

# *Stormwater Management*

## Installing Rain Gardens in Your Yard

Thomas G. Franti, Extension Surface Water Management Specialist  
 Steven N. Rodie, Extension Landscape Horticulture Specialist

This is one of a series of three NebGuides on designing and installing rain gardens to provide a functional and aesthetic means for reducing stormwater runoff in urban areas.

A rain garden can provide many benefits. Rain gardens collect runoff water, primarily from home roofs and other impervious surfaces, reduce downstream flooding, and prevent water pollution from degrading water quality. They provide an aesthetically pleasing feature to your landscape, and they can provide you with the satisfaction of a do-it-yourself project that enhances your property value.

### Design and Site Selection

Key factors for designing and locating a rain garden are soil type, drainage area (roof surfaces as well as adjacent landscape areas that also may concentrate rainwater runoff) and ground surface slope. If your soil does not meet minimum infiltration criteria your yard may not be suitable for a rain garden. G1758, *Rain Garden Design for Homeowners*, explains how to determine if your soil is suitable and how to determine garden size based on drainage area and lawn slope. If the drainage area contributing to the location you have selected is too large, consider installing more than one rain garden or rerouting some downspouts. Finally, if your soil does not meet the minimum criteria for infiltration some alternative design features or alternative rainwater management systems may be useful. Some of these are described at the end of this NebGuide.

### Preparation

After the size and location have been selected, preparations can be made to build your rain garden. Building a rain garden requires moving soil by hand (shovel and rake) or with a small backhoe. If you are doing the work by hand be sure your health and strength are adequate for the job. Consider inviting friends and family to assist to make the work easier and more fun. Before beginning, check that your proposed

location is not over a septic system or buried water line, or buried cable (electric power line, telephone line, TV cable line). Nebraska state law requires that Nebraska Digger's hotline be contacted (dial 811, the nationwide number, or 1-800-331-5666 in Nebraska) to verify utility locations 48 hours prior to digging. Be sure to call and have all utilities marked before digging in your yard. In addition, assess the site context and conditions to better determine plant materials selection. Sun and shade (morning or afternoon), wind, proximity to winter salt applications, etc. should all be noted.

### Layout

Create an outline of your proposed shape using a rope, string, marking paint or flexible garden hose. Be sure the area within the shape is approximately the design size. Odd shapes like crescent or kidney shapes can be subdivided into approximate squares, rectangles, triangles or half circles to measure and compute the area. The berm (a relatively short, gently-sloped mound of soil) of your rain garden will be constructed on the downhill and outside of the area (i. e. outside the string outline — see *Figure 1*). The width of the berm is dependent on site slope and garden size. Finally, note where runoff will flow into the rain garden. This needs to be on the uphill side. Ideally, water will flow to the garden naturally. If not, consider creating a shallow swale or channel to encourage water from the downspout to enter the rain garden properly.

### Moving Soil

The tools you will need are listed in the side bar. Soil moving can be done with a small backhoe, but some hand shoveling and leveling will be needed for finishing. If you use a backhoe be sure your backhoe operator is qualified and experienced. If your proposed rain garden location is in an existing turf area, the first step is removing sod. Use a sod cutter or shovel to remove sod and all roots from the area outlined. Leave sod in areas where berms will be built. Sod may be used elsewhere, composted or discarded. Do not use the sod for filling or berming around the rain garden. In addition, do not attempt to remove sod by rototilling (unless

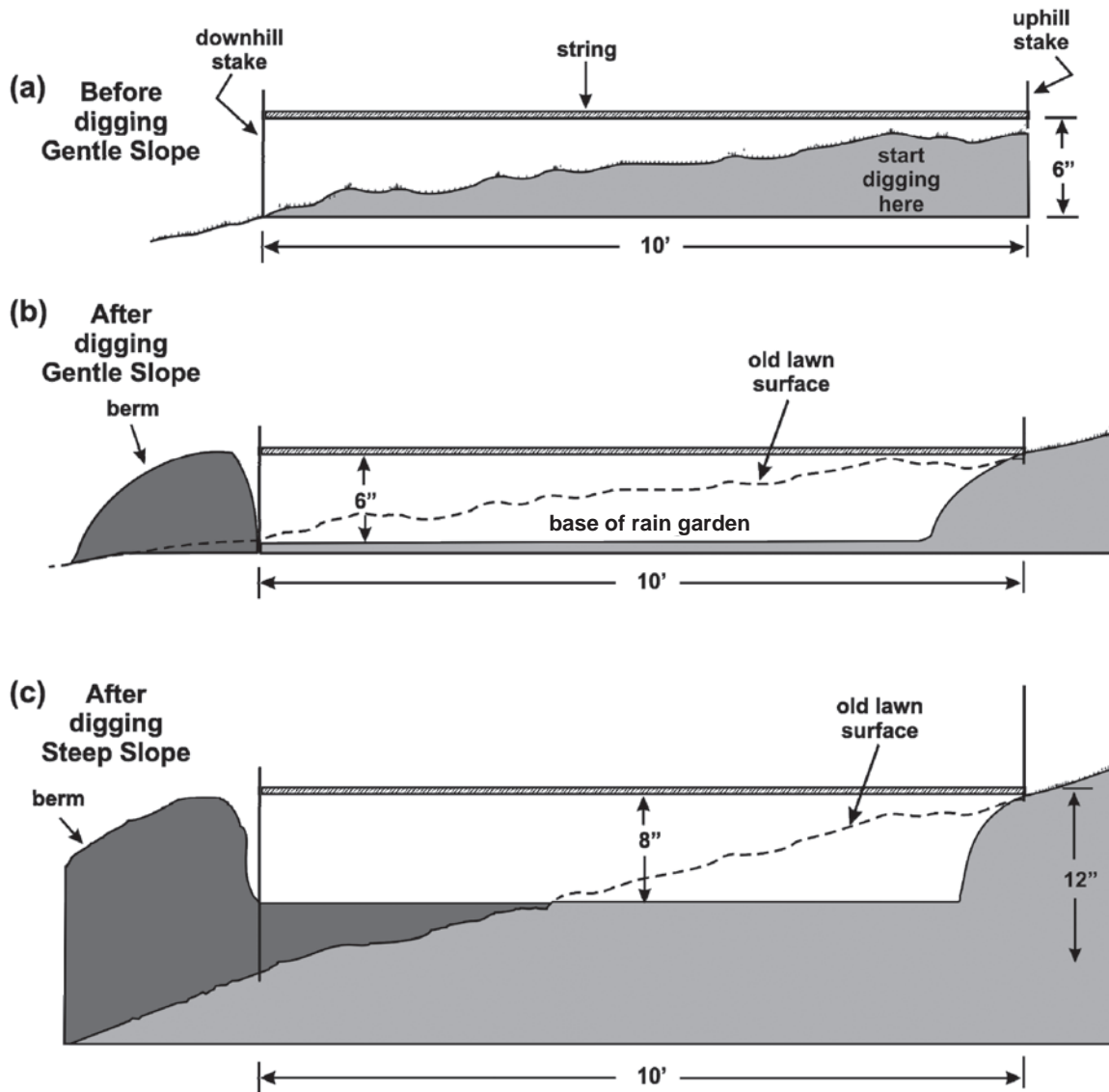


Figure 1. Rain garden cross section for gentle slope (a and b) and steep slope (c). Set string level and move in 5-foot increments along length of garden to aid digging to proper depth. (Adapted from *Rain Gardens: A how-to manual for homeowners*. UWEX Publication GWQ037)

sod is already dead); remnant pieces of sod can reintroduce turfgrass into the rain garden. An example of the amount of soil to be moved and size of berm to be constructed is illustrated in *Figure 1*, for both a shallow sloped and steeper lawn. Use these figures as guides for construction.

Use a level string to measure the depth to the base (*Figure 1*). Divide the garden into 5-foot-wide sections and dig these independently, moving the string as needed. Start digging at the uphill point and move soil downhill to level the base and build the berm. The steeper the slope the more soil will need to be moved downhill to create a level surface and to create the berm. In some cases additional soil may be need to be brought in to construct an adequate berm.

The finished base of the rain garden should be level and at the depth determined by your design. Use a 2x4 to smooth out the bottom. Also, place the 2x4 across the bottom at various locations and angles, and using the carpenter level check the base to be sure it is level. Use a shovel or trowel to cut down high spots or fill low spots to create a level base. An unlevel

base might cause water to run to low spots and reduce the water infiltration benefits over the whole area.

The berm should be constructed with its height equal to the uphill top of the garden. A string with two stakes can be placed level to help establish the height (*Figure 1*). The top of the berm should be level as it encircles the garden. Use a carpenter's level or string level to check this.

Shape the berm to a ridge about a foot across at the top and as tall as required to effectively hold water in the garden. The sideslopes should be gently sloping, especially on the outside slope. Berm sideslopes should ideally not exceed 25 percent (for turfgrass) or 33 percent (for mulched plantings); excessively steep berm slopes do not look visually appropriate and will be difficult to plant and maintain effectively. Then stomp on it or use a hand tamper to compact the soil. A well-compacted berm is important for the longevity of the rain garden. Keep in mind, however, that the berms also must support plant rooting and growth, so berms should be firm but not so hard that they lack pore space and conditions for healthy root growth. Add

additional soil layers if needed to increase the height. Compact all layers and be sure the berm creates a bath tub-like rim around three sides of the rain garden on the downhill side. The berm should be protected from erosion with a mulch, straw mat or geo-fabric mulch and ultimately planted to turf or other plants, depending on the garden design.

Before your base is leveled consider adding compost to the soil and aerating the soil. Organic compost is a great additive to the soil to increase infiltration and improve growing conditions. If you add 2 inches of compost (depth across entire base), dig the base about 2 inches deeper to allow for this additional volume. Also, aerating soil by tilling with a rototiller will increase soil volume, so dig the base deeper depending on depth of aeration.

#### Tools needed for building your rain garden:

- Tape measure
- Stout string or rope (layout)
- Leather workgloves
- Shovel and rakes
- Hand trowel
- Carpenter level (4-foot preferred)
- String level
- Wood stakes, at least 2 feet long
- String
- Hand tamping device
- 2x4 board approximately 6 feet long (optional)
- Small backhoe with caterpillar

## Planting

Select plants that will thrive in your rain garden. G1759, *Plant Selection for Rain Gardens in Nebraska*, provides planting tips and a list of potential plant selections for Nebraska. Native species are preferred as they are usually more adapted to the local climate and soil. Lay out the plantings according to the design guidelines listed in G1758, *Rain Garden Design for Homeowners*, following suggestions for grouping form and color. Draw out a plan on paper before starting to plant. Adjust plant location based on suggested spacing.

Using plugs or potted plants provides a jump start to your rain garden. Purchase healthy stock with a well-established root system. Avoid using root bound plants. Slice through any encircled roots on the outside surface of the rootball prior to planting to help encourage establishment of new roots in a spreading pattern. Transplant according to instructions for the plant or as suggested by the nursery. Dig a hole about twice the width of the root mass, and deep enough to bury roots, leaving the plant's root crown at or slightly above (1/2-3/4 inch) the finished soil surface. If bare root plants are used, dig the hole deep and wide enough to comfortably spread the root mass without folds or bends. Lightly tamp around plants as you refill the hole; applying water from the bottom up will also help to settle the soil around the root mass. Add mulch to the surface 2 to 3 inches deep to retain soil moisture, minimize weed growth, enhance soil

quality, minimize swings in soil temperature, and protect young plants; however, avoid mounding mulch around the crown of the plant.

Organic mulch should be used for maximum plant and soil benefits. Since organic mulch will break down over time, it will need to be occasionally replenished. Do not use straw as the mulch because it attracts mice. Instead use a bark or other wood-based mulch. It is best to use shredded bark or tree branch mulch rather than chips. Chips will tend to float when the rain garden is full. Shredded mulch will interweave and resist floating.

Water transplants well when planted and add at least 1 inch of water per week — in two waterings — unless adequate rainfall occurs. Do not let plants get drought stressed in the first year or two. Once plants have established root systems adequate rainfall should provide sufficient moisture. However, watering may be needed if rainfall does not occur.

Weed control (hand picking) will help growth in the first year or two. Be sure you know the desired plants from the weeds. Herbicide use is not recommended for rain gardens. Be careful with herbicide applied to adjacent landscape areas to prevent it from washing into your rain garden.

## Maintenance

Weeding is especially important in the first one to two years until plants are well established. After that mature plants will out compete most weed species. After the growing season stems and seed heads can be left for the winter to attract birds, as wildlife cover, and to provide winter interest. In the spring remove last year's plant growth to about 6 to 8 inches above the ground. Hand cut thick stemmed species. Use a string trimmer or shears for other plants. Compost or dispose of cuttings and debris rather than leaving them in the garden.

If plants become too thick burning may be an option. Burning removes old material and invigorates plant growth. This is especially true for native prairie species. Be sure to check local fire laws, get a permit, and inform your neighbors that you plan to burn. You don't want an unexpected visit from the fire department. An alternative to burning is mowing. Do this only if your mower deck can be raised to 6 inches or higher, if driving across the garden will not compact the soil, and if you can navigate safely over berms. If burning or mowing are not an option hand clippers and a string trimmer will be adequate.

Finally, check after a rain to see if standing water occurs longer than one or two days. Water standing too long may hurt or kill plants and is a sign the rain garden is not functioning properly. If this is a problem, one solution is to dig a small opening in the berm to allow drainage. Fill this opening with gravel to allow drainage through the berm, and leave it for a year or two to see if the problem disappears. If not, redigging and releveling a portion of the garden may help. If you do this consider amending soil with compost in the wet area to improve infiltration.

## Alternatives for Heavy Clay Soil

A minimum soil infiltration rate of 0.25 inches per hour is needed to create an effective rain garden. G1758, *Rain Garden Design for Homeowners*, describes how to estimate whether your soil meets this limit. Many recently developed neighborhoods, especially in Eastern Nebraska, have had their topsoil removed and the current soil surface is high in clay, and may not be acceptable for a rain garden. Below are a few alternative ideas if your soil is not acceptable.

### Deep Aeration

Plant root penetration and ongoing root regeneration will improve infiltration, and a deep rooting system can help rebuild soil structure. Poor and compacted soils in residential landscapes, however, often are lacking in the quality to support even the toughest of native and adapted plants. Aerating or digging the soil 2 to 4 feet deep can loosen soil and significantly increase infiltration. Traditional homeowner garden equipment, such as a garden rototiller, typically will not dig this deep, so larger more specialized equipment may be required. Alternatively, the area may be “double dug” — a procedure using a garden shovel that digs/moves/mixes soils a “shovel-depth” layer at a time until the desired depth is reached. In all cases, be sure the area is clear of all utilities prior to construction.

### Soil Amendment

In addition to physically loosening the soil, soil amendments incorporated in combination with digging and tilling can significantly benefit soil infiltration. For example, a thorough mixture (by volume) of 50 percent sand, 30 percent organic compost and 20 percent excavated soil incorporated 6 inches deep in the rain garden bottom can enhance infiltration.\* Caution should be used when combining sand and clay soils; unless the sand percentage is relatively high, the mixture will function more like concrete than soil.

Whenever possible, minimize walking and equipment use in the garden to reduce soil compaction once the garden is planted. Garden shapes and sizes that allow reachable weeding and maintenance access from the edges will require less direct access.

---

\*Source for amended soil ratio formula above: Wayne Pedersen, Urban Conservationist, National Resources and Conservation Service, Iowa City, IA.

## Rain Barrels

A rain barrel collects rainwater directly from a downspout. Fifty-five gallon barrels are a typical size, and these can be linked together to increase storage. Rain barrels typically cannot contain as much water as a rain garden. Rain barrels can be used alone, or can supplement rain gardens by holding some water that can be released to the rain garden after a few days when the initial water has fully drained from the soil. Rain barrel water also can be used to water other flowers or garden plants. It is important that rain barrel openings be covered with screening to prevent mosquitoes from breeding in them if water stays in them for more than a few days.

### Drainage Systems

An underdrain system can be used with a rain garden to enhance drainage rates. These drainage systems consist of trenches in the ground below the surface of the garden, often 2 to 3 feet deep, with a drain pipe in the bottom that leads to a storm sewer or open drainage channel or ditch. The trench is back filled with gravel and encased with a geo-fabric to allow water to enter but prevent fine soil particles from filling the trench. Excess water in the rain garden will drain through this system, allowing for some additional infiltration, but most water passes through as drainage runoff.

### Summary

Rain garden installation is not inherently difficult, and can be an approachable, do-it-yourself homeowner project. The slope and soil characteristics of the yard, the required size of the garden, and the existing landscape uses combine to make each installation somewhat unique. The basic installation procedures are the same for all gardens. The keys to installation success are having a well-developed design, following it closely, adapting where necessary, and investing the time to effectively select and correctly plant the plants located in the garden.

### Additional Resources

Rain Gardens: A how-to manual for homeowners. University of Wisconsin-Extension. UWEX Publication GWQ037

UNL Extension publications are available online at <http://extension.unl.edu/publications>.

## Index: Water Management Water Quality

Issued August 2007

Extension is a Division of the Institute of Agriculture and Natural Resources at the University of Nebraska–Lincoln cooperating with the Counties and the United States Department of Agriculture.

University of Nebraska–Lincoln Extension educational programs abide with the nondiscrimination policies of the University of Nebraska–Lincoln and the United States Department of Agriculture.