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Saving the Rain

Green Stormwater Solutions for Congregations

U.S. Environmental Protection Agency, Office of Water

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Purpose of this Guide

This guide was created to help congregations work through the process of enhancing their grounds by implementing green stormwater management practices.

A key tenet of many congregations is reverence and respect for nature. This guide was written to help readers identify actions they can take to care for the environment—starting with their own congregation's grounds.

Potential actions include those that can help improve air and water quality, provide habitat for wildlife, improve the aesthetics of the surrounding area, offer a peaceful outdoor sanctuary and make the community more sustainable.

INTRODUCTION

Hard surfaces such as building roofs, parking lots, sidewalks and roads—also called *impervious areas*—prevent rainfall from soaking naturally into the ground. Urban hardscapes can result in large amounts of stormwater (also known as *runoff*) entering streams, lakes, rivers, wetlands or oceans through storm drain systems. Stormwater can become polluted by contaminants on parking lots, pesticides and fertilizers on lawns, and soil eroded from bare ground.

This guide provides information to leaders and members of congregations who are interested in making their places of worship more ecologically resilient and protective of water resources as part of their faith practice.

Green stormwater management practices—also known as *green stormwater infrastructure* (GSI) or *low impact development* (LID)—mimic natural systems and can be used to absorb and treat stormwater close to where the rain falls. This approach reduces impacts to lakes, streams and estuaries. Filtering water through soil and vegetation helps clean it and reduces the amount of water and associated pollutants that flow untreated into storm drain systems and local waterways. Green stormwater management practices are designed to protect and restore the landscape so developed areas have less of an impact on local and regional water resources.

Best practices for controlling stormwater can be integrated into existing features of the built environment (e.g., buildings, streets, parking lots and landscaped areas). These practices may look like a garden, a green roof, permeable pavement or trees. They are appropriate for most settings, from urban centers and suburbs to rural areas. Using GSI can provide many benefits to the congregation, your place of worship and the larger community:

- Fulfilling the congregation's desire to care for the land, sustain life and conserve resources
- Beautifying grounds to provide a peaceful place to reflect, meditate and connect
- Enhancing wildlife habitat, including habitat for butterflies and other pollinators, birds, frogs, turtles and small mammals
- Improving water quality, reducing flooding in local streams and decreasing the risk of property loss
- Providing cooling shade on otherwise hot parking lots
- Reducing costs associated with irrigation and other inputs (USEPA's WaterSense Program offers many tips for reducing water use)
- Teaching the congregation how to share these ideas beyond the place of worship

Water will infiltrate through permeable pavers installed in parking spaces.

Benefits of Green Stormwater Infrastructure

Environmental Protection

Wildlife
Vegetated GSI can provide habitat for wildlife, particularly birds and insects. Even on small scales of implementation, GSI can help to relink a fragmented ecosystem.

Air Quality
Trees and other vegetation improve air quality by trapping airborne particulates and absorbing air pollutants such as greenhouse gases and other gases that are precursors to smog. Replacing turfgrass areas with GSI reduces the need for mowing, which reduces emissions from lawn mowers.

Water Quality and Flooding
GSI can decrease the frequency and severity of local flooding by reducing the volume and velocity of stormwater runoff moving across the land.

Public Education
The visible nature of GSI offers enhanced public education opportunities to teach congregation members, neighbors and others about improving the environment and how it relates to their faith-based worldview. Signs can explain and illustrate the function of the green stormwater features.

Quality of Life

Public Health
Vegetation buffers sound, which reduces noise pollution. It also can improve the community's connection with nature, reduce perceived walking distances and help encourage people to spend more time outdoors, all of which can improve their health and well-being.

Public Safety
GSI such as curb bump-outs at pedestrian crossings, vegetated medians and traffic islands improve safety by slowing traffic and decreasing the distance that pedestrians must travel in a traffic lane.

Recreation
Vegetated public rights-of-way offer opportunities for citizens to engage in outdoor activities such as gardening, walking, and observing pollinators and other wildlife. Porous pavement surfaces can support sport recreation.

Aesthetics
GSI that includes attractive vegetation can improve property aesthetics, which can translate into increased property values and potential additional investments.

Climate Resiliency

Urban Heat Island Impacts
GSI practices that include trees and other vegetation can reduce the threat of excessive heat exposure impacts by absorbing solar radiation, providing shade and reducing ambient temperatures.

Energy Use
Trees, hedges and green roofs provide shade, which reduces energy use (and costs) associated with cooling and can decrease the incidence and severity of heat-related illnesses.

Greenhouse Gases
GSI's ability to trap carbon in vegetation and soil can help meet greenhouse gas emission reduction goals.

Water Conservation
GSI that incorporates locally adapted or native plants reduces the need for irrigation, which reduces demand for potable and recycled water. Rain barrels and cisterns that capture rainwater can reduce use of potable and recycled water. Reducing water consumption also helps to decrease water treatment costs and associated energy use.

Stormwater Features for Greening Your Grounds

Many types of green stormwater management features can be used alone or in combination to absorb runoff from congregational sites. Rain gardens, conservation landscaping, and swales and bioretention areas (vegetated low areas) are common natural solutions. These practices are designed to capture stormwater, filter it through vegetation and soils, and infiltrate it into the ground. Vegetated stormwater management practices that include green roofs also can be beneficial to wildlife when planted with native and locally adapted plants. Other practices such as disconnecting downspouts, using permeable pavement and harvesting water can work in conjunction with these other tools to capture and filter or temporarily store rainwater on-site to help protect stream channels from erosion and to reduce localized flooding. Conservation landscapes are also beneficial because they generally require less water, fertilizer and pesticides than traditional landscapes do. They are designed to reduce power equipment use and associated fuel and energy consumption.

Rain Gardens

Rain gardens are shallow depressions planted with vegetation that allow stormwater to collect and soak directly into the soil. The gardens can be planted with ornamental plants, wildflowers and native plants that are adapted to both wet and dry conditions. Rain gardens are designed to be well-drained and might collect water on the surface only temporarily during storms. They are designed to safely overflow if large storms exceed their capacity to infiltrate in the short term.

Rain gardens can vary in size depending on the amount of built or paved area that drains to them. Because these areas are planted with vegetation, they improve wildlife habitat in comparison to a mowed grass area that provides little or no value to wildlife. Including a diverse array of plants in a rain garden provides a food source for butterflies and other pollinators and birds and other wildlife.

Conservation Landscaping

Conservation landscaping replaces grass with native vegetation. It captures rainwater more effectively than a traditional lawn does because of increased infiltration from deeper-rooted plants and rainfall interception. Conservation landscaping can absorb runoff from small impervious areas such as walkways and blends in easily with existing landscaping. Conservation landscaping is a useful tool to deploy when soils are highly compacted and do not infiltrate well. Conservation landscaping benefits the environment by improving water quality, preserving native plant species and providing wildlife habitat. Mowing, irrigating and fertilizing also can be reduced by using conservation landscaping.

Bioretention Areas

Bioretention areas are similar to rain gardens but are more engineered and drain larger areas of impervious surface such as parking lots and roadways. Bioretention areas usually have a pretreatment area near the inlet to settle trash and pollutants, an outlet that controls overflow drainage, and a soil medium engineered for water storage and optimal plant growth. Some bioretention areas have a perforated pipe installed underneath the soil if water cannot easily percolate into the ground because of the local geology; the pipe drains to a safe place such as a lawn or stormwater inlet.

Downspout Disconnection

Instead of discharging onto pavement or into piped systems, roof gutter downspouts can be directed to flow onto grass or landscaped areas where the water can soak into the ground and be filtered. Disconnecting downspouts reduces the volume of water that urban drainage systems need to handle, which helps protect local waterways from erosion and pollution. This is one of the cheapest and most-effective practices.

Water Harvesting

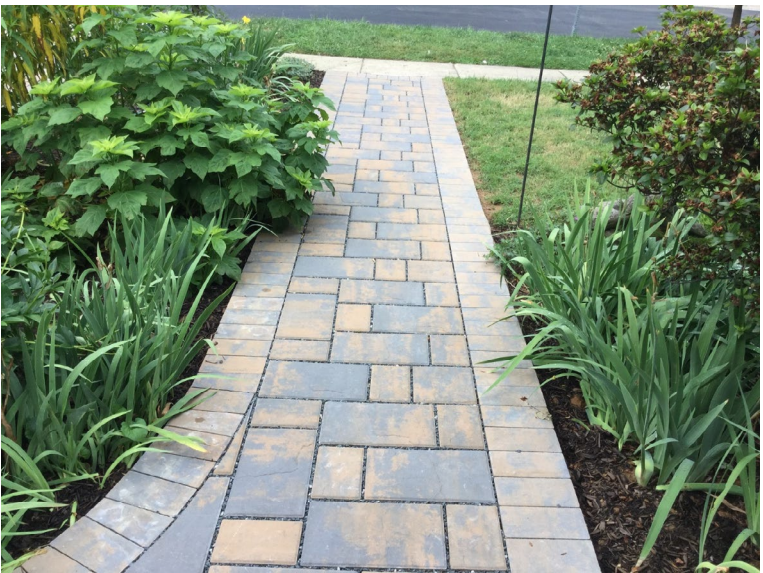
Rain barrels and cisterns capture rainwater from gutter downspouts and store it temporarily for uses such as irrigation before releasing it slowly. Mosquito management becomes important the longer you store the water. Rain barrels are typically used on smaller structures (sheds and houses) and are usually the size of 55-gallon drums, but they may store up to 200 gallons. Rain barrels should be made from food-grade materials. Cisterns can be much larger (10,000 gallons or more) and are more suitable for larger structures like office buildings. In both cases, the storage vessel needs to be designed to direct overflows either back into the downspout or out into the landscape where it will not cause foundation problems or safety issues.

Stormwater in Dry Climates

You do not need a lot of rain for stormwater features to be beneficial. In fact, features like rain barrels and cisterns that capture rainwater for later use can offset some of the costs associated with landscape irrigation and potable water use in arid and semi-arid areas. Conservation planting can include native or locally adapted plants that are drought-tolerant and can also handle short periods of wet conditions. See page 16 for more information about selecting appropriate plants.

Green Roofs

Green roofs are alternative roof surfaces that absorb and retain water, releasing it through evaporation and plant uptake. Green roofs are typically installed over an existing roof surface and consist of a waterproofing layer, soil or other lightweight planting medium, and vegetation. Care must be taken to ensure that the structural support for the roof is designed to withstand the weight of a green roof. New and existing roofs might be suitable for green roofs depending on the roof design and load-bearing capacity. In addition to capturing and retaining stormwater, green roofs also provide additional benefits such as reducing energy use for heating/cooling and providing wildlife habitat.



Permeable Pavement

Permeable pavements allow rainwater to soak through them and into the ground, while still supporting foot or vehicle traffic on the surface. They can be constructed of pervious concrete, porous asphalt or concrete pavers. These materials can be used for parking lots, parking pads, fire lanes, sidewalks and paths, basketball courts and other hardscapes. Permeable pavement is an excellent option for locations with limited planting opportunities. They can be combined with rain gardens and bioretention areas to absorb more water and provide wildlife habitat. They can be used in combination with traditional pavements, too. For example, parking stalls can be converted to permeable pavement while traditional pavement is used for driving lanes.

Site Greening Process

Now that you have seen some examples of ways you can manage stormwater on your congregation's property, let's look at the process of recruiting help and planning a project to make your site greener.

The next section of this guide, **Step 1. Get Started on Your Project**, describes how to find people who can give your project momentum and begin organizing your congregation's resources. It also outlines some initial tasks that will help stakeholders make some early decisions about the scope and budget of the project.

The **Step 2. Plan, Design and Build the Project** section provides a step-by-step resource for taking a critical look at your property and identifying areas that can be used for stormwater features. It also provides guidelines for sizing, layout, design, planting and maintenance of individual features. Finally, the section walks you through the steps for installing your project—either by volunteers or contracted professionals.

The **Step 3. Ensure Long-Term Success** section of the guide explains ways to ensure your project will be successful over the long term. Most stormwater features are low-maintenance, not no-maintenance. Developing a plan and providing a little care for your stormwater features regularly can mean the difference between functional beauty and a messy nuisance.

The **Step 4. Build on Your Success** section highlights ways in which the congregation can extend the reach of the project through its members and out into the community with targeted outreach and involvement.

As shown in this historical baptism photo in Hattiesburg, MS, clean water has long been a crucial part of many congregations' spiritual practices.

STEP 1. GET STARTED ON YOUR PROJECT

To get your project underway, begin with these five key tasks:

1. Identify champions.
2. Educate the congregation.
3. Organize a core working group to set environmental goals and priorities within the congregation's framework of faith practices.
4. Determine the type and scope of your project
5. Plan for costs

Identify Champions

Begin by identifying members of your congregation who are interested in helping to improve the grounds and who may inspire others. They can be anyone who loves to garden or create landscapes as well as bird watchers, wildlife enthusiasts and conservationists. Have each of your champions read this guide, discuss your overall goals and meet with your leadership to discuss a path forward.

Educate the Congregation

Educate your leadership and congregants about the importance of improving your worship grounds by designing and managing the site to protect water resources and to reduce energy and chemical inputs. Consider showing a video from another church with an already-established program or invite a local guest speaker. Many education resources and ideas are available from online sources (see page 24).

Key people to inform include your Buildings and Grounds Committee, Facility Manager and Business Administrator because they make critical financial support and planning decisions.

Consider Partnering and Joining a Network

There are many reasons why congregations might want to partner with an existing program rather than starting from scratch. For example, you might prefer to become part of a bigger network of eco-conscious organizations in addition to making improvements to your site. Established programs allow congregations to draw upon resources beyond their internal means as they go through the process of making their grounds more environmentally sustainable. Examples of such programs include:

- Interfaith Power and Light
- National Wildlife Federation's Sacred Grounds™ program
- RainScapes for Congregations program, Montgomery County, MD
- RainWise program, Seattle, WA
- Grow Green program, Austin, TX

Organize a Working Group

Your project champions should form a working group to begin planning an approach and identifying your congregation's goals. To get tips on how to create a successful project, the group might want to seek out other organizations or congregations that have constructed wildlife habitat and rain gardens. A tour can help you develop a better understanding of the kinds of designs, plant palettes and solutions others have used on their landscapes. Local governments, Master Gardener and Master Naturalist programs, and native plant societies can be good starting points for general information because they can often provide you with contacts for other congregations, organizations or institutions that have incorporated these features. These early planning and education experiences will help you organize the roles within your working group.

Determine the Type and Scope of Your Project

Start thinking early about the types of stormwater features that would be best for your property. You might want to start with one feature, like a rain garden, in a key location, or perhaps install a series of features at the same time such as multiple rain gardens, a cistern and conservation landscaping.

Now is also the time to consider some key design aspects. You might want to emphasize the following:

- Selecting plants that are locally appropriate, colorful, deep-rooted, drought-resistant and attractive to birds and butterflies (see page 16)
- Including informational signs with a focus on education (see page 23)
- Collecting and using rainwater with cisterns, rain barrels, etc.
- Amending soil to provide better drainage (see page 11)
- Creating a reflection garden or meditation site
- Adding sculptures, plants or bird feeders that serve as aesthetic focal points

You should consider whether you need to hire outside expertise, or if a member of your congregation is a qualified engineer or designer who is willing to donate time. Finally, decide if you want to install signs describing the feature's function and environmental and social benefits.

Use Visual Aids to Describe Concepts

Montgomery County, MD's Sacred Waters: RainScapes and Congregations in Action video and other brochures and guidance can be useful for introducing and reinforcing the reasons for stormwater and natural habitat enhancements (see page 24).

Stormwater tree pits line a permeable paver pedestrian walkway.

How to Get Started

It's not necessary for a congregation to take on a detailed, comprehensive stormwater planning process. You can start with disconnecting downspouts or installing rain barrels. These are two actions that can be done easily by volunteers if gutters and downspouts are accessible.

If you want to explore more comprehensive options, a step-by-step approach for evaluating your site and then planning stormwater features starts on page 11.

Plan for Costs

Many factors can influence the cost of your project. If you are planning a new building or campus, you can save money by incorporating stormwater features into the site plan early in the process. Using GSI for new construction also can reduce the size and number of pipes, curbing and other drainage infrastructure needed because much of the runoff is absorbed by the ground rather than being piped off-site. Savings on traditional infrastructure can offset some of the costs associated with building and maintaining the green stormwater features. Be aware that adding green stormwater features to existing development—or *retrofitting*—can be more expensive because of excavation costs and the potential need to plan around structures, trees and utilities.

One way to reduce costs for both new construction and retrofits is to prepare the site yourself. Many projects have been successfully installed by volunteers (adults and youth); having experienced team leaders is one key to success. If your team can dig and plant your garden with volunteer labor, your only costs will be for purchased materials (e.g., plants, soil amendments, mulch). If you need to hire a contractor to perform the labor, costs will be higher. Municipal public works departments often have free or low-cost compost as well as staff who can provide advice. Another cost factor is the size of the plants purchased; very small plants are less expensive than larger ones but will take longer to become established.

If you do all the site work yourself, but use purchased native plants, a rain garden will cost approximately $5 to $7 per square foot, depending on how many plants you buy and how locally available they are. If a landscaper installs the entire rain garden, the cost can rise to more than $15 per square foot.[1]

Because a growing number of local governments and other organizations offer financial assistance to install many of the green stormwater practices described in this guide, it is worth your time to check with local officials to find out what assistance is available. See the sidebar for information about costs and incentives to build stormwater features.

[1] Green Values (Center for Neighborhood Technology 2019)

Incentives for Stormwater Management

Some communities offer rebates or financial incentives for property owners who install rain gardens:

- RainScapes program (Montgomery County, MD) offers up to $20,000 to institutional property owners who install rain gardens. Residential property owners receive a rebate of up to $7,500.
- River Smart Homes program (Washington, DC) offers incentives of up to $1,200 to District of Columbia homeowners interested in reducing stormwater pollution from their properties.
- RainWise program (Seattle, WA) offers rebates for installation of rain gardens and cisterns.
- Smart Watersheds program (Ames, IA) offers rebates for installation of residential rain gardens within city limits.

Some congregations pay a stormwater utility fee to their local government, and some local governments offer rebates on the stormwater utility fee or other financial incentives if stormwater is retained on-site using rain gardens and other water quality practices:

- Clean River Rewards program (Portland, OR) offers a discount of up to 100% of the on-site stormwater charge (the on-site stormwater charge is about 35% of the total stormwater charge).
- Stormwater Credits program (Richmond, VA) offers up to a 50% credit when measures are taken to reduce the stormwater rate or volume flowing from a property.
- Alternative Compliance program (Prince George's County, MD) offers up to 100 percent reduction in the county's stormwater fee to qualified tax-exempt, faith-based organizations or other 501(c)(3) nonprofit organizations to improve water quality in the county by treating and reducing polluted stormwater runoff.

Check with your local agency for information on fees and credits.

STEP 2. PLAN, DESIGN AND BUILD THE PROJECT

Step 2 includes three key tasks:

1. Assessing and mapping the grounds
2. Developing project plans
3. Installing the GSI features

Assess the Grounds

First, assess your congregation's grounds to help identify where water is flowing and standing—these are potential locations for green stormwater management features. Below is a process for assessing and mapping the grounds, identifying potential locations for stormwater features and developing plans.

Create a Site Map

When assessing options for the grounds at your place of worship, it helps to have a map or property survey—also called a *plat* or *site plan*—of the property. If you don't have one, use graph paper to roughly sketch the grounds to a measurable scale. Apps are available to help with site mapping. Use the *Stormwater Site Assessment Worksheet* in the appendix and the information below to develop a site map and assess potential locations for a rain garden, series of rain gardens or other features.

Locate Impervious Surfaces and Where They Drain

Begin by mapping all the impervious surfaces at your site, which typically include rooftops, parking lots, driveways, walkways, patios and other hardscapes. Roof areas can be measured in overhead or plan view rather than calculating the square foot area of each slope of the roof. For roofs, after mapping the rooftop area, mark the location of all downspouts and determine the approximate roof area that drains to each downspout.

Locate Existing Landscaped Areas

Next, identify all the existing vegetation on your grounds and locate these planted areas on a copy of your base map. Vegetation can include lawns, shrubs, gardens and trees. Note any native plants or other special plants or areas of vegetation that you might want to conserve. The map can also identify areas with invasive or other undesirable plant species that the congregation might want to remove. To help you identify the welcome and unwelcome plants in your landscape, use field guides or consult with local experts such as Master Gardeners. In addition, identify areas of bare ground without plants.

Tip: New Development or Redevelopment

If you are building a new facility, work with your design team to plan for green stormwater features early in the process to ensure they are consistent with site grading, utility and infrastructure plans.

If you are making significant changes to an already-developed site, look for existing open space, low-lying areas and underused impervious surfaces as potential locations for green stormwater features.

Map Underground Utilities and Other Conflicts

Call your local utility protection service or individual utilities to mark locations of utilities such as power and gas lines, communication cables and any other underground utilities. (Call 811 from anywhere in the country a few days before digging and your call will automatically be routed to your local call center.) Mark utilities on your site map, along with the location of any septic systems. If the congregation intends to plant trees, determine whether the mature tree height has the potential to interfere with structures or aboveground utilities and if adequate soil volume is present to support the mature tree.

Identify Slopes, Flow Paths and Discharge Points

Water flows downhill, so it's important to know the slopes on your property and where the stormwater will flow. On your map, highlight any areas with an approximate slope of 5 percent (1:20, or 1 vertical foot for every 20 horizontal feet), which would be an appropriate slope for a rain garden or conservation landscaping. Also note the locations of steep slopes (greater than 10 percent, or 1:10) that would create challenges for rain garden installation. If steep slopes exist, consider adding terraces and porous retaining walls in the design or use conservation landscapes instead. On your site map, mark which direction runoff flows across the site, collects in low spots and leaves the site. Flows can leave your site by entering a stream, swale, storm drain or roadway gutter system.

Identify Potential Locations for Stormwater Features

Key factors to consider when identifying locations for a rain garden or permeable pavement include placing them:

- At least 10 feet from building foundations unless protected by a waterproof membrane.
- At least 10 feet from trees. Rain gardens can change the hydrology of the soil around an established tree and cause stress. Consult an arborist if you have concerns.
- In a sunny or somewhat shady spot (avoid completely shady locations because they often take longer to dry out and it could be difficult to establish ground cover).
- On a gentle slope with less than 10 percent grade. (A slope steeper than 10 percent will require a lot of excavation and a large berm, retaining wall or terraces on the downhill side to contain the soil and encourage infiltration.)
- In a space that has room for a stormwater feature to overflow onto a pervious area.
- In an area that will not conflict with other uses (e.g., not in the middle of a play area).
- In areas that are not consistently wet long after a storm. The goal of a rain garden is to encourage infiltration, and areas that remain wet have poor infiltration.
- In an area that has soils that will pass a perc test. If the soil for your selected stormwater feature location does not drain quickly, it can be amended with a mix of compost and sand to promote infiltration. Soil amendments are not necessary if you have well-draining soils (e.g., sandy soils). Design specifications on soil amendments are available from a variety of sources (see page 24).

Tip: Know Your Drainage

If your site's drainage patterns are not obvious, you might need to observe the flow during a significant rain event. Another option is to pour buckets of water straight down over areas where drainage patterns are not clear and watch which direction the water runs.

Percolation Tests

Rain gardens need well-drained soils to allow water to infiltrate into the ground instead of running off into storm drains and streams. To determine if your soils are well-drained, you will need to conduct a percolation (or perc) test. You can hire a contractor to conduct the perc test, or you can do it yourself. Local soil conservation districts often offer technical assistance.

- ☑ Dig a hole approximately 2 feet deep, fill it with water, and see how long it takes to drain.
- ☑ Refill the hole with water and note the time it takes for the hole to drain again.
- ☑ The water in the hole should drain completely within 36 hours; if it does not, select another location and repeat the test.

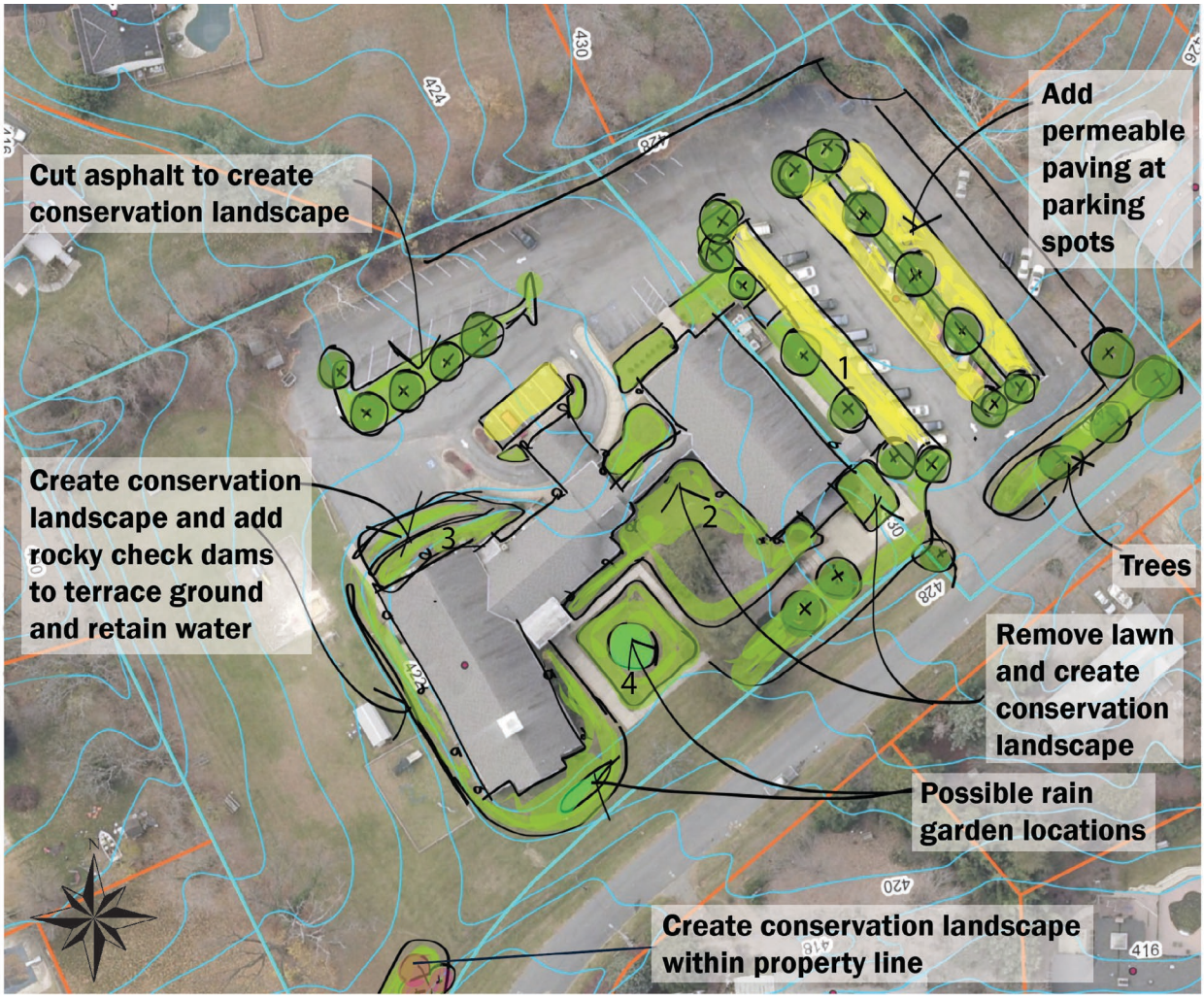
Review your site map to identify one or more potential stormwater feature locations based on the key factors cited above.

When choosing a location for a rain garden or other conservation garden, consider how its aesthetics can help the congregation appreciate the garden on more than one level. For example, consider placing a rain garden near the entrance to the place of worship or where the congregation will see it as they come and go from the site. A highly visible garden will make it more likely that it will be maintained and viewed as an asset by the congregation. The garden also can have outdoor seating nearby and serve as a place for meditation or gatherings. Wildlife that may visit the garden, particularly pollinators and birds, can be a visible reminder of the garden's purpose and connection to nature. See Figure 1 for an example of a site map.

Check with Your Local Government

If you are building a rain garden or other green stormwater feature to meet a local stormwater requirement, check with your local government before you start. Your local government's public works or environmental department might have specific procedures you need to follow and could offer guidance on garden design. You could also find out if there are programs that offer financial assistance to help you build your project. Conduct a web search for stormwater incentives to find programs in your area.

Figure 1. Example site map developed for Colesville Baptist Church, Silver Spring, MD.



Source: Department of the Environment, Montgomery County, MD

Develop Plans

Designing green stormwater management features is a step-by-step process that can vary by location. Some communities have specific requirements that should be followed if your goal is to manage stormwater on-site. If you need to meet specific local standards such as retaining 1 inch of runoff on-site, then the congregational team should consider hiring a design professional if team members lack the necessary expertise and no local resources are available to guide the team. With some study you might be able to design a rain garden or conservation landscape for an existing site.

To increase the congregation's awareness and acceptance of the project being planned, organize events to celebrate and highlight the project.

Designing a Garden

This section describes the basic steps to designing a rain garden to capture stormwater. Rain gardens are highlighted here because they are the most common stormwater feature for congregations. They are attractive and highly visible and are the easiest stormwater practice for a congregation to construct, plant and maintain. The other types of stormwater features—bioretention, permeable pavement and green roofs—require professional design and installation. Details on those practices are not provided in this guide but can be found in local and state stormwater management manuals (see the Resources section on page 24 for a selection of useful stormwater design manuals).

Measure the Area Draining to the Garden

Use the following steps to measure the size of the area draining to your garden:

- Measure and calculate the square footage of hard surfaces on your property.
- Estimate how much of that area will drain to the garden. If gutters drain to both ends of a building, use half of the roof area in your estimate for each downspout and observe where the water flows from the downspouts.

Rainy Day Visit

Go to the project site during a rainstorm to see where the water flows and collects in pools in low-lying areas. Those areas can be great places to locate rain gardens, conservation landscapes or bioretention features. However, avoid areas that remain wet long-term.

Confirm the Slope is Adequate

Part of the garden will have a temporary pond of water during storms; this should drain within a day or two. Rain gardens are designed to have 4 to 8 inches of ponded water, whereas conservation landscapes typically have 2 to 3 inches of water. Because of this, the bottom of the rain garden planting area needs to be level to evenly distribute the water across the garden.

The top of the berm will serve as a dam on the downhill side of the garden. It should be at the same height as the uphill side where the water enters the garden—this will ensure the water stays in the garden until the pond is full and does not overflow to an accidental low point in the berm. You could also incorporate an overflow notch (weir) at the height of the preferred ponding elevation.

Measure the slope of the garden site using stakes and a string to determine how high your downhill berm should be (Figure 2). Verify that the slope is less than 10 percent using the following formula:

$$Slope\ (\%) = 100 \times \frac{Rise}{Run}$$

where:

- Rise = height from the string to the ground on the downhill side
- Run = length of the string between the two stakes

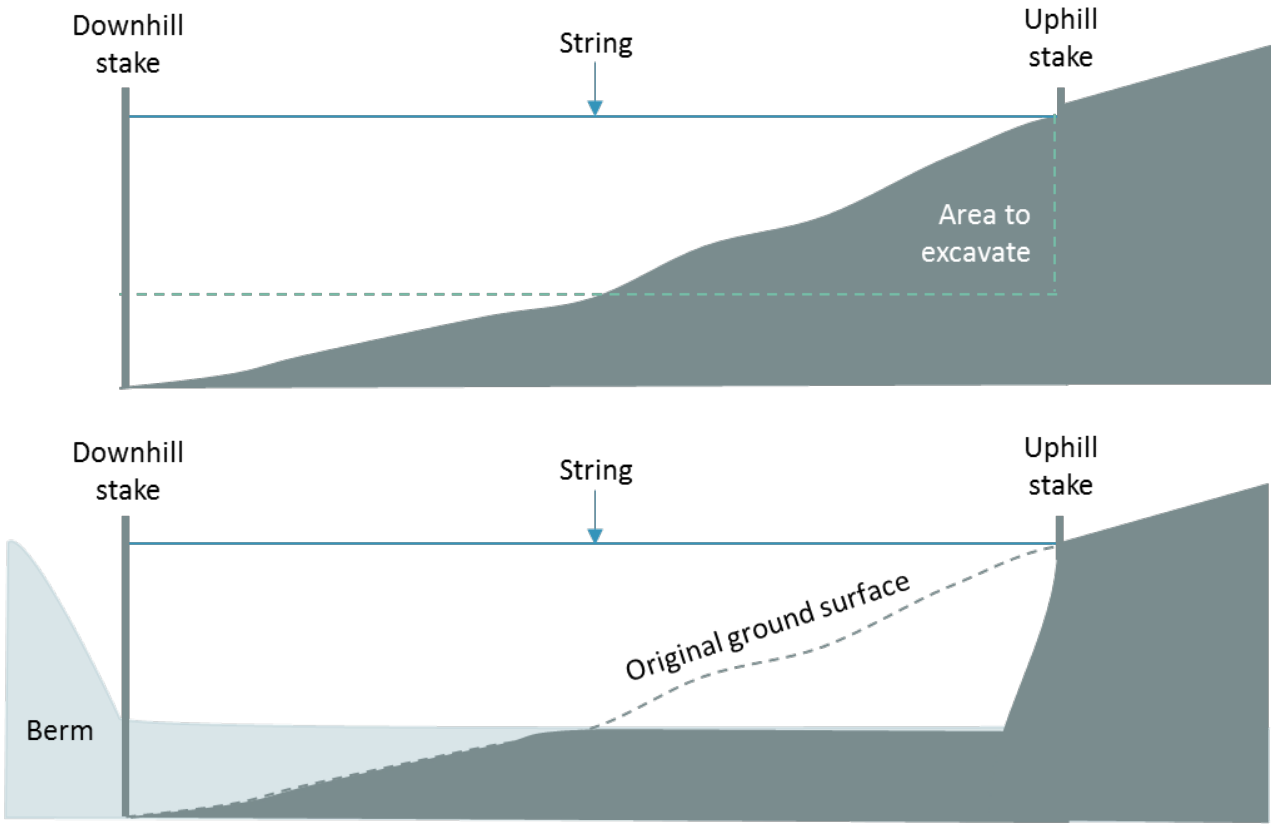


Figure 2. Side view showing an example slope before (top) and after (bottom) excavation occurs.

Determine the Size and Layout of your Garden

A reasonable size rain garden is between 50 and 250 square feet for the flat planting area. The garden might need to be larger depending on the area draining to it. Rain gardens are typically 10 to 30 percent the size of the impervious surface area draining to the garden (aiming for a larger rain garden within the general design guidelines is best). The goal is to manage on-site stormwater in smaller drainage areas rather than one large area (the maximum drainage area to a rain garden should be less than 10,000 square feet). You should also avoid placing rain gardens in areas of concentrated stormwater flow paths (like a swale); instead, place them alongside a swale so that water can exit the swale and enter the garden, and then the overflow can reenter the swale as a way to improve water treatment.

Size your rain garden based on the drainage area and depth and volume of rain to be captured from a typical small storm in your area (known as the *design storm*). A typical design storm in many areas is 1 inch of rainfall (or 0.083 feet), but if your local government has design criteria for rain gardens, you should follow those criteria.

Use the equation below to size your rain garden:

$$RA\ (ft^2) = \frac{0.083\ (ft) \times DA\ (ft^2)}{Depth\ (ft)}$$

where:

- RA = area of the rain garden
- DA = drainage area

For example, if the drainage area is 1,000 square feet and the depth of the garden (based on the slope) is 6 inches (0.5 feet), the size of the rain garden would be a ponding footprint of 166 square feet. Some rain garden design manuals also consider the soil type when sizing rain gardens. Consult your local rain garden manual, if available, to determine the best method.

You can make the garden any shape you like, but you should consider using a simple shape that is easy to maintain. Oval or kidney-shaped gardens tend to be easier to lay out and adjust to a site than are square or rectangular gardens. Whenever possible, integrate the rain garden or conservation landscape into an overall landscape plan for your property.

Devise a Planting Plan and Choose Plants

When you design a garden, consider how it will look during congregational events, particularly if it's in a highly visible area. Designing the project to align with congregational values and preferences will help your congregation see the garden as an attractive addition versus a "weedy" area that someone forgot to mow. Factors to consider during your design include:

Choosing Native Plants

You should consider the budget and expertise that will be available for maintaining the garden after it's installed. Native plants are a good choice because natives grow well in local conditions, can be more durable than ornamental species, and generally do not need supplemental water or fertilizer after the plant establishment period. Choosing low-maintenance plants means that congregational staff or volunteers should be able to keep the garden healthy and attractive without needing to hire a landscape maintenance service.

Attracting Beneficial Wildlife

To select appropriate native plants, consider the needs of the wildlife you would like to attract. All wildlife need food, water, cover and places to raise young. For example, hummingbirds feed on nectar from bright, tubular flowers, while butterflies and bees use a variety of plants for food. The National Wildlife Federation has a native plant finder that will help you find, for your zip code, the best native plants for wildlife based on their suitability as host plants for caterpillars. Caterpillars are the primary protein for nesting and migrating birds. They also turn into important butterflies and moths. The National Audubon Society offers a similar native plant database to help you choose plants to attract particular bird species.

Aesthetics

You might also consider aesthetics such as flower color and blooming time; the textures, heights and structure; and visual interest in winter. A good resource for wildflowers is the Lady Bird Johnson Wildflower Center. You can consult with local plant nurseries or local experts (e.g., local cooperative extension or conservation district staff) to determine which plants are the best candidates for your site. Native plants are available from local nurseries. Local or regional conservation organizations sometimes offer sample rain garden templates that can serve as a guide for your design (Figure 3).

Tips for Creating Planting Plans

- ☑ Assess how much sun your site gets. Choose plants for your garden conditions and understand how vigorous each plant will be in the garden.
- ☑ Plan for future growth. Plant descriptions will include the mature size, so do not overplant. However, if a "fuller" look is desired early on, it is OK to have plants a bit closer together.
- ☑ Place plants in groups of three to five of the same species and avoid complex planting plans (three to nine different kinds of plants are typically best).
- ☑ Space plants so their canopies will grow together and cover the ground to minimize weeds.
- ☑ Avoid planting in straight lines since that is more difficult to accomplish.
- ☑ Spreading evergreen groundcovers should be included to cover the ground under taller plants so that weeds are further reduced.
- ☑ Arrange plants so that taller ones will not block shorter ones from view.
- ☑ Using smaller plants such as deep landscape plugs will save money, but it will take longer for the plants to grow to full size.

Using Container Plants Versus Seeds

Containerized plants can be used on small-to-medium-sized rain gardens (up to 300 square feet). Using containerized plants, rather than seed, helps the garden to become established more quickly, and less time is needed for the plants to fill in. Plants in containers should be set "high" (1 inch above finished grade) and mulched around. When using container plants, initial maintenance can be less because it is easier to distinguish the plants from weeds, particularly if plants are grouped in blocks. Seed mixes are only appropriate for gardens that will be mowed (meadow-type gardens) because flowing water will pick up seeds and deposit them randomly within the garden.

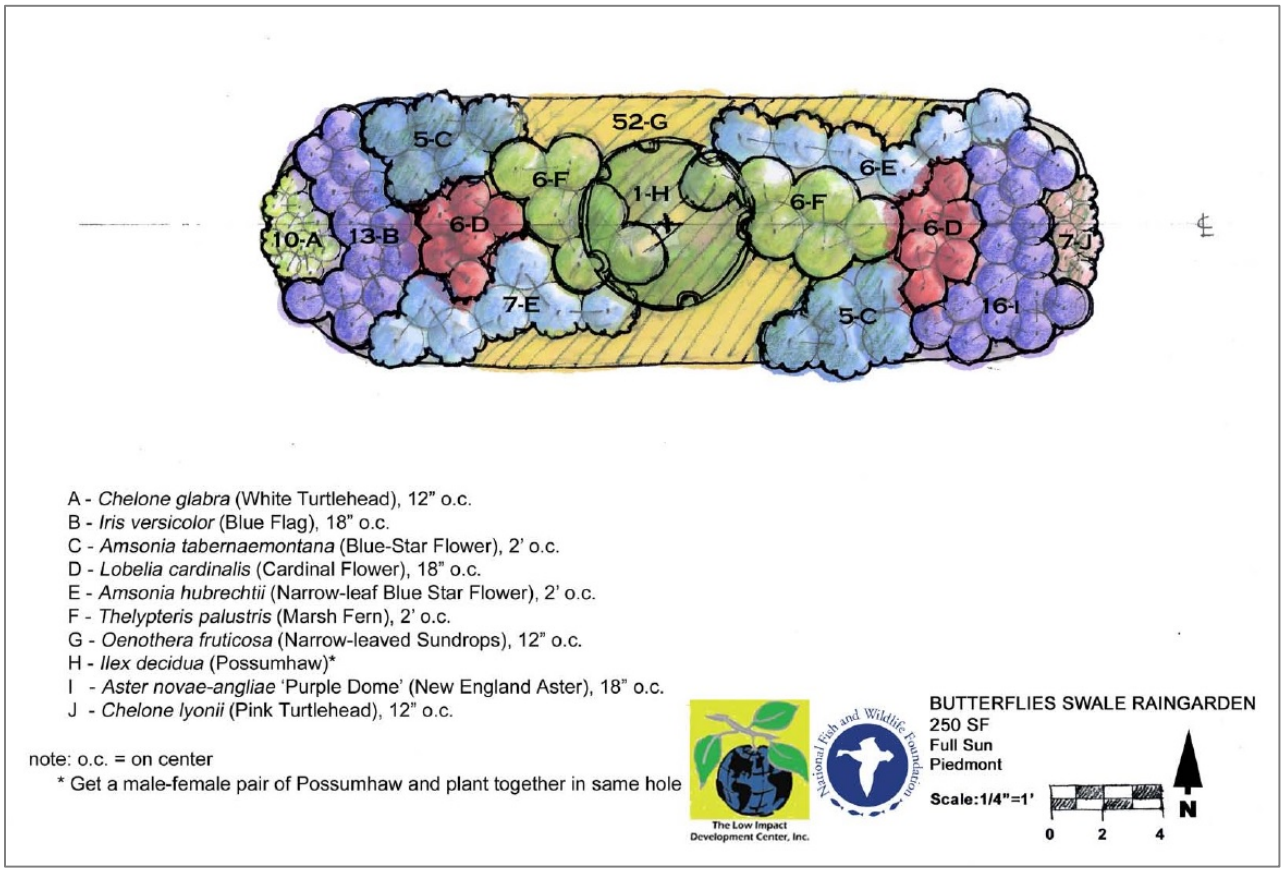


Figure 3. Example rain garden template from the Low Impact Development Center for a 250-square-foot rain garden in the Piedmont Region with full sun (see website for additional templates).

Prepare Quantity Estimates for Materials

You are now ready to prepare quantity estimates for materials. In construction terms, this is what is known as the *quantity take-off*. Practically, this means creating the shopping list for supplies, identifying prices and sources, and assembling a project budget. This budget can be used to solicit funds or as part of a grant application process. After you have identified a funding source, you can move on to planning the installation day.

Maintenance is Essential

The first 2 years are especially important when establishing vegetation. A maintenance plan can include a watering and weeding schedule specific to the establishment period, with a second schedule for long-term maintenance. For a review of important maintenance considerations, see the Sustainable Landscape Maintenance Manual developed by the Chesapeake Conservation Landscaping Council.

Prepare a Maintenance Plan

Assign maintenance responsibility to a standing committee within your congregation. A written maintenance plan should be developed to set a schedule of seasonal upkeep. The plan identifies responsible parties and the training that maintenance staff, volunteers or contractors should have. The plan also should describe common activities such as replacement and watering requirements for the specific plants selected for your rain garden. Maintenance plans for planted areas also should address mulching, trash removal, weeding and other tasks (e.g., preparing for ceremonies or festivals) as necessary. A maintenance plan should also address upkeep requirements for other green stormwater features on your site such as when to unhook or reconnect cisterns or rain barrels, or when to clean pervious pavements. Table 1 outlines an example maintenance plan for conservation landscaping practices such as rain gardens. More information about maintenance activities can be found on page 20.

Table 1. Sample maintenance plan for conservation landscaping

Task	Frequency	January	February	March	April	May	June	July	August	September	October	November	December
Inspect and remove trash	**Every two weeks**												
Weed	**Every two weeks**												
Water: during establishment	**Varies**					Weekly					Biweekly		
Water: long-term	**As needed**					After 10 days without rain							
Prune dead or damaged branches	**As needed**												
Cut back perennials	**Once every year**												
Remove leaf litter	**As needed**												
Edge	**Twice every year**												
Mulch	**Once every year**												
Fertilize	**Once every year**												

Note: Adapted from Montgomery County RainScapes maintenance plan template.

Install the Features

Now it's time to build your project. The directions below are for a rain garden installation, but they can be used for planning a conservation landscape installation as well. Installing permeable pavement is typically done by professionals. Water harvesting could be either a volunteer or professional project depending on project size.

Identify who will be helping to build your rain garden. Volunteers do not need experience and can come from the congregation or nearby community, but the crew leader(s) should have some gardening experience or have resources they can consult along the way. Schools and scout groups might be looking for volunteer credits and could be asked if they have volunteers who can help. You should provide water and/or refreshments and keep a list of the volunteers so you can thank them later.

Recruit Volunteers

Personally inviting people to your upcoming planting day and advertising it in bulletins and newsletters and through social media are great ways to rally a team of volunteers. One congregation got 60 people to join them by advertising the planting day in their children's classes and encouraging the children to bring their parents along to participate.

Schedule the Installation

The best time to build a rain garden or conservation landscape is in the spring, but fall can work, too, depending on local climate. Be sure to have a watering plan in place for the first growing season, especially if planting will occur in the spring or summer.

Most garden projects up to 500 square feet can be constructed in 1 or 2 days. Select a date and identify a back-up date in case of bad weather. Make sure plants, mulch and soil/compost are delivered by the day before you need them.

Gather Equipment

Members of your congregation might already own most of the equipment you will need to construct the rain garden or conservation landscape. Coordinate with volunteers to determine who can bring the following items:

- Shovel and rake
- Tape measure
- Wood stakes and string
- Carpenter's level
- 2- by 4-inch board, at least 6 feet long (optional)
- Rototiller or hand tiller to loosen and prepare soil
- Wheelbarrow to move soil or mulch
- Tamper for berm compaction
- Gardening gloves
- Photos of desirable and nuisance plants

Before you install the garden, hold a team meeting to review the details. Prepare a list of tasks for the project day(s) and answer any questions. If you know of other congregations that have completed a project, invite a member from their team to talk to your team.

Take Photos

Taking photos of the project effort is a great way to show the congregation how their hard work and resources have paid off. Take several before photos of where the garden will be installed, then take photos during construction and after the garden is complete (see example below).

Photos can be uploaded to the congregation's website, featured in the newsletter, and printed out and posted in places where members gather.

Stake Out and Excavate the Garden

With the planting plan you developed above, use stakes and string, spray paint, or a hose to mark the perimeter of your rain garden:

- Place a stake on the uphill side and another stake where the berm will be on the downhill side.
- Tie a string between the stakes and level it; the string should be touching the ground on the uphill stake.
- Remove turf grass (including roots), while taking care to leave as much soil as possible. Dig the rain garden to the desired depth, moving the soil to the downhill side where the berm will be.[2]
- Use a rototiller or hand tiller to loosen the soil and incorporate compost. The organic matter in the compost helps plants grow and enables water to soak into the soil more easily. Follow your local guidance.
- The bottom of the rain garden should be as flat as possible to prevent erosion and uneven ponding. Use the 2- by 4-inch board and carpenter's level to ensure the bottom is flat.
- Interior side slopes should not exceed 3:1 (vertical: horizontal) ratio.

[2] If you are removing turf to install your garden, you can recycle some of the turf pieces on the exterior of the berm to quickly establish vegetation and reduce erosion. Removing turf can be relatively easy if you have a small area; otherwise, you might consider hiring a landscaping firm or renting a sod cutter.

Build the Berm

Stormwater will enter the rain garden on the uphill side, and the rest of the garden will be surrounded by a berm. When you are constructing the berm, it should be level across its entire length and built to a height that ensures the correct ponding depth. A perfectly level, well-compacted berm allows the water to flow evenly over it, which is the best way to avoid erosion.

If you wish to design a *weir* to direct the flow of water, create a weir notch (typically a minimum of 12 inches wide) that is 2 inches lower than the berm height. The notch elevation should match the ponding height. This will allow you to direct the overflow from the garden during a large storm. To avoid erosion problems, be sure to reinforce the weir and the slope below it with small stones or sturdy, dense plantings.

Lay Out the Plants

There are some general concepts that you can follow when planting to make your garden function well and look nice from the first day:

- Consult your planting plan and lay out the plants as designed.
- Step back and evaluate the layout and adjust as necessary before planting begins.
- Place the best-looking side of the plant towards the main view of the garden.

Install the Plants

Once your soil is ready, review planting procedures with the team before beginning to plant:

- Plant the largest plants first, then the next size smaller, and so on.
- Once a specific plant is selected for planting, move it to the side and dig the hole for it.
- Generally, holes should be at least twice as wide as the plant's root structure and deep enough so the surface of soil in the pot is ½ inch to 1 inch above the planting soil.
- If the plants are root-bound and are not plugs, loosen the roots before planting them.
- Place the plant in the hole and fill in around the rootball, pressing the soil into place.
- Move onto the next plant and repeat.
- Once the plants are installed, add 2 to 3 inches of mulch. Be careful not to place the mulch too close to the plant’s base.

Water your plants deeply immediately after planting. Apply 1 inch of water per week for 6 weeks (unless it rains significantly). After the first 6 weeks, watering weekly may not be necessary; however, you should water if the weather remains dry for 10 days or more, especially during the first growing season.

STEP 3. ENSURE LONG-TERM SUCCESS

Perform Regular Maintenance

Most of the upkeep of your stormwater features can be done by congregation members, a school class, or an outside club (e.g., Scout troop) that meets at the place of worship, particularly if the project is a garden or small water-harvesting project. You can build project information into your congregation's educational materials to generate volunteer help with maintenance tasks.

Larger projects might need professional support. For example, congregations might want to update their contracts with landscaping companies to include removal of weeds in stormwater features or provide other services such as pavement cleaning. Let your landscaping firm know about the new features and explain that they should not be mown, especially during the establishment period when plants are small. Landscapers should avoid using herbicides and pesticides if possible. Provide them with a maintenance plan (see page 17) that includes which plants to remove, which to keep, and how and when they should be cut back. Below are the activities recommended for keeping vegetated stormwater features looking good and working properly.

Inspections

Visually assess your stormwater feature after every major rain storm (1 inch or more in 24 hours) and at least monthly. During inspections, look for the potential problems outlined in Table 2.

Table 2. Potential problems to look for during an inspection of your stormwater feature

Potential Problem	Remedy
Erosion	Look for channels forming in the floor of the garden, landscaping, or bioretention area or at the inlet. Additional plants might be needed to stabilize eroded areas.
Sediment	Accumulated dirt and debris should not be blocking inlets; sediment deeper than 3 inches might need to be removed.
Weeds and invasive plants	Identify and remove any undesirable weeds or invasive plants so they do not overtake the intentional plantings. Use organic best management practices.
Standing water	If water does not drain within 24 hours after the rain has stopped, look at the floor of the feature to see if sediment or trash is preventing infiltration.
Trash and debris	Remove trash and debris from the rain garden and dispose of it properly.
Mulch	Look for missing or patchy mulch or bare earth; replace or redistribute mulch as necessary.
Inlet and outlet blockage	Inspect the inlet and outlet to make sure they are clear of sediment and debris and allow water to flow freely.
Vegetation	Inspect the rain garden for any dead, diseased or overgrown plants. Remove and replace as necessary.

Common Maintenance Activities

Watering

After initial planting, provide supplemental irrigation as needed (especially during drought conditions) until plants are well established (usually just in 1 to 2 years). Ideally, you should water in the morning or evening—not during the heat of the day.

Weeding and Pruning

Remove any weeds or invasive species that start to grow and could compete with desirable plants. Once the desired vegetation is established, maintenance could include removing nonnative plants or particularly aggressive native plants. Some woody plants might need to be pruned to keep them smaller, while herbaceous plants should be cut back in the spring. Check with your local cooperative extension office or nursery to identify the proper times to prune, as well as how to prune different types of plants.

Using Pesticides/Herbicides

Minimize the use of chemicals on your stormwater features. Weeding by hand is best; consult with an expert before applying any pesticides or herbicides. Remember you are trying to reduce pollution and attract wildlife, so limiting chemical use is advisable.

Mulching

A thin layer of mulch might be needed periodically to prevent weeds and conserve soil moisture. Spread mulch evenly and avoid piling mulch around the stems of plants.

Removing Trash/Debris

Remove any trash or debris that accumulates in the stormwater feature.

Create a Plant Photo Guide

If volunteers will be performing maintenance, create a simple visual guide showing the desired plants that should remain versus the weeds that need to be removed.

- ☑ In each season of the first year after planting, take photos of the native and ornamental plants you installed. You could highlight when certain plants would be expected to flower.
- ☑ Take or find photos of common weeds that would compete with your plantings and should be pulled. Identify when these weeds are best managed.
- ☑ Common maintenance tips can accompany each photo, like pruning in the late winter, or digging a weed instead of pulling it.
- ☑ A laminated plant "cheat sheet" is sturdy enough to be used in the field.

Maintenance Equipment

The equipment needed for maintaining garden features consists of common gardening tools:

- **Gloves** to protect hands against poisonous plants, thorns and other sharp objects
- **A rake** to gather leaves or trash and to redistribute mulch or gravel
- **Garbage bags** for trash
- **Leaf bags**, unless it is possible to compost elsewhere on the property
- **Pruning shears or loppers** to cut back plants and remove dead or damaged branches
- **A round-point shovel** for digging and replacing plants
- **A flat-edge shovel** to remove sediment or to add compost in certain places
- **A storage shed** for tools if needed

For other GSI features, necessary equipment varies by the practice installed. For example, a shop vacuum can be very useful for small areas of permeable pavers. For porous concrete, a pressure washer can be used to clean the surface. Consult with your pavement provider for the procedures most appropriate for your product. Other examples include cisterns and rain barrels, which require maintenance at least twice a year. Mosquito management and proper seasonal hookup and disconnection are critical components of any water harvesting system. Consult with the American Rainwater Catchment Systems Association (ARCSA) for full details and guidance.

STEP 4. BUILD ON YOUR SUCCESS

Engage Your Congregation and Community

Once a GSI project such as a rain garden is installed, use it as a catalyst to involve the congregation. Engaging your congregation, neighborhood and the larger faith community is an excellent way to help showcase your grounds and inspire others to join your efforts to conserve water and create habitat. Some ways to transfer the sustainability philosophy and demonstrate your values beyond this project include the following:

Create Signs and Other Materials

Once a rain garden is installed, signs can be placed near the rain garden explaining its purpose, how it works, and who built it (Figure 4). These signs can be used to educate the congregation and encourage them to build rain gardens at home or elsewhere in the community. Photos and descriptions of the project can be posted on social media to reach a wider audience.

Rain gardens can serve as outdoor stewardship classrooms for kids and adults in the congregation and surrounding areas.

USEPA's Nonpoint Source Outreach Toolbox offers free, downloadable examples of outreach materials that you can use to educate others about stormwater and how to manage it. Resources include examples of signs, brochures, videos, fact sheets, stickers, slogans and other ideas for creating your own outreach materials.

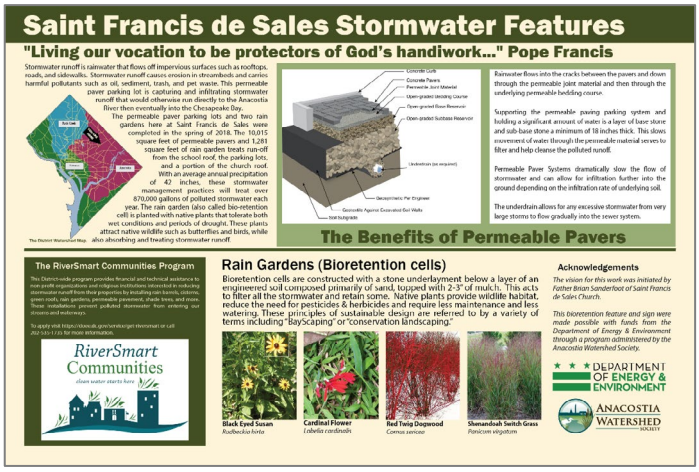


Figure 4. An educational sign developed for the RiverSmart Communities project site at St. Francis de Sales Catholic Church in Washington, DC, explains the purpose of the project for congregation members and the community.

Look to the Surrounding Neighborhood

Hold meetings with congregants and community members to discuss other ways to care for the local environment and improve neighborhood livability. Help organize volunteers for neighborhood cleanup and beautification projects.

Send the Message Home

Sponsor workshops for your congregation and the wider community to demonstrate how people can improve their own yards by converting turf areas to native gardens, choosing plants that provide food and habitat for animals, disconnecting downspouts and installing their own stormwater features.

Connect to the Congregation's Mission

Emphasize to congregants that greening and environmental stewardship align with the institution's agenda and goals.

RESOURCES

Local and National Programs

Community Wildlife Habitats Program. The National Wildlife Federation's Community Wildlife Habitats Program encourages and supports creation of habitat for wildlife throughout the community—where people live, work, learn, play and worship. Communities can certify individual backyards, school grounds and public areas like parks, community gardens, places of worship and businesses as National Wildlife Federation Certified Wildlife Habitats.® Each individual certified site within the community provides the four basic elements that all wildlife need: food, water, cover and places to raise young. These habitats help to create new corridors where wildlife can thrive. National Wildlife Federation communities also conduct outreach to educate residents about sustainable gardening practices such as reducing or eliminating chemical fertilizers and pesticides, conserving water, planting native plants and trees, composting and more. They host workshops about gardening for wildlife and hold community events such as stream cleanups and invasive species removal to make the community healthier for people and wildlife alike. Local citizens become knowledgeable advocates for wildlife and sustainability.

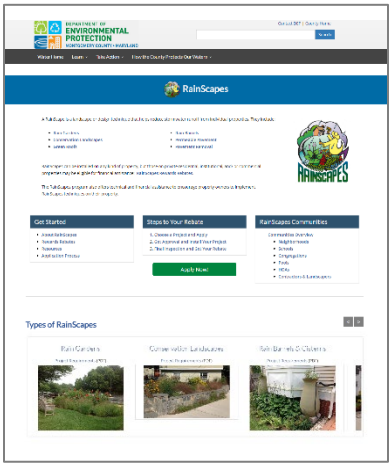
Faith in Place Website. Based in Illinois, Faith in Place offers resources to empower people of all faiths to be leaders in caring for the Earth by educating, connecting and advocating for healthier communities.

Garden for Wildlife Website. The National Wildlife Federation's Garden for Wildlife is an excellent "how-to" resource for creating and enhancing wildlife habitat on your property.

Interfaith Partners for the Chesapeake Website. Based in the Chesapeake Bay watershed, the Interfaith Partners for the Chesapeake educates, supports, and inspires people and communities of faith to advocate for the waters of the Chesapeake through policies and practices that promote a healthier environment and healthier people.

Interfaith Power and Light Website. The nonprofit Interfaith Power and Light offers a "Cool Congregations" challenge, which offers resources about greening congregations to promote energy and water conservation.

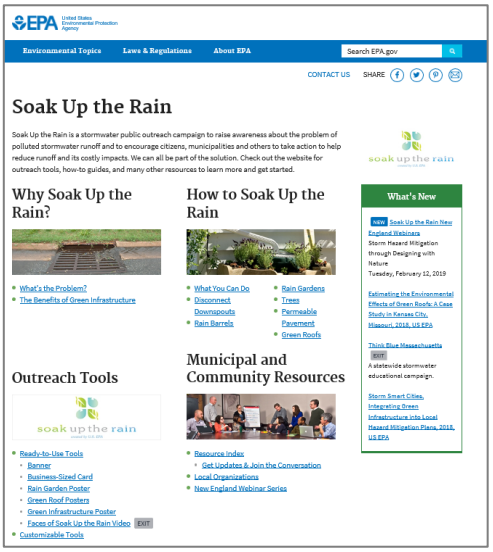
Mennonite Creation Care Network Website. Affiliated with the Mennonite Church, the Mennonite Creation Care Network offers a Greener Congregation Score Sheet and discussion guides to help congregations evaluate their current commitment to environmental care.



RainScapes Program, Montgomery County, MD. The RainScapes Program has many resources available for congregations considering rain gardens, including a Rain Garden guide, a technical design manual and a map showing locations where RainScapes projects have been installed. The RainScapes Program has several resources for developing a planting plan. You can use rain garden planting templates to help you identify potential plants and their locations and density in a rain garden. In addition, the website offers information on each of several types of RainScapes such as conservation landscapes, permeable pavement, water harvesting and green roofs. The RainScapes program has a specific website focused on RainScapes for Congregations, which has photos, a video and other resources for congregations interested in environmental stewardship.

Rain Garden Templates from the Low Impact Development Center. The Low Impact Development Center has a series of rain garden templates for the Chesapeake Bay area that illustrate the types of plants to select and where they should be planted in a number of different rain garden designs, which vary by size, sun/shade and location.

Sacred Grounds™ Program. The National Wildlife Federation's Sacred Grounds™ Program provides people of all faiths with the opportunity to connect to nature at their place of worship and to learn about the different ways their faith encourages them to be good environmental stewards. The program was developed to encourage congregations to create wildlife habitat and other important aspects of "Caring for Creation." Many congregations have greened the inside of their buildings; Sacred Grounds™ offers ideas on how to green the outside. In addition to creating and enhancing wildlife habitat, the program emphasizes the use of natural solutions to manage stormwater runoff. Lastly, the program gives congregations an opportunity to receive recognition for undertaking these landscaping projects and sharing the associated education with their congregants and beyond. Information on this website includes case studies from other congregations; tip sheets on how to provide food, cover, water and places to raise young; and a native plant finder to identify which local native plants are best for wildlife.



Soak Up the Rain Program. USEPA's Soak Up the Rain Program provides educational materials on rain gardens and similar practices. The Soak Up the Rain website features a 3-minute video you can show your congregation that features a municipal official, school principal, landscape designer, watershed activist, and homeowners describing the problem of polluted runoff and the opportunities for and benefits of soaking up the rain.

Stormwater Design Guidance

City of Portland, OR (Northwest). The city's guide, How to Manage Stormwater: Rain Gardens, describes and visually presents the steps to design a rain garden.

Connecticut Nonpoint Education for Municipal Officials (NEMO) Program. NEMO's Rain Garden App is a mobile app available for Apple's iOS or Android that walks users through how to properly site, size, install and maintain a rain garden. It includes a series of video tutorials, a Google Maps-based sizing tool, soil data from the Natural Resources Conservation Service, a plant selector tool and a personalized database for managing rain garden projects.

Designing with Natives. John Rogers' book, Designing with Natives ($20), is a roadmap for how to use native plants in design and backyard stewardship.

Master Gardener Program. Many resources are available that provide planting templates for rain gardens, including the Master Gardener program from the Cooperative Extension Service (e.g., Maryland's Master Gardener program). Choose plants appropriate for your U.S. Department of Agriculture hardiness zone (note: native plants already meet this criterion). The plants you choose should be attractive across all four seasons, be easy to maintain and provide ecological value. Plants on the rain garden media surface should be tolerant of both drought and periodic inundation and should include a mix of both woody vegetation and herbaceous plants. Plants on the slopes should be drought-tolerant.

Soil Compost Amendment Design (Mid-Atlantic). The Virginia Department of Environmental Quality developed a Soil Compost Amendment design specification document, which is applicable to the mid-Atlantic (Chesapeake Bay basin) region.

Stormwater Design Cost Calculators. To estimate costs associated with your planned stormwater management project, see USEPA's National Stormwater Calculator or the Center for Neighborhood Technology's Green Values Stormwater Management Calculator.

APPENDIX: SITE ASSESSMENT TOOLS

Stormwater Site Assessment Worksheet

Create a map of your site – Use the blank site map on the next page or draw on an available plat/map of your site to identify the following items. See page 13 for an example site map.

1. Identify all impervious surfaces:

- ☐ Parking lots
- ☐ Walkways
- ☐ Roofs (mark all downspout locations and approximate area of the roof that drains to each downspout)
- ☐ Other impervious surfaces

2. Identify landscaped areas:

- ☐ Lawn/turf areas
- ☐ Shrubs
- ☐ Gardens
- ☐ Trees
- ☐ Bare ground
- ☐ Other landscaped areas

3. Identify known underground utilities (this could include water or gas lines or other underground utilities – call your local utility to mark locations if necessary):

- ☐ a. Map underground utilities.

4. Identify slopes and stormwater flow paths:

- ☐ a. Identify areas with slopes greater than 5%.
- ☐ b. Identify where stormwater leaves your site (catch basin, swale, stream and so forth).
- ☐ c. Delineate drainage areas on your site.

Assess potential rain garden locations – Consider the factors below and circle several potential locations that are downslope from building downspouts or are at low points on the site.

1. Identify potential sites that are:

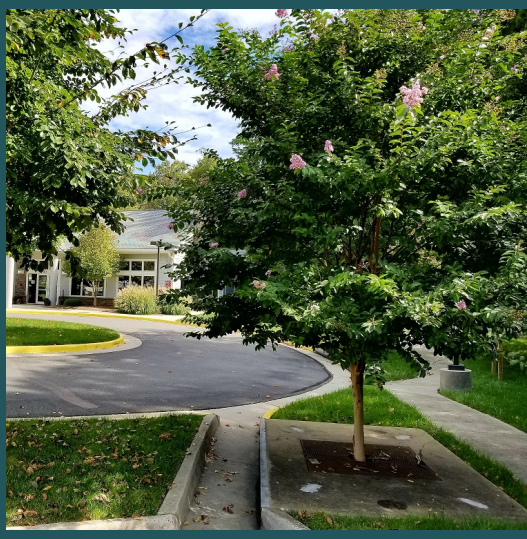
- ☐ Within 10 to 30 feet of a roof downspout
- ☐ At least 10 feet from any building foundation
- ☐ At least 10 feet from trees
- ☐ In a sunny or somewhat shady location (avoid completely shady locations)
- ☐ On relatively flat or gentle slopes
- ☐ In an area that will not conflict with other uses (e.g., not in the middle of a walkway or play area)
- ☐ In areas that are not consistently wet long after a rain event

2. Test soil suitability at each location:

- ☐ a. Dig a 6- to 8-inch hole and fill it with water.
- ☐ b. Allow water to sit for at least 1 hour and refill the hole so it is full.
- ☐ c. Measure the depth of the water with a ruler, then wait 1 hour and measure again.
- ☐ d. If the difference is 1 inch or more, the soil is suitable for a rain garden.
- ☐ e. If the rain garden is greater than 100 ft^2, do a perc test for every 100 ft^2 of garden area.

Site Map Template

Building Community, Protecting Nature



United States Environmental Protection Agency