

Rain Gardens



What is a rain garden?

Rain gardens are small vegetated depressions used to capture rainfall runoff from roofs, driveways, and sidewalks. Once rain is collected in a rain garden, it can slowly soak into the ground instead of running off the landscape. Rain gardens are planted with native grasses, wildflowers, trees, and shrubs, making them a beautiful addition to your landscape!

Why are rain gardens important?

As we increase the amount of land cover that is impervious, meaning any surface that does not allow water to soak into the ground (such as patios, driveways, roofs, and roads), this increases the amount of runoff that reaches our streams. This stormwater runoff is bad for water quality as it often contains pollutants like bacteria, trash, fertilizer, petroleum products, and sediment. Rain gardens combine plants with mulch and soil to filter pollutants from the runoff.

How to design and install a rain garden

Proper site selection, size, and plant choice are all important to the success of a rain garden. The following pages will assist you in designing, sizing and constructing a rain garden.

Rain Gardens

Rain gardens are best suited for well-drained sandy soils, but can be installed in areas with less permeable soils, such as clay. In Western North Carolina, where clay soils are more common, you can design the rain garden more as a constructed wetland.

Let the following steps guide you in designing, sizing, installing, and maintaining your rain garden. These steps are modified from the [North Carolina Cooperative Extension Backyard Rain Garden Manual](#). If you would like more information, this is a free publication and a great resource!



Advantages

- Can be integrated into existing site easily
- Can be large or small, dependent on drainage area (max drainage area is 1 acre)
- Provide an aesthetically pleasing amenity
- Used at sites where storm sewers are not available
- Can provide groundwater recharge

Disadvantages

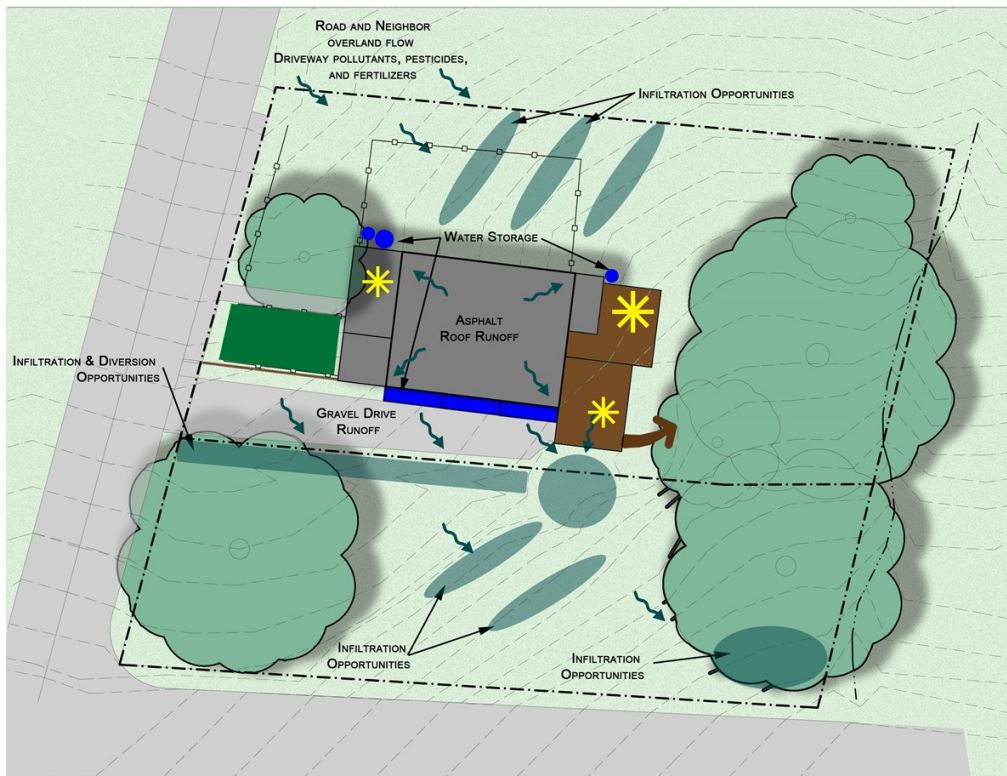
- Ponding water may take 24 to 48 hours to drain
- Some maintenance required (e.g. maintain plants, keep the basin clean, and clean out the overflow)
- Should not be used on lots with high sediment loading, especially clay deposits

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STEP ONE: LOCATE THE RAIN GARDEN

A site analysis of your property will help determine where the rain garden will be located.

- Take inventory of the impermeable surfaces such as driveways, sidewalks, patios, roofs and gutters.
- During a rain event, note where runoff is occurring on your property.



Important Design Considerations

- **Call 8-1-1 BEFORE you dig to locate any utilities!**
- Rain garden should not be within 10 feet of a building foundation.
- Locate at least 25 feet from septic tank or well head.
- Locate where the water table is at least 3 feet below the surface at the lowest point in the depression.

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Materials

- ☐ Post hole digger or shovel
- ☐ Water
- ☐ Ruler or yardstick



STEP TWO: DETERMINE DRAINAGE OF SOILS

Determining how the soil drains will help determine the type of plants that will grow well in the rain garden.

Dig a one-ft-deep hole in the potential rain garden location, then fill with water. Time how long it takes for the test pit to drain. If the site has an adequate drainage time (less than 4 days), dig 2-3 more one-ft-deep holes in that area to get an average drain time. It is good practice to conduct this test at each hole at least **twice**.

Use the table below to determine which type of rain garden is best for your site. The plant list at the end of this handout will guide you with plant selection.

Drainage Time	Appropriate Type of Rain Garden
< 12 hours	Quick Draining Rain Garden
12—72 hours	Standard Rain Garden
> 3 days	Wetland Garden

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STEP THREE: SIZE THE RAIN GARDEN

Materials

- Scaled map of property or use online GIS tool such as Google Earth

Rain gardens are designed to capture the first 1" of rainfall, which contains the majority of pollutants. To do this, the size of the rain garden should be at least 10% of the area draining to the rain garden. Rain gardens should be deep enough to pond 10 inches of rain-water on top of 3 inches of mulch. Use the equation below to determine the area of your rain garden.

Equation: **Area of Rain Garden = Area Draining to Rain Garden x 0.1**

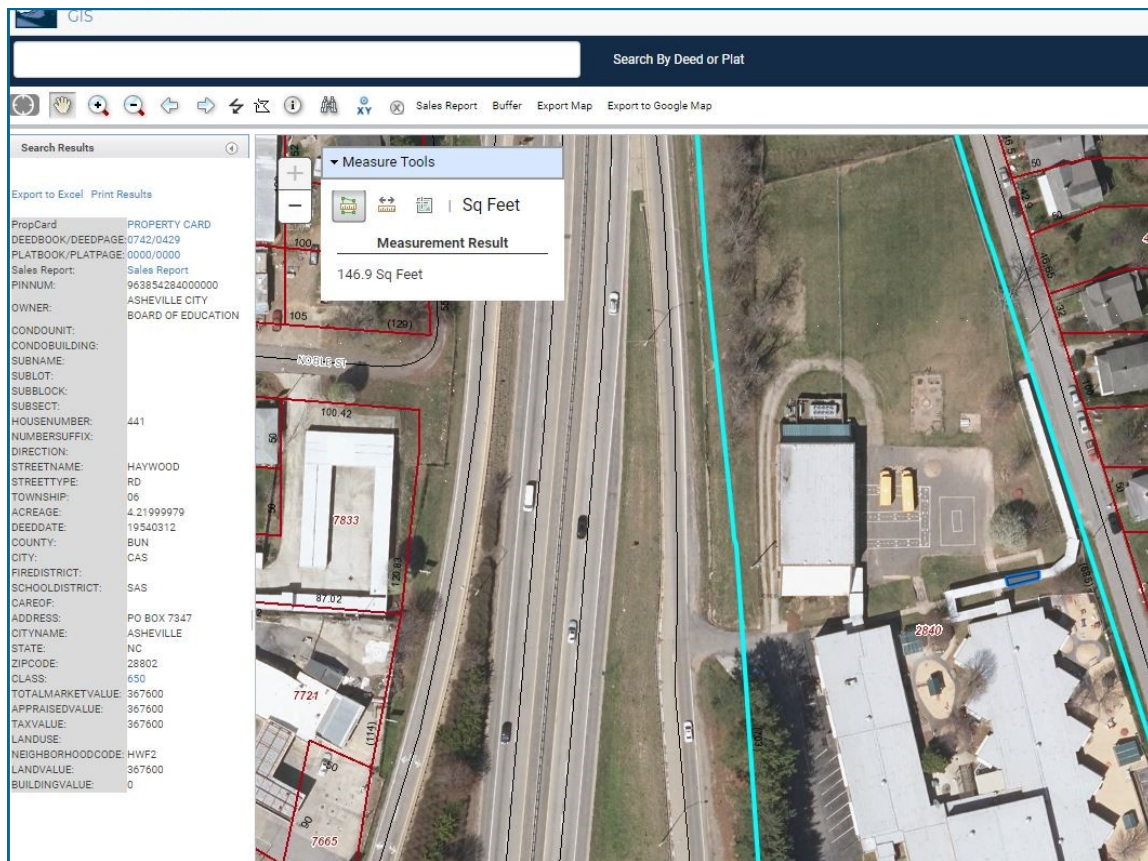
Example: A portion of a 60' x 60' roof (with 4 downspouts) and 500 ft² of driveway runs off to the rain garden location. You will direct one of the downspouts into the garden. What size should the rain garden be to adequately capture the runoff from a 1" storm?

Determine area of roof that will drain to rain garden: (60 ft x 60 ft) / 4 downspouts = 900 ft²

Determine total runoff area: 900 ft² + 500 ft² = 1400 ft²

Use the equation above: 1400 ft² x 0.1 = 140 ft²

An 11'X12' or 14'X10' garden design would be sufficient.



Area Measuring Tool on Buncombe County, NC GIS Website

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Materials

- ☐ Tape Measure
- ☐ Stakes and string
- ☐ Shovels and/or backhoe
- ☐ Rakes
- ☐ Pitchforks (optional)
- ☐ Trowels (optional)
- ☐ Tamper
- ☐ Wheelbarrow (very useful)
- ☐ Line level and/or straight edge
- ☐ Tarp

STEP FOUR: CONSTRUCT THE RAIN GARDEN

Once you have located where you will dig, mark off the boundaries using stakes and string, landscaping flags, spray paint, or any other method of your choice. Remember, before you dig **CALL 8-1-1**.

Remove any sod and save for later if you plan to use it for the berm and outlet. Then, remove the topsoil (if present) and set aside on a tarp in a separate pile. Continue digging to account for 10" ponding depth and 3" mulch (13" deep total). Finally, loosen the bottom 4-6" of soil and mix in the topsoil you saved earlier. This provides nutrients for the plants and improves drainage (which is what we want!).

Topsoil is the upper layer of soil that is usually darker in color and rich in nutrients. This layer is absent from many newer home sites where it is often removed during construction.



After digging the pool, it's time to form the berm and overflow outlet. A berm is a mound of soil at the back end of the garden that allows water to pool during storms greater than 1". Yours should be between 3" and 6" tall, compacted slightly just by the weight of your body and the tamper, and covered with mulch, plants, rocks, or the sod you saved earlier.

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An overflow outlet is a depression in the berm that allows water to flow out of the garden during extreme rain events, preventing the berm from collapsing. To determine an appropriate width for the outlet, use the area of the impervious surface(s) from which your rain garden receives stormwater runoff (see the table on the right). Outlets should be level, lower than the berm, and covered with sod or rocks. Alternatively, they can also be created with wood.

Impervious Surface Area (ft ²)	Outlet width (ft)
2000 or less	1.0
3000	1.5
4000	2.0
5000	2.5



Wooden outlet at Guilford Co. Cooperative Extension Office. Photo courtesy of NC Cooperative Extension Backyard Rain Garden Manual.



Rain Gardens



PLANT SELECTION

A complete list of plants native to Western North Carolina and suitable for rain gardens and wetlands can be found in [Appendix B: Plant Selection](#). This is your chance to make your rain garden or wetland your own. Here are some tips for selecting and placing plants:

- Place plants whose roots tolerate being under water toward the center of the rain garden.
- Place plants that are most drought resistant around the edges of the rain garden.
- After planting, cover everything with 3" of mulch.
- There should be no need to fertilize as excess nutrients will enter the rain garden from the stormwater. However, use your best judgment in this.

Maintenance

- During the first year, water once every 7-10 days without adequate rainfall (1") until plants are established.
- Weed as needed until plants become established, usually within the first year or two.
- Refresh mulch as needed, maintaining a 3" even layer.
- Prune plants as needed. Allow shrubs, grasses, and forbs to become full. Trim trees so that they do not shade out garden.



Plant List for Rain Gardens in Western North Carolina



<div><div></div><div></div></div>		Sun	Part Sun/Shade	Shade	Rain Garden- Quick Draining < 12 hours	Rain Garden- Standard 12-72 hours	Wetland > 3 days
Scientific Name	Common Name						
Perennials							
<i>Aruncus dioicus</i>	Eastern Goat's-beard						
<i>Asclepias incarnata</i>	Swamp Milkweed						
<i>Asclepias tuberosa</i>	Butterfly-weed						
<i>Baptisia australis</i>	Blue Wild Indigo						
<i>Chelone glabra</i>	White Turtlehead						
<i>Chrysogonum virginianum</i>	Virginia Green-and-gold						
<i>Eutrochium fistulosum</i>	Hollow-stem Joe-pye-weed						
<i>Eupatorium perfoliatum</i>	Boneset						
<i>Iris virginica</i>	Southern Blue Flag						
<i>Liatris spicata</i>	Blazing-star						
<i>Lobelia cardinalis</i>	Cardinal Flower						
<i>Lobelia siphilitica</i>	Great Blue Lobelia						
<i>Monarda sp.</i>	Bee balm						
<i>Osmundastrum cinnamomeum</i>	Cinnamon Fern						
<i>Rudbeckia fulgida</i>	Black-eyed Susan						
<i>Sagittaria latifolia</i>	Duck Potato						
<i>Solidago rugosa</i>	Wrinkle-leaf Goldenrod						
<i>Stokesia laevis</i>	Stokes Aster						
<i>Vernonia noveboracensis</i>	Ironweed						
<i>Xanthorrhiza simplicissima</i>	Yellowroot						
Shrubs							
<i>Aronia arbutifolia</i>	Red Chokeberry						
<i>Calycanthus floridus</i>	Sweet-shrub						
<i>Cephalanthus occidentalis</i>	Buttonbush						
<i>Ilex verticillata</i>	Winterberry						
<i>Itea virginica</i>	Virginia Sweetspire						
<i>Lindera benzoin</i>	Spicebush						
<i>Physocarpus opulifolius</i>	Eastern Ninebark						
<i>Rhododendron periclymenoides</i>	Pinxterbloom Azalea						
<i>Rhododendron viscosum</i>	Swamp Azalea						
<i>Rosa palustris</i>	Swamp Rose						
<i>Sambucus canadensis</i>	Elderberry						
<i>Spirea tomentosa</i>	Steeplebush						
<i>Vaccinium corymbosum</i>	Highbush Blueberry						
<i>Viburnum cassinoides</i>	Withe-rod						
<i>Viburnum nudum</i>	Possumhaw						
<i>Viburnum dentatum</i>	Arrow-wood						

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<div></div>		Sun	Part Sun/Shade	Shade	Rain Garden- Quick Draining < 12 hours	Rain Garden- Standard 12-72 hours	Wetland > 3 days
Scientific Name	Common Name						
Large Trees							
<i>Acer rubrum</i>	Red Maple						
<i>Aesculus flava</i>	Yellow Buckeye						
<i>Betula lenta</i>	Sweet Birch						
<i>Betula nigra</i>	River Birch						
<i>Halesia tetraptera</i>	Common Silverbell						
<i>Nyssa sylvatica</i>	Black Gum						
<i>Platanus occidentalis</i>	Sycamore						
<i>Taxodium distichum</i>	Bald-cypress						
<i>Tilia americana</i> var. <i>heterophylla</i>	Mountain Basswood						
Evergreen Trees							
<i>Ilex opaca</i>	American Holly						
<i>Magnolia virginiana</i>	Sweetbay Magnolia						



Clockwise from top left: Cardinal flower, buttonbush, bee-balm, swamp milkweed, blazing star, and beautybush