Rain Garden Design Tips for Homeowners:

Constructing a Native Soil Rain Garden

Purpose –
- Captures runoff from impervious areas such as roofs, driveways, patios.
- Encourages infiltration, reduces runoff leaving site. Should drain quickly to prevent mosquito problems (within 72 hours, 24 to 48 hours is better)
- Captures first inch of rainfall (rainfall containing most polluted runoff)

Placement -
- At least 10 feet from any structure so that infiltrating water doesn’t seep into the foundation
- Do not place the raingarden directly over underground utilities or a septic system: Locate at least 25 feet from septic tank, septic drainfield, or well head.
- It may be tempting to put the rain garden in a part of the yard where water already ponds. Don’t! The goal of the rain garden is to encourage infiltration and your yard’s wet patches show where infiltration is low … alternatively, you may consider soil amendments.
- It is better to build the rain garden in full or partial sun, not directly under a big tree.
- Check soil type: sandier soils infiltrate water faster than clayey soils, so a rain garden in clay soils must be larger than sandy or silty soils.
- Look for a flat location in your yard to make it easier to create a level garden; avoid locations with slopes that are greater than 12%
- Do not place garden site over underground utilities
- Be sure water table is at least 2 feet below soil surface.

Ponding Depth –
- Runoff is captured and held in order to enhance infiltration.
- Ponding depth is the depression between the top of mulch layer and bottom of the overflow outlet.
- Be sure to account for mulch depth (2 – 4”) during rain garden construction.
- Use slope to determine the depth of the rain garden.
  - You may calculate slope by running a string between 2 stakes and measuring the height of the downhill stake to the string. Divide the height by the length of the string and multiply by 100 to get % slope.
  - Rain gardens are usually 4 to 9 inches deep depending on slope and soils.
    - Slope less than 4% - 4” to 5” deep
    - Slope between 5-7% - 6” to 7” deep
    - Slope between 8-12% - 8” to 9” deep
Rain Garden Design Tips for Homeowners:

(*slope = height/length)

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**Shape** –
- Rain garden are not usually square or perfectly circular
- The longest dimension should be perpendicular to the major slope

**Size** –
- Rain garden are typically 100 to 300 square feet. It depends on the amount of rainwater that will drain to the garden, time and budget issues.
- How much stormwater will the garden receive? You can calculate the drainage area of your rain garden by taking into account features that will be draining to it such as lawns, driveways, and rooftops
- Determine soil type: sandy, silty/loamy, or clayey
  - Dig a 1’ deep hole in the proposed rain garden area: determine if the soil is mostly sandy, mostly clay, or somewhere in-between like a silt.
  - To be more precise in soil texture, you can contact your local county extension office [http://countyext2.okstate.edu/](http://countyext2.okstate.edu/) for instructions on obtaining a soil sample for soil type analysis or fertility analysis. See also: [http://www.soiltesting.okstate.edu/factsheets.htm](http://www.soiltesting.okstate.edu/factsheets.htm) for related fact sheets and [http://www.soiltesting.okstate.edu/Extn_Pub/lab%20publications/L-241.pdf](http://www.soiltesting.okstate.edu/Extn_Pub/lab%20publications/L-241.pdf) to estimate costs.
  - You can also fill the dug hole with water and measure the infiltration rate with a ruler and a stopwatch, then divide the inches of water lost in the hole by the amount of time since filling to get infiltration rate in units of inches per hour. The ponded depth of water in the rain garden should drain completely in less than 72 hours, with complete drainage in 24 to 48 hours preferred. Sandier soils drain faster than clay soils.
- Obtain rain garden size factor from charts below, based on previously calculated ponding depth
- Calculate raingarden size based on soil type and impervious drainage area--- Example: a 1,000 ft$^2$ roof drains into a clay soil raingarden with a 6” ponding depth Solution: 1,000 ft$^2$ * size factor 0.15 = 150 ft$^2$ raingarden

**Rain Garden Size Factors:**

<table>
<thead>
<tr>
<th>Soil type</th>
<th>Rain Garden 3-5 in.</th>
<th>Rain Garden 6-7 in.</th>
<th>Rain Garden 8 in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 30 feet from roof downspout</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From Rain Gardens – A how-to manual for homeowners
Wisconsin Dept. of Natural Resources (PUB-WT-776 2003) and
Univ. of Wisconsin Extension (UWEX Publication GWQ037)
Rain Garden Design Tips for Homeowners:

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Deep</th>
<th>Deep</th>
<th>Deep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandy soil</td>
<td>0.19</td>
<td>0.15</td>
<td>0.08</td>
</tr>
<tr>
<td>Silty soil</td>
<td>0.34</td>
<td>0.25</td>
<td>0.16</td>
</tr>
<tr>
<td>Clayey soil</td>
<td>0.43</td>
<td>0.32</td>
<td>0.20</td>
</tr>
</tbody>
</table>

More than 30 feet from roof downspout

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Size Factor, for all depths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandy soil</td>
<td>0.03</td>
</tr>
<tr>
<td>Silty soil</td>
<td>0.06</td>
</tr>
<tr>
<td>Clayey soil</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Installation –

- Layout rain garden edge with rope or garden hose
- Call before you dig to locate utilities ([http://www.callokie.com/LocateRequests/default.asp](http://www.callokie.com/LocateRequests/default.asp))
- Stockpile topsoil from rain garden area for later use
- Dig out raingarden area to a depth of 1 to 4 feet, stockpile subsoil
- Use subsoil to create a berm on downhill side (same height as uphill edge)
- Create an overflow outlet that allows water from large storm event to exit the garden in a non-erosive manner. Stone weirs, level spreaders, and large diameter pipe can be used as overflow outlets.
- The bottom of gardens should be tilled deeply and leveled to improve infiltration
- Modify soil in raingarden to a depth of 1 to 4 feet. Use tillage equipment, or shovels to mix topsoil and 3 to 4 inches of compost into every foot of native soil.
- Compost should be stable (well aged) and low in nitrogen and phosphorus. Composted pine bark is well suited for this purpose.
- Mulch with 2 to 4 inches of shredded hardwood bark (avoid pine bark - it floats)
- For more installation information visit: [http://dnr.wi.gov/runoff/rg/rgmanual.pdf](http://dnr.wi.gov/runoff/rg/rgmanual.pdf)

Connecting the Rain Garden –

- Create shallow wide swales to direct water from impervious areas to rain garden
- Some stormwater infiltration may occur in swales. Raingarden size can be adjusted to account for reduced runoff delivery.

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- Line swales with stone, or vegetation to filter runoff and prevent erosion.
- Drainage pipe can be used for delivery, but outlet protection may be needed

**Vegetation –**

- Plants must tolerate flood and drought conditions
- Consider aesthetics – rain gardens are gardens
- Visit [http://lid.okstate.edu](http://lid.okstate.edu) for suggested plant list

**Maintenance –**

- Replenish mulch to maintain 2 – 4 inch depth
- Check inlets, and overflow outlet – repair any eroded areas
- Similar to other garden areas – requires routine periodic landscape maintenance
Rain Garden Design Tips for Homeowners:

Example of a quick calculation of rain garden size using slope, watershed, and soils for a roof area coming from 1 downspout, with the rain garden location less than 30-feet from the downspout:

**Slope:**

You may calculate slope by running a level (use a hand level) string between 2 stakes and measuring the height of the downhill stake to the string. Divide the height by the length of the string and multiply by 100 to get % slope.

\[ \frac{9 \text{ inches height}}{180 \text{ inches length}} \times 100 = 5\% \text{ slope} \]

Use slope to determine the depth of the rain garden. In this case, the rain garden will be 6 inches deep.

**Soil Type and Infiltration Rate:**

A hole was dug in the rain garden location, and the soil type was determined to be silty; the rain garden size factor table (for 6-inches and less than 30-ft. from a down spout) was used to obtain a rain garden size factor of 0.25.

**Drainage Area (Watershed) Size and Rain Garden Size:**

Measure the impervious roof area and divide by the number of downspouts for a quick estimation of drainage area:

- Approx. square roof measures 48-ft by 50-ft: 2400 sq. ft. surface area
- Divide 2400 sq. ft by the number of downspouts (4): 600 sq. ft. drainage area
- 600 square foot drainage area x .25 (size factor from table on page 1) = 150 square feet of rain garden needed

Adapted from the Alabama Cooperative Extension System Water Quality Program Low Impact Development web site [http://www.aces.edu/waterquality/nemo/lid.htm](http://www.aces.edu/waterquality/nemo/lid.htm)

Visit [http://lid.okstate.edu](http://lid.okstate.edu) for more Rain Garden information and contacts.