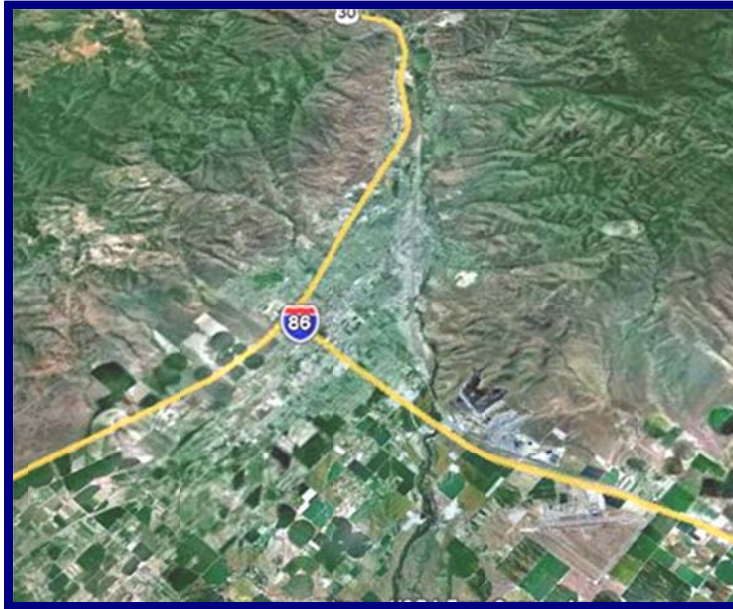


PORTNEUF VALLEY STORM WATER QUALITY DESIGN MANUAL



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Prepared by:

City of Pocatello
911 N 7th Avenue
Pocatello, Idaho 83201

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CHAPTER 1: INTRODUCTION

1.1 Purpose

This Portneuf Valley Storm Water Quality Design Manual has been developed to satisfy certain terms of the federal storm water permit (NPDES Permit No.: IDS-028053). Also known as Post Construction Storm Water Management, and one of the six minimum measures, this manual enhances existing design guidelines for storm water quality.

This manual will help construction organizations, contractors, developers and builders comply with water quality requirements. It is the companion document to the existing Storm Water Master Plan. Storm water quality requirements in this manual supersede water quality requirements in the Storm Water Master Plan. When combined with the Storm Water Master Plan, this manual provides engineers, developers and the general public with procedures and assistance for designing, installing, and maintaining storm water management facilities associated with land development, road and drainage projects. Together, both manuals outline the minimum requirements for the design of storm water management systems. The two manuals are sufficiently comprehensive that, along with good engineering judgment, they will address the myriad of drainage concerns in Pocatello.

Technical information in the Portneuf Valley Storm Water Quality Design Manual consists of design criteria and minimum requirements for use in the analysis and design of specific storm water quality management facilities. Technical information is generally organized to match the basic requirements for storm water management associated with development. All effort has been taken to make this a standalone document to meet the requirements of the federal NPDES Phase II storm water permit.

1.2 Applicability- Regulatory Threshold

The regulatory threshold, or “trigger” for requiring compliance with the basic requirements of this manual is defined as the addition or replacement of 5,000 square feet or more of impervious surfaces or the disturbance of 1 acre or more. This threshold applies to the total impervious area replaced or added at full build-out. Rebuilt or reconstructed facilities are regarded in the same manner as new development and shall generally comply with the basic requirements of this manual, as applicable.

1.3 Storm Water Quality Treatment

Water quality treatment is required to reduce pollutant loads and concentrations in storm water and can be achieved using physical, biological, and chemical removal. An analysis of the proposed land use at the project site is used to determine the pollutants of concern and the appropriate treatment methods to apply. The most effective basic treatment best management practices (BMPs) remove about 80% of the total suspended solids contained in the runoff treated

and a much smaller percentage of the dissolved pollutants. Additional treatment to remove oil, bacteria, and/or nutrients from storm water runoff may be required.

The goal of this manual is for storm water facilities to treat approximately 90% of the annual runoff from the pollutant-generating impervious surfaces (PGIS) at a project site. The total quantity of pollutants removed from the storm water will vary greatly from site to site based on precipitation patterns, land use, effectiveness of source control, and operation and maintenance of the treatment facilities.

Many treatment facilities, if designed correctly, can and do function as both a water quality treatment facility and a flow control facility. All engineering work for water quality treatment facilities shall be performed by, or under the direction of a professional engineer licensed in Idaho.

1.4 Source Control

Source control consists of measures taken to prevent pollutants from entering the storm water system and thus affecting the water quality of surface water and groundwater. Source control measures are typically in the form of best management practices (BMPs) to keep the common pollutants generated in an urban environment from contacting storm water, either through physical separation of areas or through careful management of activities that generate pollutants. The main purpose of source control BMPs is to prevent pollutants from coming into contact with storm water through physical separation and/or management of activities that produce pollutants.

1.5 Drainage Submittal

Most projects addressed in this manual already require a drainage submittal. The drainage submittal includes road and drainage construction plans, a drainage report that describes the proposed measures to dispose of storm water, and other supporting documentation as needed. This manual provides additional storm water quality requirements to be included with the drainage submittal. The contents of the drainage submittal will vary with the type, size and location of the project, and individual site characteristics.

A drainage submittal is generally required for any land-disturbing activity consistent with existing requirements for drainage requirements. (Please see existing drainage submittal requirements). Land disturbing activities are those that result in a change in the existing soil cover (both vegetative and non-vegetative) or site topography.

A drainage submittal is required for the following types of activities:

- Projects that meet the regulatory threshold or trigger;
- Plats, subdivisions, binding site plans; and,
- Manufactured and mobile home parks.

A drainage submittal is generally required for the following types of activities:

- Commercial building permits including institutional and multi-family residential projects;
- Short plats;
- Change of use permits;
- Conditional use permits;
- Grading permits; and
- Public or private road projects.

1.6 Operation and Maintenance

To ensure that storm water control facilities are adequately maintained and properly operated, and meet the requirements of the Phase II permit, documentation describing the applicable preventive maintenance and recommended maintenance schedule shall be prepared and provided by the entity responsible for maintaining the storm water system.

For drainage ponds and other drainage facilities outside of the public road right of way, the owner shall provide the financial means and arrangements for the perpetual maintenance of the drainage facilities. Storm water facility owners shall operate and maintain the facilities in accordance with a written operation and maintenance plan approved by the municipality.

1.7 Emerging Technologies

Emerging technologies are new technologies that have not been evaluated using approved protocols, but for which preliminary data indicate that they may provide a desirable level of storm water pollutant removal. The door is open and innovation is encouraged as long as City staff find that the proposal meets the intent and goals of this manual. Sources for additional concepts for storm water BMPs in Idaho include the “Catalog of Stormwater BMPs for Idaho Cities and Counties is available at:

http://www.deq.idaho.gov/water/data_reports/storm_water/catalog/index.cfm

Additional permanent storm water BMPs can be found in the Storm Water Management Manual for Eastern Washington at:

<http://www.ecy.wa.gov/programs/wq/stormwater/easternmanual/manual.html>

CHAPTER 2: TREATMENT GOALS

The goal for water quality treatment facilities is to treat approximately 90% of the annual runoff volume generated at a project site. Facilities that are designed according to the criteria set forth in this chapter should also capture and treat nearly all of the runoff from first flush events (heavy rainfall after a dry period). Bio-infiltration swales are the expected Best Management Practice (BMP) for providing basic treatment. The following describe the key pollutants of concern.

2.1 Total Suspended Solids (TSS)

Basic treatment facilities presented in this chapter are intended to achieve removal of suspended solids, including solid components of metals, for flows with TSS concentrations ranging from 100 mg/L to 200 mg/L. The following BMPs have been found to provide a significant removal process for TSS:

- Bioinfiltration swales;
- Biofiltration channels;
- Vegetated buffer strips;
- Evaporation ponds.

Basic treatment provides removal of total suspended solids (TSS) and is required for most projects.

2.2 Nutrient Treatment

Bio-infiltration swales are the only BMP that is effective at nutrient removal. The following BMPs have been found to provide a lesser degree of nutrients and shall only be used for nutrient removal in combination with some other basic treatment BMP:

- Biofiltration channels;
- Vegetated buffer strips; and,
- Evaporation ponds

Nutrient treatment is required where it has been determined by the federal, state, or local government that a water body is sensitive to nutrients and that a reduction in phosphorus and/or nitrogen from new development and redevelopment is necessary to achieve the water quality standard to protect its beneficial uses. Where it is deemed necessary, a strategy will be adopted to achieve the reduction in nutrients. The strategy will be based on knowledge of the sources of nutrients and the effectiveness of the proposed methods of removing nutrients.

2.3 Total Petroleum Hydrocarbons (TPH)

The oil control facilities presented in this chapter are intended to achieve the goal of removing any visible sheen and reducing the TPH concentration to a maximum of 10 mg/L for a 24-hour

average and a maximum of 15 mg/L for a discrete sample. Total petroleum hydrocarbon removal requirements are primarily driven by average daily traffic (ADT) data. The following BMPs provide removal of TPH:

- Significant removal for high-use and high-ADT sites:
 - Bio-infiltration swales;
 - Oil/water separators (coalescing plate and baffle type);
 - Vegetated buffer strips (for High-ADT sites only); and,
 - Evaporation ponds
- Significant removal for all sites except high-ADT sites:
 - Oil/water separators (spill control type).
- Lesser removal (this BMP shall not be used for high-use or high-ADT sites unless preceded by an oil/water separator):
 - Biofiltration channels.

All projects that meet the regulatory threshold and are high-use or high-ADT areas are required to provide oil control. High-use sites generate high concentrations of petroleum hydrocarbons due to high traffic turnover or the frequent transfer of oil and/or other petroleum products.

High-use sites and high-ADT roadways and parking areas shall treat runoff from the high-use portion of the site prior to discharge or infiltration. For high-use sites located within a larger project area, only the impervious area associated with the high-use site is subject to oil control treatment, as long as the flow from that area is separated; otherwise the treatment controls shall be sized for the entire area.

2.3.1 High Use Sites

High-use sites generate high concentrations of oil due to high traffic or the frequent transfer of petroleum products. High-use sites are land uses where sufficient quantities of free oil are likely to be present.

The following high-use sites require oil separator technology:

- A commercial or industrial site storing or transferring petroleum, not including locations where heating fuel is routinely delivered to end users;
- A commercial or industrial site subject to use, storage, or maintenance of a fleet of 25 or more vehicles that are over 10 tons gross weight;
- Fueling stations and facilities;
- Maintenance and repair facilities for vehicles, aircraft, construction equipment, railroad equipment or industrial machinery and equipment;
- Railroad yards, and,
- High-density road intersections with expected ADT count equal to or greater than 25,000 on the main roadway and equal to or greater than 15,000 on any intersecting roadway.

For the above sites, oil separator technology is defined as removing the oil from the storm water inflow in a step separate from any other pollutant removal via BMPs such as a

coalescing plate or baffle-type oil control mechanism. This typically involves a “treatment train” of two BMPs in series in order to meet the treatment goals of pollutants other than oil.

The following high-use sites are subject to oil control, but are only required to employ sorptive technologies (such as swales) that physically or chemically bind the pollutants to sediment organic particles:

- A commercial or industrial site with an expected trip end count equal to or greater than 100 vehicles per 1,000 square feet of gross building area;
- A parking lot with an expected trip end count equal to or greater than 300 vehicles;
- Commercial on-street parking areas located on streets with an expected total ADT count equal or greater than 7,500; and,
- Outdoor storage yards and other sites subject to frequent use or storage of forklifts or other hydraulic equipment.

2.3.2 High-ADT Sites

The following are high-ADT sites and require oil separator technology:

Non-employee parking areas of commercial or industrial sites with trip end counts greater than 100 vehicles per 1,000 square feet gross building area or greater than 300 total trip ends, and,

Any road or parking area with an expected ADT count equal to or greater than 30,000 (assumes a straight stretch of road, where intersecting ADTs are low).

For the above sites, oil separator technology is defined as removing the oil from the storm water inflow in a step separate from any other pollutant removal via BMPs such as a coalescing plate or baffle-type oil control mechanism. This typically involves a “treatment train” of two BMPs in series in order to meet the treatment goals of pollutants other than oil.

2.3.3 Moderate-Use Sites

Moderate-use sites are defined as moderate-ADT roadways and parking areas; primary access points for high-density residential apartments; most intersections controlled by traffic signals; and transit center stops. The following land uses are moderate-use sites:

Urban roads with expected ADT between 7,500 and 30,000;

Rural roads or freeways with expected ADT between 15,000 and 30,000; and,

Parking areas with 40 to 100 trip ends per 1,000 square feet of gross building area, or between 100 and 300 trip ends.

CHAPTER 3: TREATMENT BEST MANAGEMENT PRACTICES (BMPs)

Infiltration-based swales and ponds, filtration-based vegetated buffer strips and channels, and evaporative ponds can all be effective in treating storm water runoff. In most cases, soil properties must be appropriate to achieve effective treatment without adversely impacting groundwater resources. The location and depth to bedrock, water table, or impermeable layers, and the proximity to wells, foundations, septic system drain-fields, and unstable slopes can preclude the use of infiltration. If a lined treatment facility is proposed, the soil properties are less important, as the treatment is meant to occur via containment, plant uptake, and evaporation of the pollutants within the area of the facility that does not drain.

Oil/water separators (OWS) can be used to physically separate petroleum products from storm water. An OWS does not, however, meet the other treatment goals set forth in this manual, so it may have to be used in combination with another water quality treatment BMP, depending upon the expected pollutants.

3.1 Bio-Infiltration Swales

Bio-infiltration swales combine plant material and soil to remove storm water pollutants by both physical and chemical (ionic bonding, decomposition, plant root uptake, etc.) means via filtration and percolation into the ground. Bio-infiltration swales are sized to treat the volume equivalent of the 6-month NRCS Type II 24-hour water quality design storm. If the bio-infiltration facility is designed to function as a flow control facility as well as a water quality treatment facility, it shall also accommodate the flow control design storm event. If a bio-infiltration facility will also be used as a detention facility, refer to the Storm Water Master Plan.

3.1.1 Bio-Infiltration Swale Design

Bio-infiltration swales shall be sized using either Equation 3-1a or 3-1b. These equations estimate the volume required to treat storm water runoff.

$$V = 1133.AP^{1.53} \quad (3-1a)$$

$$V = 1815.AP^{1.53} \quad (3-1b)$$

Where: V = volume of bio-infiltration swale (cubic feet);
 A = hydraulically connected impervious area to be treated (acres); and,
 P = precipitation amount for the 6-month NRCS Type II 24 hour water quality design storm.

Note: You may use $P = 1$ inch for the Pocatello area, therefore the above equations can be simplified as follows:

$$V = 1133A \quad (3-1c)$$

$$V = 1815A \quad (3-1d)$$

Equations 3-1a and 3-1c can only be used when the following requirements are met; otherwise,

Equations 3-1b and 3-1d shall be used:

The subgrade soils have less than 12% fines; and,
The subgrade soils have an infiltration rate greater than 0.15 in/hr.

The Appendix provides a sample calculation for bioinfiltration swales.

3.1.2 Bio-Infiltration Swale Minimum Requirements

Bio-infiltration facilities shall meet the minimum requirements for limiting layers, setbacks, slopes, embankments, planting, and other general requirements. In addition, the design of bio-infiltration swales shall conform to the requirements described below.

Treatment Design Depth and Soil Criteria: Bio-infiltration swales shall fully contain the design treatment volume with a maximum treatment design depth (from the swale bottom to the elevation of the drywell grate or the first overflow or outflow mechanism) of 6 inches.

Organic matter content or cation exchange capacity (CEC) testing must be completed in order to substantiate the treatment soil composition. The tests shall be performed on composite samples taken from the treatment soil layer from the constructed pond bottom. A composite sample consists of well-mixed soil obtained from at least four cores, to a depth of at least 6 inches, randomly distributed over the pond bottom test area. A minimum of one test shall be performed for each bio-infiltration swale of 1,500 square feet or less, with one additional test for each additional 2,000 square feet of swale bottom or fraction thereof. “One test” is equal to four core samples taken uniformly over the percolation area. The soils will be considered suitable if the minimum criteria for CEC or soil organic matter content are met. Testing results shall be submitted as part of the construction certification process prior to the release of surety posted on project.

Unless recommended otherwise by a geotechnical engineer, bio-infiltration swales shall be constructed with a treatment zone of medium- to well-draining soil (tested for infiltrative and treatment criteria) at least 12 inches thick, underlain by a subgrade infiltrative layer at least 48 inches thick. All soils, including amended native soils, shall meet the infiltrative rate criteria indicated in Table 3-1.

**TABLE 3-1
BIO-INFILTRATION SWALE DESIGN CRITERIA**

CRITERIA	DESIGN REQUIREMENT
Treatment Zone Infiltration Rate (vegetated cover and treatment layer) ¹	Between 0.25 and 0.50 inches/hour
Subgrade Infiltration Rate ^{2,3}	At least 0.15 inches/hour and facility must completely drain within 72 hours
Average Cation Exchange Capacity	At least 15 milliequivalents/100 grams
Organic Matter Content	At least 2% by weight

- 1 Sand and coarser soils are not suitable to be used as top soils when treatment is required.
- 2 An infiltration test (for example, a single-ring infiltrometer test) demonstrating the facility's conformance to the infiltration rate criteria may be required prior to construction certification.
- 3 The 48-inch layer of infiltrative subgrade soils must meet geotechnical recommendations.

Unless otherwise approved by the local jurisdiction, the treatment zone shall be planted with sod or dryland grass and perennials. Trees and large shrubs may be planted in the treatment zone provided they do not inhibit the growth of the grass and perennials.

Inlets and Overflow: Curb inlets discharging into bio-infiltration swales shall be per the criteria specified in the Storm Water Master Plan. A minimum separation of 3 inches shall be maintained between the flow line in the gutter (at the curb drop) or swale inlet and the top of the drywell grate. In addition, a 2-inch drop to the finish grade (of the swale side slope or swale bottom) below the concrete apron shall be provided to inhibit vegetation overgrowth and ensure positive flow into the swale.

A bypass or overflow structure to a flow control facility must be provided unless the treatment facility is able to accommodate the flow control design storm event as well as the water quality design storm event. Swales shall not be designed to overflow to a street unless approved by the local jurisdiction.

Construction and Inspection: In order to reduce the potential for over-compaction of the swale bottom, construction equipment and vehicles shall be kept off the treatment facility. Unless waived by the local jurisdiction, an infiltration test (for example, a single-ring infiltrometer test) demonstrating the facility's conformance to the infiltrative rate criteria is required prior to construction certification. The treatment facility must have vegetation established prior to passing final inspection. In addition, if during final inspection, it is found that the constructed bio-infiltration swale does not conform to the accepted design, the system shall be reconstructed so that it does comply.

3.2 Biofiltration Channels

Biofiltration is the simultaneous process of filtration, particle settling, absorption, and biological uptake of pollutants in storm water that occurs when runoff flows over and through vegetated areas. A biofiltration channel is a sloped, vegetated channel or ditch that both conveys and treats storm water runoff. It does not provide flow control but can convey runoff to facilities designed for that purpose.

3.2.1 Biofiltration Channel Design

The following procedure shall be followed when designing biofiltration channels:

- 1 Determine the peak flow rate using the 6-month NRCS Type II 24-hour storm. The methods for calculating peak flow rates are found in the Pocatello Storm Water Master Plan. The 6-month precipitation is equal to (0.69)(2-year precipitation); Note: Similar to Bio-infiltration swales, you may use P = 1 inch for the Pocatello area.
- 2 Determine the bottom width of the ditch using equation 3-2 or 3-3.

$$Q = \frac{1.486A^{2/3}S^{1/2}}{n} \quad (3-2)$$

Where:

Q = flow (cfs);

A = cross-sectional area (square feet);

R = hydraulic radius (feet); and,

S = longitudinal slope of strip (feet/foot); slope criteria are given in the minimum geometry requirements in the following subsection; and,

n = Manning's roughness coefficient; Use n = 0.30 for sod (or channels that will be mowed regularly) and higher values such as n = 0.20 for natural (less dense) vegetation such as meadow or pasture.

For a trapezoidal channel with shallow flow, the hydraulic radius can be approximated to the depth of flow. Using this assumption, the following can be used to solve for the required width:

$$B = \frac{\left(\frac{n}{1.486}\right)Q}{y^{5/3}S^{1/2}} - Zy \quad (3-3)$$

Where:

B = bottom width of the strip (feet);

n = Manning's roughness coefficient

y = depth of flow (feet); (3 inches maximum for dryland grass and 4 inches maximum for sod);

S = longitudinal slope of strip (feet/foot); slope criteria are given in the minimum geometry requirements in the following subsection;

Z = side slope of the strip in the form Z:1; and,

Q = flow (cfs).

- 3 Calculate the cross-sectional area of flow for the given channel;
- 4 Calculate the flow velocity. If the velocity is less than 1 foot/second, proceed to Step 5. Otherwise, change the channel dimensions and/or slope and return to Step 3; and,
- 5 Calculate the length of the channel and verify that the residence time is at least 9 minutes. The minimum channel length is 200 feet unless the width is increased per the minimum geometry requirements in the following subsection.

Commercially available software is most commonly used to compute many of the parameters associated with the sizing of a biofiltration channel. *The Appendix provides a sample calculation of a biofiltration channel.*

3.2.2 Biofiltration Channel Minimum Requirements

Biofiltration channels shall meet the minimum requirements, as well as the following geometry requirements:

- The biofiltration channel shall have a length of 200 feet. If a length of 200 feet is not possible, the width of the biofiltration channel must be increased so that the treatment area is the same as or more than it would be if a 200 foot length had been used. The length shall not be reduced such that the minimum residence time and/or maximum flow depth criteria are violated. The length shall in no case be less than 100 feet.
- The maximum bottom width is 10 feet and the minimum width is 1 foot. If the calculated bottom width exceeds 10 feet, parallel biofiltration channels shall be used in conjunction with a device that splits the flow and directs an equal amount to each channel.
- The ideal cross-section is a trapezoid with side slopes no steeper than 3:1. However, a rectangular shape can be proposed if there are topographical constraints or other construction concerns.
- Typically, the depth of flow shall not exceed 4 inches during the design storm. The depth of flow is 4 inches for sod and 3 inches for dryland grasses and perennials.
- The channel slope shall be at least 1% and no greater than 5%. Slopes of 2% to 4% provide the best performance. When slopes less than 2% are used, an under-drain is required. A 6-inch-diameter perforated pipe shall be installed in a trench lined with filter fabric and filled with 5/8-inch-minus round rocks. The pipe shall

be placed at least 12 inches below the biofiltration channel bed and the bed shall incorporate topsoil that has a proportionately high sand content.

- The flow velocity shall not exceed 1 foot/second and the design shall provide for a 9-minute residence time.

3.3 Vegetated Buffer Strips

A vegetated buffer strip is a facility that is designed to provide storm water quality treatment of conventional pollutants, but generally does not provide storm water flow control.

Vegetated buffer strips are primarily used in areas adjacent to and parallel to paved areas such as parking lots or driveways, and along rural roadways where sheet flow from the paved area will pass through the buffer strip before entering a conveyance system or a flow control facility or being dispersed into areas where it can be infiltrated or evaporated.

Vegetated buffer strips are used to intercept overland sheet flow runoff from adjacent impervious areas. They slow runoff velocities, filter out sediment and other pollutants, and provide infiltration into underlying soils. One challenge associated with vegetated buffer strips is the difficulty in maintaining sheet flow. Concentrated flows can short circuit the buffer strips which can then contribute to eroded rills or flow channels across the strips. This results in little or no treatment of storm water runoff.

This BMP is acceptable for use on any project that meets the following general criteria:

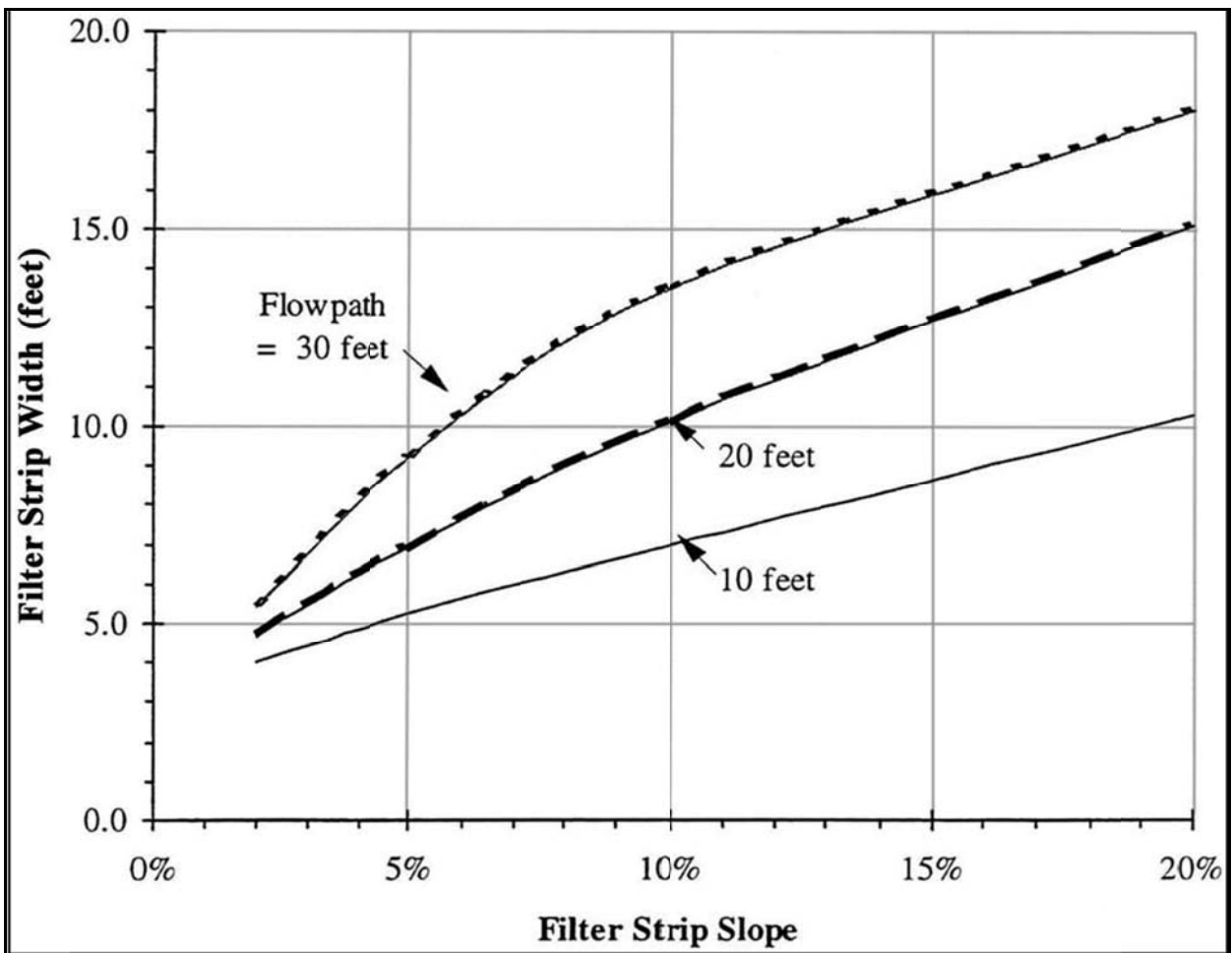
- The flow from the roadway must enter the buffer strip as sheet flow. Thus, the vegetated buffer strips must not receive concentrated flow discharges.
- A maximum flow path (paved width) of 30 feet can contribute to a buffer strip designed via this method (vegetated buffer strips should typically not be proposed for super-elevated roads, unless the 30 foot width is adhered to);
- Buffer strips may be used where the roadway ADT is less than 30,000;
- The longitudinal slope of the contributing impervious drainage area (parallel to the edge of the buffer area) shall be 5% or less;
- The lateral slope of the contributing drainage area perpendicular to the pavement edge (typically referred to as the cross-slope of the road) shall be 2% or less.
- Vegetated buffer strips shall be constructed after other portions of the project are completed.

3.3.1 Vegetated Buffer Strip Design

This procedure is based on the narrow area filter strip design. The sizing of the buffer strip is based on the length of the flow path draining to the buffer strip and the longitudinal slope of the buffer strip itself (parallel to the flow path). The following design steps shall be followed:

- 1 Determine the flow path length draining to the buffer strip. Normally this is the width of the paved area draining to the strip, but if the site is sloped, the flow path may be longer. For crowned roads, the flow path is the distance from the crown to the edge of pavement;
- 2 Determine the average lateral or cross slope of the buffer strip: Calculate the cross slope of the buffer strip (parallel to the flow path), averaged over the total width of the buffer strip. If the slope is less than 2%, use 2% for sizing purposes. The maximum cross slope allowed is 6:1 horizontal to vertical or 17%; and,

**FIGURE 3-1
VEGETATED BUFFER STRIP**



- 3 Determine the required width of the buffer strip: Use Figure 3-1 to size the buffer strip. To use the figure, find the curve representing the appropriate width of the flow path (interpolate between curves as necessary). Find the point along the curve where the design longitudinal or cross slope of the buffer strip is directly below and read the buffer strip width to the left on the y-axis. The buffer strip must be designed to provide this minimum width (W) along the entire stretch of pavement draining to it.

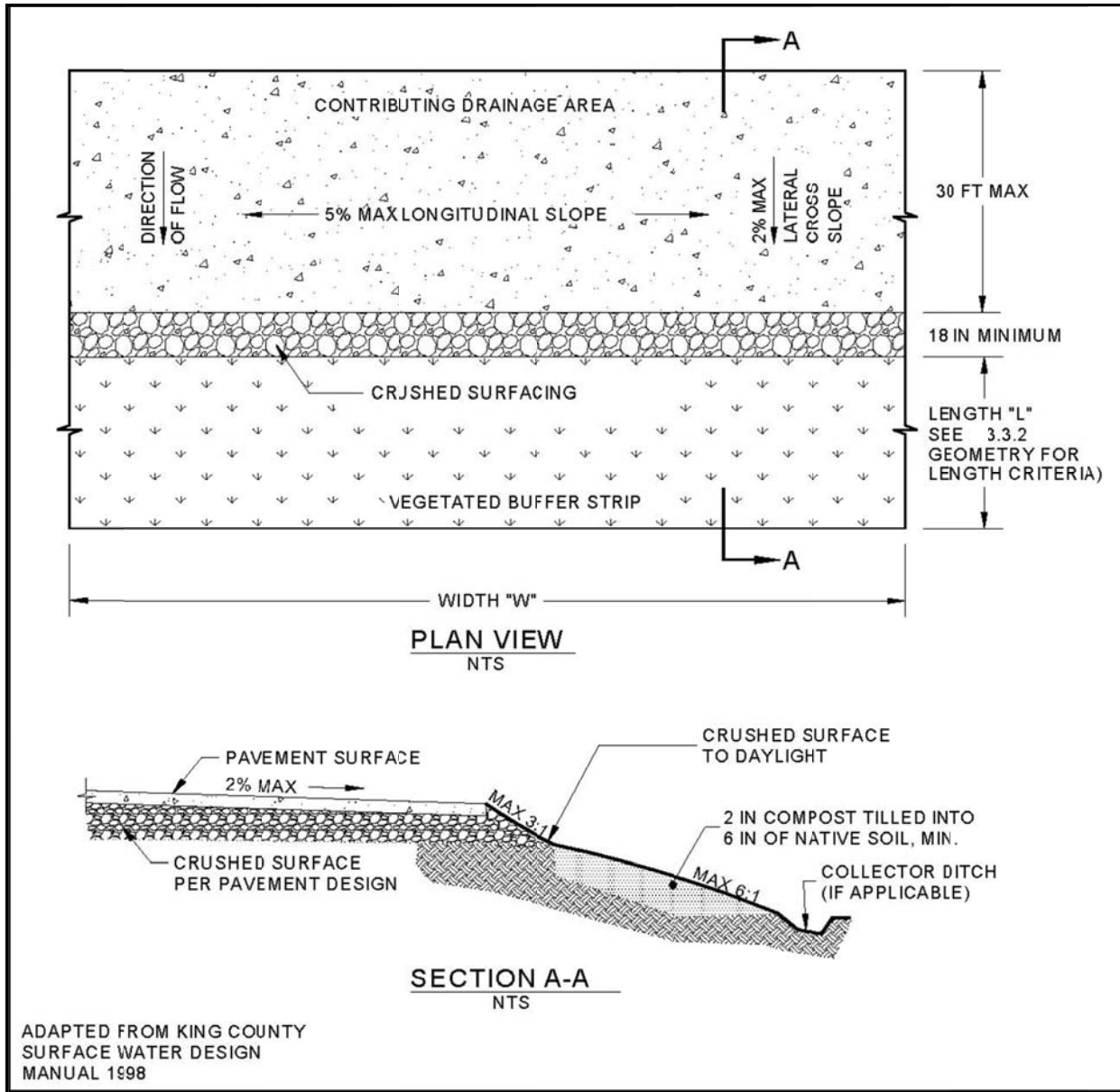
The appendix provides a sample calculation for vegetated buffer strips.

3.3.2 Vegetated Buffer Strip Minimum Requirements

Vegetated buffer strips shall meet the minimum requirements for planting, and general requirements. In addition, the design of buffer strips shall conform to the following requirements (see Figure 3-2):

- Geometry:
 - The minimum required buffer strip width is: 4 feet for a 10-foot flow path; 4.5 feet for a 25 foot flow path; and 5.5 feet for a 30-foot flow path. Flow path is the width of the paved surface discharging to the buffer strip.
 - The cross-slope of the buffer strip shall be no steeper than 6:1.
 - Along roadways, buffer strips shall be placed at least 1 foot, and preferably 3 to 4 feet, from the edge of pavement, to accommodate a vegetation free zone.
- Energy Dissipation:
 - A gravel-filled trench shall be installed between the pavement surface and the buffer strip to maintain sheet flow. This area serves as a flow spreader and shall consist of a trench filled with clean crushed aggregate.
 - The gravel filled trench shall be a minimum of 12 inches deep and 18 inches wide.

**FIGURE 3-2
TYPICAL VEGETATED BUFFER STRIP (details)**



3.4 Oil Water Separators

Three types of Oil Water Separators (OWS) are included in this Manual:

- Coalescing plate types (gravity mechanism for separation),
- Baffle types,
- Spill control separators, such as T's or elbows located inside a catch basin.

OWSs are only effective in achieving oil and TPH removal at the required levels when regular maintenance is provided. Without proper sludge, oil and sediment removal, there is a high potential for clogging which can impair the long-term efficiency of the separator.

3.4.1 Oil/Water Separator Minimum Requirements

The following design criteria are applicable to all types of oil control BMPS:

- Only impervious conveyances shall be used for oil-contaminated storm water; and,
- Oil/water separators shall not be used for the removal of dissolved or emulsified oils such as coolants, soluble lubricants, glycols, and alcohols.

The following are design criteria applicable to spill control separators:

- “T” or elbow separators in a catch basin are not allowed as an oil control device for high-ADT sites unless used in series with another water quality treatment facility;
- Oil control shall occur prior to dispersal into or through a water quality treatment facility;
- If an oil/water separator is applicable, it shall comply with the local jurisdiction's standard plan.

The following design criteria are applicable to both coalescing plate and baffle type oil/water separators:

- If practical, determine expected oil/grease (or TPH) and TSS concentrations, lowest temperature, pH, empirical oil rise rates in the runoff, oil viscosity and specific gravity of the oil;
- Follow industry standards such that the separator has a forebay, separator section, and afterbay;
- Design the surface area of the forebay at 20 square feet per 10,000 square feet of area draining to the separator;
- The length of the forebay shall be one-third to one-half the length of the entire separator;

- Include roughing screens for the forebay to remove debris (screen openings should be about $\frac{3}{4}$ inch);
- Include a submerged inlet pipe with a turned-down elbow in the forebay at least two feet from the bottom; the outlet pipe shall be a “T” sized to pass the design peak flow and placed at least 12 inches below the water surface;
- Size the separator bay for the water quality design flow rate;
- Include a shutoff mechanism at the separator outlet pipe; and,
- Use absorbents and/or skimmers in the afterbay as needed.

The following are additional design criteria applicable to baffle type oil/water separators:

- Oil retaining baffles (top baffles) shall be located at least a quarter of the total separator length from the outlet and shall extend down at least 50% of the water height and at least 1 foot from the separator bottom; and,
- Baffle height to water depth ratios shall be 0.85 for top baffles and 0.15 for bottom baffles.

CHAPTER 4 - MAINTENANCE

Insufficient maintenance of storm water control facilities can lead to poor performance, shortened life, increased maintenance and replacement costs, and property damage.

The local jurisdiction maintains the storm water system structures located within the public road right of way and structures located within border easements that serve public road runoff, unless a separate agreement exists whereby the homeowner, property owner or other independent entity is responsible for the maintenance.

Drainage tracts created by public projects will be maintained by the local jurisdiction. The project proponent is to provide for the perpetual maintenance of all elements of the storm water system located outside the public right of way. The high-frequency maintenance of vegetated cover, turf grass and other landscaping within the public right of way and within border easements that accommodate public road runoff is the responsibility of the adjacent property owner.

When applicable, the following maintenance-related items shall be submitted with the Drainage Submittal for all projects:

- A copy of the conditions, covenants and restrictions (CC&Rs) for the homeowners' association (HOA) in charge of operating and maintaining all elements of the storm water system;
- An Operations and Maintenance (O&M) Manual.

4.1 Homeowners' and Property Owners' Associations

For privately maintained storm water systems in residential neighborhoods, a homeowner's association, or alternate entity acceptable to the local jurisdiction, shall be formed to maintain the facilities located outside of the public right of way.

A draft copy of the CC&Rs for the HOA in charge of operating and maintaining the facilities associated with the storm water system shall be submitted as part of the drainage submittal review package. The CC&Rs shall summarize the maintenance and fiscal responsibilities of the HOA. Annual HOA dues shall provide funding for the annual operation and maintenance of all facilities associated with the storm water system and for the eventual replacement of these facilities.

For commercial/industrial and multi-family residential developments with joint storm water systems and multiple owners, a property owners' association (POA) or similar entity such as a business shall be formed, or a reciprocal-use agreement executed.

4.2 Operation and Maintenance Manual

For storm water systems operated and maintained by a HOA or POA, an O&M Manual is required. The O&M Manual summarizes the tasks required to ensure the proper operation of all facilities associated with the storm water system and must include, as a minimum:

- Description of the entity responsible for the perpetual maintenance of all facilities associated with the storm water system, including legal means of successorship;
- Description of maintenance tasks to be performed and their frequency;
- A list of the expected design life and replacement schedule of each component of the storm water system;
- A general site plan (drawn to scale) showing the overall layout of the site and all the facilities associated with the storm water system; and,
- A description of the source control BMPs.

APPENDIX: SAMPLE CALCULATIONS

BIO-INFILTRATION SWALE

GIVEN

- The existing site is approximately 5 acres, consisting of sandy soils. Existing surface vegetative conditions include short grass and weeds.
- The subgrade soil has 10% fines and an infiltration rate of 0.10 inches per hour.
- Post developed site conditions consist of:
 - 20 – 10,000-square foot lots
 - 1,500-square-foot homes with 500-square-foot driveways
 - 0.50 acres of road impervious areas

CALCULATIONS

1. Determine the total PGIS for the site.

Road PGIS: (0.50 acres)(43,560 square feet/acre) = 21,780 square feet

Driveway PGIS: (500 square feet)(20 driveways) = 10,000 square feet

Total PGIS: 10,000 square feet + 21,780 square feet = 31,780 square feet = 0.73 acres

2. Determine the required treatment volume, using Equation 3-1.

$$V = 1815A$$

$$V = (1815)(0.73) = 1,325$$

$$\text{Volume} = 1,325 \text{ Cubic Feet}$$

3. Determine the geometry of the bio-infiltration facility

Use a treatment depth of 6 inches

$$\text{Pond Bottom Area Required*} = \frac{1,325 \text{ cf}}{6 \text{ in}} * \frac{12 \text{ in}}{1 \text{ ft}} = 2,648 \text{ sq ft}$$

For this example, there are no space constraints and side slope volume has been ignored.

Provide an infiltrative facility with a 2,650 square foot pond bottom area

BIOFILTRATION CHANNEL

GIVEN

- Weighted pervious CN = 67
- Pervious area = 4.25 acres
- Impervious CN = 98
- Impervious area = 0.75 acres
- PGIS = 31,720 square feet
- 2-year, 24 hour storm precipitation = 1.2 inches
- Time of concentration = 6 minutes
- n = 0.2

CALCULATIONS

1. Determine the peak flow rate.

$$\begin{aligned} \text{6-month precipitation} &= (0.69)(2\text{-year precipitation}) \\ &= (0.69)(1.2 \text{ inches}) = 0.83 \text{ inches} \end{aligned}$$

Using a computer program, the peak flow rate is estimated to be 0.70 cfs.

2. Determine the bottom width of the ditch using Equation 3-3.

Assume: A trapezoidal channel with 3:1 side slopes;
 3 inches for flow depth; and,
 3% longitudinal slope for biofiltration channel.

$$B = \frac{\left(\frac{n}{1.486}\right)Q}{y^{5/3}S^{1/2}} - Zy$$

$$B = \frac{\left(\frac{0.2}{1.486}\right)(0.70\text{cfs})}{\left[\left(\frac{3\text{in}}{12\text{in}/\text{ft}}\right)^{5/3} \left(0.03\frac{\text{ft}}{\text{ft}}\right)^{1/2}\right]} - \left[3\left(\frac{3\text{in}}{12\text{in}/\text{ft}}\right)\right] = 4.75\text{ft}$$

3. Calculate the cross-sectional area of flow for the given channel and verify that the flow velocity is less than or equal to 1 foot/second;

$$\text{Area} = y (B + Zy) =$$

$$\left(\frac{3 \cdot \text{in}}{12 \text{in}/\text{ft}}\right) \left(4.75 \cdot \text{ft} + 3 \cdot \text{ft} \left(\frac{3 \cdot \text{in}}{12 \text{in}/\text{ft}}\right)\right) = 1.4 \cdot \text{sq. ft.}$$

$$\text{Velocity} = \frac{Q}{A} = \frac{0.70 \cdot \text{cfs}}{1.4 \cdot \text{sq. ft}} = 0.5 \cdot \text{ft/sec} \leq 1$$

4. Calculate the length of the channel to meet the 9 minute residence time. The minimum channel length is 200 feet unless the width is increased as prescribed by the minimum requirements.

$$L = (V)(t) = (0.50 \frac{\text{ft}}{\text{sec}})(9 \text{min})\left(\frac{60 \cdot \text{sec}}{1 \text{min}}\right) = 270 \text{ft}$$

If the site cannot accommodate the required channel length, the width can be increased. Steps 3 and 4 should be repeated until the channel geometry best fits the existing site conditions.

The proposed channel geometry design is as follows:

- Trapezoidal shape with 3:1 side slopes
- 3% longitudinal slope
- Channel bottom width is 4.75 feet
- Minimum channel length is 270 feet

VEGETATED BUFFER STRIP

GIVEN

- A typical crowned road with a 30-foot-wide half road
- Average lateral road cross slope = 2%
- Average longitudinal slope = 4%
- The land adjacent to the road (where the buffer strip will be located) slopes away at an average slope = 5%

CALCULATIONS

1. Determine the flow path length draining to the buffer strip.

Flow path is 30 feet

2. Determine the average lateral or cross slope of the buffer strip:

Calculate the cross slope of the buffer strip (parallel to the flow path), averaged over the total width of the buffer strip.
Use 5%

3. Determine required width of the buffer strip using Figure 3-1 to size the buffer strip.

From Figure 3-1: buffer strip width = 9 feet

9 feet > 5.5 feet (the minimum width for buffer strips with a 30-foot flow path)

Provide an 18-inch-wide, 1-foot-deep gravel filled trench



Portneuf Valley Storm Water Quality Manual Addendum

Material Source

The following is provided as a general guide to local sources that can assist with storm water facility efforts. This list is not exhaustive nor does it imply any recommendation for a listed source. Contact information and pricing is current at time of press.

Compost

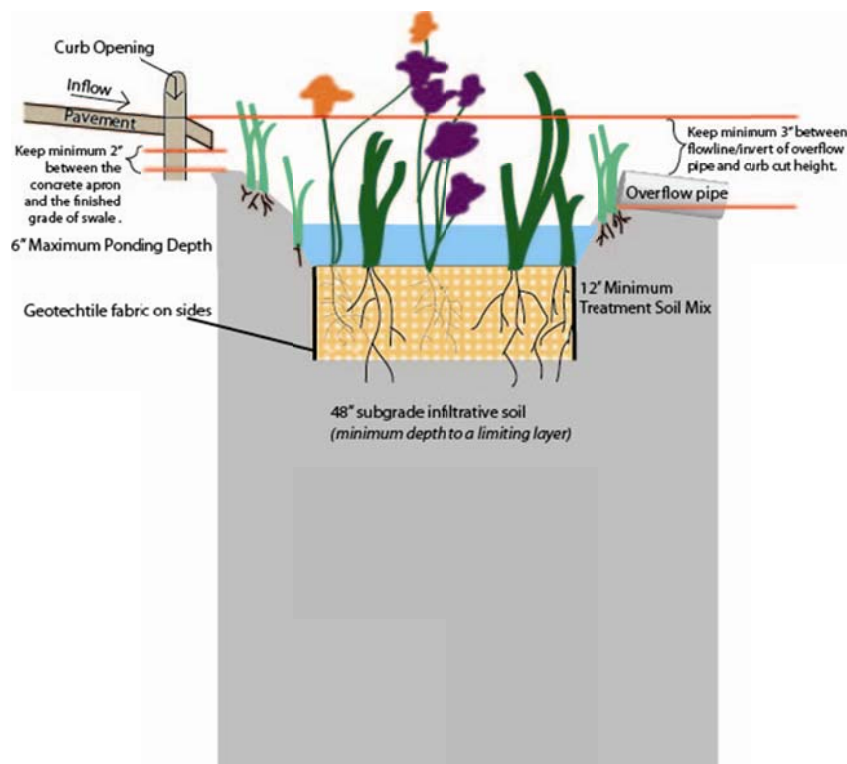
- **Bannock County Landfill Compost** Pocatello. *Product available beginning spring 2011.*
 - (208) 236-0607 www.co.bannock.id.us/waste
- **Koompin Farms** American Falls.
 - (208) 226-2773
- **Magic Valley Compost** Jerome. *Require purchase of 12 tons or more.*
 - (208) 324-4536 www.magicvalleycompost.com
- **Twin Rivers Dairy** Franklin/Preston area. *\$10/yard (material). Can deliver to Pocatello area.*
 - Dave Rallison (208) 406-6735 and Doug Rallison (208) 406-6379

Peat

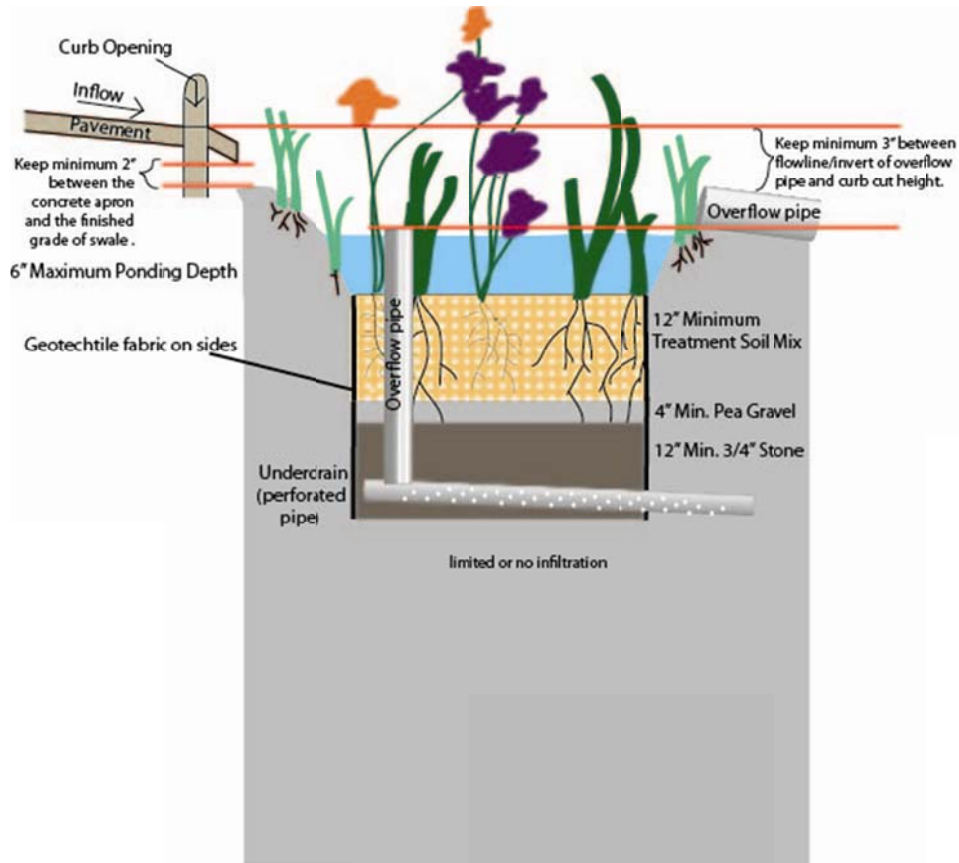
- **Downey Properties** Downey.
 - Brandon Olson (208) 241-0314

Biofiltration Swale Drawing

The following is provided as a general guide to contractors interested in installing the bio-infiltration swale, per the guidelines in the Portneuf Valley Storm Water Quality Design Manual. It is expected that contractors will work with City staff on final design of the swale.



An alternate design for areas of poor infiltration:



Additional Best Management Practices

The following links are provided for additional design of best management practices for storm water treatment and retention/infiltration using swales, planters, green roofs, permeable/porous paving, etc. Spokane (WA) and Reno (Nevada) have similar climates to Pocatello in terms of temperature, amount of precipitation, and seasonality of precipitation.

Catalog of Stormwater BMPs for Idaho Cities and Counties:

http://www.deq.idaho.gov/water/data_reports/storm_water/catalog/index.cfm

Storm Water Management Manual for Eastern Washington:

<http://www.ecy.wa.gov/programs/wq/stormwater/easternmanual/manual.html>

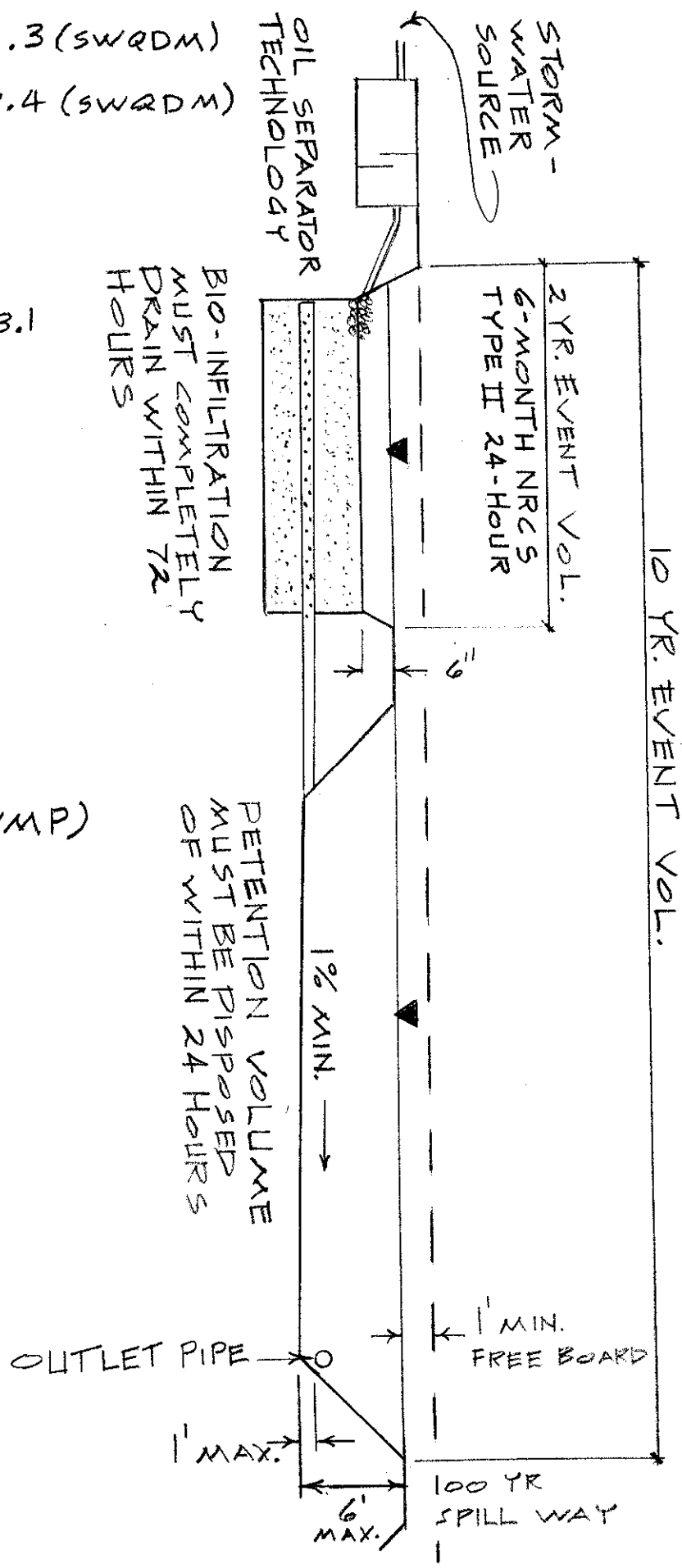
Truckee Meadows Low Impact Development (LID) Manual

<http://www.reno.gov/Modules/ShowDocument.aspx?documentid=10761>

Spokane Regional Stormwater Manual

http://www.spokanecounty.org/data/engineers/srsm_apr08final/SRSM_April2008Final.pdf

DESIGN CRITERIA:
 1. STORM WATER QUALITY DESIGN MANUAL (SWQDM)
 2. APRIL 2000 STORM WATER MASTER PLAN (SWMP)



CHAP. 2, SEC. 2.3 (SWQDM)
 CHAP. 3, SEC. 3.4 (SWQDM)

CHAP. 3, SEC. 3.1
 (SWQDM)

CHAP. II, (SWMP)

BIO-INFILTRATION
 MUST COMPLETELY
 DRAIN WITHIN 72
 HOURS

RETENTION VOLUME
 MUST BE DISPOSED
 OF WITHIN 24 HOURS