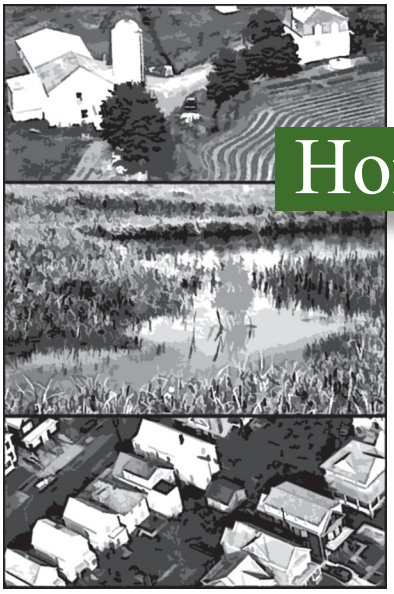
HENV-205

University of Kentucky
College of Agriculture, Food and Environment
Cooperative Extension Service



Home & Environment

Residential Rain Gardens

Design, Construction, and Maintenance

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In this Publication

Why rain gardens?

Stormwater runoff carries pollutants such as fertilizers, oil, animal waste, and dirt to local streams, lakes, and ponds and may contribute to flooding during heavy rainfall events, putting added stress on the receiving bodies of water and their ecosystems. Excess discharge impacts streams by causing erosion, destroying habitat, and deforming natural channel flow. Utilizing storage devices such as cisterns or rain barrels will minimize stormwater volume leaving your property. Contaminants discharged to streams can cause illness, impair ecological health, and increase water treatment costs.

What is a rain garden?

Rain gardens are manmade landscape features that include a shallow (6–9 inches deep) depression designed to capture and reduce stormwater runoff. By installing a rain garden homeowners can intercept stormwater and keep it on their property, allowing it to soak into the soil rather than moving to a nearby ditch or stream. Rain gardens are particularly important in urban areas because developed land (pavement, buildings, and compacted soils) increases stormwater runoff. Rain gardens are one of several stormwater management practices that homeowners can use to reduce their property's negative impact on water quality and flooding.

Is a rain garden right for me?

Nearly any residential landscape will accommodate a rain garden. The goal is to intercept water from the source before it reaches a storm drain or water body. Sources of runoff might include impervious surfaces such as your roof, sidewalk, or driveway; discharge from downspouts; or rain water that naturally flows or is

Why Have a Rain Garden?

- Increases infiltration which recharges groundwater
- Easy to maintain
- Provides food and shelter for birds, desirable insects, and other wildlife
- Beautiful addition to your landscape
- Improves water quality

Call before you dig

Before excavating any holes in the selected site, know where the utilities are buried. Call Kentucky 811 (1-800-752-6000) at least three days before you plan to excavate. It's the law.

mechanically diverted from uphill locations. Remember that the size and shape of the garden as well as the plantings can be tailored to the location and the amount of water you want to capture.

Key questions to ask myself

- **Can a rain garden be integrated into the overall landscape design?** Rain gardens are temporary catchments so they may be periodically wet or dry. You will want to keep this in mind as you consider a location. They also need to be positioned so that water will flow easily into the rain garden and, in the case of larger storms (rainfall >1 in), overflow into the lawn or other area without causing damage or erosion.
- **Will rain garden plants fit into the landscaping scheme?** Locations with full sun will be best, but with proper plant selection partial sun locations can work as well. Rain garden plants need to be able to tolerate alternating wet and dry conditions. A variety of plants are suitable for rain gardens, and you should consider how these plants will coordinate with the existing landscape.
- **How much will it cost?** The cost will be a function of the size, complexity of the draining and overflow system, and type of plantings, but in general a small residential rain garden will cost from $2 to $5 per square foot if you build it yourself.
- **How much space do I need?** For the average residential lot, impervious surfaces total around 2,400 square feet. A typical residential rain garden that captures about 25 percent of the runoff from a typical lot will be no larger than 60 square feet (e.g. 6 ft x 10 ft). To promote water quality, the goal is to capture the first half to one inch of a precipitation event within the rain garden.
- **How long does it take to build a rain garden?** Once you have selected the appropriate site, evaluated the soils, and designed your rain garden, a small garden (50 to 60 ft^2) can typically be constructed in a day or two.
- **Do rain gardens attract mosquitoes?** If the rain garden is working properly, mosquitoes will not be an issue. The rain garden discussed in this manual is designed to drain water in at least three days. A mosquito's life cycle includes four distinct life stages and ranges from four days to one month. The first three stages of the mosquito's life cycle require standing water.

How do I begin?

- Survey and sketch your property, house, and yard noting any structures, paved surfaces, locations of downspouts, etc. (Figure 1). The next time it rains, grab your galoshes and umbrella and take a stroll around the yard. Note where water infiltrates (soaks into the ground), where water runoff occurs, where water flows, and where water ponds or collects. Then note where water leaves your property. Is it flowing to a street or storm drain? Is it flowing to a creek or pond? Make a sketch of what you discovered.

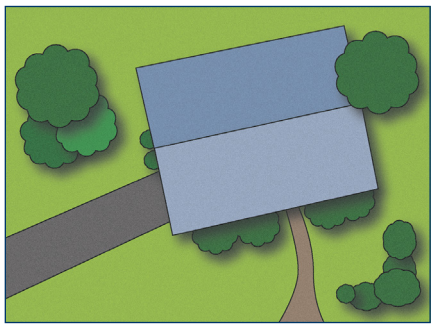


Figure 1. Property sketch.

- Pick the location. Ideally, your rain garden will be located where runoff from various sources in your yard converges. When assessing your yard, identify two or three potential locations and mark them on your map. Make sure that there is a place for the rain garden to overflow into the yard. If you are considering a location in the vicinity of an eroded area or low area, install the rain garden uphill of these areas. While rain gardens can be adapted to shaded areas, preference should be given to sites that receive partial to full sunlight.
- Do not install a rain garden within 10 feet of your home or other structure, within 25 feet of a septic tank, or within 10 feet of a wellhead, and avoid areas uphill of these structures. Also avoid installing the rain garden within the drip line of trees. If you are planning any construction around your home, it is important to postpone your rain garden installation until construction is complete. Sediment washing from construction areas may cause your rain garden to become clogged.
- Perform a percolation test. A percolation test will tell you how fast water infiltrates the soil or how long it will take for your garden to drain. This test is a necessary preliminary step. Dig three holes 12 inches deep within the proposed rain garden location. Locate the holes so they are representative of the area of interest. Fill the

Site Selection Tips

- Sunny location preferred
- Just above areas where water converges
- Away from buildings, septic tanks, water wells, trees, and utitilities
- Avoid poorly drained soils
- Upslope of eroded areas and ponded areas

holes with water and let them drain completely. This step will wet the soil in the vicinity of the hole. Refill the holes again and determine the time it takes for the holes to drain.

- Results from the percolation test will indicate if the site selected is compatible for a rain garden. Quick draining rain gardens are those that drain in less than 12 hours; standard rain gardens drain in 12 to 36 hours. If the site is poorly drained (takes >36 hours to drain), it is recommended that you consider an alternative location. Using poorly drained soils for a rain garden will result in extended periods of standing water. These conditions are not tolerated by many rain garden plants and may lead to the proliferation of mosquitoes and other undesirable insects. For a rain garden to be installed in poorly drained soils, the area will need to be modified to include a subsurface drain, which will increase installation time and cost.

How do I design my rain garden?

The size of the rain garden will depend on the amount of stormwater runoff that flows to the selected location. The amount of runoff is estimated based on the total area of the watershed draining to your garden. By watershed we mean all the components that contribute runoff water, including the impervious surfaces (buildings, sidewalks, and driveways) and pervious surfaces (lawn, gardens, and flower beds).

From your sketch identify the structures and other impervious surfaces that will contribute stormwater runoff to your garden. Using a tape measure or other measuring device, determine the area of each of these components. For roof areas measure the footprint or base of the buildings. Remember if you have downspouts directed to your garden, you will need to adjust the roof area calculation to account for the portion of your roof that drains to the downspouts.

Example: If you have four downspouts and only one of them will drain to your garden, you will need to account for one quarter of the roof area (Figure 2). Enter your measurements on the rain garden worksheet (see Appendix).

Calculate the pervious area that contributes to your rain garden. Consider dividing the drainage area into simple shapes such as rectangles and triangles to calculate the total area. While most of the rainwater falling on yards and flowers beds will penetrate into the ground, we estimate that a small portion (10%) will runoff and enter the garden during heavy rain events. Enter your pervious surface measurements onto the worksheet and calculate your total pervious surface area. Multiply the result by 0.1 to determine the adjusted pervious surface area (see Appendix for an example using this calculation).

> Total watershed area = Total impervious surface area + Adjusted pervious surface area

Now select the ponding depth for your rain garden. This is the maximum depth of the water in your rain garden when completely full.

Rule of Thumb: For most residential rain gardens, we recommend a 3-inch ponding depth.

> Rain garden size (3-inch depth) = Total watershed area/10

If you are limited on space you may need to construct a deeper garden in order to effectively capture the stormwater "first flush." In this case, divide the total watershed area by 20 to determine the area needed for a

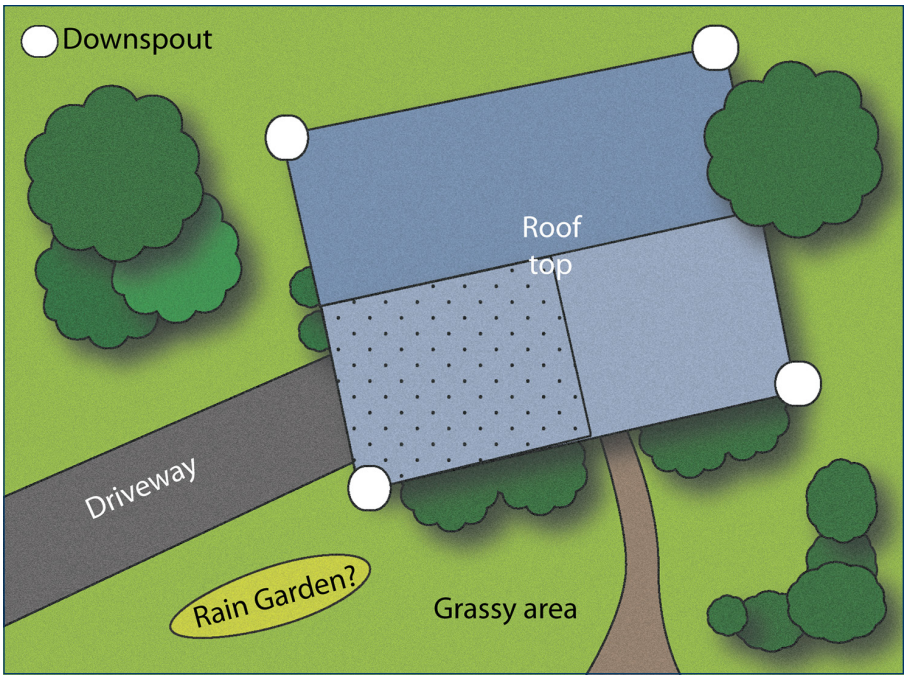


Figure 2. Sizing the rain garden.

garden with a 6-inch ponding depth. Some suggested rain garden dimensions are provided in Table 1.

Note that the ponding depth is the total number of inches of water that the rain garden will hold before it overflows (Figure 3) and is less than the excavation depth, which is addressed in the construction portion of this publication.

How do I construct my rain garden?

Your rain garden shape and style will depend on personal preference and your existing landscaping. Rain gardens can be designed as formal gardens with straight lines and symmetrical plantings or as informal gardens that have sweeping lines and more natural, asymmetric plantings. They can be integrated into or alongside existing flowerbeds or developed as a feature that stands alone.

Table 1. Suggested rain garden dimensions

Impermeable Surface Area	Required Size of Rain Garden	Potential Rain Garden Dimensions (ftxft)
3" ponding depth		
600 ft^2	60 ft^2	5X12. 6X10, 8X8
800 ft^2	80 ft^2	7X12, 8X10, 9X9
1000 ft^2	100 ft^2	7X15, 10X10
1200 ft^2	120 ft^2	6X20, 8X15, 10X12
1400 ft^2	140 ft^2	10X14, 12X12
1600 ft^2	160 ft^2	10X16, 12X13, 13X13
1800 ft^2	180 ft^2	10X18, 13X14
2000 ft^2	200 ft^2	10X20, 14x15
2500 ft^2	250 ft^2	10X25, 13X20, 16X16
3000 ft^2	300 ft^2	10X30, 17X18
6" ponding depth		
800 ft^2	40 ft^2	4X10, 5X8, 6X7
1000 ft^2	50 ft^2	5X10, 6X8
1200 ft^2	60 ft^2	4X15, 5X12, 6X10, 8X8
1400 ft^2	70 ft^2	5X14, 7X10
1600 ft^2	80 ft^2	7X12, 8X10, 9X9
1800 ft^2	90 ft^2	6X15, 7X13, 8X12, 9X10
2000 ft^2	100 ft^2	7X15, 10X10
2500 ft^2	125 ft^2	8X16, 10X13
3000 ft^2	150 ft^2	10X15, 12X13

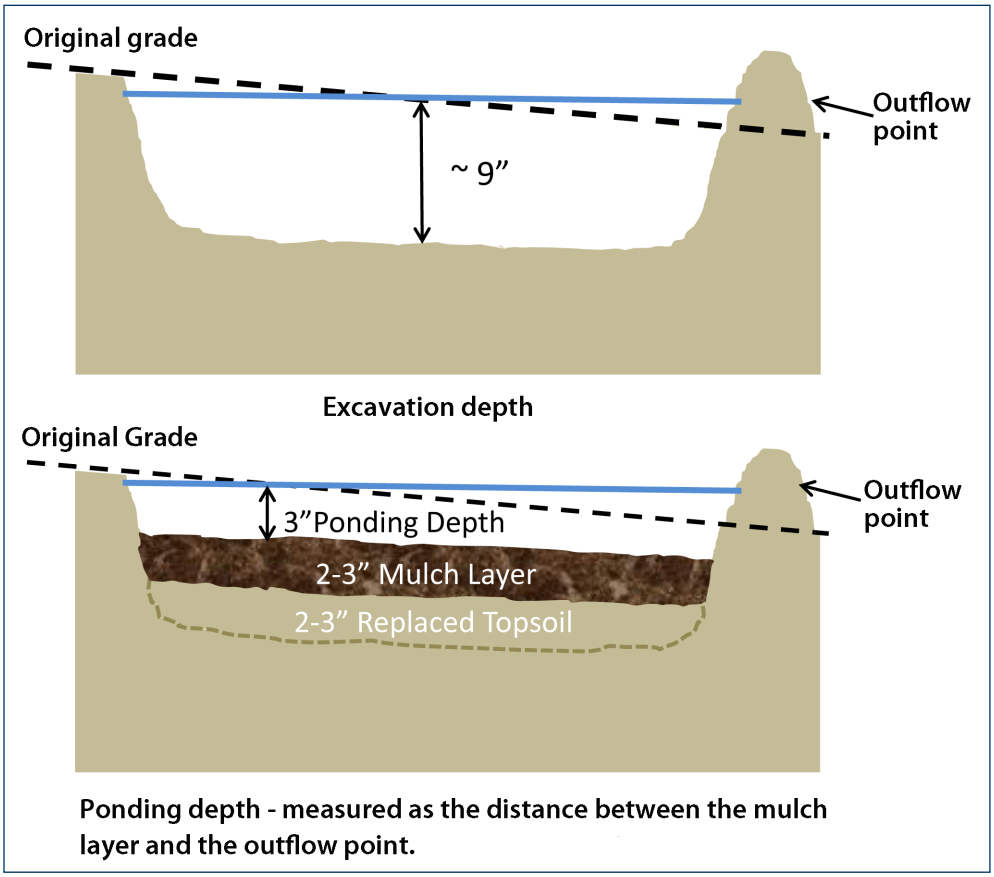


Figure 3. Excavation vs. ponding depth.

Once you have determined your landscaping needs, mark out the calculated area of your rain garden using a hose, flags, or string and stakes. Pay attention to where the water will flow into the garden (inflow area) and where it will flow out (outflow area). If possible, position your garden with the long axis perpendicular to the slope so that your garden captures as much water as possible.

The major components of a rain garden include the inflow area, basin or bowl, berm (if required), weir, and overflow area (Figure 4).

Installing a rain garden will require some digging, sod removal, and moving and packing of soil. While a rototiller, backhoe, or other mechanical device will make the job easier, most residential rain gardens can be installed using common yard implements. Some suggested supplies and materials include:

- Shovels
- Rakes
- Stakes
- Tape measure
- String
- Leveling device (e.g. level, sight level, line level)
- Heavy object or tamper
- Wheelbarrow
- Trowel
- Tarp
- Backhoe or tiller (optional)
- Mulch
- Erosion control fabric or straw
- Rocks or stones

First, call Kentucky 811 to check for buried utilities. Then remove the sod layer and topsoil and store them on a tarp (Figure 5). The sod can be re-applied to stabilize the berm or edges of the garden at the end of construction; the removed top soil is the best medium for plant growth and should be re-applied to the basin floor. After removing the sod and topsoil, excavate the garden to the desired depth, working and turning the soil to improve infiltration (Figure 6).

Excavation depth = ponding depth + topsoil and turf removed + mulch layer

Remove any large rocks, roots, or other debris. If the soil is heavily compacted, use a rototiller to work the soil as deeply as possible. The basin floor should be near level, but a slight depression in the center of the garden is allowed.

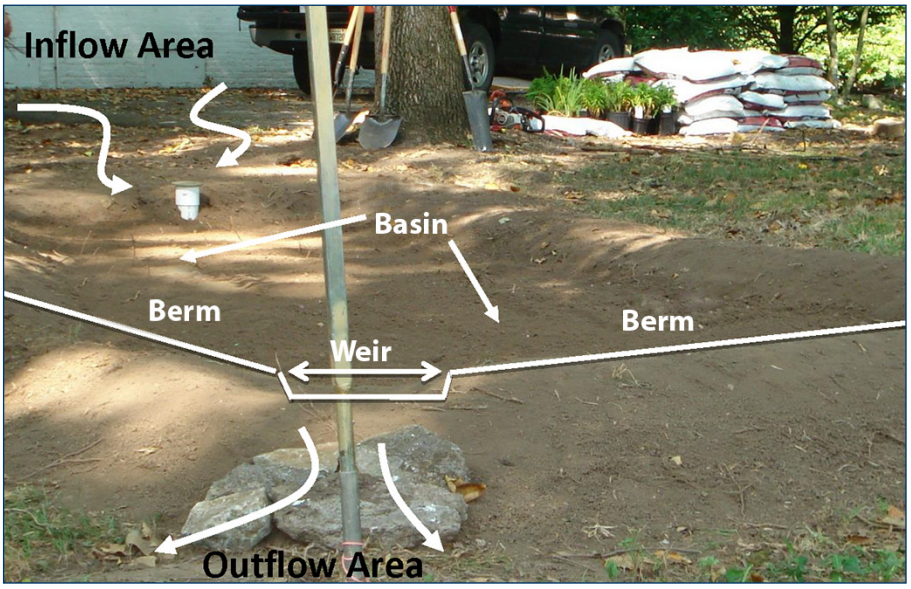


Figure 4. Components of a rain garden. Location: Garden Club of Kentucky, Paris, Kentucky. Photo by authors.

Use the removed soil to build a berm around the downslope side of the garden. The berm will help retain the stormwater in the rain garden, giving it more time to be absorbed by the soil. As you build the berm, compact it with your tamper or heavy object to stabilize the soil. Once the berm is the appropriate height (just above your designed ponding depth), cut a 12-inch-wide weir to an elevation of the desired ponding depth (3 or 6 in, depending on design) at the point where water will exit the garden. The

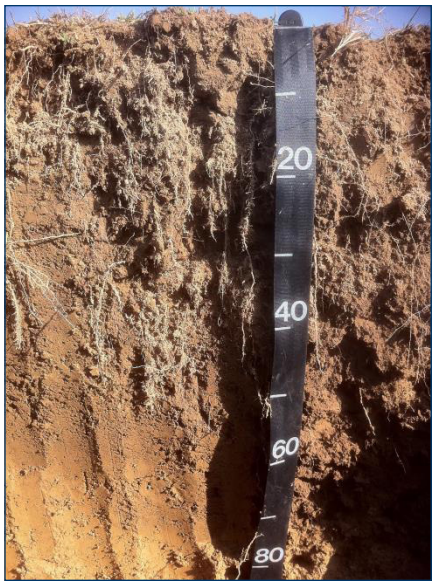


Figure 5. Photo showing difference between topsoil and subsoil. Note that the topsoil is above 50 cm and the subsoil is below 50 cm. Photo by authors.

Think of the berm and weir as a dam and a spillway. In a lake, water should never overflow the dam. Water should only overflow in the spillway where engineers have reinforced the area to handle the excess water. Similarly, in a rain garden water should never overflow the berm; it should always move over the weir where you have armored the soil to stop erosion.

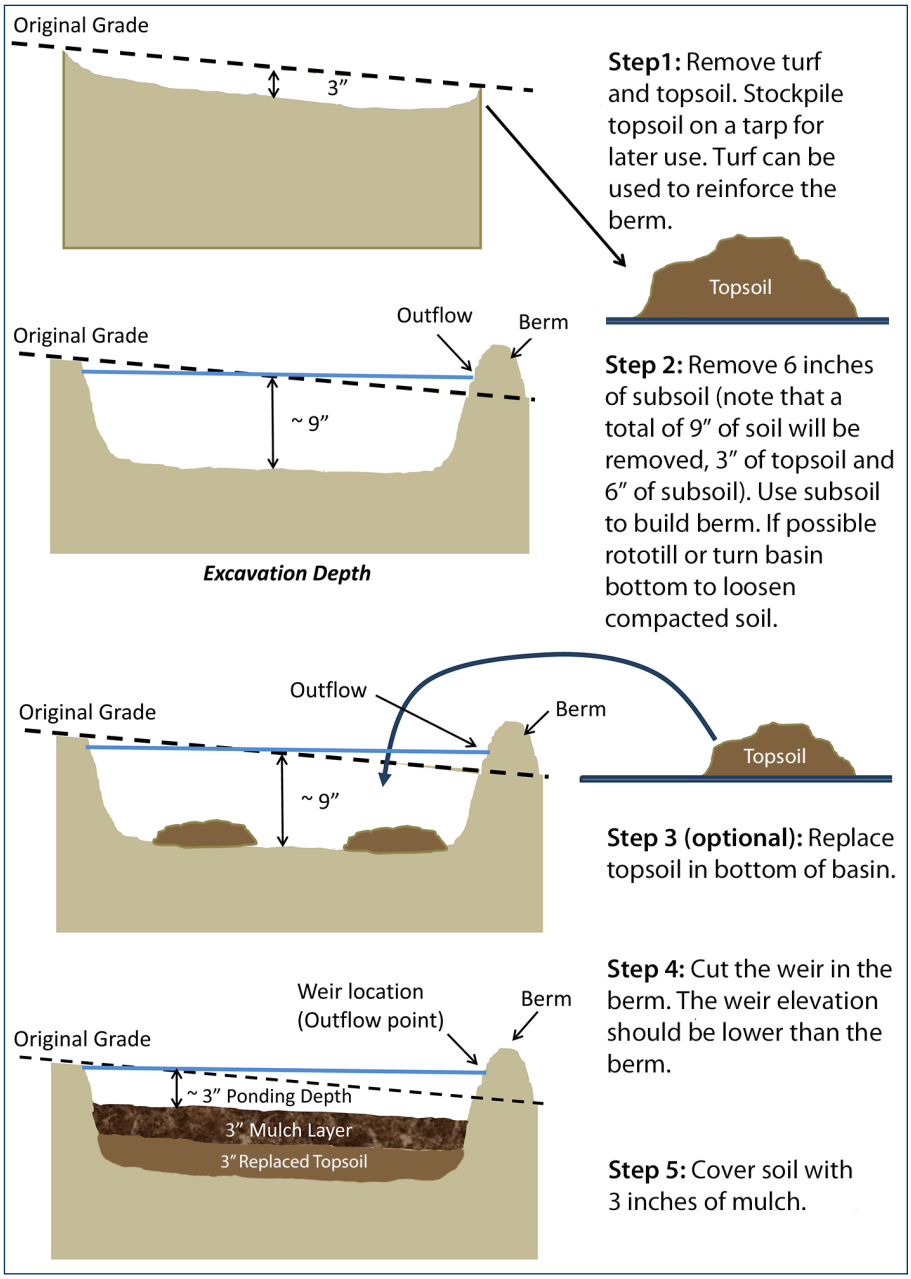


Figure 6. Steps in excavating a rain garden.

weir is at a lower elevation in the berm and is designed to allow water to move out of the basin without causing berm erosion. Compact the soil until the weir is a few inches below the berm. The weir height is critical. Use your line-level to confirm that the weir is just below the inflow point. This will allow water to flow out of the rain garden without cresting the berm. If water overflows the unfortified part of the berm it will degrade the berm's integrity (Figure 7).

The berm should be covered with erosion control fabric or straw and seeded and/or planted with appropriate plants (such as grasses). The downslope side of the weir should be armored with erosion control fabric or rock to prevent erosion (Figure 8). Planting grass on the berm provides erosion control for the berm and further filtration of pollutants.

Plants to Avoid

- Trees
- Plants requiring heavy fertilization
- Plants that are subject to root rot
- Plants that don't like wet soils
- Plants with aggressive root systems
- Invasive exotics or aggressive natives

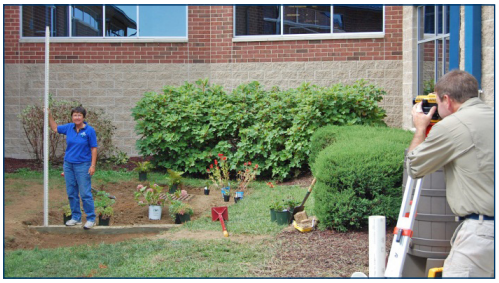
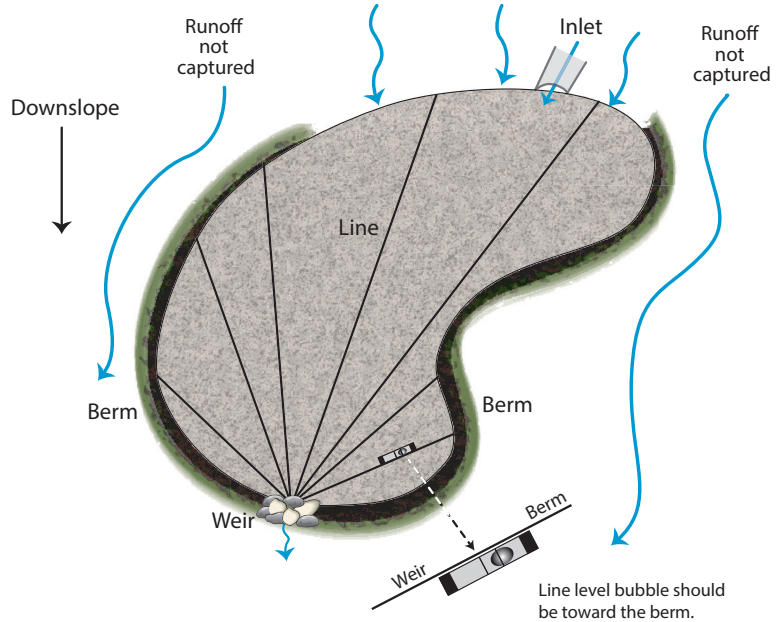


Figure 7. Anchor one end of line flat on the weir and check elevation of all upslope rain garden borders. Weir should be lowest elevation. When using a line level, the bubble should always move away from the weir.



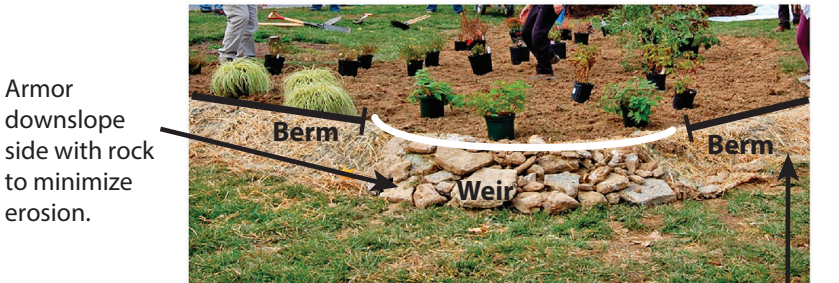


Figure 8. Berm and weir stabilization. Photos by authors (Boone and Calloway counties).

What kind of plants should I use?

Rain garden plants provide a beautiful addition to the landscape and provide food and shelter for birds, desirable insects, and other wildlife. In addition to their aesthetic appeal, they play an important role in improving water quality because they uptake excess nutrients and some heavy metals and aid in soil stabilization, which reduces erosion. They also enhance infiltration of rainwater which recharges ground water.

When sketching your planting design consider the growing conditions of your garden, such as sunlight and drainage, and select plants that are compatible with these conditions. In general, sunny locations receive greater than or equal to 6 hours of direct sunlight per day. Plants that require less water may be placed on the berm or drier areas of the garden; those with greater water needs will thrive on the garden floor. Consider native species because they are adapted to our climate, usually require less maintenance and fertilizer, and are more sustainable. A list of preferred rain garden plants is provided in Table 2.

Table 2. Rain garden plants

Scientific Name	Plant Name	Plant Characteristics		Growing Conditions					
		Height	Spread	Light Range			Moisture Range		
		Feet/Inch	Feet/Inch	Full Sun	Part Sun/Shade	Full Shade	Dry	Moderate	Wet
Ferns									
Dryopteris intermedia	Marginal Wood Fern	2-3 '			✓	✓		✓	✓
Onoclea sensibilis	Sensitive Fern	3-4 '			✓	✓		✓	
Osmunda cinnamomea	Cinnamon Fern	2-5 '			✓	✓		✓	✓
Flowers									
Asclepias incarnata	Swamp Milkweed*	4-5'		✓	✓				✓
Aquilegia canadensis	Eastern Red Columbine	2-3'		✓	✓			✓	
Aster novae-angliae	New England Aster	1.5-2'		✓	✓		✓	✓	
Baptisia alba	White Indigo	2-4'		✓			✓	✓	
Baptisia australis	False Indigo	2-4'		✓			✓	✓	
Chelone glabra	White Turtlehead	2-4'		✓	✓		✓	✓	
Coreopsis rosea	Pink Coreopsis	10-20"		✓	✓		✓	✓	✓
Coreopsis tripteris	Tall Tickseed	2-8'		✓			✓	✓	
Dicentra eximia	Wild Bleeding Heart	1-1.5'			✓			✓	
Echinacea purpurea	Purple Coneflower	2-5'		✓	✓		✓	✓	
Eupatorium coelestinum	Mistflower*	1.5-3'		✓	✓			✓	
Eupatorium purpureum	Joe Pye Weed	6-8'		✓			✓	✓	✓
Heliopsis helianthoides	Oxeye daisy*	3-6'		✓			✓	✓	
Hemerocallis hybrids	Daylily	1-3'		✓			✓	✓	✓
Hypericum prolificum	St. Johns Wort	1-5'		✓	✓			✓	
Iris versicolor	Blueflag Iris	2-2.5'		✓	✓		✓	✓	✓
Liatris spicata	Dense Blazing Star	1-3'		✓			✓		
Lobelia cardinalis	Cardinal Flower	up to 3'		✓	✓			✓	✓
Lobelia siphilitica	Great Blue Lobelia	2-3'		✓	✓			✓	✓
Mertensia virginica	Virginia bluebells	1.5-2'			✓	✓		✓	
Monarda didyma	Bee Balm*	1-4'		✓	✓			✓	✓
Monarda spp.	Monarda – Jacob Cline*	up to 4'		✓	✓		✓	✓	
Penstemon digitalis	White Beardtongue	3-5'		✓			✓	✓	
Phlox subulata	Moss Pinks	4-6'		✓				✓	
Physostegia virginiana	Obedient Plant *	3-4'		✓				✓	
Polemonium reptans	Creeping Jacob's Ladder	1.1.5'		✓	✓			✓	
Rudbeckia hirta	Black Eyed Susan	2-6'		✓	✓		✓	✓	✓
Rudbeckia laciniata	Green-headed Coneflower	2-9'		✓	✓			✓	
Sedum 'Autumn Fire'	Autumn Fire Sedum	up to 2'		✓			✓		
Solidago rugosa	Goldenrod*	up to 4'		✓			✓	✓	✓
Tradescantia virginiana	Spiderwort	1.5-3'			✓	✓		✓	
Vernonia noveboracensis	Ironweed*	up to 6'		✓				✓	✓

Table 2. Rain garden plants *(continued)*

Scientific Name	Plant Name	Plant Characteristics		Growing Conditions					
		Height	Spread	Light Range			Moisture Range		
		Feet/Inch	Feet/Inch	Full Sun	Part Sun/Shade	Full Shade	Dry	Moderate	Wet
Grasses, Rushes, and Sedges									
Acorus gramineus	Sweetflag	8-10″	6-12″	✓	✓	✓	✓	✓	✓
Andropogon gerardii	Big Bluestem	6-8′	2-3′	✓	✓		✓	✓	
Carex vulpinoidea	Fox Sedge	1-3′	0.5-2′	✓	✓				✓
Juncus effusus	Soft Rush	2-4′	2-4′	✓				✓	✓
Juncus effusus 'Spiralis'	Corkscrew Rush	1-1.5′	1-1.5′	✓	✓		✓	✓	
Muhlenbergia capillaris	Muhly Grass	3-4′	3′	✓			✓		
Panicum virgatum	Switch Grass	3-4′	3-4′	✓	✓		✓	✓	
Schizachyrium scoparium	Little Bluestem	2-4′	1.5-2′	✓			✓	✓	
Shrubs									
Aesculus parviflora	Bottlebrush Buckeye	8-12′	8-15′		✓	✓		✓	
Aronia arbutifolia	Red Chokeberry	6-10′	6-10′	✓	✓			✓	
Aronia melanocarpa	Black Chokeberry	3-6′	3-6′	✓	✓			✓	
Callicarpa americana	American Beautyberry	3-6′	3-6′	✓	✓			✓	
Cephalanthus occidentalis	Buttonbush	5-12′	4-8′	✓	✓			✓	✓
Clethra alnifolia	Summer Sweet Clethra	3-8′	4-6′	✓	✓			✓	✓
Cornus sericea	Redosier Dogwood	6-9′	7-10′	✓	✓			✓	✓
Hydrangea arborescens	Wild Hydrangea	3-5′	3-5′		✓			✓	
Hydrangea quercifolia	Oakleaf Hydrangea	6-8′	6-8′	✓	✓			✓	
Ilex glabra	Inkberry	5-8′	5-8′	✓	✓			✓	✓
Ilex verticillata	Winterberry	3-12′	3-12′	✓	✓			✓	✓
Itea virginica	Sweetspire	3-5′	3-5′	✓	✓			✓	✓
Morella cerifera	Wax Myrtle	4-6′	4-6′	✓	✓			✓	✓
Physocarpus opulifolius	Ninebark	5-8′	4-6′	✓	✓		✓	✓	
Vaccinium spp.	Blueberries**	4-6′	4-8′	✓	✓			✓	✓
Viburnum dentatum	Arrowwood Viburnum	6-10′	6-10″	✓	✓			✓	
Viburnum nudum	Possumhaw	5-12′	5-12′	✓	✓			✓	✓

Dry - quick draining rain garden or planted on the berm.
Moderate - standard rain garden
Wet - areas with prolonged wetness

Note: Spread not indicated for flowers

*Can be aggressive
**Requires acid soils

Sources for plant data include:
Missouri Botanical Garden: http://www.missouribotanicalgarden.org/
USDA Plants Database: http://plants.usda.gov/java/factSheet

How do I plant my rain garden?

One of the keys to plant success is proper planting technique. After arranging your plants in the garden, dig a hole for each plant that is at least twice the width of the root ball or container. A wide hole breaks up the surrounding soil and provides a habitat where roots can more easily grow. The hole should be at the same depth as the root ball. If the hole is too deep, it will need to be backfilled before planting. If the crown of the plant or base of the stem is submerged, the plant will often fail to thrive. Gently remove the plants from their containers by tapping or squeezing the sides of the pot and trimming roots that protrude from the base of the pot. Do not get into a tug of war between the plant and container when removing the plant. If necessary, cut or break the pot. Once removed from the pot, gently loosen the root ball by spreading the roots horizontally away from the root ball. On woody species (shrubs) cut through the ball vertically in several places to prevent girdling (circling) roots which may eventually result in plant death (Figures 9a and 9b).

9a. Gently remove the plant from the pot.

9b. Spread roots horizontally away from the root ball.

Figure 9 a, b. Proper planting technique. Photos by authors (Woodford County).

How do I care for my plants?

Water

Once the plants are in the ground, water them immediately. By watering the plants after putting them in the ground, soil will be in better contact with roots, allowing plants the ability to draw nutrients and water from the soil. Until rain gardens are established, your plants may need supplemental watering during times of infrequent rain. Apply at least 1 inch of water per week during the growing season (approximately mid-March through October) in the absence of rain. An inch of water wets the soil to a depth of 6 to 8 inches, satisfies most plants for about a week, and encourages deep root growth, which will eventually be a safeguard during periodic drought. In times of extremely hot weather it may be necessary to make two or more applications of water per week on newly installed plants.

Fertilizer

Your rain garden will require little to no fertilizer over the life cycle of the plants. Fertilizer should never be applied to the bowl of the rain garden and should be applied sparingly to the berm and bank of the garden if grass growth is poor or difficult to establish. A general rule of thumb is to apply no more than one pound of nitrogen per 1,000 square feet per growing season; additions of phosphorous (P) and potassium (K) are rarely required in Kentucky landscapes and should be added only when recommended based on soil test analysis .

Mulch

After planting, cover the basin floor with about 2 to 3 inches of mulch. Do not over-mulch. When applying mulch, leave about 2-3 inches between the base of the plant and the mulch so that water can move freely to the plant roots and the base of the plant can dry out between irrigations/rains. Shredded hardwood is the best mulch because it forms an interlocking matrix on the basin of the garden. Bark type mulches tend to float, as do cypress mulches. Hardwood mulches that have been partially composted or aged are preferred (Figure 10). Beware of mulches that are sour, usually resulting from being piled (either loose or in bags) for long periods of time. Mulches exuding an earthy smell are preferred to those that smell like vinegar.

What kind of maintenance is required?

After the first few rains, monitor your rain garden to ensure that water does not pool in the garden for more than two days of dry weather. Pooling water for extended periods during dry weather can provide a nesting area for pests such as mosquitoes. If pooling does occur, you may need to lower the weir or deter some of the inflow to bypass the rain garden. Once there is no extended pooling in the garden beyond three days, maintenance is as easy as weeding and other typical garden care.

Figure 10. Shredded hardwood mulch.

Weeding

Most weeds will be controlled or limited by the mulch. Remove small weeds by hand and large, poisonous, or invasive weeds with weed wipes. Weed wipes are wicks infused with contact herbicides and can be applied locally to problem plants. Do not use pre-emergent products; they breakdown slower, may contaminate groundwater below your rain garden, and can stop your plants from regenerating by seed and filling in the rain garden.

Pruning

Shrubs should be pruned in late winter or spring depending on when the species flowers. For those that flower in the spring, wait until after flowering to prune, otherwise you will be removing most of the flower buds when you prune. Those that bloom in summer can be pruned earlier (later winter) when they are dormant because they will produce flowers on the new growth.

Several shrubs benefit from rejuvenation pruning. Each spring about one third of the oldest main stems are removed to encourage new growth. Species such as redosier dogwood have colorful bark on their stems which fades over time so rejuvenation pruning helps keep them attractive.

Most perennial plants die back during fall and winter. This growth should be removed before new growth is produced. When you do this is up to you; however, the dead growth can provide winter appeal to the rain garden and provide food and habitat to wildlife, so delaying pruning until late winter/early spring may be desirable. It is, however, important not to allow the new growth to become intermixed with the old, which will make pruning out the old growth tedious if not impossible.

Replacement

As the rain garden ages, some renovation will be necessary. Perennials will spread and become crowded and will benefit from being lifted and divided. The best time for this activity is spring for those perennials that bloom in summer or fall; divide and replant spring-blooming perennials in the fall.

Rain gardens may become wetter (hold water longer between rains) over time due to building up of sediments in the basin. Lifting plants will help, but if the basin stays too wet it may interfere with growth of some plants. You can remove plants and dig out part of the basin or move plants higher onto the berm area.

For more information about rain gardens and environmental issues around your home, visit the See Blue Go Green website at http://www.ca.uky.edu/gogreen/, or contact your county Cooperative Extension agent.

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Appendix

Rain Garden Worksheet

In this exercise you will be assessing an area to determine the size of a rain garden. As part of this exercise you will:

1) Define watershed elements;

2) Measure permeable and impermeable surfaces;

3) Calculate the size of your rain garden.

Defining Watershed Elements

Structures (buildings and paved areas) are **impervious surfaces** because they limit or deter water from penetrating into the ground.

Within the area delineated for your rain garden, what impervious surfaces do you have?

☐ Home Roof ☐ Garage Roof ☐ Sidewalk ☐ Driveway ☐ Patio

Other: _____

If you have any buildings with downspouts, determine how many downspouts will drain to your garden from each building. Number of downspouts = _____

Grassy areas, flower beds, gardens, etc. are **pervious surfaces** because they allow water to penetrate into the ground. Within the area delineated for your rain garden, what pervious surfaces do you have?

_____

_____

Determining Watershed Surface Area

A. What portion of the selected impervious surfaces is located within your delineated watershed? Determine the area of each of the structures identified above. Hint: To approximate roof area, measure the base of the building.

	Name	Length(ft)	Width (ft)	Area (ft^2)
1				
2				
3				
4				
5				
6				
7				

Total Area of Impervious Surfaces: _____

B. Measure the area of all the pervious surfaces. Note that you might need to use different shapes to better estimate the area (ex. square, rectangle, right triangle, etc.)

	Name	Length(ft)	Width (ft)	Area (ft^2)
1				
2				
3				
4				
5				
6				

Total Area of Pervious Surfaces:_____

While most rainwater hitting the pervious area will penetrate, we estimate that 10% of the total permeable area may contribute runoff to the rain garden during heavy rain events. To calculate the Total Adjusted Pervious Surface Area multiply the Total Area of Pervious Surfaces by 0.10.

Total Adjusted Pervious Surface Area: _____

C. Determine the area of the watershed. This is the sum of the total area of impervious surfaces plus the adjusted pervious surface area.

Total Watershed Area =_____

Calculating Rain Garden Size

For most residential rain gardens, we recommend a **3" ponding depth**, which is the depth of your rain garden at full pool. However, if you have limited space, a 6" ponding depth may be appropriate. (Both calculations are shown below.)

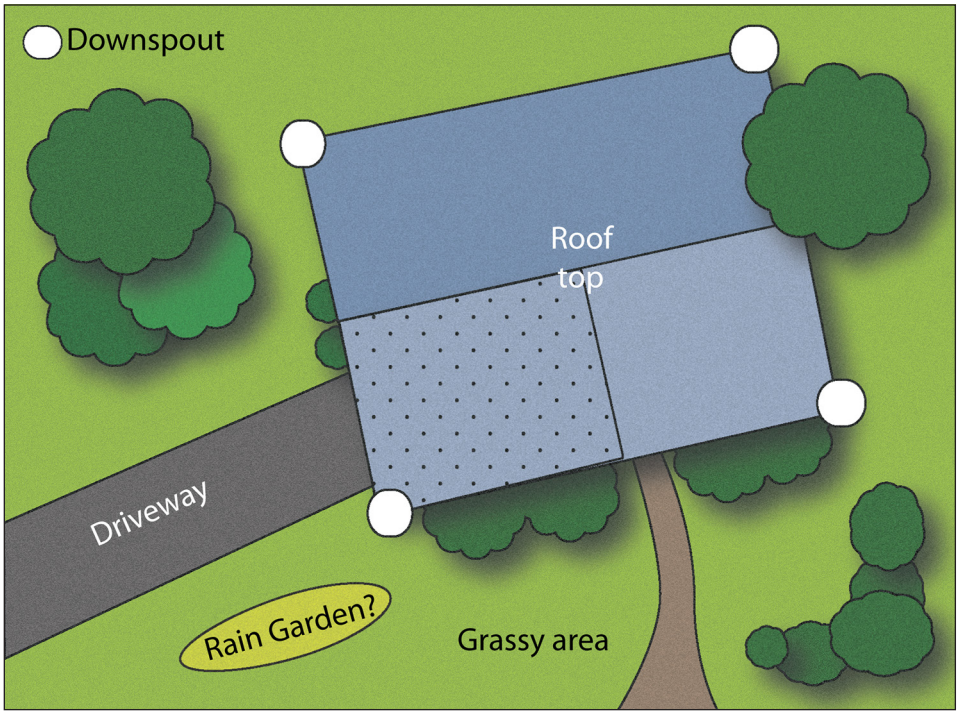
D. Calculate the size of the rain garden using one of the following formulas:

3" Ponding depth - recommended	6" Ponding Depth
Total Watershed Area/10	Total Watershed Area/20

Rain Garden Size = _____

E. Use **Table 1** (page 4) to determine the dimensions of your rain garden and enter below:

_____



Sample Calculation

The homeowner is ready to size her rain garden (see proposed site in the drawing above). The rooftop for her house is 40 ft by 50 ft and has 4 downspouts.

- Approximately 10 ft by 20 ft of driveway will also drain to the rain garden.
- The grassed area slopes toward the street in all directions (grassed area contribution to rain garden 8′ x 15′).

If the homeowner prefers rain garden at the southwest corner of the house with a ponding depth of 3 inches, what size should the rain garden be?

To estimate the total watershed area use the following equation:

Total Watershed Area = Total Impervious Surface Area + Adjusted Pervious Surface Area

Total Watershed Area =

House area = $\frac{40 \times 50}{4} = 500 ft^2$

Driveway area = 20 x 10 = $200 ft^2$

10% Grassed area = 0.1 x 8 x15 = $12 ft^2$

TOTAL AREA = 500 + 200 + 12 = 712 ft^2

To calculate the rain garden size (with a ponding dept of 3 inches) use the following equation:

Rain Garden Size (3 inch ponding depth) = Total Watershed Area/10

Rain Garden Size = 712 ft^2/10 = 71.2 ft^2 or approximately 70 ft^2