Stormwater Management Alternatives for Single Family Residences

There are three stormwater management alternatives for single family residences that may be used in Lincoln City when it is not feasible for the applicant to route and connect their downspouts and footing drains to an existing City stormwater system or to an existing ditch or natural drainage way. First, it must be determined by the City of Lincoln City Public Works Department (LC PWD) that it is not feasible for the applicant to extend any nearby existing City stormwater system so that the applicant may route and connect their downspouts and footing drains to the extended system. The following Single Family Residential Stormwater Management Decision Tree **(Figure 1)** shall be used to determine the appropriate stormwater management alternative for single family residential development:

If it is determined by LC PWD that it is not feasible for the applicant to extend and/or connect to an existing City stormwater system or to an existing ditch or natural drainage way, then the applicant follow the steps in the Single Family Residential Stormwater Management Decision Tree to determine the appropriate stormwater management alternative. The three alternatives are listed as follows:

1. Drywell
2. Rain Garden
3. Erosion Preventative Landscaping and Infiltration Trench

In order to function properly these facilities must be matched with the characteristics of the site. The following fact sheets present applicability considerations, site constraints, and design guidance for the three alternatives.

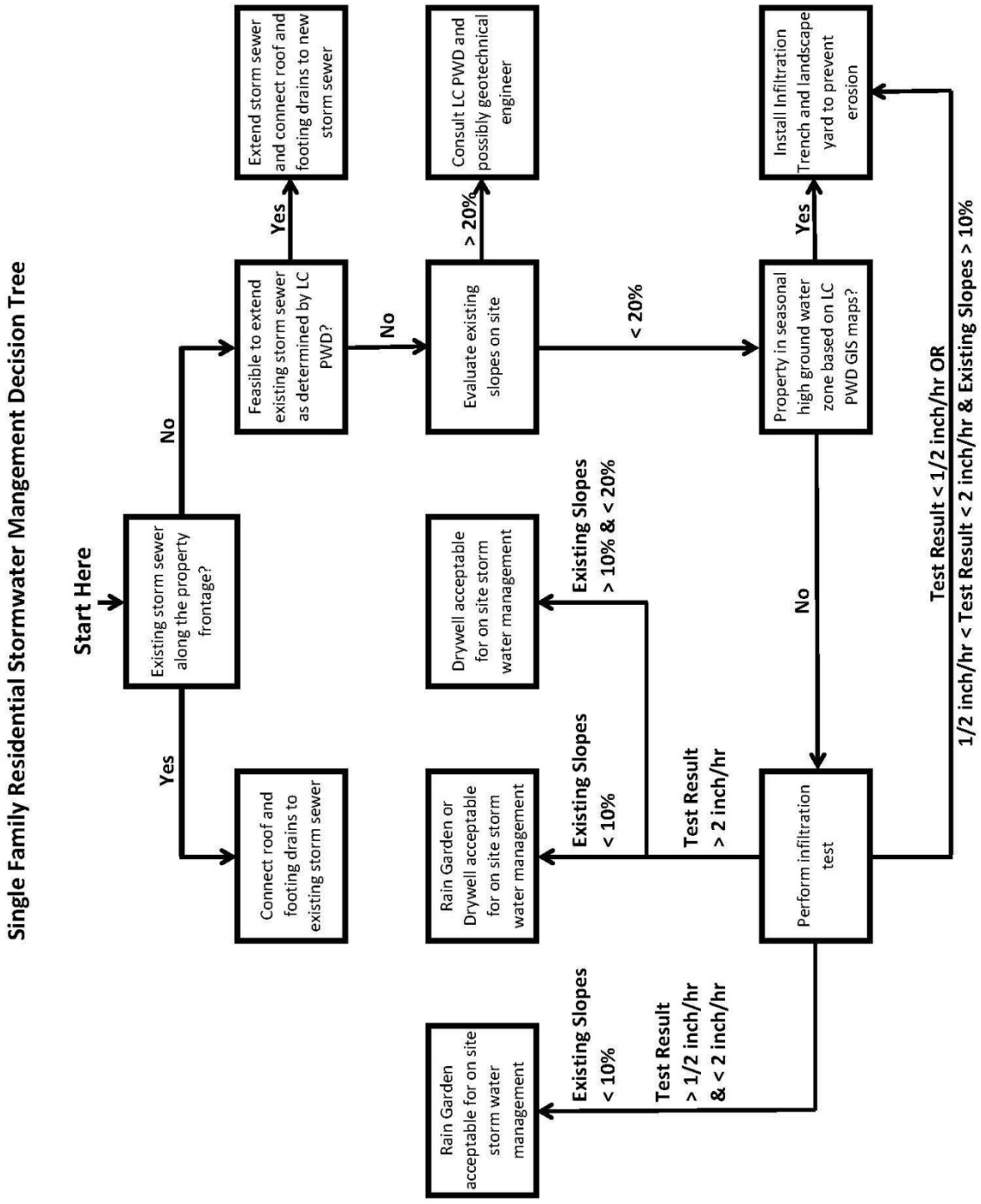


Figure 1: Single Family Residential Stormwater Management Decision Tree

Drywells

Drywells are designed to collect stormwater runoff and infiltrate it into the ground. They are typically constructed of perforated concrete or PVC pipe that is buried in the ground and surrounded with drain rock. Stormwater from downspouts and footing drains is directed to the drywell through an inlet pipe that empties into the drywell.

Drywell Safety and Siting Requirements:

- Site soils must be adequately permeable to infiltrate runoff to groundwater. A minimum infiltration rate of 2 inches per hour is required at the facility base. Refer to the Infiltration Testing section of this document for information on how to test the infiltration rate of your soil.
- Property must be located outside of the Seasonal High Ground Water Zone as determined by LC PWD GIS maps.
- Installation of drywells in fill material is not permitted.
- Drywells are not allowed in the public right-of-way.
- Drywells must be at least 100 feet from the top of any slope 20 percent or greater, unless a geotechnical report is submitted that verifies that a drywell placed within 100 feet from the top of the slope will not compromise the stability of the slope.
- Drywells must be at least 5 feet from property lines and 10 feet from building foundations, the top of the drywell shall be located downgradient from the foundations and at a lower elevation than local basements.
- Drywells must be at least 500 feet from any drinking water wells, and should be downgradient from septic drain fields.
- Drywells may not be constructed beneath an impervious surface, or a pervious surface subject to vehicle traffic.
- Pits for drywells must be at least 4 feet in diameter and 5 feet deep. Drywells must be surrounded by 12 inches of gravel drain rock extending out from the outside of the drywell. The drain rock shall be washed ¾ - 2½-inch round or crushed rock, and shall be separated from native soil and overlying backfill using filter fabric. Minimum diameter of the central, perforated drywell pipe is 24 inches.
- Refer to the Typical Drywell Detail attached hereto as Appendix A for design guidance. Location and dimensions of drywell must be submitted on the required Site Plan and approved by LC PWD prior to final acceptance.

Drywell Maintenance:

To ensure that drywells continue to function properly it is necessary to perform routine maintenance on them. Maintenance should include periodic removal of excessive debris and upkeep of the inlet and outlet pipes. Drywells that become clogged with debris will not function properly and must be refurbished or replaced.

Rain Gardens

Design guidance adapted from the Oregon Rain Garden Guide.

Rain gardens are shallow, landscaped depressions used to collect and infiltrate stormwater runoff. **Figure 2**, below, depicts a cross section of a typical rain garden:

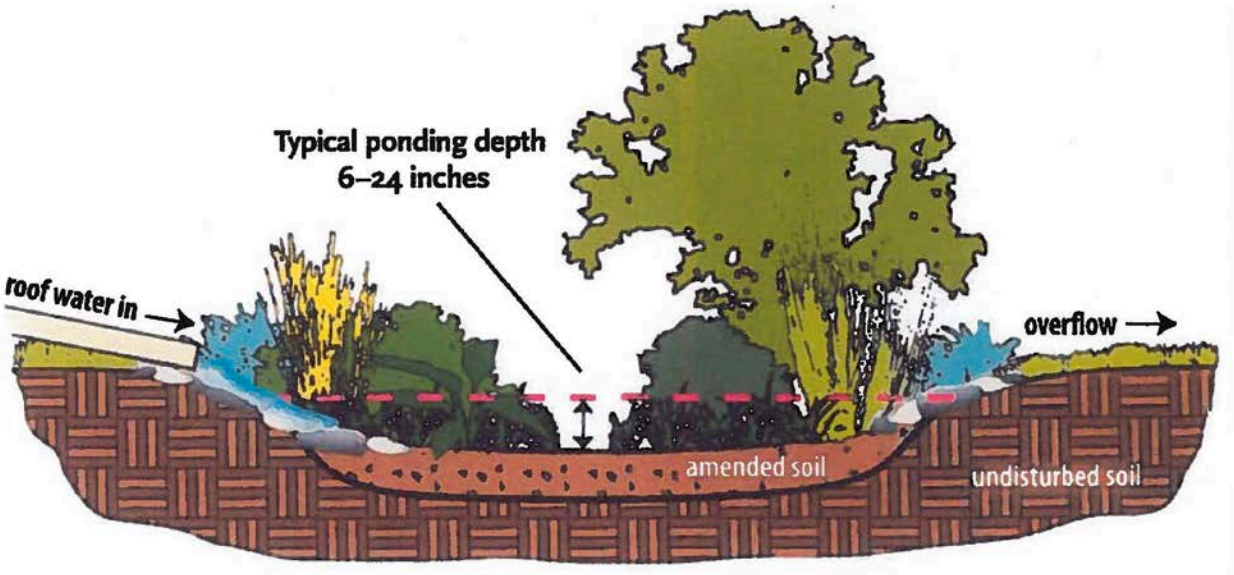


Figure 2: Typical Rain Garden Cross Section (Graphic: EMSWCD)

Rain Garden Safety and Siting Requirements:

- The site must be large enough to accommodate the rain garden and allow maintenance access.
- Site soils must be adequately permeable to infiltrate runoff to groundwater. A minimum infiltration rate of ½ inches per hour is required in the proposed location of the facility, or the facility must be designed as a flow-through facility with an approved outlet point. Refer to the Infiltration Testing section of this document for information on how to test the infiltration rate of your soil.
- Property must be located outside of the Seasonal High Ground Water Zone as determined by LC PWD GIS maps.
- Rain gardens must be located at least 5 feet away from property lines and at least 10 feet from building foundations.
- Rain gardens must be located at least 50 feet downgradient from a septic system.
- Rain gardens must be at least 100 feet from the top of any slope exceeding 10 percent. Add an addition 5 feet of setback for each additional percent of slope, up to 30 percent.
- Rain gardens are not appropriate for sites that stay wet throughout the rainy season.
- Refer to the Typical Rain Garden Details attached hereto as Appendix B for design guidance. Location, dimensions and a planting list for proposed Rain Gardens must be submitted on the required Site Plan and approved by LC PWD prior to final acceptance.

Rain Garden Design Guidance:

- If the rain garden is to provide flow control and water quality treatment, it shall be sized to have a surface area of at least 15 percent of the impervious surface draining to it. A smaller facility may be proposed if calculations are provided demonstrating that the rain garden has adequate capacity for the 25-year, 24-hour design storm.

- Rain gardens shall have a ponding depth of between 6 and 24 inches. If the infiltration rate is less than 1 inch per hour, a minimum ponding depth of 12 inches shall be provided.

- Provide energy dissipation at the inflow and surface outflow in the form of rocks and gravel.

- Apply mulch or compost at a depth of 2 to 3 inches across the rain garden. Fine grade double-shredded conifer bark mulch (bark dust) is one option for mulch material, although alternative materials are acceptable.

- Refer to the Oregon Rain Garden Guide for additional design, construction and maintenance guidance. The following is a link to the online guide: http://seagrant.oregonstate.edu/sgpubs/onlinepubs/h10001.pdf

- A safe overflow route that does not drain onto neighboring properties shall be provided in the event of overflow.

- When selecting vegetation, consider the rain garden's exposure to sunlight. Many grasses require full sunlight and should not be used in swales shaded by surrounding trees, shrubs, or buildings. Other species, such as ferns, prefer shade. Consult the LC PWD's Rain Garden Planting List (available upon request from LC PWD) for vegetation recommendations.

- If drain rock is installed at the base of the facility, it shall be 1½ inch to ¾ inch washed pea gravel. Gravel shall be separated from growing medium by approved filter fabric.

- Growing medium shall be a sandy loam mixed with compost or a sand/soil/compost blend. It shall be approximately 1/3 compost derived from plant material. No animal waste is permitted.

Rain Garden Geometry

The rain garden must conform to the following parameters:

- Minimum bottom width is 2 feet.
- 2-4 inches of freeboard (distance between highest water surface elevation and overtopping elevation) shall be provided above the ponding depth.
- Growing medium shall be at least 18 inches deep.
- Maximum side slopes shall be 3 horizontal units to 1 vertical unit.

Rain Garden Plantings

Successful planting is one of the keys to ensuring that a rain garden will function properly when it is first constructed and into the future. Plants are highly adapted to specific ecological conditions, such

as temperature, the amount of sunlight, and the amount of soil moisture. Many species that thrive in Washington may wither in Oregon. Plants native to the Willamette Valley may not be suitable for the Oregon Coast. A list of plants adapted for rain garden facilities in the Lincoln City area is available upon request from LC PWD.

Figure 3 shows a cross-section of a rain garden, indicating the ecological planting zones, which are explained below. This figure and explanations should be used in conjunction with the Rain Garden Planting List in order to ensure appropriate species selection for rain gardens within the City.

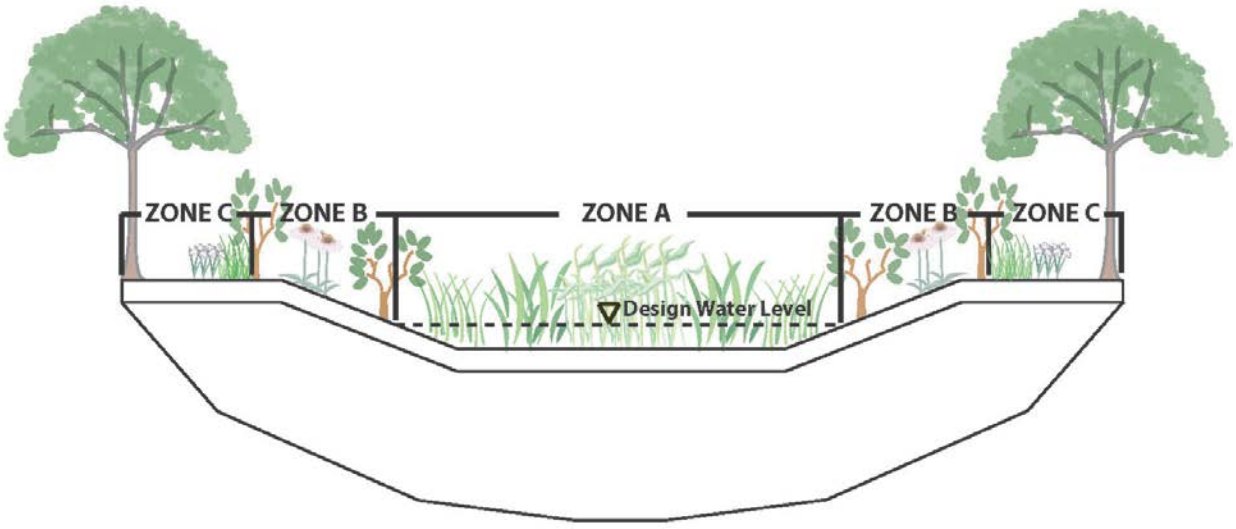


Figure 3: Rain Garden Planting Zones

Rain Garden Zones

Zone A

This is the basin of a stormwater facility, where soil remains wet or moist longest. These areas may be wet anywhere between 1 and 3 days after a storm event, but soils will dry out between storms. Plants in this area must be able to tolerate water levels to the designed water level.

Zone B

This is the area of the facility defined as the side slopes from the defined high water mark up to the top edge of the facility. The soils are typically drier, with more moist soils located further down the side slopes. Plants located in this area need to stabilize facility slopes and tolerate moist to dry conditions.

Zone C

This is the dry/upland area of the facility. Plants in this area need to tolerate dry conditions.

Rain Garden Maintenance:

To ensure that rain gardens continue to function properly it is necessary to perform routine maintenance on them. During the first few years, while the plantings are being established, it is necessary to keep the rain garden free of weeds and their roots. Weeds may not be as much of an issue as the plantings become more mature in the third year and beyond, however, weeding isolated patches may still be necessary on occasion. Periodic pruning of the plants in the rain garden is also necessary to maintain the aesthetics of the rain garden as well as the health of the plantings. Additionally, it is necessary to maintain the organic mulch layer. The layer should be replenished as necessary to maintain plant health. Please refer to The Oregon Rain Garden Guide's section on maintenance for more information on how to weed, prune, mulch and otherwise properly care for your rain garden.

Erosion Preventative Landscaping and Infiltration Trench

If it is determined by LC PWD that it is not feasible for the applicant to extend and/or connect to an existing City stormwater system or to an existing ditch or natural drainage way, and if the conditions of the site slopes and/or soils do not lend themselves to the installation of a drywell or rain garden, then the applicant must install erosion preventative landscaping and an infiltration trench **(Figure 4)** around the property's setbacks in order to prevent stormwater runoff from flowing onto neighboring properties. Erosion preventative landscaping shall be defined as groundcover as described in the City of Lincoln City's Guide to Landscape Selections Volume 1: Living Groundcover, available from the City of Lincoln City Department of Planning and Community Development. In order to successfully prevent erosion 100% of the site must be covered with groundcover by the planting reach maturity. During the interim, erosion control measures must be taken to prevent erosion while the plantings reach maturity and cover the site.

Figure 4: Infiltration Trench

Erosion control measures that will be required include, but are not limited to the following:

- Temporary groundcover in the form of straw or jute matting
- Temporary flow control measures at the downspout locations in the form of waddles
- Measures to ensure that the above systems function effectively until the groundcover is fully established (may take anywhere from 1 to 3 years)

In addition to the landscaping requirements, this alternative requires the installation of Infiltration Trenches at strategic locations around the property. An infiltration trench is a shallow trench with perforated drainage pipe in permeable soil that is backfilled with washed drain rock and lined with filter

fabric. The trench surface may be covered with grass, stone, sand, or plantings. Applicants shall consult with LC PWD to determine the locations where Infiltration Trenches will be required on their particular site. Infiltration Trenches shall be shown on the required Site Plan for review and approval by LC PWD prior to final acceptance.

Infiltration Testing

Adapted from: Portland Stormwater Management Manual – Revised February 1, 2010

To properly size and locate stormwater management facilities, it is necessary to characterize the soil infiltration conditions at the location of the proposed facility. All applicants that propose onsite infiltration must evaluate existing site conditions and determine if the infiltration rate is adequate to support the proposed stormwater management facility. Infiltration testing shall be conducted when soils are not frozen. The results of the infiltration testing must be documented on the Infiltration Test Report Form attached hereto as Appendix C.

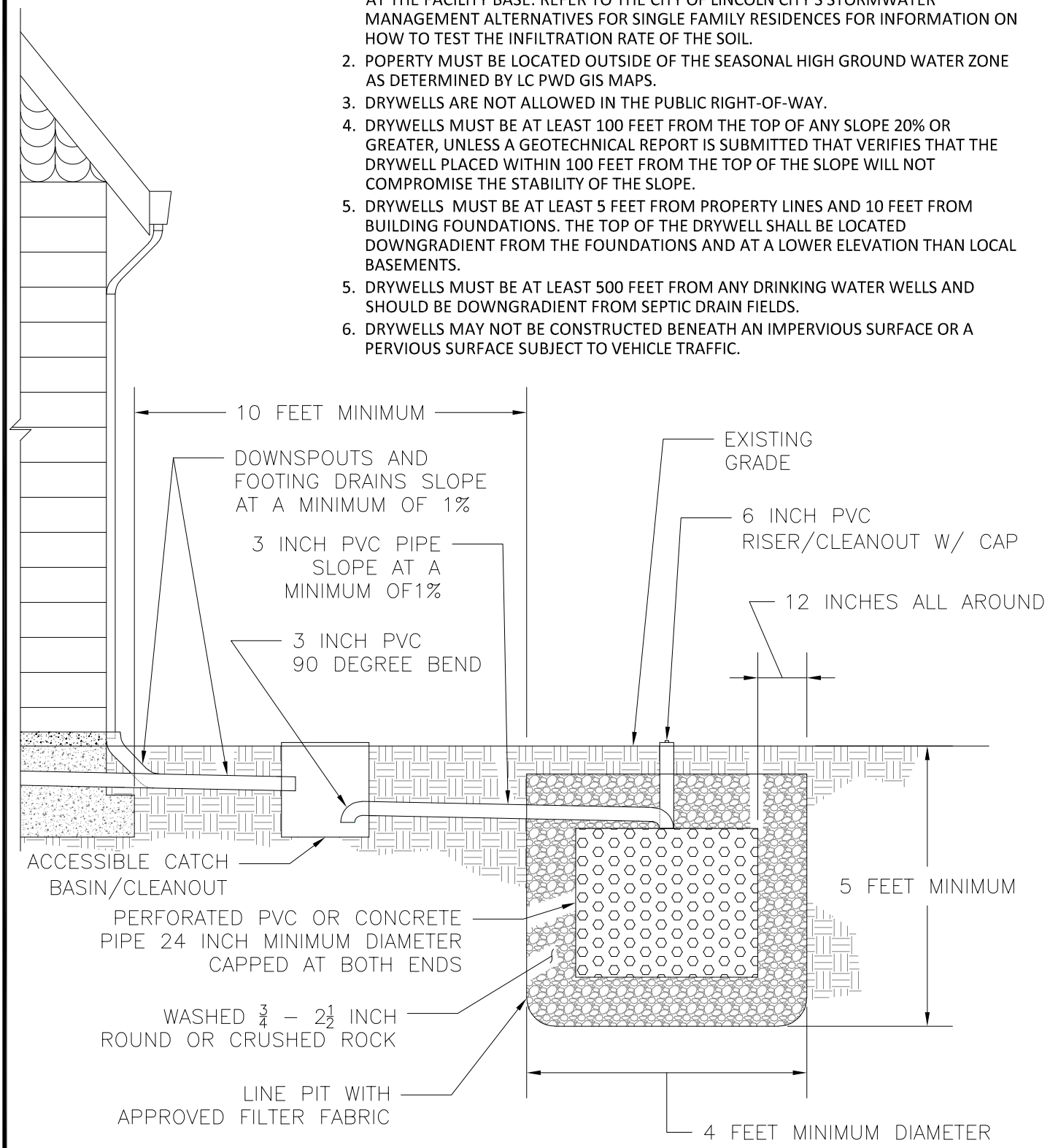
Infiltration testing procedure:

- *Call before you dig.* Make sure you do not damage underground utilities by digging an infiltration test pit. Call 1-800-332-2344 to locate underground utilities. The service is free and required by Oregon law.
- Excavate a test pit in the location of the proposed facility or within the immediate vicinity. The pit shall be excavated to the depth of the bottom of the proposed infiltration system, or otherwise to 4 feet. The test hole can be excavated with small excavation equipment or by hand using a shovel, auger, or post hole digger. If a layer hard enough to prevent further excavation is encountered, or if noticeable moisture/water is encountered in the soil, stop and measure the depth from the surface and record it on the Infiltration Test Report Form. Proceed with the test at this depth.
- Fill the hole with water to a height of about 6 inches below the top edge of the hole and record the exact time. Check the water level at regular intervals (every 1 minute for fast-draining soils to every 10 minutes for slower-draining soils) for a minimum of one hour or until all of the water has infiltrated. Record the distance the water has dropped from the original level of 6 inches below the top edge of the hole.
- Repeat this process two more times, for a total of three rounds of testing. These tests should be performed as close together as possible to accurately portray the soil's ability to infiltrate at different levels of saturation. The **third test** provides the best measure of the saturated infiltration rate.
- Submit all three testing results recorded on the Infiltration Test Report Form with the date, duration and drop in water height, to the LC PWD.

Appendix A
Typical Drywell Detail

NOTES:

1. SITE SOILS MUST BE ADEQUATELY PERMEABLE TO INFILTRATE RUNOFF INTO GROUNDWATER. A MINIMUM INFILTRATION RATE OF 2 INCHES PER HOUR IS REQUIRED AT THE FACILITY BASE. REFER TO THE CITY OF LINCOLN CITY'S STORMWATER MANAGEMENT ALTERNATIVES FOR SINGLE FAMILY RESIDENCES FOR INFORMATION ON HOW TO TEST THE INFILTRATION RATE OF THE SOIL.
2. POPERTY MUST BE LOCATED OUTSIDE OF THE SEASONAL HIGH GROUND WATER ZONE AS DETERMINED BY LC PWD GIS MAPS.
3. DRYWELLS ARE NOT ALLOWED IN THE PUBLIC RIGHT-OF-WAY.
4. DRYWELLS MUST BE AT LEAST 100 FEET FROM THE TOP OF ANY SLOPE 20% OR GREATER, UNLESS A GEOTECHNICAL REPORT IS SUBMITTED THAT VERIFIES THAT THE DRYWELL PLACED WITHIN 100 FEET FROM THE TOP OF THE SLOPE WILL NOT COMPROMISE THE STABILITY OF THE SLOPE.
5. DRYWELLS MUST BE AT LEAST 5 FEET FROM PROPERTY LINES AND 10 FEET FROM BUILDING FOUNDATIONS. THE TOP OF THE DRYWELL SHALL BE LOCATED DOWNGRADIENT FROM THE FOUNDATIONS AND AT A LOWER ELEVATION THAN LOCAL BASEMENTS.
5. DRYWELLS MUST BE AT LEAST 500 FEET FROM ANY DRINKING WATER WELLS AND SHOULD BE DOWNGRADIENT FROM SEPTIC DRAIN FIELDS.
6. DRYWELLS MAY NOT BE CONSTRUCTED BENEATH AN IMPERVIOUS SURFACE OR A PERVIOUS SURFACE SUBJECT TO VEHICLE TRAFFIC.

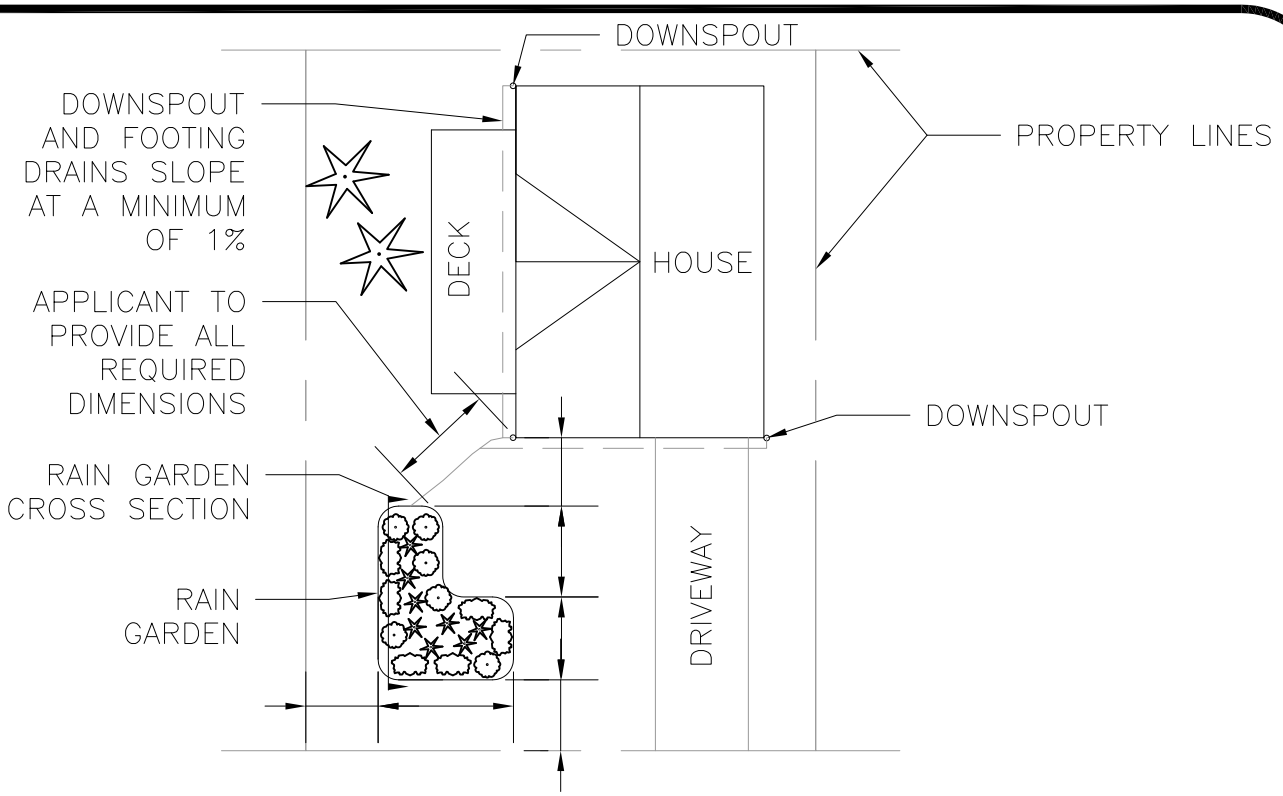


LCPW STANDARD DRYWELL

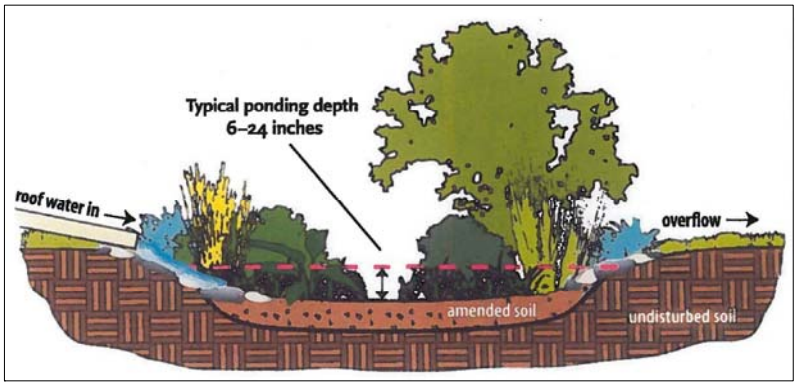
DETAIL: 320 LCPW OnSiteStorm–Drywell

REVISED:
APRIL 2019

Appendix B
Typical Rain Garden Detail



PLAN VIEW



CROSS SECTION (GRAPHIC: EMSWCD)

NOTES:

1. THIS TYPICAL DETAIL IS INTENDED TO ILLUSTRATE WHAT IS REQUIRED ON A SITE PLAN FOR RAIN GARDEN INFORMATION. THESE REQUIREMENTS ARE IN ADDITION TO THE REQUIREMENTS SET FORTH IN THE RESIDENTIAL SITE PLAN REQUIREMENT CHECKLIST.
2. SITE SOILS MUST BE ADEQUATELY PERMEABLE TO INFILTRATE RUNOFF INTO GROUNDWATER. A MINIMUM INFILTRATION RATE OF $\frac{1}{2}$ INCHES PER HOUR IS REQUIRED AT THE FACILITY BASE. REFER TO THE CITY OF LINCOLN CITY'S STORMWATER MANAGEMENT ALTERNATIVES FOR SINGLE FAMILY RESIDENCES FOR INFORMATION ON HOW TO TEST THE INFILTRATION RATE OF THE SOIL.
3. PROPERTY MUST BE LOCATED OUTSIDE OF THE SEASONAL HIGH GROUNDWATER ZONE AS DETERMINED BY LC PWD GIS MAPS.
4. RAIN GARDENS ARE NOT ALLOWED IN THE PUBLIC RIGHT-OF-WAY.
5. RAIN GARDENS MUST BE AT LEAST 100 FEET FROM THE TOP OF ANY SLOPE 10% OR GREATER.
6. RAIN GARDENS MUST BE AT AT LEAST 5 FEET FROM PROPERTY LINES AND 10 FEET FROM BUILDING FOUNDATIONS.
7. RAIN GARDENS MUST BE AT LEAST 50 FEET DOWNGRADIENT FROM SEPTIC DRAIN FIELDS.
8. RAIN GARDENS MAY NOT BE CONSTRUCTED BENEATH AN IMPERVIOUS SURFACE OR A PERVIOUS SURFACE SUBJECT TO VEHICLE TRAFFIC.
9. REFER TO THE OREGON RAIN GARDEN GUIDE FOR ADDITIONAL DESIGN, CONSTRUCTION AND MAINTENANCE GUIDANCE. THE FOLLOWING IS A LINK TO THE ONLINE GUIDE: HTTP://SEAGRANT.OREGONSTATE.EDU/SGPUBS/ONLINEPUBS/H10001.PDF
10. CONSULT THE RAIN GARDEN PLANTING LIST FOR VEGETATION RECOMMENDATIONS AND INCLUDE LANDSCAPING PLAN/PLANT LIST ON REQUIRED SITE PLAN.

CITY OF LINCOLN CITY
TYPICAL RAIN GARDEN DETAIL

Appendix C
Infiltration Test Report Form

City of Lincoln City

Infiltration Test Report Form

Name: _____ Map & Taxlot No.: _____

Site Address: _____ Depth of Excavation: _____

_____

_____

Test 1		Test 2		Test 3	
Date:	*	Date:	*	Date:	*
Time:		Time:		Time:	
Initial water level:	inches	Initial water level:	inches	Initial water level:	inches
(measured in inches from top of pit)		(measured in inches from top of pit)		(measured in inches from top of pit)	
Final water level:	inches	Final water level:	inches	Final water level:	inches
(measured in inches from top of pit)		(measured in inches from top of pit)		(measured in inches from top of pit)	
Change in water level:	inches	Change in water level:	inches	Change in water level:	inches
(Final water level - Initial water level)		(Final water level - Initial water level)		(Final water level - Initial water level)	
Duration of test:	hours	Duration of test:	hours	Duration of test:	hours
(measured in hours)		(measured in hours)		(measured in hours)	
Infiltration rate:		Infiltration rate:		Infiltration rate:	
(Change in water level/Duration of test)		(Change in water level/Duration of test)		(Change in water level/Duration of test)	

* Date of all three tests shall be the same

Signature: _____ **Date:** _____