COMMUNITY DEVELOPMENT

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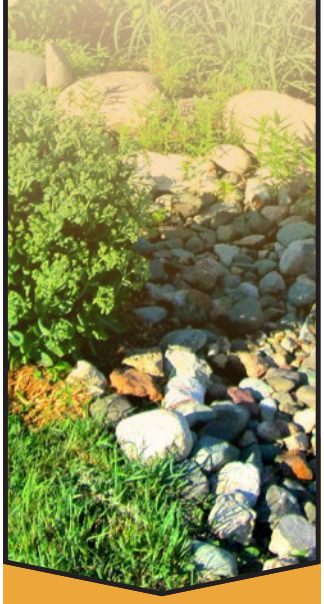
Residential Rain Garden Design & Construction Guide



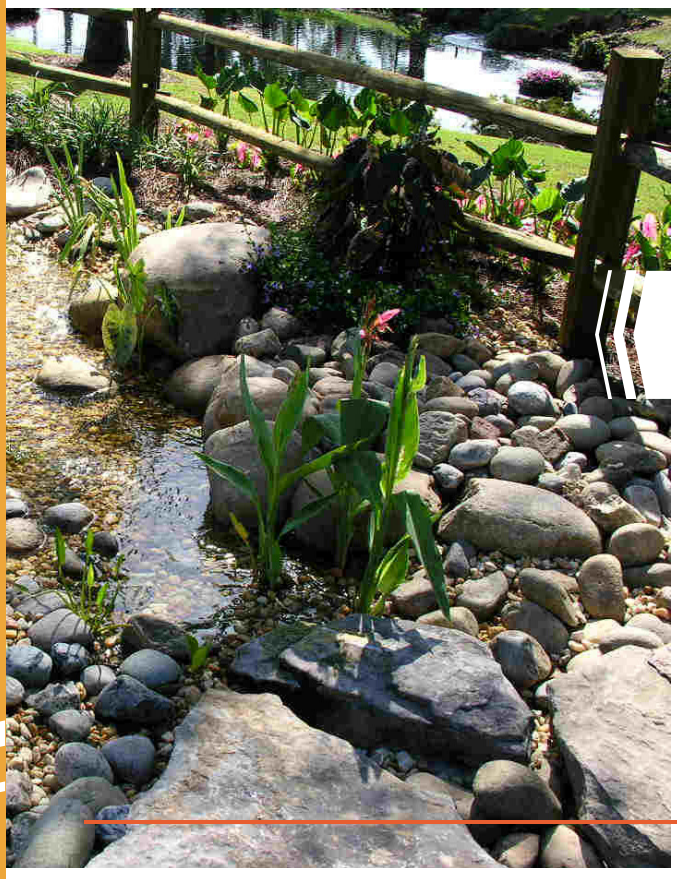
ELIGIBILITY

This handout is intended to aid applicants using the Stormwater Permit Application for Small Projects who have determined that a rain garden is the best method for managing stormwater from their project. This handout may also be used by owners of existing homes and other small structures to retrofit their property.

INSTRUCTIONS FOR USING THIS HANDOUT

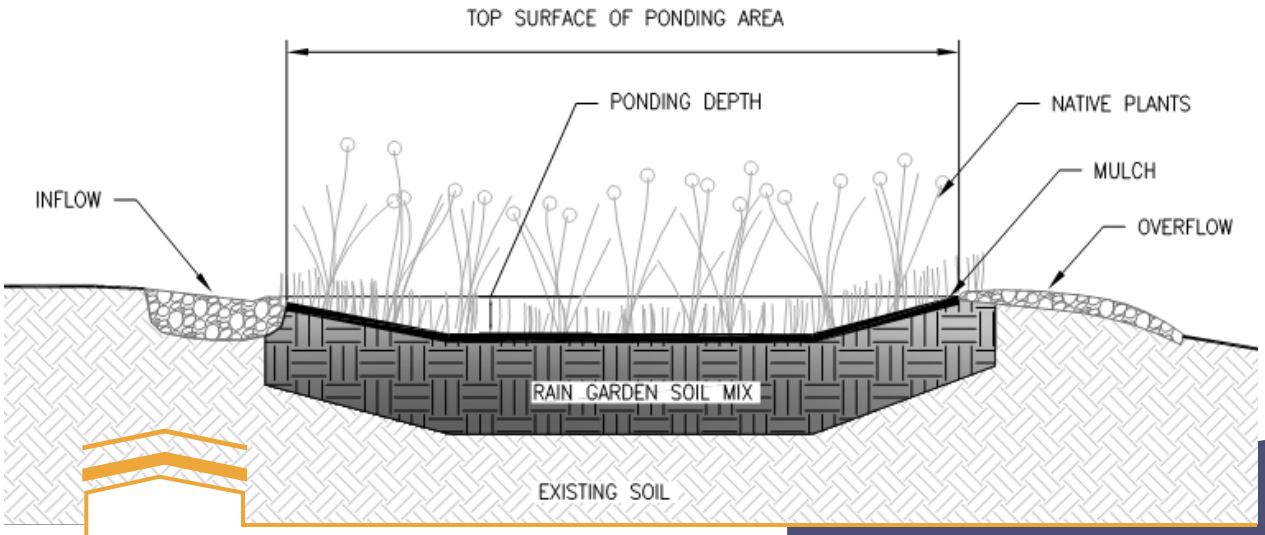
This handout gives instructions for constructing a rain garden for on-site stormwater management. The information in this handout is adapted from the *Rain Garden Handbook for Western Washington.* This handout is intended to provide information for simple rain gardens on level sites. If you wish to build a more intricate garden, or your site is constricted or sloped (greater than 5% slope) please refer to the *Rain Garden Handbook for Western Washington (https://fortress.wa.gov/ecy/publications/documents/1310027.pdf).*

This guidance is intended for use by property owners and is not a substitute for Washougal Municipal Code. We have substituted some technical language with plainer terms. In case of conflict, the meaning and intent adopted in the Washougal Municipal Code and the Washougal Engineering Standards for Public Works Construction shall prevail.



WHAT ARE RAIN GARDENS?

A rain garden is a landscaped depression that collects stormwater runoff from hard surfaces, such as roof tops and driveways, and allows the runoff to infiltrate into the ground. The rain garden is lined with a soil mix that drains well and supports plant growth. The rain garden is usually planted with low-maintenance native plants. The soil and plants in the rain garden soak up the stormwater and filter out pollutants. Rain gardens must be located in well-drained soil away from structures, utilities, and steep slopes.



Anatomy of a Rain Garden

WHAT ARE THE BENEFITS OF RAIN GARDENS?

As cities and suburbs grow, they replace forests and other open spaces with roofs, pavement, and other impervious surfaces. Most rain or snow that falls on native forests and prairies is quickly absorbed into the soil or evaporated. When rain falls on impervious surfaces, it cannot be absorbed and quickly runs off. This runoff can cause erosion and flooding and carries pollutants including pesticides, oil, and heavy metals into lakes and streams. On-site stormwater management BMPs such as rain gardens mimic natural conditions. Rain gardens help recharge aquifers and help protect streams and lakes from pollution.

WHERE SHOULD I BUILD MY RAIN GARDEN?

The detailed feasibility requirements for rain gardens can be found in the Washougal Stormwater Permit Application for Small Projects, the Full Infeasibility Checklist and the Design Guidelines of the *Stormwater Management Manual for Western Washington.*

Once you have determined if a rain garden is feasible on your site, you can decide where to place your rain garden. You should locate your rain garden close to the surfaces you want to drain into it: roof downspouts, driveways, patios, etc. You may need more than one rain garden if you have a lot of impervious surfaces. Water should flow into the garden by gravity.

RAIN GARDENS SHOULD NOT BE LOCATED:

1. **Within 10 feet of a building foundation.**
2. **Over utilities –** Make sure to have all utilities located and marked before digging. Contact utility locate services by calling 811.
3. **Near the edge of steep slopes or bluffs –** The additional water soaking into the ground on steep slopes can cause landslides or unwanted settling. Do not build a rain garden within 50 feet of a slope greater than 20%.
4. **Near a septic tank, septic drainfield, or reserve drainfield area –** Provide at least 10 feet between the rain garden and an existing or planned septic system.
5. **In low spots that do not drain well.**
6. **In areas that would require disturbing healthy native soils, trees and other vegetation –** These areas already do a good job of filtering and storing stormwater.
7. **Where there is high groundwater during the winter –** If groundwater rises to within one foot of the bottom (excavated soil surface) of your rain garden during winter (highest level), you should consider a different location. In areas with high groundwater a rain garden will not drain or function properly.
8. **Near wells –** Your rain garden must be set back a minimum of 100 feet from drinking water wells.

HOW DO I DESIGN MY RAIN GARDEN?

1. **INFILTRATION RATE:** Get the infiltration rate for your proposed location from the Infiltration / Percolation Evaluation report completed as part of the Construction Stormwater Application for Small Projects.

2. **RUNOFF AREA:** Calculate the area that will drain to your rain garden. This may include a roof, patio, driveway, or other hard surface or a combination of surfaces. Or you may need to build multiple gardens to capture the runoff from different parts of your project.

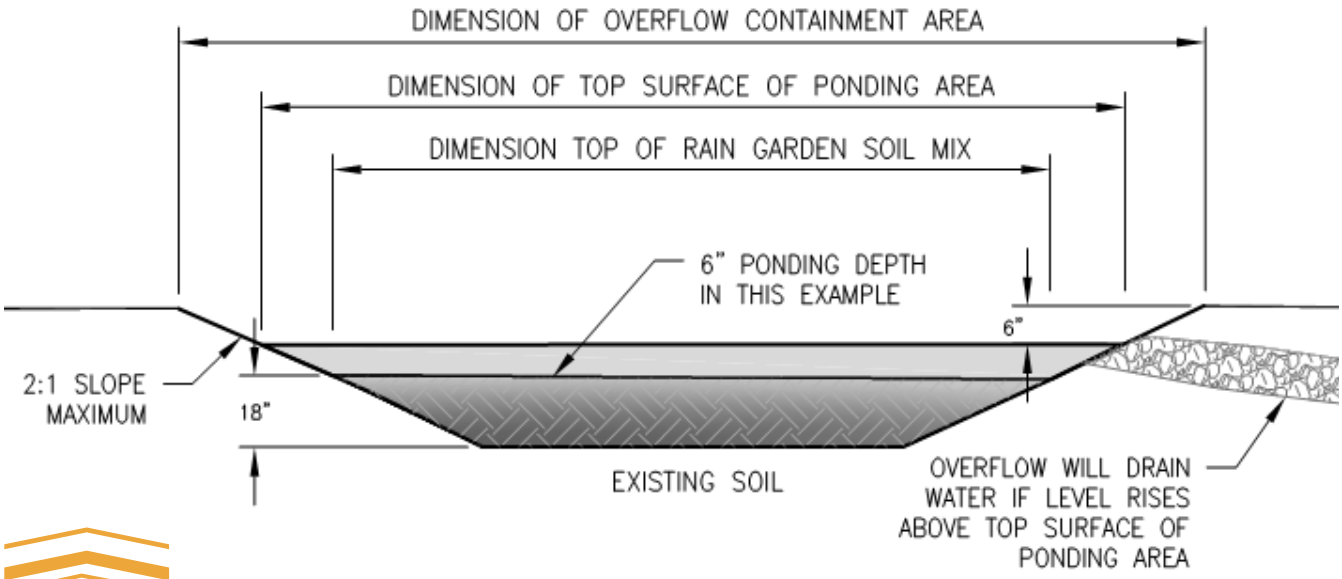
3. **RAIN GARDEN DEPTH:** A ponding depth between 6 inches and 12 inches is required. A shallower pond will have a larger footprint, but a deeper ponding area will take longer to drain and require more water-tolerant plants.

Infiltration rate = _____ inches/hour

Runoff area = _____ square feet

(length x width = area in square feet)

Depth = ☐ 6 inches ☐ 12 inches



Rain Garden Depth Section View

4. POND AREA: The infiltration rate, runoff area, and depth of your pond determine the area of the pond surface.

4a. Use the chart below to find the sizing factor based on the infiltration rate and pond depth.

PONDING DEPTH	INFILTRATION RATE				
	0.10-0.24 inches/hour	0.25-0.49 inches/hour	0.5-0.99 inches/hour	1.00-2.49 inches/hour	2.50 + inches/hour
	SIZING FACTOR % (SIZING FACTOR DECIMAL)				
6 inches	54% (0.54)	43% (.43)	34% (.34)	27% (.27)	18% (.18)
12 inches	N/A	36% (.36)	31% (.31)	25% (.25)	17% (.17)

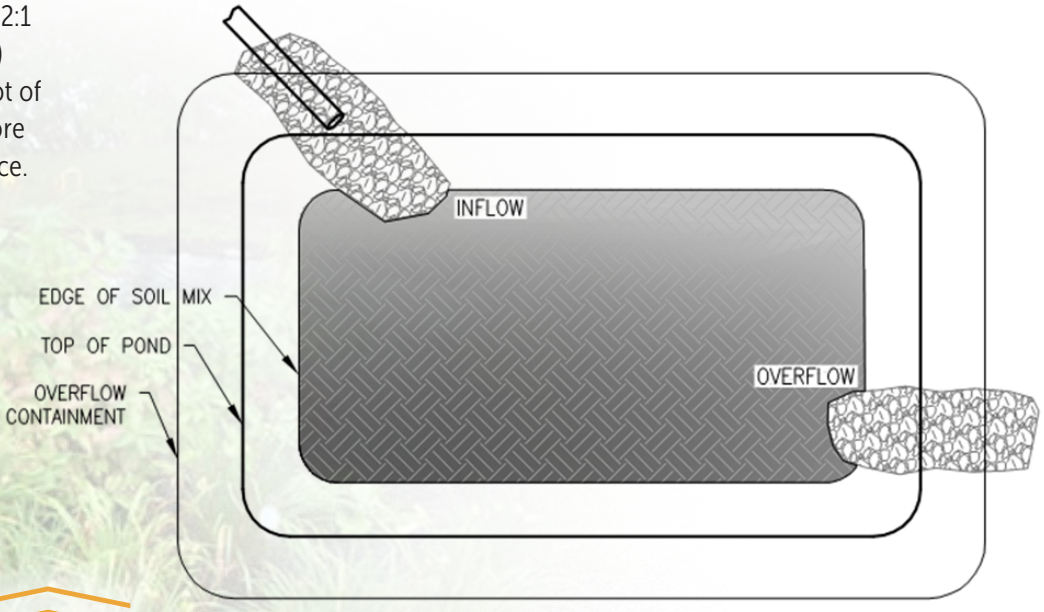
(Source: Rain Garden Handbook for Western Washington. Sizing factors are for "Best performance" in region 4, average annual precipitation 50-70 inches.)

4b. Calculate the pond surface area using the following equation:

(Runoff area = _____ sq. ft.) x (Sizing factor decimal _____) = Top surface area of pond _____ (sq. ft.)

EXAMPLE: For a rain garden with a depth of 6 in. and an infiltration rate of 0.3 in/hr, the sizing factor is 43%. If the area that drains to the rain garden (runoff area) is 1,200 sq. ft., the surface of the ponding area = 516 sq. ft.

5. RAIN GARDEN PERIMETER AND SIDE SLOPES: After a heavy storm, water may rise above the ponding level, and the overflow containment area directs the excess to the overflow location. The extra height should be a minimum of 6 inches higher than the top of ponding surface. The sides of the rain garden should be gently sloped so the rain garden is not a hazard and to prevent erosion of the sides. With a maximum recommended slope of 2:1 (2 feet horizontal to 1 foot vertical) the pond needs an additional 1 foot of extra space all the way around. More gradual slopes will need more space.



Rain Garden Depth Plan View

HOW DO I BUILD MY RAIN GARDEN?

1. DESIGN THE INFLOW AND OUTFLOW

Designing the inflow and outflow of your rain garden is the first step to build your rain garden.

INFLOW: Water can be delivered to your rain garden across a landscaped area, through an open swale, or through a pipe. If the slope is gentled (2% or less) and the swale or landscaped area is well protected with vegetation or rock, then no special design is needed. If the slope is more than 2% and water is directed through a swale, add small rock check dams every 5 to 10 feet to slow the water. Where water enters the rain garden from a swale or pipe, place a pad of rock to slow the water and guard against erosion.

OUTFLOW: During winter most of the water that flows into your rain garden will soak into the ground. During a big storm, the rain garden may fill up and overflow. Design the rain garden with an overflow lined with rock to protect from erosion. Extend the rock about 4 feet outside the rain garden to slow water as it exits. Direct water safely to a storm drain or disperse into the landscape.

2. LAY OUT

Lay out the rain garden using the area of the rain garden perimeter.

3. SELECT A SOIL OPTION:

OPTION 1. Excavate Soil and Add New Rain Garden Soil: Excavate the soil and completely replace with new rain garden soil mix. Rain garden soil mix contains about 60% screened sand and 40% compost by volume. Rain garden soil mix is available from landscape suppliers, and it may be known as 2-way mix, rain garden soil or bioretention soil. Use this option when you have poor quality soils high in clay content.

OPTION 2. Excavate and amend soil for reuse: Excavate the soil, amend it by mixing in compost, and then put it back into the rain garden. Use this option when you have moderately good to good quality soils without too much clay. Mix 65% excavated soil with 35% compost.

OPTION 3. Amend soil in place: Amend your existing soil in place by mixing in compost after you've excavated to the proper depth. Use this option if you have good quality soil with minimal clay content and a soil drainage rate of more than 1 inch per hour. With this option, you won't excavate as far down (see below).

Note: In all cases, compost for rain gardens must not contain manure or biosolids. If possible, avoid mushroom compost.

Excavating and adding new soil is the best option if you have poor quality soils.

4. EXCAVATE

Determine the depth of excavation necessary.

After calculating the depth necessary for your rain garden, excavation can begin.

Soil Options 1 and 2:

Ponding depth =	☐ 6 inches	☐ 12 inches
+ Soil mix depth		+ 18 inches
+ Overflow containment area depth		+ 6 inches (minimum)
= Excavation depth	= _____	inches

Soil Option 3:

Gently slope the sides with a minimum of 2:1 (horizontal distance to vertical distance) slope. To prevent compacting the soil under the rain garden, don't excavate when soil is wet and don't use machinery inside the rain garden area.

Ponding depth =	☐ 6 inches	☐ 12 inches
+ Room for compost		+ 3 inches
+ Overflow containment area depth		+ 6 inches (minimum)
= Excavation depth	= _____	inches

Example of a finished overflow containment area

5. OVERFLOW CONTAINMENT AREA

The overflow containment area can be provided by one of two approaches:

- **Create a berm that rises a minimum of 6 inches, at a maximum of 2:1 slope from the outside of the top surface of the ponding area.** If a berm is used, it must be water tight. If your soil is sandy, you may need to import soil with higher clay or silt content. Before the soil is placed remove all vegetation and rough up the ground under berm. Firmly compact the berm every few inches as you add soil.
- **Dig down from the ground surface, start 12 inches out from the perimeter of the top surface of the ponding area on a 2:1 slope.**

6. LEVEL BOTTOM

Rain gardens need a level bottom to function properly. This allows the water to spread out and infiltrate across the entire surface.

7. INSTALL INFLOW

Install the pipe or downspout extension to carry water to your rain garden if you're using one, and test that water flows freely to the rain garden.

8. CALCULATE QUANTITY OF RAIN GARDEN SOIL OR COMPOST REQUIRED

Soil Option 1:

Ponding depth = ☐ 6 inches ☐ 12 inches
+ Room for compost + 3 inches
+ Overflow containment area depth + 6 inches *(minimum)*
= Excavation depth = _____ inches

Soil Option 2:

Excavated soil depth (from step 4) = _____ inches

Divide by 12 (inches/foot) = _____ feet

Multiply by top surface of ponding area
(How do I design my rain garden?) = _____ cubic feet

Divide by 27 = _____ **cubic yards rain garden soil mix required**

Soil Option 3:

Top surface of ponding area
(How do I design my rain garden?) = _____ square feet

Multiply by 0.25 feet (3 inches) = _____ cubic feet

Divide by 27 = _____ **cubic yards compost required**

Placing the soil mix is one of the last steps before planting your rain garden

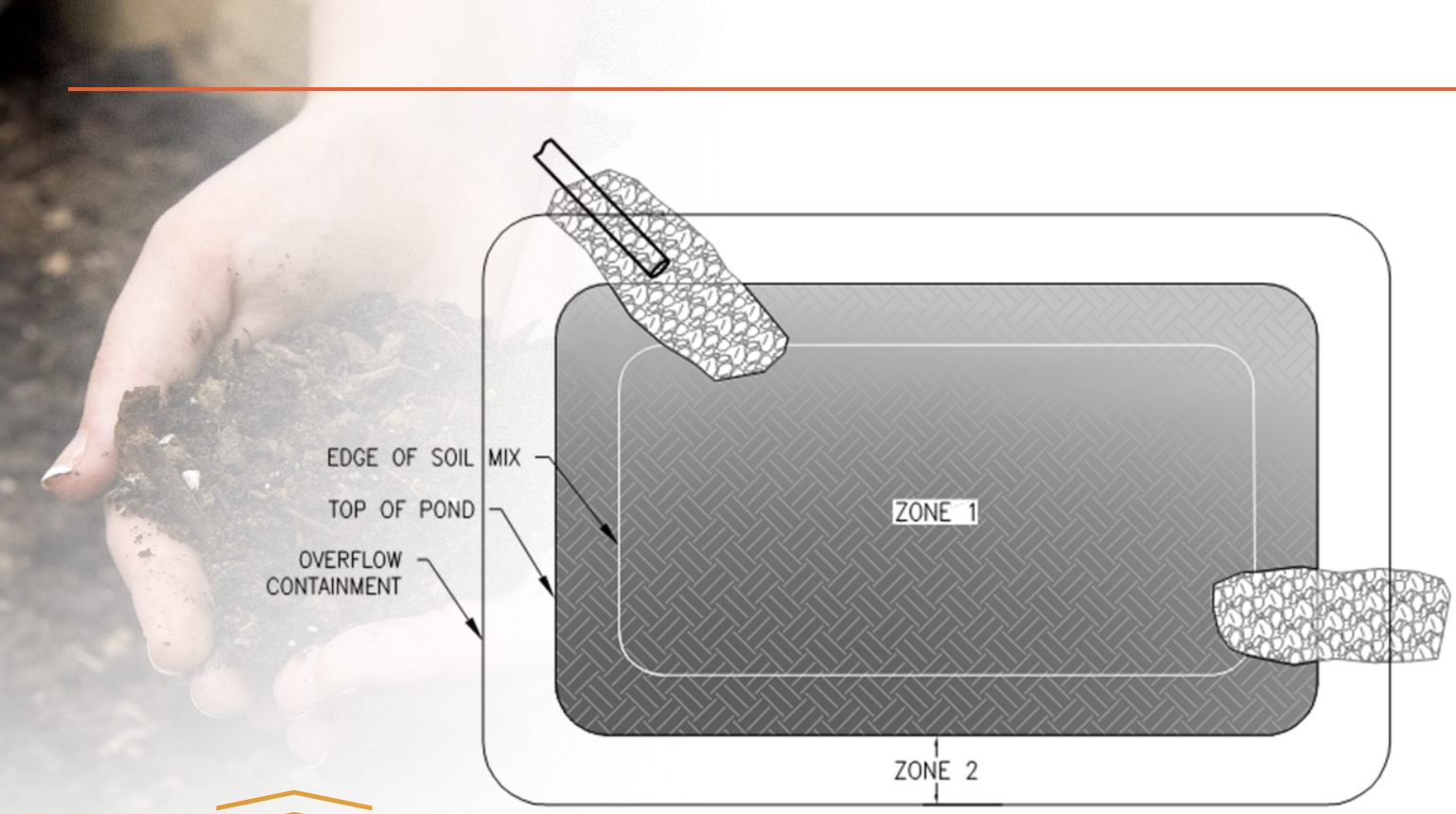
9. PLACE SOIL MIX

Soil Options 1 and 2: Avoid compacting the pond area. Before adding rain garden soil mix, use a rake, shovel or rototiller to rough up the bottom of the excavated area. Roughing up the soil at the bottom will improve drainage in the garden. Place the soil mix in the rain garden about 6 inches at a time and lightly tamp down. Fill the soil to the level that provides the desired ponding depth and overflow containment area. When placing the soil mix, keep the bottom of the rain garden flat and level.

Soil Option 3: Spread 3 inches of compost at the bottom of the garden and till to a depth of 4 or 5 inches. When placing the compost and tilling, keep the bottom of the rain garden flat and level.

10. PROTECT THE INFLOW AND OUTFLOW

Place a pad of rock where water enters the rain garden and where water exists at the overflow. The rock slows the flow of the water and prevents erosion. Use round rock that is a minimum of 2 inches in diameter. If the overflow is through a berm, armor the overflow with extra rock, and extend the rock down the slope a minimum of 4 feet to prevent erosion.



Planting Zones

HOW DO I PLANT MY RAIN GARDEN?

Plant easy to maintain native or adapted plants in your rain garden. Plants must be selected from the City of Washougal approved plant list. An abbreviated list of recommended plants is on the next page.

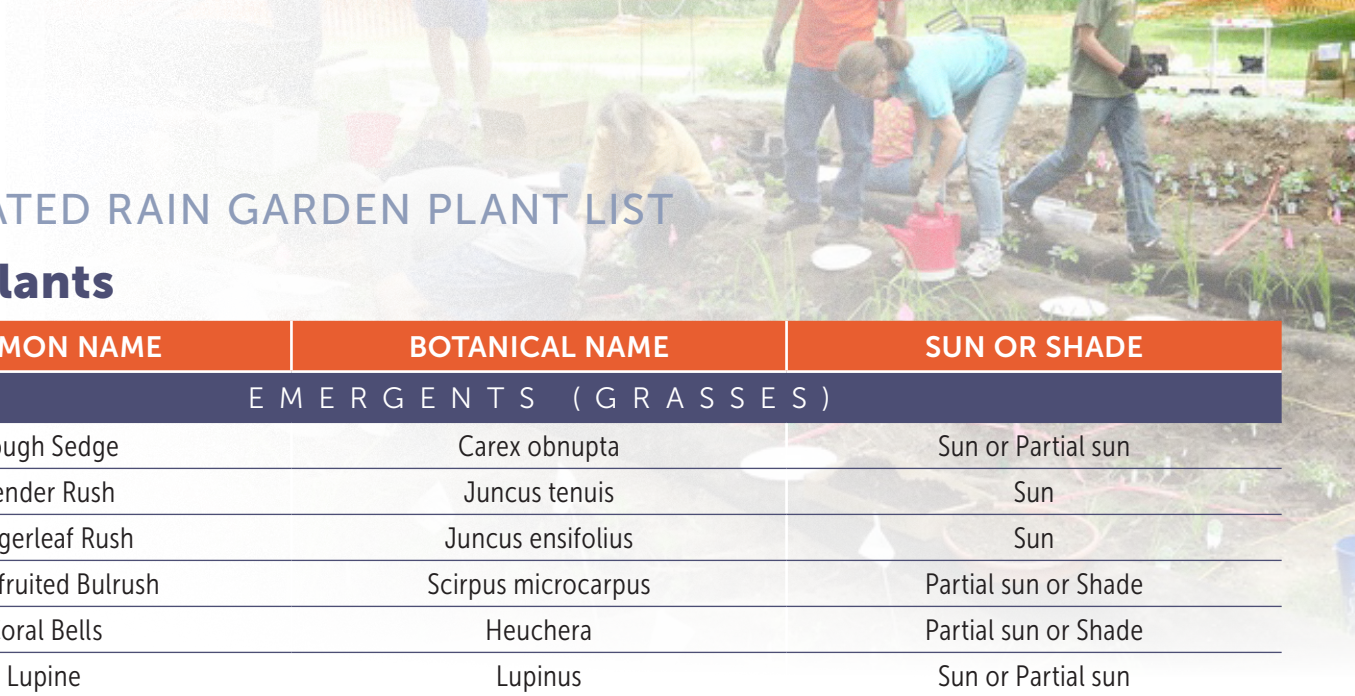
There are two planting zones:

- Zone 1 is the bottom of the rain garden below the ponding depth, the wettest area.
- Zone 2 covers the side slopes above the ponding depth and the area around the perimeter or on the berm, where plants will grow in drier soil.

The recommended plant size is a 1 gallon container. For grasses, plant at a rate of 115 for 100 sq. ft. For shrubs, plant at a rate of 13 per 100 sq. ft. and space at approximately 3' on center. Distribute plants evenly throughout the rain garden.

After planting, place two to three inches of mulch over the surface of the rain garden. Compost mulch is recommended. Do not use grass clippings, pine bark or beauty bark as mulch.

Until the plants are established and thriving, they need to be irrigated or watered regularly. After the plants are established, they usually will not require watering. Keep weeds down by refreshing compost mulch, when it gets bare spots, and hand-pulling weeds. Avoid using herbicides and fertilizers in your rain garden.



ABBREVIATED RAIN GARDEN PLANT LIST

Zone 1 Plants

COMMON NAME	BOTANICAL NAME	SUN OR SHADE
EMERGENTS (GRASSES)		
Slough Sedge	Carex obnupta	Sun or Partial sun
Slender Rush	Juncus tenuis	Sun
Daggerleaf Rush	Juncus ensifolius	Sun
Small-fruited Bulrush	Scirpus microcarpus	Partial sun or Shade
Coral Bells	Heuchera	Partial sun or Shade
Lupine	Lupinus	Sun or Partial sun
SHRUBS		
Dwarf Blue Arctic Willow	Salix purpurea 'Nana'	Sun or Partial sun
Douglas Spirea	Spiraea douglasii	Sun or Partial sun
Pacific Wax Myrtle	Myrica californica	Sun or Partial sun
TREES		
Pacific Crabapple	Malus fusca	Sun or Partial sun

Zone 2 Plants

COMMON NAME	BOTANICAL NAME	SUN OR SHADE
GROUNDCOVER		
Western Columbine	Aquilegia Formosa	Sun or Partial sun
Kinnikinnick	Arctostaphylos uva-ursi	Sun or Partial sun
Geum	Avens	Sun, Partial sun or Shade
Common Camas	Camassia quamash	Sun or Partial sun
Blue Fescue	Festuca ovina 'Glauca'	Sun or Partial sun
Coral Bells	Heuchera	Partial sun or Shade
Lupine	Lupinus	Sun or Partial sun
SHRUBS		
Vine Maple	Acer circinatum	Partial sun or Shade
Redtwig Dogwood	Cornus sericea	Sun or Partial sun
Snowberry	Symphoricarpos albus	Sun, Partial sun or Shade
TREES		
Western Serviceberry	Amelanchier alnifolia	Sun or Partial sun
Beaked Hazelnut	Corylus cornuta	Sun, Partial sun or Shade