

A How-to Manual for Homeowners
RAIN GARDENS



Town of Newburgh
Director of Planning and Development

RAIN GARDENS

Your Personal Contribution to Cleaner Water

Homeowners in many parts of the country are catching on to rain gardens – landscaped areas planted with wild flowers and other native vegetation that soak up rain water, mainly from the roof of a house or other building. The rain garden fills with a few inches of water after a storm and the water slowly filters into the ground rather than running off to a storm drain. Compared to a conventional patch of lawn, a rain garden allows about 30% more water to soak into the ground.

Why are rain gardens important? As cities and suburbs grow and replace forests and agricultural land, increased stormwater runoff from impervious surfaces becomes a problem. Stormwater runoff from developed areas increases flooding, carries pollutants from streets, parking lots and even lawns into local streams and lakes, and leads to costly municipal improvements in stormwater treatment structures.

By reducing stormwater runoff, rain gardens can be a valuable part of changing these trends. While an individual rain garden may seem like a small thing, collectively they produce substantial neighborhood and community environmental benefits. Rain gardens work for us in several ways by:

- ❖ Increasing the amount of water that filters into the ground, which recharges local and regional aquifer
- ❖ Helping protect communities from flooding and drainage problems
- ❖ Helping protect streams and lakes from pollutants carried by urban stormwater. Lawn fertilizers and pesticides, oil and other fluids that leak from cars, and numerous harmful substances that wash off roofs and paved areas
- ❖ Enhancing the beauty of yards and neighborhoods
- ❖ Providing valuable habitat for birds, butterflies and many beneficial insects

Who should use this manual?

This manual provides homeowners and landscape professionals with the information needed to design and build rain gardens on residential lots. Guidelines presented in this manual can also be used to treat roof runoff at commercial and institutional sites. This manual should not be used to design rain gardens for parking lots, busy streets and other heavily used paved areas where stormwater would require pre-treatment before entering a rain garden.

FREQUENTLY ASKED QUESTIONS

Does a rain garden form a pond?

No. The rain water will soak in so the rain garden is dry between rainfalls. (Note: Some rain gardens can be designed to include a permanent pond, but that type of rain garden is not addressed in this publication)

Are they a breeding ground for mosquitoes?

No. Mosquitoes need 7 to 12 days to lay and hatch eggs, and standing water in the rain garden will last for a few hours after most storms. Mosquitoes are more likely to lay eggs in bird baths, storm sewers, and lawns than in a sunny rain garden. Also rain gardens attract dragonflies, which eat mosquitoes!

Do they require a lot of maintenance?

Rain gardens can be maintained with little effort after the plants are established. Some weeding and watering will be needed in the first two years, and perhaps some thinning in later years as the plants mature.



Is a rain garden expensive?

It doesn't have to be. Family and a few friends could provide the labor. The main cost will be purchasing the plants, and even this cost can be minimized by using some native plants that might already exist in the yard or in a neighbor's yard.

STEP 1 SIZING AND PLACING THE RAIN GARDEN

This section of the manual covers rain garden basics – where to put the rain garden, how big to make it, how deep to dig it, and what kind of soils and slope are best.

If you already know the size you want your rain garden to be, then skip ahead to the section about building the rain garden; however, take time to read the pointers about location, and do find the slope of the lawn. If the location has a slope more than 12%, it is best to pick a different location because of the effort it will take to create a level rain garden.



An extension of PVC pipe helps direct downspout water to this rain garden.

Where should the rain garden go?

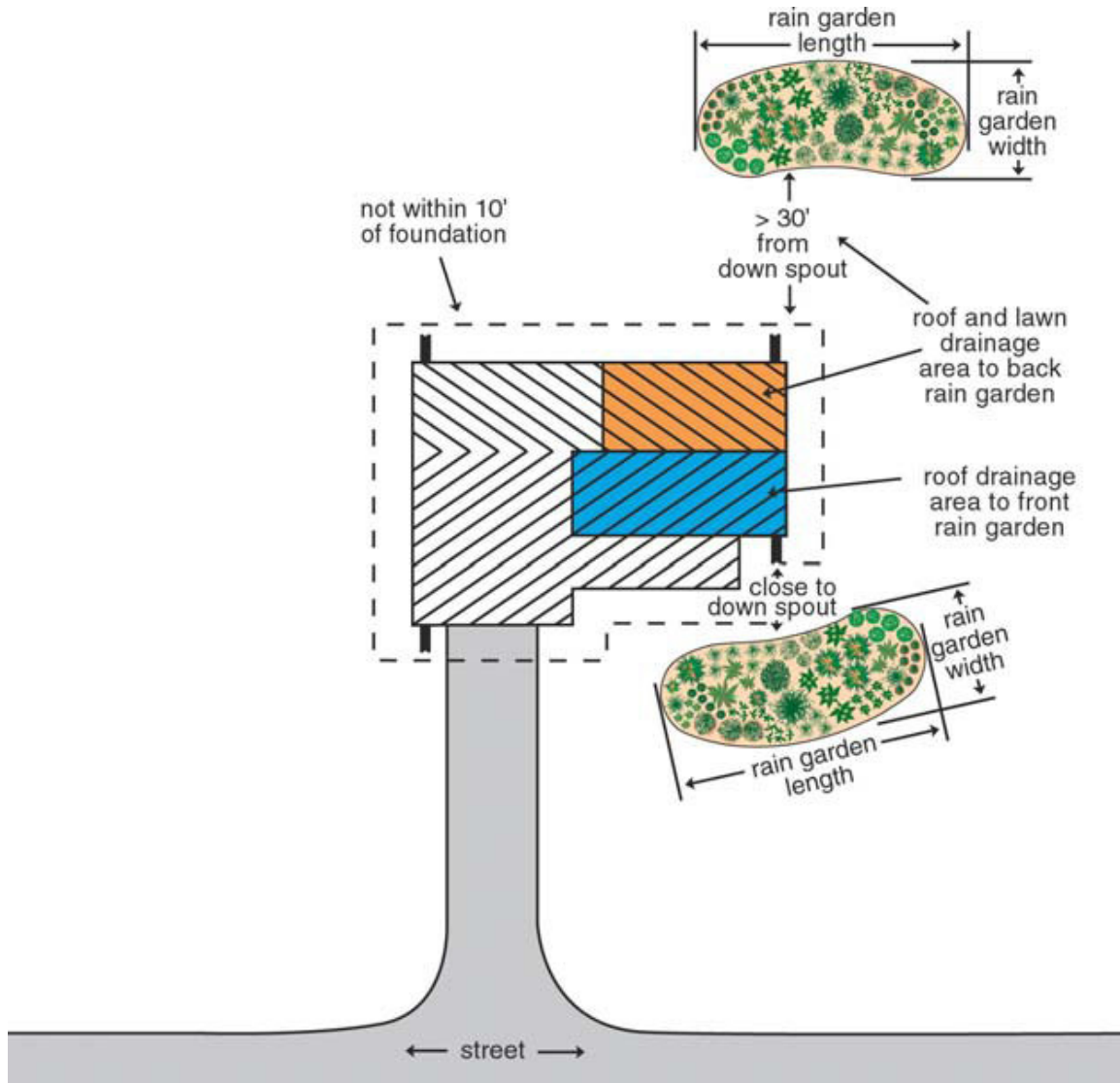
Home rain gardens can be in one of two places – near the houses to catch only roof runoff or farther out on the lawn to collect water from the lawn and roof. To help decide where to put a rain garden, consider these points:

- ❖ The rain garden should be at least 10 feet from the house, so infiltrating water doesn't seep into the foundation.
- ❖ Do not place the rain garden directly over a septic system.
- ❖ It may be tempting to put the rain garden in a part of the yard where water already ponds. **Do not!** The goal of a rain garden is to encourage infiltration, and your yard's wet patches show where infiltration is slow.
- ❖ It is better to build the rain garden in full or partial sun, not directly under a big tree.
- ❖ Putting the rain garden in a flatter part of the yard will make digging much easier. For example, a rain garden 10 feet wide on a 10% slope must be 12 inches deep to be level, unless you import topsoil or use cut and fill.

CONSIDER YOUR OVERALL LANDSCAPE

When considering placement of your rain garden, design with the end in mind.

Carefully consider how the rain garden can be integrated into existing and future landscaping. Also, pay attention to views from inside the house as well as those throughout the landscape. Determine how far or how close you want your rain garden from outdoor gathering spaces or other play areas. Why not locate it near a patio where you can take advantage of the colors and fragrances for hours on end?



A rain garden can be built in the front or back yard. Pick a pleasing shape for the rain garden. Crescent, kidney, and teardrop shapes seem to work well.

How big should the rain garden be?

The surface area of the rain garden can be almost any size, but time and cost will always be important considerations in sizing decisions. Any reasonably sized rain garden will provide some stormwater runoff control. A typical residential rain garden ranges from 100 to 300 square feet. Rain gardens can be smaller than 100 square feet, but very small gardens have little plant variety. If a rain garden is larger than 300 square feet it takes a lot more time to dig, is more difficult to make level, and could be hard on your budget.

The size of the rain garden will depend on:

- ❖ How deep the garden will be?
- ❖ What type of soils the garden will be planted in?
- ❖ How much roof and/or lawn will drain to the garden?

This information, along with the rain garden size factors contained in this manual, will determine the surface area of the rain garden.

GUIDELINES ARE NOT RULES...

The sizing guidelines described in this manual are based on a goal of controlling 100% of the runoff for the average rainfall year while keeping the size of the rain garden reasonable. If you follow the guidelines in the manual and decide the calculated surface area is just too large for your goals, it is perfectly acceptable to make the rain garden smaller. On the other hand, it is fine to make the rain garden bigger than the guidelines indicate.

You want your garden to be a size that you can handle, with plants that are easy to manage and that you like. A manageable, appealing garden is far more important than any of the more technical components, such as how big to make it, how much water your soil infiltrates, putting in subsoil, etc.

How deep should the rain garden be?

A typical rain garden is between four and eight inches deep. A rain garden more than eight inches deep might pond water too long, look like a hole in the ground, and present a tripping hazard for somebody stepping into it. A rain garden much less than four inches deep will need an excessive amount of surface area to provide enough water storage to infiltrate the larger storms.

No matter what the depth of the rain garden, the goal is to keep the garden level. Digging a very shallow rain garden on a steep lawn will require bringing in extra topsoil to bring the down-slope part of the garden up to the same height as the up-slope part of the garden. As the slope gets steeper, it is easier to dig the rain garden a little deeper to make it level.

The slope of the lawn should determine the depth of the rain garden.

Find the slope of your lawn by following these steps:

- 1.** Pound one stake in at the uphill end of your rain garden site and pound the other stake in at the downhill end. The stakes should be about 15 feet apart.
- 2.** Tie a string to the bottom of the uphill stake and run the string to the downhill stake.
- 3.** Using a string level or the carpenter's level, make the string horizontal and tie the string to the downhill stake at that height.
- 4.** Measure the width (in inches) between the two stakes.
- 5.** Now measure the height (in inches) on the downhill stake between the ground and string.
- 6.** Divide the height by the width and multiply the result by 100 to find the lawn's percent slope. If the slope is more than 12%, it's best to find another site or talk to a professional landscaper.

Using the slope of the lawn, select the depth of the rain garden from the following options:

- ❖ If the slope is less than 4%, it is easiest to build a 3 to 5-inch deep rain garden.
- ❖ If the slope is between 5 and 7%, it is easiest to build one 6 to 7 inches deep.
- ❖ If the slope is between 8 and 12%, it is easiest to build one about 8 inches deep.

Example

Pam measures the length of the string between the stakes; it is 180 in. long. The height is 9 in. She divides the height by the width to find her lawn's percent slope. With a 5% slope, Pam should build a 6 in. deep rain garden.

What type of soils are on the rain garden site?

After choosing a rain garden depth, identify the lawn's soil type as sandy, silty, or clayey. Sandy soils have the fastest infiltration; clayey soils have the slowest. Since clayey soils take longer to absorb water, rain gardens in clayey soil must be bigger than rain gardens in sandy or silty soil. If the soil feels very gritty and coarse, you probably have sandy soil. If your soil is smooth but not sticky, you have silty soil. If it is very sticky and clumpy, you probably have clayey soil.

How big is the area draining to the rain garden?

The next step in choosing your rain garden size is to find the area that will drain to the rain garden. As the size of the drainage area increases, so should the size of the rain garden.

There is some guesswork in determining the size of a drainage area, especially if a large part of the lawn is up-slope from the proposed garden site. Use the suggestions below to estimate the drainage area without spending a lot of time.

Rain Gardens Less than 30 feet from the Downspout

- 1.** In this case, where the rain garden is close to the house, almost all water will come from the roof downspout. Walk around the house and estimate what percent of the roof feeds to that downspout. Many houses have four downspouts, each taking about 25% of the roof's runoff.
- 2.** Next, find your home's footprint, the area of the first floor. If you don't already know it, use a tape measure to find your home's length and width. Multiply the two together to find the approximate area of your roof.
- 3.** Finally, multiply the roof area by the percent of the roof that feeds to the rain garden downspout. This is the roof drainage area.

Rain Gardens More than 30 feet from the Downspout

- 1.** If there is a significant area of lawn uphill that will also drain to the rain garden, add this lawn area to the roof drainage area. First, find the roof drainage area using the steps above for a rain garden less than 30' from the downspout.
- 2.** Next find the area of the lawn that will drain to the rain garden. Stand where your rain garden will be and look up toward the house. Identify the part of the lawn sloping into the rain garden.
- 3.** Measure the length and width of the uphill lawn, and multiply them to find the lawn area.
- 4.** Add the lawn area to the roof drainage area to find the total drainage area.

Note:

If the rain garden is far from the house, and you don't want a swale or downspout cutting across the lawn, run a PVC pipe underground from the downspout to the rain garden. In this case, do calculations as for a rain garden less than 30 feet from the house.

Example

Pam's house is 60 ft. by 40 ft., so the roof area is 2400 sq. ft. She estimates that the downspout collects water from 25% of the roof, so she multiplies 2400 by 0.25 to get a downspout drainage area of 600 sq. ft.

Simple Soil Test

- ❖ Dig a hole about 6 inches deep where the rain garden is to be located.
- ❖ Fill the hole with water.
- ❖ If the water takes more than 24 hours to soak in, the soil is **not suitable** for a rain garden.

Using the Rain Garden Size Factors

Having estimated the drainage area, soil type, and depth for your rain garden, use Table 1 or Table 2 to determine the rain garden's surface area. Use Table 1 if the rain garden is less than 30 feet from the downspout, and use Table 2 if it is more than 30 feet from the downspout.

Table 1 - Rain gardens less than 30 feet from downspout.

	3-5 in. deep	6-7 in. deep	8 in. deep
Sandy soil	0.19	0.15	0.08
Silty soil	0.34	0.25	0.16
Clayey soil	0.43	0.32	0.20

Table 2 - Rain gardens more than 30 feet from downspout.

	Size Factor, for all depths
Sandy soil	0.03
Silty soil	0.06
Clayey soil	0.10

- 1.** Find the size factor for the soil type and rain garden depth.
- 2.** Multiply the size factor by the drainage area. This number is the recommended rain garden area.
- 3.** If the recommended rain garden area is much more than 300 square feet, divide it into smaller rain gardens.

Example

Pam's rain garden is less than 30 ft. from the downspout, and her lawn has a 5% slope, so she will have a 6 in. deep rain garden. Her lawn is silty, so table 1 recommends a size factor of 0.25. She multiplies the downspout drainage area, 600 sq. ft., by 0.25 to find the recommended rain garden area, 150 sq. ft.

Choose a Size that is Best for Your Yard

Remember that these are only guidelines. The size of the rain garden also depends on how much money you want to spend, how much room you have in your yard, and how much runoff you want to control. Again, you can reduce the size of your rain garden by as much as 30% and still control almost 90% of the runoff. If the sizing table suggests that the rain garden be 200 square feet, but there is only enough room for a 140-square-foot rain garden, that is fine. A smaller rain garden will usually work to control most stormwater runoff, although some bigger storms might over-top the berm.

How long and how wide should the rain garden be?

Before building the rain garden, think about how it will catch water. Runoff will flow out of a downspout and should spread evenly across the entire length of the rain garden. The rain garden must be as level as possible so water doesn't pool at one end and spill over before it has a chance to infiltrate. The longer side of the rain garden should face upslope; that is, the length of the rain garden should be perpendicular to the slope and the downspout. This way the garden catches as much water as possible. However, the rain garden should still be wide enough for the water to spread evenly over the whole bottom and to provide the space to plant a variety of plants. A good rule of thumb is that the rain garden should be about twice as long (perpendicular to the slope) as it is wide. When choosing the width of the garden, think about the slope of the lawn. Wide rain gardens and rain gardens on steep slopes will need to be dug very deep at one end in order to be level. If the rain garden is too wide, it may be necessary to bring in additional soil to fill up the downhill half. Experience shows that making a rain garden about 10 feet wide is a good compromise between the effect of slope and how deep the rain garden should be. A rain garden should have a maximum width of about 15 feet, especially for lawns with more than about an 8 percent slope.

To determine the length of the rain garden:

- 1.** Pick the best rain garden width for your lawn and landscaping.
- 2.** Divide the size of your rain garden by the width to find your rain garden's length.

Example

Pam wants a 10 ft. wide rain garden, so she divides 150 by 10 to find the rain garden length, 15 ft.

STEP 2 BUILDING THE RAIN GARDEN

Now that the size and place for the rain garden are set, it is time to get a shovel and start digging. Working alone, it will take about six hours to dig an average-size rain garden. If friends help it will go much faster, possibly only an hour or two.

If you are building the rain garden into an existing lawn, digging time can be reduced by killing the grass first. Certain chemicals that only kill weeds can be used, but a more environmentally friendly approach is to place black plastic over the lawn until the grass dies. Also, the best time to build the rain garden is in the spring. It will be easier to dig, and the plants are more likely to thrive.

A note on tools –

The following tools will be helpful in building the rain garden:

- ❖ Tape measure
- ❖ Shovels
- ❖ Rakes
- ❖ Trowels
- ❖ Carpenter's level
- ❖ Wood stakes, at least 2 ft. long
- ❖ String
- ❖ 2 x 4 board, at least 6 ft. long (optional)
- ❖ Small backhoe with caterpillar treads (optional)



Digging with a rented backhoe.

Digging the Rain Garden



Before you start... CALL BEFORE YOU DIG - 811 or (800) 382-5544

While digging the rain garden to the correct depth, heap the soil around the edge where the berm will be. (The berm is a low “wall” around three sides of the rain garden that holds the water in during a storm.) On a steeper lawn, the lower part of the rain garden can be filled in with soil from the uphill half, and extra soil might be needed to be brought in for the berm.

Start by laying string around the perimeter of your rain garden. Remember that the berm will go outside the string. Next, put stakes along the uphill and downhill sides, lining them up so that each uphill stake has a stake directly downhill. Place one stake every 5 feet along the length of the rain garden.

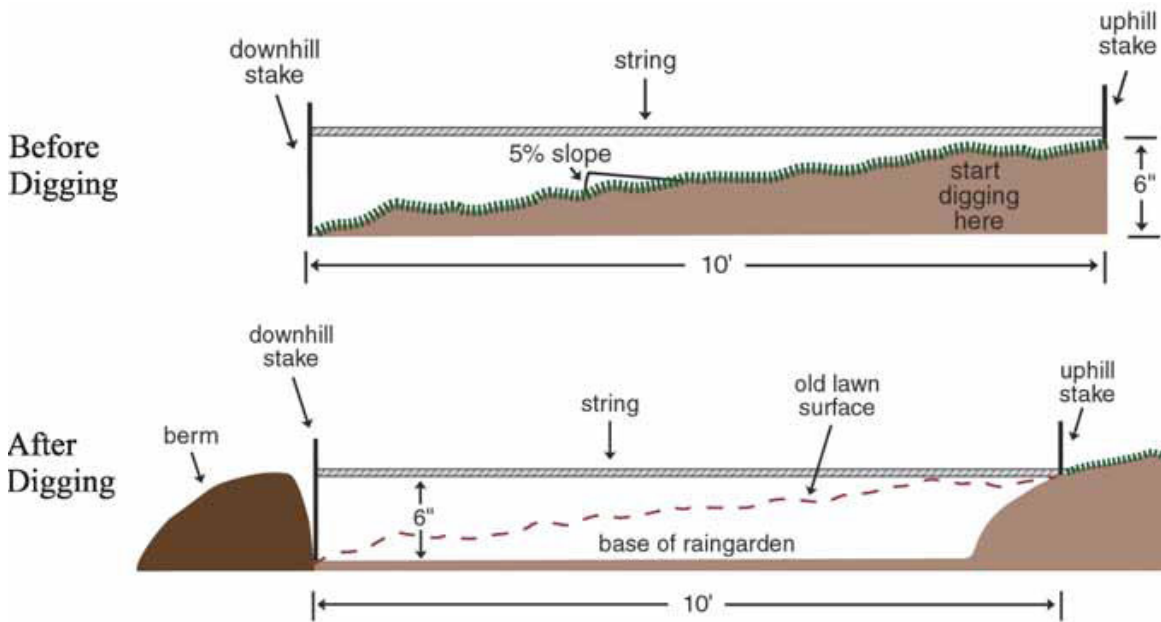
Start at one end of the rain garden and tie a string to the uphill stake at ground level. Tie it to the stake directly downhill so that the string is level. Work in 5-foot-wide sections, with only one string at a time. Otherwise, the strings will become an obstacle.

Start digging at the uphill side of the string. Measure down from the string and dig until you reach the depth you want the rain garden to be. If the rain garden will be four inches deep, then dig four inches down from the string.

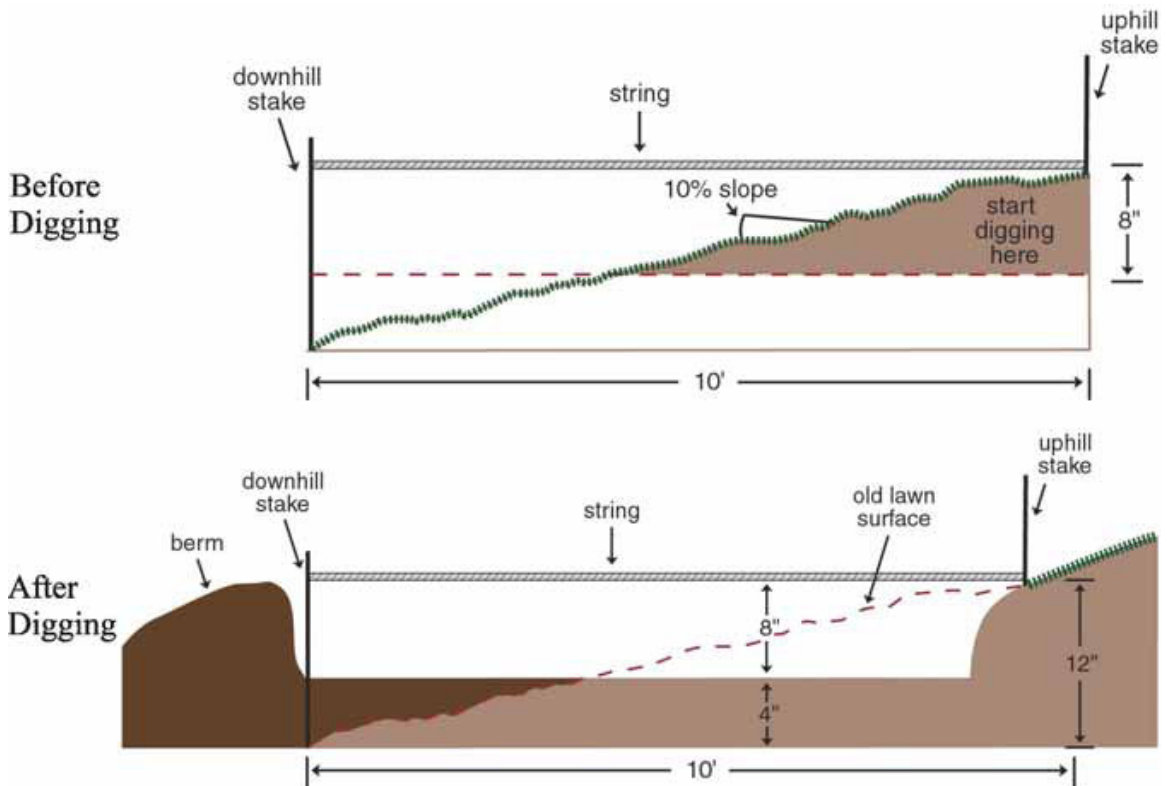
If the lawn is almost flat, you will be digging at the same depth throughout the rain garden and using the soil for the berm. If the lawn is steeper, the high end of the rain garden will need to be dug out noticeably more than the low end, and some of the soil from the upper end can be used in the lower end to make the rain garden level. Continue digging and filling one section at a time across the length of your rain garden until it is as level as possible.

In any garden, compost will help the plants become established. This would be the time to mix in compost if needed. Using a roto-tiller can make mixing much easier, but is not necessary. If you do add compost, dig the rain garden a bit deeper. To add two inches of compost, dig the rain garden one to two inches deeper than planned.

Where to dig and where to put the soil you've dug.



Between 3% and 8% slope lawn



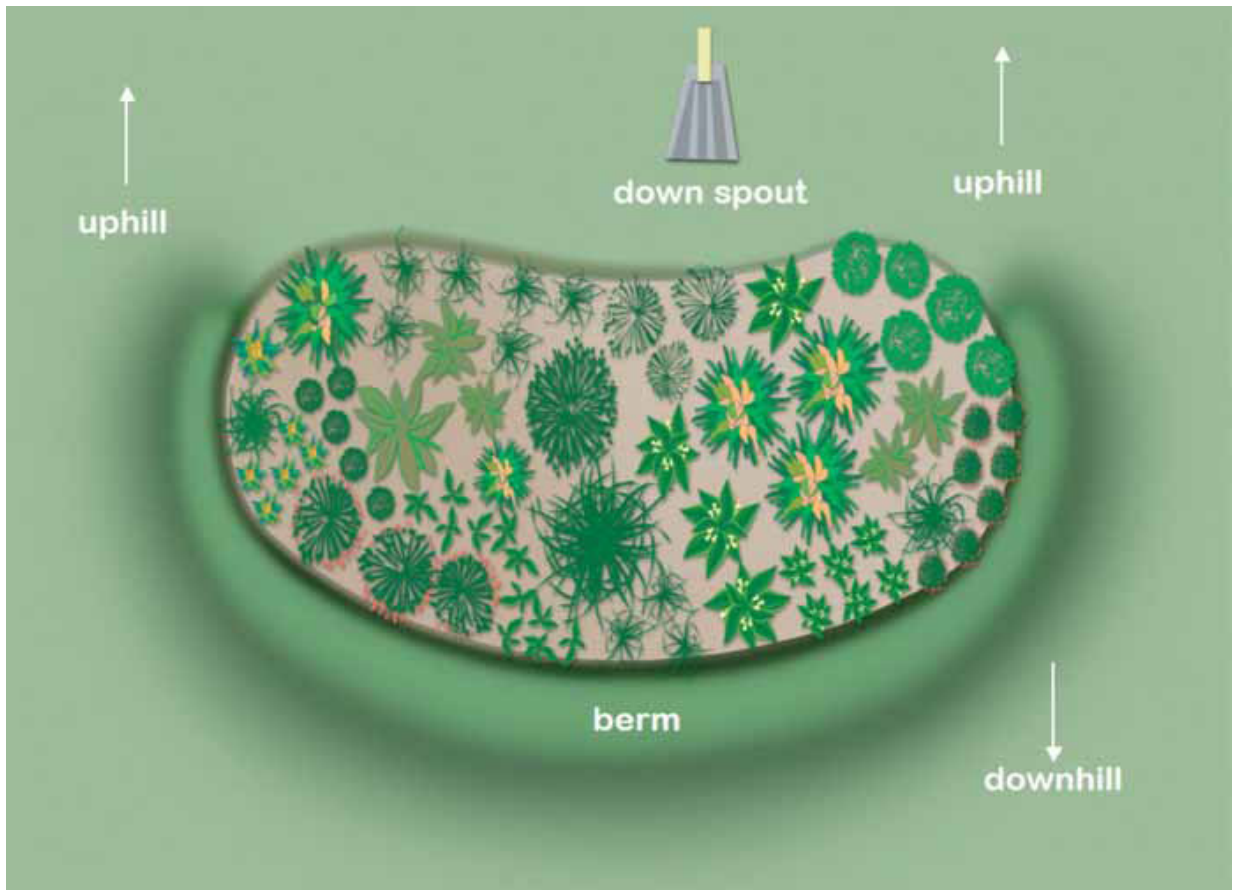
Greater than 8% slope lawn

Leveling the Rain Garden

One way to check the level of the rain garden is to just “eyeball” it.

To do it more accurately follow these steps:

- ❖ When the whole area has been dug out to about the right depth, lay the 2x4 board in the rain garden with the carpenter’s level sitting on it. Find the spots that are not flat. Fill in the low places and dig out the high places.
- ❖ Move the board to different places and different directions, filling and digging as necessary to make the surface level.
- ❖ When the rain garden is as level as you can get it, rake the soil smooth.



The top of the downhill part of the berm should come up to the same elevation as the entry to the rain garden on the uphill end.

Making the Berm

Water flowing into the rain garden will naturally try to run off the downhill edge. A berm is needed to keep the water in the garden. The berm is a “wall” across the bottom and up the sides of the rain garden.

The berm will need to be highest at the downhill side. Up the sides of the rain garden, the berm will become lower and gradually taper off by the time it reaches the top of the rain garden.



On a gentle slope, soil from digging out the garden can be used to create the berm. This rain garden is 4” deep.

On a flat slope, there should be plenty of soil from digging out the rain garden to use for a berm. On a steeper slope, most of the soil from the uphill part of the rain garden was probably used to fill in the downhill half, and soil will have to be brought in from somewhere else. After shaping the berm into a smooth ridge about a foot across, stomp on it. It is very important to have a well-compacted berm, so stomp hard. The berm should have very gently sloping sides. This helps smoothly integrate the rain garden with the surrounding lawn and also makes the berm less susceptible to erosion.

To prevent erosion, cover the berm with mulch or plant grass. Use straw or erosion-control mat to protect the berm from erosion while the grass is taking root.

If you do not want to plant grass or mulch over the outside of the berm, you can also plant dry-tolerant prairie species. Some potential berm species are prairie dropseed, little bluestem, prairie smoke, blue-eyed grass, prairie phlox, and shooting star.

Note: If the downspout is a few feet from the entry to the rain garden, make sure the water runs into the garden by either digging a shallow grass swale or attaching an extension to the downspout.

Designing the Rain Garden

While rain gardens are a highly functional way to help protect water quality, they are also gardens and should be an attractive part of your yard and neighborhood. Think of the rain garden in the context of your home's overall landscape design.

Here are a few tips:

- ❖ When choosing native plants for the garden, it is important to consider the height of each plant, bloom time and color, and its overall texture.
- ❖ Use plants that bloom at different times to create a long flowering season.
- ❖ Mix heights, shapes, and textures to give the garden depth and dimension. This will keep the rain garden looking interesting even when few wildflowers are in bloom.
- ❖ When laying plants out, randomly clump individual species in groups of 3 to 7 plants to provide a bolder statement of color.
- ❖ Make sure to repeat these individual groupings to create repetition and cohesion in a planting. This will provide a more traditional formal look to the planting.
- ❖ Try incorporating a diverse mixture of sedges, rushes, and grasses with your flowering species (forbs). This creates necessary root competition that will allow plants to follow their normal growth patterns and not outgrow or out-compete other species.
- ❖ In natural areas, a diversity of plant types adds beauty and creates a thick underground root matrix that keeps the entire plant community in balance.
- ❖ 80% of the plant mass in native prairie communities is underground.
- ❖ Once the rain garden has matured and your sedges, rushes and grasses have established a deep, thick root system, there will be less change in species location from year to year, and weeds will naturally decline.
- ❖ Consider enhancing the rain garden by using local or existing stone, ornamental fences, trails, garden benches, or additional wildflower plantings. This will help give the new garden an intentional and cohesive look and provide a feeling of neatness that the neighbors will appreciate.

STEP 3 PLANTING AND MAINTAINING THE RAIN GARDEN

Planting the rain garden is the fun part! A number of planting designs and lists of suggested plants are included at the end of this manual. Use these for ideas, but do not be afraid to be creative – there is no single best way to plant a rain garden. Anyone who has ever done any gardening will have no problem planting a rain garden, but a few basic reminders are listed below.



Planting

Select plants that have a well-established root system. Usually one or two-year-old plants will have root systems that are beginning to circle or get matted. (Note: use only nursery-propagated plants; do not collect plants from the wild)

Make sure to have at least a rough plan for which plants will be planted where. Lay out the plants as planned one foot apart in a grid pattern, keeping them in containers if possible until they are actually planted to prevent drying out before they get in the ground.

Dig each hole twice as wide as the plant plug and deep enough to keep the crown of the young plant level with the existing grade (just as it was growing in the cell pack or container). Make sure the crown is level and then, fill the hole and firmly tamp around the roots to avoid air pockets.

Apply double-shredded mulch evenly over the bed approximately two inches thick, but avoid burying the crowns of the new transplants. Mulching is usually not necessary after the second growing season unless the “mulched look” is desired.

Stick plant labels next to each individual grouping. This will help identify the young native plants from non-desirable species (weeds) as you weed the garden.

As a general rule plants need one inch of water per week. Water immediately after planting and continue to water twice a week (unless rain does the job) until the plugs are established. You should not have to water your rain garden once the plants are established. Plugs can be planted anytime during the growing season as long as they get adequate water.



Maintaining

Weeding will be needed the first couple of years. Remove by hand only those plants you are certain are weeds. Try to get out all the roots of the weedy plants. Weeds may not be a problem in the second season, depending on the variety and tenacity of weeds present. In the third year and beyond, the native grasses, sedges, rushes, and wildflowers will begin to mature and will out-compete the weeds. Weeding isolated patches might still be needed on occasion.

After each growing season, the stems and seed heads can be left for winter interest, wildlife cover and bird food. Once spring arrives and new growth is 4-6-inches tall, cut all tattered plants back. If the growth is really thick, hand-cut the largest plants and then use a string trimmer to mow the planting back to a height of six to eight inches. Dead plant material can also be removed with a string trimmer or scythe and composted or disposed of as appropriate.

Burning dead plant material stimulates native plant growth; however, burning is prohibited in the Town limits. You can mow the dead plant material. If the mowing deck of your lawn mower can be raised to a height of six inches or so, go ahead and simply mow your rain garden. Then, rake up and compost, or properly dispose of the dead plant material.

If the mower deck will not raise that high, use a string trimmer or weed-eater to cut the stems at a height of 6-8 inches. On thicker stems, such as cup plant, goldenrods and some asters, a string trimmer may not be strong enough. For these, use hand clippers or pruning shears to cut the individual stems.

What does a rain garden cost?

The cost of a rain garden will vary depending on who does the work and where the plants come from. If you grow your own plants or have a friend or neighbor who can provide you with plants, there can be very little or no cost at all. If you do all the work but use purchased prairie plants, a rain garden will cost approximately \$3 to \$5 per square foot. If a landscaper does everything, it will cost approximately \$10 to \$12 per square foot.

It might seem easiest to sow native wildflower seed over the garden, but experience shows that seeding a rain garden has its problems. Protecting the seeds from wind, flooding, weeds, and garden pests is very difficult, and the rain garden will be mostly weeds for the first two years. Growing plugs from seed indoors or dividing a friend's plants is much better. If you grow plugs, start them about four months before moving them to the rain garden. When the roots have filled the pot and the plants are healthy, they may be planted in the rain garden.

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For additional information contact:

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SOURCES

Northeast Ohio, Public Involvement Public Education Committee
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