



RAIN GARDENS

Rain gardens are small, landscaped depressions that are filled with a mix of native soil and compost, and are planted with trees, shrubs and other garden-like vegetation. They are designed to temporarily store storm water runoff from rooftops, driveways, patios and other areas around your home while reducing runoff rates and pollutant loads in your local watershed. A rain garden can be a beautiful and functional addition to your landscape.



LOCATION

- Rain gardens should be located to receive the maximum amount of storm water runoff from impervious surfaces, and where downspouts or driveway runoff can enter garden flowing away from the home.
- Swales, berms, or downspout extensions may be helpful to route runoff to the rain garden.
- Locate at least 10 feet from foundations, not within the public right of way, away from utility lines, not over septic fields, and not near a steep bluff edge. Call Missouri One Call before you dig to locate the utility lines on your property.
- Rain gardens on steep slopes (>10% or 10:1) may require an alternative design with terracing.

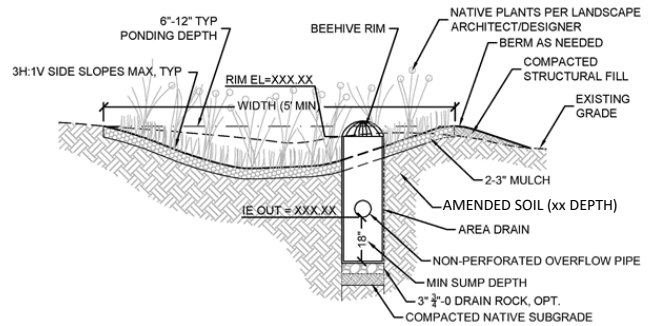
DESIGN

- The size of the rain garden will vary depending on the impervious surface draining to it and the depth of the amended soils. Use the table to determine the required surface area. A good rule of thumb is that the rain garden should be about twice as long (perpendicular to the slope) as it is wide.
- **Ponding Depth / Berm.** The rain garden ponding depth (settling basin) is determined by the slope of the lawn. For up to 4% slopes, construct a 4-inch-deep rain garden ponding depth. For a maximum 5% (20:1) slope, construct a 6-inch-deep rain garden ponding depth. A maximum ponding depth of 6 inches is allowed within rain gardens. On average, rain gardens drain within a day, which will not create a mosquito problem. A berm is not required when the lawn slope is flat ($\leq 2\%$ or 50:1). The berms shall have side slopes no steeper than a 33% or 3:1 (H:V).
- **Entrance.** Design the rain garden entrance to immediately intercept stones, dense hardy vegetation or by other means.
- **Side Slope.** If sides are to be mowed, rain gardens should be designed with side slopes of 33% or 3:1(H:V) or flatter.
- **Soil Characteristics.** For best results, it is suggested to test your soil characteristics as you would for a garden, or contact your local County Extension Service for help (<https://extension2.missouri.edu/counties/st-louis/services>). Soils for rain gardens should be amended native soils containing: 2/3 native soils and 1/3 compost.
- **Mulch Layer.** A mulch layer consisting of 2-3 inches of non-floatable organic mulch (fine shredded hardwood mulch, pine straw, or leaf compost) should be included on the surface of the rain garden. Pine bark and wood chips should not be used.
- **Defined Edge.** Often rain gardens have a better appearance and can be more easily maintained if they have defined edges similar to a normal garden.



Source:
<https://www.quartoknows.com/blog/quartohomes/howtomakea-raingarden>

- Overflow Spillway / Inlet Grate (Catch Basin or Atrium Grate).** An overflow spillway is a small indentation in the berm of a rain garden that serves as the point where excess water will flow out of the garden should it overflow during a major rain storm. This indentation can also be filled with non-erodible material (i.e., paving stones). The indentation should be made on the downhill side and is used to direct water flow towards the traditional rainwater system (culverts, etc.). The overflow from the rain garden can also include an inlet grate (catch basin) set at the proper elevation in the garden instead of the indentation. The grate should be set at a slant or be domed (atrium grate) to allow clogging debris to fall off.
- Underdrain Requirement. NOTE: This method can only be used with an infiltration rate greater than 0.25 in/hr. If the rate is less than 0.25 in/hr, this method can only be used with an underdrain as described in Appendix D.** Provide an infiltration test (See Appendix A) with your plan and computation submittal that results in an infiltration rate greater than 0.25 in/hr or include an underdrain in your rain garden. An underdrain shall span the width of the rain garden and discharge to daylight or through a pop-up emitter. The discharge point shall be at least 10 feet from the property line and should not cause a nuisance or result in erosion.



Source: <https://extension.oregonstate.edu/node/119221/printable/print>

VEGETATION

- Vegetation commonly planted in rain gardens includes native trees, shrubs and other herbaceous vegetation (See **Appendix B Recommended Plants**). When developing a landscaping plan, you should choose vegetation that will be able to stabilize soils, handle the expected amount of sunlight, and tolerate the storm water runoff rates and volumes that will pass through the rain garden.

How many Plants?

When deciding how many plants to get for your rain garden a good estimate is that you will need one-plant-per-square-foot (square spacing). However, keep in mind how large the plants that you chose will be at maturity. Many plants have their own spacing recommendations so check these out and plant accordingly. If a plant needs more than a square foot then give it more room, and if one requires less space then don't leave it as much room.

Single-Plant Rain Garden. An aesthetically pleasing, low-maintenance landscape can be attained using a plant palette of regionally-native plants. Choose a diversity of hardy native plants—they offer a palette of plants that are well-adapted, beautiful, reliably hardy, enhance much-needed biodiversity while allowing for more opportunities to observe nature. A single plant with a large plant-spacing that meets the spacing requirements will not be aesthetically pleasing and not meet the planting requirement.



Rule of Thumb. Your selection of plants and their recommended spacing (square or triangular grid) will dictate the number of plants required. For estimating purposes it is suggested to use one plant per square foot of rain garden (Some plants selected may need more than one square foot and some plants need less, so the plants actually chosen should average out to one-plant-per-square-foot rule as a guide (square spacing). Your ultimate



selection will govern).^{*} This means to estimate the quantity of plants needed use one plant per square footage of the rain garden. So;

square feet of my garden = number of plants I will need
My rain garden is _____ square feet, so I will need _____ plants.

^{*}If you will be planting trees or shrubs in your rain garden then do not use the one-plant-per-square-foot rule. Instead, go by the spacing recommendations for each plant, making sure the garden is aesthetically pleasing.

Note to first-time gardeners:

Your garden will probably look kind of sparse at first, but give it time and it will fill in nicely - all gardens take a minimum of three years to mature and look their best. You can also add more plants and replace plants that do not survive or that you decide you don't like later.

- Vegetation used in rain gardens should also be able to tolerate both wet and dry conditions. A Plant Spacing Plan shall be included in BMP submittal. Please refer to **Appendix B Recommended Plants** for additional information on spacing and plants appropriate for rain gardens.
- As with any garden, in the first season the vegetation may require irrigation to become well established.
- It may be appropriate to plant more densely than a normal garden to obtain the benefit of plant soil stabilization and evapotranspiration as soon as possible.

MAINTAIN

Routine garden maintenance should include weeding, deadheading, replacing dead plants, and replenishing mulch when depleted. Catching areas of erosion is also important as is correcting standing water problems. If standing water persists it may be necessary to place a perforated underdrain in the garden daylighting downstream.

The following page provides a typical section for layout of a rain garden.

Lay out the plants according to the design. This is the time to double-check spacing, arrangement and any other considerations such as texture, height and bloom time. When planting, gently remove the plant from its container and loosen the roots if they are root-bound.

If the planting is in weed-barrier landscape fabric (Mirafi® Mscape E or an approved equal), cut an x-shaped hole in the netting large enough to adequately set the plant in the soil beneath.

Each planting hole should be dug approximately twice as wide as the root mass and deep enough to allow for the crown (junction of roots and green shoots) to be set at ground level. Firm the soil both in the planting hole and around the plant after planting. Do not leave root ball/potting soil exposed to air.

Applying 2–3" of shredded hardwood bark mulch to your rain garden will help lessen the compaction of the soil thereby improving the functioning of your rain garden. When mulching, apply a 2–3" thick layer around the plants, but not on top of the crowns. This will help keep moisture around the root zone as the plants become established.



Note: In rain gardens with high water volume, high water velocity, and/or steep slopes, organic mulches such as



shredded bark are not recommended since they easily wash away and expose the soil to erosion. Instead, use stone and gravel in areas with high-energy water such as these.

Use of name labels on plants will help with identification and tracking which plants are doing well. You may want to add them for general knowledge and understanding of the garden.

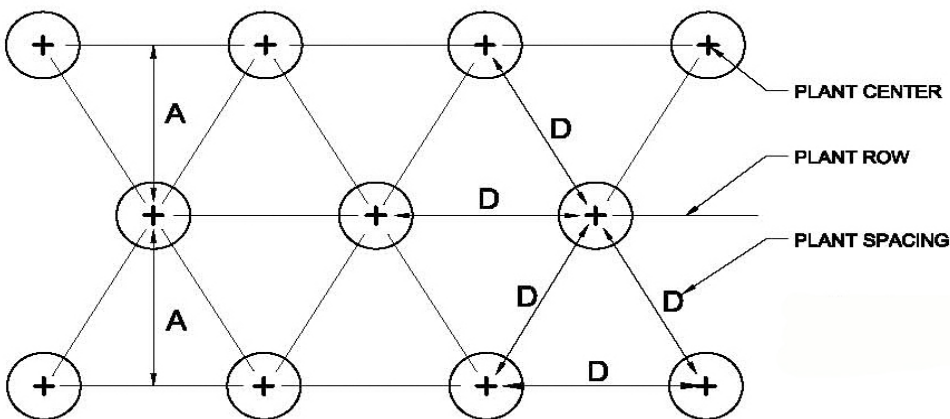
Source: <https://www.missouribotanicalgarden.org/sustainability-conservation/sustainable-living/at-home/rainscaping-guide/design-and-build-a-rain-garden/plant.aspx>



RAIN GARDEN – LAYOUT SKETCH

| SPACING "D" | ROW "A" | NUMBER OF PLANTS/SQ. FT. |
|-------------|---------|--------------------------|
| 30" | 26" | .160 |
| 24" | 20.8" | .25 |
| 18" | 15.6" | .450 |
| 15" | 13.0" | .640 |
| 12" | 10.4" | 1.00 |
| 10" | 8.66" | 1.44 |
| 8" | 6.93" | 2.25 |

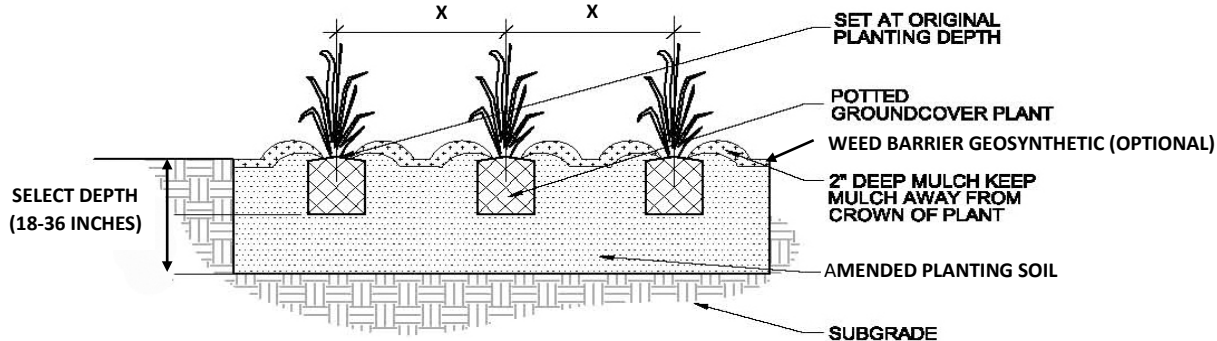
NOTE: PLANT QUANTITIES WERE DETERMINED BY MULTIPLYING AREA (SQ. FT.) BY NUMBER OF PLANTS/SQ. FT. FOR REQUIRED SPACING.



Quantity of plants as noted in planting schedule.

GROUND COVER SPACING

SEE PLANTING LIST FOR PLANT SPACING



NOTES:

1. REMOVE SPENT FLOWERS PRIOR TO PLANTING.
2. LOOSEN ROOT MASS AT BOTTOM OF ROOTBALL.
3. TOP OF ROOTBALL STRIPPED OF ¼" SURFACE GROWING MEDIA AND COVERED WITH ¼" LANDSCAPE BED MIX PLUS SURFACE MULCH.



Plant Spacing Plan

N.T.S.

Planting Detail Courtesy of Ted Spaid
SWT Design, St. Louis, MO



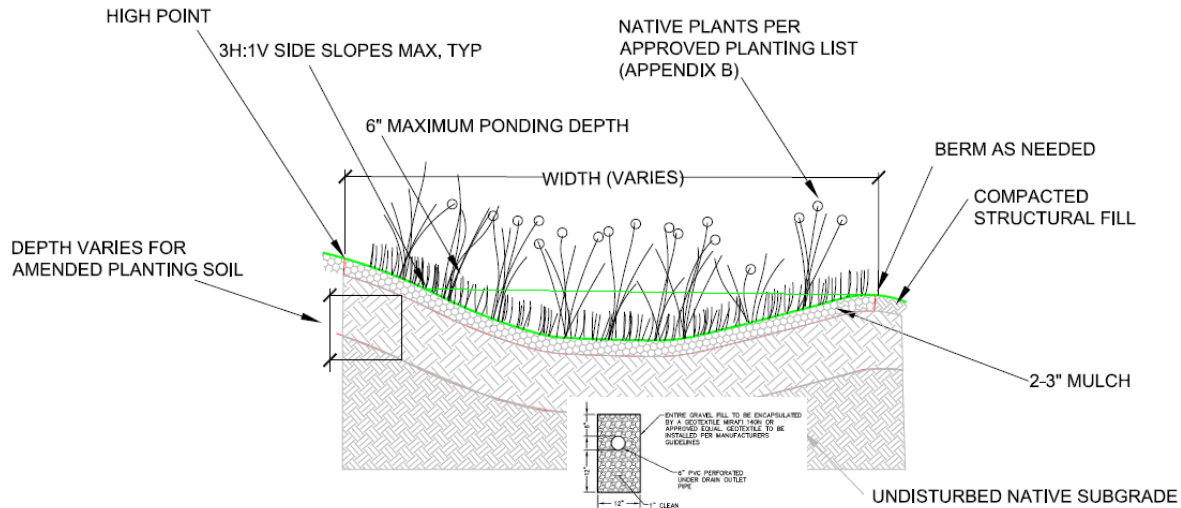


Figure 1 UNDERDRAIN (AS REQUIRED)

CONSTRUCTION STEPS:

1. Locate rain garden(s) where downspouts or driveway runoff can enter garden flowing away from the home. Locate at least 10 feet from foundations, not within the public right of way, away from buried utility lines, not over septic fields, and not near a steep bluff edge.
2. Measure the area draining to the planned garden and determine required rain garden surface area from the table on the next page and your planned excavation depth.
3. Prior to submittal, perform an infiltration test according to Appendix A, if the rate is less than 0.25 in/hr an underdrain will be necessary. If the rate is more than 0.50 in/hr the size of the garden may be decreased 10% for every 0.50 in/hr infiltration rate increase above 0.50 in/hr.
4. Measure elevations and stake out the garden to the required dimensions insuring positive flow into the garden, the overflow elevation allows for desired depth of ponding (six inches maximum), and the perimeter of the garden is higher than the overflow point. If the garden is on a gentle slope a berm at least two feet wide can be constructed on the downhill side and/or the garden can be dug into the hillside taking greater care for erosion control at the garden inlet(s).
5. Remove turf or other vegetation in the area of the rain garden. Excavate garden being careful not to compact soils in the bottom of the garden. Level bottom of garden as much as possible to maximize infiltration area.
6. If underdrain required, excavate area, install geosynthetic, install bedding aggregate, and install perforated schedule 40 PVC (or equivalent) pipe wrapped with polyester filter sock.

INITIAL INSPECTION POINT

7. Mix compost, topsoil, and some of the excavated subsoil together to make the 'amended soil'. The soil mix should be 1/3 compost, 2/3 native soil (topsoil and subsoil combined). The following table can be used to estimate compost quantity:

| Depth of Amended Soil, (Inches) | 18 | 24 | 30 | 36 |
|---|------|------|------|------|
| Volume of Compost per 100 Square Feet of Rain Garden, (Cubic Yards) | 1.83 | 2.47 | 3.09 | 3.70 |

8. Fill rain garden with the amended soil, leaving the surface eight inches below your highest surrounding surface. Eight inches allows for 6 inches ponding and 2" of mulch. The surface of the rain garden should be as close to level as possible.
9. Build a berm at the downhill edge and sides of the rain garden with the remaining subsoil. The top of the berm needs to be level, and set at the maximum ponding elevation.
10. Plant the rain garden using a selection of plants from Appendix B Plantings. **Submit planting list at the time of initial inspection.**
11. Mulch the surface of the rain garden with two to three inches of non-floating organic mulch. The best choice is finely shredded hardwood mulch.
12. Water all plants thoroughly. As in any new garden or flower bed, regular watering will likely be needed to establish plants during the first growing season.
13. During construction build the inlet feature as a pipe directly connected to a downspout or use a rock lined swale with a gentle slope. Use of an impermeable liner under the rocks at the end of the swale near the house is recommended to keep water from soaking in at that point. Test the drainage of water from the source to the garden prior to finishing.
14. Create an overflow at least 10 feet from your property edge and ensure it is protected from erosion.

FINAL INSPECTION POINT

| | | |
|---------------------------------------|--|---|
| CITY OF KIRKWOOD PROPERTY ADDRESS: | ATTACH THIS THREE-PAGE SPECIFICATION TO SITE PLAN SUBMITTAL | RAIN GARDEN SPECIFICATIONS PAGE 1 OF 3 |
| DATE: | | |



SKETCH LAYOUT

PROVIDE PLAN VIEWS OF RAIN GARDEN AND HOUSE SHOWING DRAINAGE AREA DIRECTED TO RAIN GARDEN AND KEY DIMENSIONS AND OVERFLOW AREA RELATIVE TO PROPERTY LINE.

SIZING CALCULATION:

SITE INFILTRATION RATE= _____ IN/HR (0.05 IN/HR, MIN.)

- IS UNDERDRAIN REQUIRED? ☐ YES ☐ NO ☐ N/A
 - CAN BMP SIZE BE REDUCED? ☐ YES ☐ NO ☐ N/A
- IF YES, BY WHAT %: ☐ 10 ☐ 20

| Contributing Drainage Area (square feet) | Depth of Amended Soil (inches) | | | |
|--|-----------------------------------|-----|-----|-----|
| | 18 | 24 | 30 | 36 |
| | Area of Rain Garden (square feet) | | | |
| 100 | 7.7 | 6.7 | 6.0 | 5.3 |
| 500 | 40 | 35 | 30 | 28 |
| 1000 | 80 | 70 | 60 | 55 |
| 2000 | 155 | 135 | 120 | 110 |
| 3000 | 235 | 205 | 180 | 160 |
| 4000 | 310 | 270 | 240 | 215 |
| 5000 | 390 | 340 | 300 | 270 |

MEASURE CONTRIBUTING DRAINAGE AREA AND READ AREA FOR GIVEN MEDIA DEPTH.

CONTRIBUTING DRAINAGE AREA= _____ SQUARE FEET

DEPTH OF AMENDED SOIL (INCHES)= ☐ 18 ☐ 24 ☐ 30 ☐ 36

RAIN GARDEN AREA= _____ SQUARE FEET

COMPOST VOLUME = _____ CUBIC YARDS

MAINTENANCE:

1. IRRIGATE VEGETATION AS NEEDED IN FIRST SEASON
2. REMOVE WEEDS
3. REPLACE UNSUCCESSFUL PLANTINGS
4. REPLENISH MULCH
5. REPAIR ERODED AREAS
6. RAKE CLOGGED SURFACE TO RESTORE INFILTRATION
7. MONITOR RAIN GARDEN FOR APPROPRIATE DRAINAGE TIMES. IF GARDEN DOES NOT DRAIN, AN UNDERDRAIN MAY BE NECESSARY

CITY OF KIRKWOOD
PROPERTY ADDRESS:

DATE:

ATTACH THIS THREE-PAGE
SPECIFICATION TO SITE PLAN
SUBMITTAL

RAIN GARDEN
SPECIFICATIONS
PAGE 2 OF 3



PLANTING LAYOUT

PROVIDE PLAN VIEWS OF RAIN GARDEN PLANTING PLAN SHOWING KEY DIMENSIONS AND PLANTING SCHEDULE.

Select Planting Pattern: ☐ Triangular ☐ Square

PLANTING SCHEDULE- Use Appendix B to complete

| PLANT ID | DESCRIPTION | SPACING (IN FEET) | NUMBER | AREA (SQUARE FEET) |
|---------------------------------|-------------|----------------------|--------|--------------------------|
| A | | | | |
| B | | | | |
| C | | | | |
| D | | | | |
| E | | | | |
| F | | | | |
| G | | | | |
| H | | | | |
| I | | | | |
| TOTAL NUMBER OF PLANTS: | | | | |
| RAIN GARDEN AREA (SQUARE FEET): | | | | |
| PLANTING AREA SUMMARY: | | | | |

NOTE: PLANTING AREA MUST BE GREATER THAN OR EQUAL TO RAIN GARDEN AREA

| | | |
|--|---|--|
| CITY OF KIRKWOOD PROPERTY ADDRESS: DATE: | ATTACH THIS THREE-PAGE SPECIFICATION TO SITE PLAN SUBMITTAL | RAIN GARDEN SPECIFICATIONS PAGE 2 OF 3 |
|--|---|--|