

# Rain Garden Handbook

for Western Washington



A Guide for Design,  
Installation, and Maintenance

# Rain Garden Handbook for Western Washington

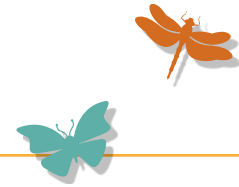
A Guide for Design, Maintenance, and Installation

JUNE 2013



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# Acknowledgements



## Principal Author

**Curtis Hinman** *Washington State University Extension Faculty, Green Stormwater Infrastructure Specialist and Green Stormwater Infrastructure Program Lead*



## Advisory Committee and Contributors

**Teresa Brooks** *Kitsap Conservation District*  
**Peggy Campbell** *Snohomish County*  
**Michael Carey** *City of Tacoma*  
**Mindy Fohn** *Kitsap County*  
**Dan Gariépy** *Washington State Department of Ecology*  
**Erica Guttman** *Washington State University Extension, Thurston County*  
**David Hymel** *Rain Dog Designs*  
**Marilyn Jacobs** *Rain Dog Designs*  
**Colleen Miko** *Washington State University Extension, Kitsap County*  
**Zsofia Pasztor** *Innovative Landscape Technologies; Edmonds Community College*  
**Mandi Roberts** *Otak, Inc.*  
**Bob Spencer** *Seattle Public Utilities*



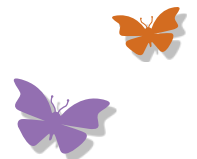
## Editing, Sizing Tool Development, and Graphic Design

**Marissa Chargualaf** *Otak, Inc.*  
**Cheyenne Covington**  
**Finis Ray**  
**Mandi Roberts**  
**Neil Schaner**  
**Mark Shelby**  
**Sharlene Sherwood**



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*Sources of photographs are listed with each. Background photograph on cover is from [www.istockphoto.com](http://www.istockphoto.com).*









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## Tips



Look for these boxes with helpful tips and information throughout the handbook.

## Tools and Materials Checklist



These checklists are provided to help you gather the tools and materials you may need in each stage of creating your rain garden.

## Local and State Requirements Alert



This box reminds you to check local and state requirements, including Department of Ecology Stormwater Minimum Requirements, that may apply to your project.



Erica Guttman



Erica Guttman

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This handbook will guide you through the following stages: PLAN, BUILD, PLANT, and MAINTAIN. The handbook is written for conditions specific to western Washington, including appropriate plant selections and sizing recommendations based on regional soils and rainfall patterns.



# INTRODUCTION



## In this Section

- How Rain Gardens Enhance Our Natural Environment and Quality of Life
- What Is a Rain Garden?
- Rain Gardens As Part of the Overall Approach to Low Impact Development
- Rain Gardens Provide Multiple Benefits
- Four Stages to Create & Sustain a Rain Garden
- Recommended Timeline



# How Rain Gardens Enhance Our Natural Environment and Quality of Life

Native soils and forests of western Washington absorb, store, filter, and slowly release cool, clean water to rivers, streams, wetlands, lakes, and coastal waters. The rich diversity of life in marine and fresh water, as well as on land, depends on clean water to thrive.

As the region grows, native forests and soils are replaced with roads, rooftops, and other hard surfaces. When it rains or snows, more water flows from these hard surfaces than undisturbed areas, carrying oil, fertilizers, pesticides, sediments, and other pollutants downstream. In fact, much of the pollution in streams, wetlands, and Puget Sound now comes from stormwater flowing off developed areas. The added water and associated pollutants from developed lands are damaging water resources and harming aquatic life in western Washington.

## How You Can Help



You can make an important contribution by reducing the amount of stormwater and pollutants coming from your property and entering our region's waterways by installing rain gardens in your yard and other places throughout your community.



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# What Is a Rain Garden?

A rain garden is a landscaped area that collects, absorbs, and filters stormwater runoff from roof tops, driveways, patios, and other hard surfaces that don't allow water to soak in. Rain gardens are sized to accommodate temporary ponding after it rains and are not meant to be permanent ponds. Simply put, rain gardens are shallow depressions that:

- Can be shaped and sized to fit your yard.
- Are constructed with soil mixes that allow water to soak in rapidly, treat runoff, and support plant growth.
- Can be landscaped with a variety of plants to fit the surroundings.

## Anatomy of a Rain Garden

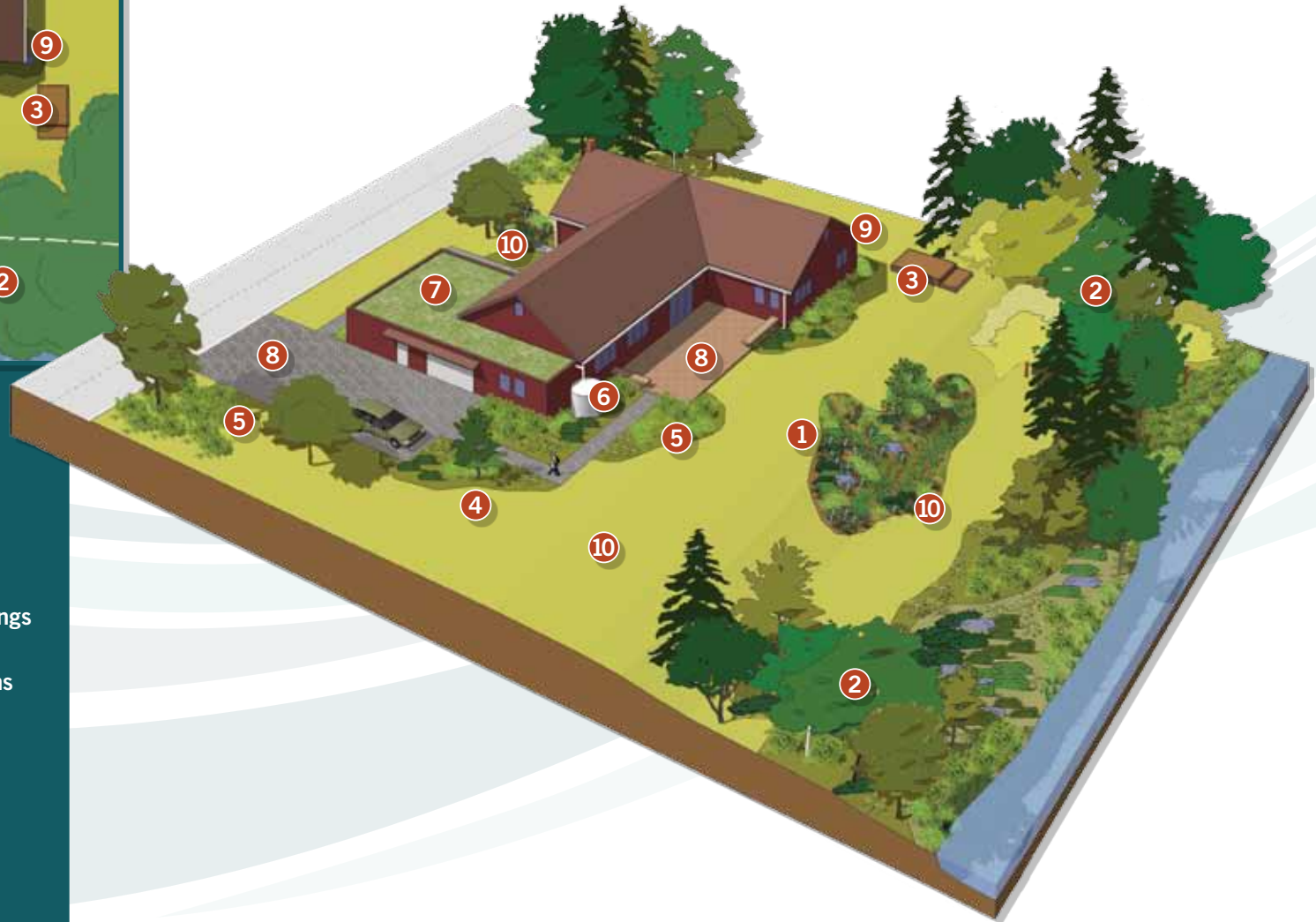


# Rain Gardens As Part of the Overall Approach to Low Impact Development



Rain gardens are important and versatile tools in the approach to managing stormwater called low impact development. In addition to rain gardens, preservation of natural areas, permeable pavement, compost-amended soils, vegetated roofs, rainwater collection systems, and other techniques can help to manage stormwater runoff in commercial and residential areas including your home. Rain gardens that are part of an engineered stormwater management system are called “bioretention” facilities.

- 1 Rain Gardens
- 2 Preservation of Existing Trees and Vegetation
- 3 Composting and Mulching
- 4 Natural Yard Management (No Pesticides or Fertilizers)
- 5 Retain/Restore Native Plantings as Lawn Alternatives
- 6 Rainwater Harvesting/Cisterns
- 7 Green Roofs
- 8 Permeable Pavement
- 9 Splash Blocks for Roof Downspouts
- 10 Soil Amendments





# Rain Gardens Provide Multiple Benefits

Rain gardens can:

- Enhance the landscaping and appearance of the homes and yards.
- Provide habitat for beneficial insects and birds.
- Filter oil and grease from driveways, pesticides and fertilizers from lawns, and other pollutants before they reach groundwater or the storm drain and eventually streams, wetlands, lakes, and marine waters.
- Reduce flooding on neighboring property, overflows in sewers, and erosion in streams by absorbing runoff from hard surfaces.
- Increase the amount of water that soaks into the ground to recharge local groundwater.



# Four Stages to Create & Sustain a RAIN GARDEN





## PLAN

## 1



Mandi Roberts

- Check with your local municipality to confirm requirements for your project.
- Confirm the location of existing utilities and avoid conflicts.
- Determine how much contributing area will drain to your rain garden.
- Observe how drainage flows from the contributing area and pick a location to capture the runoff.
- Test the soil drainage rate in that location to be sure rain will soak into the ground.
- Identify a safe place to direct overflow.
- Determine the size and shape of your rain garden.
- Confirm that the selected location will accommodate the rain garden.

## BUILD

## 2



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Stewardship Partners

- Lay out your rain garden using stakes, rope, ground paint, and/or other tools.
- Excavate the soil.
- Create an entry for water (extended rain gutter downspout, pipe, swale, or landscaped area) into your rain garden.
- Level the excavated bottom of your rain garden (but do not compact the soil).
- Provide a rock-lined overflow.
- Obtain an approved rain garden soil mix or mix compost into your existing soil.
- Place the soil mix and leave space below the overflow for ponding.
- Level the surface of the rain garden soil mix, and be sure not to over compact the soil.

## PLANT

## 3



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- Use a variety of small trees, shrubs, groundcovers, and grasses.
- Select plants suitable for the three planting zones within your rain garden and around the perimeter.
- Cover exposed soil with mulch to minimize erosion and weeds.
- Provide water to establish plants.

## MAINTAIN

## 4



Erica Guttman

- Keep inlet and overflow clear of debris and well protected with rock.
- Do not use fertilizers, pesticides, or herbicides.
- Provide water as needed.
- Provide additional mulch as needed.

# Recommended Timeline

Generally, the best time to build a rain garden is in fall or spring when the ground is moist but not soaking wet; however, rain gardens also can be built in the summer months. The best time to plant is in the fall, allowing trees and vegetation to establish during the rainy winter months. Many people also plant in the spring.

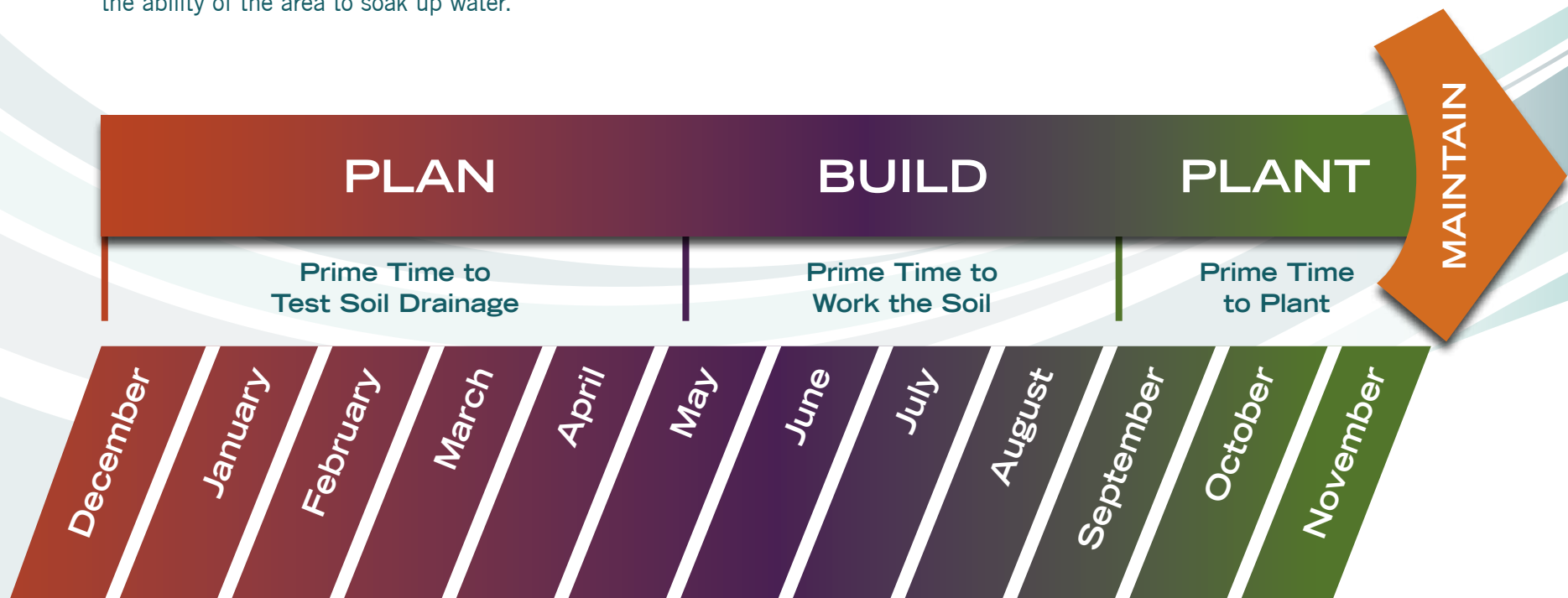
Testing soil drainage and ground water level is best performed, and strongly recommended during the winter months (December through April with late winter or March ideal). See pages 15, 16, and 17 for guidelines on testing soil drainage rate.

Avoid major excavation work in the winter. Disturbing the ground can cause serious erosion during rain storms. And if the ground is wet, machinery can compact the soil more than if it is dry, thus reducing the ability of the area to soak up water.

## Why You Shouldn't Worry About Mosquitoes



When properly designed and constructed, rain gardens drain rapidly with water present for only one to three days. Mosquitoes take four to seven days to become adults after eggs are deposited in standing water.





Rain gardens can be sized and shaped to fit in a variety of locations on your property or project site. Several important considerations are highlighted in this section of the handbook for planning and creating a successful rain garden design.



# PLAN

# 1

## In this Section

- How to Get Started
- Check Site Drainage
- Where to Locate a Rain Garden
- Where Not to Locate a Rain Garden
- Test Your Soil
- Determine the Size of Your Rain Garden
- Rain Garden Sizing Chart
- Rainfall Regions for Western Washington
- Rain Garden Terms
- Determine the Shape of Your Rain Garden

# How to Get Started

## Tools and Materials Checklist



- DRAWING PAPER**  
*(Grid Paper Suggested)*

---

- PEN OR PENCIL**

---

- CALCULATOR**

---

- MAP**  
*(of Yard/Site Where Rain Garden Will Be Placed with Existing Utilities and Other Features to Avoid; Can Be Your Own Quick Map of the Area)*

---

- MEASURING TAPE**

---

- WATER SOURCE**  
*(for Soil Drainage Test)*

---

- YARDSTICK OR SELF-MADE GAUGE**  
*(2" x 4" Board or Pipe with Half Inch Marks)*

---

- SHOVELS**  
*(for Soil Drainage Test)*

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- DIGGING BAR**

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- POST HOLE DIGGER**

To start planning your rain garden, gather the tools and materials listed on this page and follow the guidance in this section of the handbook.

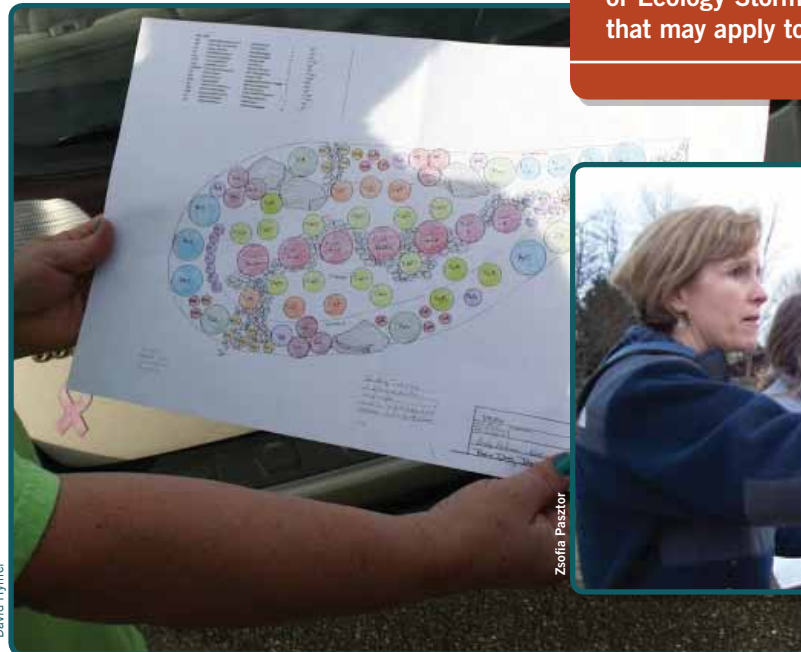
### CONSIDER LOCAL AND STATE REQUIREMENTS

Keep in mind that if you are creating or replacing between 2,000 and 5,000 square feet of hard surfaces (such as a building addition or adding onto your driveway), or if you are disturbing between 7,000 and 33,000 square feet (3/4 acre) or more of land, state and local requirements may apply to your project. For most homeowners installing rain gardens, these requirements do not apply. Refer to Appendix C for additional information. Also look for these red alert boxes as you read through the handbook.

### Local and State Requirements Alert



This box reminds you to check local and state requirements, including Department of Ecology Stormwater Minimum Requirements, that may apply to your project.



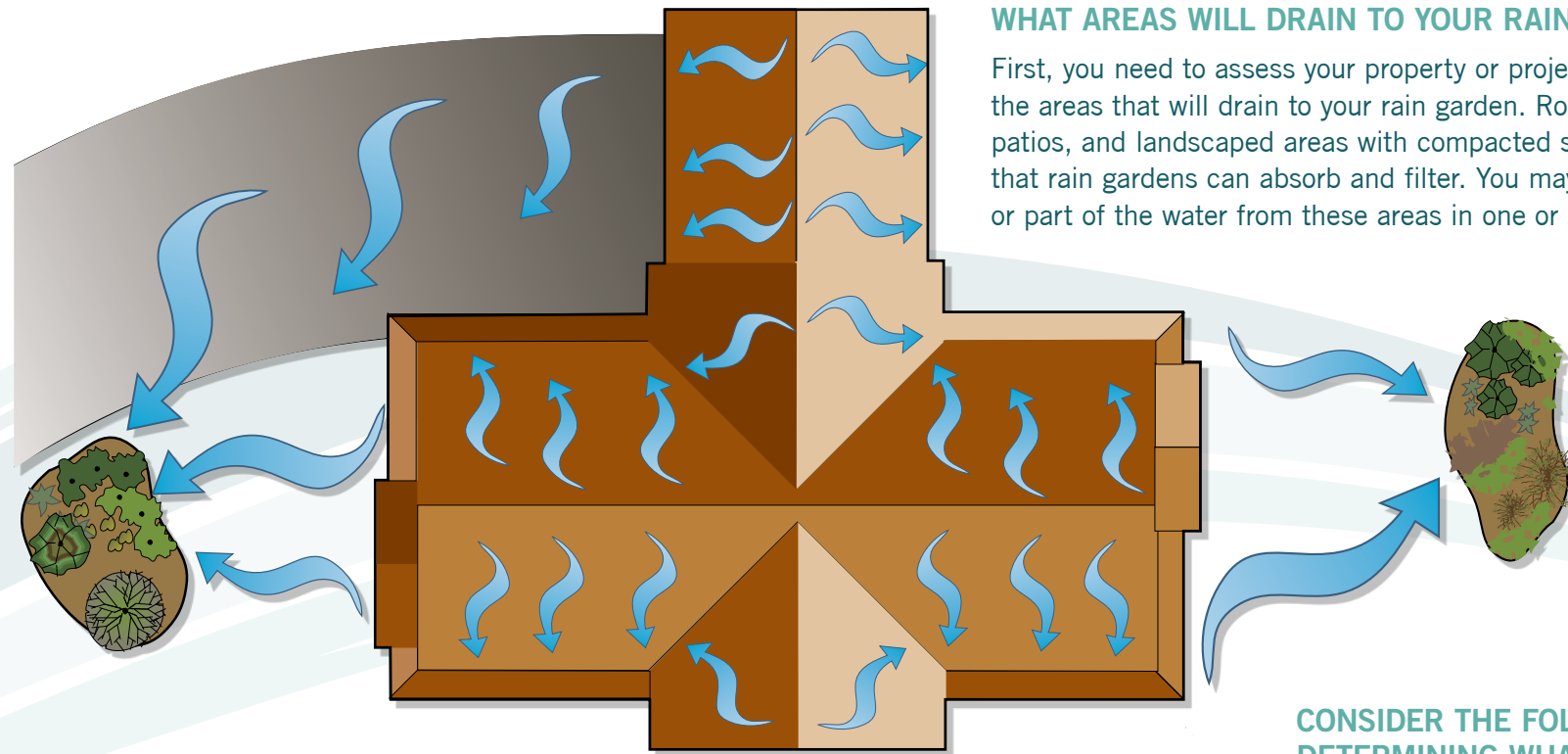
David Hymel

Zofia Pasztor





# Check Site Drainage



## WHAT AREAS WILL DRAIN TO YOUR RAIN GARDEN?

First, you need to assess your property or project site to determine the areas that will drain to your rain garden. Roof tops, driveways, patios, and landscaped areas with compacted soils produce runoff that rain gardens can absorb and filter. You may want to capture all or part of the water from these areas in one or more rain gardens.

## CONSIDER THE FOLLOWING WHEN DETERMINING WHAT AREAS YOU WANT TO DRAIN TO THE RAIN GARDEN

- Water can be delivered to the rain garden across a landscaped area, through an open swale lined with plants and decorative rock, or through an underground pipe (such as from a roof downspout).
- Rain gardens can be placed in more than one location. For example, you can direct water from one part of the roof to a rain garden in the back yard and water from another part of the roof to a rain garden in the front yard.

## Check for Seeps and Springs



In the winter, observe the areas that will be draining to your rain garden and check for seeps and springs and other sources of water that may be coming from around your site and adjacent properties. Be sure to include all areas draining to your rain garden in your calculations.



David Hymel

Erica Guttman

# Where to Locate a Rain Garden

## DO LOCATE YOUR RAIN GARDEN WHERE:

- It improves the appearance of your home. Rain gardens can provide attractive visual buffers from roads or neighboring homes.
- You have enough space (see guidance for sizing your rain garden on page 18) and in a place that will not be used for other purposes in the future (such as a reserve drainfield area).
- The overflow can direct water safely away from the home and neighboring property.
- Water flows to the garden by gravity.

Be sure to check local city or county requirements that may apply to your rain garden project, including the need for any permits or approvals.



Michael Carey



Mandi Roberts



Mandi Roberts

## GUIDANCE FOR LOCATING RAIN GARDENS NEAR OR ON SLOPES

If you want to place your rain garden near or on a slope greater than 10%, have a qualified geotechnical engineer evaluate the site for potential problems. Collecting and allowing water to soak into steep slopes can cause instability and possibly landslides.

## CALCULATING SLOPE

Slope is typically described in degrees or percent. When using percent, calculate the rise (vertical distance) divided by the run (horizontal distance) and multiply by 100.

$$\text{Slope} = \frac{\text{Rise (Vertical Distance)}}{\text{Run (Horizontal Distance)}}$$

**Example:**  $\text{Slope} = \frac{2 \text{ ft Rise}}{20 \text{ ft Run}} = .10$

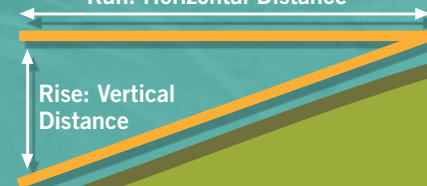
To convert decimal to percent, multiply by 100 and include the % symbol:  $.10 \times 100 = 10\%$

The easiest way to multiply by 100 is to move the decimal point two places to the right.

*\*Consult a geotechnical engineer if the slope is 10% or more.*

Run: Horizontal Distance

Rise: Vertical Distance





# Where NOT to Locate a Rain Garden

## DON'T LOCATE YOUR RAIN GARDEN:

1. **Within 10 feet of a building foundation**—to avoid water getting into basements and crawl spaces.
2. **Over utilities**—to prevent extra expense and hazardous conditions, make sure to have all utilities located and marked before digging. Utility companies typically locate and mark power, gas, phone, water, and other lines and facilities. 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. In general, slopes should be less than 10% for a conventional rain garden. If the rain garden is within 50 feet of a slope that is more than 10%, consult with a geotechnical engineer.
4. **Near a septic tank, septic drainfield, or reserve drainfield area**—generally, if uphill of a septic system, provide at least 50 feet and if downhill provide at least 10 feet between the rain garden and the existing or planned septic system. Consult your local health department for specific setback requirements.
5. **In low spots that do not drain well**—these areas may be helpful for naturally slowing and storing stormwater on your property, but poorly draining depressions will not support rain garden plants very 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 the winter (highest level), you should consider another location. In areas of 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.



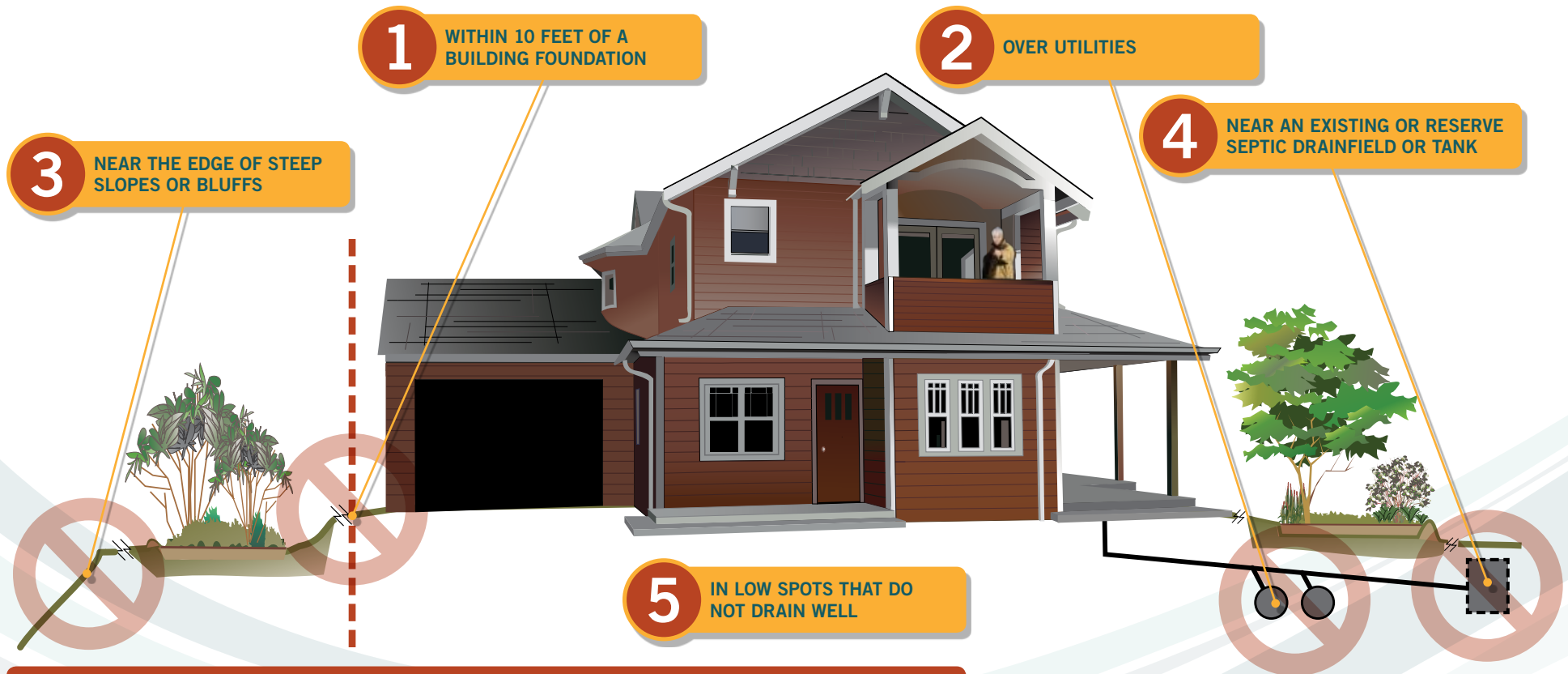
## DIAL 811— Call Before You Dig!



Be sure to have all your utilities (gas, power, water, communications, etc.) located and marked as you plan where to build your rain garden and before digging to test for soil and groundwater conditions. In addition to the 811 service that primarily locates utilities in public rights-of-way, utility locate businesses can be retained to locate and mark public and private utilities. You also can contact the utility providers directly for more information. *Note: Utility locates expire after 45 days, and the property owner is responsible for calling 811 to have utilities re-marked after that.*



# Where NOT to Locate a Rain Garden



## Local and State Requirements Alert



If your rain garden project is used to control stormwater flow under Minimum Requirements 1-5 of the Washington State Department of Ecology Stormwater Management Manual for Western Washington, refer to Appendix C for location restrictions, discussed in part in the "infeasibility" criteria. These requirements apply to projects that create 2,000 to 5,000 square feet of new or replaced hard surfaces or that disturb between 7,000 and 33,000 or more square feet of land. Also, be sure to check with your local municipality to see if they have specific location and feasibility requirements.

6

IN AREAS THAT WOULD REQUIRE DISTURBING HEALTHY NATIVE SOILS AND VEGETATION

7

WHERE THERE IS HIGH GROUNDWATER DURING THE WINTER

8

NEAR WELLS—STAY BACK 100 FEET FROM DRINKING WATER WELLS



# Test Your Soil

After finding a location for your rain garden, the next step is to test the soil in that location. You will be evaluating the texture (size of soil particles) and the soil drainage rate (the amount of time it takes water to soak into the ground). Understanding these characteristics will help you properly size your rain garden.

Curtis Hinman



Curtis Hinman



**Left Photo:** Clay soil—feels sticky, smooth, and can be molded like modeling clay.

**Right Photo:** Sandy soil—feels gritty and crumbles easy.

## Soil Texture



Soil texture is determined by the amount of sand, silt, and clay in the soil. The mix of these components affects how well the soil drains and how well it holds water and nutrients for plants to use.

### Be Sure to Check for High Groundwater



Avoid locating your rain garden in an area with high groundwater. Test the groundwater level during the rainy winter months, December through April. Late winter through March is the ideal time. To check for high groundwater, dig down 36 inches in a separate hole from where you plan to do your soil drainage test, but within 3 to 5 feet of that location. You can use a post hole digger for the groundwater test. Look into the hole. If you see water seeping in from the bottom or sides, find another location for your rain garden. If you don't see groundwater, go ahead and conduct your soil drainage test at a nearby spot.

## THERE ARE FOUR STEPS TO COMPLETE THE SOIL DRAINAGE TEST

1. Dig Test Hole
2. Evaluate Soil Texture
3. Determine Desired Ponding Depth
4. Fill the Hole with Water and Observe Drainage Rate

### 1. DIG TEST HOLE

Dig a small hole about 2 feet deep and 1 to 2 feet in diameter. A bigger hole is OK if you have a backhoe or mini-excavator.

### 2. EVALUATE SOIL TEXTURE

As you dig, and before adding water to the hole to test drainage, evaluate the texture of the soil.

- If the soil is moist, put some in the palm of your hand and try to squeeze it into a ball.
- If the soil falls apart or can be broken up easily and is gritty feeling, this suggests a sandier, well-draining soil. If the soil is sticky, smooth, and forms a ball that can be worked like modeling clay, this suggests poor-draining soil with higher clay content.

- If the soil is smooth but not sticky, then it is likely a silty soil and moderate to poor-draining.
- If the soil is dry, add water a few drops at a time, break down the chunks to work the water into soil, and then perform the soil texture test.

Record your observations. These observations will help determine how the rain garden is constructed in the next section, 2-BUILD.

### 3. DETERMINE PONDING DEPTH

Next, decide on the maximum depth that water will pond in your rain garden (6 or 12 inches is recommended). Typically, a rain garden designed with a ponding depth of 12 inches will hold and manage more water from your drainage areas, particularly on poor soils. However, just as important is your preference for how the rain garden looks in your landscape. For example, you may wish to have a 12-inch depth, even if 6 inches is all you need for stormwater storage.

### 4. FILL THE HOLE WITH WATER AND OBSERVE DRAINAGE RATE

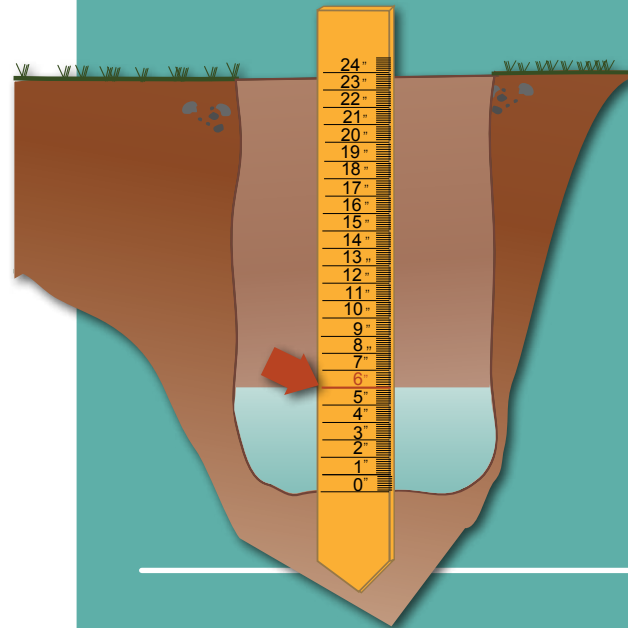
Finally, fill the hole with 6 or 12 inches of water, depending on the maximum depth of ponding decided in Step 3. Secure a yard stick or a self-made gauge in the hole for measuring the drainage rate. The self-made gauge can be a board or pipe with markings every half inch from the bottom.

Time how long it takes for the water to drain out completely. By the way, this can take awhile, so start in the morning. If there is still water in the hole after a day, it's OK to record how many inches have gone down since you started the test. Divide total inches by total hours to calculate the soil drainage rate.

## How to Determine the Soil Drainage Rate

### *Divide Total Inches by Total Hours*

Calculate the soil drainage rate by observing how long it takes water to drain in your test hole, then divide the total inches by the total hours.



#### EXAMPLE #1

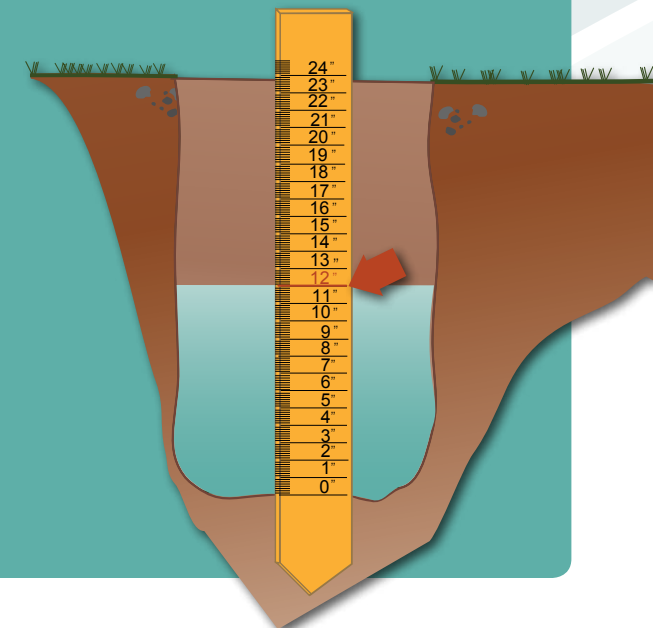
Fill the hole with 6 inches of water.

- If the water drains from the hole in 12 hours, the drainage or infiltration rate is:
  - 6 inches divided by 12 hours = 0.5 inches per hour.
  - Record the drainage rate for later comparison to the rates shown in the Rain Garden Sizing Chart (see page 21).

#### EXAMPLE #2

Fill the hole with 12 inches of water.

- If the water drains from the hole in 40 hours, the drainage or infiltration rate is:
  - 12 inches divided by 40 hours = 0.3 inches per hour.
  - Record the drainage rate for later comparison to the rates shown in the Rain Garden Sizing Chart (see page 21).







Erica Guttman



David Hymel

### REPEAT TEST THREE TIMES DURING THE DRY SEASON

If it's the wet season (December through April), do this soil drainage test once. If you must test during the dry season, do the test three times (with each test performed immediately after completion of the last). Use the third test as your drainage rate (measured in inches per hour). Testing three times during the dry season provides a better estimate of wetter conditions present in the winter when the rain garden is doing the most work. Testing in the dry season is not recommended, but sometimes may be unavoidable.

The soil drainage test is important for determining the size of the rain garden, but the test also helps you make the following important decisions:

- If the drainage rate is less than 0.25 inches per hour, but more than 0.1 inches per hour, the location may be OK for the rain garden. However, keep in mind that standing water may be present for extended periods during the wettest months (December through April).
- If the drainage rate is less than 0.1 inches per hour, consider a different location for your rain garden.

## Local and State Requirements Alert



The Washington State Department of Ecology calls for more stringent soil testing for new development and redevelopment projects required to meet Minimum Requirements 1-5. Ecology's soil testing procedure is discussed in Appendix C with full details in the 2012 Stormwater Management Manual for Western Washington. Consult with your local municipality for specific soil drainage testing procedures they may require.



# Determine the Size of Your Rain Garden

Once you've tested the drainage rate of the soil, you're ready to determine the size of the rain garden. Five questions are important:

1. How well does your soil drain?
2. How much area will drain to the rain garden?
3. How much rainfall does your location receive?
4. How much water do you want the rain garden to hold?
5. How much room do you have for your rain garden?



David Hymel



David Hymel



Michael Carey

## Local and State Requirements Alert



The Washington State Department of Ecology has a minimum sizing criterion for new development and redevelopment projects subject to Minimum Requirements 1-5. Ecology's sizing methodology is discussed in Appendix C with full details in the 2012 Stormwater Management Manual for Western Washington. Also, be sure to check with your local municipality to see if they have specific sizing requirements.



David Hymel

### 1. HOW WELL DOES YOUR SOIL DRAIN?

In the last section (Test Your Soil) you calculated the soil drainage rate. Refer to this rate to size your rain garden using the sizing chart on page 21.

### 2. HOW MUCH AREA WILL DRAIN TO THE RAIN GARDEN?

To determine the drainage area, measure the driveway, rooftop, landscape areas, and other surfaces that will drain to your rain garden, and note the area in square feet. To find the area of a rooftop, measure the length and width of the building, including the roof overhang area. Don't worry about the slope of the roof since it doesn't influence the drainage area.

### 3. HOW MUCH RAINFALL DOES YOUR LOCATION RECEIVE?

Look on the maps on pages 22 and 23 to find your location and how much rain that location receives. Now go to page 21 to determine the size of your rain garden.



### Example

LENGTH x WIDTH = AREA IN SQUARE FEET (sq ft)

#### DRIVEWAY

15 ft x 30 ft = 450 sq ft

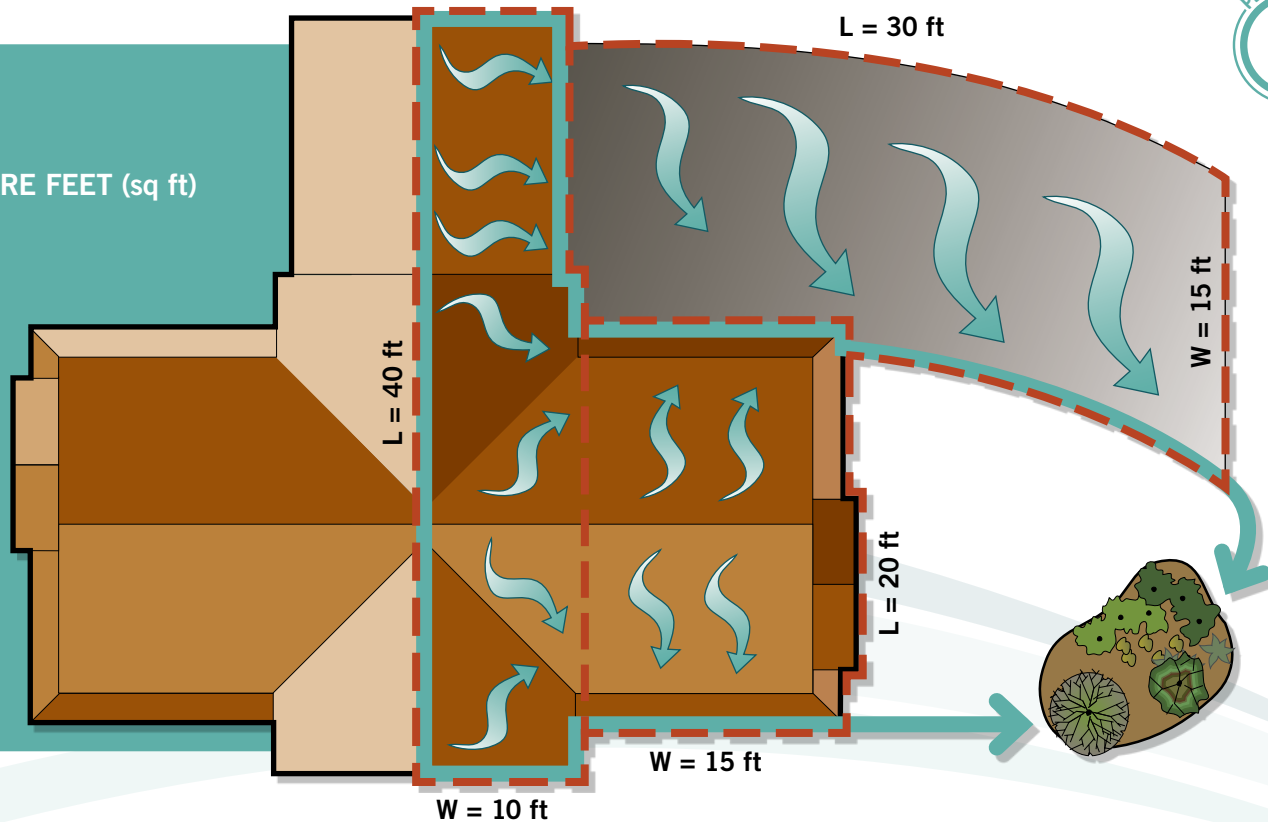
#### ROOF

15 ft x 20 ft = 300 sq ft

10 ft x 40 ft = 400 sq ft

TOTAL = 1,150 sq ft

The rain garden on page 26 is sized to capture this total contributing area. Refer to page 25 to see how this rain garden was sized using the guidance in this handbook.



#### 4. HOW MUCH WATER DO YOU WANT THE RAIN GARDEN TO HOLD?

A ponding depth of 6 inches or 12 inches is recommended. You may wish to have a shallower or deeper ponding area in your landscape based on aesthetics. Keep in mind that a deeper ponding area generally will take longer to drain and will need more water-tolerant plants in the bottom (except with sandy, well-draining soils). The depth you choose can also influence how large the surface of your ponding area needs to be.

After you decide on a 6-inch or 12-inch ponding depth, it's time to determine the size of the top surface of the rain garden ponding area. Refer to the Rain Garden Sizing Chart on page 21. This chart shows rainfall regions for western Washington, color coded to the maps on pages 22 and 23. The chart also shows soil drainage rates. Using the chart and rainfall region maps, follow steps A through D to determine the size of the **top surface of your ponding area**.

- A. Choose which performance level you want to achieve—Good, Better, or Best. Find the performance levels in the sizing chart on page 21.

**Good** performance will capture about 80 percent of the water from the contributing areas that flows to your rain garden.

**Better** performance will capture about 95 percent of the water from the contributing areas.

**Best** performance will capture most all the water from the contributing areas.

Under Best performance, a 12-inch ponding depth will require less space than a 6-inch ponding depth. But under Good or Better performance, the rain garden will be generally the same size at either 12 or 6 inches of depth.

- B.** Identify the row with the rainfall region where your rain garden will be installed by looking at the maps on pages 22 and 23. Match the color and region number shown in the map to the color and number in the sizing chart.
- C.** Find your soil drainage rate in the sizing chart based on your soil drainage test. If your selected performance level is Best, be sure to pick the right row for your ponding depth, either 6 inches or 12 inches.
- D.** Referencing soil drainage rate, rainfall region, and desired performance level, find the “sizing factor” to determine the area in square feet of the top surface of the ponding area of your rain garden. The sizing factor is shown as a percentage of the total amount of contributing areas. Multiply the total contributing area by the sizing factor to get the top surface of the ponding area.

***Total Contributing Area x Sizing Factor Percentage = Top Surface of Ponding Area***



Mandi Roberts



Erica Guttman

Erica Guttman

Erica Guttman

## 5. HOW MUCH ROOM DO YOU HAVE FOR YOUR RAIN GARDEN?

Measure how much space is available for the rain garden. If it does not fit in the selected location, consider the following options:

- Reduce the size of the rain garden by reducing the size of the contributing area.
- Reduce your performance level (from Best to Better or Better to Good).
- Consider a different shape—rain gardens can be long and narrow. See page 26 for more information.
- Divide the rain garden into more than one location with separate drainage areas.
- Find another location.



# Rain Garden Sizing Chart

	Rainfall Region	Ponding Depth	SOIL DRAINAGE RATES				
			0.10 - 0.24* Inches/Hour	0.25 - 0.49 Inches/Hour	0.50 - 0.99 Inches/Hour	1.00 - 2.49 Inches/Hour	2.50 + Inches/Hour
<i>Recommended Sizing Factor: Size the top surface of the ponding area for your rain garden by multiplying the contributing area by this percentage.</i>							
<b>GOOD</b> (80%)	REGION 1	6" to 12"	8%	7%	7%	6%	6%
	REGION 2	6" to 12"	14%	10%	8%	6%	6%
	REGION 3	6" to 12"	16%	11%	8%	7%	6%
	REGION 4	6" to 12"	19%	12%	10%	7%	6%
	REGION 5	6" to 12"	23%	15%	11%	9%	6%
	REGION 6	6" to 12"	28%	18%	13%	10%	7%
<b>BETTER</b> (95%)	REGION 1	6" to 12"	9%	9%	8%	8%	7%
	REGION 2	6" to 12"	20%	14%	11%	9%	7%
	REGION 3	6" to 12"	22%	15%	12%	10%	7%
	REGION 4	6" to 12"	29%	18%	14%	11%	8%
	REGION 5	6" to 12"	34%	22%	16%	13%	9%
	REGION 6	6" to 12"	42%	27%	19%	15%	10%
<b>BEST</b> (Most All the Water)	REGION 1	6"	13%	10%	9%	9%	8%
		12"	N/A*	10%	9%	8%	8%
	REGION 2	6"	39%	32%	26%	21%	15%
		12"	N/A*	27%	23%	20%	15%
	REGION 3	6"	45%	36%	30%	25%	17%
		12"	N/A*	31%	26%	22%	17%
	REGION 4	6"	54%	43%	34%	27%	18%
		12"	N/A*	36%	31%	25%	17%
	REGION 5	6"	75%	47%	35%	26%	17%
		12"	N/A*	45%	31%	25%	17%
	REGION 6	6"	72%	56%	42%	30%	19%
		12"	N/A*	48%	39%	29%	19%

SIZING FACTORS

\*At these low drainage rates, a 12-inch pond will not drain down within 3 days. Use a 6-inch ponding depth.

## Notes to Guide the Use of this Chart

Choose one of three performance levels you want to achieve with your rain garden—**GOOD**, **BETTER**, or **BEST**.

**GOOD** performance will capture about 80 percent of the water that flows to your rain garden.

**BETTER** performance will capture about 95 percent of the water from the contributing areas.

**BEST** performance will capture most all the water from the contributing areas.

When sizing your rain garden to achieve either “Good” or “Better” performance, the top surface of the ponding area will be the same for rain gardens with 6-inch or 12-inch ponding depths. For “Best” performance, areas with 6-inch ponding depths will generally need to be bigger than areas with 12-inch ponding depths.

Rain gardens built over slower draining soils and with deeper ponding levels may hold water for longer periods of time (possibly several days), and may overflow more frequently, especially after heavy rainfall and frequent storms. These conditions will happen more often if you choose “Good” performance instead of “Better” or “Best.” Be sure to choose plants that can tolerate longer periods of water for the bottom of the rain garden in these situations.

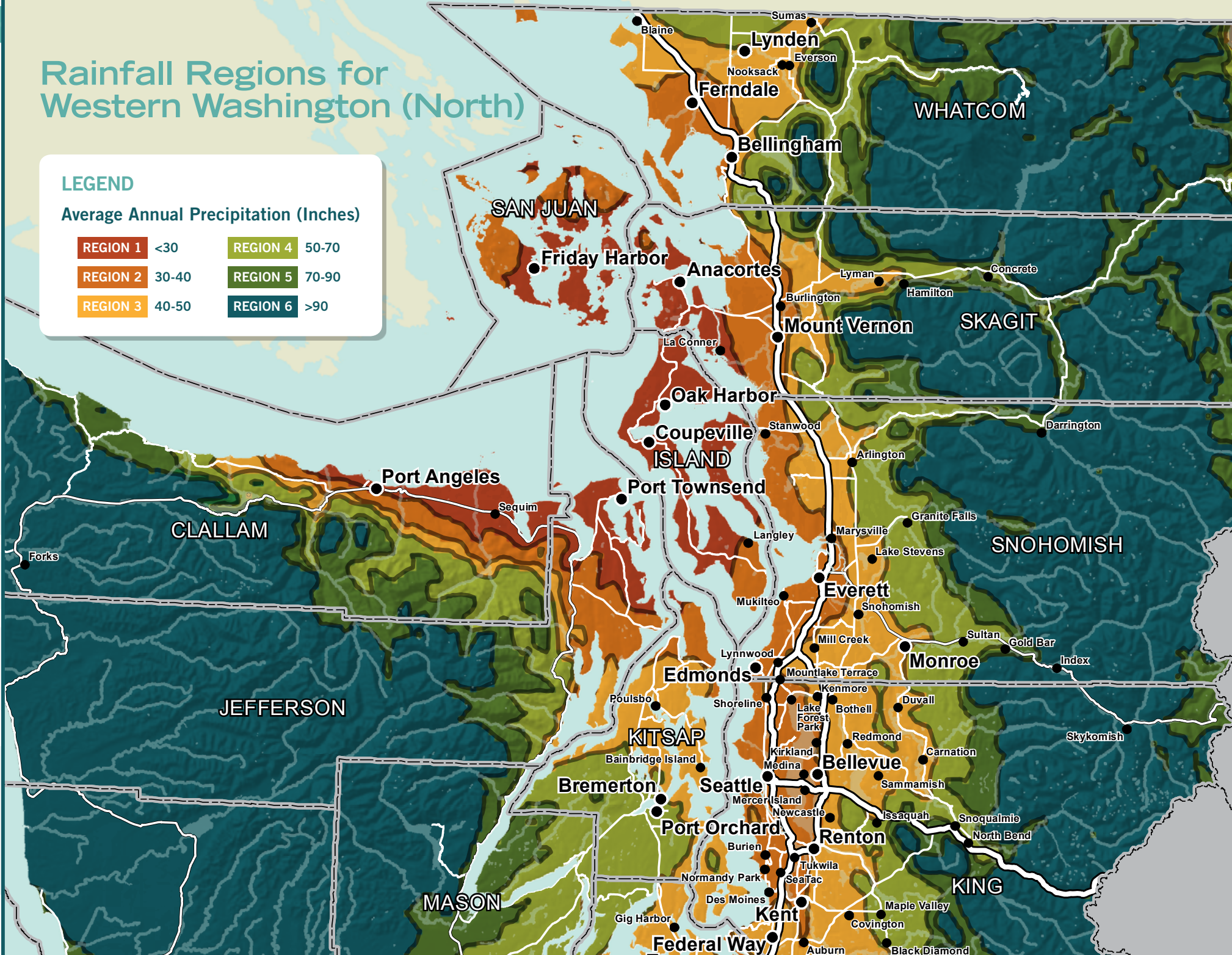
Keep in mind that rainfall patterns and other factors influencing stormwater runoff are complex and variable within these regions. This sizing chart is meant to be a tool to help you meet your goals for managing runoff. The sizing chart should not be used to meet regulatory requirements such as the Washington State Department of Ecology's stormwater regulations.

# Rainfall Regions for Western Washington (North)

## LEGEND

Average Annual Precipitation (Inches)

REGION 1	<30	REGION 4	50-70
REGION 2	30-40	REGION 5	70-90
REGION 3	40-50	REGION 6	>90



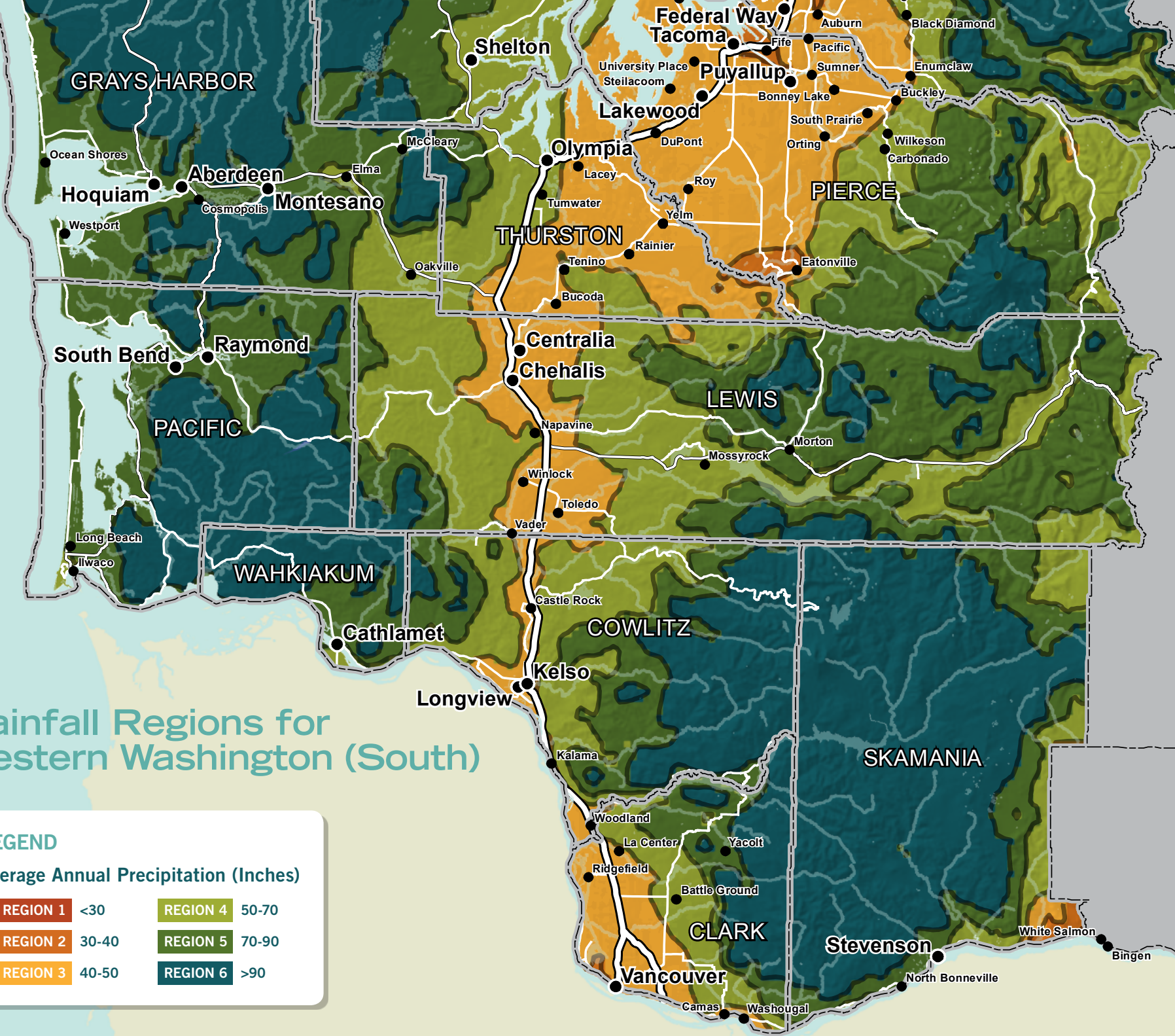


# Rainfall Regions for Western Washington (South)

## LEGEND

Average Annual Precipitation (Inches)

REGION 1	<30	REGION 4	50-70
REGION 2	30-40	REGION 5	70-90
REGION 3	40-50	REGION 6	>90



## Rain Garden Terms

### TOP SURFACE OF PONDING AREA

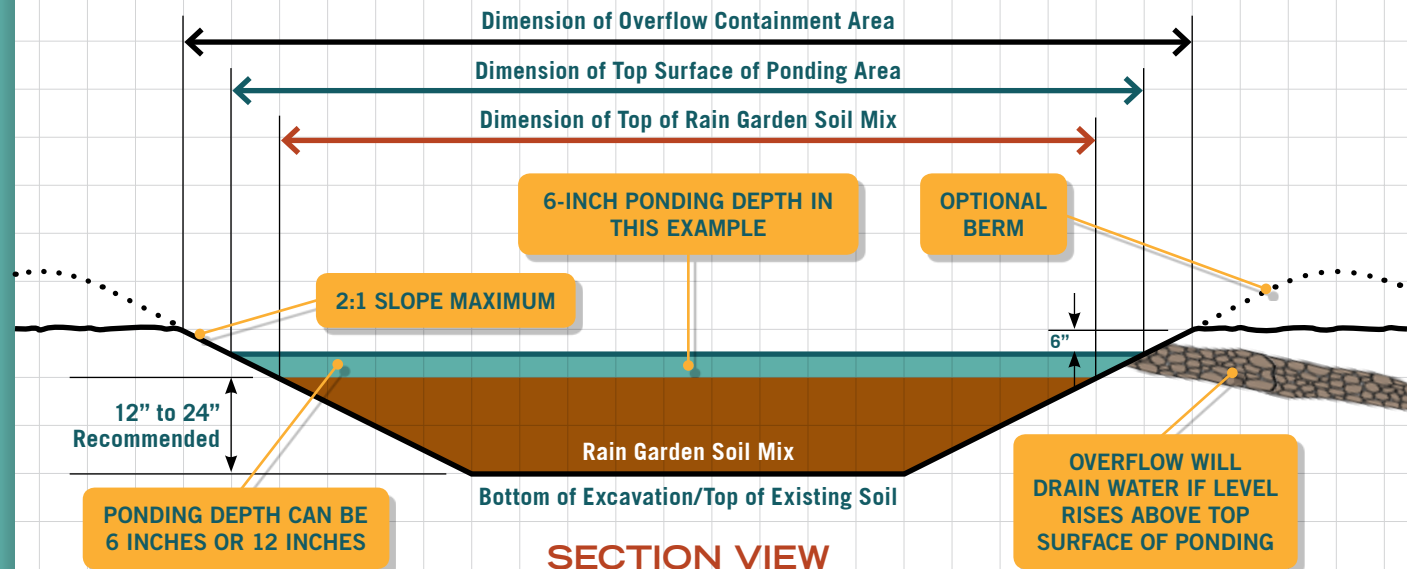
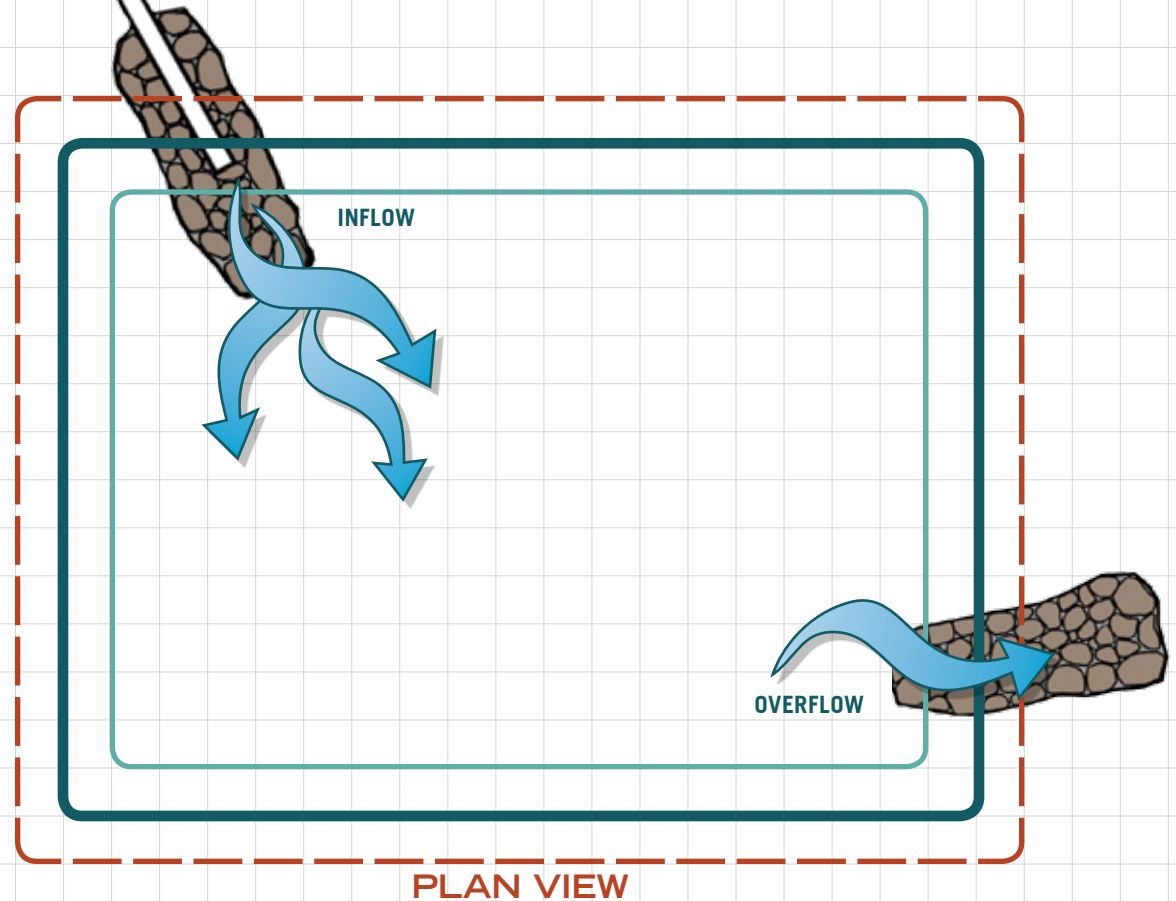
- This is the level that water will rise to before overflowing out of the rain garden.
- Multiply the sizing factor from the Rain Garden Sizing Chart by the contributing area to calculate the top surface of ponding area.

### OVERFLOW CONTAINMENT AREA

- The overflow containment area provides extra ponding depth in case the overflow becomes clogged with leaves or other debris. It will help direct water to the overflow, particularly after a period of heavy rainfall when more water flows into the rain garden.
- Overflow containment should be a minimum of 6 inches higher than the top surface of the ponding area.

### OVERFLOW

- Typically will only flow after a big storm.
- If your rain garden has a berm, the overflow will cut through the berm in a depression that slopes out from the ponding area.
- The overflow must direct water to a safe location (e.g. open space, roadside swale, or storm drain). Do not direct overflow towards adjacent properties or structures.





## HOW TO DETERMINE THE RAIN GARDEN PERIMETER AND WHERE TO START DIGGING

The sizing chart on page 21 provides the sizing factor, which is a percentage of the total contributing area draining to the rain garden. Multiply the sizing factor by the total contributing area to calculate the top surface of the ponding area. This is the area where the rain garden will pond (6 or 12 inches) and drain down.

Occasionally, such as after a heavy storm, water may rise above the ponding level and start to pour out the overflow. Providing an upper rim of extra height around the perimeter of the ponding area will direct water to the designed overflow location and provide additional capacity should the overflow become partially blocked with debris. This extra height, called the overflow containment area, should be a minimum of 6 inches

high. The rock-lined overflow will cut through the overflow containment area in a depression that slopes outward from the ponding area.

If your side slopes are the maximum recommended of 2:1 ( 2 feet horizontal to 1 foot vertical), start digging out 12 inches in horizontal distance to provide the 6 inches of vertical depth for the overflow containment. If your side slopes are more gradual, such as 3:1 or 4:1, you will need to start digging out 18 or 24 inches from the top surface of the ponding area to create the 6-inch overflow containment depth. You may also create the overflow containment by building a water-tight berm at the perimeter of the ponding area. See page 39. Refer to page 24 for a diagram of the overflow containment and ponding areas.

### Example Sizing Calculations

SOIL DRAINAGE RATE	0.50 Inches per Hour	<i>Per test described on pages 15-17</i>
CONTRIBUTING AREA	1,150 SF	<i>As calculated in the example on page 19</i>
DESIRED PONDING DEPTH	6 Inches	<i>Based on installer's preference</i>
DESIRED PERFORMANCE LEVEL	Best	<i>Based on installer's preference</i>
RAINFALL REGION	Region 4, Maple Valley, Washington	<i>Location for this example, from map on page 22</i>
SIZING FACTOR	34% (.34)	<i>Using the Rain Garden Sizing Chart on page 21</i>

#### Results:

REQUIRED SIZE OF TOP SURFACE OF PONDING AREA	391 SF (1,150 SF x 0.34 = 391 SF)	<i>Multiply contributing area by sizing factor</i>
DESIGN DIMENSIONS FOR TOP SURFACE OF PONDING AREA	16' Width x 24.5' Length = 392 SF (Rounding Up from 391 SF)	<i>Dimensions that fit in available space and based on installer's preference</i>
OVERFLOW CONTAINMENT AREA	18' Width x 26.5' Length = 477 SF	<i>Calculated by adding 1 foot horizontal to all sides for the 6-inch vertical depth required on a 2:1 slope</i>



# Determine the Shape of Your Rain Garden

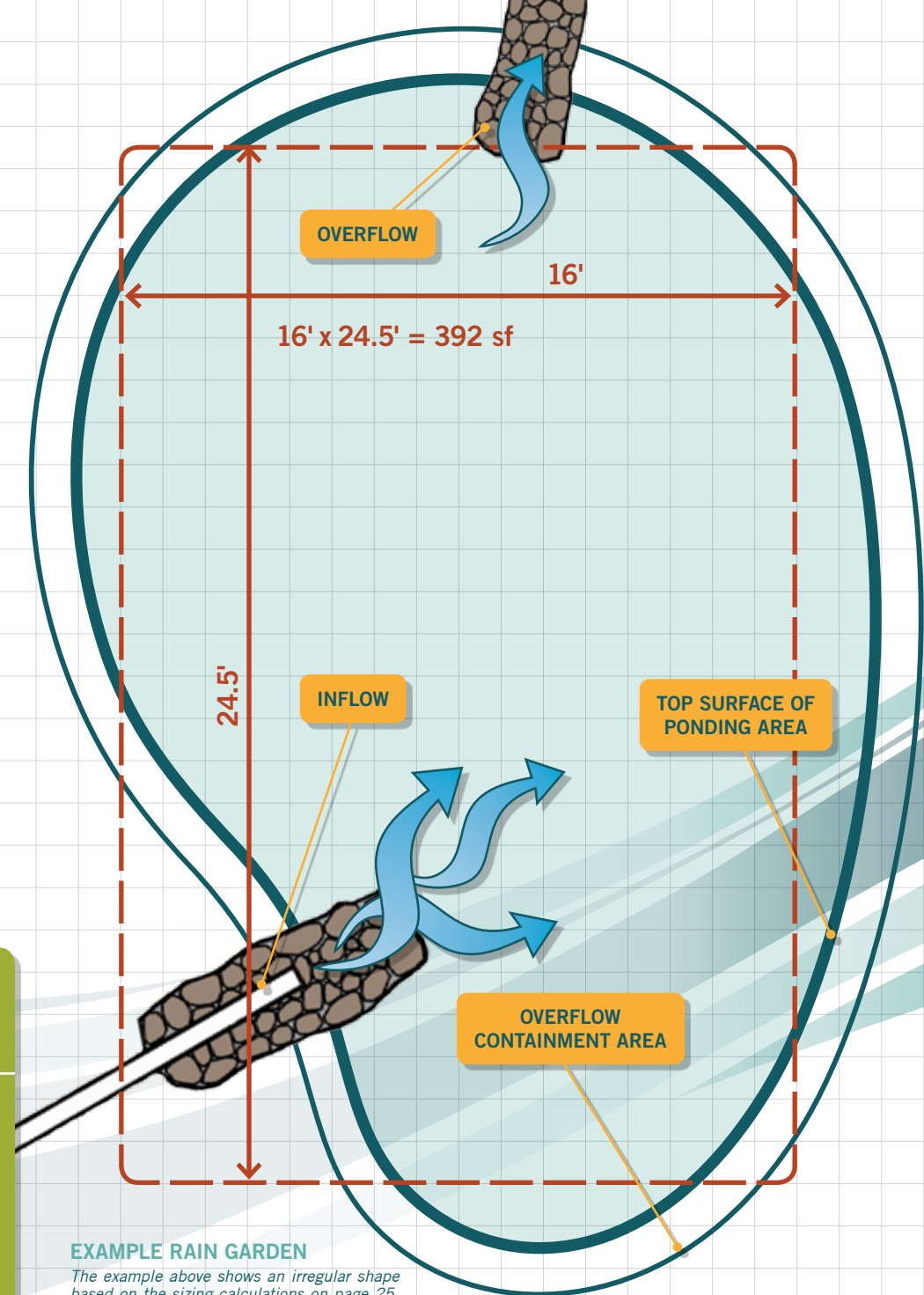
The shape of the rain garden often is determined by existing features such as the need to avoid structures, trees, and utilities. Rain gardens can be shaped to fit available space and site conditions. For example, a long, narrow rain garden works well on sloping ground. Position the long dimension so it follows the contour of the slope, creating a bench. This will reduce the amount of excavation needed to keep the bottom flat so water doesn't flow to one end and pool, leaving the rest dry. See page 37 for more information about construction on slopes.

Remember to provide additional space for the overflow containment area and plantings around the ponding area.

## Count the Grid Boxes



When creating an irregular shape, lay out the rain garden on grid paper to confirm the correct size. Use the grid paper to check if your irregular-shaped ponding area is sized appropriately. After drawing a square or rectangle with the calculated square footage you need, draw your desired shape. Count the number of squares inside the square or rectangle and the number of squares inside the desired shape to make sure they match. Adjust your design if needed to get the number of squares to match.



### EXAMPLE RAIN GARDEN

The example above shows an irregular shape based on the sizing calculations on page 25. This is just one example. Rain gardens can be designed in many different sizes and shapes. See 3-PLANT for other examples.



Using the information in 1-PLAN, this section provides guidelines for how to build your rain garden.



## In this Section

- Prepare for Construction
- Locate and Design the Inflow
- Always Provide an Overflow
- Rain Garden Cross Section
- Lay Out
- Excavate
- Create a Flat, Level Bottom
- Install the Inflow
- Place the Rain Garden Soil Mix
- Protect the Inflow and Overflow
- Edging

# BUILD

# 2

# Prepare for Construction

## Tools and Materials Checklist



- MEASURING TAPE
- WOOD STAKES
- ROPE, STRING, GROUND PAINT, AND/OR BUILDER'S CHALK *(For Lay Out)*
- HAMMER
- SHOVELS AND RAKES
- DIGGING BAR
- MINI-EXCAVATOR  
*(Motorized Excavation Equipment is Optional)*
- RAIN GARDEN SOIL MIX OR SOIL AMENDMENTS
- LEVEL *(Water, Laser, String, or Other Level for Measuring Elevations)*
- 2" x 4" BOARD & CARPENTER'S LEVEL  
*(To Help with Leveling the Soil)*
- MULCH
- ACCESS TO WATER
- PIPE FOR INFLOW IF NEEDED
- ROCKS (COBBLES) FOR OVERFLOW AND INFLOW

The planning is over and it's time to start construction. These are the main tasks ahead:

1. Gather the tools and materials.
2. Check the drainage surrounding and within the proposed location for your rain garden. Confirm the best locations for the inflow and overflow.
3. Lay out the proposed plan for your rain garden using rope, string, ground paint, and/or builder's chalk. Mark the inflow and overflow with wood stakes.
4. Decide if you will import a new rain garden soil mix or amend your existing on-site soil with compost.
5. Excavate the rain garden according to the ponding depth, the overflow containment area, and the depth of the soil mix.
6. Install the pipe, swale, or roof downspout extension from contributing areas that will deliver water to the rain garden.
7. Either create a berm around the outside of your ponding area or start digging at least 1 foot beyond (with a 2:1 slope) the top surface of the ponding area to provide overflow containment.
8. Place the soil mix (do not over compact).
9. Rock-line your inflow and overflow areas with cobbles.
10. Place edging around the perimeter of the rain garden area if desired.



Erica Guttman



David Hymel



David Hymel



# Locate and Design the Inflow

Water can be delivered to your rain garden across a landscaped area, through an open swale with plants and decorative rock, or through a pipe. Whatever technique is used, consider the slope and protect against erosion. If the slope is gentle (about 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, consider adding small rock check dams every 5 to 10 feet to slow the water (see page 41 for photograph example). Where water enters the rain garden from a swale or pipe, place a pad of rock to slow the water and guard against erosion.



INFLOW

# Always Provide an Overflow

During the winter most all the water that flows into your rain garden will soak into the ground. Occasionally, when the ground is wet and a big storm delivers a lot of rain, the rain garden may fill up and overflow. So, 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 the storm drain or disperse into the landscape. If you design a rain garden that is shared between homes, make sure everyone is in agreement about where excess water can be directed.



## Check the Flow of Water

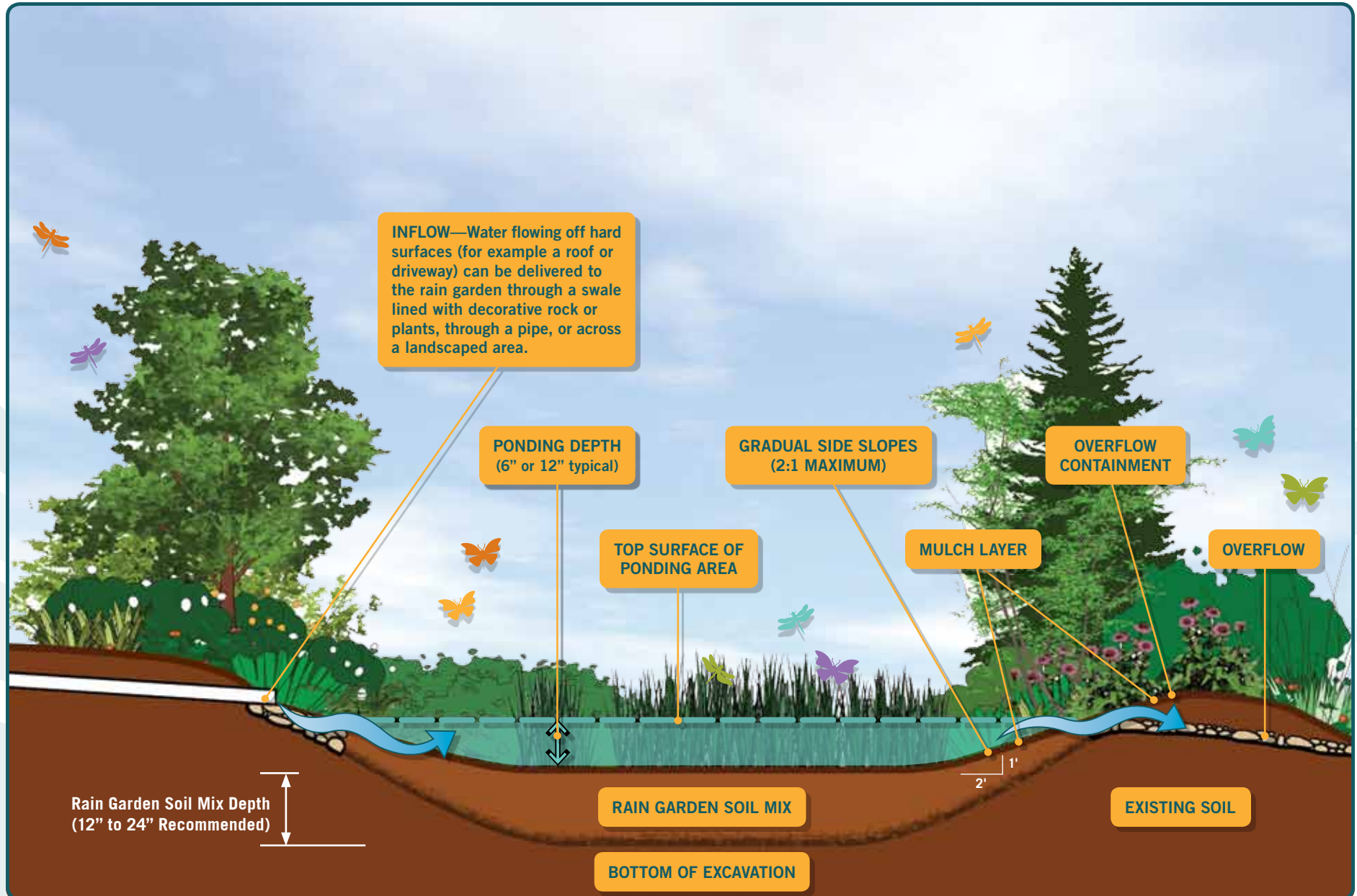


Before burying the inlet pipe, check that water flows easily to your rain garden from the source.



OVERFLOW

# Rain Garden Cross Section





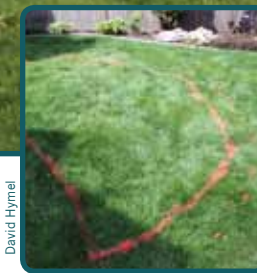
# Lay Out

First, lay out your rain garden to see if fits the area well. Remember the guidance about where and where not to locate your rain garden in 1-PLAN. Rope, string, a hose, ground paint, and/or builder's chalk are good ways to mark the area because the boundaries can be easily adjusted to your preference. You can also use wood stakes to mark proposed inflow and overflow locations and other features of your rain garden.

Once you have marked the rain garden perimeter and before excavating, check again to make sure that water can easily flow to the rain garden across the landscaping or through a swale or pipe that will be installed after excavation.



David Hymel



David Hymel



David Hymel

## Remember to Call Before You Dig



If the utility markings that were located during the initial rain garden planning are unclear or faded, call 811 again and have the locations confirmed and re-marked. Utility locates expire after 45 days, and it is your responsibility to contact 811 to have utilities re-marked before construction. Remember that 811 primarily locates utilities in the public right-of-way. If there are private utilities near your rain garden site, call those providers to locate and mark the lines and connections. You can also retain utility locate businesses to locate and mark public and private services.



David Hymel

## Avoid the Dripline



As you lay out your rain garden, remember to stay outside the driplines of existing trees and away from vegetation that you want to preserve. The dripline is the outside perimeter of the canopy or branching limits of a tree or large shrub. Staying outside the dripline, avoids most of the shallow roots. When working around large, mature trees, consult an arborist for advice.



# Excavate

Before digging, determine the depth of excavation necessary to accommodate the ponding depth, soil mix depth, and overflow containment area. Recommended ponding depth is 6 inches or 12 inches. Recommended overflow containment depth is 6 inches minimum. Recommended rain garden soil mix depths are 12 to 24 inches. Examples for determining excavation depth are provided for each of the three rain garden soil mix options below. Refer to page 24 for a typical cross section showing rain garden excavation depths.

## Rain Garden Soil—Three Options

There are three options for providing rain garden soil. Instructions about how to choose one of these options are provided on the following pages.

- OPTION 1. Excavate and Replace Soil:** Excavate the soil and completely replace with new rain garden soil mix.
- OPTION 2. Excavate and Amend Soil for Reuse:** Excavate the soil, amend it by mixing in compost, then put it back into the rain garden.
- OPTION 3. Amend Soil in Place:** Amend your existing soil in place by mixing in compost after you've excavated to the proper depth.

### Many Hands Make Light Work



If you are digging a small rain garden that's not very deep, digging by hand with friends may work well. If you're installing a bigger rain garden, consider renting a mini-excavator. The ground often gets more dense and harder to dig the deeper you go.







Kim Gridley

### OPTION 1—EXCAVATE AND REPLACE SOIL

Option 1 should be used when you have poor quality soils. In 1-PLAN you examined the texture of the soil in your rain garden area. Soils high in clay content do not drain well or support good plant growth. If your soil forms a cohesive ball and can be shaped like modeling clay, it has high clay content. In this case, you should replace the soil with a new, imported rain garden soil mix.

Typically, 12 to 24 inches of rain garden soil mix is recommended. If you have poor quality soils, consider using the 24-inch depth for better plant growth and storing more water.

**Excavation Depth Example:**

- 6" Overflow Containment (Assuming No Berm is Constructed)
- + 6" or 12" Ponding Depth
- + 12" to 24" Rain Garden Soil Mix (Imported)

---

- = 24" to 42" Excavation Depth



David Hymel

### Rain Garden Soil Mix



A good rain garden soil mix typically contains about 60% screened sand and 40% compost by volume. Contact your local landscape and compost suppliers for rain garden soil mixes. You can also use an approved bioretention soil mix for your rain garden.

## OPTION 2—EXCAVATE AND AMEND SOIL FOR REUSE

Option 2 should be used when you have moderately good to good quality soils without too much clay. Excavate the soil and set it aside for mixing with compost on-site.

### **Mix Compost with Excavated Soil as Follows:**

65% Excavated Soil to 35% Compost

### **Excavation Depth Examples and Mixing Instructions:**

- 6" Overflow Containment (Assuming No Berm is Constructed)
- + 6" or 12" Ponding Depth
- + 12" to 24" Rain Garden Soil Mix (Created On-site)

---

- = 24" to 42" Excavation Depth

Excavation depths will be the same as Option 1. However, compost will be blended with on-site excavated soil to create the rain garden soil mix.



Patricia Pyle

## HOW MANY CUBIC YARDS DO YOU NEED?

Soil and compost suppliers deliver material in cubic yards. To calculate how many cubic yards you need, use the top surface of the ponding area as the square footage for soil placement. Convert the depth of material you want to order from inches to feet.

$$\text{Example: } 18 \text{ inches} \times \frac{1 \text{ foot}}{12 \text{ inches}} = 1.5 \text{ feet}$$

Now multiply your soil placement area by the depth of material to calculate CUBIC FEET.

$$\text{Example: } 392 \text{ square feet} \times 1.5 \text{ feet} = 588 \text{ cubic feet}$$

There are 27 cubic feet in a CUBIC YARD, so to convert, divide by 27.

$$\text{Example: } 588 \text{ cubic feet} / 27 \text{ cubic feet} = 21.78 \text{ cubic yards}$$

Refer to [www.raingarden.wsu.edu](http://www.raingarden.wsu.edu) for additional information, including worksheets for calculations.

## Rough Up the Bottom



Before adding rain garden soil mix, use a rake, shovel, or rototiller to rough up (scarify) the bottom of the excavated area (but avoid compaction of the area). Loosening the soil at the excavated bottom of the rain garden will enhance drainage and promote root growth.



## Disposing of Your Excavated Soil



Under any of the rain garden soil options, you usually will have excess soil. You may be able to use the soil to create a berm around the outside of your rain garden (see page 39). If you will not be reusing the soil, find an acceptable disposal site. Contact your local city or county for information.

For mixing rain garden soil under Option 2, use one of the following methods:

1. If digging down from existing ground surface on fairly flat ground, you typically will only reuse approximately 2/3 of the soil excavated. For this reason, consider making 2 piles—1 pile with 2/3 of the excavated soil set aside for mixing in compost and re-use and 1 pile with 1/3 of the remaining soil. Mix approximately 1/3 compost by volume into the larger pile of excavated soil before placing back in the rain garden.
2. If berming, use the excavated soil, mixing in approximately 1/3 compost by volume before placing back in the rain garden and in the berm. With this method, you may be able to use all of the excavated soil, avoiding the need for off-site disposal. Firmly compact the sides of the berm as it is constructed (see page 39 for more information).

### OPTION 3—AMEND SOIL IN PLACE

Option 3 can be used if you have good quality soil with minimal clay content and a soil drainage rate of more than 1 inch per hour. Excavate to the desired ponding depth (6 inches or 12 inches) and overflow containment (6 inches), plus 3 inches below that to make room for the compost you'll be adding. Set the excavated soil aside. Spread the 3 inches of compost and till to a depth of 4 to 5 inches. Adding compost will help your rain plants adapt and thrive.

#### **Excavation Depth Examples:**

- 6" Overflow Containment (Assuming No Berm is Constructed)
  - + 6" or 12" Ponding Depth
  - + 3" of Compost (Tilled into Existing Soil)
- 
- = 15" to 21" Excavation Depth

## Choose Compost Carefully

Compost should be stable and mature and made from organic waste materials such as yard debris or wood wastes. Don't use mushroom compost, uncomposted manure, pure bark, or sawdust. Mushroom compost can be too high in nitrogen and give the soil mix an undesirable texture. Manure can be too high in nitrogen and introduce pathogens in the rain garden. Bark and sawdust will likely lead to a shortage of nitrogen.

A simple way to judge compost quality is to smell and examine the finished product, which should have the following characteristics:

- Earthy smell that is not sour, sweet, or ammonia-like
- Brown to black in color
- Crumbly texture with mixed particle size
- Stable temperature that doesn't get hot when re-wetted



David Hymel



David Hymel



David Hymel

## Avoid Soil Compaction in the Rain Garden

If using a mini-excavator or other machinery for excavation, keep equipment away from the bottom of the rain garden. Operating machinery inside the rain garden will compact the soil and reduce the drainage rate. Instead, operate the machinery from adjacent areas, outside the rain garden.



## Excavating on Fairly Flat Ground

If the rain garden is installed on fairly flat ground (5% grade or less), excavate soil to the desired depth. Set soil aside and see instructions for replacing soil on pages 32 through 35.



Linda Andrews

### Don't Add Sand to High Clay Soils

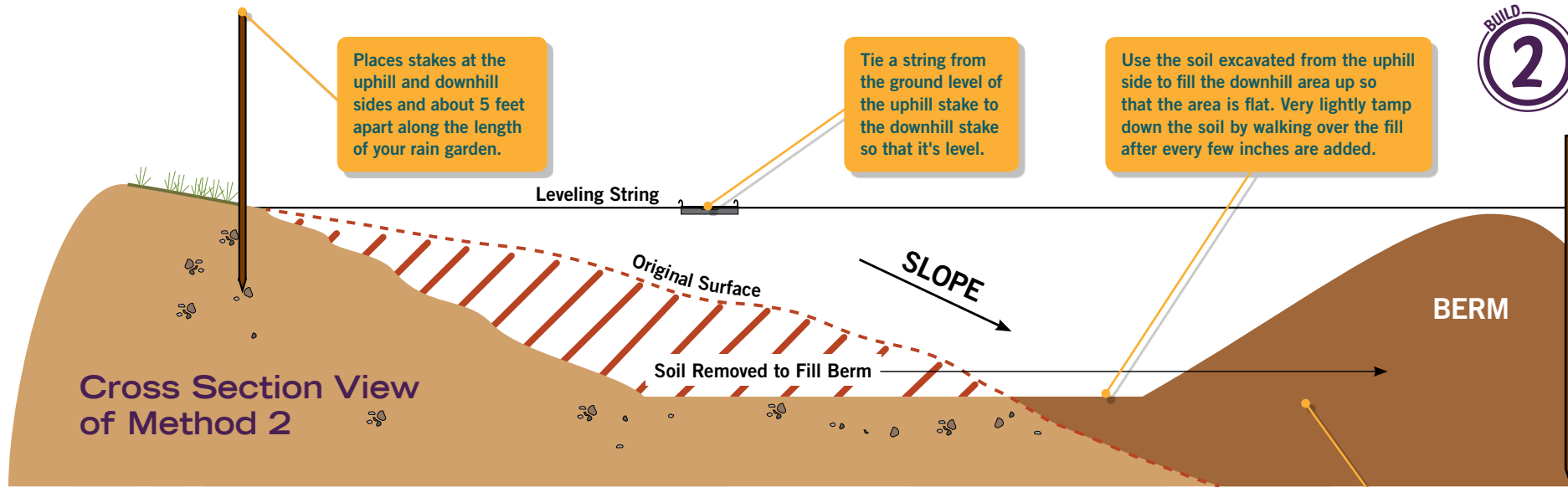


Don't add sand to a soil with high clay content. Adding a little sand to soils with lots of clay can create a concrete-like mixture.



David Hymel





Create a berm at the downhill side to confine water in the rain garden. For the correct height, build the berm up to the string.

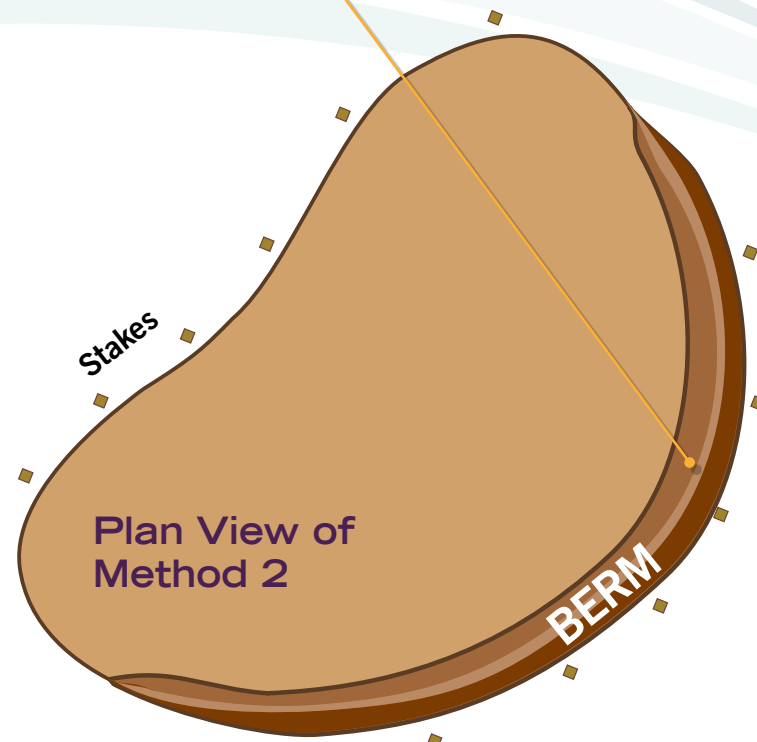
## Excavating On Slopes

If the rain garden area is sloped more than 5%, then consider one of the following two methods for excavating soil to the necessary depth.

**Method 1:** Dig the downhill side to the desired depth and create a flat bottom. This means that the depth at the uphill side will be more than the downhill side, which is good for additional water storage but requires more digging. Set the soil aside for reuse and/or disposal.

**Method 2:** An alternative method (shown on this page) to get the desired depth on slopes is to excavate soil from the uphill end and use the soil to fill and create a berm to get the desired depth at the downhill end. If you choose this method, do the following:

- Place stakes at the uphill and downhill sides and about 5 feet apart along the length of the rain garden.
- Tie a string from the ground level of the uphill stake to the downhill stake so that it's level. A small, lightweight line level works well for this.
- Rather than tie all strings to the stakes at once, work with one at a time and in 5-foot sections so that the strings don't get in your way.





Michael Carey

## Constructing the Overflow Containment Area

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

- Either create a berm that rises a minimum of 6 inches, at a maximum 2:1 slope, from the outside of the top surface of the ponding area (photo on bottom left).
- OR start digging down from the ground surface. Remember to start 12 inches out from the perimeter of the top surface of the ponding area on a 2:1 slope to accommodate the 6-inch overflow containment area (photo on bottom right).

- Start digging on the uphill side, measuring down from the string to the desired depth.
- Use the soil excavated from the uphill side to fill the downhill area, creating a flat, level bottom and a berm on the downhill side.
- Lightly tamp down the soil on the level bottom by walking over the fill after every few inches is added, avoiding over compaction.
- Create a more heavily compacted berm at the downhill side to confine water in the rain garden. For the correct height, build the berm up to the string. To keep the top level, the berm will be highest at the downhill end and then become shorter until tapering off at the uphill end(s). The berm should have sloping sides at 2:1 maximum and be well compacted. See pages 37 and 39 for more information.



David Hymel



David Hymel



## If a Berm is Used to Hold Water in the Rain Garden

- Water flowing into the rain garden can erode the berm if the soil is loose and unprotected, so pack the berm with firm foot pressure, mulch, and plant fast-growing groundcovers and low shrubs. Refer to the Plant List in Appendix A.
- Before the soil is placed remove all vegetation and rough up the ground under the berm so the fill bonds well to the ground surface. As the berm is constructed, be sure to firmly compact the soil after every few inches is added.
- The berm should be at least 6 inches above the maximum ponding depth and at least twice as wide as it is high.
- Where the overflow extends through the berm, cover the overflow area with rock to protect it from erosion (see page 42).



### The Berm Has to Be Water Tight



A sandy soil that drains well isn't the best material for a berm around the rain garden. The berm needs to hold water after heavy rainfall or frequent storms. Consider bringing in soil with higher clay or silt content that is less well-draining to construct the berm. Before the soil is placed, remove all vegetation and rough up the ground under the berm. As the berm is constructed, be sure to firmly compact the soil after every few inches added, but do not compact the bottom of the rain garden.



## How to Use a Laser Level

1. Set the level up just outside of the work area so it is out of the way of construction and has an unobstructed view of the entire rain garden and the planned inflow and overflow locations.
2. For fairly level ground, place the receiver on the measurement rod at a height equal to the distance from the laser to the ground, plus the desired depth of excavation. Excavate the rain garden to the depth the receiver beeps.
3. With Method 1 for “Excavation on Slopes” place the receiver on the measurement rod at a height equal to the distance from the laser to the ground, plus the desired depth of excavation at the uphill end. Excavate the entire bottom of the rain garden to the depth that the receiver beeps.
4. With Method 2 for “Excavation on Slopes” place the receiver on the measurement rod at a height equal to the distance from the laser to the ground, plus the desired depth of excavation at the uphill end. Excavate the up-slope and fill the down-slope areas to the depth that the receiver beeps.

# Create a Flat, Level Bottom

Your rain garden should have a flat, level bottom. Whichever excavation method is used, dig the rain garden so the bottom is flat. An easy way to determine if the bottom is flat is to use a straight board with a carpenter's level on top. Place the board at different locations and in various directions and dig or fill areas to get the bottom flat. A laser level can be used for this as well.



Erica Guttman



Curtis Hinman



# Install the Inflow

If applicable, install any pipes, runnels, roof downspout extensions, or other features that will carry water to your rain garden. This should be done at the end of excavation and before placing your rain garden soil mix. Install pipes so that they slope toward the rain garden for the most efficient water flow. Downspouts and waterworks designed as attractive garden elements and art features can add a nice touch. Don't use flexible pipe to deliver water to the rain garden. Rigid pipe is easier to maintain and doesn't settle as much over time, which can impede drainage. Be sure to test that water flows freely to the rain garden and adjust placement as necessary before permanent installation. Remember if water is directed through a swale sloping more than 2%, consider providing small rock check dams every 5 to 10 feet to slow the water (see photo below).

# Place the Rain Garden Soil Mix

Place the soil mix in the rain garden about 6 inches at a time and walk on each layer to lightly tamp down. Fill the soil up to a level that provides the desired ponding depth (6 or 12 inches is recommended) and overflow containment area (6 inches above the overflow minimum). Be sure to keep the bottom of your rain garden flat and level.



Teresa Brooks



Erica Guttman



Bob Spencer



Bob Spencer



David Hymel



# Protect the Inflow and Overflow

Where water enters the rain garden from a swale or pipe, and where water exits at the overflow, place a pad of rock to slow the water and guard against erosion. For both the inflow and overflow, use round rock (cobble or river rock) that is minimum 2 inches in diameter. The rock should be free of sediment, so order washed rock. If the overflow is through a berm, be particularly careful to armor the overflow with extra rock and extend the rock all the way down the slope and a minimum of 4 feet beyond the berm to prevent erosion.



# Edging

Edging will help separate the rain garden from other surrounding landscapes and reduce encroachment of lawn into the rain garden. Edging comes in many forms including curvilinear concrete curbing, unit pavers, flagstone, metal, and other materials. Cutting a sharp line between the rain garden edge and the lawn with a spade during the growing season will typically prevent grass from spreading into the rain garden. You may be able to avoid the need for edging by locating the rain garden away from a lawn area.





Selecting the right plants for your rain garden can be fun. This section of the handbook provides a summary of important considerations related to landscaping your rain garden.



## In this Section

- Prepare to Landscape Your Rain Garden
- The Benefits of Plants
- Planting Zones
- Landscaping Guidelines and Suggestions
- Mulch
- Sample Planting Plans

# PLANT

# 3



# Prepare to Landscape Your Rain Garden

Obtain your plants and gather the tools and materials you'll need to start landscaping your rain garden. Remember that you may need to order your plants from the nursery or other sources ahead of time. Be sure to choose a variety of plants for year-round interest and color.

## Tools and Materials Checklist



### PLANTS

*(Emergents, Perennials, Grasses, Groundcovers, Shrubs, and Trees)*



### SHOVEL(S)



### SMALL HAND TOOLS

*(Dibbles, Planting Bars, Weeding Knives—  
for Planting Tubes and Bare-Root Emergents)*



### WHEEL BARROW



### RAKE



### MULCH

*(Shredded Wood or Chipped Wood)*



### WATER



### STONES/ROCK



David Hymel



David Hymel



Rod Gilbert



Wikipedia Commons



David Hymel



# The Benefits of Plants

Plants and soil work together in the rain garden. The plant roots and soil organisms build soil structure, create channels and pores to soak up and filter water, and improve nutrient and oxygen availability necessary to support an abundance of life. While plants help the rain garden absorb stormwater, they also create an attractive landscape for your yard and neighborhood. For sample planting plans see pages 51 through 54 and refer to Appendix A for a recommended plant list.



Washington State University Extension



Washington State University Extension

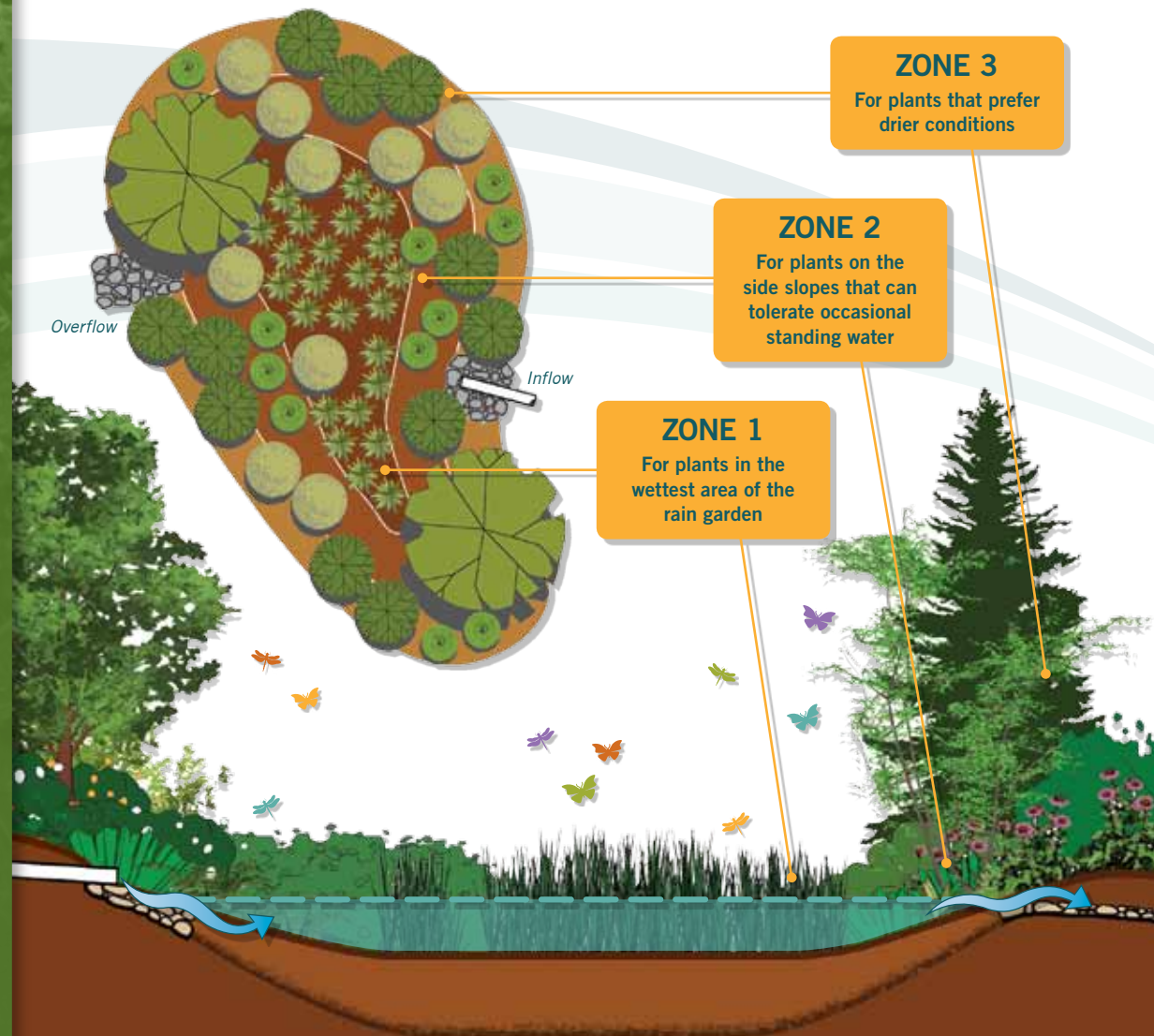
## Plant It Right



There are many great resources for plant selection and landscaping. Be sure to check out [www.greatplantpicks.org](http://www.greatplantpicks.org) and [www.raingarden.wsu.edu](http://www.raingarden.wsu.edu), and refer to Appendix B for a full list of resources.

# Planting Zones

Rain gardens have three planting zones. Zone 1 is the bottom of the rain garden—the wettest area. Zone 2 covers the side slopes, which occasionally may become wet. This zone requires plants to help stabilize the slopes. Zone 3 covers the area around the perimeter of the rain garden and/or on the berm, where plants will grow in drier soil.



# Landscaping Guidelines and Suggestions

The following guidelines and suggestions will help you landscape your rain garden.

## General

- Existing trees and plants already do a great job soaking up stormwater, so preserve existing vegetation around your rain garden as much as possible. Remember that any work within the dripline of a tree or shrub could damage its roots.
- Consult with an expert (landscape architect, garden designer, arborist, nursery professional, and/or other specialist) if you need assistance with planting design and preservation of existing trees and vegetation.



### Include Some Evergreens for Year-Round Benefits



Include a mix of evergreens and deciduous plants in your rain garden. Evergreens will provide year-round greenery and shade, which will reduce weed growth and maintenance.



## Rain Gardens are Not Places to Grow Food



Remember that rain gardens help to filter pollutants, and they are not suitable as vegetable gardens. You also should avoid eating berries, nuts, and other edibles that may be growing in a rain garden.

David Hymel



Erica Guttman



Erica Guttman



## Plant Selection, Siting, and Spacing

- Consider a mix of deciduous and evergreen plants for your rain garden to provide all-season interest.
- Carefully choose plants with their eventual mature size in mind. The rain garden soil mix provides an excellent growing medium, so plan on most plants reaching their mature width and height, perhaps more quickly than in other locations. Space trees, shrubs, and plants at installation according to their expected mature size.
- Provide good coverage with a mix of trees, shrubs, and groundcover, layered in the landscape.
- Plants that are too large can require more maintenance later, such as more pruning and thinning, so choose the right-sized plants from the start.
- Avoid planting within the root zones of existing trees and shrubs.
- If your rain garden is near a roadway, driveway, or intersection, make sure the mature plants won't block drivers' vision.
- If your rain garden is located under overhead power and utility lines, be sure to comply with maximum height requirements for trees.
- If there are underground utilities near your rain garden, select plants that won't grow into and break or block pipes.
- Check out local rain gardens that have been installed for a few years to get ideas.

David Hymel





## Good Plants for Attracting Hummingbirds, Butterflies, Bees, Other Birds, and Insects

COMMON NAME	Scientific Name
WESTERN SERVICEBERRY	<i>Amelanchier alnifolia</i>
RED-TWIG DOGWOOD	<i>Cornus sericea</i>
PURPLE CONEFLOWER	<i>Echinacea</i>
LAVENDER	<i>Lavendula</i>
OREGON GRAPE	<i>Mahonia (All)</i>
MOCK ORANGE	<i>Philadelphus lewisii</i>
PACIFIC NINEBARK	<i>Physocarpus capitatus</i>
CASCARA	<i>Frangula purshiana</i>
RED-FLOWERING CURRANT	<i>Ribes sanguineum</i>
SALMONBERRY	<i>Rubus spectabilis</i>
BLACK-EYED SUSAN	<i>Rudbeckia</i>
SNOWBERRY	<i>Symphoricarpos albus</i>



Rod Gilbert

## Aesthetics

- Incorporate a diversity of plants, including small trees, shrubs, herbs, emergents (sedges, rushes, and bulrushes), and grasses for year-round/seasonal color and interesting differences in height and texture.
- Consider the context of the surrounding landscape, including your neighborhood and the native plant community.
- Choose plants that complement the character of your existing landscape. If your yard is more natural and informal, you may choose more native plants. If your yard is more formal, you may prefer plants that are more ornamental and compact. Native plants and ornamentals also can be mixed, resulting in an attractive garden.
- Arrange landscaping according to your view of the rain garden. If you want to see the water after a rain storm, leave a view corridor open to the ponding area.
- Consider plants that provide a pleasing visual buffer between homes and roadways. For example, there are several attractive evergreen shrubs that perform well in western Washington. (See the Plant List, Appendix A.)



# Maintenance

- Maintain access to the bottom of the rain garden for weeding and other tasks. A few strategically placed flat rocks can allow access to the bottom of the rain garden without compacting the soil.
- Edging around the rain garden (such as pavers, stones, etc.) can facilitate access for maintenance and provide separation from lawn and other landscaped areas.
- Refer to 4-MAINTAIN for more information.



Erica Guttman

## Why Native Plants are Good



Native plants are already adapted to the region and will use less water and require less maintenance once established. They also can provide habitat for wildlife.

## Good Plants for Seasonal Color

COMMON NAME	Scientific Name
STRAWBERRY TREE	<i>Arbutus unedo 'Compacta'</i>
HIMALAYAN BIRCH	<i>Betula utilis 'Jacquemontii'</i>
ORANGE NEW ZEALAND SEDGE	<i>Carex testacea</i>
CORNELIAN CHERRY	<i>Cornus mas</i>
RED-TWIG DOGWOOD	<i>Cornus sericea</i> , <i>C. s. 'Midwinter Fire'</i> , <i>C. s. 'Kelseyi'</i> (all varieties)
BLUE OAT GRASS	<i>Helictotrichon sempervirens</i>
OREGON GRAPE	<i>Mahonia (All)</i>
PACIFIC NINEBARK	<i>Physocarpus opulifolius 'Diablo'</i>
WESTERN SWORD FERN	<i>Polystichum munitum</i>
SNOWBERRY	<i>Symphoricarpos albus</i>
EVERGREEN HUCKLEBERRY	<i>Vaccinium ovatum</i>



King County Native



Patricia Pyle



# Mulch

Mulch provides multiple benefits for rain gardens by helping to:

- Keep the soil moist.
- Replenish organic material in the soil.
- Prevent erosion.
- Discourage weeds.

Spread 2 or 3 inches of shredded or chipped wood mulch all throughout your rain garden—on the bottom, the sides, and around the perimeter. Make sure the mulch does not contain weed seeds. Freshly cut wood chips from a good source, such as a local arborist, are recommended.



King County Native



Wikipedia Commons



King County Native



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King County Native



Erica Guttman





David Hymel

## How Much Mulch?



About 1 cubic yard of mulch, spread 3 inches thick, will cover about 100 square feet.

## MULCH SHOULD NOT BE:

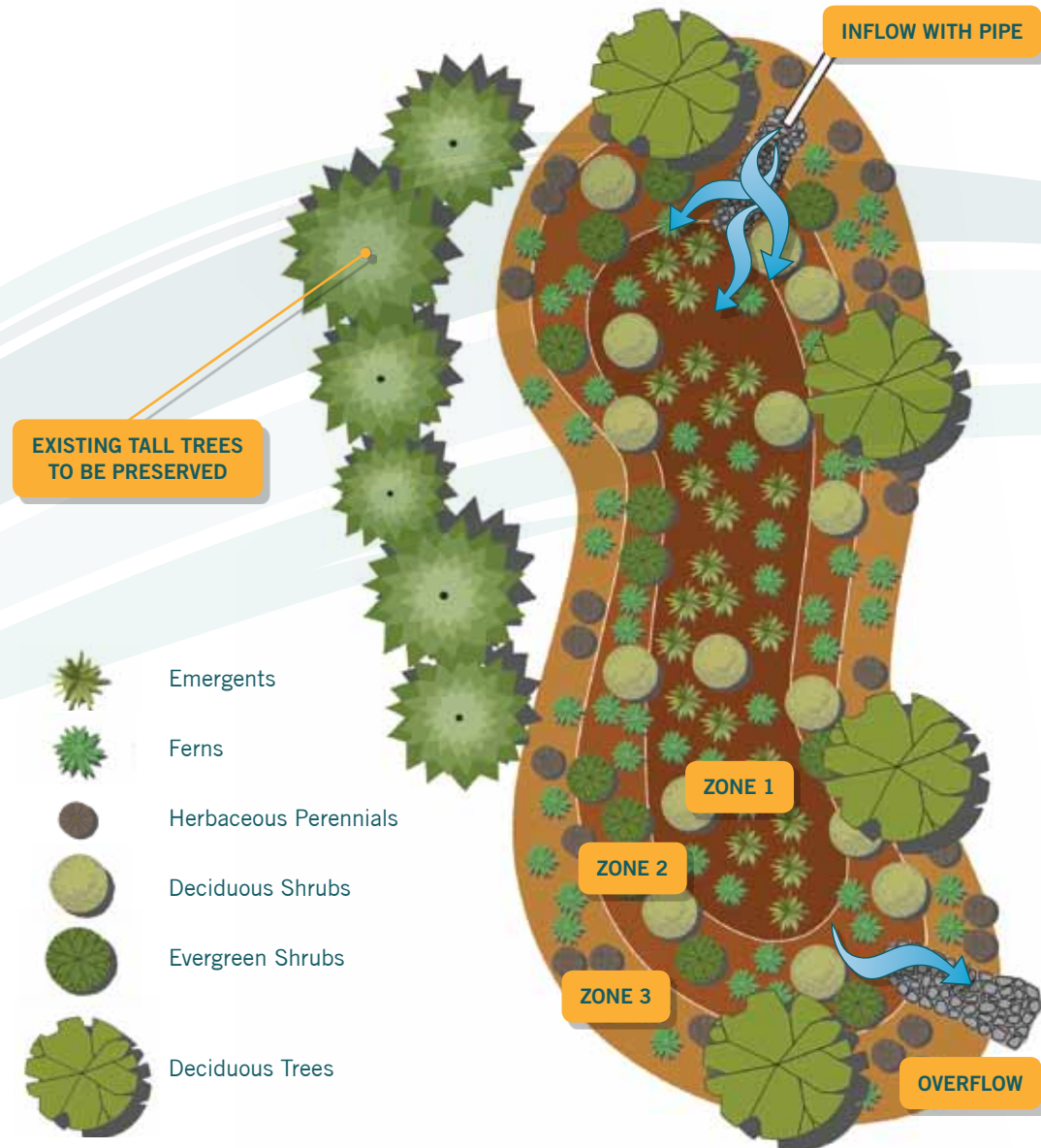
- 
 • **Grass clippings**—decomposing grass clippings are a source of excess nutrients that can harm streams and wetlands if water flows out of the rain garden and into the storm drain system.
- 
 • **Pure bark or beauty bark**—bark is not as good a source of organic material for replenishing soil.



# Sample Planting Plans

## Rain Garden in the Shade

This sample planting plan represents just one of many approaches to landscaping a rain garden. The creative possibilities are many when selecting plants for your rain garden. Refer to the Plant List in the Appendix for additional ideas.



### SUGGESTED PLANTS

#### ZONE 1

- Emergents** Slough sedge (*Carex obnupta*) and small-fruited bulrush (*Scirpus microcarpus*)
- Ferns** Lady fern (*Athyrium filix-femina*) and deer fern (*Blechnum spicant*)
- Deciduous Shrubs** Dwarf red-twig dogwood (*Cornus sericea* 'Kelseyi') and if your garden is large enough add black twinberry (*Lonicera involucrata*)

#### ZONE 2

- Ferns** Sword fern (*Polystichum munitum*) and lady fern (*Athyrium filix-femina*)
- Deciduous Shrubs** Snowberry (*Symphoricarpos albus*)
- Evergreen Shrubs** Salal (*Gaultheria shallon*) and boxwood honeysuckle (*Lonicera pileata*)

#### ZONE 3

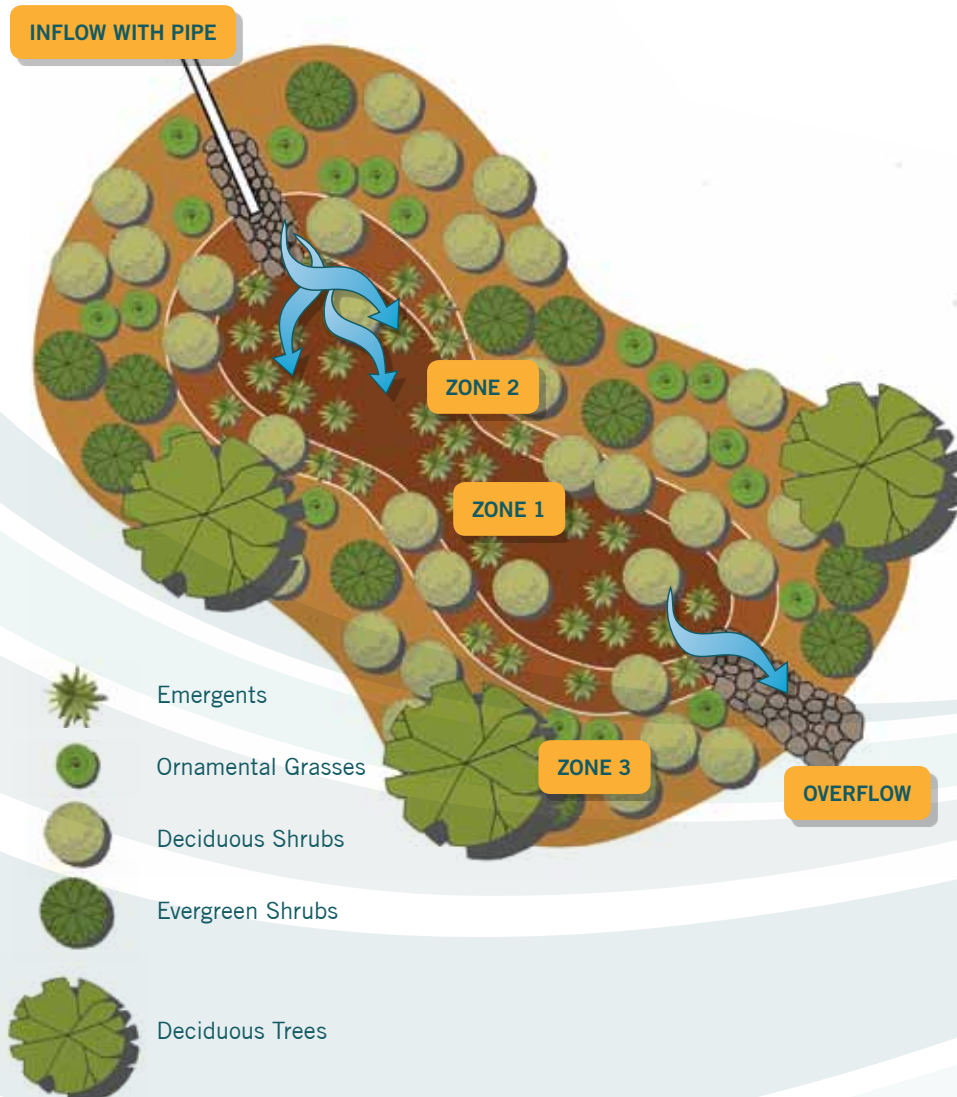
- Herbaceous Perennials** Wild ginger (*Asarum caudatum*), inside-out flower (*Vancouveria hexandra*), and western bleeding heart (*Dicentra formosa*)
- Ferns** Sword fern (*Polystichum munitum*)
- Evergreen Shrubs** Evergreen huckleberry (*Vaccinium ovatum*) and low Oregon grape (*Mahonia nervosa*)
- Deciduous Trees and Large Shrubs** Vine maple (*Acer circinatum*), cascara (*Frangula purshiana*), and Indian plum (*Oemleria cerasiformis*)

Sample planting plan suggestions by Erica Guttman, WSU; originally created for the 2007 handbook and updated for this edition.

# Sample Planting Plans

## Large Rain Garden in Sunny Area with Native Plants for Habitat

This sample planting plan represents just one of many approaches to landscaping a rain garden. The creative possibilities are many when selecting plants for your rain garden. Refer to the Plant List in the Appendix for additional ideas.



### SUGGESTED PLANTS

#### ZONE 1

<b>Emergents</b>	Dagger-leaf rush ( <i>Juncus ensifolius</i> ), and taper-tipped rush ( <i>Juncus acuminatus</i> )
<b>Herbaceous Perennials</b>	Henderson's checker-mallow ( <i>Sidalcea hendersonii</i> )
<b>Deciduous Shrubs</b>	Dwarf red-twig dogwood ( <i>Cornus sericea</i> 'Kelsey'), Pacific ninebark ( <i>Physocarpus capitatus</i> 'Diablo'), and Bloodtwig dogwood ( <i>Cornus sanguinea</i> 'Midwinter Fire')

#### ZONE 2

<b>Herbaceous Perennials</b>	Daylily ( <i>Hemerocallis</i> spp.) and giant camas ( <i>Camassia leichtlinii</i> )
<b>Deciduous Shrubs</b>	Dwarf red-twig dogwood ( <i>Cornus sericea</i> 'Kelsey'), snowberry ( <i>Symphoricarpos albus</i> ), and Hancock coralberry ( <i>Symphoricarpos x chenaultii</i> 'Hancock')
<b>Evergreen Shrubs</b>	Boxwood honeysuckle ( <i>Lonicera pileata</i> ) and dwarf tall Oregon grape ( <i>Mahonia aquifolium</i> 'Compacta')

#### ZONE 3

<b>Ornamental Grasses</b>	Miscanthus ( <i>Pennisetum alopecuroides</i> 'Morning Light') and switch grasses ( <i>Panicum virgatum</i> 'Heavy Metal,' and 'Shenandoah')
<b>Deciduous Shrubs</b>	Oceanspray ( <i>Holodiscus discolor</i> ), red-flowering currant ( <i>Ribes sanguineum</i> ), and snowberry ( <i>Symphoricarpos albus</i> ) set back from the grasses to fill in
<b>Evergreen Shrubs</b>	Tall Oregon grape ( <i>Mahonia aquifolium</i> )
<b>Deciduous and Evergreen Trees and Large Shrubs</b>	Western serviceberry ( <i>Amelanchier alnifolia</i> ), Oceanspray ( <i>Holodiscus discolor</i> ), and dwarf strawberry tree ( <i>Arbutus unedo</i> 'Compacta')

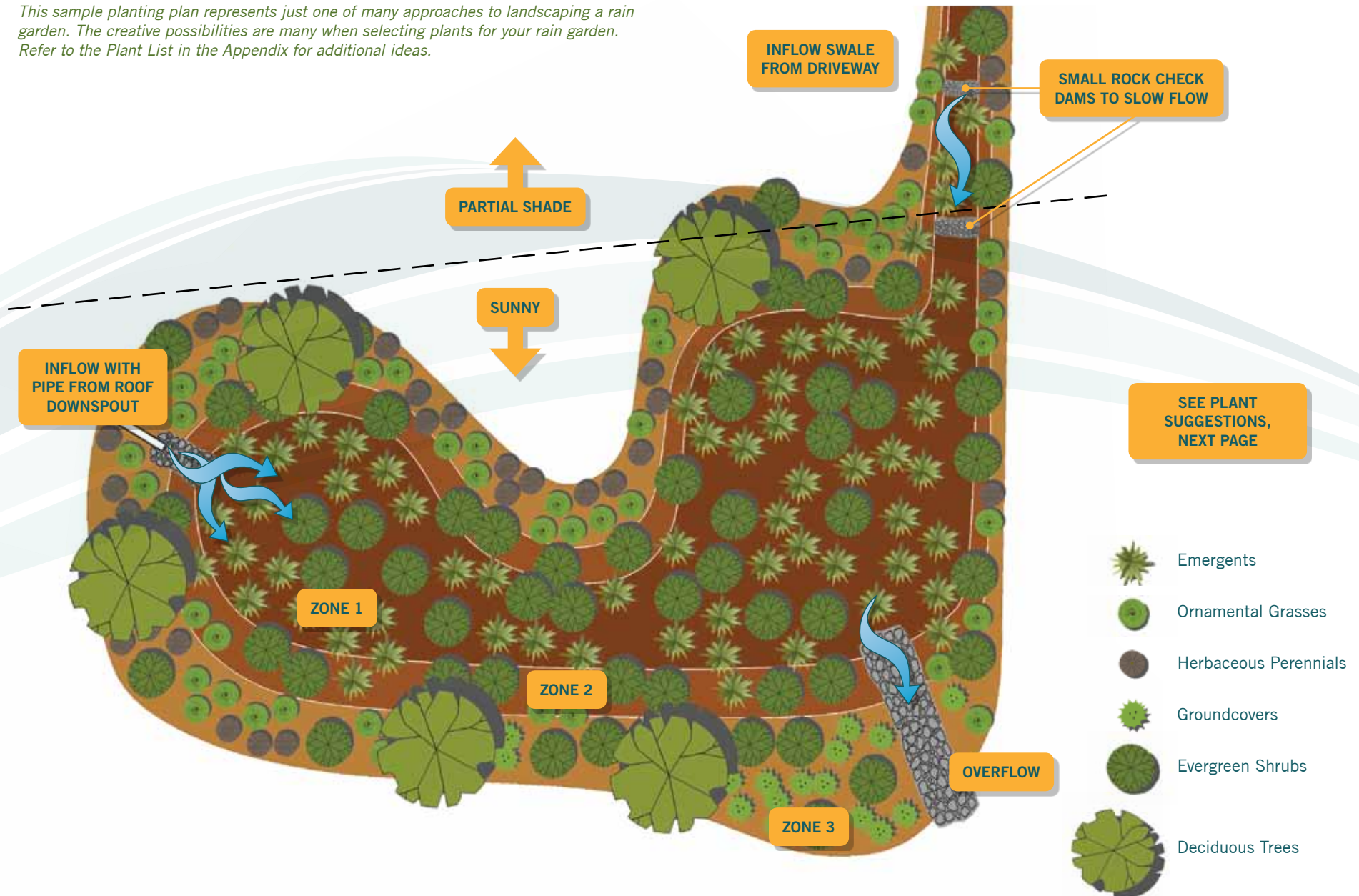
Sample planting plan suggestions by Erica Guttman, WSU; originally created for the 2007 handbook and updated for this edition.



# Sample Planting Plans

## Large Rain Garden with Two Inflows

*This sample planting plan represents just one of many approaches to landscaping a rain garden. The creative possibilities are many when selecting plants for your rain garden. Refer to the Plant List in the Appendix for additional ideas.*



## SUGGESTED PLANTS FOR THE SUNNY AREA OF THE RAIN GARDEN ON PAGE 53

### ZONE 1

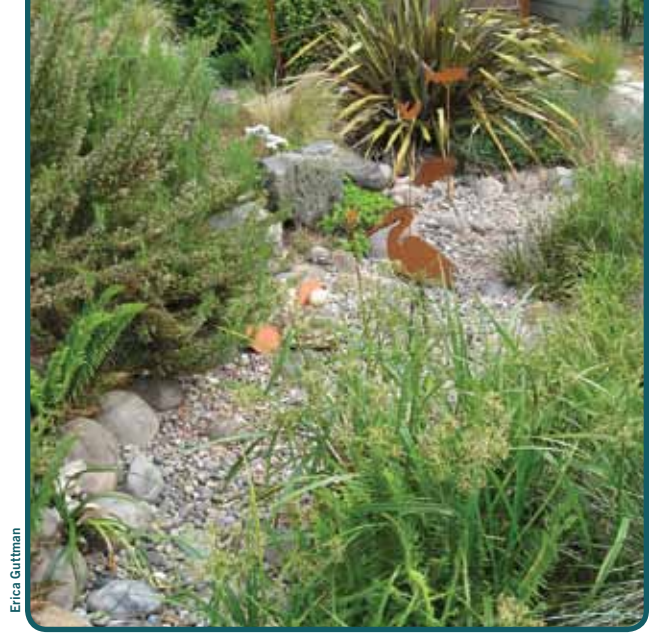
<b>Emergents</b>	Dagger-leaf rush ( <i>Juncus ensifolius</i> ) and taper-tipped rush ( <i>Juncus acuminatus</i> )
<b>Herbaceous Perennials</b>	Oregon iris ( <i>Iris tenax</i> )
<b>Deciduous Shrubs</b>	Dwarf red-twig dogwood ( <i>Cornus sericea</i> 'Kelseyi'), Douglas spirea ( <i>Spiraea douglasii</i> ), Alpine spirea ( <i>Spiraea densiflora</i> )

### ZONE 2

<b>Herbaceous Perennials</b>	Daylily ( <i>Hemerocallis</i> spp.), western columbine ( <i>Aquilegia formosa</i> ), and crimson flag ( <i>Hesperantha coccinea</i> )
<b>Evergreen and Deciduous Shrubs</b>	Dwarf red-twig dogwood ( <i>Cornus sericea</i> 'Kelseyi'), dwarf tall Oregon grape ( <i>Mahonia aquifolium</i> 'Compacta'), and boxwood honeysuckle ( <i>Lonicera pileata</i> )

### ZONE 3

<b>Herbaceous Perennials</b>	Gaura 'Siskiyou Pink', Echinacea 'White Swan', gayfeather ( <i>Liatris spicata</i> ), and Coreopsis 'Creme Brulee', Geum 'Mango Lassi', yellow yarrow ( <i>Achillea</i> 'Moonshine'), and showy fleabane ( <i>Erigeron speciosus</i> 'Darkest of All')
<b>Ornamental Grasses</b>	Pennisetum 'Hameln', Pennisetum 'Little Bunny', Pennisetum 'Little Honey', blue oat grass ( <i>Helictotrichon sempervirens</i> ), and Miscanthus 'Little Kitten.' Arrange above mix in small clusters to mimic a natural pond.
<b>Evergreen and Deciduous Shrubs</b>	Dwarf tall Oregon grape ( <i>Mahonia aquifolium</i> 'Compacta'), shrubby wallflower ( <i>Erysimum</i> 'Apricot Twist'), orange sunrose ( <i>Helianthemum</i> 'Henfield Brilliant'), English lavender ( <i>Lavendula angustifolium</i> ), and Goldflame spirea ( <i>Spiraea x bumalda</i> 'Goldflame')
<b>Deciduous Trees and Large Shrubs</b>	Persian ironwood ( <i>Parrotia persica</i> 'Vanessa'), cutleaf crabapple ( <i>Malus transitoria</i> 'Schmidcutleaf' Golden Raindrops™), and red-flowering currant ( <i>Ribes sanguineum</i> )



Erica Guttman

## SUGGESTED PLANTS FOR THE SHADY AREA OF THE RAIN GARDEN ON PAGE 53

### ZONE 1

<b>Emergents</b>	Slough sedge ( <i>Carex obnupta</i> ), small-fruited bulrush ( <i>Scirpus microcarpus</i> )
<b>Deciduous Shrubs</b>	Dwarf red-twig dogwood ( <i>Cornus sericea</i> 'Kelseyi')

### ZONES 2/3

<b>Herbaceous Perennials</b>	Foamflower ( <i>Tiarella trifoliata</i> ), fringe cup ( <i>Tellima grandiflora</i> ), variegated moor grass ( <i>Molinia caerulea</i> 'Variegata') and daylily ( <i>Hemerocallis</i> spp.)
<b>Evergreen Shrubs</b>	Creeping Oregon grape ( <i>Mahonia repens</i> )

Sample planting plan suggestions by Erica Guttman, WSU; originally created for the 2007 handbook and updated for this edition.



Rain gardens, just like any garden area, need maintenance to perform well and look good.

However, a well-designed rain garden needs minimum care once established.



## In this Section

- Keep the Water Flowing
- Provide Routine Maintenance
- Minimize Exposed Soil and Erosion
- Maintenance Checklist

# MAINTAIN

# 4

# Keep the Water Flowing

After heavy storms, check the inflow and overflow areas to make sure they are still intact and can continue to carry water into and out of the rain garden. Remove any debris or litter in the rain garden that may interfere with flow. Keep the inflow pipe accessible and flush out pipe if necessary. Look for areas where water may not be soaking into the ground. This may be due to fine sediment or compaction of the soil. Remove sediment that may be building up and rake the soil surface. If you suspect compaction, break up and loosen the soil when it is not saturated.



# Minimize Exposed Soil and Erosion

Sediment flowing into your rain garden can clog the soil mix and slow drainage. Sediment carried out of the rain garden can harm streams and wetlands in many ways, including transporting pollutants, covering fish spawning areas, and filling stream channels and pools. To guard against soil erosion problems:

- Check the rain garden for areas of exposed soil, particularly in the fall before the wet season begins, as well as during the winter.
- Replenish mulch areas throughout your rain garden—on the sides and bottom of the rain garden and also around the perimeter (and on the berm if applicable).
- Maintain a healthy cover of plants.
- Maintain a decorative cobble rock pad to protect the ground and prevent erosion where concentrated water flows into the rain garden from a pipe or swale.
- If sediment is deposited from water entering the rain garden, immediately determine the source and stabilize the area.
- If there is a localized area of erosion, consider stabilizing the area with rocks to spread out the flows causing erosion. If there are already rocks in this area, use larger rocks or cover a larger area with rock to spread out the flow.
- If erosion is occurring at the inflow and overflow locations, you may need to extend the cobble rock in these areas to disperse water flow.
- If erosion persists, water may be flowing into the rain garden too rapidly. In this case, the slope of the pipe or swale directing water may need to be reduced, or the amount of water flowing into the rain garden may need to be decreased. Adding small rock check dams every few feet in the inflow can slow water and reduce erosion.



# Provide Routine Maintenance

In the short term (during the first 2 to 3 years), more frequent maintenance will be needed until the plants in your rain garden become established. The following routine activities should be part of your maintenance program.

## Replenish Mulch

Mulch prevents erosion, controls weeds, retains moisture, adds organic material to the soil, and improves drainage. Every year check the mulch layer and, if needed, replenish to maintain a depth of 2 to 3 inches. Spread mulch between plants and on bare ground. Added mulch should be shredded or chipped hardwood or softwood. Mulch can be applied any time of year, but maintaining a sufficient mulch layer for the dry summer and rainy winter months is particularly beneficial.

Avoid using mulch that has been stockpiled for extended periods of time since it may contain weed seeds.

## Watering

For the first 1 to 3 years, most plants in your rain garden will need deep watering during the dry season to establish healthy root systems. If you have selected the appropriate plants including native species and others adapted to western Washington, your rain garden will need little or no watering after 2 or 3 years. However, watering may be necessary during prolonged dry periods even if plants are established. During these periods watch for signs of stress, such as wilting leaves or fading evergreen needles.

### Where to Find Wood Mulch



Local tree services can be a good source for free shredded or chipped wood mulch.



David Hymel



earthfix.org; Kate Campbell

## Water Wisely



- Check soil before watering with a shovel or trowel (soil should be dry 1 to 2 inches below surface before watering).
- Check the plants to see if they are wilting and in need of water.
- Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist.
- Don't over water because this can rot plant roots, and soggy soil reduces oxygen needed for healthy soil and plants.
- Water in the morning to reduce evaporation during warm mid-day temperatures.



## WATERING FREQUENCY (DURING THE DRY SEASON)

### Year 1:

- During planting and the first week after installation: water plants as soon as they are planted and every day or every other day.
- From the second week after installation and until fall rains begin: water 2 or 3 times per week (watch for signs of water stress and adjust watering if necessary).

### Year 2:

- Water deeply about every 1 to 3 weeks depending on your plants and site conditions.

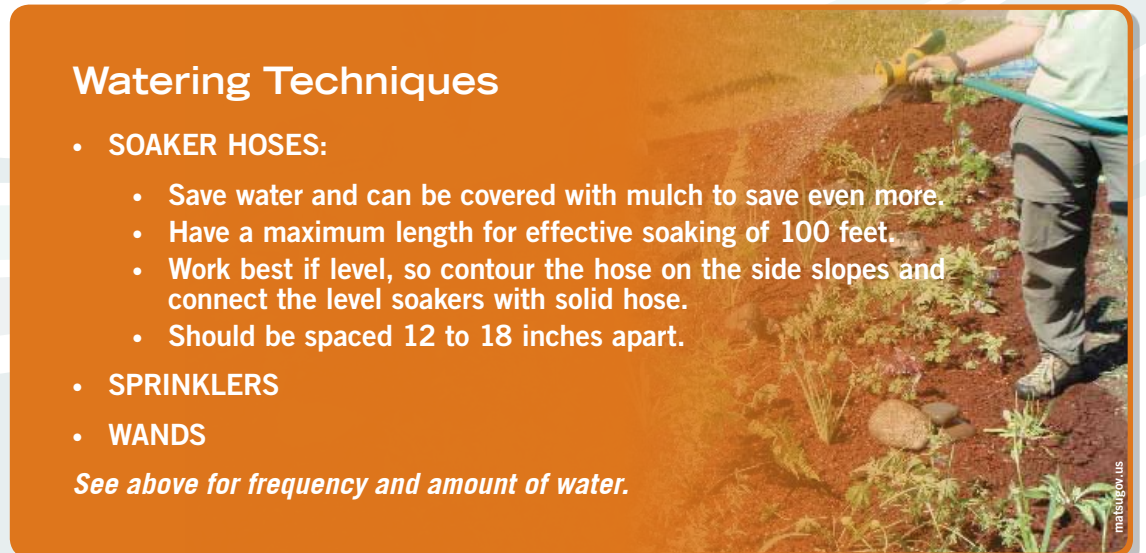
### Year 3 and Beyond:

- Minimal or no water should be needed, except during prolonged periods of drought.

## Watering Techniques

- **SOAKER HOSES:**
  - Save water and can be covered with mulch to save even more.
  - Have a maximum length for effective soaking of 100 feet.
  - Work best if level, so contour the hose on the side slopes and connect the level soakers with solid hose.
  - Should be spaced 12 to 18 inches apart.
- **SPRINKLERS**
- **WANDS**

*See above for frequency and amount of water.*







David Hymel



Erica Guttman

## Weeding

More weeding may be needed during the first 1 to 2 years after your rain garden is installed, until plants become established and start to knit together, leaving less space for weeds to grow. Rain gardens will soak up and filter stormwater even if weeds are present. However, the plants will not likely grow as well with all the competition, and your rain garden will not be as attractive.

Weed by hand and be careful to avoid compacting the soil in your rain garden.

## Plant Care

Maintaining healthy plants in your rain garden minimizes weed seed germination, improves drainage, and reduces erosion.

- If certain plants continue to do poorly or fail, they may be the wrong plants for that location. Consider the sun exposure, soil moisture, adjacent plants, and other growing factors, and replace the plants with varieties better suited for that location in the rain garden.
- You may need to thin out some plants—plants often grow rapidly to full size in rain gardens due to the healthy soil and good moisture.

Minimal pruning should be needed in your rain garden, but occasionally you may need to:

- Prune or trim back shrubs to keep sidewalks and sight distances at driveways and along roadways clear.
- If you find that the same plants need to be trimmed back too frequently, consider replacing with lower-growing alternatives.
- Remove broken and dead branches and suckers.
- Clear vegetation growth from water inflow and overflow areas.
- Cut back perennials and ornamental grasses in late winter, before spring perennials and new flower stalks emerge.

### Tips for Weeding Your Rain Garden



- Soils in rain gardens have good structure, so weeds should be easy to pull by hand, especially in the spring when the soil is moist and the weeds are small.
- Dig or pull weeds out by the roots before they go to seed.
- Need more information on identifying and managing weeds? Go to <http://gardening.wsu.edu/text/weed.htm>



## Avoid Fertilizers, Herbicides, and Pesticides

Do not apply fertilizers, herbicides, or pesticides in or near your rain garden. The rain garden soil mix provides plenty of nutrients, and if you have selected the appropriate native species and/or plants adapted to this region, no fertilizing will be needed.



## Check Your Berm

If you have a berm around your rain garden, check it for settling, and add and compact soil as needed. Cover bare spots with mulch or plants to minimize erosion.

## Clean Up Debris and Sediment

To maintain an attractive year-round rain garden, remove litter and debris. Although natural leaf debris can serve as beneficial compost for the garden, other debris and trash should be removed. Fine sediments can clog the soil layer and interfere with drainage. Remove sediment, rake the soil, and replenish wood mulch annually to reduce sediment problems.





# Maintenance Checklist

RAIN GARDEN LOCATION	CONDITION	MAINTENANCE ACTIVITY
<b>Side Slopes</b>	Persistent soil erosion on slopes	See “Minimize Exposed Soil and Erosion.”
<b>Rain Garden Bottom Area</b>	Visible sediment in the rain garden that reduces drainage rate	<ul style="list-style-type: none"> <li>Remove sediment accumulation.</li> <li>If sediment is deposited from water entering the rain garden, determine the source and stabilize the area. See “Minimize Exposed Soil and Erosion.”</li> </ul>
	Matted accumulation of leaves reducing drainage rate	Remove leaves.
<b>Ponded Water</b>	Ponded water remains in the basin more than 3 days after the end of a storm	<p>Confirm leaf, debris or sediment buildup is not reducing drainage rate. If necessary, remove leaf litter, debris or sediment. If this does not solve the problem, consult a professional with rain garden expertise to evaluate the following:</p> <ul style="list-style-type: none"> <li>Check for other water inputs (e.g., groundwater).</li> <li>Verify that the rain garden is sized appropriately for the contributing area. Confirm that the contributing area has not increased.</li> <li>Determine if the soil is clogged by sediment or if the soil is compacted.</li> </ul>
<b>Pipe Inlet/Outlet</b>	Water is backing up in pipe	Clear pipes of sediment and debris with snake and/or flush with water.
	Damaged or cracked drain pipes	Repair or seal cracks, or replace if repair is insufficient.
<b>Water Inlet</b>	Rock or cobble is removed or missing and flow is eroding soil.	Maintain a cover of rock or cobbles to protect the ground where water flows into the rain garden from a pipe or swale.
<b>Weeds</b>	Problem weeds are present.	<ul style="list-style-type: none"> <li>Remove weeds by hand, especially in spring when the soil is moist and the weeds are small.</li> <li>Dig or pull weeds out by the roots before they go to seed.</li> <li>Apply mulch after weeding (see “Mulch”).</li> </ul>

RAIN GARDEN LOCATION	CONDITION	MAINTENANCE ACTIVITY
<b>Vegetation</b>	Dying, dead, or unhealthy plants	<ul style="list-style-type: none"> <li>• Maintain a healthy cover of plants.</li> <li>• Remove any diseased plants or plant parts and dispose to avoid risk of spreading the disease to other plants.</li> <li>• Disinfect gardening tools after pruning to prevent the spread of disease.</li> <li>• Re-stake trees if they need more support, but plan to remove stakes and ties after the first year.</li> </ul>
	Vegetation reduces sight distances and sidewalks.	Keep sidewalks and sight distances on roadways clear. Choose low-growing species where sight lines are required.
	Vegetation is crowding inlets and outlets.	Keep water inlets and outlets in the rain garden clear of vegetation. Move vegetation if problem persists.
	Yellowing, poor growth, poor flowering, spotting or curled leaves, weak roots or stems	<ul style="list-style-type: none"> <li>• Test soil to identify specific nutrient deficiencies.</li> <li>• Consult with a professional knowledgeable in natural amendments or refer to natural lawn and garden care resources.</li> <li>• Do not use synthetic fertilizers.</li> <li>• Consider selecting different plants for soil conditions.</li> </ul>
<b>Mulch</b>	Bare spots (without mulch cover) are present or mulch depth less than 2 inches.	<ul style="list-style-type: none"> <li>• Supplement mulch with hand tools to a depth of 2 to 3 inches.</li> <li>• Keep all mulch away from woody stems.</li> </ul>



The following appendices to the Rain Garden Handbook for Western Washington include reference materials that support the guidance in 1-PLAN, 2-BUILD, 3-PLANT, and 4-MAINTAIN.



## Appendices

- Appendix A: Plant List
- Appendix B: Other Resources and Websites
- Appendix C: Introduction to Washington State Department of Ecology's Requirements for Rain Gardens in Western Washington

# APPENDICES



# Selected Plants for Rain Gardens in Western Washington

The plant list on the following pages includes native and non-native plant species and varieties suitable for rain gardens and commonly available in western Washington. This plant list is not intended to be an inclusive list of all plants appropriate for rain gardens, but a guide to some of the more commonly used rain garden plants in our region at the time of publication. You can explore many plant choices for rain gardens, especially for Zone 3 plantings. The website [www.greatplantpicks.org](http://www.greatplantpicks.org) is a great resource for plants adapted to native or western Washington. Refer to the resources list (Appendix B) for some additional reference sources for plants.

Select the right plants to fit soil, sun/shade exposure, and other conditions on your site. The plant list identifies each plant's correlation to the three planting zones (characterized by soil moisture):

**Zone 1:** Areas of periodic, or frequent, standing or flowing water. Zone 1 plants should also tolerate the seasonally dry summers in western Washington without extra watering (except during the initial 1 to 2 year establishment period).

**Zone 2:** Periodically moist or saturated soils during larger storms. Plants are typically planted on the side slopes in this zone and can help to protect against erosion once established.

**Zone 3:** Drier soils, infrequently subject to inundation or saturation. May be planted on a berm or just outside the perimeter of the rain garden. This zone can blend with the existing landscape of the site if desired. The plant list includes only some of the many beautiful plants you can explore for Zone 3.





## OTHER SPECIAL CONSIDERATIONS

**Exposure** - Noted in the plant list, some plants do better in full sun, partial sun/partial shade, and/or shade. When planning your garden layout, remember to consider that some areas of the garden may be sunny and some may be shady. Or if in full sun or shade, choose plants carefully to fit the conditions.


























**Drought Tolerance** - Plants included are typically tolerant of dry summer conditions experienced in Western Washington. Nonetheless, summer irrigation will be necessary during the first 1 to 2 years after planting to establish these plants, and may be necessary during periods of drought in subsequent years.




























**Plant Spacing and Large Trees** - Consider height, spread, and extent of roots at maturity. Use caution in plant selection for areas near utilities, buried pipes and other structures. If placed close to a road or driveway, consider the potential for lower limbs to cause visibility problems.

## PLANT LIST LEGEND






























-  Native Plant
-  Full Sun Exposure
-  Partial Sun Exposure
-  Shade
- D Deciduous
- E Evergreen
- 1, 2, or 3** Planting Zones
- E\*  
(Semi) Semi-evergreen; typically evergreen in mild winters




























	Scientific Name Common Name	ZONE			D or E	NATIVE	EXPOSURE			MATURE SIZE		TIME OF BLOOM	PLANT CHARACTERISTICS
		1	2	3			Sun	Partial	Shade	Height	Width		
EMERGENTS (SEDGES, RUSHES, AND BULRUSHES)													
Peggy Campbell	 <i>Carex comans</i> var. 'Frosted Curls' New Zealand hair sedge	1	2	3	E					12" to 18"	To 18" Spreading		Fine-textured, tufted 1/16"-wide, hair-like silvery leaves, almost cylindrical leaves; shimmers iridescent in the breeze; illusion of falling water
King County Native	 <i>Carex obnupta</i> Slough sedge	1	2		E					12" to 36"	To 48" Spreading	April - May	Shiny foliage; excellent soil binder; can spread rapidly
Peggy Campbell	 <i>Carex oshimensis</i> 'Evergold' Variegated Japanese sedge		2	3	E					12" to 24"	24" to 36"	Late Spring or Early Summer	Deep green variegated creamy white band on foliage that turns to yellow; great accent plant; good for edges and borders
Snohomish County	 <i>Carex testacea</i> Orange New Zealand sedge	1	2	3	E					12" to 15"	To 15" Spreading	Early Summer	Mounding form; orange-brown/bronze color in spring and summer; more intensive orange in winter
Wikipedia Commons	 <i>Juncus acuminatus</i> Taper-tipped rush	1			E					6" to 18"	12" - 24" Spreading	Spring to Summer	A delicate rush with purple to reddish brown flowers in an open array of clusters
King County Native	 <i>Juncus ensifolius</i> Dagger-leaf rush	1			E					6" to 15"	6" to 9" Spreading	Summer	Flattened stems like an iris; dark brown flowers small and rounded like pom-poms; yellow-orange fall color
Wikipedia Commons	 <i>Juncus patens</i> 'Elk Blue' Spreading rush	1	2		E					12" to 24"	18" to 24" Spreading	May - August	Spiky, blue-green grass-like foliage; other cultivars readily available
Wikipedia Commons	 <i>Juncus tenuis</i> Slender rush	1	2		E					6" to 20"	6" to 30"	May - September	Soft, bright green foliage and delicate flowers




















	Scientific Name Common Name	ZONE			D or E	NATIVE	EXPOSURE			MATURE SIZE		TIME OF BLOOM	PLANT CHARACTERISTICS
		1	2	3			Sun	Partial	Shade	Height	Width		
<b>EMERGENTS CONTINUED</b>													
King County Native	 <i>Scirpus microcarpus</i> Small-fruited bulrush	1			E				24" to 36"	12" to 24" Spreading	June to August	<i>Large, round flower clusters persist over winter; attractive in combination with spiky flowers; good soil binder; spreads aggressively</i>	
<b>GROUNDCOVERS, ORNAMENTAL GRASSES, HERBACEOUS PERENNIALS, AND FERNS</b>													
Peggy Campbell	 <i>Achillea</i> Yarrow			3	D					24" to 36"	24" to 36"	Summer to Early Fall	<i>Attracts insects and butterflies; aromatic leaves; many varieties including 'Moonshine' 'Paprika', and 'Terracotta'; flower stalks remain over winter providing forage for wildlife</i>
Missouri Botanical Garden	 <i>Acorus calamus</i> 'Variegatus' Sweet flag		2	3	E* (Semi)					24"	18" to 24"		<i>Fragrant; sword-shaped leaves; may require more water to get established</i>
Gardens and Plants	 <i>Acorus gramineus</i> 'Ogon' Golden variegated sweet flag	1	2		E* (Semi)					10"	4" to 6"	Spring	<i>Grows in clumps; semi-evergreen, brighter in sun; deer resistant; fragrant flowers; may require more water to get established</i>
Peggy Campbell	 <i>Aquilegia formosa</i> Western columbine		2	3	D					12" to 36"	12" to 36"	Spring	<i>Beautiful red and yellow flowers; attracts hummingbirds and butterflies; will re-seed; tolerant of seasonal flooding</i>
Snohomish County	 <i>Arctostaphylos uva-ursi</i> Bearberry, Kinnikinnick		2	3	E					6" to 12"	24" to 36" Spreading	March to June	<i>Low-growing ground cover; easy-care once established; pink buds open to small, bell-shaped white flowers; red berries</i>
King County Native	 <i>Asarum caudatum</i> Wild ginger		2	3	E					4" to 6"	36" Spreading	April to June	<i>Unique dark purple-reddish-brown three-lobed blooms; kidney shaped glossy leaves smell like ginger when crushed: <i>Asarum caudatum</i> f. <i>album</i> has white flowers</i>




























	Scientific Name Common Name	ZONE			D or E	NATIVE	EXPOSURE			MATURE SIZE		TIME OF BLOOM	PLANT CHARACTERISTICS
		1	2	3			Sun	Partial	Shade	Height	Width		
GROUNDCOVERS, ORNAMENTAL GRASSES, HERBACEOUS PERENNIALS, AND FERNS (CONTINUED)													
Washington Native Plant	 <i>Aster modestus</i> Great northern aster		2	3	D					12" to 42"	36"	July to August	Violet to purple flowers; thrives in full sun
King County Native	 <i>Athrium filix-femina</i> Lady fern	1	2	3	D					36" to 60"	18" to 24" Spreading		Finely textured wide frond, vigorous grower; tolerant of shallow flooding; can handle full sun in wet conditions but prefers shade
King County Native	 <i>Blechnum spicant</i> Deer fern	1	2	3	E					12" to 36"	24"	April to May	Long, narrow, dark, glossy leaves with wavy, crinkled edges; tolerant of shallow flooding; avoid sun exposure
King County Native	 <i>Camassia leichtlinii</i> Large or giant camas		2	3	D					36" to 48"	18"	Late Spring to Early Summer	Loose clusters of flowers ranging from light to deep blue; particularly showy planted in groups
King County Native	 <i>Camassia quamash</i> Common camas		2	3	D					18"	12"	May to June	Loose clusters of deep blue flowers; particularly showy planted in groups
Wikipedia Commons	 <i>Coreopsis verticillata</i> or <i>C. lanceolata</i> Tickseed		2	3	E* (Semi)					18" to 36"	12" to 18"	Summer to Fall	Smooth stems and leaves; flowers of yellow, orange, maroon, and bronze; thrives in full sun; try 'Moonbeam,' 'Zagreb,' or 'Full Moon'
Snohomish County	 <i>Deschampsia cespitosa</i> 'Northern Lights' Tufted hair grass		2	3	E* (Semi)					6" to 12"	6" to 12"	Late Spring to Early Summer	Stunning, grassy foliage with creamy white variegation that turns pink in winter (attractive in winter months); several other cultivars available
Washington Native Plant	 <i>Dicentra formosa</i> Western or Pacific bleeding heart		2	3	D					8" to 12"	24"	Spring	Delicate foliage with attractive pink to red flowers; many cultivars available, as well as <i>Dicentra spectabilis</i> , a popular non-native bleeding heart

	Scientific Name Common Name	ZONE			D or E	NATIVE	EXPOSURE			MATURE SIZE		TIME OF BLOOM	PLANT CHARACTERISTICS
		1	2	3			Sun	Partial	Shade	Height	Width		
GROUNDCOVERS, ORNAMENTAL GRASSES, HERBACEOUS PERENNIALS, AND FERNS (CONTINUED)													
Wikipedia Commons	 <i>Echinacea purpurea</i> Purple coneflower			3	D					36" to 48"	24"	Mid-Summer to Late Fall	Flowering may continue until frost; flowers have rosy-purple hue with a large orange cone in the center; many cultivars available with various flower colors; thrives in full sun
Peggy Campbell	 <i>Echinops</i> Globe thistle			3	D					24" to 48"	18" to 24"	Mid-Summer to Late Fall	Wide, coarse, prickly, grayish-green leaves; spherical blue-purple flowers golf-ball sized; great plant for butterflies/pollinators; several species
Missouri Botanical Garden	 <i>Elymus magellanicus</i> Magellan wheatgrass			3	D					24" to 36"	18" to 24"	Summer	Metallic blue leaves; often grown for foliage over summer-blooming flowers
PNW Flowers	 <i>Erigeron speciosus</i> 'Darkest of All' Showy Fleabane		2	3	D					18"	24"	Spring to Summer	Leafy stems; produces clusters of dark violet/lavender flowers with bright yellow eye; various other cultivars available
Wikipedia Commons	 <i>Erysimum</i> Shrubby wallflowers		2	3	E* (Semi)					6" to 24"	12" to 24"	Spring to Fall	Evergreen shrubs varying in height, fragrance, and flower color. Many cultivars, such as 'Apricot Twist,' 'Fragrant Sunshine,' 'John Coddington,' and 'Wenlock Beauty,'
WSU PNW Plants	 <i>Festuca glauca</i> 'Elijah Blue' Blue fescue			3	E* (Semi)					Up to 12"	Up to 12"	Summer	Striking blue gray to silvery white clumping grass; good as edging
King County Native	 <i>Fragaria chiloensis</i> Beach or coastal strawberry		2	3	D					6" to 10"	36" Spreading	Summer	Shiny, evergreen foliage with large white flowers; small hairy strawberries; great groundcover for weed control but will be an aggressive spreader
American Meadows	 <i>Gaura lindheimeri</i> Wand flower or Gaura		2	3	E* (Semi)					30" to 36"	30" to 36"	May to August	Airy clusters of small, attractive pink flowers; many cultivars available including 'Siskiyou Pink,' 'Whirling Butterflies,' and 'Passionate Rainbow'






















































	Scientific Name Common Name	ZONE			D or E	NATIVE	EXPOSURE			MATURE SIZE		TIME OF BLOOM	PLANT CHARACTERISTICS
		1	2	3			Sun	Partial	Shade	Height	Width		
Peggy Campbell	<i>Geranium cantabrigiense</i> 'Biokovo' Biokovo hardy geranium	1	2	3	E* (Semi)					6" to 8"	6" to 8"	Early Spring to Summer	Pleasantly scented foliage; pinkish white blooms
Colleen Miko	<i>Geranium macrorrhizum</i> Hardy geranium, Cranes-bill			3	D					12" to 18"	18" to 24"	Summer	Flower colors vary by cultivar; aromatic leaves when crushed; many cultivars available including 'Album', 'Bevan's Variety' and 'Ingwersen's Variety'
US Forest Service	<i>Geum</i> Avens		2	3	D					8" to 20"	12"	Spring to Summer (Long Blooming)	Flowers of red, apricot, orange, and yellow; many are evergreen or semi-evergreen; many cultivars such as 'Mango Lassi,' 'Starker's Magnificum,' 'Borsii,' and 'Mrs. Bradshaw'
Wikipedia Commons	<i>Helianthemum mummularium</i> Sunrose			3	E* (Semi)					6" to 24"	36"	May to July	Low-growing evergreen subshrub that's great for berms, front of borders; many varieties available for flower color variation - salmon, pink, red, yellow, white, and golden color
Wikipedia Commons	<i>Helictotrichon sempervirens</i> Blue oat grass			3	E					24" to 48"	24" to 48"	Summer	Striking blue foliage; great accent alone or in clusters; thrives in full sun
Wikipedia Commons	<i>Hemerocallis</i> Daylily		2	3	D					24" to 48"	24"	Spring to Summer (Long Blooming)	New varieties are fragrant and repeat bloomers; clusters of flowers attract butterflies; many colors to choose from including pinks, reds, yellows, oranges, lavender, and white
Wikipedia Commons	<i>Hesperantha coccinea</i> Crimson flag	1	2	3	E* (Semi)					18" to 24"	18" to 24"	Spring and Late Summer (repeat bloom sequence)	Showy red or coral flowers in gladiolus-type arrangement; clump-forming habit with sword-like foliage; some cultivars are evergreen
Peggy Campbell	<i>Heuchera</i> Coral bells or alumroot		2	3	D					24" to 36"	12" to 18"	Late Spring to Early Summer	Highly variable depending on cultivar selected, foliage from chartreuse to black; flowers white to scarlet; some are more sun tolerant than others; try 'Purple Palace,' or 'Obsidian'

## GROUNDCOVERS, ORNAMENTAL GRASSES, HERBACEOUS PERENNIALS, AND FERNS (CONTINUED)













	Scientific Name Common Name	ZONE			D or E	NATIVE	EXPOSURE			MATURE SIZE		TIME OF BLOOM	PLANT CHARACTERISTICS
		1	2	3			Sun	Partial	Shade	Height	Width		
		GROUNDCOVERS, ORNAMENTAL GRASSES, HERBACEOUS PERENNIALS, AND FERNS (CONTINUED)											
Wikipedia	 <i>Hyssopus officinalis</i> 'Nana' Dwarf blue hyssop		2	3	E					18" to 24"	18" to 24"	Summer to Fall	Evergreen subshrub with pungent foliage; dark blue flower spikes; attracts butterflies and bees
Snohomish County	 <i>Iris douglasiana</i> Douglas iris	1	2		E					12" to 24"	18" to 24"	Early Spring	Purple and blue flowers, narrow foliage in clumps similar to course grass; do not use non-native and invasive yellow-flag iris
Pacific Bulb Society	 <i>Iris tenax</i> Oregon or tough-leaf iris	1	2		E					12" to 18"	12"	May to June	Attractive and showy blue flowers; do not use non-native and invasive yellow-flag iris
Peggy Campbell	 <i>Lavendula angustifolia</i> English lavender			3	E					24"	24" to 60" Spreading	June to August	Blue to purple flowers; aromatic flowers and leaves; attracts insects; great for edges; many cultivars are available
Jean-Pol Grandmont	 <i>Lavendula stoechas</i> Spanish lavender			3	E					36"	24"	May to July	Gray-green leaves; dark purple flowers with bracts above like bunny ears; highly attractive to butterflies and honey bees; many cultivars are available
Most Beautiful Flower	 <i>Liatris spicata</i> Gayfeather		2	3	D					24" to 48"	6" to 18"	Mid to Late Summer	Spiky purple-to-pink flowers; handles broad range of soils, clay to sand; nice complement to ornamental grasses, daylilies
US Forest Service	 <i>Lupinus</i> Lupine			3	D					18" to 48"	24" to 30"	Summer	Clusters of blue, purple, or reddish flowers on spikes; important for butterflies and butterfly caterpillars; many species and cultivars are available
Prairie Star Flowers	 <i>Miscanthus sinensis</i> Japanese silver grass		2	3	D					24" to 60"	48"	Summer (some persist to Winter)	Good accent plants around edges to mimic natural ponds; dwarf varieties available; try 'Morning Light', 'Little Kitten,' and 'Yaku Jima'















	Scientific Name Common Name	ZONE			D or E	NATIVE	EXPOSURE			MATURE SIZE		TIME OF BLOOM	PLANT CHARACTERISTICS	
		1	2	3			Sun	Partial	Shade	Height	Width			
GROUNDCOVERS, ORNAMENTAL GRASSES, HERBACEOUS PERENNIALS, AND FERNS (CONTINUED)														
Blue Sky Nursery	 <i>Molinia caerulea</i> 'Variegata' Moor grass (variegated)	1	2		D						12" to 18"	12" to 18"	July	<i>This cultivar has creamy yellow and white striped foliage; many others available; provides an attractive edge</i>
Wikipedia Commons	 <i>Nepeta x faassenii</i> Catmint			3	E* (Semi)						12"	18" to 24"	Late Spring to Early Summer	<i>Heart-shaped, gray-green leaves; lavender-blue flowers; attractive to cats; thrives in full sun; many cultivars with differing heights, spread, and flower color</i>
Wikipedia Commons	 <i>Nothochelone nemorosa</i> Turtlehead, woodland beard-tongue			3	D						12" to 42"	12" to 42"	Summer	<i>Long-flowering with purple-pink flowers</i>
Wikipedia Commons	 <i>Ophiopogon planiscapus</i> Black mondo grass			3	E* (Semi)						Up to 12"	Up to 12"	Late Spring to Early Summer	<i>Striking black grass-like foliage is a nice background for brightly colored flowers; spreads slowly; bell-shaped white or purple flowers; best in filtered light; try 'Nigrescens' or 'Ebony Knight'</i>
Wikipedia Commons	 <i>Panicum virgatum</i> Switch grass		2	3	D						48" to 72"	48" to 72"	Summer	<i>Clump-forming grass with showy, airy flowers; foliage ranges from bright red to bluish; great fall color and winter interest; try 'Heavy Metal,' Dallas Blues,' or 'Shenandoah'</i>
MouPNNV Flowers	 <i>Pennisetum alopecuroides</i> Fountain grass			3	D						4" to 48"	12" to 24"	Summer; Some Over Winter	<i>Several varieties in dwarf and various colors; bottle-brush-like flowers; some persist through winter; cut dried foliage in late winter/early spring; try 'Hameln' 'Little Bunny,' or 'Moudry'</i>
PNW Flowers	 <i>Penstemon cardwellii</i> Cardwell's penstemon, beard tongue			3	E* (Semi)						12" to 30"	12" to 24"	Early Summer	<i>Bright purple to blue purple flowers; found in west side forests and on rocky slopes; other natives available including other evergreens</i>
Wikipedia Commons	 <i>Perovskia atriplicifolia</i> Russian sage			3	E* (Semi)						36" to 48"	36" to 48"	Late Spring to Late Summer	<i>Semi-woody; aromatic gray-green foliage; small lavender-blue flowers; very adaptable</i>






























	Scientific Name Common Name	ZONE			D or E	NATIVE	EXPOSURE			MATURE SIZE		TIME OF BLOOM	PLANT CHARACTERISTICS
		1	2	3			Sun	Partial	Shade	Height	Width		
GROUNDCOVERS, ORNAMENTAL GRASSES, HERBACEOUS PERENNIALS, AND FERNS (CONTINUED)													
NW Plants	 <i>Polystichum munitum</i> Western sword fern		2	3	E					36" to 48"	36" to 60"		Large native fern; stately appearance; prefers some shade
Wikipedia Commons	 <i>Rubus calycinoides</i> 'Emerald Carpet' Creeping Raspberry/ Bramble			3	E					4" to 8"	36" to 60" Slowly Spreading	Spring	White flowers producing orange berries; turns raspberry red with the onset of autumn; requires more regular water to become established
Wikipedia Commons	 <i>Rudbeckia hirta</i> Black-eyed Susan			3	D					12" to 36"	12" to 36"	June to October	Orange-yellow flowers with dark brownish-black centers; attractive to bees
King County Native	 <i>Sidalcea hendersonii</i> Henderson's checker-mallow	1			D					36" to 48"	24" to 36"	Summer	Spiky pink flower clusters atop long stems are nice complement to tall bulrushes; can spread aggressively to quickly fill in Zone 1 with emergents
US Forest Service	 <i>Symphyotrichum chilense</i> Pacific aster		2		D					18" to 36"	36"	June to September	White to purple flowers; thrives in full sun
Flickr	 <i>Symphyotrichum subspicatum</i> Douglas aster	1	2	3	D					6" to 36"	36" Spreading	June to September (Late Season Bloomer)	Blue to purple flowers with yellow centers; prefers full sun, tolerates some shade; nice complement to checker-mallow and bulrushes; other species and cultivars are available
King County Native	 <i>Tellima grandiflora</i> Fringecup		2	3	D					12"	Up to 12"	March to June	Yellow-green to pink flowers; foliage persists somewhat over winter
King County Native	 <i>Tiarella trioliata</i> Foamflower		2	3	D					12"	12"	Early to Mid Summer	Can form dense colonies; showy sprays of creamy-white flowers; foliage persists somewhat over winter



	Scientific Name Common Name	ZONE			D or E	NATIVE	EXPOSURE			MATURE SIZE		TIME OF BLOOM	PLANT CHARACTERISTICS
		1	2	3			Sun	Partial	Shade	Height	Width		
GROUNDCOVERS, ORNAMENTAL GRASSES, HERBACEOUS PERENNIALS, AND FERNS (CONTINUED)													
King County Native	 <i>Tolmiea menziesii</i> Youth-on-age, piggyback plant		2		D					12" to 24"	12"	April to August	Brownish-purple flowers; makes effective groundcover in summer; foliage present in winter, when tiny leaves are seen in axils of older leaves
Washington Native Plant	 <i>Trillium ovatum</i> Western trillium	1			D					Up to 18"	12"	Early Spring	Unique, white flowers; not easily adaptable
Colleen Wilko	 <i>Vancouveria hexandra</i> Inside-out flower or duck's foot		2	3	E* (Semi)					8" to 12"	12" to 36"	Spring	Groundcover blends with other natives; unique flowers; foliage is somewhat persistent over winter




























SMALL TO MEDIUM SHRUBS





Wikipedia Commons	 <i>Arbutus unedo</i> 'Compacta' Dwarf strawberry tree			3	E					6' to 8'	5' to 6'	Fall	Adaptable; white to greenish-white flowers; striking red-orange fruit
WSU Extension	 <i>Caryopteris clandonensis</i> Blue mist			3	E* (Semi)					2' to 3'	2' to 3'	Mid Summer to Fall	Low-growing, semi-evergreen woody perennial; small lavender-blue or sapphire-blue flowers in robust clusters; some cultivars have golden yellow fall foliage; many cultivars available
The Seattle Times	 <i>Cornus sanguinea</i> 'Midwinter Fire' Bloodtwig dogwood	1	2	3	D					5' to 6'	4' to 6'	May to June	Tiny white flower clusters; bright red stems in winter; adaptable to various soil conditions
US Forest Service	 <i>Cornus sericea</i> Red-twig dogwood	1	2	3	D					7' to 9'	12' Spreading	May to June	Small white flowers in clusters; berry-like bluish-white fruits; striking red stems provide winter color; adaptable to various soil conditions

	Scientific Name Common Name	ZONE			D or E	NATIVE	EXPOSURE			MATURE SIZE		TIME OF BLOOM	PLANT CHARACTERISTICS
		1	2	3			Sun	Partial	Shade	Height	Width		
UW Botanical Garden	 <i>Cornus sericea</i> 'Flaviramea' Yellow-twig dogwood	1	2	3	D					6' to 8'	5' Spreading	May to June	Small white flowers; reddish-purple fall color; yellow stems provide color in winter; adaptable to various soil conditions
Oregon State	 <i>Cornus sericea</i> 'Kelseyi' Dwarf red-twig dogwood	1	2	3	D					1.5' to 3'	3' Spreading	May to June	Small white flowers; berry-like fruit; compact form; good groundcover; striking winter color with red stems
King County Native	 <i>Gaultheria shallon</i> Salal		2	3	E					2' to 5'	5' Spreading	March to June	White or pinkish flowers; reddish-blue to dark purple berries; spreads well in shade
OSU Extension	 <i>Hebe</i> Hebe			3	E					2' to 4'	2' to 5'	Varies; Mostly Summer	Small/compact; flowering; choose the hardiest cultivars available (USDA Zone 7 or below); many cultivars including 'Autumn Glory,' 'Buxifolia,' and 'Blue Mist'
Colleen Miko	 <i>Hydrangea quercifolia</i> Oakleaf hydrangea			3	D					3' to 8'	4' to 6'	Summer to Fall	The only drought-tolerant hydrangea; features unusual oak-like leaves and long white flower clusters; several cultivars offer dwarf to taller shrubs and single to double flowers
Wikipedia Commons	 <i>Lonicera pileata</i> Boxwood honeysuckle		2	3	E					3'	5'	April to June	Low-growing, spreading shrub with glossy evergreen leaves is great for covering berms and side slopes
Wikipedia Commons	 <i>Mahonia aquifolium</i> Tall Oregon grape		2	3	E					6' to 10'	5'	March to April	Glossy leaves; yellow flowers; attracts hummingbirds; blue-black berries
WSU PNW Plants	 <i>Mahonia aquifolium</i> 'Compacta' Compact or dwarf tall Oregon grape		2	3	E					2' to 3'	3' to 4'	April to June	Dwarf form of sun-loving native Oregon grape has same flowers; stays compact

SMALL TO MEDIUM SHRUBS (CONTINUED)



	Scientific Name Common Name	ZONE			D or E	NATIVE	EXPOSURE			MATURE SIZE		TIME OF BLOOM	PLANT CHARACTERISTICS
		1	2	3			Sun	Partial	Shade	Height	Width		
SMALL TO MEDIUM SHRUBS (CONTINUED)													
King County Native	 <b><i>Mahonia nervosa</i></b> Low Oregon grape		2	3	E					2' to 3'	2' to 3'	April to June	Glossy leaves; yellow flowers; attracts hummingbirds; blue berries
Wikipedia Commons	 <b><i>Mahonia repens</i></b> Creeping mahonia		2	3	E					3'	3' Spreading	April to June	This creeping Oregon grape from eastern Washington performs best in part day sun/shade; tidy, compact form
Snohomish County	 <b><i>Myrica gale</i></b> Sweet gale	1	2	3	D					4' to 8'	4' to 6'	May to June	Similar to Pacific Wax Myrtle, but deciduous and smaller; may need more water to get established
Peggy Campbell	 <b><i>Philadelphus lewisii</i></b> Mock-orange		2	3	D					5' to 10'	5' to 10'	June to July	Fragrant white flowers; makes thickets
OSU Extension	 <b><i>Physocarpus opulifolius</i></b> Common ninebark		2	3	D					4' to 10'	3' to 8'	May to July	Cultivars offer differing heights, leaf color, and fall color; all offer peeling bark and white flowers; see "Large Shrubs & Trees" list for native Pacific ninebark; try 'Diablo,' or 'Center Glow'
Wikipedia Commons	 <b><i>Pinus mugo mugo</i></b> Dwarf mugho pine			3	E					1' to 4'	3' to 5'	May to June	Low-growing evergreen is great for berms and anchoring corners; several cultivars available; some stay very low, others grow taller
King County Native	 <b><i>Ribes bracteosum</i></b> Stink currant	1			D					5' to 7'	5' to 7'	April to May	Big palmate leaves have pungent but pleasant aroma. long clusters of white flowers followed by blue fruits that attract native birds. May require loamier soils
Washington Native Plant	 <b><i>Ribes sanguineum</i></b> Red-flowering currant		2	3	D					6' to 12'	4' to 10'	March to May	Large clusters of rosy-red flowers attract hummingbirds and other pollinators; dark blue to black berries; vase-shaped form; thornless




	Scientific Name Common Name	ZONE			D or E	NATIVE	EXPOSURE			MATURE SIZE		TIME OF BLOOM	PLANT CHARACTERISTICS
		1	2	3			Sun	Partial	Shade	Height	Width		
Wikipedia Commons	 <b><i>Rubus parviflorus</i></b> Thimbleberry		2	3	D					4' to 8'	8'	April to June	Native, thornless raspberry shrub features large, fuzzy palmate leaves, giant white flowers, and red fruits; spreads by rhizome, sometimes aggressively
King County Native	 <b><i>Rubus spectabilis</i></b> Salmonberry	1	2	3	D					5' to 10'	10' Spreading	February to April	Magenta flowers; yellow-orange fruits are early nectar source for hummingbirds; spreads aggressively and makes thickets; good soil binder
WSU PNW Plants	 <b><i>Salix purpurea</i> 'Nana'</b> Dwarf arctic willow	1			D					5' to 8'	5' to 8'	April to May	Finely textured blue-gray foliage; small white flowers; purple stems adds winter interest; fast growing; note that despite the name "dwarf," this shrub will become large
Dancing Oaks	 <b><i>Sambucus nigra</i> 'Black Lace'</b> Black Lace Elderberry	1	2	3	D					6' to 8'	6' to 8'		A dramatic accent plant with rosy flowers contrasting with blackish, deeply dissected foliage; blackish-red berries attract wildlife; prune if necessary after blooming
King County Native	 <b><i>Spiraea densiflora</i></b> Subalpine spirea	1	2	3	D					3' to 4'	2' to 4'	May to June	Showy pink flower clusters on orangish twigs make this a nice compact shrub for Zone 1
King County Native	 <b><i>Spiraea douglassii</i></b> Douglas spirea	1	2		D					4' to 7'	6' to 10' Spreading	June to August	Spikes of rosy-pink flower clusters; great for butterflies; can self-seed readily and may spread and crowd out other plants in consistently wet soils
Wikipedia Commons	 <b><i>Spiraea thunbergii</i> and <i>Spiraea japonica</i></b> Thunberg spirea and Japanese spirea		2	3	D					1.5' to 5'	1.5' to 5'	April to July	Cultivars with different height, flower color, and foliage; some have golden or orange new growth; try 'Ogon,' 'Magic Carpet,' 'Dakota Charm,' 'Little Princess,' and 'Neon Flash'
King County Native	 <b><i>Symphoricarpos albus</i></b> Snowberry		2	3	D					2' to 6'	6' Spreading	April to June	White berries from summer to winter; clusters of pink flowers are great for pollinators; great combined with red-twig dogwood and Oregon grape; spreads and forms thickets

SMALL TO MEDIUM SHRUBS (CONTINUED)



	Scientific Name Common Name	ZONE			D or E	NATIVE	EXPOSURE			MATURE SIZE		TIME OF BLOOM	PLANT CHARACTERISTICS
		1	2	3			Sun	Partial	Shade	Height	Width		
SMALL TO MEDIUM SHRUBS (CONTINUED)													
Wikipedia Commons	 <i>Symphoricarpos x doorenbosii</i> 'Magic Berry' Coralberry		2	3	D					4' to 6'	4' to 6'	April to June	Magenta berries cover this upright coralberry and add winter interest
Missouri Botanical Garden	 <i>Symphoricarpos x chenaulti</i> 'Hancock' Hancock coralberry		2	3	D					2'	6' to 10'	May to June	Bright magenta berries persist through the winter on this shrub that protects berms from erosion
Tall Trees Group	 <i>Taxodium distichum</i> 'Peve Minaret' Dwarf bald cypress	1	2	3	E					5'	3' to 4'		Dwarf variety with compact spire form; see other cultivars such as 'Cascade Falls' (weeping to 20'), 'Shawnee Brave' (narrow pyramid to 20'); may still require occasional summer irrigation
PNW Plants	 <i>Thuja plicata</i> 'Whipcord' Dwarf western red cedar		2	3	E					5'	4'		Dwarf variety of western red cedar; unusual threadlike cascading bright green branches; turns bronze in winter; other smaller cultivars such as 'Collyer's Gold' available
King County Native	 <i>Vaccinium ovatum</i> Evergreen huckleberry			3	E					4' to 10'	6'	March to June	For partly or very shady spots, this native evergreen provides flowers, beautiful foliage and wildlife habitat
Wikipedia Commons	 <i>Viburnum opulus</i> 'Nanum' Dwarf Cranberry Bush		2	3	D					2' to 3'	3' Spreading	Late Spring	White flowers; dense mounding habit; compact; tri-lobed leaves; deer resistant; handsome filler plant; readily re-seeds requiring extra maintenance to control; many other shrubs available































## LARGE SHRUBS AND TREES

Wikipedia Commons	 <i>Acer buergerianum</i> Trident maple			3	D					20' to 25'	20' to 25'	Early Spring	Red, orange, or yellow fall color; attractive flaking bark on older trees
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	Scientific Name Common Name	ZONE			D or E	NATIVE	EXPOSURE			MATURE SIZE		TIME OF BLOOM	PLANT CHARACTERISTICS
		1	2	3			Sun	Partial	Shade	Height	Width		
King County Native	 <b><i>Acer circinatum</i></b> Vine maple		2	3	D				15' to 20'	15' to 20'	Early Spring	Small, multi-stemmed tree, brilliant red-orange fall color; excellent soil binder	
WSU PNW Flowers	 <b><i>Acer palmatum</i></b> 'Sango Kaku' Coral bark Japanese maple			3	D				20' to 25'	18' to 20'		Coral-red bark; attractive form in garden	
King County Native	 <b><i>Amelanchier alnifolia</i></b> Western serviceberry		2	3	D				8' to 20'	5' to 10'	April to May	Large white flower clusters; purple to blue-black berries; attracts native birds	
Wikipedia Commons	 <b><i>Betula albosinensis</i></b> 'Septentrionalis' Chinese red birch			3	D				40' to 60'	10'		Tall slender tree; peeling copper-orange bark is an attractive accent	
Wikipedia Commons	 <b><i>Betula jacquemontii</i></b> Himalayan or jacquemontii birch			3	D				35' to 40'	18' to 20'	April	Showy white bark	
WSU PNW Plants	 <b><i>Betula nigra</i></b> River birch			3	D				50' to 70'	30'	April to May	Tall narrow form; best suited to larger rain gardens; peeling bark	
Wikipedia Commons	 <b><i>Betula papyrifera</i></b> Paper birch			3	D				50' to 90'	25' to 45'		Best suited to large rain gardens; creamy white peeling bark	
Wikipedia Commons	 <b><i>Cornus mas</i></b> Cornelian cherry			3	D				20'	20'	March to April	Adaptable; yellow flowers; red fruit	

LARGE SHRUBS AND TREES (CONTINUED)



	Scientific Name Common Name	ZONE			D or E	NATIVE	EXPOSURE			MATURE SIZE		TIME OF BLOOM	PLANT CHARACTERISTICS
		1	2	3			Sun	Partial	Shade	Height	Width		
King County Native	 <i>Corylus cornuta</i> Beaked hazelnut		2	3	D					10' to 20'	8' to 15'	March to May	Beautiful native for larger spaces; will attract wildlife; can be pruned into tree-like form or left to its natural vase-like shape; dangling male catkins add winter interest
Wikipedia Commons	 <i>Crataegus x lavellei</i> Lavalle hawthorn			3	D					15' to 30'	15' to 30'	May to June	Small white flowers; small orange-red fruits
King County Native	 <i>Frangula purshiana</i> Cascara		2	3	D					15' to 30'	5' to 10'	April to May	Narrow form fits in smaller spaces; purple to blue-black berries; glossy foliage turns orange to yellow in fall
King County Native	 <i>Holodiscus discolor</i> Oceanspray			3	D					8' to 15'	6' to 15'	June to July	Creamy-white flower clusters persist as brown seeds over winter; great for native butterflies and birds; good soil binder
Peggy Campbell	 <i>Lonicera involucrata</i> Black twinberry	1	2	3	D					6' to 9'	8' to 10'	Summer/June	Yellow flowers with bright red bracts; shiny black berries; attractive to hummingbirds; need space to look their best; pruning may be necessary to keep looking tidy
Wikipedia Commons	 <i>Magnolia virginiana</i> 'Moonglow' Sweet bay or swamp magnolia		1		E* (Semi)					35' to 40'	15' to 18'	Late Spring to Early Summer	Best for large rain gardens creamy, white flowers; needs acidic soils; this cultivar is hardier, more upright; may require some summer irrigation after established
King County Native	 <i>Malus fusca</i> Pacific crabapple	1	2	3	D					10' - 30'	10' - 30'	April to May	Best suited to large rain gardens; white to pink apple blossoms in small clusters; clusters of yellowish-red fruits; nice fall color; attractive to wildlife
Great Plant Picks	 <i>Malus transitoria</i> 'Schmidtcutleaf' Golden Raindrops™ Cutleaf crabapple			3	D					20'	15'	Spring	Upright growing, vase shaped; small star-shaped flowers from pink buds; profuse blooms; also explore other disease resistant non-native species

## LARGE SHRUBS AND TREES (CONTINUED)

	Scientific Name Common Name	ZONE			D or E	NATIVE	EXPOSURE			MATURE SIZE		TIME OF BLOOM	PLANT CHARACTERISTICS
		1	2	3			Sun	Partial	Shade	Height	Width		
Peggy Campbell	 <b><i>Myrica californica</i></b> Pacific wax myrtle	1	2	3	E					8' to 18'	10' to 20'	May to June	<i>For large areas or where pruning will be regular; provides good wildlife habitat</i>
UW - Burke Museum	 <b><i>Oemleria cerasiformis</i></b> Indian plum; osoberry		2	3	D					5' to 16'	5' to 12' Spreading	February to April	<i>One of the first natives to bloom in early spring; peach-like berries in spring, then plum-like berries in summer; spreads via underground stems</i>
Scott Arboretum	 <b><i>Parrotia persica</i></b> 'Vanessa' Persian ironwood			3	D					30'	15'	Late Winter to Early Spring	<i>Multi-stemmed, colorful tree particularly in fall; this cultivar is dense and narrowly upright; tiny flowers with red stamens</i>
Washington Native Plant	 <b><i>Physocarpus capitatus</i></b> Pacific ninebark	1	2	3	D					8' to 13'	6' to 15'	May to June	<i>Best in part shade; beautiful, peeling multi-colored bark; white flowers; see also P. opulifolius and cultivars in the "small to medium" shrub list</i>
Washington Native Plant	 <b><i>Sambucus caerulea</i></b> Blue elderberry		2	3	D					10' to 20'	8' to 12'	May to June	<i>A large, fast-growing shrub with edible blue fruits that appear in mid-summer following the large clusters of creamy-white flowers</i>
Missouri Botanical Garden	 <b><i>Xanthocyparis nootkatensis</i></b> ( <i>Chamaecyparis nootkatensis</i> ) 'Pendula' Weeping Alaska yellow cedar			3	E					Up to 30'	12'		<i>Smaller weeping form; slender and pyramidal</i>

LARGE SHRUBS AND TREES (CONTINUED)



# Other Resources and Websites

## WESTERN WASHINGTON RESOURCES

- Washington State University Extension Rain Gardens Website: <http://raingarden.wsu.edu/>
- 12,000 Rain Gardens in Puget Sound Campaign: <http://www.12000raingardens.org/index.phtml>

### *Others in Alphabetical Order by Topic or Source:*

- Building Healthy Soil and Erosion Control, Washington Organic Recycling Council: <http://www.buildingsoil.org>
- Compost Sources for Protecting Water Resources, Washington Organic Recycling Council: <http://www.soilsforsalmon.org>
- Conservation Districts Contact Information: <http://www.scc.wa.gov/contacts/conservation-districts/>
- Great Plant Picks—Unbeatable Plants for Your Maritime Northwest Garden: <http://www.greatplantpicks.org/>
- Native Plant Salvage Project Websites: <http://county.wsu.edu/thurston/nrs/nativeplants/Pages/default.aspx> and <http://www.nativeplantsalvage.org/>
- Natural Yard Care (King County): <http://your.kingcounty.gov/solidwaste/naturalyardcare/>
- Natural Yard Care Information and Information on Organic Materials Management (Washington State Department of Ecology): <http://www.ecy.wa.gov/programs/swfa/organics/soil.html>
- Noxious Weed Control: <http://www.kingcounty.gov/weeds>
- Master Gardeners, Washington State University Extension: <http://mastergardener.wsu.edu/>
- Pierce County Rain Gardens Webpage: <http://www.co.pierce.wa.us/index.aspx?NID=2812>
- Puget Sound Partnership Website/Low Impact Development in Puget Sound: <http://www.psp.wa.gov/> and <http://www.pierce.wsu.edu>
- Rain Gardens—Local Agency Websites:
  - City of Olympia Rain Gardens Webpage: <http://olympiawa.gov/city-utilities/storm-and-surface-water/rain-gardens>
  - City of Tacoma Rain Gardens Webpage: <http://www.cityoftacoma.org/cms/One.aspx?portalId=169&pageId=7123>
  - Kitsap County Rain Gardens Webpage: [http://www.kitsapgov.com/sswm/rain\\_gardens.htm](http://www.kitsapgov.com/sswm/rain_gardens.htm)
- Rain Garden Network: <http://www.raingardennetwork.com/>
- Rain Gardens as Low Impact Development: [http://www.lowimpactdevelopment.org/raingarden\\_design/whatisaraingarden.htm](http://www.lowimpactdevelopment.org/raingarden_design/whatisaraingarden.htm)
- Seattle Public Utilities RainWise Program and Build a Rain Garden brochure: <http://www.seattle.gov/util/MyServices/DrainageSewer/Projects/GreenStormwaterInfrastructure/ResidentialRainWise/index.htm> and [http://www.seattle.gov/util/groups/public/@spu/@usm/documents/webcontent/spu01\\_006287.pdf](http://www.seattle.gov/util/groups/public/@spu/@usm/documents/webcontent/spu01_006287.pdf)
- Stewardship Partners (Rain Gardens Information): <http://www.stewardshippartners.org/programs/rain-gardens/>

- Washington Native Plant Society Website: <http://www.wnps.org/>
- Washington State Department of Ecology Stormwater Homepage: <http://www.ecy.wa.gov/programs/wq/stormwater/>

### OTHER RAIN GARDEN HANDBOOKS, MANUALS, BOOKS, AND REFERENCES

- *A Rain Garden Manual for South Carolina*. Giacalone, Katie 2008. Carolina CLEAR, Clemson University Public Service. <http://www.clemson.edu/public/carolinaclear/>
- *Build Your Own Rain Garden*. Student BaySavers Projects. Chesapeake Bay Foundation. [http://www.lowimpactdevelopment.org/raingarden\\_design/downloads/BaysaversRainGardenGuide.pdf](http://www.lowimpactdevelopment.org/raingarden_design/downloads/BaysaversRainGardenGuide.pdf)
- *Creating Rain Gardens: Capturing the Rain for Your Own Water-Efficient Garden*. Woelfle-Erskine, Cleo and Uncapher, Apryl. 2012. Timber Press
- Portland METRO Rain Gardens Website: <http://www.oregonmetro.gov/index.cfm/go/by.web/id=25102>
- *Rain Garden Design and Construction, A Northern Virginia Homeowner's Guide*. Fairfax County and Northern Virginia Soil and Water Conservation District. 2009. <http://www.fairfaxcounty.gov/nvswcd/raingardenbk.pdf>
- *Rain Gardens: Managing Water Sustainably in the Garden and Designed Landscape*. Dunnett, Nigel, and Andy Clayden. 2007. Timber Press.
- *Rain Gardens for Nashville, A Resource Guide for Planning, Designing, and Maintaining a Beautiful Rain Garden*. Metro Water Services Stormwater NPDES Department. Ashworth Environmental Design, LLC. <http://www.raingardensfornashville.com/>
- *Rain Gardens: A How-to Manual for Homeowners*. UWEX Publication GWQ037 1-06-5M-100-S. University of Wisconsin Extension. Bannerman, Roger, and Ellen Considine. 2003. <http://learningstore.uwex.edu/assets/pdfs/GWQ037.pdf>
- *The Oregon Rain Garden Guide, A Step-by-Step Guide to Landscaping for Clean Water and Healthy Streams*. Emanuel, Robert and Godwin, Derek. 2010. Oregon Sea Grant Extension, Oregon State University. <http://seagrant.oregonstate.edu/sgpubs/onlinepubs/h10001.pdf>
- *The Vermont Rain Garden Manual: Gardening to Absorb the Storm*. Andreoletti, Jessica. 2008. Winooski Natural Resources Conservation District. <http://www.uvm.edu:8889/~seagrant/communications/assets/VtRainGardenManual.pdf>
- University of Connecticut NEMO Rain Garden App: <http://nemo.uconn.edu/>
- West Michigan Environmental Action Council Rain Gardens Website: <https://www.raingardens.org/>

*Note: All websites and webpages were checked on June 30, 2013 for viability.*



# Introduction to Washington State Department of Ecology's Requirements for Rain Gardens in Western Washington

This appendix is divided into three sections:

- **Background** - An overview of the Washington State Department of Ecology's requirements including implementation timelines
- **Six Important Questions about Rain Gardens and the 2012 Stormwater Management Manual for Western Washington (SWMMWW) Minimum Requirements** - How rain gardens may be used to meet Ecology's stormwater requirements
- **References** – A table of references and links to further resources.

*Please note that local jurisdictions may have requirements that vary from Ecology's stormwater requirements. You should talk with your municipal building permits or development services department about your project to find out the exact requirements that apply to your project.*

## Background

The federal Clean Water Act requires cities and counties meeting certain population levels to have a National Pollutant Discharge Elimination System (NPDES) permit for stormwater management. In Washington State, the Washington State Department of Ecology (Ecology) has been delegated the authority to administer the NPDES permits. State law (RCW 90.48.030 and RCW 90.48.162) also authorizes Ecology to control impacts of stormwater discharges to all waters of Washington State, including groundwater, through permits.

Requirements within the permits vary substantially between Western Washington and Eastern Washington. This appendix only discusses requirements associated with Western Washington.

Ecology has issued two Municipal Stormwater General Permits to cities and counties within Western Washington based on population. The Phase I Municipal Stormwater permit covers the Cities of Seattle and Tacoma, and Snohomish, Pierce, King and Clark Counties. The Phase II Western Washington Municipal Stormwater permit covers approximately 82 cities and 5 counties in Western Washington. To see if your city or county is covered under a Municipal Stormwater Permit visit <http://www.ecy.wa.gov/programs/wq/stormwater/municipal/MuniStrmWtrPermList.html>.

### **HOW DO THE MUNICIPAL STORMWATER PERMITS RELATE TO THE STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON (SWMMWW)?**

Within the municipal stormwater permits, there are certain requirements associated with controlling stormwater runoff from new development, redevelopment, and construction sites. As part of these requirements, cities and counties are required by their permit to adopt Minimum Requirements that are the same as, or equivalent to, the minimum requirements within the Stormwater Management Manual for Western Washington (SWMMWW).

*Local jurisdictions may also choose to have more stringent requirements. You should talk with your municipal building permits or development services department about your project to find out the exact requirements that apply to your project.*

The SWMMWW can be downloaded here: <http://www.ecy.wa.gov/programs/wq/stormwater/manual.html>

## WHEN ARE THE REQUIREMENTS OF THE SWMMWW (OR MUNICIPAL EQUIVALENT) TO BE IMPLEMENTED?

In 2012, Ecology reissued the SWMMWW. Western Washington municipalities have different deadlines for adopting the 2012 SWMMWW or equivalent:

- June 30, 2015 for Phase I cities and counties
- December 31, 2016 or by their Growth Management Act Comprehensive Plan timeline, whichever is later for Phase II cities and counties

Cities and Counties may choose to adopt earlier, with a few already adopting the SWMMWW prior to the publication of the Rain Garden Handbook.

This appendix focuses on the Washington State Department of Ecology's SWMMWW only. Local Jurisdictions may prepare their own guidance. Check with your local city or County to ensure that you are using the proper guidance.

## Six Important Questions about Rain Gardens and the 2012 SWMMWW Minimum Requirements

These questions provide an introductory guide of where to look for more details.

### 1. WHAT ARE THE MINIMUM REQUIREMENTS IN THE 2012 SWMMWW?

Within the 2012 SWMMWW there are nine minimum requirements:

- |  |                              |
|--|------------------------------|
| 1. Preparation of Stormwater Site Plan                   | 6. Runoff Treatment          |
| 2. Construction Stormwater Pollution Prevention (SWPPP)  | 7. Flow Control              |
| 3. Source Control of Pollution                           | 8. Wetlands Protection       |
| 4. Preservation of Natural Drainage Systems and Outfalls | 9. Operation and Maintenance |
| 5. On-site Stormwater Management                         |                              |

Rain Gardens can be used to help satisfy Minimum Requirement #5 when only Minimum Requirements #1 through #5 apply.



**2012 SWMMWW Reference:**

- Volume I, Chapter 2 – Minimum Requirements for New and Redevelopment, pages 2-1 to 2-2

**2. WHEN DO MINIMUM REQUIREMENTS #1 THROUGH #5 APPLY?**

Projects are evaluated based on project type, size, and other thresholds to determine which Minimum Requirements apply to the project. If your project is:

- Creating or replacing between 2,000 and 5,000 square feet of hard surfaces (such as building an addition, adding a new driveway)
- OR disturbing between 7,000 square feet and 33,000 square feet ( $\frac{3}{4}$  acre)

Then most likely, Minimum Requirements #1 through #5 will apply to your project. Rain Gardens are not appropriate for larger projects that are required to meet all Minimum Requirements #1 through #9.

**Examples of projects where Minimum Requirements #1 through #5 apply:**

Hard surfaces that trigger Minimum Requirements #1 through #5 include any impervious surface, permeable pavement or vegetated roofs. Disturbed areas include when your project converts vegetation to lawn. Examples of projects that would trigger Minimum Requirements #1 through #5 include:

- A new 2,000 square foot roof.
- A 1,000 square foot asphalt driveway that is replaced (not just overlaid or resealed). This example assumes that existing asphalt is removed to the underlying gravel and 1,000 square feet of asphalt is added to widen the driveway and increase parking.
- A new 2,000 square foot gravel driveway.
- 7,000 square feet lot is cleared and replaced with a 1,000 square foot building, 500 square feet of asphalt and 5,500 square feet of lawn.

**2012 SWMMWW References:**

- Volume I, Chapter 2, Section 2.4—Applicability of the Minimum Requirements, pages 2-9 to 2-15
- Volume I, Chapter 2, Section 2.5—Minimum Requirements, Minimum Requirements #1 through #5, pages 2-16 to 2-32

**3. HOW DO RAIN GARDENS FIT INTO MINIMUM REQUIREMENT #5?**

In the 2012 SWMMWW, rain gardens are considered as an On-site Stormwater Management Best Management Practice (BMP). On-site Stormwater Management BMPs are a synonym for Low Impact Development (LID) BMPs. It is important to note that rain gardens are not considered as a “Stormwater Treatment and Flow Control BMP/Facility” (used to satisfy Minimum Requirements #6 and #7).

Minimum Requirement #5: On-site Stormwater Management, requires the use of On-site Stormwater Management Best Management Practices (BMPs) to infiltrate, disperse, and retain stormwater runoff on-site to the extent feasible without causing flooding or erosion impacts. This requirement

may be met either by using a prescribed list approach, or by meeting the LID Performance Standard. Both of these approaches are explained in detail in 2012 SWMMWW Volume I, Chapter 2, Section 2.5.5 – Minimum Requirement #5: On-site Stormwater Management, pages 2-28 to 2-32.

Rain Gardens are part of List #1, the prescribed list of BMPs in the SWMMWW, which can be used to meet Minimum Requirement #5. Rain Gardens are in the second option on List #1 to address runoff from Roofs and Other Hard Surfaces. If Full Dispersion (BMP T5.30) or Downspout Full Infiltration (BMP T5.10A) options are feasible, then those BMPs must be used instead of rain gardens.

**2012 SWMMWW Reference:**

- Volume I, Section 2.5.5 Minimum Requirement #5: On-Site Stormwater Management, pages 2-28 to 2-32.

**4. ARE THERE LOCATIONS WHERE A RAIN GARDEN IS “INFEASIBLE” FOR MINIMUM REQUIREMENT #5?**

Ecology has a list of criteria for when a rain garden does not need to be considered to meet Minimum Requirement #5. These are called “infeasibility criteria”. These “infeasibility criteria” are separate from the “Where to Locate a Rain Garden” and “Where Not to Locate a Rain Garden” guidance discussed in the PLAN section of the Rain Garden Handbook. The infeasibility criteria for Rain Gardens used to meet Minimum Requirement #5 are the same as the infeasibility criteria for Bioretention. If the Rain Garden is deemed infeasible according to this criteria, then the project does not need to use a Rain Garden and can use the next BMP on List #1.

**2012 SWMMWW Reference:**

- Volume V, Section 7.4 BMPs for Infiltration and Bioretention Treatment, BMP T7.30: Bioretention Cells, Swales and Planter Boxes,
  - Infeasibility Criteria, pages 7-7 to 7-9
  - Other Site Suitability Factors, pages 7-9 to 7-10

**5. WHAT TYPES OF SITE ANALYSES ARE REQUIRED FOR RAIN GARDENS USED TO HELP MEET MINIMUM REQUIREMENT #5?**

Rain Gardens used to meet Minimum Requirement #5 must meet Site Procedures and Design Guidance that are more extensive than those described in this Rain Garden Handbook. The 2012 SWMMWW outlines Ecology’s recommended testing criteria, but your City or County may have more specific requirements and other testing procedures.

**2012 SWMMWW References:**

- Volume I, Chapter 3.1 Stormwater Site Plans: Step-By-Step, pages 3-1 to 3-16.
- Volume III, Section 3.4 Stormwater-related Site Procedures and Design Guidance for Bioretention and Permeable Pavement, pages 3-103 to 3-106.
- Volume III, Section 3.3.6 Saturated Hydraulic Conductivity – Guidelines and Criteria, pages 3-75 to 3-81 (Note: The text concerning correction factors does not apply to rain garden designs.)



## 6. HOW IS A RAIN GARDEN SIZED TO MEET MINIMUM REQUIREMENT #5?

Rain Gardens must have a minimum horizontal projected surface area below the overflow (Top Surface of Ponding, shown on page 24 of this Handbook) which is at least 5 percent of the area draining to it. The designer may choose a larger size, but Rain Garden performance does not need to be predicted with computer models to meet Minimum Requirement #5.

### ***2012 SWMMWW Reference:***

- Volume V, Section 5.3 Best Management Practices for On-Site Stormwater Management, BMP T5.14A: Rain Gardens, pages 5-11 through 5-12.

# References

**TABLE 1: REFERENCES TO THE 2012 SWMMWW THAT RELATE TO RAIN GARDENS**

QUESTION	2012 SWMMWW REFERENCE
<b>1. What are the Minimum Requirements in the SWMMWW?</b>	Volume I, Chapter 2 – Minimum Requirements for New and Redevelopment , pages 2-1 to 2-2
<b>2. When do Minimum Requirements #1 through #5 Apply?</b>	Volume I, Chapter 2, Section 2.4—Applicability of the Minimum Requirements, pages 2-9 to 2-15
	Volume I, Chapter 2, Section 2.5—Minimum Requirements, Minimum Requirements #1 through #5 pages 2-16 to 2-32
<b>3. How do Rain Gardens fit into Minimum Requirement #5?</b>	Volume I, Section 2.5.5 Minimum Requirement #5: On-Site Stormwater Management, pages 2-28 to 2-32.
<b>4. Are there locations where a Rain Garden is “infeasible” for Minimum Requirement #5?</b>	Volume V, Section 7.4 BMPs for Infiltration and Bioretention Treatment, BMP T7.30: Bioretention Cells, Swales and Planter Boxes <ul style="list-style-type: none"> <li>• Infeasibility Criteria, pages 7-7 to 7-9</li> <li>• Other Site Suitability Factors, pages 7-9 to 7-10</li> </ul>
<b>5. What types of site analyses are required for Rain Gardens used to help meet Minimum Requirement #5?</b>	Volume I, Chapter 3.1 Stormwater Site Plans: Step-By-Step, pages 3-1 to 3-16
	Volume III, Section 3.4 Stormwater-related Site Procedures and Design Guidance for Bioretention and Permeable Pavement, pages 3-103 to 3-106.
	Volume III, Section 3.3.6 Saturated Hydraulic Conductivity – Guidelines and Criteria, pages 3-75 to 3-83.
<b>6. How is a Rain Garden sized to meet Minimum Requirement #5?</b>	Volume V, Section 5.3 Best Management Practices for On-Site Stormwater Management, BMP T5.14A: Rain Gardens, pages 5-11 to 5-12.

## LINKS TO RESOURCES

To Download the 2012 SWMMWW visit: <http://www.ecy.wa.gov/programs/wq/stormwater/manual.html>

For more information on the Municipal Stormwater Permits visit: <http://www.ecy.wa.gov/programs/wq/stormwater/municipal/index.html>

To see if your city or county is covered under a Municipal Stormwater Permit visit: <http://www.ecy.wa.gov/programs/wq/stormwater/municipal/MuniStrmWtrPermList.html>

The Municipal Stormwater Permits contain specific requirements for cities and counties to inspect rain gardens. Recent Guidance was provided in the Western Washington Low Impact Development (LID) Operation and Maintenance (O&M) Document. To download this document visit: <http://www.ecy.wa.gov/programs/wq/stormwater/municipal/LID/TRAINING/LIDO&MGuidanceDocument.pdf>





