

## Rain Gardens

### What is a rain garden and how does it work?

Rain gardens, sometimes called bio-retention areas, are shallow depressions in the landscape that capture stormwater and allow it to gradually percolate into the soil. Planted with moisture-loving plants that help filter out pollutants, rain gardens provide an attractive way to reduce the impact of stormwater on the environment.

*Recently installed rain garden at the University of Delaware's Louise and David Roselle Center for the Arts.*



### What are the benefits of rain gardens?

- **Manages stormwater on site.** Rainwater is captured by a rain garden instead of flowing off-site, where it picks up pollutants on paved surfaces before flowing into storm drains and then into natural water bodies. Rain gardens reduce flooding and erosion associated with large amounts of stormwater entering streams during heavy rainfalls.
- **Helps recharge the water table.** By capturing water and allowing it to percolate into the soil, rain gardens help replenish local aquifers.
- **Filters out pollutants to reduce contamination of groundwater.** Ongoing research suggests that rain gardens can be quite effective at filtering out some of the most common pollutants in stormwater, including chemicals, metals, fertilizers, and pesticides. Charged soil particles can attract and absorb metals and chemicals; microorganisms decompose pathogens and organic litter; and plants can filter out and utilize the nitrogen and phosphorous contained in fertilizer runoff.

- **Delights the senses.** The diversity of plant textures, colors and fragrances possible in rain garden plantings can enhance the appearance of a home landscape. For more information about how people benefit from gardens, consult the fact sheet “Human Benefits of Green Spaces,” available at <http://www.ag.udel.edu/udbg/sl/humanwellness.html>.
- **Attracts wildlife.** Plantings that provide food, nectar and shelter for wildlife can help preserve biodiversity. For more information about maximizing the wildlife value of the landscape, consult the fact sheet “Supporting Biodiversity in the Garden,” available at <http://www.ag.udel.edu/udbg/sl/vegetation.html>

## Installing a Rain Garden

This section describes basic guidelines for rain garden construction. For more in-depth instructions, consult “Rain Gardens: A How-To Manual for Homeowners” from the University of Wisconsin-Extension, available online at <http://clean-water.uwex.edu/pubs/>

### Location

The best place for your rain garden is on gently sloping ground where stormwater drains off impermeable surfaces or turf grass, such as the downhill side of a patio, driveway, or lawn. You can also site it in a location 10–30 feet away from your building where flexible piping can be used to direct the flow of your downspouts. Do not locate a rain garden in a low spot on the property that drains poorly. Poorly drained areas may not support sufficient plant growth to function as a rain garden.

A rain garden must have level sides to effectively capture water; a flatter slope requires less digging. Slopes of 1-10% are ideal. Orient your rain garden so the long side is perpendicular to the slope—this will maximize the amount of runoff captured.

Building code requires any water retention device, including rain gardens, to be located at least 10 feet from any building as a guard against flooding. Also avoid building your rain garden over a septic system, or where the seasonally high water table is less than 2 feet from the surface. Any time you dig in your yard, you also need to confirm the location of underground utilities; in Delaware you can call Miss Utility at 1-800-282-8555.

Finally, try to locate your rain garden in an area that receives full to partial sun, as most plants that do well in rain gardens are sun-lovers. There is, however, a limited selection of rain garden plants that can tolerate shade.

### Size

The surface area of your rain garden will depend on the rain garden’s depth, the size of the area from which you are capturing runoff, and your soil type. Typically, rain gardens are roughly 10-20% the size of the source area; several smaller gardens may be used in lieu of one

big one. Even if you do not have enough space for rain gardens that treat all of your site's runoff, remember that every bit helps—a rain garden is 30% more effective at draining runoff than a turf area of the same size.

You can use the following equations to calculate the approximate surface area, where:

- **Runoff area** = surface area of the area that the runoff will be draining from; for example, the size of your rooftop, driveway, patio, or sloping lawn.
- **Depth of runoff** = average amount of rainfall in a storm. For most storm events in the Mid-Atlantic region, the rainfall is less than 2 inches.
- **Rain garden depth:** Recommendations for rain garden depth ranges from 3 inches to 12 inches. The deeper the rain garden, the smaller the required surface area required. Note that a larger slope will require deeper digging for the rain garden to be level.

$$\text{[Runoff area (ft}^2\text{) x depth of run off (inches)]} \div \text{rain garden depth (inches)} \\ = \text{rain garden area (ft}^2\text{)}$$

For example, if your 4-inch deep rain garden will treat up to 2 inches of rainfall that drains from the downspout of 10 x 25 ft. roof, your rain garden will need to be 125 ft<sup>2</sup>, or 10 x 12.5 ft:

$$\text{[125 ft}^2\text{ x 2 in]} / \text{4 in} = \text{125 ft}^2$$

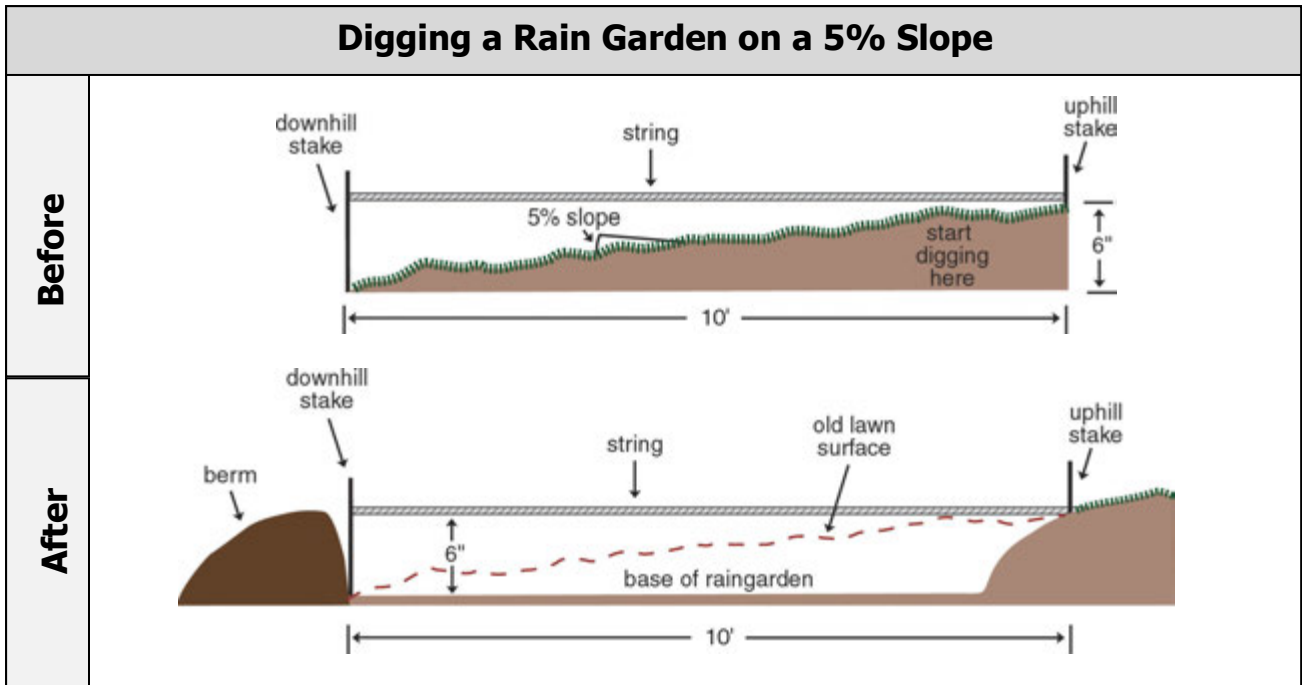
### Preparing the site

Site preparation depends largely on the soil type of your site. In sandy or well-draining loamy soil, you simply need to dig a level-bottomed depression with gently sloping sides. Use the excavated soil to build a berm around the garden, leaving an opening on the uphill side where runoff will enter. Two stakes with a level string tied between them can serve as a guide for creating a level-bottomed depression on sloped ground. Consult the drawings on the next page for more information about digging a rain garden.

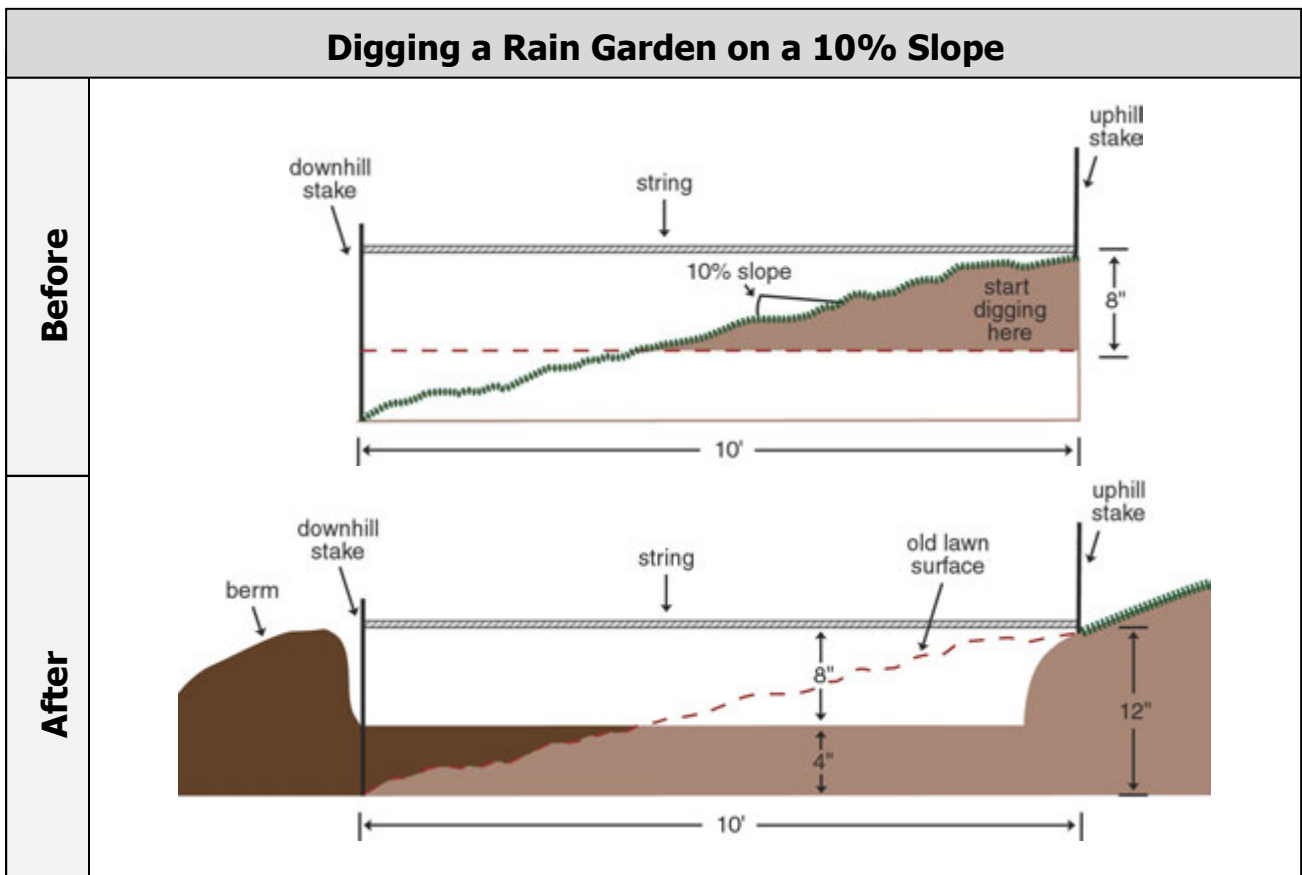
Clay soils or compacted, poorly draining soils often require more intensive excavation to be effective. Excavate or till to 3 or 4 feet, and fill partway with a layer of coarse gravel. Then, cover the gravel with a layer of permeable filter fabric, followed by sandy, free-draining soil and then a top layer of topsoil. Incorporating compost into the topsoil provides nutrients and added drainage capabilities. (For more information about compost, consult the fact sheet "Yard Waste and Composting," available at <http://ag.udel.edu/extension/horticulture/>).

As you would prepare any garden bed, perform a soil test and add nutrients as needed. Consult the *Sustainable Landscapes: Soils* page at <http://www.ag.udel.edu/udbg/sl/soils.html> for more information on sustainable soil practices.

## Digging a Rain Garden on a 5% Slope



## Digging a Rain Garden on a 10% Slope



Graphics courtesy of University of Wisconsin-Extension and the Wisconsin Department of Natural Resources, from "Rain Gardens: A How-to Manual for Home Owners," available at [http://clean-water.uwex.edu/pubs/pdf/home\\_rgmanual.pdf](http://clean-water.uwex.edu/pubs/pdf/home_rgmanual.pdf)

Sustainable Landscapes – <http://ag.udel.edu/udbg/sl> – <http://ag.udel.edu/extension>

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## Plants

Rain garden plants must be able to tolerate not only moisture, but also drought, as the rain garden is designed to drain water quickly. For this reason, many plants typical to wetland environments are not appropriate for a rain garden. Hardy herbaceous perennials are most commonly used, through a variety of shrubs and trees also perform well in rain garden conditions. For specific plant recommendations, consult the list at the end of this fact sheet.

## Maintenance

- **Mulching.** After planting, apply mulch at a depth of at least 2 inches to preserve soil moisture, suppress weeds, and reduce erosion. Shredded hardwood mulch is an effective, attractive option; be sure to avoid mulches that float (for example, pine bark). As your rain garden matures, maintain the protective layer of mulch, adding more as the lower layers decompose. Research has shown that over time, decomposing mulch helps maintain the pollutant-absorbing properties of the soil. Eventually, the plants may grow together and mulch will no longer be needed.
- **Watering.** Until the plants become established over the course of a few months, the garden will need to receive thorough watering at least twice a week by either rainfall or irrigation. More water may be needed in hot summer weather. With proper plant choice to fit your climate conditions, the garden will require no supplemental irrigation after the initial establishment period, except perhaps during extreme drought.
- **Weeding.** Control for weeds until good plant cover is established.
- **Pruning and other maintenance.** Prune shrubs to remove dead stems or rejuvenate plants such as red twig dogwood whose new growth is more desirable. Proper plant selection should limit the need for much pruning. In late winter/early spring (before new growth begins), perennial stems from the previous season can be cut within a few inches of the ground.

## Plants for a Delaware Rain Garden

### Herbaceous Perennials

|                                |                    |
|--------------------------------|--------------------|
| <i>Amsonia ciliata</i>         | downy blue star    |
| <i>Amsonia hubrechtii</i>      | Arkansas blue star |
| <i>Amsonia tabernaemontana</i> | blue star          |
| <i>Aquilegia canadense</i>     | columbine          |
| <i>Arisaema triphyllum</i>     | Jack-in-the-pulpit |
| <i>Asclepias incarnata</i>     | swamp milkweed     |
| <i>Aster novae-angliae,</i>    | New England aster  |
| <i>Aster novi-belgii</i>       | New York Aster     |
| <i>Athyrium filix-femina</i>   | lady fern          |



*Amsonia hubrechtii*



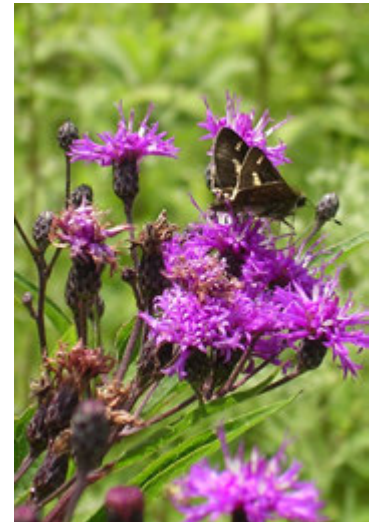
|                                    |                         |
|------------------------------------|-------------------------|
| <i>Baptisia australis</i>          | false indigo            |
| <i>Boltonia asteroides</i>         | boltonia                |
| <i>Caltha palustris</i>            | marsh marigold          |
| <i>Campanula divaricata</i>        | southern harebell       |
| <i>Carex stipata</i>               | tussock sedge           |
| <i>Chasmanthium latifolium</i>     | sea oats                |
| <i>Chelone glabra</i>              | white turtlehead        |
| <i>Chelone lyonii</i>              | pink turtlehead         |
| <i>Cimicifuga racemosa</i>         | black snakeroot         |
| <i>Convallaria majalis</i>         | lily-of-the-valley      |
| <i>Eupatorium maculatum</i>        | Joe-pye weed            |
| <i>Gillenia trifoliata</i>         | Bowman's root           |
| <i>Helianthus angulstifolius</i>   | swamp sunflower         |
| <i>Hibiscus moscheutos</i>         | marsh mallow            |
| <i>Iris cristata</i>               | dwarf crested iris      |
| <i>Kosteletskyia virginica</i>     | seashore mallow         |
| <i>Lobelia cardinalis</i>          | cardinal flower         |
| <i>Lobelia siphilitica</i>         | blue lobelia            |
| <i>Meehania cordata</i>            | Meehan's mint           |
| <i>Monarda didyma</i>              | Oswego tea, beebalm     |
| <i>Muhlenbergia capillaris</i>     | muhly grass             |
| <i>Osmunda regalis</i>             | royal fern              |
| <i>Osmunda cinnamomea</i>          | cinnamon fern           |
| <i>Panicum virgatum</i>            | switchgrass             |
| <i>Persicaria virginiana</i>       | tovara                  |
| <i>Phlox paniculata</i>            | garden phlox            |
| <i>Physostegia virginiana</i>      | obedient plant          |
| <i>Rudbeckia fulgida</i>           | black-eyed Susan        |
| <i>Rudbeckia laciniata</i>         | green-headed coneflower |
| <i>Solidago rugosa</i>             | goldenrod               |
| <i>Sorghastrum nutans</i>          | Indian grass            |
| <i>Spartina pectinata</i>          | cord grass              |
| <i>Spiranthes cernua</i>           | nodding lady's tresses  |
| <i>Stylophorum diphyllum</i>       | celandine poppy         |
| <i>Tradescantia x andersoniana</i> | Virginia spiderwort     |
| <i>Veratrum viride</i>             | Indian poke             |
| <i>Vernonia noveboracensis</i>     | common ironweed         |
| <i>Veronicastrum virginicum</i>    | Culver's root           |



*Hibiscus moscheutos*



*Lobelia cardinalis*



*Vernonia noveboracensis*

## Trees

|                                |                   |
|--------------------------------|-------------------|
| <i>Amelanchier laevis</i>      | shadbush          |
| <i>Asimina triloba</i>         | pawpaw            |
| <i>Betula nigra</i>            | river birch       |
| <i>Diospyros virginiana</i>    | persimmon         |
| <i>Liquidambar styraciflua</i> | sweet gum         |
| <i>Magnolia virginiana</i>     | sweetbay magnolia |



*Magnolia virginiana*

## Shrubs

|                                  |                     |
|----------------------------------|---------------------|
| <i>Cephalanthus occidentalis</i> | buttonbush          |
| <i>Clethra alnifolia</i>         | sweet pepperbush    |
| <i>Cornus amomum</i>             | silky dogwood       |
| <i>Cornus sanguinea</i>          | bloodtwig dogwood   |
| <i>Fothergilla gardenii</i>      | dwarf fothergilla   |
| <i>Ilex glabra</i>               | inkberry holly      |
| <i>Ilex verticillata</i>         | winterberry holly   |
| <i>Itea virginica</i>            | Virginia sweetspire |
| <i>Lindera benzoin</i>           | spicebush           |
| <i>Sambucus canadensis</i>       | American elderberry |
| <i>Viburnum dentatum</i>         | arrowwood           |



*Itea virginica*

## Additional Resources

Designing Rain Gardens (Bio-Retention Areas)

[www.bae.ncsu.edu/stormwater/PublicationFiles/DesigningRainGardens2001.pdf](http://www.bae.ncsu.edu/stormwater/PublicationFiles/DesigningRainGardens2001.pdf)

Rain Gardens

<http://www.apporiver.org/projects/PastProjects/RainGardenborchure.pdf>

Rain Gardens: A How-to Manual for Homeowners

<http://clean-water.uwex.edu/pubs/pdf/home.rgmanual.pdf>

Rainscapes: Harvesting the Heavens

<http://www.montgomerycountymd.gov/Content/DEP/Rainscapes/pdf/harvesting.pdf>

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## Bibliography

Sustainable Landscapes – <http://ag.udel.edu/udbg/sl> – <http://ag.udel.edu/extension>

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