Rogue Valley

Stormwater Quality Design Manual

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Rogue Valley Stormwater Quality Design Manual

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Abbreviations

BMPs	Best Management Practices
CEG	Certified Engineering Geologist
CN	Curve number
CULD	Conditional Use Level Designation
DEQ	Oregon Department of Environmental Quality
DoC	Declaration of Covenants
EPDM	Ethylene Propylene Diene Terpolymer
GRP	Green Roof Professional
GULD	General Use Level Designation
HDPE	High Density Polyethylene
IA	Impervious Area
IPM	Integrated pest management
MS4	Municipal Separate Storm Sewer System
NPSO	Native Plant Society of Oregon
NRCS	Natural Resources Conservation Service
NWCB	Noxious Weed Control Board
O&M	Operation and Maintenance
ODOT	Oregon Department of Transportation
PA	Pervious Area
PE	Professional Engineer
PNW	Pacific Northwest
RA	Roof Area
RVSS	Rogue Valley Sewer Service's
SBUH	Santa Barbara Urban Hydrograph
SF	Square Feet
SLOPES	Standard Local Operating Procedures for Endangered Species
SW	Stormwater
SWAT	Stormwater Advisory Team
SWF	Stormwater Facility
SWMPs	Stormwater Management Programs
TAPE	Technology Assessment Protocol- Ecology
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
UIC	Underground Injection Control

Chapter 1 – Introduction and General Information

1.1 INTRODUCTION

Managing stormwater is an essential part of maintaining livability in an urban area. Urbanization results in vegetation removal, soil compaction, and impervious surface creation. Impervious surfaces collect precipitation, often increasing the temperature and amount of pollutants, from which runoff is quickly discharged into the closest water body. The quality, quantity, and rate of stormwater discharged can detrimentally impact aquatic ecosystems, drinking water quality, and recreation opportunities. Stormwater management attempts to mitigate these impacts by removing pollutants from runoff and reducing the quantity and rate of runoff.

To address impacts of urbanization on water quality, Municipal Separate Storm Sewer System (MS4) Phase II permits have been issued to urbanized jurisdictions (Permittees) in the Rogue Valley by the Oregon Department of Environmental Quality (DEQ). Permittees are required to develop Stormwater Management Programs (SWMPs) to reduce discharges of pollutants and address stormwater runoff from new and redevelopment projects that meet or exceed impervious area thresholds set by DEQ. The Permittee developed SWMPs must also include requirements for Permittee review and inspection of stormwater management plans for new and redevelopment projects. Permittees must submit their SWMPs to DEQ for review and approval and must report to DEQ annually on the implementation of the SWMPs.

The Rogue Valley Stormwater Design Manual (Design Manual) was jointly developed by jurisdictions in the Rogue Valley. This Design Manual was created to establish stormwater management standards and facilitate the design, review, and implementation of stormwater management facilities compulsory for site development. The requirements described herein were developed in accordance with DEQ's MS4 Phase II General Permit effective March 2019, and are based on local climatology, geography, soils, and other regional conditions.

1.2 MANUAL OBJECTIVES

For the purposes of the Design Manual, Stormwater Management is Retention, Treatment, and Detention of site runoff. The purpose of this Design Manual is to establish stormwater management standards to satisfy local development ordinances and the Post-Construction Stormwater Management Requirements (Schedule A.3.e) of the MS4 Phase II permit. Numeric stormwater management requirements were developed for this Design Manual that target predevelopment hydrologic function and meet the intent of the MS4 permit. More specifically, this Design Manual intends to:

1) Establish stormwater management standards for public and private developments in the Rogue Valley;
2) Identify Best Management Practices (BMPs) that meet Retention, Treatment, and Detention standards;
3) Describe Operation and Maintenance Requirements for BMPs; and,
4) Establish submission criteria for stormwater management plans.

1.3 JURISDICTIONS ADOPTING THE DESIGN MANUAL

The Design Manual is a regional manual, first implemented in 2006, that has been adopted by many MS4 jurisdictions within the Rogue Valley. Rogue Valley Sewer Service's (RVSS) service map, linked here shows the boundaries of the MS4 jurisdictions. The jurisdictions that formally adopt the Design Manual become voting members of the Stormwater Advisory Team (SWAT), which oversees development of the Design Manual. As of the publication date, the Design Manual was adopted by the following jurisdictions: City of Ashland, City of Central Point, City of Medford, and RVSS (Figure 1.1). RVSS holds the MS4 permit for the cities of Eagle Point, Phoenix, and Talent as well as the urbanized, unincorporated portions of Jackson County. Project designers will need to submit to the appropriate approving jurisdiction for compliance with the Design Manual.

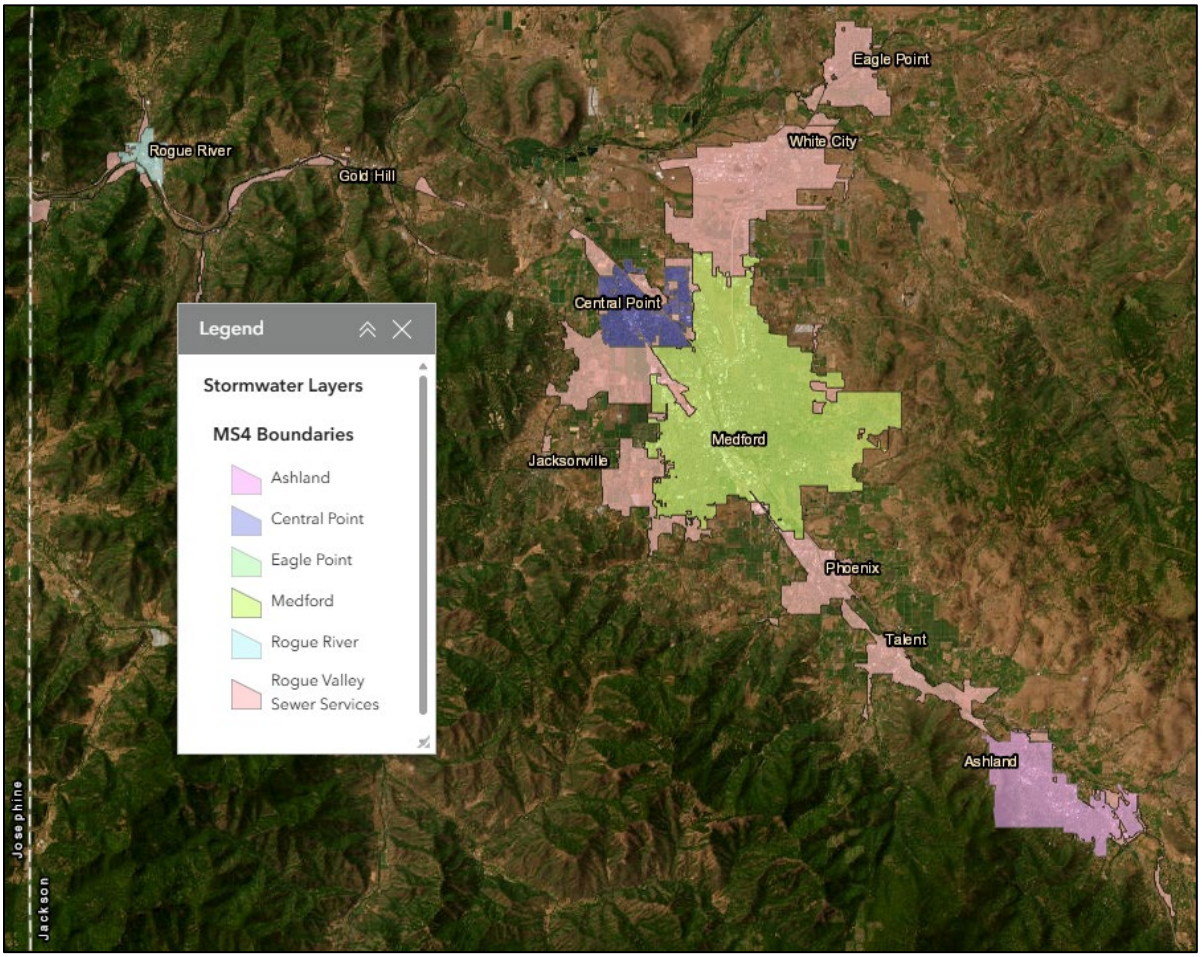

Figure 1.1. MS4 Permittees that have adopted the Rogue Valley Stormwater Quality Design Manual, at the time of this revision, are shown in shaded colors.

Initial drafting of the Design Manual began in 2004, when DEQ advised communities that they would soon be required to comply with MS4 permits. The Design Manual has been amended many times since 2006 to clarify and provide better guidance to designers. A revised Design Manual was issued in 2018 with completely updated design details and standard drawings for each of the BMPs. In 2019, a new MS4 permit became effective that included many new requirements for post-construction stormwater management, necessitating revisions to the design storms and a new edition of the Design Manual.

1.4 AUTHORITY

Authority for the requirements in this Design Manual come from the MS4 permit, as well as the applicable development ordinances and codes of the municipalities and RVSS that have adopted this Design Manual.

1.5 DESIGN MANUAL APPLICABILITY

The requirements of this Design Manual apply to Development and Redevelopment, within the limits of any jurisdiction that has adopted the manual. The thresholds are outlined in Table 1.1.

Table 1.1 Design Manual applicability for Development or Redevelopment.

Location	Impervious Surface Area	Requirements
Within city limits	< 5,000 sf	None from this Design Manual
	≥ 5,000 sf	Retention and/ or Treatment
	≥ 10,000 sf	Detention
Outside city limits but inside MS4	≥ 10,890 sf	Retention and/ or Treatment and Detention*

* No Detention within the White City Residential boundary.

1.6 RELATIONSHIP TO OTHER REQUIREMENTS AND STANDARDS

Projects may also need to comply with other requirements established by local, state or federal agencies. It is the responsibility of the project designer to ensure all applicable requirements are met and to resolve potential conflicts. The following are local requirements that may apply:

- Bear Creek and the Rogue River both have water quality that does not meet state water quality standards. To work toward improvement, DEQ has established Total Maximum Daily Loads (TMDLs) that stipulate the amount of pollution that can be contributed to the water bodies. Each jurisdiction that discharges into the water bodies is required to develop a TMDL Implementation Plan to address the pollution; a large number of required TMDL plan elements relate to post-construction stormwater management, and are addressed by this manual, or local codes.
- Riparian ordinances established by local jurisdictions.
- Construction activities must follow local jurisdiction ordinances and may require obtainment of erosion prevention and sediment control permits.
- Drainage, planning, and design ordinances established by local jurisdictions.
- Design standards for conveyance systems are not included in this Design Manual, refer to the local jurisdiction for these requirements.
- The impervious area thresholds listed in Section 1.5 (Design Manual Applicability) and the Exemptions from Retention, Treatment, and Detention in Section 2.6 of the Design Manual may not apply for development in the Special Flood Hazard Area (SFHA).

1.7 REVISION AND AMENDMENT PROCESS

The SWAT is the approving body for any revisions to the Design Manual. Typically, the SWAT attempts to approve necessary minor amendments once a year and have them go into effect on July 1. Larger revisions to the Design Manual are undertaken as required by the MS4 permit, developed through a working group, and brought to the SWAT for approval. All proposed changes to the Design Manual are required to be noticed to the SWAT 30 days prior to a vote. The public may attend SWAT meetings and provide comment on proposals but does not vote.

Chapter 2 – Water Quality and Peak Flow Control Requirements

2.1 INTRODUCTION

The MS4 Phase II permit requires permittees to "…establish a Site Performance Standard with a numeric stormwater retention requirement to target natural surface or predevelopment hydrologic function to retain rainfall on-site and minimize the offsite discharge of precipitation utilizing stormwater controls that infiltrate, capture and/or evapotranspirate stormwater." Based on these requirements, Retention of stormwater runoff using infiltration is the priority method of stormwater management and can be accomplished through the use of Low Impact Development and Green Infrastructure.

> "*Low Impact Development (LID) is a stormwater management approach that seeks to mitigate the impacts of increased runoff and stormwater pollution using a set of planning, design and construction approaches and stormwater management practices that promote the use of natural systems for infiltration, evapotranspiration, and reuse of rainwater, and can occur at a wide range of landscape scales (i.e., regional, community and site). Low Impact Development is a comprehensive land planning and engineering design approach to stormwater management with a goal of mimicking the pre-development hydrologic regime of urban and developing watersheds"* [1]
>
> *"The term 'green infrastructure' means the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspirate stormwater and reduce flows to sewer systems or to surface waters."* [2]

Retention Facilities are designed to collect and hold site runoff to limit the volume of downstream discharge. The volume of downstream discharge from a Retention Facility may not exceed pre-developed levels and all runoff above the pre-developed runoff volume must leave the facility via infiltration, evapotranspiration, absorption by vegetation, or reuse on-site.

The MS4 Phase II permit also requires Permittees to establish Treatment standards. Treatment Facilities are designed to capture, filter and/or hold runoff for the length of time needed for suspended particles to settle out of the water column, runoff is then released downstream.

Local ordinance requires the implementation of peak flow control or Detention to attenuate the downstream impact of peak flow rates generated by an increase in impervious surfaces. Detention Facilities are designed to hold and release runoff at a rate no larger than the pre-developed peak runoff rate.

2.2 RETENTION REQUIREMENTS

Retention Facilities function based on the ability of water to infiltrate into the ground or evapotranspirate into the atmosphere.

2.2.1 Retention Design Storm

Retention Facilities must be designed to Retain runoff from the 80th percentile storm event (0.46 inches). The 80th percentile rainfall event is the event with precipitation depth greater than or equal to the depth of 80% of all storm events over a given period. A 36-year period of record from 1984 to 2019 was examined using data from the Medford Airport WSO AP weather station to determine the 80th percentile event for the Rogue Valley.

[1] DEQ NPDES MS4 Phase II General Permit, March 2021.

[2] Water Infrastructure Improvement Act, Public Law 115-436, 2019.

2.2.2 Retention Exemptions

Many conditions, including geology and site location, may limit the ability of a Retention Facility to properly function at a site. Described in **Section 2.4.1** are technical criteria that this Design Manual acknowledges inhibit Retention, if any of these exist on the site, the site is considered infeasible for retention-based stormwater facilities. Technical justification must be provided in the form of a site-specific hydrologic or design analysis conducted or endorsed by an Oregon registered Professional Engineer (PE) or Oregon Certified Engineering Geologist (CEG) demonstrating that infeasibility factors exist on the site. The analysis must receive concurrence from the approving jurisdiction. If Retention is deemed infeasible for a site, Option 1.b (**Section 2.4**) treatment of the 95th percentile storm is still required.

2.3 TREATMENT REQUIREMENTS

Treatment Facilities are designed to remove total suspended solids (TSS) through filtration, infiltration, or settling of solids. Stormwater management facilities can be designed to achieve both Retention and Treatment, or a treatment train with multiple facilities may be utilized. Furthermore, when selecting a Treatment Facility, Green Infrastructure facilities must be considered first. Stormwater Facilities meeting Retention, Treatment and/or Green Infrastructure requirements are identified in **Table 2.1**.

2.3.1 Treatment Design Storm

Treatment Facilities must be designed to treat all runoff from the 95th percentile storm event (0.84 inches). The 95th percentile rainfall event is the event with precipitation depth greater than or equal to the depth of 95% of all storm events over a given period. A 36-year period of record from 1984 to 2019 was examined using data from the Medford Airport WSO AP weather station to determine the 95th percentile event for the Rogue Valley.

2.3.2 Treatment Exemptions

Refer to the Transportation paragraph in **Section 2.6** Exemptions from Retention, Treatment and Detention.

2.3.3 Pollutant Parameters

The Phase 2 MS4 permit requires a minimum removal of 80% of TSS from the treatment design storm. The facilities detailed in **Chapter 4** of this Design Manual are assumed to meet this TSS removal requirement. Any proposed alternative facility must meet or exceed this requirement.

2.4 WATER QUALITY REQUIREMENTS: RETENTION AND TREATMENT

Retention and Treatment requirements have been established for this Design Manual and can be met by satisfying either Option 1 or 2 below. The options are provided to allow flexibility on project sites. Option 1 has two parts; Retention and Treatment, while Option 2 only has Retention, but applies it to the entire runoff volume from newly developed and redeveloped areas. Detention requirements are covered in **Section 2.5** of this Design Manual.

2.4.1 Design Storms

- Retention Storm: 0.46 inches in 24 hours (80th percentile storm event)
- Treatment Storm: 0.84 inches in 24 hours (95th percentile storm event)

Choose Option 1 or Option 2

Option 1.

a) Target natural surface or predevelopment hydrologic function by retaining all additional runoff volume generated by the Retention storm from post-developed site conditions when compared to pre-developed conditions. Refer to **Section 2.4.3** for a discussion of Technical Infeasibility Factors. If the approving jurisdiction concurs that the site is technically infeasible for Retention, only part 1.b. is required.

And,

b) Treat all runoff generated by the Treatment storm from new and redeveloped impervious surfaces. Green Infrastructure must be prioritized as the treatment mechanism.

Or,

Option 2.

Retain 100% of the runoff volume generated by the Retention storm from newly developed and redeveloped areas. The Treatment requirement is considered satisfied with this option. Option 2 may not be used if claiming technical infeasibility for a project site.

2.4.2 Mitigation Alternatives

If both Options 1 & 2 noted in **Section 2.4.1** are proven to be technically infeasible for the project site, designers may propose alternatives to the reviewing jurisdiction to satisfy the Retention and Treatment standards.

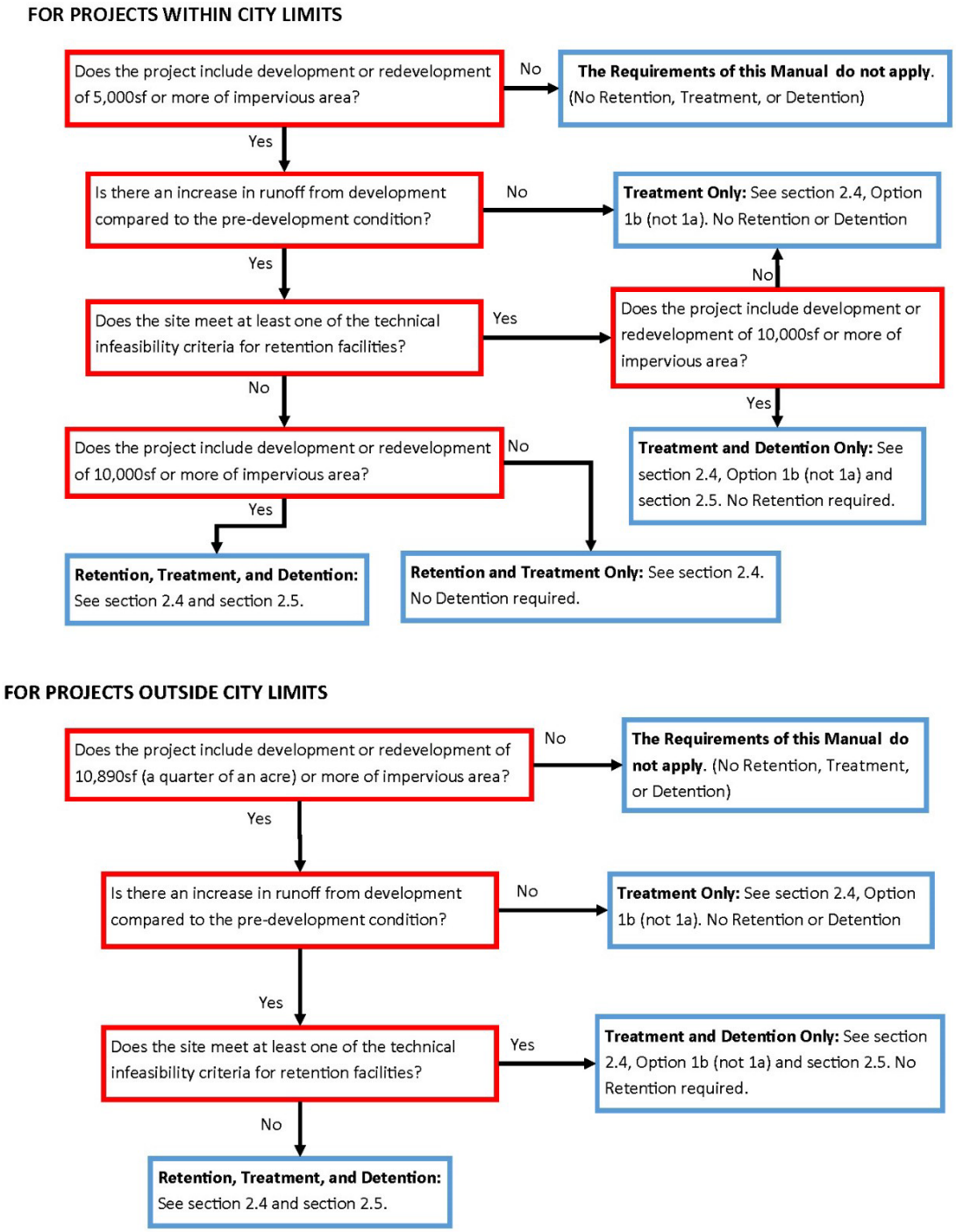

Figure 2.1. Flow chart used for determining Stormwater Management requirements for Development or Redevelopment.

2.4.3 Retention Requirement Technical Infeasibility Criteria

The factors discussed below make a site infeasible for Retention Facilities. If a site meets any of these infeasibility criteria, Option 1b must be followed.

Separation Distance from Seasonal High Groundwater and Bedrock

Depth to seasonal high groundwater and bedrock for design and determination of technical infeasibility for Retention shall utilize the best available information. Results of geotechnical investigations, well boring logs, observations during infiltration testing, and/or other site-specific studies are preferred. However, if such information is unavailable, use of the Natural Resources Conservation Service (NRCS) soil data, available via the web soil survey, is acceptable. The stormwater Calculation Report, prepared by an Oregon registered PE or CEG, shall include a discussion of the methodology and data sources used to determine depth to groundwater and/or bedrock. Separation distance shall be measured from stormwater facility subgrade as represented in **Figure 2.2**.

1) A separation distance of less than three feet exempts the following stormwater facilities from Retention:
    a) Facilities that are not Underground Injection Controls (UICs) and do contain soil growth media,
    b) Pervious paving receiving rainfall only.
2) A separation distance of less than five feet exempts the following facilities from Retention:
    a) Stormwater facilities that do not have soil growth media;
    b) Or pervious paving receiving run-on.

These facilities may be classified as UIC's by DEQ, refer to DEQ's website for the current UIC definition.

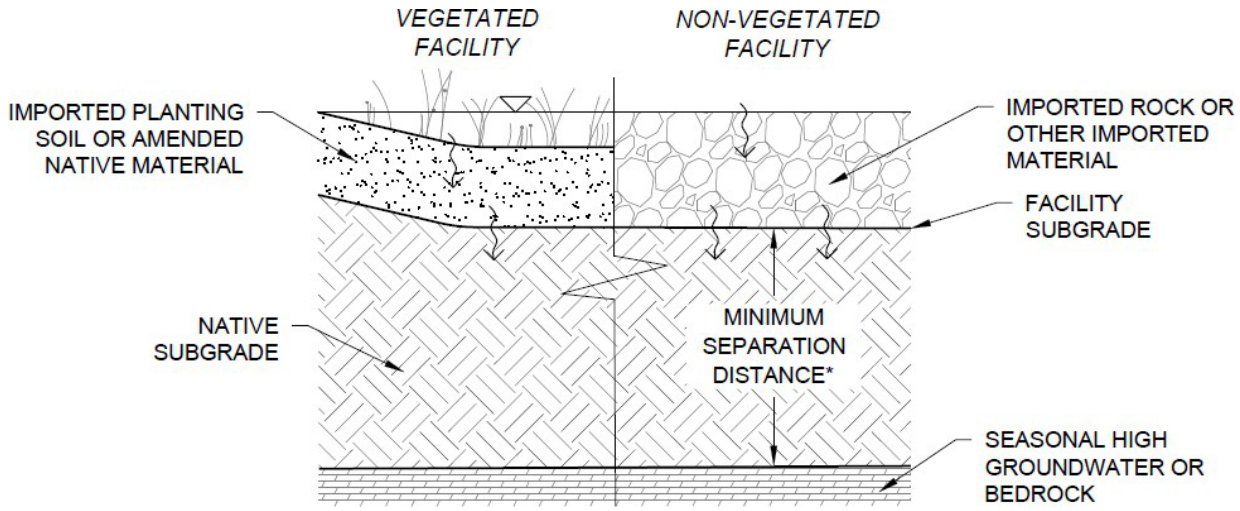

Figure 2.2 The required separation distance from seasonal high groundwater or bedrock should be measured as illustrated.

Steep Slopes

Slopes of 15% or more on average across the project site will exempt the site from the Retention requirements. Or, if an Oregon registered PE or CEG recommends the avoidance of infiltration on-site due to instability, then the site will be exempt from Retention requirements.

Distance to Drinking Water Wells

Sites will be exempt from Retention requirements if there is less than 500 feet of separation from a UIC to a drinking water well, or less than 50 feet of separation between a stormwater (SW) facility and a drinking water well, with the exception of lined facilities. At the time of publication of this Design Manual, the separation distance required by DEQ between UICs and drinking water wells was 500 feet; however, designers should verify with DEQ that this is still the standard.

Land Use Planning

Jurisdictional planning requirements that make infiltration stormwater facilities infeasible are considered to make Retention infeasible. If intending to use this infeasibility criteria, the designer shall seek prior approval from the local jurisdiction.

Transportation

The following public and private transportation related projects are considered infeasible for Retention:

- Any project that would require the purchase of right-of-way for a Retention Facility.

Infiltration Rate

Sites with a Measured Infiltration Rate of 1.5 inches per hour or less are exempt from Retention requirements. However, retention may be used on sites with a measured infiltration less than 1.5 inches per hour if the proposed facility is designed to meet the design standards in Chapter 4. Infiltration measurement shall follow the protocol outlined in **Appendix A**, or a protocol recommended by an Oregon registered PE or CEG.

Contaminated Soils

If DEQ has deemed that the project site has any contaminated soils, the project site will be infeasible for Retention.

Other Requirements

If other requirements are applied to the site, such as SLOPES (Standard Local Operating Procedures for Endangered Species), that may impact the ability to incorporate Retention, discuss these with the local jurisdiction prior to design.

2.5 PEAK FLOW CONTROL: DETENTION STANDARDS

Detention standards are intended to prevent an increase in peak flow runoff from a developing site in order to preserve the capacity in downstream storm drains and to prevent downstream erosion. Detention Facilities are required to be installed at the time of Development and must be sized so that the post-development peak flow is less than or equal to the pre-development peak flow for the 10-year event. Detention Facilities may be required to be designed to a different standard if the local jurisdiction is aware of reduced capacity downstream.

2.5.1 Detention Design Storms

- Peak Flow: 10-year event, 24-hour rainfall depth of 3.0 inches
- Auxiliary Overflow: 25-year event, 24-hour rainfall depth of 3.25 inches, if required

2.6 EXEMPTIONS FROM RETENTION, TREATMENT AND DETENTION

Transportation

The following transportation activities are exempt from Retention, Treatment and Detention requirements:

- Repair of road base that does not concurrently expand the impervious surface greater than the applicable threshold from **Section 1.5**
- Widening less than a single lane for less than 1,000 linear feet,
- Shoulder additions that do not include installation of curb and/or gutter,
- Surface maintenance work, including dig outs, within the existing impervious footprint,
- Correcting substandard intersections, for reasons of function, capacity, or safety,
- Improving existing drainage systems,
- Emergency roadwork that occurs outside the normal Capital Improvement Process.
- Paving and repairing road base of existing gravel alleys.

Bike and Pedestrian Improvement Projects in the following situations:

- Exclusive bike and pedestrian projects that do not include installation of curb and/or gutter,
- The bike and pedestrian portions of a larger project, that do not include installation of curb and/or gutter.

Utility Trenches

Utility trenches are exempt from Retention, Treatment and Detention requirements.

2.7 OPERATION AND MAINTENANCE REQUIREMENTS

Stormwater management facilities for Retention, Treatment, and Detention of stormwater runoff must be maintained in perpetuity. The designer shall discuss with the property owner the operation and maintenance requirements of any proposed Stormwater Management Facilities prior to choosing a facility. An Operation and Maintenance Manual must be prepared for all stormwater management facilities, in accordance with the requirements of **Chapter 5** and **Appendix H** and be submitted to the approving jurisdiction for review and approval.

2.8 PROJECT PLANNING, FACILITY AND APPROACH SELECTION

Use of Green Infrastructure for stormwater management must be prioritized on all projects. **Table 2.1** identifies the type of stormwater facilities that are considered Green Infrastructure by this Design Manual. The basic steps below will help to characterize a site and determine applicable standards.

1) Evaluate the Site. Identify natural resources and trees that must be preserved, drainage patterns, and existing utilities.
2) Characterize Site Drainage. Evaluate drainage area, groundwater and bedrock depth, soil types, and conduct infiltration testing per **Appendix A**.
3) Consider:
    a) Minimization of impervious surfaces through LID concepts such as reduced building footprints, efficient parking, and narrow streets,
    b) Evapotranspiration through planting of trees and perennial vegetation,
    c) Reuse of stormwater on-site.
    d) Stormwater facilities must be operated and maintained in perpetuity, consider what will be required for maintenance. Refer to **Chapter 5** for a discussion of the required Operation and Maintenance Manual.
4) Determine Applicable Design Standards. Based on the new or redeveloped impervious square footage, and considering Retention technical infeasibility criteria, and any other exemptions, determine if stormwater facilities will need to provide Retention, Treatment, and or Detention.

5) Maximize Infiltration. To the extent feasible, locate stormwater facilities in areas with highly infiltrating soils. Integrate landscaping requirements with stormwater management facilities.
6) Select and Size Facilities. Utilize the approved design approaches described in this Design Manual.

2.8.1 Approach Selection

Approved structural stormwater management controls, hereafter referred to as Best Management Practices (BMPs), are provided in this Design Manual. Calculation and Design standards used to size and design BMPs in this Design Manual are approved by the SWAT and must be implemented to meet Water Quality (Retention and Treatment) and Peak Flow Control (Detention) requirements.

Two approaches are allowed by this Design Manual, Simplified and Performance. The Simplified Approach is allowed for some, generally smaller, facilities while the Performance Design Approach is acceptable for any BMP. The general methodology for each approach is outlined below. Once the required standards for a particular site are understood, and a design approach is selected, **Table 2.1** can be used to help choose appropriate stormwater facilities.

Table 2.1 Allowed design approach, standards and green infrastructure applicability.

		Design Approach		Can be Designed For:		
BMP #	BMP Name	Simplified	Performance	Retention	Treatment	Green Infrastructure
4.4.1	**Ponded Retention** (Rain Garden/ Retention Ponds, Stormwater Planters)	Y	Y	Y	Y	Y
4.4.2	**Pervious Surface Retention**	Y*	Y	Y	Y	Y
4.4.3	**Underground Retention**	N	Y	Y	Y	Y
4.5.1	**Soil Filtration** (Rain Gardens and Stormwater Planters with Underdrains)	N	Y	N	Y	Y
4.5.2	**Water Quality Swale**	N	Y	N	Y	Y
4.5.3	**Dispersion** (Vegetated Filter Strip)	Y	Y	N	Y	Y
4.5.3	**Dispersion** (Disconnected Downspout)	Y	N	N	Y	Y
4.5.4	**Water Quality Settling Basin** (Extended Detention formerly)	N	Y	N	Y	Y
4.5.5	**Proprietary Treatment**	N	Y	N	Y	N**
4.5.6	**Vegetated Roof**	N	Y	N	Y	Y
4.6	**Detention** (Flow Control)***	N	Y	N	N	N

*Only for non-vehicular pervious surfaces.

**If no soil filtration medium.

***Can be designed in combination with other facilities.

Simplified Approach

The Simplified Approach is intended to be a streamlined stormwater management approach for small projects and is not required to be performed by an Oregon registered PE or CEG. See **Chapter 3** for the implementation standards of this approach.

Simplified Approach allowed when:

a) < 10,000 square feet of impervious surface Development or Redevelopment for the entire Project, and
b) Contributing Drainage Area of an individual BMP < 10,000 square feet

Retention and Treatment requirements are assumed to be satisfied with the Simplified Approach. Detention requirements are independent of this approach and must be determined based on the total Developed and/or Redeveloped impervious surface of the site.

Even though this approach is allowed without a PE or CEG, there may be features of the project that would be best addressed by a PE or CEG to avoid negative results such as poor site drainage, high groundwater, flooding, or impacts to neighboring properties. Additionally, liability may exist for draining water onto an adjacent property or causing water to flood onto an adjacent property. The project manager and owner should assess these risks to determine whether a PE or CEG should be hired to develop a site design including a grading, drainage, and or utility plan. The PE or CEG would still be allowed to use the Simplified Approach, thus reducing the time and effort required to comply with the requirements of this Design Manual.

Performance Design Approach

The Performance approach is required for the design of BMPs with a Contributing Drainage Area of 10,000 square feet or more and may be utilized for the design of any BMP. This approach must utilize the calculation and design standards in **Chapter 4** and must be performed by an Oregon registered PE or CEG.

2.9 CREDITS

RVSS provides credits stormwater fees and incentive funding for projects that go above and beyond the requirements of this manual. See Appendix I for information on stormwater credits and visit RVSS' website for information on incentive funding.

Chapter 3 – Simplified Approach Structural Stormwater Controls (BMPs) and Design Standards

3.1 APPLICABILITY

The Simplified Approach is intended to be a streamlined stormwater management method for small projects to address Retention and Treatment. Implementation of this approach can be done by anyone (an Oregon registered Professional Engineer (PE), or an Oregon Certified Engineering Geologist (CEG) is not required).

Simplified Approach allowed when:

- < 10,000 square feet of impervious surface Development or Redevelopment for the entire Project
- Contributing Drainage Area of an individual BMP < 10,000 square

Even though this approach is allowed without an Oregon registered PE or an Oregon CEG, there may be features of the project that would be best addressed by a PE or CEG to avoid negative results such as poor site drainage, high groundwater, flooding, or impacts to neighboring properties. Additionally, liability may exist for draining water onto an adjacent property or causing water to flood onto an adjacent property. The project manager and owner should assess these risks to determine whether a PE or CEG should be hired to develop a site design including a grading, drainage, and/or utility plan. The PE or CEG would still be allowed to use the Simplified Approach, thus reducing the time and effort required to comply with the requirements of this Design Manual.

3.2 APPROVED SIMPLIFIED APPROACH BMPs

3.2.1 Ponded Retention (Rain Garden/Retention Ponds or Stormwater Planters)

Rain Gardens impound stormwater runoff aboveground in low lying areas allowing the runoff to infiltrate into the existing subgrade.

Figure 3.1. Rain garden six months after planting.

Stormwater Planters may either be in-ground or aboveground and have vertical sides created by curbs, walls, or containers allowing the runoff to infiltrate into the existing subgrade.

Figure 3.2 Stormwater Planter.

Simplified Approach Requirements

1) Facility must be constructed per the applicable Standard Drawing in **Appendix B**.
2) Facility must be at least 10 feet from building foundations.
3) The post-developed Contributing Impervious Area must drain to the facility.
4) Bottom area must be 5% of the post-developed Contributing Impervious Area.

$$SWF\ A = IA \times SF$$

Where:

SWF A = Stormwater facility wetted area

IA = post-developed Contributing Impervious Area to be treated by the facility

SF = Sizing Factor of 0.05

Example: For a post-developed Contributing Impervious Area of 9,000 square feet, the wetted area of the facility shall be 450 square feet.

5) The overflow location must be identified on the site plan.

3.2.2 Pervious Surface Retention

Pervious surfaces (also known as permeable pavements and porous pavements) are stormwater management facilities that allow water to move through void spaces within the pavement surface and rock below and infiltrate into underlying soils.

Figure 3.3. Pervious surface not intended for vehicular use.

Simplified Approach Requirements

1) The surface should only receive direct rainfall, runoff from other areas cannot flow onto the pervious surface.
2) Pervious surface is not intended for vehicular use.
3) Pervious surface must be at least 10 feet away from building foundations.
4) Facility must be constructed per the applicable Standard Drawing in **Appendix B**.
5) If pavers are not themselves pervious, spacing between the pavers must be 20% of the overall surface area, per Standard Drawing 4.4.2.c.
6) Base rock and pavement thickness must be as recommended by the manufacturer.
7) General flow direction and off-site discharge locations must be shown on the site plan.

3.2.3 Dispersion (Vegetated Filter Strips)

Vegetated Filter Strips can be installed alongside impervious surfaces such as roadways, walkways, and patios. Vegetated filter strips run parallel to the impervious surface, are gently sloped away from the impervious surface, and must be completely vegetated to filter and reduce velocity as runoff flows through the facility.

Figure 3.4. A vegetated Filter Strip runs along the left side of this path.

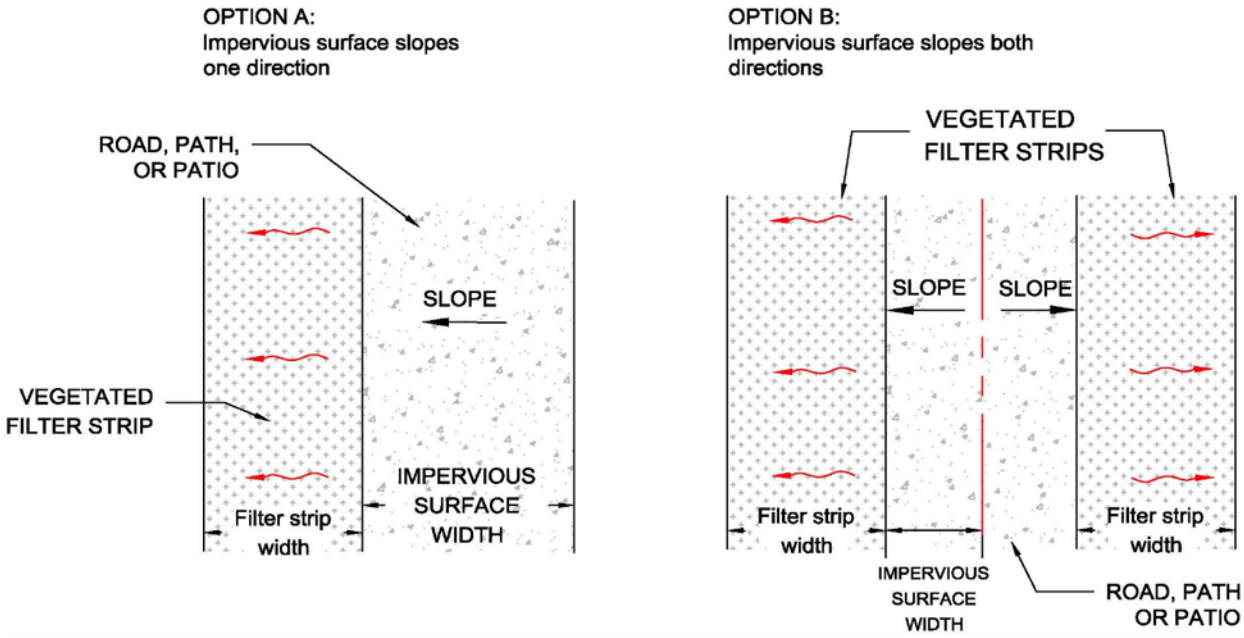

Figure 3.5. Schematic of a Vegetated Filter Strip.

Simplified Approach Requirements

1) Facility must be constructed per the applicable Standard Drawing in **Appendix B**.
2) Filter strip should not slope towards building foundations.
3) Impervious surface must slope towards the filter strip at a maximum slope of 5%.
4) Filter strip must slope away from the impervious surface with a maximum slope of 10%.
5) Maximum impervious surface "width" (see Figure 3.5) prior to entering the filter strip is 75 feet as measured along the cross-slope of the impervious surface draining towards the filter strip.
6) Maximum longitudinal slope of the impervious surface and filter strip is 4%.
7) Filter strip should be sized at a ratio of 1 foot of filter strip width for every 2 feet of impervious surface.

$$FS\ W = IS\ W \times SF$$

Where:

FS W = Filter strip width

IS W = Impervious surface width

SF = Sizing Factor of 0.5

Example: For an access road that is 10 feet wide, with a crown down the center of the road, the filter strips on each side of the road should each be at least 2.5 feet wide. Or, for an access road that is 10 feet wide, with the entire width sloping to one side (no crown), the filter strip should be at least 5 feet wide on one side.

8) The overflow location must be identified on the site plan.

3.2.4 Dispersion (Disconnected Downspouts to Pervious Area or Infiltration Trench)

Disconnected Downspouts to Pervious Area

Runoff is directed from downspouts or underground drainpipe to a pervious area in-lieu of discharging directly to a storm drain system.

Figure 3.6. A Disconnected Downspout discharging to a pervious area.

Disconnected Downspouts with an Infiltration Trench

Runoff is directed from downspouts or underground drainpipe to a trench filled with gravel for infiltration in-lieu of discharging directly to a storm drain system.

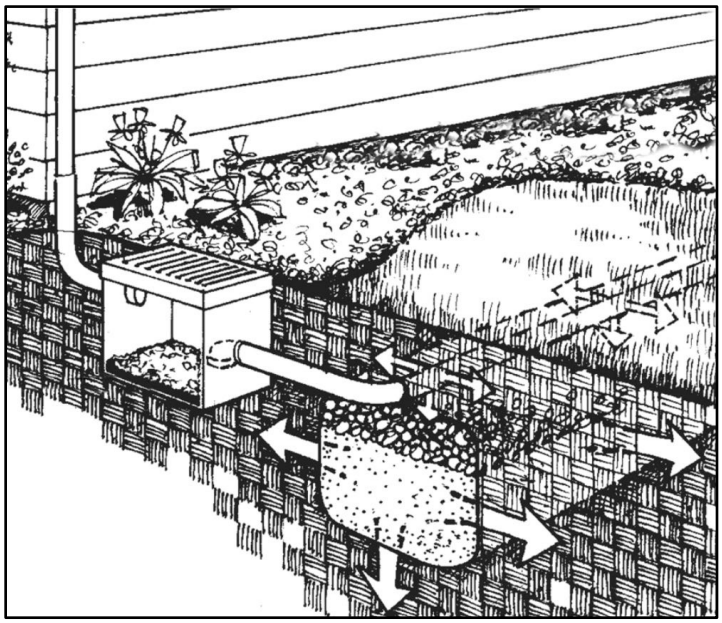

Figure 3.7. Schematic of a Disconnected Downspout discharging to an infiltration trench.

Simplified Approach Requirements – Disconnected Downspouts to Pervious Area:

1) Not allowed on lots where the average slope is greater than 10%.
2) Facility must be constructed per the applicable Standard Drawings in **Appendix B**.
3) Splash blocks or energy dissipation is required at the end of the downspout.

4) Downspout extensions may be installed above ground or underground. Aboveground downspout extensions must discharge a minimum of five feet from building foundations. Belowground downspout extensions must discharge a minimum of 10 feet from building foundations. If underground, a cleanout box should be added near the building.
5) Downspout discharge point cannot be less than 10 feet from the property line.
6) Discharge from downspout may not flow over an impervious surface.
7) General flow direction and off-site discharge locations must be shown on the site plan.
8) Maximum Contributing Impervious Area is 700 square feet of roof per downspout.
9) Pervious flow path must slope away from the building between 2% and 5%.
10) Pervious area must be 5% of the Contributing Drainage Area (roof area).

$$PA = RA \times SF$$

Where:

PA = Pervious area

RA = Contributing Impervious Area (roof area)

SF = Sizing Factor of 0.05

Example: For a roof area that is 700 square feet, the disconnected downspout should discharge to a pervious area that is at least 35 square feet.

Simplified Approach Requirements – Disconnected Downspouts to Infiltration Trench

1) Not allowed on lots where the average slope is greater than 10%.
2) Facility must be constructed per the applicable Standard Drawings in **Appendix B**.
3) Downspouts must discharge into the infiltration trench a minimum of 10 feet from building foundations, and a cleanout box should be added near the building.
4) Infiltration trenches must be located more than 10 feet from the property line.
5) Maximum Contributing Impervious Area is 700 square feet of roof per downspout.
6) The infiltration trench should be 10 feet long, 2 feet wide, 18 inches deep, and be perpendicular to the slope (flat).
7) General flow direction and off-site discharge locations must be shown on the site plan.

Chapter 4 – Performance Approach Structural Stormwater Controls (BMPs) and Design Standards

4.1 INTRODUCTION

Chapter 4 focuses on calculation and design standards for approved BMPs. The standards in this chapter must be used when employing the Performance Design Approach outlined in **Chapter 2** to meet Retention, Treatment, and Detention requirements. The following points outline how the standards in this chapter are implemented:

1) One or multiple BMPs that provide Retention, Treatment, and Detention or a combination thereof may be incorporated at one location. For efficiency, these are referred to as Stormwater Management Facilities or SWFs in this manual.
2) All standards in this chapter shall apply as applicable to the design and construction of each SWF.
3) General Design Standards apply to all BMPs including Retention, Treatment, and Detention BMPs.
4) Standards specific to the design of Retention SWFs are separated from the General Design Standards and must be adhered to in the design of Retention facilities.
5) Design standards specific to individual BMPs are listed in the appropriate BMP section and shall govern in the case of a standard overlap or contradiction.
6) Alternative Retention, Treatment, or Detention systems not approved by this manual may be implemented on a case-by-case basis. However, alternative systems must comply with the applicable requirements in **Chapter 2** and the General Calculation and Design Standards in this chapter. Alternative system design and methodology must be submitted to and approved by the reviewing jurisdiction.

4.2 GENERAL HYDROLOGIC CALCULATION CRITERIA

This section outlines the methodology and parameters which are implemented for the design storms defined in **Chapter 2** to calculate runoff volume, storage, and peak flows.

Accepted Calculation Methodologies

Peak flow and runoff volume may be calculated using the Santa Barbara Urban Hydrograph Method (SBUH) (**Appendix C**), the Natural Resources Conservation Service (NRCS) Curve Number Method with a Type 1A rainfall distribution, or by any other method acceptable to the reviewing jurisdiction. Required storage volumes must be determined using hydrograph routing.

Contributing Drainage Area

Contributing Drainage Area is the total drainage area used to calculate peak flows and runoff volumes and includes all impervious and pervious surfaces which contribute runoff to a specific location. BMPs must be sized to accommodate all runoff from contributing drainage areas. Flows that are not required to be Retained, Treated, or Detained may be routed around a facility via a bypass structure and/or a bypass conveyance system. A contributing drainage area map must be submitted for all projects.

Time of Concentration

For the Pre-Development Hydrologic Function, the Time of Concentration is the time it takes for water to travel from the hydraulically most distant point of the drainage basin to the location where most runoff may leave the drainage basin. For the Post-Development Condition, the Time of Concentration is the time it takes for water to travel from the hydraulically most distant point of the drainage basin to the runoff location. The NRCS TR-55 method is preferred for calculation of the Time of Concentration.

Runoff CN

Runoff curve numbers (CNs) are used to categorize runoff potential based on soil type and land use. Curve numbers were developed by the NRCS and are published in the TR-55, **Table 2-2**, which is included in **Appendix D**. For the Pre-Development Condition, the CN(s) must be selected from the TR-55 **Table 2-2** and a statement must be provided in the stormwater report justifying how the CN applies to the site's Pre-Development Hydrologic Function, unless another method is approved by the local jurisdiction.

4.3 GENERAL SITING, GEOMETRIC, AND MATERIAL DESIGN STANDARDS

This section specifies general siting, geometric, and material standards, which are used along with peak flows and storage volumes to size and design all BMPs approved by this manual.

4.3.1 General BMP Design Standards: Retention

The following are general design standards that apply to facilities that provide Retention. Additional BMP specific design requirements are found in **Section 4.4** and must be followed.

1) **Retention Technical Infeasibility Criteria**: Retention facility design must comply with the Technical Infeasibility Criteria outlined in **Section 4.4.1**.
2) **Infiltration Testing**: Infiltration Testing is required for all sites. The Measured Infiltration Rate shall be determined based on infiltration testing procedures outlined in **Appendix A**, or by a protocol recommended by an Oregon registered PE or CEG.
3) **Design Infiltration Rates**: The Design Infiltration Rate shall be used in all calculations.
    a) The minimum Measured Infiltration Rate for Retention facilities shall be per **Section 2.4.1.**
    b) Design Infiltration Rates shall be determined by applying a minimum factor of safety of 3 to the Measured Infiltration Rate. An alternate factor of safety is allowed for the Ponded Retention BMP, see **Section 4.4.1**.
    c) The Maximum Design Infiltration Rate for Retention Facilities shall be 12 inches per hour.
4) **Depth to Groundwater**: A site-specific determination must be included in the Stormwater Calculation Report to ensure that the minimum separation distance from seasonal high groundwater will be achieved for proposed infiltration facilities, see **Section 2.4.1** for allowable methodologies.
5) **Retention Facility Volume**: Must be calculated using the required design storms in **Chapter 2** and one of the accepted methodologies outlined in **Section 4.2**. Stormwater outflow from the facility is calculated by applying the Design Infiltration Rate obtained per the Infiltration Testing standard. Retention Facility Sizing calculations must be performed using a hydrograph routing methodology.
6) **Isolated Retention Facilities**: If infeasible to discharge to an approved storm drain system, Retention Facilities must be designed to fully infiltrate the 25-year storm without discharge. Additionally, a designated auxiliary overflow must be provided at a safe location for storms larger than the 25-year event.

7) **Retention Facility Drain Time**: Retention Facilities must be designed to fully infiltrate or drain within six days, or as approved by the reviewing agency.
8) **Bottom Grade**: Less than 0.5% in any direction (applies to facility bottom and subgrade where infiltration is designed to occur).

4.3.2 General BMP Design Standards: All Facilities

The following are general design standards that apply to Retention, Treatment, and Detention BMPs and shall be followed when incorporating any of the items below. Additional BMP specific design standards are provided in **Sections 4.4**, **4.5**, and **4.6** below. BMP specific design standards shall govern in the case of standard overlap or contradiction.

General Geometric and Hydraulic Design Standards:

1) **Side Slope**: Maximum Grade for earth slopes within wetted area:
   a) 3H:1V Areas not mown
   b) 4H:1V Areas to be mown
2) **Maximum Depth**:
   a) Maximum ponding depth in parking lots is 9 inches. Stormwater water may not be ponded in gravel parking areas. Ponding of stormwater in landscaped areas is allowed.
3) **Safety Fencing**: Safety fences shall be installed on all facilities with any of the following conditions:
   a) Where fences are required by local building codes.
   b) The designed ponding depth is 4 feet or greater.
   c) Areas where small children are present, as required by the local building jurisdiction.
   d) Where water depths either exceed 3 feet for more than 24 hours or are permanently wet and have side slopes steeper than 3H:1V.
   e) Where slopes are equal to or steeper than 1.5H:1V.
4) **Overflow:** All facilities must be designed with an overflow structure to avoid flooding. The overflow structure shall be designed to convey the 10-year storm in conjunction with the Freeboard standards in this section.
5) **Freeboard:** Freeboard for Treatment, Retention, and Detention facilities shall be per the following:
   a) For facilities that provide treatment and/or store less than 5,000 cubic feet of water, Freeboard shall be 6 inches measured from the maximum 10-year water surface flowing over the overflow structure assuming the orifice is plugged.
   b) For facilities that store more than 5,000 cubic feet of water, Freeboard shall be 12 inches measured from the 10-year water surface or the facility overflow, whichever is higher. Accounting for flow through the orifice is allowable.
   c) For underground facilities, Freeboard shall be 6 inches measured from the maximum 10-year water surface elevation flowing over the overflow structure.
   d) For berms located inside of stormwater facilities intended to direct water for treatment or to mitigate short circuiting, Freeboard shall be 6 inches measured from the maximum water quality water surface.
6) **Berms**
   a) Berms intended to impound less than 5,000 cubic feet of water shall be constructed of suitable clayey material and shall have a minimum top width of 2 feet.
   b) Berms intended to impound greater than 5,000 cubic feet of water shall be constructed of suitable clayey material and shall have a minimum top width of 5 feet.
   c) Berms located inside of stormwater facilities intended to direct water for treatment or to mitigate short circuiting shall have a minimum top width of 12 inches.

7) **Spillways/Auxiliary Overflow:**
   a) An analysis shall be provided for all facilities to determine the surcharge release point of the stormwater facility and up-stream drainage system assuming the overflow and orifice are inoperable. The surcharge release of stormwater shall be routed to an approved location.
   b) Aboveground Spillways: Facilities using walls or berms constructed above the adjacent ground to impound water must have spillways constructed of non-erodible material which
   c) discharge to an approved location and are sized to convey the 10-year storm. For facilities storing over 100,000 cubic feet, the spillway shall be sized to convey the 25-year storm.
8) **Stormwater Facility Proximity:** The Retention or Treatment area of a Stormwater Facility must be located per the criteria below:
   a) Minimum of 10 feet from structural foundations (Impermeable Liners may be installed in-lieu of the 10-foot separation).
   b) Minimum of 10 feet from underground tanks (Impermeable Liners may be installed in-lieu of the 10-foot separation).
   c) Retention BMPs located near property lines must be designed and located such that they do not adversely affect adjacent properties.
   d) As approved by the reviewing agency.
9) **Energy Dissipation**: Energy dissipation must be placed at each entry and exit point to a facility, as well as any outfall. Energy dissipation must be constructed of non-erodible material such as concrete or rock. Rock apron energy dissipation must be sized appropriately and may not be constructed with material with a nominal gradation less than four inches.
10) **Orifice**: The minimum orifice size is 1 inch in diameter.
11) **Flow Control Obstruction Prevention**: A minimum 12-inch-deep concrete or rock lined sump must be provided below all orifices and weirs.
12) **Access**: Access for stormwater facility maintenance and inspection must be provided per the following:
   a) Public stormwater facilities – unrestricted all-weather access including to all inlets, pipe openings, and flow control structures, or as specified by the reviewing agency.
   b) Private stormwater facilities - unrestricted access, which must be traversable by maintenance vehicles during dry months.

General Material Standards:

13) **Storage Rock**
   a) Shall be Granular Drain Backfill 1½ inch to ¾ inch and installed per the applicable standard drawing.
   b) Storage rock shall be separated from growing media and/or facility subgrade, as specified on the standard drawings, or by non-woven geotextile fabric.
   c) Maximum allowable void space = 35% by volume.
14) **Impermeable Liners:** Liners shall be a minimum 30 mil ethylene propylene diene terpolymer (EPDM), High Density Polyethylene (HDPE), polyvinyl chloride (PVC), approved equal, or bentonite treated subgrade. Facilities may be partially or fully lined. Underdrains must be installed on fully lined facilities.
15) **Non-Woven Geotextiles:** Geotextiles for separating storage material from subgrade or separation rock shall be Oregon Department of Transportation (ODOT) Drainage Geotextiles Type 1, non-woven meeting ODOT Standard Specification Section 02320. Geotextile under the road base in the Vegetated Filter Strip BMP, **Section 4.5.3**, shall be Subgrade Geotextile meeting ODOT Standard Specification Section 02320.

16) **Underdrains/Piping:** Underdrains and piping shall be rigid pipe in compliance with approving jurisdictional standards and/or the current version of the Oregon Specialty Plumbing Code. Facilities with perforated underdrains must have a clean out or access point at the upstream end.

17) **Observation Port:** Facilities that utilize underground vaults of any kind must install at least one observation port and/or an access for maintenance and cleaning. Observation ports shall have a maximum spacing of 200 feet, additional observation ports may be required. Observation port piping shall be a minimum six-inch diameter non-perforated pipe. Equip the end above ground with an operable cap.

18) **Curb Openings:**
    a) Curb opening width and spacing shall be sized appropriately and constructed per Standard Detail 1.01, or as required by the jurisdictional authority.
    b) Curb openings shall have a local gutter depression of two inches.

General Natural Material Standards:

19) **Ground Stabilization:** All ground within the facility must be stabilized with one of the options below.

    a) **Hydroseeding** – Hydroseeding with tackifier.
    b) **Matting** – Matting shall be used to hold the soil in place until vegetation becomes established. If hand seeding, place seed and then install erosion control matting. If planting, install erosion control matting and then install plants through the matting. Matting is not required on slopes 4H:1V or shallower, or on slopes that have been hydroseeded. Matting must be biodegradable.
    c) **Mulch** – Mulch is not allowed below the water quality ponding depth or within the flow path of an inlet or outfall. Mulch shall be either shredded wood chips, coarse compost, or gravel. Mulch must be dye, pesticide, and weed free, spread in a minimum 2-inch layer over bare soil or in a ring around plants. Ensure that mulch does not touch plant stems.

20) **Growing Media:** Growing media can be either an imported water quality mix or amended native soil and must be provided at the depths shown on the Standard Drawings provided in **Appendix F**.

    a) Imported Water Quality Mixture – Is based on the ODOT "Water Quality Mixture" and shall be comprised of soil meeting the gradation in **Table 4.1**, and compost meeting ODOT specification Section 03020. A Seal of Testing Assurance certification from the US Composting Council must be provided to the approving jurisdiction for compost.

Table 4.1. Soil Gradation Requirements

Sieve Size	Percent Passing (by Weight)
No. 4	100
No 10	95 - 100
No. 40	40 - 60
No. 100	10 - 25
No. 200	5 - 10

    b) Mix the soil and compost so the "Water Quality Mixture":
        i) Is comprised of between 20% - 25% compost and between 75% - 80% soil.
        ii) Has a pH between 5.5 and 8.0.
        iii) Does not have clumps greater than 3 inches in any direction.
    c) Amended Native Soil - If amending native soil, add compost so that the top 18 inches is roughly 30% compost. Compost must meet ODOT specification Section 03020.

21) **Vegetation Standard**: This vegetation standard shall be implemented per the requirements in each BMP section as applicable. If this vegetation standard is not specified or implemented, all disturbed ground within a stormwater facility must be stabilized per the Ground Stabilization Standards in Section 4.3.2.18.

a) Landscape plans must be submitted per the submittal requirements outlined in Chapter 6.

b) Vegetation planting density must be provided per **Table 4.2** below, **Table 4.3** is optional.

c) As an alternative to the plant number and spacing requirements in **Table 4.2**, 100% perennial native low-mow or no-mow seed coverage may be used, density shall be per the supplier's guidelines**. Table 4.4** provides an acceptable seed mix and application rate for the Rogue Valley.

d) 90% of the Treatment area must have vegetation cover after three years. Vegetation must be maintained per the Operation and Maintenance Manual and Declaration of Covenants recorded for the facility. Irrigation, establishment period maintenance, soil depth, plant choice, and planting technique are important factors in achieving the required vegetation coverage. In-ground irrigation is strongly recommended. Additional guidance on these topics can be found in **Appendix E**.

Table 4.2 Plant Number and Spacing Requirements.

Number of Plants	Vegetation Type	Per Square Feet of BMP	Size	Spacing Density (Average on
66	Herbaceous Plants	100	Plugs or Larger	1.5 Feet
OR				
58	Herbaceous Plants	100	Plugs or Larger	1.5 Feet
4	Small Shrubs	100	1 Gallon	3 Feet to 4 Feet**
OR				
58	Herbaceous Plants	100	Plugs or Larger	1.5 Feet
4	Large Shrubs	100	1 Gallon	4 Feet to 8 Feet**
OR				
35	Small Shrubs	100	1 Gallon	3 Feet to 4 Feet**
6	Medium to Small Shrubs	100	1 Gallon	3 Feet to 8 Feet**

*To reduce erosion, plants should be randomly located, not placed in rows. The average on-center density is provided as general guidance.

**Depending on mature spread. Shrubs may be placed farther away than the density indicated.

Table 4.3 Recommended Minimum Tree Density.

Number of Plants	Vegetation Type	Per Square Feet of BMP	Size
1	Evergreen Tree	300	6 Feet Minimum Height
OR			
1	Deciduous Tree	300	1.5 Inches Minimum Diameter*

*Measured at a height 6 inches above the base.

Table 4.4 Optional/Acceptable Seed Mix and Application Rate for the Rogue Valley.

Species	PLS lbs/ac
Agropyron spicatum (Bluebunch Wheatgrass)	12
Elymus trachycaulus (Slender wheatgrass)	12
Elymus elymoides (Bottlebrush Squirreltain)	3
Poa Sandbergii (Sandberg Bluegrass)	2
Total PLS lbs/ac	**29**

4.4 RETENTION BMPS

Retention BMPs are designed to hold and infiltrate site runoff for treatment and limit the volume of downstream discharge. Retention BMP design must comply with the Retention and Water Quality Requirements in **Chapter 2**, Retention and General Design Standards in **Chapter 4**, and the specific requirements in each BMP section.

4.4.1 Ponded Retention BMP (Rain Garden/Retention Ponds and Stormwater Planters)

Figure 4.1. An established Rain Garden on a commercial lot, view from an inlet (left), and looking into the facility inlet (right).

Rain Gardens and Retention Ponds impound stormwater runoff above-ground in low lying areas allowing the runoff to infiltrate into the existing subgrade/ground beneath the facility (**Figure 4.1**). Stormwater planters may be either in-ground or above-ground (**Figure 4.2**) and have vertical sides created by curbs, walls or containers. Runoff typically enters the facility above ground via sheet flow, curb cuts, pipes, and/or gutter downspouts. The stormwater will infiltrate into the open bottom of the facility then into the existing subgrade.

A single stormwater planter cell may be installed on flat areas (as smooth as practical). On sloping ground, a stormwater planter may incorporate check dams to create a series of cells where overflow may occur in the lowest elevation cell (**Figure 4.2**).

Figure 4.2. A single basin in-ground Stormwater Planter (left), and an in-ground Stormwater Planter with separate cells (right) to allow the water to pond and overflow to each cell down the facility.

Performance Design Approach and Specific Design Standards:

1) Ponded Retention BMP design must comply with the Retention and Water Quality Requirements in Chapter 2 and the Retention and General Design Standards in this chapter.
2) An Infiltration Rate safety factor of 2 may be applied if the ground within the Ponded Retention area is fully vegetated per the standards in Section 4.3.2.20 of this chapter. Otherwise, if not fully vegetated, the facility must be stabilized per the Ground Stabilization standards in Section 4.3.2.18 of this chapter and an Infiltration Rate safety factor of 3 must be applied.
3) Facility must be constructed per the applicable Standard Drawings provided in **Appendix F**.

4.4.2 Pervious Surface Retention BMP

Pervious surfaces (also known as permeable pavements and porous pavements) are stormwater management facilities that allow water to move through void spaces within the pavement surface and rock below and infiltrate into underlying soils.

Figure 4.3. Permeable Pavers intercept rainfall and infiltrate it into the ground, the catch basin will only receive runoff from large storm events.

Pavement Surface Types Overview

Pervious Asphalt and Pervious Concrete. Pervious asphalt and pervious concrete are similar to their impervious counterparts but are made with "open-graded aggregate", which includes few to no fines (*i.e.* small particles). When bound together, interconnected voids between the aggregate allow water to flow through.

Permeable Pavers. Permeable pavers are paver units of stone, concrete or other durable impervious material with gaps between or within the pavers that provide voids for water to reach sub-soils. Pervious commercial pavers, like pervious concrete discussed above, are now available and may not need space between them.

Flexible Paving Systems. Flexible paving systems are prefabricated grids made of plastics or other solid materials finished with clean sand/gravel or turf. Grids with pervious media provide a stable surface and sometimes resemble lawn.

Pervious Gravel. Conventional gravel surfaces (*i.e*. without a permeable sub-base) are not inherently free draining. During conventional gravel pavement installation, soil is compacted to support vehicular loads, and gravel with many small particles, usually a material like "¾-inch minus drain rock", is installed and compacted in lifts (*i.e.* smaller portions of the total depth). This results in a low void ratio with little storage for stormwater.

Pervious gravel driveways and walkways are alternatives that can be especially helpful in retrofit situations where drainage problems exist. To create a pervious gravel pavement, specify Granular Drain Rock ¾-inch to ½-inch, which is the same material used as base rock in other pervious surfaces and has no fine particles.

Site Suitability & Other Considerations:

Pervious surfaces should be placed on compacted soil per the manufacturer or design engineer's recommendation and should not be located at sites with high incidence of fine aggregate materials, soils, or other materials that would readily clog the pervious surface. Sites that may be poor locations for pervious surfaces include home improvement stores, aggregate or soil supply businesses, and concrete contractor yards.

This manual covers the design of stormwater management facilities only. It is suggested that the pervious pavement structural section be designed by a professional engineer or manufacturer's representative to accommodate the anticipated loading (vehicle or otherwise) assuming a saturated sub-base. This is especially important if any heavier vehicles are expected such as delivery trucks, buses, or garbage trucks.

Performance Design Approach and Specific Design Standards:

1) Jurisdiction of the subject right-of-way must approve all pervious surfaces within the right-of-way.
2) Pervious Surface Retention BMP design must comply with the Retention and Water Quality Requirements in **Chapter 2** and the Retention and General Design Standards in this chapter.
3) Facility must be constructed per the applicable Standard Drawings provided in **Appendix F.**
4) Finish grade must be < 8.0%.
5) Pervious surfaces must be hydraulically isolated, meaning the surface only receives direct rainfall and does not receive run-on from any other areas. If the Pervious Surface receives run-on from other areas, it must be designed per the Underground Retention BMP standards.
6) Signage - Signs must be installed identifying the surface as pervious and indicating that stockpiling and sealing are not allowed on the surface.

4.4.3 Underground Retention BMP

Underground Retention occurs when stormwater is stored below the ground surface until it infiltrates into the subgrade/soil below. Stormwater can be stored within the voids of rock and/or within open bottom chambers. These facilities can be located below landscaping or paved areas.

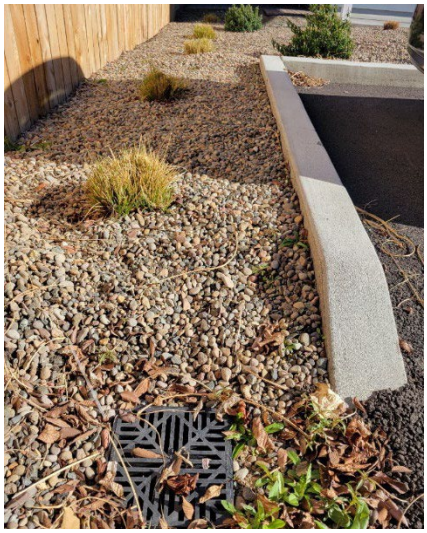

Figure 4.4. Underground chambers (left) are one example of underground Retention when designed to fully infiltrate the Retention storm. Underground Retention can also be designed under a landscape area (right).

Performance Design Approach and Specific Design Standards:

1) Underground Retention BMP design must comply with the Retention and Water Quality Requirements in **Chapter 2** and the Retention and General Design Standards in this chapter.
2) Facility must be constructed per the applicable Standard Drawings provided in **Appendix F** or per the manufacturer's standard drawings for approved proprietary facilities.
3) Pretreatment – To prevent clogging from sediment, pretreatment must be included. Options for pretreatment include inlet sumps, filtration through soil with geotextile separation, a proprietary system with filter media, or if runoff will only be from roofs, gutters or screens may be used.
4) UIC guidance – It is likely that underground retention BMPs are considered Underground Injection Control facilities and may need to be authorized by DEQ. Visit DEQ's UIC webpage or refer to the DEQ Fact Sheet titled "Identifying an Underground Injection Control" for more information.

4.5 TREATMENT BMPS

4.5.1 Soil Filtration BMP (Rain Gardens and Stormwater Planters with Underdrains)

Soil Filtration BMPs collect stormwater and route it through facility substrate, which is typically imported soil and drain rock. The filtration capacity of this BMP is determined by the hydraulic loading of the facility and the infiltration rate of the imported soil. Runoff is captured by subsurface underdrains and routed to an approved discharge location.

Figure 4.5. Stormwater Planters located flush with a public building (left), a fully-lined residential above-ground Stormwater Planter with an underdrain (upper right), and a newly constructed above-ground Stormwater Planter with an underdrain (lower right).

Performance Design Approach and Specific Design Standards:

1) Soil Filtration BMP design must comply with the Treatment and Water Quality Requirements in Chapter 2 and the General Design Standards in this chapter.
2) Facility must be constructed per the applicable Standard Drawings provided in **Appendix F**.
3) Soil Filtration BMP sizing calculations must be performed using hydrograph routing methodology. The facility size is determined by routing the Treatment inflow of the facility versus the infiltration rate (outflow) of the imported soil.
    - The hydraulic loading of the facility is determined per the Hydrologic Design Criteria in this chapter.
    - Soil Filtration BMP shall be sized with a maximum Design Infiltration rate of 12 inches per hour. If using the imported water quality soil mixture, it can be assumed to have an infiltration rate of 12 inches per hour.
4) Underdrains must be sized to accommodate the maximum design flow rate for the facility, *i.e*. peak water quality flow rate or peak detention flow rate as applicable.
5) Bottom Slopes must be 0 to 1% slope, SWFs with steeper slopes must use check dams to distribute the water.

4.5.2 Water Quality Swale BMP

Water quality swales treat stormwater by conveying it through the substrate and vegetation. Treatment is achieved by filtration and settlement as the water slowly flows through the facility. Swales must be planted with dense vegetation in the Treatment zone to filter the stormwater.

Figure 4.6. A Water Quality Swale with dense mature vegetation that provides filtering of stormwater runoff.

Performance Design Approach and Specific Design Standards:

1) Water Quality Swale BMP design must comply with the Treatment and Water Quality Requirements in **Chapter 2** and the General Design Standards in this chapter.
2) Facility must be constructed per the applicable Standard Drawings provided in **Appendix F**.
3) Vegetation - All ground within the treatment area of the Water Quality Swale BMP must be vegetated per the Vegetation standards in **Section 4.3.2.20** of this Chapter.
4) Swale Length - Water Quality Swale length shall be calculated based on a minimum residence time of 9 minutes. Residence time of less than 9 min may be allowed for up to 25% of the total runoff that enters the swale via sheet flow or curb cuts along the swale length. Check dams must be installed downstream of these locations per the requirements of this section.
5) Roughness Coefficient - Manning's n value must be a value between 0.22 and 0.24.
6) Flow Depth - Maximum depth of the water quality flow is 4 inches.
7) Bottom Width
    a) Bottom width = 1 foot minimum and 10 foot maximum
    b) If the bottom width is wider than 4 feet, flow spreaders or check dams are required every 50 feet.

8) Longitudinal Slope
   a) Minimum slope = 0.5%
   b) Check dams must be installed on longitudinal slopes greater than 6%.
9) Check Dams - Must be constructed of non-biodegradable material such as concrete or rock. Check dams must have a flat top and be installed per the standard drawings in **Appendix F**.
10) Flow Spreaders – Must be constructed of non-biodegradable materials per the Standard Detail in **Appendix F**.

4.5.3 Dispersion BMP (Vegetated Filter Strips & Disconnected Downspouts)

Dispersion is a BMP that spreads runoff over a landscape area specifically to reduce pollution and runoff velocity. Dispersion is suitable for various applications that generate relatively small amounts of runoff and/or for runoff that enters the facility in the form of sheet flow.

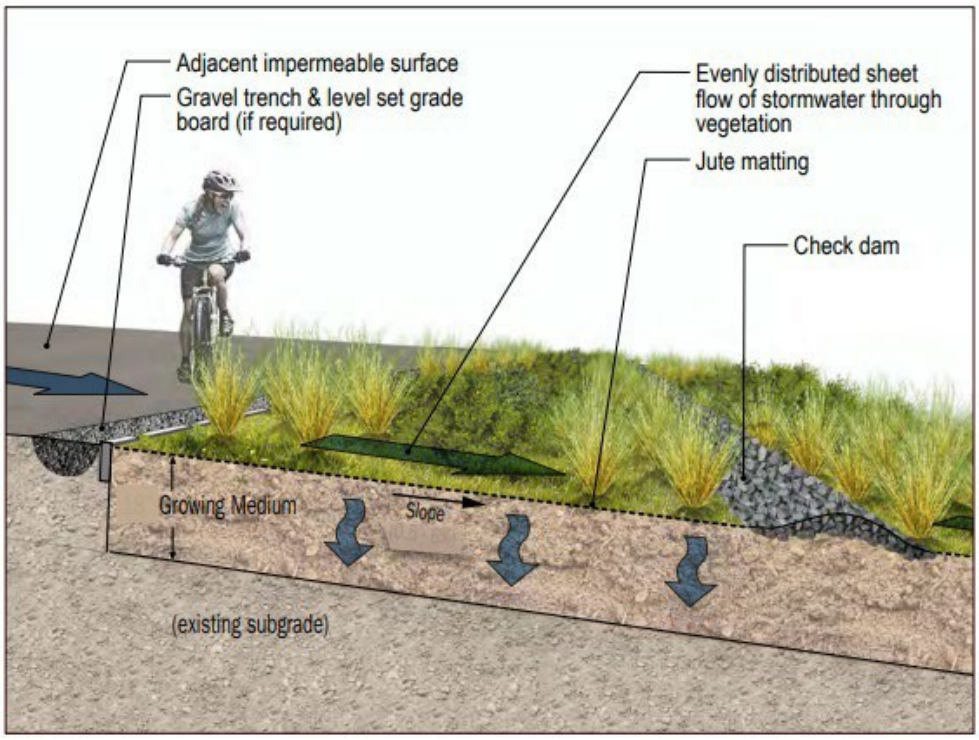

Figure 4.7. Schematic of a Vegetated Filter Strip courtesy of Clean Water Services LIDA Handbook.

Vegetated Filter Strips can be installed along linear features such as roadways, walkways, and patios. Vegetated filter strips typically run parallel to an impervious surface, are gently sloped away from the impervious surface, and must be completely vegetated to filter and reduce velocity as runoff flows through the facility.

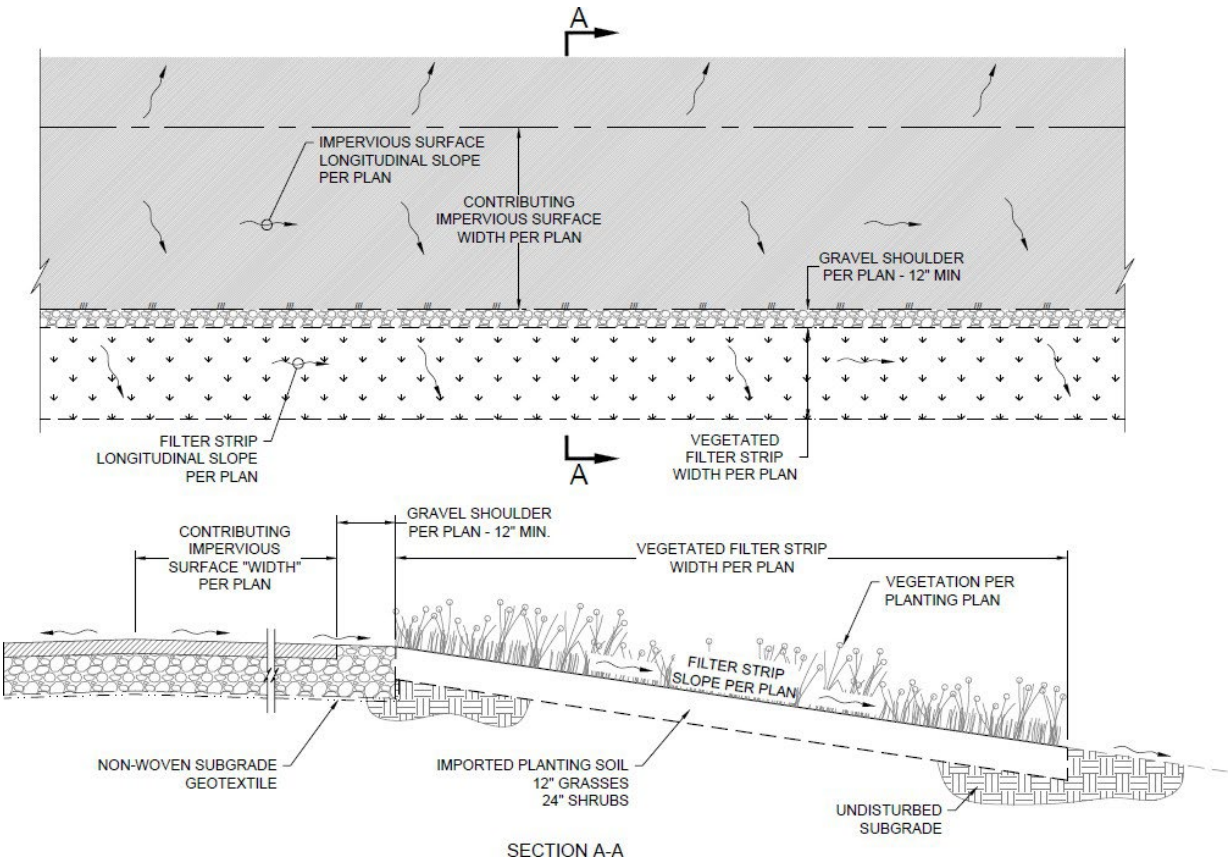

Figure 4.8. Vegetated filter strip general layout along a roadway.

Performance Design Approach and Specific Design Standards:

1) The Vegetated Filter Strip BMP design must comply with the Treatment and Water Quality Requirements in Chapter 2 and the General Design Standards in this chapter.
2) Facility must be constructed per the applicable Standard Drawings provided in **Appendix F**.
3) Vegetation - All ground within the treatment area of the Vegetated Filter Strip must be vegetated per the vegetation standards in Section 4.3.2.20 of this Chapter.
4) Maximum contributing impervious surface "width" prior to entering the facility is 75 feet as measured along the sheet flow drainage path or x-slope of the impervious surface draining toward the Vegetated Filter Strip.
5) Maximum slope of impervious surface up-stream of the facility is 5%.
6) Maximum longitudinal slope of impervious surface is 4%.
7) Maximum longitudinal slope of Vegetated Filter Strip is 2%.
8) The width of the Vegetated Filter Strip is sized based on the design slope of the Vegetated Filter Strip and the width of the impervious surface draining to the Vegetated Filter Strip, which is measured along the x-slope or flow path. **Table 4.5** shows treatment capacity of 1 foot of Vegetated Filter Strip at specific design slopes.
9) Signage – Signs must be installed identifying each end of the Vegetated Filter Strip, longitudinally. Alternatively, a decorative or utilitarian fence can be installed around the facility.

10) Gravel Shoulder – Minimum 12-inch gravel shoulder must be provided between the impervious surface and filter strip. Non-woven roadway geotextile fabric must extend under the shoulder from roadways.

Table 4.5. Vegetated Filter Strip Treatment capacity vs. design slope

Allowable Vegetated Filter Strip Slopes (%)	Treatment Capacity of 1 Foot of Vegetated Filter Strip Width, Listed in Contributing Impervious Surface Width (feet)
0.5% - 2%	4 Feet (Impervious. Surface Width)
2% - 5%	3 Feet (Impervious Surface Width)
5% - 10%	2 Feet (Impervious Surface Width)
10% - 15%	1.5 Feet (Impervious Surface Width)

Example: A Vegetated Filter Strip with a design slope of 4% is to be installed along a standard crowned roadway. The roadway measures 30 feet from edge of asphalt to crown.

$$\text{Vegetated Filter Strip width} = \frac{impervious\ surface\ width\ (ft)}{Treatment\ Capacity\ \left(\frac{ft}{ft}\right)} = \frac{30ft}{3\left(\frac{ft}{ft}\right)} = 10 \text{ foot wide Vegetated Filter Strip}$$

Disconnected Downspouts direct runoff from downspouts or underground drainpipe to a landscaped or mulched area for infiltration and/or filtration in-lieu of discharging directly to a municipal storm drain system. The Disconnected Downspout BMP is only allowed for projects that Develop or Redevelop less than 10,000 square feet of impervious surface. See the Simplified Approach in Chapter 3 for implementation standards.

Figure 4.9. Disconnected Downspout to a Pervious Surface

4.5.4 Water Quality Settling Basin BMP (formerly Extended Detention)

The Water Quality Settling Basin BMP releases stored runoff at a controlled rate over a specified period of time and achieves longer Detention times than with standard Peak Flow Control Detention. This is accomplished by designing the Water Quality Settling Basin to achieve a minimum Detention Time rather than controlling the maximum Peak Flow Rate. Temporary ponding enables particulate pollutants to settle out and reduces the maximum peak discharge to the downstream channel.

Figure 4.10. Example of a Water Quality Settling Basin with a vegetated baffle system to lengthen the distance from the inlet and outlet.

Performance Design Approach and Specific Design Standards:

1) Water Quality Settling Basin design must comply with the Treatment and Water Quality Requirements in Chapter 2 and the General Design Standards in this chapter.
2) Facility sizing calculations must be performed using hydrograph routing methodology.
3) Facility must be designed with a minimum water quality detention time of 24 hours. The water quality detention time is defined as the time to empty the pond from the maximum ponded water surface. The pond shall be considered empty when the calculated water depth is 0.5 inch.
4) If the Contributing Drainage Area requires a smaller orifice than 1 inch to attain a Detention Time of 24 hours, this BMP may not be used.
5) The minimum length-to-width ratio of the facility is 3L:1W at the maximum water surface elevation. If this ratio cannot be maintained the basin must be equipped with baffles or islands to increase the flow distance between inlet and outlet.
6) The distance from the inlet and outlet of the pond must be maximized to facilitate sedimentation.
7) Growing media must be at a depth of either a minimum of 12 inches of imported soil or 18 inches of amended native soil and must meet the Growing Media standards in Section 4.3.2.19. All ground within the facility must be stabilized per the Ground Stabilization Standards in Section 4.3.2.18.
8) The maximum ponded depth for water quality shall be 4 feet.

9) Forebay – Must be provided on aboveground ponds with bottom areas greater than 300 square feet. A pre-treatment (sedimentation) manhole may be used in-lieu of a forebay for ponds with bottom areas less than 1,000 square feet. Forebays and/or pre-treatment manholes must comply with the following standards as applicable:
   a) Forebays must segregate the first 25% of the pond area directly downstream of the inflow to the pond.
   b) Forebay berms must be constructed of non-erodible material such as concrete, masonry, or rock no smaller than 4 inches.
   c) Rock Forebay berm cross section must be generally trapezoidal with a height of 12 inches, a 2-foot minimum top width, and 2H:1V front and back slopes.
   d) Pre-treatment manhole must have an oil/water separation mechanism, minimum diameter of 48 inches, and minimum sump depth of 24 inches.

4.5.5 Proprietary Treatment BMP

Proprietary treatment devices provide water quality treatment by filtering stormwater, or by some other approved method, and are usually installed below grade.

Figure 4.11. Filterra Units (left) and Filter Cartridge Units (right) are examples of proprietary Treatment devices that meet the requirements of this Design Manual.

Performance Design Approach and Specific Design Standards:

1) The Proprietary Treatment BMP design must comply with the Treatment and Water Quality Requirements in Chapter 2 and the General Design Standards in this chapter.
2) Justification – If a proprietary system is chosen that does not utilize growing media, a statement of why the proprietary system is chosen in-lieu of a BMP with growing media must be included in the calculation report.

4) Facility sizing calculations must be performed using hydrograph routing methodology or other methodology accepted by the reviewing agency.
5) UIC Guidance – Some proprietary treatment devices that store water underground may be considered Underground Injection Control facilities and may need to be authorized by DEQ. Visit DEQ's UIC webpage or refer to the DEQ Fact Sheet titled "Identifying an Underground Injection Control" for more information.
6) The proposed treatment device must meet one of the following criteria:
    a) On the Washington Department of Ecology's Technology Assessment Protocol – Ecology (TAPE) Approved Stormwater Technologies List, https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies. Devices from the TAPE approved list must meet the following criteria:
        i. Devices must have a General Use Level Designation (GULD) or a Conditional Use Level Designation (CULD).
        ii. Devices must comply with the Treatment Standards in **Section 2.3** of this manual. Treatment Standards for suspended solids will be considered met for devices designated by TAPE for Basic Treatment.
    b) On the list of Pre-Approved Proprietary Stormwater Treatment Technologies, located in **Appendix G**. The devices listed in Appendix G have been evaluated by the SWAT and determined to meet the treatment requirements of the Rogue Valley Stormwater Design Manual. Individual jurisdictions which make up the SWAT may have separate or alternative requirements for specific proprietary treatment devices. These jurisdictions must be consulted for individual project compliance.

4.5.6 Vegetated Roof BMP

Vegetated roofs manage stormwater by holding direct rainfall in the imported growing medium and drainage layer (if used) to be used by the associated vegetation. While the term "green roof" is a more commonly used term, the term "vegetated roof" is more appropriate for much of Oregon, which has dry summers, where some plants are dry and inactive until the rainy season begins again.

Evaporation from the growing medium and evapotranspiration from the plants releases a high volume of moisture back into the atmosphere, even in winter, which is unique amongst all the BMPs in this guidance. Vegetated roofs usually consist of a waterproof membrane, an optional drainage layer, an engineered growing medium or soil, a layer of plants and optional mineral mulch for non-irrigated systems.

Figure 4-12. Vegetated Roof example on a convenience store.

Performance Design Approach and Specific Design Standards:

1) Facility must be designed to meet the water quality requirements in Section 2.4
2) Performance Design Approach must be performed by an Oregon registered PE or CEG.
3) The roof must be vegetated per the Vegetation standards in Section 4.3.2

Vegetated Roof BMP Specific Design Considerations:

Depending on the scale and complexity of the project, the design of vegetated roofs may involve a number of licensed professionals, including a structural engineer, landscape architect, architect, and/or a "Green Roof Professional" (Green Roofs for Healthy Cities, GRP Accreditation). Refer to local building codes and jurisdiction for requirements. The final design will be determined by the licensed professional in responsible charge of the project.

4.6 DETENTION BMP (FLOW CONTROL)

Detention facilities are intended to prevent an increase in peak flow runoff and preserve capacity of downstream storm drains and drainage ways. Detention facilities store runoff that is then slowly released though a designed flow control mechanism such as an orifice, weir, or pump.

Many Retention and Treatment BMPs can provide Detention by incorporating a flow control structure that is typically installed to drain water above the required Retention volume. Detention may also be provided in a facility designed exclusively for storage, such as underground piping, storage rock, vaults or parking lots.

Figure 4.13. A Detention Basin designed to capture and temporarily hold Peak Runoff that is then slowly released through the control structure.

Performance Design Approach and Specific Design Standards:

1) The Detention BMP design must comply with the Peak Flow Control: Detention Standards in Chapter 2 and the General Design Standards in this chapter.
2) Sizing - Facility sizing calculations must be performed using hydrograph routing methodology.
3) Forebay – Must be provided on aboveground ponds with bottom areas greater than 300 square feet. A pre-treatment (sedimentation) manhole may be used in-lieu of a forebay for ponds with bottom areas less than 1,000 square feet. Forebays and/or pre-treatment manholes must comply with the following standards as applicable:
   a) Forebays must segregate the first 25% of the pond area directly downstream of the inflow to the pond.
   b) Forebay berms must be constructed of non-erodible material such as concrete, masonry, or rock no smaller than 4 inches.
   c) Rock Forebay berm cross section must be generally trapezoidal with a height of 12 inches, a 2-foot minimum top width, and 2H:1V front and back slopes.
   d) Pre-treatment manhole must have an oil/water separation mechanism, minimum diameter of 48 inches, and minimum sump depth of 24 inches.
4) UIC guidance – If Detention is being provided in an underground facility, it may be considered an Underground Injection Control facility and may need to be authorized by DEQ. Visit DEQ's UIC webpage or refer to the DEQ Fact Sheet titled "Identifying an Underground Injection Control" for more information.

Chapter 5 - Stormwater Facility Maintenance and Operation Requirements

The Stormwater Facilities Operation and Maintenance Manual (O&M Manual) provides the actions needed to keep the stormwater facility (SWF) operating as designed. The O&M Manual is to be submitted as a separate document from the Stormwater Calculation Report for review and approval. The Declaration of Covenants, contained within the O&M Manual, describes the legal responsibilities of the property owner. The entire O&M Manual is to be recorded on the deed of the property and a scan of the final recorded document sent to the approving agency. Agency approval of a project will not be issued until the final O&M Manual is received.

An annual inspection of all SWFs is required, some aspects of the SWF must be inspected during a storm event, refer to the Maintenance Checklists. The property owner must keep a copy of the approved O&M Manual on the property and is responsible for ensuring that maintenance is performed, and records kept, even if maintenance is delegated to a third party.

5.1 OPERATION AND MAINTENANCE ENFORCEMENT

Long term operation and maintenance of structural stormwater controls is required. Oversight inspections by the local approving jurisdiction will be carried out periodically to ensure SWFs are being maintained to function as designed. Failure to properly operate and maintain a SWF may result in financial penalty through the approving jurisdiction's ordinance.

5.2 REVISIONS TO APPROVED STORMWATER FACILITY

Altering an approved SWF may require revised stormwater calculations or civil plans. If a property owner plans to change the design of an approved stormwater facility, they must contact the approving jurisdiction to determine what document revisions will be required. Revisions that must be reviewed include changes to the: inlet structure, discharge structure, facility size, facility slopes, vegetation location or vegetation quantity.

5.3 REMOVAL OF STORMWATER FACILITY DUE TO REDEVELOPMENT

Prior to removing an approved SWF due to redevelopment, a new stormwater management plan and a new O&M Manual must be submitted for review and approval.

5.4 POLLUTION PREVENTION/SPILL RESPONSE

Best Management Practices must be implemented on all sites to prevent stormwater contamination. Spills should be cleaned up following best management practices and should never be washed into a SWF. If a spill occurs in the SWF, contact the approving jurisdiction immediately. Document date and time, weather conditions, what spilled, approximately how much, and any corrective action taken.

5.5 OPERATION AND MAINTENANCE MANUAL CONTENTS

The O&M Manual details who is responsible for maintenance, provides SWF access and design details, describes required and suggested maintenance activities, includes a log-sheet for recording maintenance actions, and a hazardous spill response fact sheet. A fillable pdf template for the O&M Manual is provided in **Appendix H** for download and must be used.

Contact Information Form: The entire form must be completed. If contact information ever changes, an updated form must be provided to the reviewing jurisdiction. If a third party will be responsible for operation and maintenance, the Responsible Party Designation form must be completed.

Declaration of Covenants (DoC): The DoC details the legal responsibilities of the property owner. This must include a legal description or the Instrument number for the tax lot(s). The Instrument Number for a tax lot can be obtained from Jackson County's property database. Enter the address or tax lot in the search criteria, then click on "*Assessment and Planning Details*", click on "*Account Detail*", scroll down to "*Sales Data"* to view the Instrument Number. Each jurisdiction adopting this manual will have its own DoC, which must be obtained from them. A DoC is not required for SWFs that will be publicly maintained.

Stormwater Facility Plans: The approved plans for the SWF, including the plan view and details, must be included in the O&M Manual. Only plan sheets pertaining to the SWF design and construction should be included. Plan sheets can be no larger than 8.5 by 14 inches for recording.

Inspection and Maintenance Action Checklists: Standard maintenance checklists are provided for download and are included in **Appendix H** for reference. The checklists provide a list of conditions to look for and state whether maintenance is required or suggested should the condition exist. Select only the applicable checklists for the site's stormwater facility and include them in the O&M Manual. If a proprietary structure is used, the manufacturer's maintenance documents must be included. The date of inspection as well as whether maintenance is needed should be documented on the checklist.

Maintenance Record: A generic maintenance record is provided; however, a site specific one can be created as long as it documents inspection dates, items inspected, and dates of any repair work and a description of work completed. Except for trash removal, all actions specified as required on the checklists must be documented. Invoices and work orders for actions taken should be kept as documentation. Records shall be kept for five years and made available to the approving jurisdiction upon request. Whether the facility is operated and maintained by the property owner, or a third party, it is ultimately the property owner's responsibility to ensure that maintenance occurs as required and that records are kept detailing maintenance actions.

Spill Response Guidance: Spills should not be allowed to enter public or private stormwater facilities. A DEQ Fact Sheet for responding to spills is included in the O&M Manual.

Chapter 6 – Performance Approach Submittal Requirements

6.1 INTRODUCTION

This chapter defines requirements for design calculations, construction plans, landscape plans, and operation and maintenance plans that must be submitted to ensure compliance with stormwater management requirements of this Design Manual. Stormwater management facilities (SWF) designed with the Simplified Approach (refer to **Section 2.7.1**) do not need to be prepared by a licensed engineer and can utilize the submission documents in **Appendix B**. Stormwater facilities designed with the Performance Approach (refer to **Section 2.7.1**) must follow the submission requirements outlined in this chapter.

6.2 PLAN REQUIREMENTS

Stormwater construction plans must be submitted for review in electronic format. Plans must include the following information:

1) North arrow and scale;
2) Site street address;
3) Project location map;
4) Grading with existing and proposed topography;
5) Existing and new utilities;
6) Existing and new storm drain conveyance, including conveyance to and from the SWF;
7) Site plan with existing and proposed impervious surfaces;
8) Erosion prevention and sediment control plans, as applicable;
9) Relevant standard details;
10) ROW, easements, property lines and setbacks;
11) Any areas of special note i.e., drinking water wells, contaminated soils, steep slopes, waterways, wetlands, riparian buffers;
12) Plan view of any SWFs; with all elevations and dimensions necessary to complete calculations in the SWF report and build the SWF;
13) If the site will contain multiple SWFs, each SWF must be clearly numbered/named and match the numbering/naming in the Stormwater Calculation Report;
14) Profile view of SWF(s) with related elevations and dimensions to complete calculations in the SWF report and build the SWF;
15) Detail(s) for the SWF inlet and outlet structure with related elevations and dimensions to complete calculations in the SWF report and build the SWF;
16) Proposed stormwater discharge location(s);
17) Observation ports and cleanouts, as applicable; and,
18) Standard Drawings, General Notes and specifications for the SWF.

6.3 LANDSCAPE SUBMITTAL REQUIREMENTS

Landscape specifications and plans are required for all SWFs requiring vegetation. At this time, there is no required species list for vegetated SWFs; however, species should be drought tolerant and carefully selected for the site conditions, refer to **Appendix E**, Criteria for Choosing Plants, for guidance. Landscape specifications and plans must include:

1) Delineation of all vegetation to be preserved on-site;
2) Statement on whether imported or amended soil will be used and reference to the soil specifications from the required General Notes. The required General Notes must be included in the construction plan set;
3) A planting plan that indicates the size, species and location, by hydrologic zone, of all plants within the facility. See **Appendix E**, **Figure E.1** for guidance on hydrologic zones, as well as the standard drawings for the BMP chosen;
4) Plant table that contains scientific and common names, plant size, number and spacing;
5) If applicable, seed mix type and PLS lbs/ac;
6) Location of any proposed or existing trees to be used for SW credits.

6.4 STORMWATER CALCULATION REPORT

Design calculations per **Chapter 4** of this manual must demonstrate that Retention, Treatment, and Peak Flow control is provided for all runoff generated from developed or re-developed impervious surfaces on the subject property. A Stormwater Calculation Report must be submitted that includes the following:

1) Cover sheet which includes project name, property owner's name, site street address, map and tax lot, submission/revision date;
2) Page numbers on each page of the document (can be hand numbered);
3) Engineer of record's contact information, Engineer's stamp (only required for facilities treating 10,000 sf or more of impervious surface and/or providing flow control);
4) A short narrative to explain the project, state the type of SWF that is proposed, and how the SWF design meets the requirements of the Rogue Valley Stormwater Quality Design Manual (RVSQDM);
5) If the site will contain multiple SWFs, each SWF must be clearly numbered/named and match the numbering/naming on the plans;
6) If technical infeasibility for retention is claimed, per **Section 2.4.1**, a technical justification must be provided in the form of a site-specific hydrologic or design analysis conducted or endorsed by an Oregon registered Professional Engineer (PE) or Oregon Certified Engineering Geologist (CEG) demonstrating the presence and extent of infeasibility factors that exist on the site;
7) If a proprietary system, not utilizing growing media is chosen, provide a justification for the choice;
8) Contributing Drainage map showing on and offsite stormwater flows for each stormwater facility;

9) A map showing existing contours or grades a distance of 100 ft from the project area, which can be shown on the drainage map;

10) Site conditions including soil types, existing contours and proposed impervious surfaces;

11) Infiltration testing report form;

12) Values of impervious area acreage to be developed/redeveloped, and final pervious area acreage;

13) Total site disturbance area acreage;

14) A statement on why the chosen Curve Number is appropriate for the project site;

15) Pre- and Post-development Time of Concentration calculations;

16) Design assumptions used to size SWF including variables and their sources, design storms, and software used;

17) Design calculations, as required for each facility;

18) For each facility using the Performance Design Approach provide the following hydrographs and peak flow calculations as applicable (refer to **Chapter 2**):

    a) Retention Storm: Pre-development, post-development and facility routing hydrographs,

    b) Treatment Storm: Post-development and facility routing hydrographs,

    c) Peak Flow Control: Pre-development, post-development and facility routing hydrographs,

    d) Overflow: Post-development and facility routing hydrographs;

19) Bypass calculations (only for facilities treating 10,000 sf or more of impervious surface and/or provide flow control); and,

20) Statement that access is provided to the SWF for maintenance:

    a) Public stormwater facilities: Must provide unrestricted all-weather access to all inlets, pipe openings, flow control structures, or as specified by the reviewing agency.

    b) Private stormwater facilities: Must provide unrestricted access, which must be traversable by maintenance vehicles during dry months.

6.5 PROPRIETARY SYSTEMS

If a proprietary system will be used, in addition to the items in **Section 6.4**, the Stormwater Calculation Report must include the following:

1) Documentation from the manufacturer supporting the selected facility type and size.

2) Design layout and specifications from the manufacturer for any proprietary SWF.

3) All applicable standard drawings from the manufacturer.

6.6 OPERATIONS AND MAINTENANCE PLAN

Operation and maintenance plans are required for all stormwater facilities, refer to **Chapter 5**, the provided template must be used. A Declaration of Covenants is not required for publicly maintained facilities.

6.7 STORMWATER FACILITY EASEMENT

Stormwater facilities that will be publicly maintained will require the owner to provide a Stormwater Facility Easement. The easement will allow the jurisdiction access to the property for the purpose of constructing, installing, maintaining, and/or inspecting the SWF.

DEFINITION OF TERMS

Best Management Practices (BMPs): Schedules of activities, prohibition of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the state. BMPs also mean treatment requirements, operating procedures, and practices to control runoff, spillage, or leaks, sludge, or waste disposal, or drainage from raw material storages. See EPA 40 CFR § 122.2 and 122.44(k). For the purposes of this permit, BMPs are synonymous with structural and non-structural stormwater controls and include the schedule of activities, controls, prohibition of practices, maintenance procedures, and other management practices designed to prevent or reduce pollution.

BMPs, Non-Structural: Intangible methods of stormwater management including pollution removal standards, ordinances governing stormwater management, and public education on stormwater quality.

BMPs, Structural: The design and construction of physical structures that provide stormwater management. Structural BMPs are described in **Chapter 3** and **Chapter 4** of this Manual.

Check Dam: A structure constructed perpendicular to the flow path to slow water.

Cleanout: An access point for cleaning out a pipe.

Common Plan of Development: A contiguous construction project or projects where multiple separate and distinct construction activities may be taking place at different times on different schedules, but under one plan.

Construction Activity: Includes, but is not limited to, clearing, grading, excavation, and other site preparation work related to the construction of residential buildings and non-residential buildings, and heavy construction (for example, highways, streets, bridges, tunnels, pipelines, transmission lines, and industrial non-building structures).

Contributing Drainage Area: The total drainage area used to calculate peak flows and runoff volumes and includes all impervious and pervious surfaces that contribute runoff to a specific location.

Control Structure: A device used to hold back or direct a calculated amount of stormwater to or from a stormwater management facility. Typical control structures include vaults or manholes fitted with baffles, weirs, or orifices.

Conveyance: The transport of stormwater from one point to another.

Destination: The ultimate discharge point for stormwater from a particular site. Destination points can include drywells and sumps, soakage trenches, ditches, drainage ways, rivers and streams, off-site storm pipes, and beneficial uses or re-uses.

Detention: See Peak Flow Control.

Detention Facility: A facility designed to receive, hold, and release stormwater at a rate no greater than the peak flow rate from the pre-developed condition. The volume of water required to achieve the detention requirement can be ponded above ground or stored underground in chambers, vaults, pipes, or available void spaces in rock or soil. The full volume of stormwater that enters the facility is eventually released.

Detention Time: The time to empty the pond from the maximum ponded water surface.

Development: Any human-induced conversion of previously undeveloped or pervious land to impervious surfaces whether public or private, including but not limited to construction, installation, or expansion of a building or other structure, land division, street construction, drilling, and site alteration such as dredging, grading, paving, parking or storage facilities, excavation, filling, or clearing.

Energy Dissipation: Rock, or other material, used to reduce the erosive force of water.

Erosion: A mechanical process of soil movement by water or wind.

Erosion Control Matting: A product made of various materials including straw, coconut fiber, and jute that is attached to the soil to reduce exposure of the soil to wind and precipitation, which cause erosion.

Evapotranspiration: The sum of evaporation and transpiration of water from the earth's surface to the atmosphere. It includes evaporation of liquid or solid water plus the transpiration from plants.

Factor of Safety: A sizing multiplier that evaluates the risks and values of specific conditions, including the failure mode of the construction material, unexpected construction deficiencies, and potential cost of system failure. The safety factor is applied to the maximum performance limit to calculate a risk-based design value used for sizing facilities. A safety factor must be used to provide reasonable assurance of acceptable long-term system performance.

Flow Spreaders: Devices installed perpendicular to the flow direction to evenly distribute flow across a stormwater facility.

Forebay: An area near the inlet of a stormwater facility that is designed to collect sediment and is separated from the rest of the facility by a low wall or flow spreader.

Freeboard: The vertical distance between the maximum ponding depth and the elevation at which overtopping of the structure or facility that contains the water would occur.

Green Infrastructure: The term 'green infrastructure' means the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspirate stormwater and reduce flows to sewer systems or to surface waters.

Growing Media: The soil/compost mixture that supports plants and microorganisms within the stormwater facility.

Impervious Surface: Any surface resulting from development activities that prevents the infiltration of water. Common impervious surfaces include: building roofs; traditional concrete or asphalt paving on walkways, driveways, parking lots, gravel lots and roads; and heavily compacted earthen materials.

Infiltration: The percolation of water into the ground.

Infiltration Rate, Design: The infiltration rate measured on site and divided by a Factor of Safety of three.

Infiltration Rate, Measured: The infiltration rate that is measured on site using one of the methods described in **Appendix B**.

Inlet: The point at which stormwater from impervious surfaces or conveyance piping enters a stormwater management facility. The term "inlet" can also be used in reference to a catch basin.

Low Impact Development (LID): A stormwater management approach that seeks to mitigate the impacts of increased runoff and stormwater pollution using a set of planning, design and construction approaches, and stormwater management practices that promote the use of natural systems for infiltration, evapotranspiration, and reuse of rainwater, and can occur at a wide range of landscape scales (i.e., regional, community, and site). Low impact development is a comprehensive land planning and engineering design approach to stormwater management with a goal of mimicking the pre-development hydrologic regime of urban and developing watersheds.

Maintenance Activities: As used in the definition of Redevelopment means activities such as pavement preservation projects, restoration of impervious surfaces disturbed by construction, maintenance or repair utilities, and roof replacement projects.

Maximum Extent Practicable (MEP): The technology-based discharge standard for municipal separate storm sewer systems to reduce pollutants in storm water discharges that was established by Section 402(p)(3)(B)(iii) of the Clean Water Act [33 U.S.C §1342(p)(3)(B)(iii)].

Municipal Separate Storm Sewer System (MS4): Defined in 40 CFR §122.26(b) and means a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains): (i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under Section 208 of the Clean Water Act that discharges to waters of the state; (ii) Designed or used for collecting or conveying storm water; (iii) Which is not a combined sewer; and (iv) Which is not part of a Publicly Owned Treatment Works as defined at 40 CFR §122.2 .

Observation Port: An opening through which the condition of the structure can be observed.

Operations and Maintenance (O&M): The continuing activities required to keep stormwater management facilities and their components functioning in accordance with design objectives.

Orifice: An opening in a control structure through which water flows.

Outfall: The point where a municipal separate storm sewer discharges to waters of the State and does not include open conveyances connecting two municipal separate storm sewers or pipes, tunnels, or other conveyances which connect segments of the same stream or other waters of the state and are used to convey waters of the State.

Overflow: A point through which stormwater that exceeds the facility's design capacity flows.

Peak Flow Control: The capture, holding, and slow release downstream of runoff from a site during a 10-year event. The practice is intended to protect downstream properties, infrastructure, and natural resources from the increased stormwater runoff peak flow rates and volumes resulting from development.

Performance Approach: Required for the design of BMPs with a Contributing Drainage Area of 10,000 square feet or more. This approach must utilize the calculation and design standards in **Chapter 4** and must be performed by an Oregon registered PE or CEG.

Permittee: In the Design Manual, a Permittee is a jurisdiction that has been issued an MS4 permit by DEQ.

Pervious Surface: A natural or created surface that allows water to percolate through it into subsurface drainage systems or the ground.

Pesticide: Any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. As used in the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA); a pest is any insect, rodent, nematode, fungus, weed, or any other form of terrestrial or aquatic plant or animal life or virus, bacteria, or other micro-organism.

Pollutant: An elemental or physical product that can be mobilized by water or air and creates a negative impact on the environment. Pollutants include suspended solids (sediment), heavy metals (such as lead, copper, zinc, and cadmium), nutrients (such as nitrogen and phosphorus), bacteria and viruses, organics (such as oil, grease, hydrocarbons, pesticides, and fertilizers), floatable debris, and increased temperature.

Post-Developed Condition: As related to new or redevelopment: A site's ground cover after development.

Predevelopment Hydrologic Function: The hydrology of a site reflecting the local rainfall patterns, soil characteristics, land cover, evapotranspiration, and topography. The term predevelopment as used in predevelopment hydrologic function is consistent with the term predevelopment as discussed in Federal Register Volume 64, Number 235 and refers to the runoff conditions that exist onsite immediately before the planned development activities occur. Predevelopment is not intended to be interpreted as the period before any human-induced land disturbance activity has occurred.

Proprietary Treatment Technology: A manufactured structural facility designed to remove pollutants from stormwater.

Redevelopment: A project that entails Construction Activities, occurs on a previously developed site and results in the addition or replacement of impervious surface. To the extent allowable under federal law, Redevelopment does not include: Maintenance Activities; Construction Activities conducted to ameliorate a public health or safety emergency or natural disaster; and/or Construction Activities within an existing footprint to repair or replace a site or a structure damaged by a public health or safety emergency or natural disaster.

Retention: As defined in this manual, capture of stormwater runoff above the pre-developed volume that is only released via infiltration, evapotranspiration or reuse on-site.

Retention Facility: A facility designed to receive and hold stormwater runoff. Any runoff above the pre-developed volume may only leave the facility via infiltration, evapotranspiration, or absorption by surrounding vegetation. In this way, retention facilities reduce the total volume of excess water released to downstream conveyance facilities.

Roughness Coefficient: The resistance to flow, as represented by the Manning's n value.

Runoff Curve Number: A number used to categorize runoff potential based on soil types and land use. They were defined by the Natural Resources Conservation Service and are published in TR-55, Table 2.2, which is included in **Appendix D**.

Santa Barbara Urban Hydrograph (SBUH): A hydrologic method used to calculate runoff hydrographs.

Sedimentation: The process of depositing soil particles that were suspended in water or air.

Simplified Approach: Intended to be a streamlined stormwater management approach for small projects and is not required to be performed by an Oregon registered PE or CEG.

Storm Event: Any precipitation that falls within a defined time period and geographic area.

Stormwater Management: As used in this manual, is the combination of techniques used to reduce pollutants in stormwater through Retention, Treatment or Detention.

Stormwater Management Facility (SWF): A structural stormwater control designed to provide Retention, Treatment, or Detention, or a combination thereof at one location.

Stormwater Management Program (SWMP): A comprehensive program to manage the quality of stormwater discharged from the MS4. The SWMP consists of the actions and activities conducted by the Permittee as required by the MS4 permit.

Stormwater Runoff: Snow melt runoff, surface runoff and drainage, and is defined in 40 CFR §122.26(b)(13). "Stormwater" means that portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, channels, or pipes into a defined surface water channel or a constructed infiltration facility.

Stormwater System Capacity: The capacity of a stormwater drainage system is the flow volume or rate that a facility (e.g., pipe, pond, vault, swale, ditch, drywell) is designed to safely contain, receive, convey, reduce pollutants from or infiltrate stormwater and that meets a specific performance standard.

Subwatershed: A subdivision of a watershed that is the sixth-level 12-digit unit of the hydrologic unit hierarchy as defined by the National Watershed Boundary Dataset (USGS et al 2013).

Sump: Any volume of a facility below the point of outlet, in which water can accumulate.

Time of Concentration (T of C): The time it takes stormwater runoff to travel from the most distant point on a particular site or drainage basin to a particular point of interest.

Total Suspended Solids (TSS): A measure of solids suspended in the water column that is greater than 0.45µm in diameter.

Transpiration: Release of water vapor into the atmosphere through plant stomata or pores.

Treatment: As defined in this manual, removal of TSS from stormwater runoff.

Treatment Facility: A facility designed to remove TSS.

Treatment Train: A series of stormwater facilities designed to meet or exceed the treatment standards required by this Manual.

Underground Injection Control (UIC): A Federal program under the Safe Drinking Water Act, delegated to the Oregon Department of Environmental Quality (DEQ), which regulates the injection of water below ground. The intent of the program is to protect groundwater aquifers, primarily those used as a source of drinking water, from contamination. For information on UICs see Oregon DEQ UIC page.

Appendices

Appendix A Infiltration Testing Methodology
Falling Head Test Report Form

Appendix B Simplified Approach Procedure and Details

Appendix C Santa Barbara Urban Hydrograph Spreadsheet Example
SBUH Excel spreadsheet for download

Appendix D NRCS Table of Curve Numbers and Time of Concentration Calculation
Medford IDF Curves

Appendix E Plant Specifications
Plant Material Source List

Appendix F Standard Drawings Index
General Construction Notes and Material Specifications
PDF Standard Drawings
DWG Standard Drawings

Appendix G SWAT Pre-Approved Proprietary SW Treatment Technologies

Appendix H Stormwater Operation and Maintenance Plan Templates
O&M Manual Template
RVSS Declaration of Covenants
SW Facility Inspection and Maintenance Checklists

Appendix I RVSS Stormwater Credits