

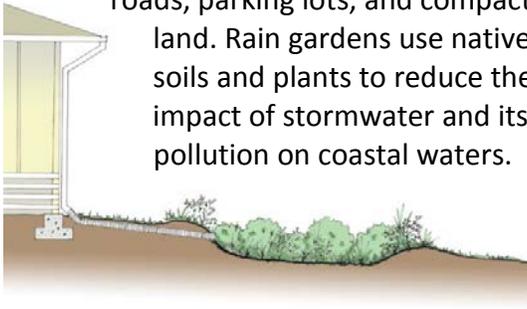
Rain Garden Installation Training Guide



Rain Garden Basics

SEE GLOSSARY
IN BACK FOR
UNDERLINED
WORDS

Rain gardens are depressions, or shallow holes in the ground, designed and built to collect stormwater runoff from rooftops, driveways, roads, parking lots, and compacted land. Rain gardens use native (local) soils and plants to reduce the impact of stormwater and its pollution on coastal waters.

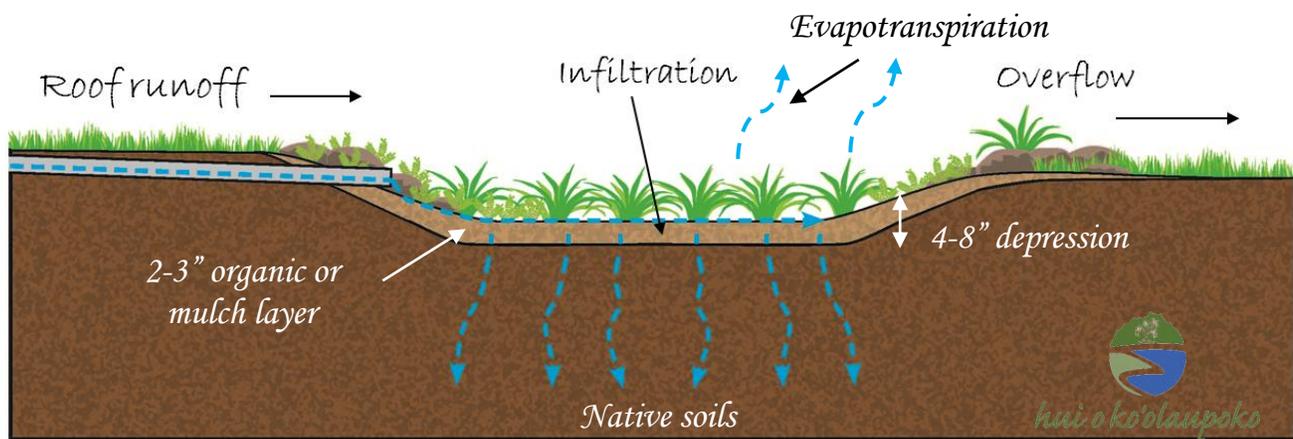


Stormwater runoff is the rainfall that collects and runs off of hard, impervious surfaces instead of soaking into the ground, evaporating, or being taken up by plants. This runoff can: 1) carry pollutants; 2) cause flooding; 3) erode streams, ditches, and exposed soils; 4) damage infrastructure; and 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 garden's plants. Rain gardens can also help your land look better, replace other landscaped features, and provide habitat. They should drain in less than 24 hours after a normal rainstorm and should not create a habitat for mosquitos, which need several days of standing water to develop.

Environmental and building professionals use a more complex version of rain gardens, called bioretention practices, to manage stormwater and protect local water resources. These are more complex (e.g., underdrain system, outlet structure, and an engineered soil media) and require professional help in design and installation. Rain gardens are simpler in design, may include minor soil changes, and are intended for landowners to build. Both practices, along with other best management practices (BMPs), can be used in American Samoa to help reduce the impacts of stormwater runoff on our coral reefs, fisheries, and local water quality.



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 pathways, as well as trees, retaining walls, nearby property, cesspools, etc.
- ✓ Identify areas that will drain to the garden, the slope of the land, water movement, and soil characteristics

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
 - 10 ft from houses and other structures
 - 3-4 ft from a sidewalk/driveway
 - 25-50 ft from septic/cesspools
- ✓ Avoid areas:
 - That are always wet; this means there is poor drainage
 - With soils that have high groundwater or bedrock
 - Where infiltration is $< \frac{1}{2}$ in/hr, unless you plan to amend soils
 - Under or near trees where 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
 - That you can't get rainwater into and out of easily; you need a good entrance and exit



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 square feet; 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 infiltration rate (see the photo below); use Table 1. for guidance based on results



Determining infiltration rate: In a couple areas around the garden location, dig holes about 16" deep. Fill it with water and let it drain. Fill it again and time how long it takes to fully drain. How many inches did it drain after an hour?

Table 1. Results from Infiltration Tests

Drainage Rate	Recommendation
< ½inch/hour	May want to seek professional help; 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 plan for additional overflow during high-rainfall storms.
1 - 2 inches/hour	Great infiltration for a rain garden. Proper planning for overflow during high-rainfall storms is still needed.
> 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 the depth of the inner bowl, or ponding depth. Home rain gardens are typically 200-400 sq ft in surface area. The size of the rain garden depends on the amount of runoff to be collected 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) in American Samoa.

- ✓ Garden depth can depend upon the soil
 - Sand and/or loam: great! 4-8" deep will be good
 - Clay and/or silt: not so great! Consider another site or mix in compost to amend the soil and allow for better infiltration

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

- ✓ Calculate surface area of the garden using the equation below
- ✓ Adjust size based on flow of water over pervious area, ponding depth chosen, amended soils, or designing the garden for less than the target rainfall depth

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

2. Direct water in and out.

- ✓ For inlet (entrance) to the garden, consider the following:
 - Extend a downspout/gutter
 - Across the lawn via a gradual slope
 - Vegetated (filled with plants) or stone-lined swales (shallow ditches)
 - Berm along bottom of slope
 - New or existing paved surface that directs water into the garden
- ✓ For overflows (exit), consider the following:
 - Do not direct overflow to other properties or buildings
 - Making berm higher near buildings
 - Directing wide, slow moving flows of water over a lawn, driveway, or walkway
 - Directing flows into existing yard drain inlets
 - Directing flows into existing storm drain inlets on streets

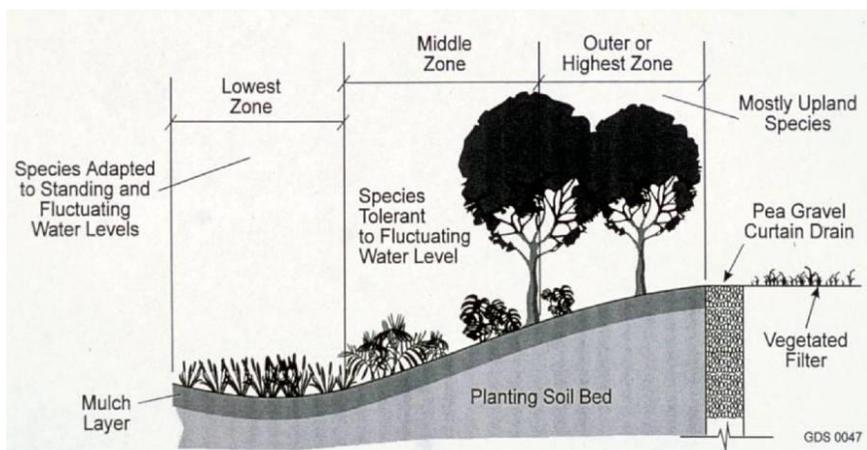
- ✓ Use plants tolerant to both wet & dry conditions, as well as site shade & salt conditions
- ✓ Try to select native species and DO NOT plant invasive vegetation
- ✓ Avoid using edible plants if collecting stormwater from parking lots or roads
- ✓ Use plants with different heights, color, leaf shape
- ✓ Avoid placing woody plants at inlet/outflow locations
- ✓ Consider appearance and maintenance

3. Develop a planting plan.

Check with the local Land Grant Extension, NRCS, or other resources to determine best match for local climate, soils, and shade

Example Local Plant Options

- Ornamental taro
- Native ginger- 'Ava pui vao
- Hibiscus- 'Aute Samoa
- Gardenia- Pua Samoa
- Bromeliads
- Miniature ti plants
- Lemon grass-Moegalo
- Candelabra bush- La'au failafa



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)
- ✓ Sledgehammer
- ✓ Gloves
- ✓ 3' level and 2"x4"
- ✓ Wheel barrow
- ✓ Tarp
- ✓ 2 wooden stakes
- ✓ String
- ✓ Rope or spray paint (to mark outline)
- ✓ Measuring Tape
- ✓ Calculator
- ✓ Hose for watering
- ✓ Rototiller (optional)
- ✓ Backhoe (optional)
- ✓ Saw (for roots; optional)

List of supplies

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

1. Prepare

- ✓ Mark garden outline with string/spray paint
- ✓ Install erosion & sediment controls (ESC), if needed
- ✓ Set up materials and equipment
- ✓ Remove grass (reuse, if possible)
- ✓ Call for utility locations before you dig!!

2. Excavate

- ✓ If ponding depth is 8", excavate 10" to allow for 2" of organic layer (mulch/compost); may need to over-excavate to aerate compacted soils
- ✓ Create and compact berms with excavated soil
- ✓ If needed, work amendments into the native soil
- ✓ Be sure to level the bottom of ponding area
- ✓ Avoid compacting garden bottom

3. Install inlets and overflows

4. Plant

- ✓ Arrange plants first, then remove from containers
- ✓ Break up roots of root-bound plants
- ✓ Dig holes; hole width should be twice the root ball width and as deep as the container from which the plant came
- ✓ Plugs can go in after mulch

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

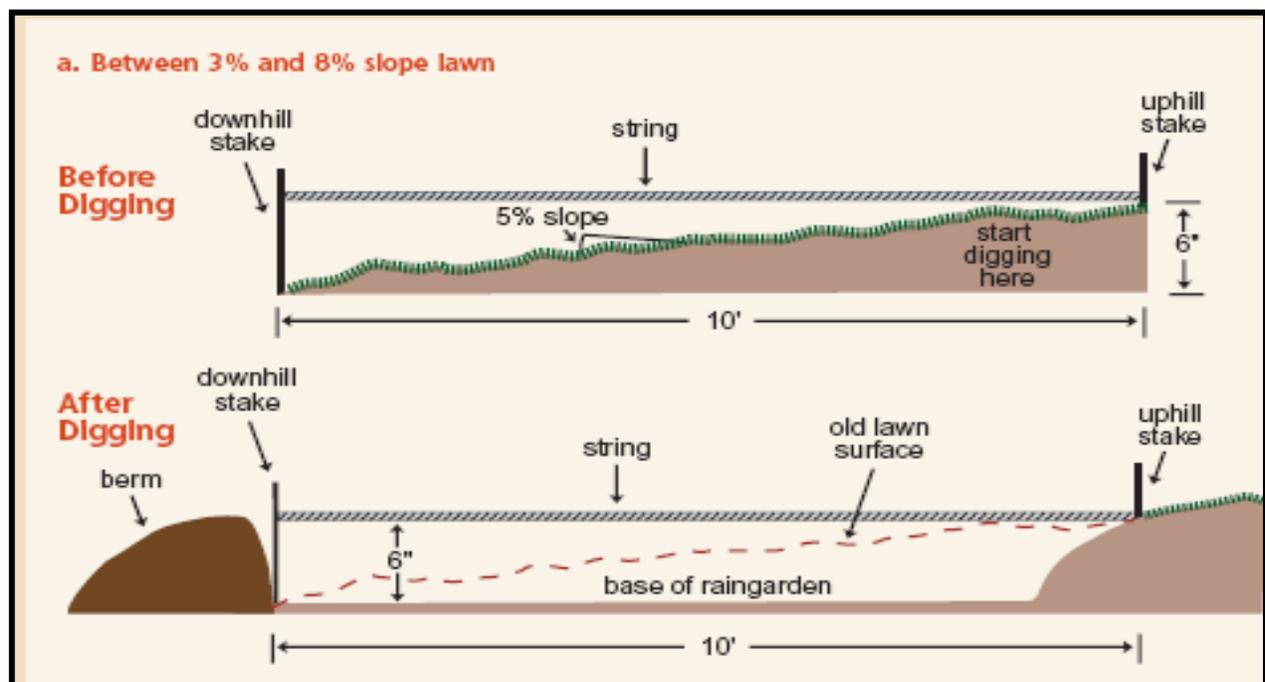
- ✓ Protect small plants while leaving room around stems

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



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

Inspection & Maintenance

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

1. Establish a maintenance plan for the rain garden.
2. Maintenance inspections should be done once a month for the first few months after installation. Afterwards, inspections should generally happen once a year, after heavy rain storms, and during regular on-site landscaping activities. Maintenance plans should be specifically written for each specific rain garden to address unique features and/or continual maintenance concerns.
3. Be sure to look for:
 - ✓ Debris and trash build-up

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

4. Maintenance for your rain garden may include:
 - ✓ 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., structure repair, soil replacement)

Glossary

Berm - a raised strip of land or other material used in rain gardens to help control water

Evapotranspiration - the process of evaporation and transpiration: water molecules escape the surface of the earth and enter the atmosphere (evaporation); plants soak up water through their roots and release it through their leaves (transpiration)

Gullying - a type of erosion; a deep, narrow path in the land caused by the flow of water

Impervious - not allowing water or other fluids to pass through

Infiltration - the process of water or other fluids soaking into the ground

Invasive - a plant or animal species, usually not native, that spreads, causing environmental damage

Loam - soil with about equal portions of sand, silt, and clay

O.C. = "on center" - distance between plants is measured from the center of each plant

Soil amendments - any material mixed into soil to improve its physical and/or chemical characteristics

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/sgpsubs/onlinepubs.html>



Faga'alu Park rain garden temporarily filled with water during a storm; photo credit: Kersten Schnurle, NPSA

For more information, contact:

Coral Reef Advisory Group (CRAG) of American Samoa
(684) 633-4456/0382



Faga'alu Park rain garden installation, August 2015