained BMPs may ultimately have longer lifecycles, possibly 20 years or longer. It is important to establish an agreed-upon lifecycle as well as intervals at which to apply performance standards, such as 1, 3, 5, and 10 years.

The most maintenance-intensive period of a BMP occurs during the first year. Associated costs may likely be higher the first through third years. Once established, a functioning BMP may only need simple annual or seasonal maintenance, or possibly more complicated maintenance every 5 years.

A GIRMA advisory team may wish to establish agreed-upon performance metrics and standards, and a process for reporting, so that maintenance activities can be measured and adjusted to optimize performance.

Practices

For the purposes of this report, routine maintenance activities and practices are divided into four categories: structural, vegetative, support, and repair practices. The first three groups represent common and recommended activities for preventive, routine maintenance, while repairs are more complicated practices.

Structural

These practices address all non-vegetative aspects of BMPs and include:

- Sediment cleaning: vacuuming pumps, manhole covers, traps and inlets; sweeping streets and permeable pavers; and manual removal of sediment from basins.

Vegetative

These practices address the overall planting scheme and are especially important for bioinfiltration basins/raingardens and storm ponds. They include:

- Leaf and organics cleanout
- Renovations: replanting, dividing, mulching
- Weeding (spraying, hand-pulling)

Support

These practices occur concurrently or following installation and maintenance activities, and include:

- Inspection and reporting: check for structural and vegetative failures that require major repairs, collect information for MS4 and other requirements, monitor effectiveness of BMP
- Professional supervision and crew training

Repair

More extensive and complicated practices including repairs of:

- Erosion and slope slippage
- Poor design or placement of inlet structure resulting in ponding or sediment buildup
- Ponding due to miscalculation of soil type or infiltration capabilities
- Poor choice of plants for soil and sun exposure, resulting in chronic plant die-off, disease, or weed establishment.

Examples of specific, itemized maintenance costs for raingardens documented by Capitol Region Watershed District are included in the Appendix.

As mentioned in the *Menu of Service Options* section above (pg 21) , the GIRMA program can offer options for both disbursement of funds, as well as for actual maintenance activities performed. Cities could use the protocol and performance standard information generated by GIRMA to determine their own needs and select from

the range of maintenance practices those that would serve them best. For example, cities with existing BMPs might have repair needs that a city just undertaking a new installation project would not.

Frequency and Responsibility

The practices listed above occur at different times and with differing frequency. In addition, responsibility for performance of each activity can vary from one city to the next. Frequency and possible options for responsibility of activities are shown in the tables below (Figures 6 and 7). It can be reasonably expected that maintenance needs will be greatest the first year, with careful inspection the first 3 years for signs of problems.

Cities and watershed districts could arrange their maintenance schedules according to their own staffing resources, BMP needs, and desired configuration from the Menu of Service Options presented earlier (pg 21). The program could be customizable.

To solidify responsibility for maintenance, a contract can be signed by all parties outlining the scope of maintenance work to be performed, who will perform what activities, a timeline, fees, and contingency plans for unforeseen circumstances (such as a natural disaster causing complete failure of infrastructure, vandalism, periodic intensive maintenance or replacement work, owner's desire to remove or expand raingarden, etc.).

Challenges and Concerns

1. If land containing a BMP is sold, what strategies and mechanisms are available to ensure the new landowner abides by the previous agreement for responsibility of maintenance?
2. What happens if a landowner damages a BMP while trying to maintain it? Who is responsible for physical repairs and costs?

	Category	Maintenance Task	Metro Blooms/MCC	City/ Municipality	Landowner	Other Partners
Essential minimums	A	Clean Inlet, sediment traps	X	X		
	A	Check drainage ways for obstructions or repair needs (downspouts, underground pipes, grates)	X	X		
	C	Inspect berm or overflow device for frost heaving or winter damage	X	X	X	
	C	Check for signs of erosion, if necessary re-grade and replant with clump-forming grass and/or boulders	X	X	X	
	F	Water when dry, especially first 2 years (plants establishing root systems)			X	
	C	Check that all original plants still present, healthy, and performing, replant or move if necessary, check for pests and treat if needed	X		X	
	C	Maintain 3" mulch, reapply early spring	X		X	
Menu of Options	B	Remove & compost last year's growth	X		X	
	B	Remove trash and debris, excess leaves, organic matter	X		X	
	D	Pull cool weather weeds by Memorial Day (dandelions, thistle)	X		X	
	D	Pull warm weather weeds by 4th of July (crab grass, creeping charlie, foxtail) and volunteer trees (ash, elm, hackberry, boxelder, buckthorn)	X		X	
	E	After large rain events, check that garden drains within 24 hours			X	
	F	Avoid plowing or shoveling snow into rain garden, avoid compaction			X	
	B	remove weeds and excess leaves (more than 2") from drainage and garden areas.	X		X	
	C	trim shrubs and trees	X		X	
	C	add fall mulch to maintain 3" depth	X		X	
	C	divide large or overgrown perennials	X		X	
	E	Document garden with photos, apply for awards		X	X	

Figure 22. Gradient of maintenance tasks

Annual performance	Season				Party Responsible			
Maintenance Category	Spring	Summer	Fall	Winter	Metro Blooms/ MCC or contractor	City/ Municipality	Landowner	Other Partners (WDs, BWSR)
A. Structural: Sediment cleaning					X	X		
B. Vegetative: Leaf, organics and debris cleanout					X	X	X	
C. Vegetative: Renovations (replanting, dividing, mulching)					X	X	X	
D. Vegetative: Weeding					X		X	
E. Support: Inspection and reporting					X	X	X	X
F. Support: Professional supervision and crew training					X	X		X
G. Repair					X	X	X	X

Figure 23. Seasonal timeline of annual maintenance

Costs

15 Year Lifecycle Performance	Year																				Lifecycle Frequency
Maintenance Category	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Frequency
A. Structural: Sediment cleaning																					once a year
B. Vegetative: Leaf, organics and debris cleanout																					twice a year
C. Vegetative: Renovations (replanting, dividing, mulching)																					ongoing for minor repairs, every 3 years for major inspection
D. Vegetative: Weeding																					3 times a year
E. Support: Inspection and reporting																					ongoing for minor issues, twice a year major inspection
F. Support: Professional supervision and crew training																					ongoing
G. Repair																					as needed

Figure 24. Annual timeline of lifecycle maintenance.

Percentage of Installation

There are various approaches to estimating the total costs of maintenance for BMPs. Most often this is calculated as a percentage of the total installation cost.

Peter Weiss and colleagues a the University of MN Civil Engineering department conducted research in 2005 on maintenance costs of several types of BMPs, collecting data from published literature. Figure 8 shows national EPA estimates of operations and maintenance (O&M) costs, as well as the report researchers' own estimates from collected data. Bioretention units (raingarden) maintenance ranged from 0.7%-10.9% of total construction cost.

SMP	Summary of Typical AOM Costs (% of Construction Cost) (USEPA, 1999A)	Collected Cost Data: Estimated Annual O&M Costs (% of Construction Costs)
Retention Basins and Constructed Wetlands	3%-6%	--
Detention Basins	<1%	1.8%-2.7%
Constructed Wetlands	2%	4%-14.1%
Infiltration Trench	5%-20%	5.1%-126%
Infiltration Basin	1%-3% 5%-10%	2.8%-4.9%
Sand Filters	11%-13%	0.9%-9.5%
Swales	5%-7%	4.0%-178%
Bioretention	5%-7%	0.7%-10.9%
Filter Strips	$320/Acre (maintained)	--
Wet Basins	Not Reported	1.9%-10.2%

Figure 25. Estimation of maintenance costs as a percentage of construction costs. Source: Weiss et al, MNDOT

Fee-for-Service

CC of MN has devised a formula for fee-for service with three levels: a daily rate of $925 for a 5-person crew; costs for raingardens up to 1000 square feet, and costs for large gardens over 1000 square feet (Figure 9). CC of MNs costs may be low for contracted services because of their funding support from the Clean Water Legacy fund, however the structure is a useful one for simplifying cost estimations. Especially important is the consideration of project management.

	Gardens up to 1000 square feet	Large gardens over 1000 square feet
Weeding	$100	$100+ $75 for each additional 500 sq ft
Litter Removal	$50	$50+ $25 for each additional 500 sq ft
Plant Replacement	$100+ plant cost	$100+ plant cost+ $25 for each additional 500 sq ft
Mulching	$150+ mulch cost	$150+ mulch cost+ $75 for each additional 500 sq ft
Inlet Maintenance	$50	no additional charge
Project Management	$125-200	no additional charge

Figure 26. Maintenance tasks costs. Source: Minnesota Conservation Corps

Should a GIRMA program include work with youth or other non-professional crews, then professional oversight and project management would be an important consideration.

Performance-Based

Charges could be based upon the amount of phosphorus or other targeted pollutant such as sediment that is removed. This approach would require a thorough and reliable monitoring program.

Square Footage or Cost per BMP

It may be important to consider whether service providers should offer to maintain BMPs to the level of the design, or to the level of functionality. The latter may be more economical and realistic. If using this approach, it would be better to estimate maintenance costs based on square footage or by type of BMP, rather than per project.

Variables

Maintenance costs of BMPs should vary according to commonly used variables such as soil type and infiltration rate, and drainage area. Additional considerations could include: sediment load, sweeping practices, catchment canopy, catchment slopes, catchment soil erodibility, illicit discharges, pollutant hotspots, and spills, how many raingardens a city has total and of what size, and need for soil amendments. In addition, administration costs may vary from municipality to municipality. These factors should be considered in a cost/benefit analysis.

A more generalized estimation of practice costs gathered from baseline quantitative data costs region-wide is presented below (Figure 10). Examples of costs as estimated by Capitol Region Watershed District are included in *Appendix B: Example Maintenance Costs*.

Task Type	Maintenance Task Category	Cost Estimate Range
Structural	Sediment cleaning	$10-20/hour
	Leaf, organics and debris cleanout	$10-25/hour
Vegetative	Renovations (repairs, replanting, mulching)	$25-50/hour
	Weeding	$20-40/hour
Support	Inspection and reporting	$15-45/hour
	Professional supervision and crew training	$25-50/hour
Repair	Repair	varies

Figure 27. Estimated maintenance tasks.

Task	Frequency	Maintenance Notes
Pruning	1 - 2 times / year	Nutrients in runoff often cause vegetation to flourish
Mowing	2 - 12 times / year	Frequency depends upon location and desired aesthetic appeal
Mulching	1 - 2 times / year	Use shreaded hardwood mulch
Mulch removal	1 time / 2 - 3 years	Mulch accumulation reduces available water storage volume. Removal of mulch also increases surface infiltration rate of fill soil.
Watering	1 time / 2 - 3 days for first 1 - 2 months. Sporadically after establishment	If droughty, watering after the initial year may be required.
Fertilization	1 time initially	One time spot fertilization for "first year" vegetation
Remove and replace dead plants	1 time / year	Within the first year, 10 percent of plants may die. Survival rates increase with time.
Miscellaneous upkeep	12 times / year	Tasks include trash collection, spot weeding, and removing mulch from overflow device.

Figure 28. Maintenance frequency. NCSU, www.bae.ncsu.edu/topic/bioretention/design-maintenance.html

Questions, Challenges and Research Needed

1. Must a subwatershed soil infiltration analysis be done for each project to assess soils before calculating costs? What level and scale of soil assessment will be acceptable?
2. There is an expected failure rate of BMPs after installation (ex, 10%) that should be factored into the costs of maintenance.
3. Would maintenance fees be different for infrastructure not originally designed/ installed using a GIRMA grant?

V. Monitoring and Evaluation Requirements

MPCA and the Clean Water Legacy Act

TMDL and MS4

Watershed District and Local Requirements

Monitoring and Evaluation Requirements

In order to use raingardens and other BMPs for stormwater management, it is important to provide empirical evidence of their effectiveness, not only to impact public opinion, but also to verify their value and to meet data requirements for national, state, and local legislation and policy.

Often BMPs are evaluated based on performance - the amount and type of pollutant they are removing from stormwater as well as the amount of water infiltrated, stored, or redirected.

In addition, municipalities may have separate expectations for aesthetics or public education. A GIRMA maintenance program must consider and provide for data collection as part of its practices. One useful tool for assessment is the SAF four-part methodology mentioned in the *Thresholds of Service* section above (pg 24) that prescribes specific steps for visual inspection, capacity testing, synthetic runoff testing, and monitoring (Figure 11).

Metro Blooms' volunteer-based, garden evaluation program utilizes a base of trained volunteers (65 - 85 each year) to evaluate raingardens based on aesthetics and function. Factors considered include: Plant Variety and Health (includes perennials, natives, pollinators, trees, shrubs, seasonal interest, thriving); Design (composition, balance, creativty; Maintenance (weeded, appropriately deadheaded and mulched, tidy edges, no standing water). Each factor is ranked from 0 (none) to 4 (outstanding). Volunteers enter data through an online system and gardeners receive an award based on their score. Up to 2,000 Minneapolis gardens are evaluated and recognized each year. This 30 year old program offers a sustainable evaluation option for veryifying and promoting raingarden maintenance.

MPCA and the Clean Water Legacy Act

In 2006 the Minnesota Legislature passed the Clean Water Legacy (CWL) Act, a plan to restore and protect water quality in state lakes, streams, and wetlands. It supports activities to assess, plan for, restore or create, and monitor clean water, including TMDL studies. The implementation of the

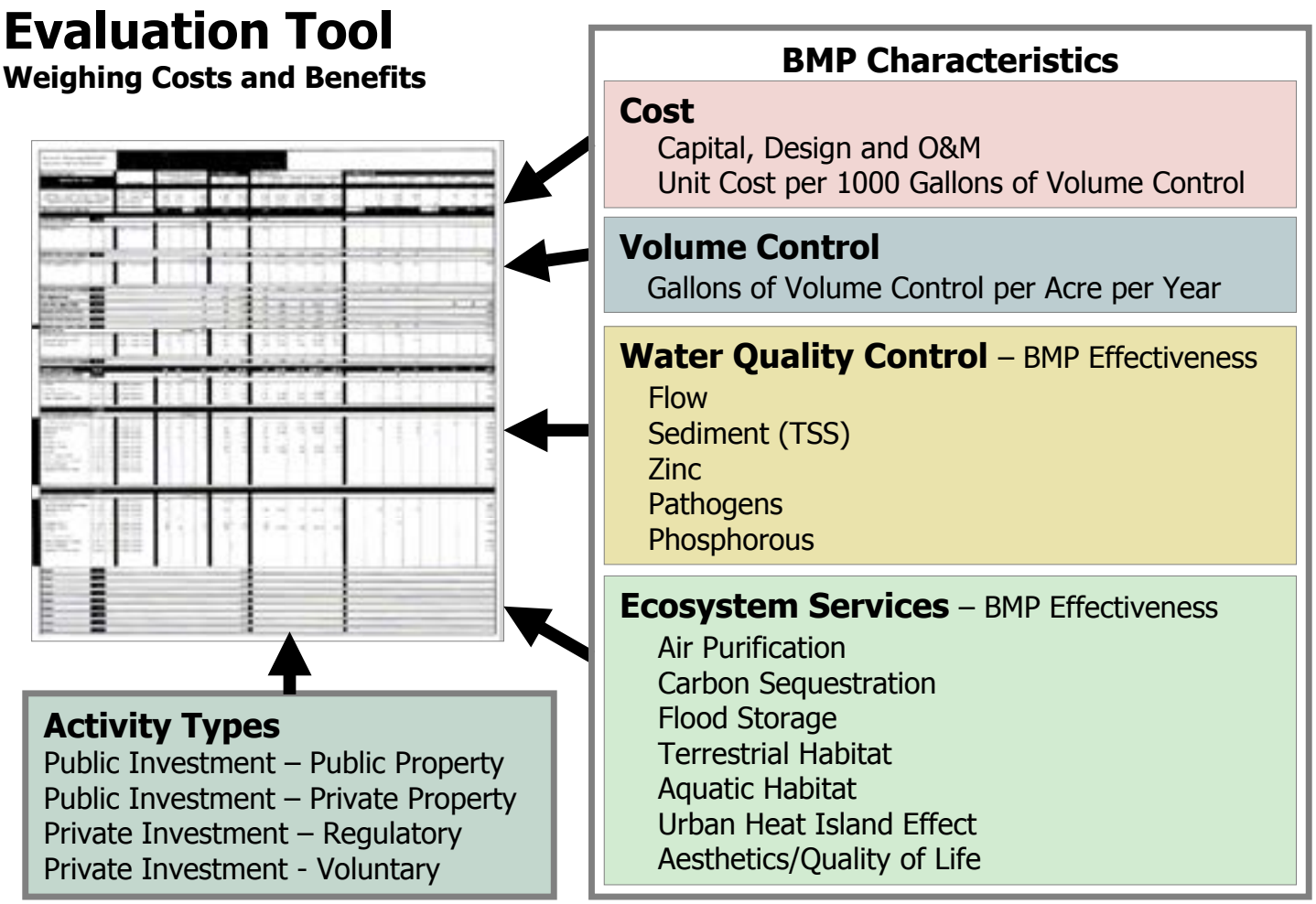


Figure 29. Example evaluation tool. Source: Environmental Services, City of Portland. Marketplace Feasibility Study



Figures 30-32: Raingarden plants. Source: Google Images

Act is the responsibility of the Minnesota Pollution Control Agency. The purpose of the act is to:

"protect, restore, and preserve the quality of Minnesota's surface waters by providing authority, direction, and resources to achieve and maintain water quality standards for surface waters as required by section 303(d) of the federal Clean Water Act, United States Code, title 33, section 1313(d), and applicable federal regulations."
- Source: MN Statutes 2007 -114D, Clean Water Legacy Act. www.revisor.leg.state.mn.us

BMP-specific documentation required of Clean Water Legacy Grant recipients includes providing information on BMP type, lifecyle/lifespan, size, and date of installation, indicators of performance, type and amount of pollutant removed.

TMDL and MS4

Cities and other municipal entities are required to develop Total Maximum Daily Load (TMDL) studies and/ or implementation plans for impaired waters, and to meet Municipal Separate Storm Sewer Systems (MS4) permitting requirements through Storm Water Pollution Prevention Programs (SWPPP). Any maintenance efforts conducted on BMPs could be coordinated with inspection, monitoring, reporting, and education efforts intended to meet these requirements. This simultaneous, coordinated effort could result in cost-and labor-saving efficiencies of scale.

"Total Maximum Daily Loads are the federally mandated tool for addressing 303(d) impairments and restoring polluted waters to water-quality standards. The TMDL process sets the maximum overall amount (load) of specific pollutants that can be present in a lake or stream, and allocates needed reductions among all the sources causing an impairment. MPCA is the lead agency" (Governor Pawlenty's Clean Water Initiative, 2006).

The National Pollution Discharge Elimination Service (NPDES) regulates discharge into water bodies. Permitting authority is managed through the MPCA and consists of three types of permits: construction, industrial, and MS4.

"MS4s are required to develop and implement a stormwater pollution prevention program (SWPPP) to reduce the discharge of pollutants from their storm sewer system to the maximum extent practicable. The SWPPP must cover six minimum control measures. The MS4 must identify best management practices (BMPs) and measurable goals associated with each minimum control measure. An annual report on the implementation of the SWPPP must be submitted each year." (MPCA MS4 Permit Requirements, www.pca.state.mn.us)

Watershed District and Local Requirements

Watershed Districts and other Local Government Units (LGUs) may have additional permit requirements for stormwater practices in their areas. For example, Minnehaha Creek Watershed District has rules for managing erosion, protecting wetlands, dredging, controlling phosphorus levels and controlling stormwater volume and rate. Data collection, tracking and reporting is required to assure compliance with rules. The City of Portland, Oregon collects such information in a single spreadsheet (Figure 12).

<u>Challenges and Concerns</u>

1. Who is most qualified, cost effective, and reliable to conduct monitoring and evaluation requirements? Can robust and reliable data be collected by landowners, volunteers, and contractors, or must municipal staff always be involved? What training would be required?
2. If landowners will perform evaluation and reporting, how can quality controls and enforcement be assured?
3. What national standards apply, such as through EPA?

VI. Public Education and Engagement

Public Education and Engagement

35: Public participation workshop. Source: Seattle.gov

With the GIRMA program there may be an opportunity to expand public education and paricipation: 1) outreach and dissemination of general information on BMP function and value; and 2) engagement and skills training activities for volunteer and landowner maintenance and monitoring to standardized expectations. Whether or not the second type is necessary depends on choices each municipality makes from the menu of service options.

Public education and engagement efforts are often labor- and time-intensive and can put a strain on offices with limited staff. Several city staff interviewed for this research project expressed interest in hiring or working with another entity, such as through a GIRMA program, to manage their public education and participation campaigns of both types.

Incorporating a public education and engagement element into the GIRMA program helps ensure the long-term success of BMPs, relieves stress on city staff time, and opens additional funding sources from foundations and nonprofits.

Outreach

Several cities, watershed districts, and soil and water conservation districts already maintain robust and successful public education campaigns. Should GIRMA choose to establish a shared maintenance and evaluation curriculum for this purpose, one of these already successful programs could serve as a model.

Volunteer-Based Evaluation and Recognition

Metro Blooms' volunteer-based, garden evaluation program utilizes a base of trained volunteers (65 - 85 each year) to evaluate raingardens based on aesthetics and function. Factors considered include:

1. Plant Variety and Health (includes perennials, natives, pollinators, trees, shrubs, seasonal interest, thriving),
2. Design and Use of Color (composition, balance, creativty, visual impact),
3. Maintenance (weeded, appropriately deadheaded and mulched, tidy edges, no standing water).
4. Each factor is ranked from 0 (none) to 4 (outstanding). Volunteers enter data through an online system. Gardeners are presented an award based on their score. Up to 2,000 Minneapolis gardens are evaluated each year.

Several cities have existing volunteer-based garden evaluation and recognition programs. These and Metro Blooms' 30 year old program offers a sustainable evaluation opton for verifying and promoting raingarden maintenance.

LandownerSkills Training

If landowners are to be involved in maintenance and monitoring, some training options include:

1. for plants, the monitoring of moisture, sun/shade exposure, use of appropriate perennials and natives, replanting,
2. other general maintenance, such as watering, mulch replacement,
3. sediment, litter, and debris removal,
4. documentation and reporting of suspected major repair issues

In addition, training of youth crews or contractors would require an agreed upon specifications or curriculum to ensure maintenance is performed correctly and consistently. This standardization is particularly important for determining associated costs. The use of youth crews could support additional public service policy goals by providing job training and skills in conservation, horticulture, landscaping, and urban development.

Concurrent Activities

Benefits of the GIRMA program not only include efficiencies of scale – using one crew to maintain several BMPs regionally, but also the efficiencies of concurrent activities – using maintenance crews to also deliver public education and training while already on-site for maintenance activities, and promoting and standardizing volunteer based evaluation and recognition programs, In this way, GIRMA becomes a "one-stop shop" for BMP needs.

VII. Potential Future Scenarios

Scenario 1: Invested Funds
Scenario 2: Formula
Scenario 3: Appropriation

Potential Future Scenarios

Based upon information gathered through interviews for case studies, several future scenarios can be envisioned for GIRMA. They differ primarily in how the initial principal is established and grown.

Scenario 1: Invested Funds
Under this project-based scenario, landowners arrange to have a GIRMA maintenance contractor design and/or install green infrastructure on their property, then landowners contribute 1-5% of the total project cost up front to the fund principal, and watershed districts/management organizations, cities, and/or counties would also contribute 1-5% of project costs to the fund. Metro Blooms establishes the fund with a 10K grant.

Planning for an average 4% return on investment, only around $400 could be collected annually from the entire GIRMA fund in the early stages if only Metro Blooms' $10K grant plus 1-4% of project costs are invested up front. If an average maintenance project costs $500, and the estimated number of projects annually is 20, it will be necessary to fundraise $250,000 for a base fund principal tin order to provide the desired $10,000 in annual grants.

Assuming a $250,000 base fund is established, returns can be granted quarterly, annually, or on a project-by-project basis and entrusted to Metro Blooms' advisory team, GIRMA advisory team, or similar decision-making body. The advisory team reviews projects, confirms participation in the fund, and awards maintenance grants. Taxes on the grants will be paid by recipients.

Grants can be awarded in a number of ways. If given directly to contractors, they could partly or completely fund maintenance activities directly. For example, if grants covered 75% of the cost of maintenance, then landowners or cities would only have to pay a reduced cost of 25% of the total. This allows the fund to be stretched farther than if all maintenance practices were funded 100%, and also requires commitment from landowners.

This is also the point at which a partnership with a reduced-cost labor group could be established, such as a youth organization or MCC, further stretching maintenance dollars distributed from the fund. A contract is signed by all parties outlining scope of maintenance work to be performed, timeline, fees, and contingency plans for unforeseen circumstances (such as low fund performance/grant availability, natural disaster causing complete failure of infrastructure, vandalism, periodic intensive maintenance or replacement work, owner's desire to remove or expand raingarden, etc.).

If grants are instead given directly to cities or LGUs, these entities could decide how to utilize the funds, choosing from a menu of service options, partnerships, and cost-sharing arrangements. Cities could use funds to pay for contractors, city staff, or training for landowners to perform maintenance.

Figures 36-39. Stormwater BMPs. Sources: Ecopondsolutions, King County WA, Delaware DOT, CRWD.

Scenario 2: Formula
This scenario would be similar to the invested funds scenario above, except contributions from watershed districts and LGUs would be based on an annual formula, not on a project-by-project basis. LGUs could use permit fees, assessments, stormwater fees, or other means to collect funds for their contribution. The consistency of contributions to the fund ensures that cities receive an annual return they can use for maintenance, reporting, and/or education activities.

Scenario 3: Appropriation
This scenario would be similar to the invested funds scenario above, except contributions to principal would come annually from legislative appropriation, special fees, or assessments. Cities could choose to leverage these fees independently or in addition to a GIRMA program, or efforts could be focused on the Capitol for a state-wide funding approach.

VIII. Closing






Figures 40-45: Examples of successful raingarden installations. Source: Google Images

Closing

Stormwater green infrastructure best management practices require regular, professional maintenance to ensure functionality and appearance. To meet TMDL and MS4 requirements, they are being installed by cities, counties, and watershed districts in increasing numbers. Funding for professional maintenance and public education needs to keep pace, but local government units do not have the funds necessary to achieve this on their own. The goal of the Green Infrastructure Regional Maintenance Alliance (GIRMA) program is to provide a joint financial mechanism that can support ongoing stormwater BMP maintenance, while building a partner alliance to coordinate processes, practices, and performance standards for maximum efficiencies of scale. Several approaches are explored in this report, which helps to reveal paths of future research and consideration.

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IX. Appendices

A. List of Potential Partners
B. Example Maintenance Costs
C. Interviewee Contact Information
D. References

A. List of Potential Partners

Local Government Agencies and Units:
Metro region cities
Metro region counties
Metro region watershed districts and WMOs
Soil and Water Conservation Districts

State Agencies:
MN Board of Water and Soil Resources (BWSR)
MN Conservation Corps (MCC)
MN Pollution Control Agency (MPCA)
MN Department of Natural Resources (MNDNR)
MN Department of Transportation (MNDOT)

Academic Organizations:
Saint Anthony Falls Laboratory
University of Minnesota Stormwater U via Extension Services
University of Minnesota Department of Civil Engineering

Financial Institutions:
Minneapolis Foundation
Robert Shepard at Capital Management
Rotary Club (for fundraising on water issues)

Service Contractors including Metro Blooms

Nonprofit Organizations including Metro Blooms

B. Example Maintenance Costs

2007 Itemized Arlington-McKinley Rain Garden Operation and Maintenance Costs.

Item	Number of Staff	Rate	Hours	Total Hours	Cost
Inspection	1	$21.00	0.3	0.3	$5
Inspection	2	$21.00	0.5	1.0	$21
Inspection, weeded, removed sod from inlet	2	$17.00	1.0	2.0	$34
Installed inlet trap	1	$21.00	0.3	0.3	$5
Surveyed	3	$15.67	4.0	12.0	$188
Inspection with consultants	3	$27.00	1.0	3.0	$81
Weeded	2	$21.00	1.5	3.0	$63
New plantings	7	$21.29	1.0	7.0	$149
Watered new plants	2	$17.00	1.0	2.0	$34
Watered	2	$13.00	1.0	2.0	$26
Inspection	2	$21.00	0.3	0.5	$11
Weeded	1	$21.00	4.0	4.0	$84
Inspection,cleaned inlet, picked up trash, added river rock to inlets	1	$21.00	1.5	1.5	$32
Installed temporary fencing	3	$15.67	1.0	3.0	$47
Inspection, cleaned inlet	2	$21.00	0.3	0.5	$11
Cleaned inlet	2	$21.00	0.3	0.5	$11
Removed temporary fencing, weeded, mowed, clipped grasses, inspection, added river rock to inlet	3	$15.67	2.0	6.0	$94
Cleaned inlet, picked up trash	1	$21.00	0.5	0.5	$11
Cleaned inlet	2	$13.00	0.5	1.0	$13
Cleaned inlet	2	$13.00	0.5	1.0	$13
Inspection	2	$13.00	0.3	0.5	$7
Cleaned inlet	1	$21.00	0.5	0.5	$11
Crest gauge survey	2	$17.00	0.3	0.5	$9
Inspection, raked out leaves	1	$21.00	8.0	8.0	$168
Raked out leaves, clipped grasses, removed crest gauge	4	$25.50	2.5	10.0	$255
				Total:	70.5	$1,380
aterials						
Tools and Supplies						$2
Tools and Supplies						$6
Tools and Supplies						$7
Tools and Supplies						$7
Tools and Supplies						$4
Tools and Supplies						$39
Tools and Supplies						$14
Tools and Supplies						$5
Tools and Supplies						$9
Tools and Supplies						$19
Tools and Supplies						$22
Tools and Supplies						$4
Plants						$21
Hydrant Meter						$78
Polypropylene Rope						$54
Tools and Supplies						$3
					Total:	$293
Watering Services-City of Saint Paul						$67
					Total:	$62
				Grand Total:	70.5	$1,735

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-9. 2008 Itemized Arlington-McKinley Rain Garden Operation and Maintenance Costs.

Item	Number of Staff	Rate	Hours	Total Hours	Cost
Inspection	1	$21.00	0.1	0.1	$1
Debris Removal, Leaf Removal, Weeding, Cleaned Inlet	3	$15.67	0.9	2.6	$41
Inspection	2	$17.00	0.2	0.3	$5
Debris Removal, Mowing	3	$15.67	0.1	0.4	$6
Debris Removal From Inlet	3	$15.67	0.0	0.1	$1
Debris Removal, Inspection, Weeding	3	$15.67	0.1	0.4	$6
Debris Removal, Inspection, Weeding	3	$15.67	0.1	0.4	$6
Mowing, Cleaned Inlet	2	$15.67	0.2	0.3	$5
Inspection	1	$13.00	0.3	0.3	$4
Watering, Weeding, Installed plants	9	$25.22	0.5	4.3	$109
Mulching	6	$22.83	0.2	1.0	$23
Watering	2	$25.50	0.1	0.2	$6
Watering	2	$17.00	0.3	0.5	$9
Watering	2	$13.00	0.4	0.8	$11
Watering	3	$15.67	0.3	1.0	$15
Watering	1	$13.00	0.4	0.4	$5
Debris Removal	1	$13.00	0.0	0.0	$0
Weeding, Thinned Plants	2	$17.00	0.4	0.8	$14
Thinning Plants, Weeding	2	$17.00	1.0	1.9	$33
Debris Removal, Inspection, Thinning Plants, Weeding, Installed temporary fencing	4	$15.00	0.5	1.8	$27
Inspection, Cleaned Inlet	1	$13.00	0.2	0.2	$3
Removed temporary fencing	2	$13.00	0.1	0.2	$3
Debris Removal	1	$21.00	0.1	0.1	$1
Inspection, Thinning Plants, Weeding	3	$13.00	0.6	1.7	$21
Surveying	2	$17.00	0.2	0.3	$5
Inspection, Cleaned Inlet	2	$30.00	0.1	0.2	$6
Inspection	1	$13.00	0.1	0.1	$1
Cutting back plants, debris removal, cleaned inlet, leaf removal	2	$30.00	1.5	3.0	$90
Inspection	1	$21.00	0.1	0.1	$3
			CRWD Labor Total:	**23.6**	**$462**
			Volunteer Labor Total:	17.3	$0
d Materials					
Tools and Supplies					$1
Tools and Supplies					$1
Tools and Supplies					$6
Tools and Supplies					$6
Tools and Supplies					$2
Tools and Supplies					$4
Tools and Supplies					$1
Tools and Supplies					$8
Plants					$81
Plants					$14
Plants					$4
Hardwood Bark Mulch					$12
Tools and Supplies					$5
Plants					$10
Hardwood Bark Mulch					$5
Hose Reel					$20
Compost Bags					$2
Compost Bags					$2
Hardwood Bark Mulch					$5
				Total:	**$186**
ices					
				Total:	**$0**
			Grand Total:	**41.0**	**$649**

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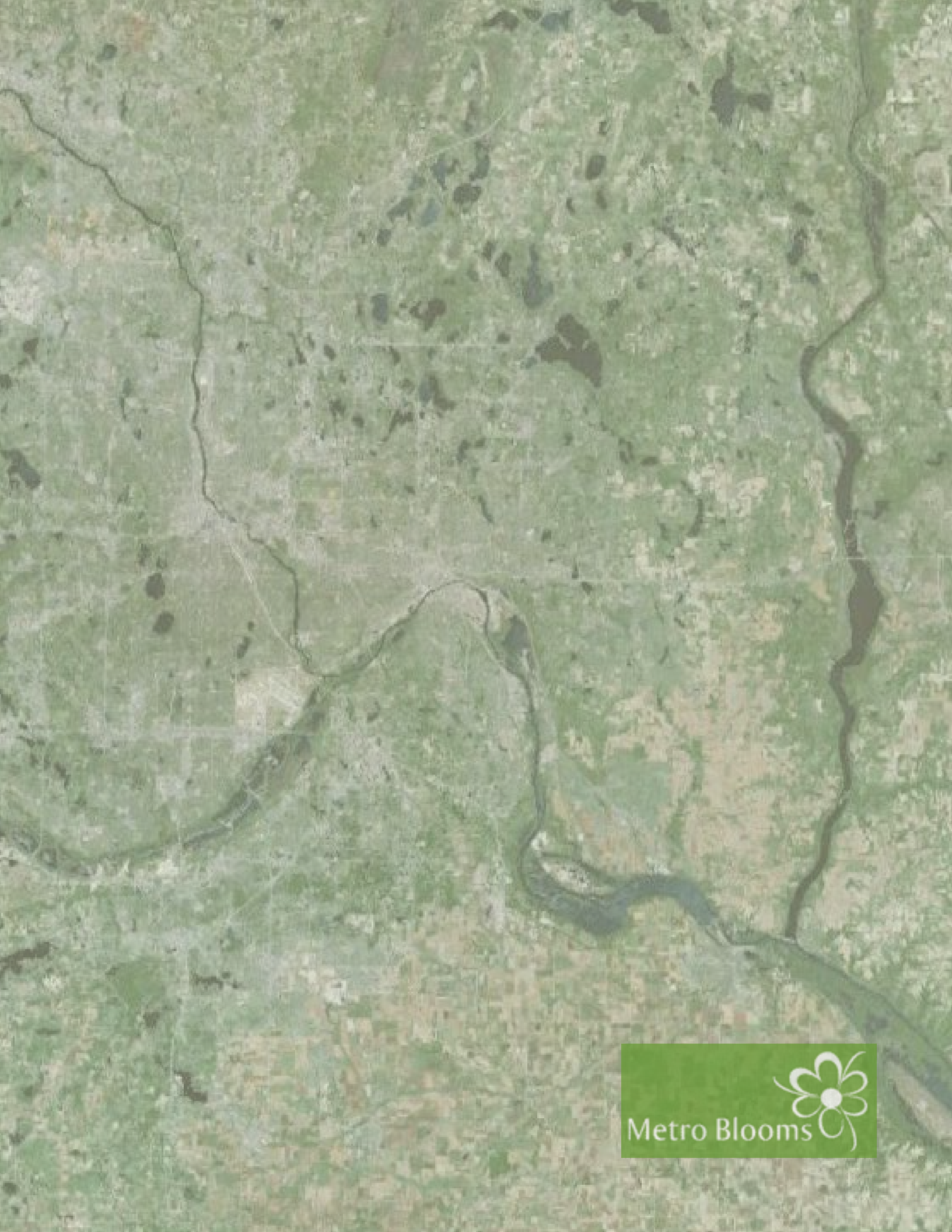
Metro Blooms