

How to Manage Stormwater with Rain Gardens



ENVIRONMENTAL SERVICES
CITY OF PORTLAND

how to build a residential rain garden

Rain that runs off your roof or patio can flow into a sewer pipe, stream, or groundwater. Why not put it to better use? You can create an attractive rain garden in your yard that captures runoff and lets it soak into the ground. Containing rainwater from hard surfaces on your property also reduces wear and tear on the sewer system, protects water quality in local streams, and recharges groundwater.

What is a rain garden?

A rain garden is a shallow depression that collects rainwater and is often planted with native plants. They can blend with your existing landscape, and the design can be formal or informal. A rain garden is a great place to direct the water from downspouts and paved areas, or to capture overflow from a rainwater harvesting system like a rain barrel.

Why plant a rain garden?

When rain falls, it washes over roofs, driveways, and other impervious surfaces and picks up dirt, oil, and other pollutants. If this runoff isn't managed properly, it can wash these pollutants into our local rivers and streams.

A rain garden collects and filters pollutants out of stormwater before allowing it to soak into the ground to replenish groundwater. Rain gardens can help reduce flooding and erosion in streams, keep sewers from backing up into basements, and reduce combined sewer overflows, also called CSOs, to the Willamette River and Columbia Slough.

In addition, rain gardens can add beauty to your yard while providing habitat for birds and beneficial insects like bees and butterflies.

Can a rain garden save me money?

Yes, installing a rain garden on your home's property can save you money. When you contain the rain safely on your property, you could qualify for [Clean](#)



Rain gardens are a natural way to manage the rain on your property while adding beauty to your landscape. They can be a good solution for flatter spaces where the soils allow water to quickly and safely soak into the ground.

[River Rewards](#), Portland's stormwater discount program. See the **Resources** section at the back of this guide for more information.

How to get started

Plan for success by learning about your site and designing your rain garden to ensure the plants will thrive and stormwater will soak safely into the ground. This guide describes an easy process to help you plan, design, and build your rain garden. See the **Resources** section for more information.

Step 1. Observe your site

Where does rain go on your property? Do the downspouts from your roof send water flowing to your lawn? Are they connected to the sewer system or a drywell? Does rain run off your driveway into your yard or does it flow to the street?

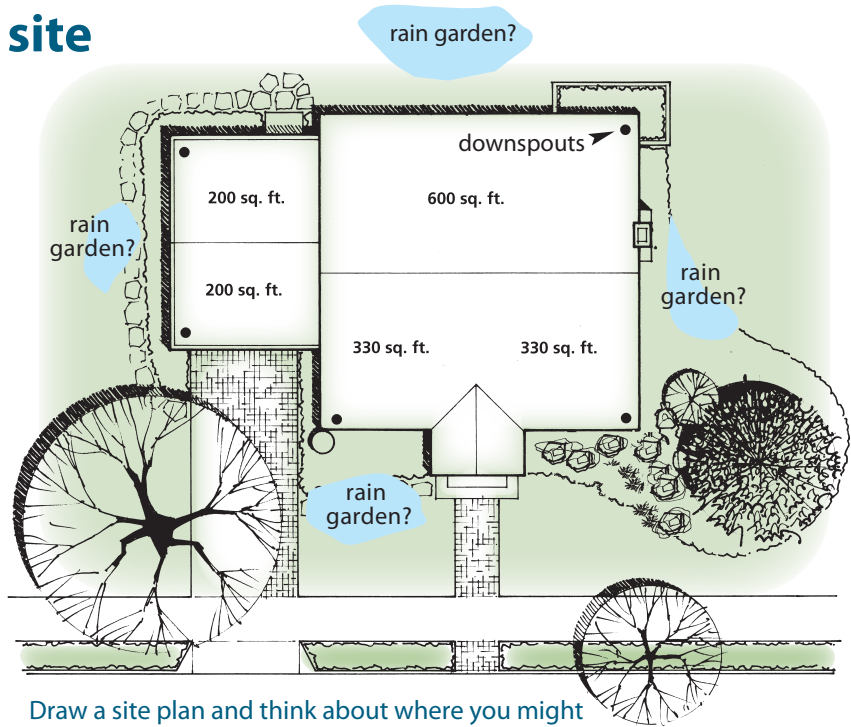
All of this information will help you locate your rain garden in the best spot to intercept and collect the most runoff.

Draw what you see

- Sketch a site plan. You can start by printing an aerial view of your property from portlandmaps.com.
- Mark the locations of downspouts and paved areas. Remember, you can always move a downspout and regrade gutters so the rain drains to a suitable location to build your rain garden such as landscaped or lawn areas.
- Estimate the square footage of your roof area and the pavement that will drain to the new rain garden.
- Map out where you might construct a rain garden. Choose spots that are downslope of the downspouts or paved areas so rain will drain to the rain garden.

Safety considerations

- **Call before you dig.** Make sure you don't damage underground utilities by digging a rain garden. Call 1-800-332-2344 or 811 or go online to www.callbeforeyoudig.org/oregon to locate all underground utilities before digging. This service is free.
- You may need to add or remove soil to make sure that the slope of the ground allows water to flow away from building foundations and neighboring properties.



Draw a site plan and think about where you might add your rain garden or gardens.

- Disconnected downspouts must discharge water at least 6 feet from a building's basement and 2 feet from a building's crawl space or concrete slab foundation. Use these distances as well to determine how close the edges of your rain garden are from foundations.
- Water in your rain garden must be at least 5 feet away from neighboring properties.
- Do not locate the rain garden over a septic system, drain field, or underground oil tank unless they have been decommissioned.
- Do not locate your rain garden over a water line.
- Do not build a rain garden in an area that is too small for the amount of water that will flow to it from your roof or paved area.
- Do not locate rain gardens within 10 feet from the top of retaining walls greater than 3 feet high and do not locate rain gardens with 5 feet from the base of retaining walls greater than 3 feet high.
- The deepest point of the rain garden must be at least 10 feet from neighboring structures.

Other factors to consider

- It's easier to build a rain garden in a relatively flat area.
- A naturally low spot with good drainage is the ideal location for a rain garden because water already ends up there.
- Avoid building a rain garden where water ponds, because that indicates that soils don't drain well.
- Consider removing paved surfaces to create space for a rain garden or replacing pavement or concrete with pavers or gravel where appropriate.
- Avoid placing rain gardens underneath the canopy of existing trees.

Do I need a permit?

You will need a City permit to construct a residential rain garden if your project involves any of the following activities or if any of the following conditions apply to your property.

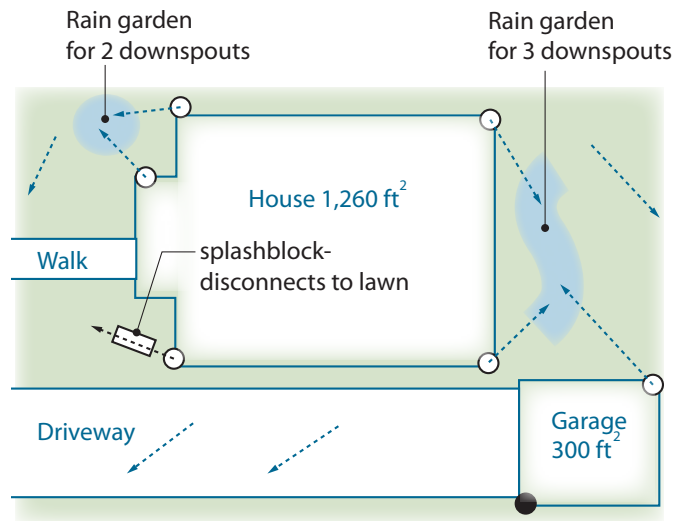
- You excavate or remove more than 10 cubic yards of dirt (that's about enough to fill one standard size dump truck).
- Your property has a 10 percent slope or more (see the section on **How to Measure Slope**).
- Your property is within 50 feet of a wetland or waterbody.
- Your property is in a floodplain.

If any of these conditions apply to your property or project, you may need to apply for a City permit, consult a professional, or include additional elements in your design in order to safely manage the stormwater on your property. See the **Resources** section for ways to find more information.

2. Design your rain garden

Add your rain garden to your existing site plan. Mark where you might move downspouts, where stormwater comes from and flows to, and where you might add or move plants.

Make sure your rain garden is large enough to drain the water directed to it within 48 hours. This keeps water from stagnating and mosquitoes from breeding. Size your rain garden to be **at least 10 percent** of the area that drains to it. If your soils drain slowly, your rain garden may need to be larger.



Example of how to size your rain garden

If you would like to drain a rooftop with 500 square feet to your rain garden, the rain garden should be at least 50 square feet.

roof area	sizing factor	rain garden size
500 sq ft	x 10 percent	= 50 sq ft

You could construct a rain garden that is 5 feet x 10 feet.

Conduct a soil test

Conduct the test in and/or near the location where you'd like to build your rain garden.

1. Dig a hole 2 feet long by 2 feet wide and 2 feet deep. Check for standing water or hard soil that prevents excavation. If either is present, contact Environmental Services Private Property Drainage Inquiries (see the resources section) before proceeding. A rain garden might not be appropriate for your site.
2. Fill the pit with at least 12 inches of water. Check the water depth at regular intervals until all of the water has been absorbed or for one hour, whichever occurs first. Record the time and final water depth at the end of the test.

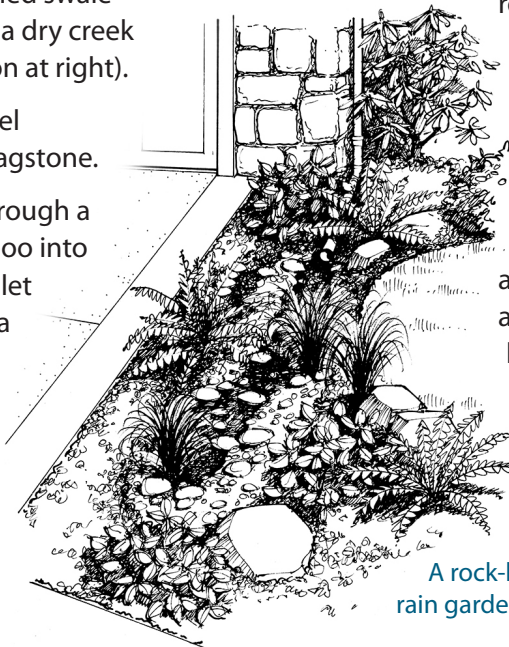
3. Repeat the process two more times for a total of three rounds. Conduct the tests one after the other so you get a good idea of the infiltration rate when the soil is saturated. The third test provides the best measure of the infiltration rate when the soil is saturated.

If the pit drains at least 2 inches per hour, the soils are good for a rain garden. For example, if the pit was filled with 12 inches of water it needs to drain within six hours. It's a good idea to test a few locations in your yard to see if drainage is uniform.

Direct water away from your house and neighboring properties

Aboveground. An aboveground pipe is the easiest way to convey water from your downspout to your rain garden. Metal downspout material is durable, easy to find at hardware stores, and good for the aboveground option. For an aesthetic aboveground feature, consider the following:

- Direct the water into a shallow conveyance swale. Make sure the swale is lined if it's close to buildings.
- Build a rock-lined swale that looks like a dry creek bed (illustration at right).
- Carve a channel in a piece of flagstone.
- Send water through a piece of bamboo into a container or let it splash onto a rock.
- Use a concrete or plastic splashblock.



Underground. For a more durable long-term solution, buried pipe that daylights directly into the rain garden is preferable. Whether you select an aboveground or underground option, make sure the materials you use are sturdy and made for outdoor conditions (no dryer hose or indoor tubing). For buried pipe, suggested materials include cast iron and Schedule 40 ABS or PVC. If you are draining less than 1,500 square feet of roof to your rain garden, you should use 3-inch pipe. If you are draining more roof area, use 4-inch pipe.

Every garden must have a safe escape route

Plan in advance where the rain garden will overflow when it gets completely full. Make sure excess water will flow away from buildings and neighboring properties. You may need to use additional stormwater management options to handle the overflow or if you only have a small area available for a rain garden. See the brochure's **Resources** section for more information on managing stormwater safely on your property.

A rock-lined swale can direct water from a downspout to your rain garden and away from your house.

3. Build your rain garden

Now you're ready to start!

- A. Outline the garden.** Use string and stakes or flags to outline the area you're going to dig.

Did you call to locate underground utilities?

If not, do so now at 1-800-332-2344 or 811.

- B. Prepare the ground.** If it's summertime, moisten hard soils with a garden hose to make digging easier. Dig up existing grass and plants. Set aside any plants you might be able to replant in the rain garden.

- C. You're ready to dig!** Dig the entire rain garden about 18 inches deep to loosen soil, then add a few inches of soil, sloping the sides at a ratio of 3 to 1 to reduce the risk of erosion and soil falling back into the bottom of the rain garden. Accent boulders should be utilized to stabilize slopes that are greater than 3 to 1 and can also be a nice aesthetic addition to your garden.

- D. Minimum depth.** The minimum suggested depth of the finished rain garden should be 6 to 12 inches. The deepest part of your rain garden should be farthest from buildings, a suggested 10-foot distance.

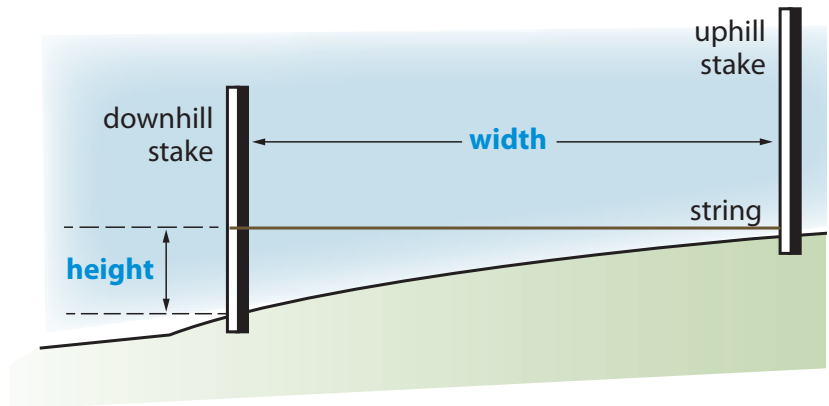
- E. Plant your rain garden.** Use a variety of species and plant densely to make it harder for weeds to take root and to reduce soil erosion. After planting, add some compost to prevent erosion and provide nutrients to plants.

- F. Disconnect your downspouts.** Disconnect your downspouts from the sewer or stormwater system and direct the rain to your new rain garden. Watch it in action!



How to measure the slope

Tie a level string from a stake pounded into the ground at an uphill spot to a stake pounded into the ground downhill. Measure the distance between the stakes (width) and from the string to the ground at the downhill stake to the ground (height). Divide the height by the width to get the slope in decimal format. Multiply this by 100 to obtain the percent.



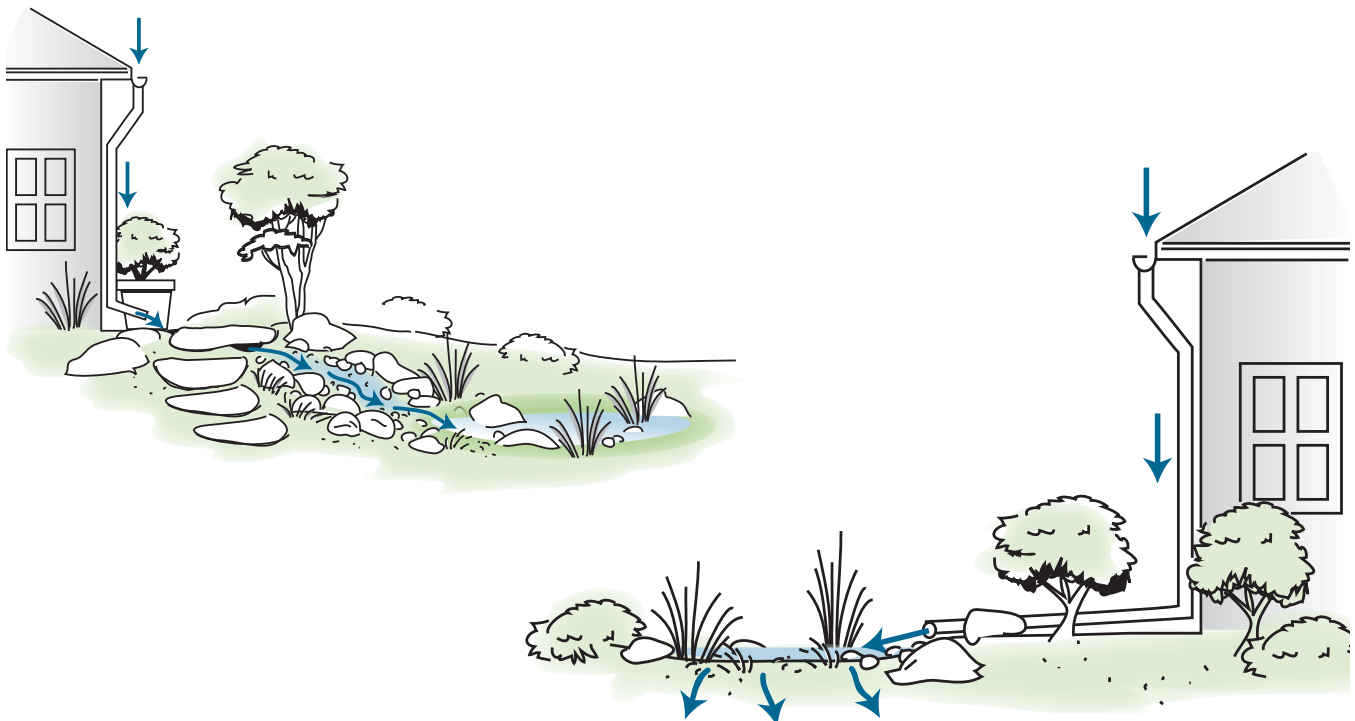
For your rain garden:

- Make the main basin of the garden as level as possible so that water spreads evenly over the rain garden surface.
- If the garden is on a slight slope, add a berm on the downhill slope to hold in rainwater.
- Use plastic or concrete splashblocks, rocks or boulders at the end of downspouts to control erosion and add visual interest.

Measuring slope

Divide the **height** by the **width** to get the slope in decimal format. Multiply this by 100. If the width is 10 feet and height is 6 inches, then your slope is 5 percent.

$$\begin{array}{ccccccc} 6 \text{ inches} & \div & 10 \text{ feet} & \times & 100 & = & 5\% \\ \text{(0.5 feet)} & & \text{width} & & & & \text{slope} \\ \text{height} & & & & & & \end{array}$$



4. Maintenance

Regular maintenance will keep your rain garden working well.

- Inspect your rain garden periodically, especially after a heavy rain.
- Irrigate deeply once a week during dry months to encourage root growth and keep plants strong, especially while plants are getting established during the first two summers.
- Avoid chemical weed killers or fertilizers. Pull weeds by hand before they become established.
- Remove sediment and debris, watch for erosion, and replace plants as needed.
- Layer compost or mulch 2 to 3 inches deep once a year to suppress weeds and feed the plants.
- Often plants need to be thinned or pruned to retain the rain garden aesthetic. Divide dense plantings every 2-5 years.
- Remove leaves in the fall. Leaf build-up will reduce rain garden capacity and smother plantings.
- Maintain your gutters and downspouts to help rain flow to the garden. Check and clean your gutters at least twice a year — more often if you have overhanging trees. Fix any problems. Check and clear elbows or bends in downspouts to prevent clogging.

After the garden is established in one to three years, maintenance should be minimal.

Be flexible

If a plant isn't thriving where you first placed it, move it to another part of the rain garden. Some areas in a rain garden will be wetter or drier than others. Sometimes it isn't easy to tell where a plant will grow best until it's rained a few times. A rain garden is a living system, so go with the flow.

5. Resources

Other how-to guides

Find all of Environmental Services' how-to guides at portland.gov/bes including:

- How to Manage Stormwater with Downspout Disconnection portland.gov/bes/downspout-disconnect
- How to Manage Stormwater with Rain Gardens portland.gov/bes/rain-gardens
- How to Install and Maintain a Rain Barrel portland.gov/bes/rain-barrels

Additional guides on rain gardens

- Washington State University Extension, Rain Gardens: ext100.wsu.edu/raingarden
- Rain Garden Network: raingardennetwork.com
- East Multnomah Soil and Water Conservation District: emswcd.org/in-your-yard/rain-gardens

Additional resources

Call Before You Dig – 811

Call **8-1-1** or online: www.callbeforeyoudig.org/oregon

City of Portland 2020 Stormwater Management Manual: portland.gov/bes/swmm

Bureau of Environmental Services
portland.gov/bes

Environmental Services Private Property Drainage Inquiries, 503-823-5858
drainage.inquiries@portlandoregon.gov

Bureau of Development Services
portland.gov/bds

Residential plumbing permits
portland.gov/bds/residential-permitting/residential-plumbing-permits

City of Portland Research and Records
503-823-7660



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