

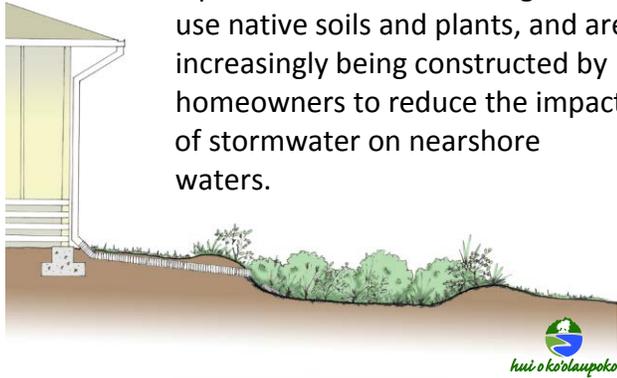
Rain Garden Installation Training Guide

August 2015



Rain Garden Basics

Rain gardens are vegetated depressions designed and built to accept stormwater runoff from rooftops, driveways, roads, parking lots, and compacted lawn areas. Rain gardens use native soils and plants, and are increasingly being constructed by homeowners to reduce the impact of stormwater on nearshore waters.



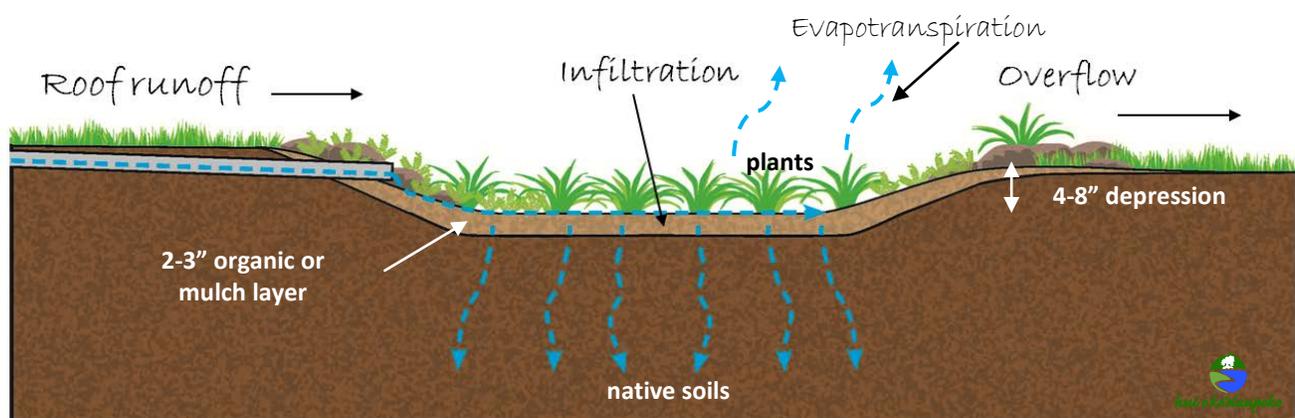
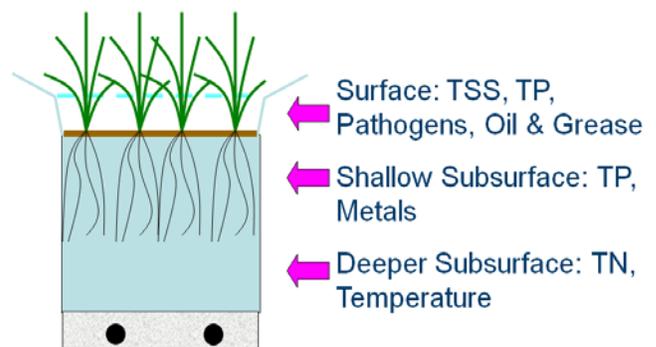
Stormwater runoff is the fraction of rainfall that collects on impervious surfaces such as rooftops, roads, parking lots, and compacted soils rather than soaking into the ground, evaporating, or being taken up by plants. This runoff can: 1) carry pollutants; 2) cause flooding; 3) erode streams, ditches, and exposed soils; 4) damage infrastructure; and 5) negatively impact freshwater and marine ecosystems.

Rain garden soils can filter some of the pollutants from stormwater runoff, promote recharge to groundwater, and encourage evapotranspiration from the plants. Rain gardens can also serve aesthetic purposes,

replace other landscaped features, and provide habitat. They should drain in well under 24 hours after a small rain event.

The 2006 CNMI/Guam Stormwater Design Manual provides standards and information on structural best management practices (BMPs) that can be used in Guam to help reduce the impacts of stormwater runoff. Rain gardens are “lighter” versions of the bioretention facilities included in the manual. Rain gardens are simpler in design, may include minor soil modifications, and are intended for homeowners to construct. Bioretention practices are more engineered (e.g., underdrain system, outlet structure, and an engineered soil media) and require professional assistance in design and installation.

How Rain Gardens Remove Pollutants



Cross-section of a typical rain garden and the fate of stormwater runoff (adapted from Hui o ko'olaupoko).

Designing a Rain Garden

Site Selection

1. Walk the site.

- ✓ Trace the stormwater flow path;
- ✓ Note location of drainage infrastructure as well as trees, retaining walls, adjacent property, cesspools, etc; and
- ✓ Identify drainage area, slope, conveyance options, and soils.

2. Determine the best location for your rain garden.

Several issues need to be considered before determining the exact location of your rain garden:

- ✓ Setbacks
 - 2 ft from a crawl space or slab;
 - 10 ft from a wall and basements;
 - 3-4 ft from a sidewalk/driveway; and
 - 25-50 ft from septic/cesspools.
- ✓ Avoid areas:
 - That stay consistently wet, as this indicates poor drainage;
 - In soils that have high groundwater or bedrock;
 - Where infiltration is $< \frac{1}{2}$ in/hr, unless you plan to amend soils.
 - Under trees or within close proximity such that roots will be damaged during digging;
 - On steep slopes, unless you are prepared for more digging and/or engineering;
 - Where there is a large contributing drainage area; and
 - That you can't get water into and out of easily.



Follow the flow path to identify a good spot for a rain garden.

3. Estimate drainage area, slope, soils, and infiltration rates.

- For simplicity, the drainage area is defined as the total impervious area draining to the rain garden measured in sq ft. Roofs are easy; parking lots and roads can be a little more difficult.
- Slope can be estimated using two stakes, a string, a level, and a measuring tape.
- For soils, consider testing nutrients, pH, texture, and percolation rate ([see attached sheet for procedures](#)). Use Table 1. for guidance based on results.



Dig a hole and test the soil infiltration rate.

Table 1. Results from Infiltration Tests

Drainage Rate	Recommendation
< ½inch/hour	May want to seek professional assistance; rain garden likely needs perforated drain pipe in or under the soil layer.
½ - 1 inch/hour	Low infiltration for a rain garden. Homeowners may want to build a larger or deeper garden, or likewise plan for additional overflow during high-rainfall storms.
1 - 1 ½ inches/hour	Adequate infiltration for a rain garden. Plan for sufficient overflow during high-rainfall storms.
1 ½ - 2 inches/hour	
> 2 inches/hour	High infiltration for a rain garden. Design should feature fewer moisture-loving and more drought-tolerant plants. The rain garden may also be sized to hold smaller amounts of water, have a deeper mulch layer, or have denser plantings.

Source: OSU, Sea Grant: The Oregon Rain Garden Guide

Rain Garden Design

1. Size your rain garden.

Rain garden dimensions include surface area and ponding depth. Residential rain gardens are typically 200-400 sq ft in surface area. The size of the rain garden can be estimated as a function of volume of runoff to be treated and infiltrated. A good target to shoot for is sizing the rain garden to handle 90% of most storm events, which is equal to **1.6 inches** (or 0.13 ft).

- ✓ Depth can depend upon the soil
 - Sandy loam: great! 4-8" depth
 - Clay: not so great! Increase the surface area, decrease the depth, or amend soils (coarse sand and/or compost). 3" depth recommended.

Table 2. Approximate Rain Garden Size (ft²) to meet AS rainfall target of 1.6" (0.13 ft)

Impervious Drainage Area	Ponding Depth		
	3" (.25 ft)	6" (.50 ft)	8" (.67 ft)
500 ft ²	260	130	100
750 ft ²	390	195	150
1000 ft ²	520	260	195
1500 ft ²	780	390	290
2000 ft ²	1040	520	390

- ✓ Approximate surface area can be derived using the equation below.
- ✓ Adjust size based on length of flow path over pervious area; depth selected; amended soils; drainage area reductions; or managing less than the target rainfall depth.

$$\text{Rain garden surface area (ft}^2\text{)} = \frac{\text{Drainage area (ft}^2\text{ impervious)} \times \text{AS rainfall target (ft)}}{\text{Rain garden ponding depth (ft)}}$$

2. Amend soils (if necessary).

- ✓ For 100 sq ft rain garden with 6" ponding depth:
 - Coarse Sand (Bank Run Sand)—1 cubic yard
 - Compost—1 cubic yard

3. Direct water in and out.

- ✓ For inlet, consider the following:
 - Extended downspout/gutter;
 - Across lawn via a gradual slope;
 - Vegetated or stone-lined swales;
 - Diversion berm along bottom of slope; and
 - Paved surface.
- ✓ For overflows, consider the following:
 - Do not direct overflow to other properties or structures (i.e., away from buildings);
 - Making berm higher near buildings;
 - Directing sheet flow over lawn, driveway or walkway;
 - Directing flows into existing yard drain inlets; and
 - Directing flows into existing storm drain inlets on streets.

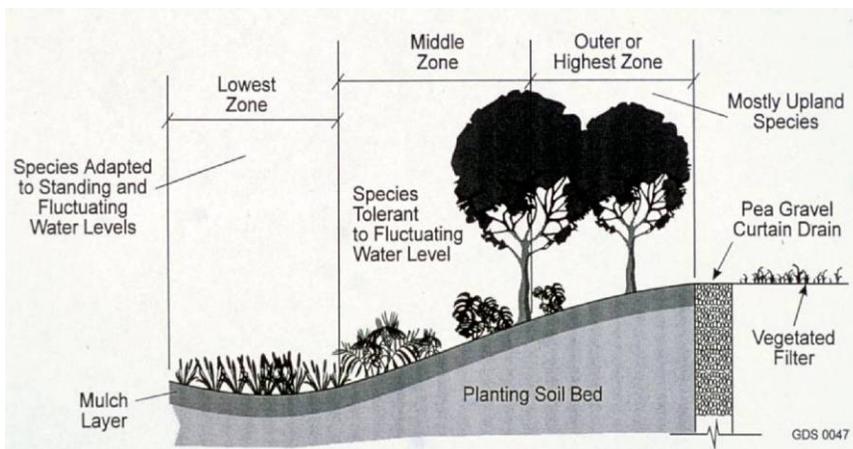
4. Develop a planting plan.

Check with University Extension, NRCS, or other resources to determine best match for local climate.

- ✓ Use plants tolerant to both wet/dry conditions, as well as site shade & salt;
- ✓ Prefer native species and DO NOT plant invasive vegetation;
- ✓ Avoid using edible plants, particularly if treating parking lots or roads;
- ✓ Provide for variable heights, color, leaf shape (trees, shrubs, herbaceous);
- ✓ Avoid placing woody vegetation at inflow/outflow locations; and
- ✓ Consider visual appeal and maintenance.

Example Local Plant Options

Ornamental taro	Red joyweed
Red ginger	Ferns
Caladium	Masiksik
Aloe	Javanese flatsedge
Bromeliads	Figwort
Miniature ti plants	Sea purslane
Mondo grass	Indian fleabane
Gaogao uchan	



Example locations within a rain garden for placement of various types of plants.

Approximate # of Plants Based on Size at Maturity

Size of Rain Garden	Approximate Amount of Plants
100 square feet	1 Small Tree (Optional) 7 Shrubs 24 Herbaceous Species
200 square feet	1 Small Tree (Optional) 14 Shrubs 48 Herbaceous Species

Plant Spacing Cheat Sheet

- 18" O.C. = multiply sq. ft by .44
- 24" O.C. = multiply sq. ft by .25
- 30" O.C. = multiply sq. ft by .16
- 36" O.C. = multiply sq. ft by .11

Installing a Rain Garden

List of tools

- ✓ Shovel(s)
- ✓ Trowel(s)
- ✓ Rake(s)
- ✓ Hammer
- ✓ Gloves
- ✓ 3' level and 2"x4" (optional)
- ✓ Wheel barrow
- ✓ Tarp
- ✓ 2 wooden stakes
- ✓ String
- ✓ Rope or spray paint (to mark footprint)
- ✓ Measuring Tape
- ✓ Calculator
- ✓ Hose for watering
- ✓ Rototiller (optional)
- ✓ Backhoe (optional)
- ✓ Saw (optional)

List of supplies

- ✓ Soil amendments (if needed)
- ✓ Mulch or compost
- ✓ Plants
- ✓ Stone (optional)
- ✓ Pipe (optional)
- ✓ Timber (optional)

1. Prepare.

- ✓ Delineate footprint with string/spray paint.
- ✓ Install erosion & sediment controls (ESC).
- ✓ Material and equipment staging.
- ✓ Remove grass (reuse, if possible).
- ✓ Call for utility locations before you dig!!

2. Excavate.

- ✓ With a ponding depth of 4-8", plus 2-3" of organic layer, may need to excavate ½-1 ft. May need to over-excavate to aerate compacted soils.
- ✓ Create berms with excavated material.
- ✓ Work amendments into the native soil.
- ✓ Be sure to level the bottom of ponding area.

3. Install inlets and overflows.

4. Plant.

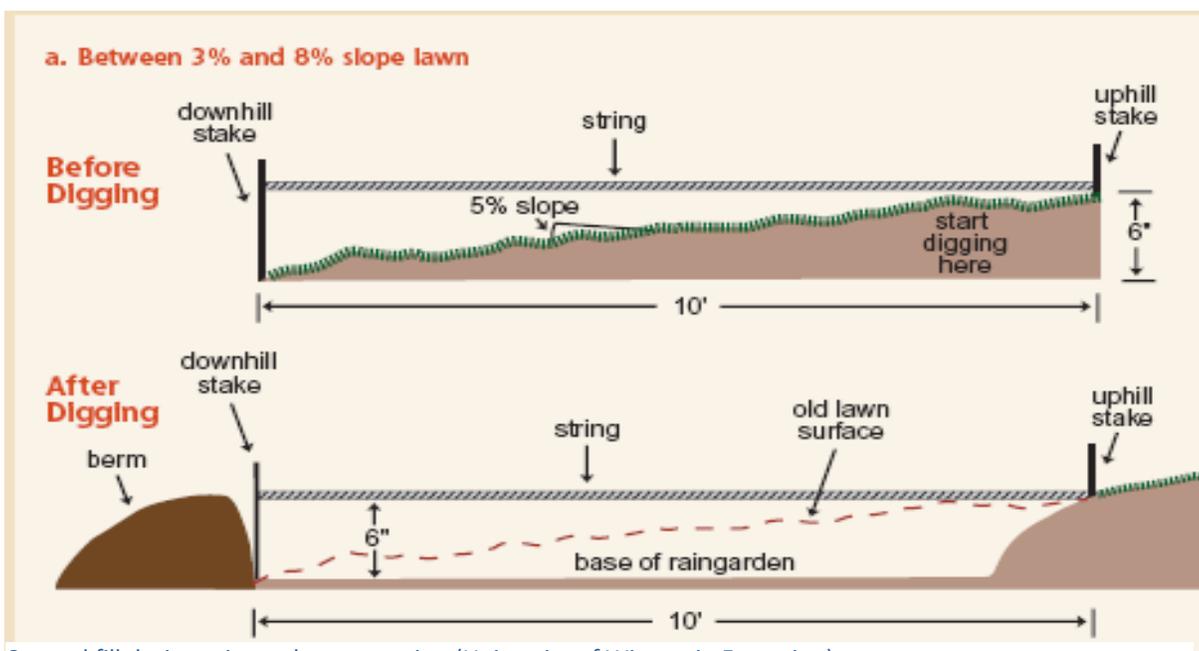
- ✓ Arrange plants first, then remove from containers.
- ✓ Score root-bound plants.
- ✓ Dig holes (width 2 x root ball width); leave room for mulch layer.
- ✓ Plugs can go in after mulch.

5. Add mulch/organic surface layer (1-3"). Protect small plants.

6. Turn on water to inspect flow path and to soak plants. May need to water for the first few weeks.

7. Clean up site. Remove ESC once area is stabilized.

Amend soils with sand and organics, where necessary. Clayey soils will need more amending. Be sure not to compact area when refilling.



Cut and fill during rain garden excavation (University of Wisconsin Extension).

Inspection & Maintenance

Regular inspection and maintenance is critical to ensuring proper rain garden function.

1. Establish a maintenance plan for the rain garden (see attached handout).
2. Maintenance inspections should be performed once a month for the first few months after installation. Afterwards, inspections should generally occur on an annual-basis, after rain storms, and during regular on-site landscaping activities. Maintenance plans should be tailored to specific installations to address unique features and/or chronic maintenance concerns.
3. Be sure to look for:
 - ✓ Debris and trash accumulation
 - ✓ Weeds and invasive plants

- ✓ Sediment build up
- ✓ Plant and grass health
- ✓ Erosion/gullying
- ✓ Inlet/outlet structure clogging
- ✓ Standing water/drainage issues

4. Outline specific procedures for each individual rain garden that give instructions for:
 - ✓ Debris and sediment removal
 - ✓ Vegetation pruning and trimming
 - ✓ Mowing
 - ✓ Chemical maintenance for disease and pest control (not suggested). No fertilization is recommended
 - ✓ Plant and mulch replacement
 - ✓ Measures for dealing with drainage failures (e.g., structural repair, soil replacement)

Resources

Bannerman, Roger, and Ellen Considine. 2003. *Rain Gardens: A How-to Manual for Homeowners*. UWEX Publication GWQ0371-06-5M-100-S. University of Wisconsin Extension. <http://dnr.wi.gov/runoff/pdf/rg/rgmanual.pdf>

CT NEMO Program. Rain Garden Design Guide Website and Mobile App for iPhone and Android. <http://nemo.uconn.edu/raingardens/index.htm>

Dietz, M., Filchak, K., and Schadt. 2011. *Rain Gardens: a Design Guideline for homeowners in Connecticut*. University of Connecticut. http://nemo.uconn.edu/publications/rain_garden_broch.pdf.

Hui o Ko'olaupoko. 2011. He'eia Rain Garden. <http://huihawaii.org/raingardens.html>

2012. State of Hawaii Rain Garden Manual with plant selection guide (coming soon).

Oregon State University. 2010. *The Oregon Rain Garden Guide: Landscaping for Clean Water and Healthy Streams*. http://seagrant.oregonstate.edu/sgpubs/online_pubs.html

