Drainage Design and Erosion Control Manual

November 2022

Volume IV

Source Control BMP Library

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Executive Summary of Volume IV

Welcome to Volume IV of the City of Olympia's Drainage Design and Erosion Control Manual (DDECM). This DDECM applies to all of the City of Olympia (City) and is designed to be equivalent to the Washington State Department of Ecology's 2019 Stormwater Management Manual for Western Washington. Volume IV contains a collection of operational and structural source control Best Management Practices (BMPs). Stormwater source control BMPs focus on preventing stormwater pollution from occurring, as opposed to other BMP types that reduce the volume, timing, or pollution in stormwater flows. This Volume contains the following:

IV-2 Stormwater Site Management Plans provides guidance for preparing a Stormwater Site Management Plan and IV-3 Source Control of Pollution provides guidance for preparing a Pollution Source Control Program.

IV-4 Source Control BMPs Applicable to All Sites through *IV-7 BMPs for Single-Family Residences* provide BMPs grouped by types of activities that have the potential to produce pollution.

IV-8 Maintenance Standards for Stormwater Facilities provides guidance for preparing a Stormwater Facility Maintenance Program.

Appendix IV-A: Urban Land Uses and Pollutant Generating Sources identifies pollutant-generating sources at various land uses, i.e., manufacturing, transportation, communication, wholesale, retail, and service land uses.

Appendix IV-B: Management of Street Waste Solids and Liquids addresses what to do with waste generated from stormwater maintenance activities such as street sweeping, catch basin cleaning, and Flow Control and Runoff Treatment BMP maintenance.

Appendix IV-C1 and *IV-C2* contain residential and commercial pollution source control program templates.

Appendix IV-D addresses recycling and disposal of vehicle fluids and other wastes.

Appendix IV-E addresses regulatory requirements that impact stormwater programs.

Appendix IV-F includes information on NPDES stormwater discharge permits.

Appendix IV-G contains examples of an integrated pest management program.

Appendix IV-H1 and *IV-H2* provide residential and commercial agreements to maintain stormwater facilities templates.

Appendix IV-I provides a stormwater facility maintenance program template.

Appendix IV-J contains stormwater facility description and checklists.

Appendix IV-K contains a stormwater facility inspection form and log sheet.

Refer to Volumes I, II, III, and V for information on the following:

Volume I introduces the measures necessary to control the quantity and quality of stormwater produced by new development and redevelopment. It includes an introduction to stormwater management, guidance on regulatory requirements for stormwater management, and details the minimum requirements for new development and redevelopment sites.

Volume II focuses on managing stormwater impacts associated with construction activities. It discusses the need for pollution prevention for construction stormwater, details how to document construction BMPs in a construction stormwater pollution prevention plan and includes information on how to implement construction stormwater BMPs.

Volume III provides guidance on how to choose, hydrologically model, and document stormwater BMPs in a stormwater site plan.

Volume V contains a library of design criteria for BMPs that project proponents can use to meet I-3.4.5 CR5: On-Site Stormwater Management, I-3.4.6 CR6: Runoff Treatment, and/or I-3.4.7 CR7: Flow Control.

IV-1 How to Use this Volume

IV-1.1 Stormwater Site Management Plans

Section 2 of this Volume outlines the structure and content necessary for preparing Stormwater Site Management Plans for projects and management areas. Preparation of a Stormwater Site Management Plan is only necessary when required to meet both *Core Requirement #3 – Source Control of Pollution* and *Core Requirement #9 – Operation and Maintenance*. Projects subject to both Core Requirement #3 and #9 will start preparation of Stormwater Site Management Plans by consulting Section IV-2.

IV-1.2 Pollution Source Control Program

Use Section IV-3 through IV-7 and associated appendices of this Volume in preparing Pollution Source Control Programs as required by Core Requirement #3 of Volume I.

Within this Volume, the reader should interpret the term “applicable” when referring to specific operational or structural source controls as meaning “mandatory” or “required”.

Users should consult Appendix IV-A regarding their specific businesses and activities to identify their common pollutant sources. Then refer to the appropriate worksheets contained in the templates of Appendix IV-B to identify proper source control BMPs for a given type of pollutant source. Sections IV-4 through IV-7 also contain design criteria for source control BMPs. Some users will wish to refer to additional appendices for specific information on regulatory requirements affecting their projects.

Section IV-5 identifies pollution source control BMPs that apply to specific types of pollutant sources. For a more complete discussion of treatment BMP design information, refer to Volume V.

Operators under Ecology’s Industrial Stormwater General Permit, Boatyard General Permit, or Sand and Gravel General Permit should use Volume IV of Ecology’s Stormwater Management Manual for Western Washington to identify applicable (mandatory) and recommended operational and structural source control BMPs for inclusion in their Stormwater Pollution Prevention Plans (SWPPPs).

Operators of commercial, industrial, and multifamily properties not under an Ecology permit should use Section 3 of this volume in developing their SWPPPs and should check with the City of Olympia regarding local requirements related to source control BMPs and SWPPPs.

IV-1.3 Stormwater Facility Maintenance and Inspection

Section 8 and associated appendices of this Volume shall be used in preparing Stormwater Facility Maintenance Programs as required by *Core Requirement #9 – Operation and Maintenance*, of Volume I.

Appendix IV-H, Appendix IV-J, and Appendix IV-K contain maintenance agreements, stormwater facility checklists, descriptions, and inspection reporting materials to be used when preparing a Stormwater Facility Maintenance Program.

IV-2 Stormwater Site Management Plans

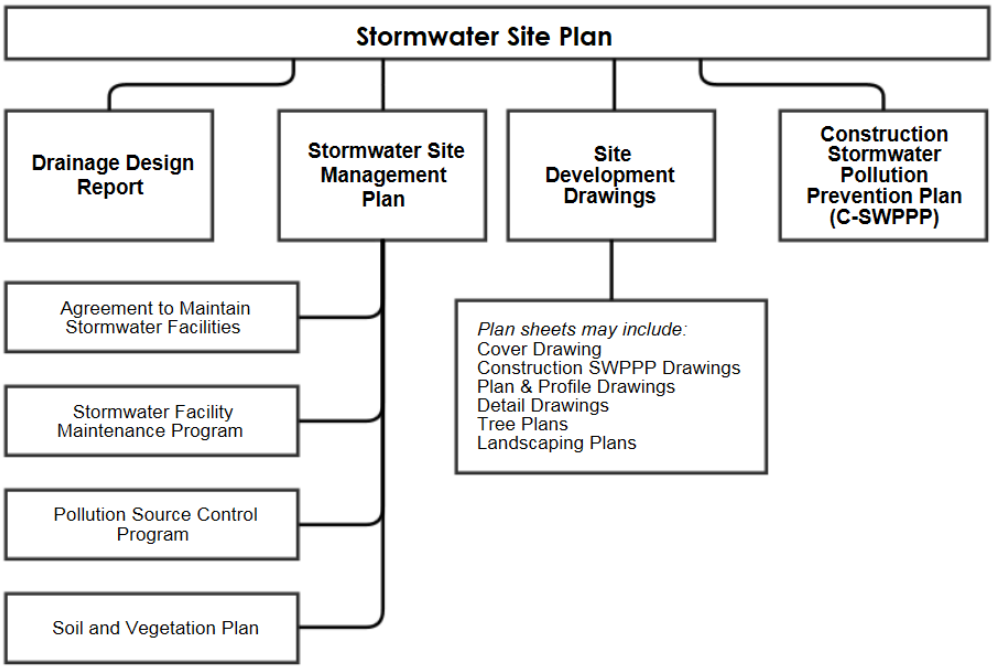
A Stormwater Site Management Plan is a document prepared for all development projects required to meet both Core Requirement #3 – Source Control of Pollution and Core Requirement #9 – Operation and Maintenance of Volume I of this DDECM. Stormwater Site Management Plans address all operational and structural Best Management Practices (BMPs) designed for the site to manage stormwater in accordance with this DDECM. The Stormwater Site Management Plan is a site-specific, comprehensive document that addresses not only the operation and maintenance of structural stormwater system components, but also addresses the management of tree tracts, Soil and Vegetation Protection Areas, vegetated dispersal areas, and low impact development stormwater controls.

Stormwater Site Management Plans shall contain the following components:

- A legal agreement (known as a stormwater maintenance agreement) between the site owner and the City of Olympia to maintain stormwater facilities owned by the development
- A Stormwater Facility Maintenance Program for the site
- A Pollution Source Control Program specific to site use
- Soil and Vegetation Plans (when applicable)

Prior to final acceptance of constructed stormwater facilities, the Stormwater Site Management Plan shall be reviewed and approved by the Stormwater Manual Administrator or designated City of Olympia Public Works – Water Resources staff. Stormwater Site Management Plans shall be included as part of a project Stormwater Site Plan submittal prepared in accordance with Volume I. See Figure IV-2.1 for components of a Stormwater Site Plan.

Figure IV-2-1 Typical Stormwater Site Plan Components



IV-2.1 Site Inspection and Reporting Requirements

Within the City of Olympia, private property owners are responsible for maintaining stormwater management structures and facilities that they own. Stormwater management facilities that require routine inspection and maintenance are identified in a recorded operation and maintenance agreement between the City and the owner of the stormwater management site. Legal agreements for stormwater facility maintenance shall run with the property and be transferred to successive owners. Owners of stormwater sites and facilities should have a maintenance program that addresses every component of the stormwater system and other areas designated for protection. The purpose of the operation and maintenance program is to ensure the management site and systems within it do not lose their intended capability to manage stormwater.

The operation and maintenance agreement for stormwater management sites requires owners of private stormwater management facilities to conduct routine and non-routine inspection and maintenance of their stormwater system. Owners and operators of stormwater management sites shall prepare an annual inspection report and submit to City of Olympia Public Works – Water Resources department on or before May 15 each year.

Owners/Operators of stormwater management sites shall:

- Implement a Stormwater Facility Maintenance Program for the site that ensures proper functionality of the system.
- Implement a site-specific Pollution Source Control Program that limits pollution that may potentially enter the stormwater facility or receiving waters.

- Maintain a record of steps taken to implement the Stormwater Facility Maintenance Program and Pollution Source Control Program for the site. This may include the completion of inspection checklists, notes regarding issues encountered, and steps taken to remedy deficiencies or issues with stormwater management BMPs.
- Submit an annual report regarding implementation of the above programs by May 15.

Technical resources and City staff contact information for private stormwater site inspections and source control pollution prevention can be found on the City of Olympia website. Stormwater Facility Descriptions and Checklists and Stormwater Facility Inspection Form with Log Sheet used for reporting are found in Appendix IV-J and Appendix IV-K, respectively.

IV-2.2 Preparation of Stormwater Site Management Plans

Stormwater Site Management Plans shall be prepared in accordance with this section and included in the Stormwater Site Plan documents.

Refer to Volume I for Stormwater Site Plan submittal requirements.

IV-2.2.1 Stormwater Site Management Plan Format and Requirements

Stormwater Site Management Plans shall be formatted per the requirements of the Thurston County Auditor's office for recorded documents. The recorded plan shall include the following items:

Cover Sheet

The Stormwater Site Management Plan cover sheet should identify the document and the name of the project or site the plan is prepared for. The party responsible for preparing the plan and the date it was prepared shall be also included on the cover sheet.

Agreement to Maintain Stormwater Facilities

A legal agreement between the owner of the site covered by the Stormwater Site Management Plan and the City of Olympia shall be prepared and included using the appropriate template and language from Appendix IV-H. The legal description shall include all parcels, tracts, or easements covered by the Plan and those subject to the Stormwater Facility Maintenance Program and/or the Pollution Source Control Program.

Attachment "A" – Stormwater Facility Maintenance Program

The Stormwater Facility Maintenance Program shall include all appropriate guidance, narrative, key maps, inspection checklists, and log forms necessary for the owner to complete inspection and maintenance tasks associated with the management site. Refer to *Section IV-8.3* for specific guidance and requirements. Additionally, Soil and Vegetation Plans associated with site Soil and Vegetation Protection Areas (SVPAs) shall be included in the Stormwater Facility Maintenance Program.

Attachment "B" – Pollution Source Control Program

A site-specific Pollution Source Control Program shall be prepared as part of all Stormwater Site Management Plans. Preparation of Pollution Source Control Programs for both commercial and residential development projects shall be prepared using the guidance in Section 8 of Volume IV. Templates to aid in Pollution Source Control Program preparation and identification of appropriate source control BMPs are included in Appendix IV-A and Appendix IV-C.

Projects required to prepare an Integrated Pest Management Plan (IPMP) shall also include this additional section the Pollution Source Control Program document. An example of an Integrated Pest Management Program can be found in Appendix IV-F.

IV-3 Source Control of Pollution

This section provides guidance in selecting source control Best Management Practices (BMPs) and preparing Pollution Source Control Programs to meet *Core Requirement #3 – Source Control of Pollution* in Volume I. Best Management Practices (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural, and/or managerial practices that prevent or reduce the release of pollutants and other adverse impacts to waters of Washington State. BMPs can be used singularly or in combination.

Stormwater source control BMPs focus on preventing stormwater pollution from occurring. As opposed to other BMP types that attempt to reduce the volume, timing, or existing pollution in stormwater flows (refer to Volumes II, III, and V).

Facilities covered under Ecology's Industrial Stormwater General Permit, Boatyard General Permit, or Sand and Gravel General Permit should also consult this chapter to identify applicable (mandatory) and recommended operational and structural BMPs. All three permits require permittees to develop and implement Stormwater Pollution Prevention Plans (SWPPPs). Industrial SWPPPs and Boatyard SWPPPs must include Operational Source Control BMPs and Structural Source Control BMPs listed as "applicable" in this Volume.

All known, available and reasonable source control BMPs shall be applied to all projects and potential pollution generating sites and sources within Olympia city limits. Source control BMPs shall be selected, designed, and maintained according to this manual.

A site-specific Pollution Source Control Program consistent with the provisions of this volume shall be prepared for all projects where Core Requirement #3 applies. The party (or parties) responsible for implementation of the Program - the Program Operator - shall be identified in the prepared document. The Pollution Source Control Program shall be an attachment to the agreement to maintain stormwater management sites and be executed and recorded with the agreement to maintain. The Pollution Source Control Program shall run with the land and be transferred automatically to all subsequent owners. Copies of the agreement and Pollution Source Control Program shall be retained onsite or within reasonable access to the site. Pollution Source Control Program preparation templates are available in Appendix IV-C.

IV-3.1 Pollutants Targeted

Applying the source control BMPs in this section can help the City of Olympia residents and businesses control urban sources of conventional and toxic pollutants in stormwater and aid them in meeting State water quality standards to protect beneficial uses of receiving waters.

The stormwater pollutants of most concern are total suspended solids (TSS), oil and grease, nutrients, pesticides, other organics, pathogens, biochemical oxygen demand (BOD), heavy metals, and salts (chlorides) (USEPA, 1995, Field and Pitt, 1997, Strecker, et.al., 1997)

Total Suspended Solids

This represents particulate solids such as eroded soil, heavy metal precipitates, and biological solids (all considered as conventional pollutants), which can cause sedimentation in streams and turbidity in receiving surface waters. These sediments can destroy the desired habitat for fish and can affect drinking water supplies. The sediment may be carried to streams, lakes, or Puget Sound where they may be toxic to aquatic life and make dredging necessary.

Oil and Grease

Oil and grease can be toxic to aquatic life. Concentrations in stormwater from commercial and industrial areas often exceed the Washington Department of Ecology (Ecology) guidelines of 10 mg/l maximum daily average, 15 mg/L maximum at any time, and no ongoing or frequently recurring visible sheen.

Nutrients

Phosphorus and nitrogen compounds can cause excessive growth of aquatic vegetation in lakes and marine waters.

BOD

Biological Oxygen Demand (BOD) is a measure of the oxygen demand from organic, nitrogenous, and other materials that are consumed by bacteria present in receiving waters. BOD in the water may deplete Oxygen in the process, threatening higher organisms such as fish.

Toxic Organics

A study found 19 of the U.S. Environmental Protection Agency's 121 priority pollutants present in the runoff from Seattle streets. The most frequently detected pollutants were pesticides, phenols, phthalates, and polynuclear aromatic hydrocarbons (PAHs).

Heavy Metals

Stormwater can contain heavy metals such as lead, zinc, cadmium, and copper at concentrations that often exceed water quality criteria and that can be toxic to fish and other aquatic life. Research in Puget Sound has shown that metals and toxic organics concentrate in sediments and at the water surface (microlayer) where they interfere with the reproductive cycle of many biotic species as well as cause tumors and lesions in fish.

pH

A measure of the alkalinity or acidity that can be toxic to fish if it varies appreciably from neutral pH, which is 7.0.

Bacteria and Viruses

Stormwater can contain disease-causing bacteria and viruses, although not at concentrations found in sanitary sewage. Shellfish subjected to stormwater discharges near urban areas are usually unsafe for human consumption.

Research has shown that the concentrations of pollutants in stormwater from residential, commercial, and industrial areas can exceed Ecology's water quality standards and guidelines.

IV-3.2 Operational and Structural Source Control BMPs

There are two categories of source control BMPs: operational and structural.

Operational source control BMPs are non-structural practices that prevent or reduce pollutants from entering stormwater. Examples include formation of a pollution prevention team, good housekeeping practices, preventive maintenance procedures, spill prevention and cleanup, employee training, inspections of pollutant sources, and record keeping (See *Section IV-4*). They can also include process changes, raw material/product changes, and recycling wastes.

Most stormwater experts consider operational source control BMPs the most cost-effective practice to reduce pollution.

Structural source control BMPs are physical, structural, or mechanical devices or facilities intended to prevent pollutants from entering stormwater. Structural source control BMPs typically include:

- Enclosing and/or covering the pollutant source (e.g., within a building or other enclosure, a roof over storage and working areas, temporary tarp, etc.).
- Physically segregating the pollutant source to prevent run-on of uncontaminated stormwater.
- Devices that direct contaminated stormwater to appropriate treatment BMPs (e.g., discharge to a sanitary sewer if allowed by the City of Olympia).

IV-3.3 Treatment BMPs for Specific Pollutant Sources

Section IV-5 identifies specific treatment BMPs that apply to particular pollutant sources, such as fueling stations, railroad yards, material storage and transfer areas, etc.

Treatment BMPs are intended to remove pollutants from stormwater. Examples include settling basins or vaults, oil/water separators, biofilters, wet ponds, constructed wetlands, infiltration systems, and emerging technologies such as media filtration.

Facilities required to install additional treatment BMPs to comply with Ecology's Industrial Stormwater General Permit (or other General Stormwater Permits) should consider the treatment BMPs identified in Volume IV and V when selecting and designing treatment BMPs. In addition, facilities should consider the sediment control and treatment BMPs in Volume II if turbidity and/or sediment reduction is required.

IV-3.4 Distinction between Applicable and Recommended BMPs

This Volume uses the terminology "applicable BMPs" and "recommended BMPs" to address an important distinction. This section explains the use of these terms.

IV-3.4.1 Applicable (Mandatory) BMPs

Each potentially pollution generating activity in this Volume has a listing of applicable BMPs to be implemented. In context of this Volume of the Manual, *applicable* shall be interpreted to mean *mandatory* implementation of the BMPs for that activity.

The City of Olympia requires all projects (e.g., residential plats, commercial, industrial, and multifamily properties) to implement the BMPs in this Volume when necessary to meet *Core Requirement #3* of

Volume I. Operators of these property types should refer to the source control program prepared for their site for guidance. If no program exists, operators should utilize this chapter in preparation of a site-specific source control program.

All sites covered under the Industrial Stormwater General Permit must include and implement the applicable (mandatory) BMPs in their Industrial SWPPP.

Industrial sites covered by individual industrial stormwater permits must comply with the specific source control and treatment BMPs listed in their permits. Operators under individual industrial stormwater permits may include additional BMPs from this manual, if desired.

All sites covered under the Boatyard Stormwater General Permit must include and implement the applicable (mandatory) BMPs in their Boatyard SWPPP.

Facilities covered under the Sand and Gravel General Permit must include source control BMPs as necessary in their Sand and Gravel SWPPP to achieve AKART and compliance with the stormwater discharge limits in their permit.

Other facilities that are not required by an NPDES permit or City of Olympia to use the BMPs described in this volume are encouraged to implement both applicable and recommended BMPs.

Regulatory programs such as the State Environmental Policy Act (SEPA), water quality certification under Section 401 of the Clean Water Act, and Hydraulic Project Approvals (HPAs) may also require use of the BMPs described in this volume.

IV-3.4.2 Recommended BMPs

This Volume also contains recommended BMPs under each potentially pollution generating activity. Ecology offers these BMPs as approaches that go beyond or complement the applicable (mandatory) BMPs. Implementing the recommended BMPs may improve control of pollutants and provide a more comprehensive and environmentally effective stormwater management program. Ecology encourages all operators to review their SWPPPs and use recommended BMPs where possible.

Facilities covered under the Industrial Stormwater General Permit who trigger a corrective action should consider implementing one or more recommended BMPs as a means to fulfill their corrective action requirements and achieve benchmark values.

IV-3.5 Regulatory Requirements Affecting Stormwater Pollutant Control

Refer to Appendices IV-D and IV-E for information on related requirements from the following organizations:

- City of Olympia or Ecology requirements for discharges to storm, sanitary, and combined sewers; stormwater flow control, treatment and pollutant source control; and air pollution control.
- Ecology requirements for dangerous or hazardous wastes, underground storage tanks, waste reduction, spill control and cleanup, and NPDES stormwater and wastewater discharge permit requirements.
- U. S. Environmental Protection Agency requirements for spill control and cleanup plans, and for NPDES permits on tribal lands.

- Washington State Department of Agriculture requirements for pesticide and fertilizer application control.
- Thurston County Health Department requirements for the disposal of solid wastes to landfills or other facilities.
- U. S. Coast Guard requirements for transfer of petroleum products between marine vessels and onshore facilities and related spill control.
- Local and Washington State Fire Marshall requirements for storage and handling of flammable materials.

IV-3.6 Preparing a Pollution Source Control Program

This Section outlines the process for developing a site-specific **Pollution Source Control Program** that complies with *Core Requirement #3 – Source Control of Pollution* in Volume I. Sites and facilities that hold any of the following permits are subject to additional requirements of their respective programs and should refer to source control program and Stormwater Pollution Prevention Plan (SWPPP) development guidance in Ecology's Stormwater Management Manual for Western Washington:

- Industrial Stormwater General Permit (ISGP)
- Boatyard General Permit
- Sand and Gravel Permit

A Pollution Source Control Program is a component of a Stormwater Site Management Plan.

IV-3.6.1 Steps for Preparing a Pollution Source Control Program

Step 1: Select a Program Template

Pollution Source Control Program templates for different land uses are provided in Appendix IV-C. For a given site or project, the appropriate template will aid in program preparation.

Projects falling into these land use categories shall use and customize the "Commercial" template:

- Commercial sites
- Industrial sites
- Multi-family residential sites

Projects that fall into any of the single-family residential uses below will use the "Residential" template.

- Single-family home construction required to meet *Core Requirement #3*
- Residential subdivisions and plats

Projects using the Residential template need only to complete Steps 1 and 2, and if applicable Step 7.

Step 2: Customize the Program Template

Complete the cover page and add project or site specific information in the appropriate locations such as the Annual Report Checklist (Attachment E). Some sections or attachments in the program template may not be applicable to all sites.

Step 3: Complete the Site Activities Worksheet

Complete the BMP selection and activities worksheet included in the program templates in Appendix IV-C. This worksheet will be included in the final Pollution Source Control Program document as 'Appendix A'.

Select those activities from the list that apply to the site or business. Each activity is linked by number to one or more source control BMPs found in this Volume.

Step 4: Copy and Attach Source Control BMPs

Copy and include the applicable BMPs from this Volume based on the activities identified in Step 3 above. This list of BMPs will be included in the Pollution Source Control Program as 'Appendix B'. BMP numbered identifiers used in this chapter shall be retained when including these BMPs in Appendix B.

Step 5: Complete Table 2 – Operational Source Control Practices Summary

Complete *Table 2 – Operational Source Control Practices Summary* in Section 4.0 of the program template. Include the applicable activities and operational BMPs from Step 3 above. Indicate for each activity the required and recommended operational BMPs applicable to the site.

Step 6: Emergency Spill Control Plan

Some businesses and site activities may require the preparation of an Emergency Spill Control Plan. Prepare this plan using the appropriate guidance for the site use and include as 'Appendix D'. This plan may not always be appropriate or required for residential sites.

Step 7: Integrated Pest Management Plan

Projects meeting thresholds and criteria specified by Thurston County Environmental Health are required to prepare an Integrated Pest Management Plan (IPMP).

An IPMP reviewed and approved by Thurston County Environmental Health shall be included in the Pollution Source Control Program as 'Appendix E' when site use or location require this BMP.

IV-4 Source Control BMPs Applicable (Mandatory) to All Sites

All sites and facilities that require implementation of source control BMPs to meet Core Requirement #3 – Source Control of Pollution shall include the following operational source control BMPs in their Pollution Source Control Program.

Pollution Source Control Programs prepared using program templates in Appendix IV-C will meet this requirement for applicable operational source control BMPs.

S410 BMPs for Correcting Illicit Discharges to Storm Drains

Description of Pollutant Sources: Illicit discharges are unpermitted sanitary or process wastewater discharges to a storm sewer or to surface water, rather than to a sanitary sewer, industrial process wastewater, or other appropriate treatment. They can also include swimming pool water, filter backwash, cleaning solutions/washwaters, cooling water, etc. Experience has shown that illicit discharges are common, particularly in older buildings. In the City of Olympia, if has been found that many businesses and residences hooked internal building drains, sump overflows, process wastewater

discharges, and even sanitary sewer and septic system pipes to the storm drain in the past, allowing a variety of pollutants to flow directly to receiving waters instead of the sanitary sewer or a septic system.

Pollutant Control Approach: Identify and eliminate unpermitted discharges or obtain an NPDES permit, where necessary, particularly at industrial and commercial facilities.

Applicable Operational BMPs:

- All businesses and residences in the City of Olympia must examine their plumbing systems to identify any potential illicit discharges. Review site plans, engineering drawings, or other sources of information for the plumbing systems on the property. Wherever toilets, sinks, appliances, showers and bathtubs, floor drains, industrial process waters, or other indoor activities are connected to the stormwater drainage system, immediately reroute them to the sanitary or septic system, holding tanks, or process treatment system.
- Industries and businesses that have been issued an NPDES Baseline General Permit by Ecology and are allowed specific discharges under that permit are exceptions to this requirement. Please refer to Volume I to determine if your type of business is required to have a NPDES permit.
- If sanitary facilities (such as toilets) are connected to the stormwater drainage system, you must obtain a permit from the City of Olympia Community Planning and Development Department and reroute them to the sanitary sewer.
- Dye testing with a non-toxic dye is one way to determine where a pipe or structure drains if not obvious by observations or on plans. The dye is put into the structure and flushed with some water. Observations are then made at ends-of-pipes, drainage ditches, catch basins, and manholes to look for the color coming through. Contact City of Olympia Stormwater/Wastewater Operations (360) 753-8333 if you need assistance in locating structures adjacent to your property.
- Smoke testing can also help detect illegal connections and is best done by qualified personnel. To conduct smoke testing, shut off all indoor discharges, place a smoke bomb or other smoke-generating device in a storm drain manhole, and force air in after it. Station personnel at each suspect drain location to observe if smoke is coming out. Identify smoking drains for future rerouting.
- Drains which are found to connect to the stormwater drainage system must either be permanently plugged or disconnected and rerouted as soon as possible. Plug unused drains with concrete or similar permanent materials. If a drainpipe is to be rerouted and a sanitary sewer services the property, then the City of Olympia must be contacted. Restrictions on certain types of discharges, particularly industrial process waters, may require pretreatment of discharges before entering the sanitary sewer. It is the responsibility of the property owner or business operator to follow through on rerouting illicit storm drainage connections to the sanitary sewer.
- If the property is not served by a sanitary sewer, alternate measures will be necessary. If the discharge is anything other than domestic waste, then a holding tank or onsite treatment will be necessary. Contact LOTT Alliance Industrial Pretreatment Program at (360) 528-5700 or the City of Olympia Community Planning and Development Department for specific directions for installation and disposal.

Recommended Additional Operational BMPs:

At commercial and industrial facilities, conduct a survey of wastewater discharge connections to storm drains and to surface water as follows:

- Conduct a field survey of buildings, particularly older buildings, and other industrial areas to locate storm drains from buildings and paved surfaces. Note where these discharge.
- During non-stormwater conditions, inspect each storm drain for non-stormwater discharges. Record the locations of all non-stormwater discharges. Include all permitted discharges.
- If useful, prepare a map of each area. Show on the map the known location of storm sewers, sanitary sewers, and permitted and unpermitted discharges. Aerial photos may be useful. Check records such as piping schematics to identify known side sewer connections and show these on the map. Consider using smoke, dye, or chemical analysis tests to detect connections between two conveyance systems (e.g., process water and stormwater). If desirable, conduct TV inspections of the storm drains and record the footage on videotape.
- Compare the observed locations of connections with the information on the map and revise the map accordingly. Note suspect connections that are inconsistent with the field survey.
- Identify all connections to storm sewers or to surface water and take the actions specified above as applicable BMPs.

S453 BMPs for Formation of a Pollution Prevention Team

The pollution prevention team should be responsible for implementing and maintaining all BMPs and treatment for the site. This team should be able to address any corrective actions needed on site to mitigate potential stormwater contamination. The team members should:

- Consist of those people who are familiar with the facility and its operations.
- Possess the knowledge and skills to assess conditions and activities that could impact stormwater quality at your facility, and who can evaluate the effectiveness of control measures.
- Assign pollution prevention team staff to be on duty on a daily basis to cover applicable permittee facilities when those facilities are in operation.
- Have the primary responsibility for developing and overseeing facility activities necessary to comply with stormwater requirements.
- Have access to all applicable permit, monitoring, SWPPP, and other records.
- Be trained in the operation, maintenance and inspections of all BMPs and reporting procedures.
- Establish responsibilities for inspections, operation, maintenance, and emergencies.
- Regularly meet to review overall facility operations and BMP effectiveness.

S454 BMPs for Preventive Maintenance / Good Housekeeping

Preventative maintenance and good housekeeping practices reduce the potential for stormwater to come into contact with pollutants and can reduce maintenance intervals for the drainage system and sewer system.

Applicable BMPs:

- Prevent the discharge of unpermitted liquid or solid wastes, process wastewater, and sewage to ground or surface water, or to storm drains that discharge to surface water, or to the ground. Conduct all oily parts cleaning, steam cleaning, or pressure washing of equipment or containers inside a building, or on an impervious contained area, such as a concrete pad. Direct

contaminated stormwater from such an area to a sanitary sewer where allowed by local sewer authority, or to other approved treatment.

- Promptly contain and clean up solid and liquid pollutant leaks and spills including oils, solvents, fuels, and dust from manufacturing operations on an exposed soil, vegetation, or paved area.
- If a contaminated surface must be pressure washed, collect the resulting washwater for proper disposal (usually involves plugging storm drains, or otherwise preventing discharge and pumping or vacuuming up washwater, for discharge to sanitary sewer or for eductor truck transport to a wastewater treatment plant for disposal).
- Do not hose down pollutants from any area to the ground, storm drains, conveyance ditches, or receiving water. Convey pollutants before discharge to a treatment system approved by the local jurisdiction.
- Sweep all appropriate surfaces with vacuum sweepers quarterly, or more frequently as needed, for the collection and disposal of dust and debris that could contaminate stormwater. Use mechanical sweepers, and manual sweeping as necessary to access areas that a vacuum sweeper can't reach to ensure that all surface contaminants are routinely removed.
- Do not pave over contaminated soil unless it has been determined that ground water has not been and will not be contaminated by the soil. Call Ecology for assistance.
- Construct impervious areas that are compatible with the materials handled. Portland cement concrete, asphalt, or equivalent material may be considered.
- Use drip pans to collect leaks and spills from industrial/commercial equipment such as cranes at ship/boat building and repair facilities, log stackers, industrial parts, trucks and other vehicles stored outside. Empty drip pans immediately after a spill or leak.
- At industrial and commercial facilities, drain oil and fuel filters before disposal. Discard empty oil and fuel filters, oily rags, and other oily solid waste into appropriately closed and properly labeled containers, and in compliance with the Uniform Fire Code or International Building Code.
- For the storage of liquids use containers, such as steel and plastic drums, that are rigid and durable, corrosion resistant to the weather and fluid content, non-absorbent, water tight, rodent-proof, and equipped with a close fitting cover. Unopened containers, such as drums, should be placed on pallets to be up off the ground. Open and in use containers should be placed on a secondary containment pallet.
- For the temporary storage of solid wastes contaminated with liquids or other potential polluted materials use dumpsters, garbage cans, drums, and comparable containers, which are durable, corrosion resistant, non-absorbent, non-leaking, and equipped with either a solid cover or screen cover to prevent littering. If covered with a screen, the container must be stored under a roof or other form of adequate cover. Dumpsters, garbage cans and drums must be kept closed.
- Where exposed to stormwater, use containers, piping, tubing, pumps, fittings, and valves that are appropriate for their intended use and for the contained liquid.
- Clean oils, debris, sludge, etc. from all stormwater facilities regularly, including catch basins, settling/detention basins, oil/water separators, boomed areas, and conveyance systems to prevent the contamination of stormwater. Refer to Ecology Requirements for Generators of Dangerous Wastes in I-2.15 Other Requirements for references to assist in handling potentially dangerous waste.
- Promptly repair or replace all substantially cracked or otherwise damaged paved secondary containment, high-intensity parking, and any other drainage areas, subjected to pollutant

material leaks or spills. Promptly repair or replace all leaking connections, pipes, hoses, valves, etc., which can contaminate stormwater.

- Do not connect floor drains in potential pollutant source areas to storm drains, surface water, or to the ground.

Recommended BMPs:

- Where feasible, store potential stormwater pollutant materials inside a building or under a cover and/or containment.
- Minimize use of toxic cleaning solvents, such as chlorinated solvents, and other toxic chemicals.
- Use environmentally safe raw materials, products, additives, etc. such as substitutes for zinc used in rubber production.
- Recycle waste materials such as solvents, coolants, oils, degreasers, and batteries to the maximum extent feasible. Contact Ecology's *Hazardous Waste & Toxics Reduction Program* at *https://ecology.wa.gov/About-us/Get-to-know-us/Our-Programs/Hazardous-Waste-Toxics-Reduction* for recommendations on recycling or disposal of vehicle waste liquids and other waste materials.
- Stencil warning signs at stormwater catch basins and drains, e.g., "Dump no waste – Drains to waterbody".
- Use solid absorbents, e.g., clay and peat absorbents and rags for cleanup of liquid spills/leaks, where practicable.
- Promptly repair/replace/reseal damaged paved areas at industrial facilities.
- Recycle materials, such as oils, solvents, and wood waste, to the maximum extent practicable.

Note: Evidence of stormwater contamination by oils and grease can include the presence of visible sheen, color, or turbidity in the runoff, or present or historical operational problems at the facility. Operators can use simple pH tests, for example with litmus or pH paper. These tests can screen for high or low pH levels (anything outside a 6.5-8.5 range) due to contamination in stormwater.

S455 BMPs for Spill Prevention and Cleanup

Description of Pollutant Sources: Spills and leaks can damage public infrastructure, interfere with sewage treatment, and cause a threat to human health or the environment. Spills are often preventable if appropriate chemical and waste handling techniques are practiced effectively, and the spill response plan is immediately implemented. Additional spill control requirements may be required based on the specific activity occurring on site.

Applicable BMPs:

Spill Prevention

- Clearly label or mark all containers .
- Store and transport liquid materials in appropriate containers with tight-fitting lids.
- Place drip pans underneath all containers, fittings, valves, and where materials are likely to spill or leak.
- Use tarpaulins, ground cloths, or drip pans in areas where materials are mixed, carried, and applied to capture any spilled materials.

- Train employees on the safe techniques for handling materials used on the site and to check for leaks and spills.

Spill Plan

- Develop and implement a spill plan and update it annually or whenever there is a change in activities or staff responsible for spill cleanup. Post a written summary of the plan at areas with a high potential for spills, such as loading docks, product storage areas, waste storage areas, and near a phone. The spill plan may need to be posted at multiple locations. Describe the facility, including the owner's name, address, and telephone number; the nature of the facility activity; and the general types of chemicals used at the facility.
- Designate spill response employees to be on-site during business activities. Provide a current list of the names and telephone numbers (home and office) of designated spill response employees who are responsible for implementing the spill plan.
- Provide a site plan showing the locations of storage areas for chemicals, inlets/catch basins, spill kits and other relevant infrastructure or materials information.
- Describe the emergency cleanup and disposal procedures. Note the location of all spill kits in the spill plan.
- List the names and telephone numbers of public agencies to contact in the event of a spill and include where the list is located on-site.

Spill Cleanup Kits

- Store all cleanup kits near areas with a high potential for spills so that they are easily accessible in the event of a spill. The contents of the spill kit must be appropriate to the types and quantities of materials stored or otherwise used at the facility and refilled when the materials are used. Spill kits must be located within 25 feet of all fueling/fuel transfer areas, including on-board mobile fuel trucks.
- Note: Ecology recommends that the kit(s) include salvage drums or containers, such as high density polyethylene, polypropylene or polyethylene sheet-lined steel; polyethylene or equivalent disposal bags; an emergency response guidebook; safety gloves/clothes/equipment; shovels or other soil removal equipment; and oil containment booms and absorbent pads; all stored in an impervious container.

Spill Cleanup and Proper Disposal of Waste

- Stop, contain, and clean up all spills immediately upon discovery.
- Implement the spill plan immediately.
- Contact the designated spill response employees.
- Block off and seal nearby inlets/catch basins to prevent materials from entering the drainage system or combined sewer.
- Use the appropriate material to clean up the spill.
- Do not use emulsifiers or dispersants such as liquid detergents or degreasers unless disposed of properly. Emulsifiers and dispersants are not allowed to be used on surface water, or in a place where they may enter storm drains, surface waters, treatments systems, or sanitary sewers.
- Immediately notify Ecology and the local jurisdiction if a spill has reached or may reach a sanitary or storm sewer, ground water, or surface water. Notification must comply with state and federal spill reporting requirements.

- Do not wash absorbent material into interior floor drains or inlets/catch basins.
- Place used spill control materials in appropriate containers and dispose of according to regulations.

S456 BMPs for Employee Training

Train all employees that work in pollutant source areas about the following topics:

- Identifying Pollution Prevention Team Members.
- Identifying pollutant sources.
- Understanding pollutant control measures.
- Spill prevention and response.
- Emergency response procedures.
- Handling practices that are environmentally acceptable. Particularly those related to vehicle/equipment liquids such as fuels, and vehicle/equipment cleaning.

Additional specialized training may be needed for staff who will be responsible for handling hazardous materials.

S457 BMPS for Inspections

Qualified personnel shall conduct inspections monthly. Make and maintain a record of each inspection on-site. The following requirements apply to inspections:

- Be conducted by someone familiar with the facility's site, operations, and BMPs.
- Verify the accuracy of the pollutant source descriptions in the SWPPP.
- Assess all BMPs that have been implemented for effectiveness and needed maintenance and locate areas where additional BMPs are needed.
- Reflect current conditions on the site.
- Include written observations of the presence of floating materials, suspended solids, oil and grease, discoloration, turbidity and odor in the stormwater discharges; in outside vehicle maintenance/repair; and liquid handling, and storage areas. In areas where acid or alkaline materials are handled or stored use a simple litmus or pH paper to identify those types of stormwater contaminants where needed.
- Eliminate or obtain a permit for unpermitted non-stormwater discharges to storm drains or receiving waters, such as process wastewater and vehicle/equipment washwater.
- Identify actions to address inspection deficiencies.

S458 BMPs for Record Keeping

See the applicable permit for specific record-keeping requirements and retention schedules for the following reports. At a minimum, retain the following reports for five years:

- Inspection reports which should include:
    - Time and date of the inspection
    - Locations inspected

    - Statement on status of compliance with the permit
    - Summary report of any remediation activities required
    - Name, title, and signature of person conducting the inspection
- Reports on spills of oil or hazardous substances in greater than Reportable Quantities (Code of Federal Regulations Title 40 Parts 302.4 and 117). Report spills of the following: antifreeze, oil, gasoline, or diesel fuel, that cause:
    - A violation of the State of Washington's Water Quality Standards.
    - A film or sheen upon or discoloration of the waters of the State or adjoining shorelines.
    - A sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines.

To report a spill or to determine if a spill is a substance of a Reportable Quantity, call the Ecology regional office and ask for an oil spill operations or a dangerous waste specialist:

- Northwest Region (425) 649-7000
- Southwest Region (360) 407-6300
- Eastern Region (509) 329-3400
- Central Region (509) 575-2490

In addition, call the Washington Emergency Management Division at 1-800-258-5990 or 1-800-OILS-911 AND the National Response Center at 1-800-424-8802.

Also, refer to *Focus on Emergency Spill Response* (Ecology, 2009).

The following is additional recommended record keeping:

Maintain records of all related pollutant control and pollutant generating activities such as training, materials purchased, material use and disposal, maintenance performed, etc.

S100 Dispose of Collected Runoff and Waste Materials Properly

Every business and residence in the City of Olympia must dispose of solid and liquid wastes and contaminated stormwater properly. There are generally four options for disposal depending on the type of materials. These options include:

- Sanitary sewer and septic systems
- Recycling facilities
- Municipal solid waste disposal facilities
- Hazardous waste treatment, storage, and disposal facilities.

Many liquid wastes and contaminated stormwater (depending on the pollutants and associated concentrations present) may be put into the sanitary sewer, subject to approval by the LOTT Alliance Industrial Pretreatment Program at (360) 528-5700 or the City of Olympia at (360) 753-8333.

If wastes cannot be legally discharged to a sanitary sewer or septic system, one of the other three disposal options must be used. Sumps or holding tanks may be useful for storing liquid wastes temporarily. The contents must be disposed of in the sanitary sewer or at a dangerous waste facility depending on the nature of the waste.

Recycling facilities are a recommended option for many commercial and household items, including used oils, used batteries, old equipment, glass, some plastics, metal scrap materials, solvents, paints, wood and land clearing wastes, and various other solid wastes. Solid wastes that cannot be recycled and that are not hazardous must be disposed of at a licensed municipal solid waste disposal facility.

Dangerous and hazardous wastes must be properly transported to an appropriate hazardous waste treatment, storage, and disposal facility.

Costs of disposal vary considerably from option to option. Especially in the case of dangerous wastes, different types of wastes should be kept segregated. Disposal costs are usually determined by the most hazardous or difficult to dispose of waste present, so you can keep your costs down by not mixing wastes. The City of Olympia Department of Public Works (360) 753-8333 can help you determine the best disposal options for your waste.

S101 Connect Process Water Discharges to a Sanitary Sewer, Holding Tank, or Wastewater Treatment System

This BMP is a core requirement for all industrial and commercial activities that generate contaminated process wastewater, such as washing activities, composting activities, and production and processing activities. The water used in these activities cannot drain to surface waters or groundwater untreated. Process water must drain to a sanitary sewer, holding tank, or wastewater treatment system, or it can be recycled.

The first priority for these businesses is discharge of process water to a sanitary sewer via a new or existing plumbing connection. In order to connect to the sewer, you must contact LOTT Alliance Industrial Pretreatment Program at (360) 528-5700 or City of Olympia Community Planning and Development Department for information on permits for the connection. Pretreatment of industrial wastewaters will often be necessary before it is allowed to discharge to the sewer, and more information can be obtained by calling the number above.

If a sanitary sewer is not available, or if it is determined that a discharge connection is not allowed, the only remaining options are holding tanks or an onsite wastewater treatment facility. Consideration should be given to using a holding tank for used process water if the volume of process water generated by the activity is not excessive. The contents of the holding tank must be pumped out or drained before the tank is full and disposed of properly. If a sanitary sewer connection cannot be made and a holding tank is not used, a wastewater treatment facility must be constructed on the site. This treatment facility must be designed to receive and effectively treat all discharges of process water from the business.

Ecology must be contacted for approval of such a facility, since discharges from the treatment facility will enter surface waters or be spread on land.

For all types of process water discharges the following measures are required if the activity is to remain uncovered. Define a designated area for the activity and provide a mechanism for prevention of stormwater run-on into the activity area. This can be a curb, dike, or berm or similar effective means to prevent run-on. In this manner, only the precipitation that falls within

the activity area is discharged and/or treated along with the activity process water. The designated area should be paved and sloped to a central collection drain. The collection drain must connect to the sanitary sewer (with pretreatment if required), the onsite holding tank, or the onsite treatment facility, whichever method is selected.

This process water BMP can be made more effective if the activity is covered, thus reducing the total amount of water to be treated.

IV-5 Pollutant Source-Specific Activities and BMPs

The BMPs outlined in this Volume are focused on source control; that is, methods to prevent pollution from reaching stormwater in the first place. The use of source control BMPs is always the first line of defense in stormwater pollution prevention efforts for several reasons:

- In many cases, source control BMPs are adequate to correct stormwater pollution problems.
- Most source control BMPs are relatively inexpensive and easy to implement.
- Treatment BMPs are used after pollution has entered stormwater. These BMPs are more expensive and can never remove 100 percent of stormwater pollution. This source control volume identifies specific treatment BMPs that apply to particular pollutant sources, such as fueling stations, railroad yards, storage and transfer of materials, etc.
- NOTE: At times, the type of pollutants present, or the condition of a site could mean treatment BMPs are required. Information about treatment BMPs is found in Volume V of this manual.

Requirements for stormwater source control are contained in Volume I, Core Requirement #3: Source Control of Pollution. In accordance with this core requirement, all known, available and reasonable source control BMPs shall be applied to all projects.

Stormwater treatment may also be required for certain types of businesses, based on the information provided in this volume and in Volume I, Core Requirement #6: Runoff Treatment and in Volume V, Runoff Treatment BMPs. Volume V contains detailed information about stormwater treatment BMPs.

Every site or project in the City of Olympia is required to use the BMPs described in this DDECM to control stormwater pollution. The BMPs of this Section and Sections IV.4 and IV6 are those that primarily apply to commercial and industrial sites. Section IV-7 contains BMPs applicable to single-family residential sites.

The list of BMPs in this section corresponds to the numbering and naming of activities found in the worksheet of Appendix IV-C. If operators perform the listed activity indoors, controlling all discharges from the activity (e.g., process water, washwater, lubricants, solvents, fugitive dust, granular material, blow down waste, etc.) such that no exposure to stormwater occurs, then you do not have to institute new BMPs for that activity. However, if you checked the column for activities performed outdoors, match the number from the worksheet to the BMPs listed in this chapter to find the suggested BMPs you should implement and include them in your Pollution Source Control Program.

In some instances, there are BMPs mandated by various federal, state, or county laws. If you are subject to those laws and regulations via another permit or formal regulatory approval, you are encouraged, but not required to use additional BMPs to further protect our water quality. Developers are responsible for ensuring that discharges from their BMPs meet water quality requirements.

Some businesses are (or will be) required to obtain a NPDES permit for stormwater discharges. These permits are issued and regulated by Ecology. Businesses regulated under the NPDES stormwater program may be exempt from implementing some BMPs outlined in this volume, since they will be implementing BMPs required by the state. Refer to Volume I, for more information about NPDES permits for industries.

The source-specific BMPs described in this section, may be applied to control the sources of pollutants identified in Appendix IV-A. Ecology encourages all operators of facilities that implement pollutant-generating sources in Appendix IV-A to review their SWPPPs and use both the applicable (mandatory) and recommended BMPs where possible.

IV-5.1 Cleaning or Washing Source Control BMPs

S431 BMPs for Washing and Steam Cleaning Vehicles / Equipment / Building Structures

Description of Pollutant Sources: Pollutant sources include the commercial cleaning of vehicles, aircraft, vessels, and other transportation, restaurant kitchens, carpets, and industrial equipment, and large buildings with low- or high-pressure water or steam. This includes "charity" car washes at gas stations and commercial parking lots. The cleaning can include hand washing, scrubbing, sanding, etc. Washwater from cleaning activities can contain oil and grease, suspended solids, heavy metals, soluble organics, soaps, and detergents that can contaminate stormwater.

Permitting Requirements: Obtain all necessary permits for installing, altering, or repairing onsite drainage and side sewers. Restrictions on certain types of discharges may require pretreatment before they enter the sanitary sewer.

Pollutant Control Approach: The preferred approach is to cover and/or contain the cleaning activity, or conduct the activity inside a building, to separate the uncontaminated stormwater from the washwater sources. Convey washwater to a sanitary sewer after approval by the local sewer authority. Provide temporary storage before proper disposal, or recycling. Under this preferred approach, no discharge to the ground, to a storm drain, or to surface water should occur.

The Industrial Stormwater General Permit prohibits the discharge of process wastewater (e.g., vehicle washing wastewater) to ground water or surface water. Stormwater that commingles with process wastewater is considered process wastewater.

Facilities not covered under the Industrial Stormwater General Permit that are unable to follow one of the preferred approaches listed above may discharge washwater to the ground only after proper treatment in accordance with *Vehicle and Equipment Washwater Discharges Best Management Practices Manual* (Ecology, 2012).

The quality of any discharge to the ground after proper treatment must comply with Ecology's Ground Water Quality Standards, *Chapter 173-200 WAC*.

Facilities not covered under the Industrial Stormwater General Permit that are unable to comply with one of the preferred approaches and want to discharge to storm sewer, must meet their local stormwater requirements. Local authorities may require treatment prior to discharge.

Contact the local Ecology Regional Office to discuss permitting options for discharge of washwater to surface water or to a storm drain after on-site treatment.

Applicable Structural Source Control BMPs:

Conduct vehicle/equipment washing in one of the following locations:

- At a commercial washing facility in which the washing occurs in an enclosure and drains to the sanitary sewer, or
- In a building constructed specifically for washing of vehicles and equipment, which drains to a sanitary sewer.
- In a paved area, construct a spill containment pad to prevent the run-on of stormwater from adjacent areas. Slope the spill containment area to collect washwater in a containment pad drain system with perimeter drains, trench drains or catchment drains. Size the containment pad to extend out a minimum of four feet on all sides of the washed vehicles and/or equipment.
- Convey the washwater to a sump (like a grit separator) and then to a sanitary sewer (if allowed by the local Sewer Authority), or other appropriate wastewater treatment or recycle system. The containment sump must have a positive control outlet valve for spill control with live containment volume, and oil/water separation. Size the minimum live storage volume to contain the maximum expected daily washwater flow plus the sludge storage volume below the outlet pipe. Shut the outlet valve during the washing cycle to collect the washwater in the sump. The valve should remain shut for at least two hours following the washing operation to allow the oil and solids to separate before discharge to a sanitary sewer.
- Use a two way valve for discharges from the containment pad. This valve should be normally switched to direct water to treatment but may be switched to the drainage system after that pad is clean to handle stormwater runoff. The stormwater can then drain into the conveyance/discharge system outside of the wash pad (essentially bypassing the sanitary sewer or recycle system). Post signs to inform people of the operation and purpose of the valve. Clean the concrete pad thoroughly until there is no foam or visible sheen in the washwater prior to closing the inlet valve and allowing uncontaminated stormwater to overflow and drain off the pad.
- *Note that the purpose of the valve is to convey only washwater and contaminated stormwater to a treatment system.*
- Collect the washwater from building structures and convey it to appropriate treatment such as a sanitary sewer system if it contains oils, soaps, or detergents. If the washwater does not contain oils, soaps, or detergents (in this case only a low pressure, clean, cold water rinse is allowed) then it could drain to soils that have sufficient natural attenuation capacity for dust and sediment.
- Sweep surfaces prior to cleaning/washing to remove excess sediment and other pollutants.
- If roof equipment or hood vents are cleaned, ensure that no washwater or process water is discharged to the roof drains or drainage systems.
- Label all mobile cleaning equipment as follows: "Properly dispose of all wastewater. Do not discharge to an inlet/catch basin, ditch, stream, or on the ground."

Recommended Additional BMPs:

- Mark the wash area at gas stations, multifamily residences and any other business where non-employees wash vehicles.
- Operators may use a manually operated positive control valve for uncovered wash pads, but a pneumatic or electric valve system is preferable. The valve may be on a timer circuit and opened upon completion of a wash cycle. After draining the sump or separator, the timer would then close the valve.
- Minimize the use of water and detergents in washing operations when practicable.
- Use phosphate-free biodegradable detergents when practicable.

- Use the least hazardous cleaning products available.
- Consider recycling the washwater.

Operators may use soluble/emulsifiable detergents in the wash medium and should use it with care and the appropriate treatment. Carefully consider the selection of soaps and detergents and treatment BMPs. Oil/water separators are ineffective in removing emulsified or water soluble detergents. Another treatment appropriate for emulsified and water soluble detergents may be required.

Exceptions:

- At gas stations (for charity car washes) or commercial parking lots, where it is not possible to discharge the washwater to a sanitary sewer, a temporary plug or a temporary sump pump can be used at the storm drain to collect the washwater for off-site disposal such as to a nearby sanitary sewer.
- New and used car dealerships may wash vehicles in the parking stalls as long as employees use a temporary plug system to collect the washwater for disposal as stated above, or an approved treatment system for the washwater is in place.

At industrial sites, contact Ecology for NPDES Permit requirements even when not using soaps, detergents, and/or other chemical cleaners in washing trucks.

S434 BMPs for Dock Washing

Description of Pollutant Sources: Washing docks (or wharves, piers, floats, and boat ramps) can result in the discharge dirt, bird feces, soaps, and detergents that can be toxic to aquatic life, especially after they take on contaminants while cleaning. The BMPs in this section do not address dry docks, graving docks, or marine railway cleaning operations.

Pollutant Control Approach: Use dry methods and equipment (scraping, sweeping, vacuuming) to remove debris and contaminants prior to cleaning with water to prevent these substances from entering surface water.

Applicable Operational BMPs:

Surface Preparation and Spot Cleaning

- Scoop and collect debris and bird feces.
- Sweep, capture, and dispose of debris from the dock as solid waste. Sweep or vacuum docks to minimize the need for chemical cleaners.
- During cleaning activities, if debris, substances, or wash water could enter surface waters through drains, temporarily block the drains and collect the water for proper disposal.
- Hose down the area if necessary and collect water as feasible.
- Try spot cleaning with water and a coarse cloth before using soaps or detergents.
- If a cleaner is needed for spot cleaning:
    - Mix it in a bucket and use it to scrub down only the areas that need extra attention.
    - Start with vinegar and baking soda and move to other options as needed. Spot clean using a rag if harsher cleaning products are needed.

    - Avoid or minimize the use of petroleum distillates, chlorinated solvents, and ammoniated cleaning agents.
    - Use degreasers or absorbent material to remove residual grease by hand and do not allow this material to enter surface water.
    - Keep cleaners in sealed containers. Keep cleaner containers closed securely when transporting between the shore and docks.
    - Properly dispose of the dirty bucket water.
- Minimize the scour impact of wash water to any exposed soil at the landward end(s) of the dock or below the dock. Place a tarp over exposed soil, plant vegetation, or put berms to contain eroded soil.

Dock Washing and Disposal

- To the extent practicable, collect any wash water generated from hosing down, pressure washing, or cleaning dock areas, and dispose of it properly.
- The following video, provided courtesy of the Port of Seattle, highlights the methods they have developed to collect wash water generated during dock washing.
- Video: Dock Scrubbing at Port of Seattle (YouTube Link): *https://www.youtube.com/watch?v=7RBFdjC3K1Q*
- Try pressure washing using light pressure. This uses less water and decreases the need for soap and scrubbing when washing the dock. Avoid using excessive pressure, which may damage the dock or send flakes of paint and other material into the water.
- Do not place any debris and substances resulting from cleaning activities in shoreline areas, riparian areas, or on adjacent land where these substances may erode into waters of the state.
- Where treated wood associated with the structure being washed are present, use non-abrasive methods and tools that, to the maximum extent practicable, minimize removal of the creosote or treated wood fibers when it removes marine growth from creosote or any other treated wood.
- Do not discharge removed marine growth to waters of the state where such marine growth would accumulate on the sea bed.
- Do not discharge emulsifiers, dispersants, solvents, or other toxic deleterious materials to waters of the state.

S441 BMPs for Potable Water Line Flushing, Water Tank Maintenance, and Hydrant Testing

Description of Pollutant Sources: Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in systems. Flushing done improperly can result in the discharge of solids to receiving waters. Hydrant testing may result in the discharge of rust particles.

Chemicals used in line flushing and tank maintenance are highly toxic to aquatic organisms and can degrade receiving waters.

Pollutant Control Approach: Dechlorinate and pH adjust water used for flushing, tank maintenance, or hydrant testing. Dispose of the water to the sanitary sewer if possible.

Applicable Operational BMPs:

- Remove solids from associated curbs and gutters before flushing water. Use erosion andĚ sediment control BMPs such as BMP C235: Wattles, BMP C220: Inlet Protection, etc. to collectĚ any solids resulting from flushing activities.
- If using super chlorination or chemical treatment as part of flushing, discharge water to theĚ sanitary sewer. If sanitary sewer is not available, the water may be infiltrated to the ground asĚ long as all of the following are met:
    - The water is dechlorinated to a total residual chlorine of 0.1 ppm or less.
    - Water quality standards are met.
    - A diffuser is used to prevent erosion.
    - The water does not cross property lines.
- Discharging water to a drainage system requires approval from the local jurisdiction. Check withĚ the City of Olympia to determine their requirements for approval. Most jurisdictions will requireĚ the water to be dechlorinated to a total residual chlorine concentration of 0.1 ppm or less andĚ pH adjusted if necessary. Water must be volumetrically and velocity controlled to preventĚ resuspension of sediments or pollutants in the Municipal Separate Storm Sewer System (MS4).
- Do not over apply dechlorination agents. This can deplete the dissolved oxygen concentrationĚ and reduce the pH in discharge / receiving waters.

Optional Operational BMPs:

- If possible, design flushing to convey accumulated material to strategic locations, such as to the sanitary sewer or to a treatment facility; thus, preventing re-suspension and overflow of a portion of the solids during storm events.
- If possible, conduct flushing and tank maintenance activities on non-rainy days and during the time of year that poses the least risk to aquatic biota.

Optional Treatment BMPs:

- Treatment for dechlorinating can include an application of a stoichiometric quantity of:
    - Ascorbic Acid, Sodium Ascorbate (Vitamin C)
    - Calcium Thiosulfate
    - Sodium Sulfite tablets
    - Sodium Thiosulfate
    - Sodium Bisulfite
    - Alternate Dechlorination Solutions

S108 BMPs for Cleaning or Washing of Tools, Engines, and Manufacturing Equipment

This activity applies to businesses and public agencies that clean manufacturing equipment such as saws, grinders, screens, and other processing devices outside of buildings, and businesses engaged in pressure washing of engines, equipment, and portable objects.

Description of Pollutant Sources: Pollutant sources include toxic hydrocarbons, organic compounds, oils and greases, nutrients, heavy metals, pH, suspended solids, biochemical oxygen demand (BOD), and chemical oxygen demand (COD).

Pollutant Control Approach: The preferred approach is to cover and/or contain the cleaning activity or conduct the activity inside a building. Washwater must be conveyed to a sanitary sewer after approval by your sewer service provider, temporarily stored before proper disposal, or recycled, with no discharge to the ground, a storm drain, or surface water. Washwater may be discharged to the ground after proper treatment in accordance with *Ecology guidance WQ-R-95-56, "Vehicle and Equipment Washwater Discharges," Revised 9/2007*. The quality of any discharge to the ground after proper treatment (gravity separation followed by media filtration) must comply with Ecology's Ground Water Quality Standards, Chapter 173-200 WAC. Contact the Ecology Southwest Regional Office for an NPDES permit application for discharge of washwater to surface water or to a storm drain after onsite treatment.

Required BMPs

The following BMPs (or equivalent measures) are required of all businesses and public agencies that clean or wash tools, engines, equipment, and portable objects:

- Illicit connections to the stormwater drainage system must be eliminated.
- Train employees to control washing operations to prevent stormwater contamination.
- All washwater must discharge to a holding tank, process treatment system, or sanitary sewer--never to the stormwater drainage system.
- Pressure washing must be performed in a designated area (such as a wash pad) provided with a sump drain and stormwater run-on prevention (Figures IV-5.1 and IV-5.2).

Figure IV-5.1 Wash Pad for Tool and Equipment Washing

Photo courtesy of Seattle Public Utilities)

Figure IV-5.2 Uncovered Washing Area for Tools, Engines, Equipment, and Portable Objects, with Drains to a Sanitary Sewer, Process Treatment, or a Dead-End Sump.

(Photo courtesy of Seattle Public Utilities)

Suggested BMPs

The following BMPs are not required but can provide additional pollution control:

- If soaps or detergents are used, use the least toxic cleaner capable of doing the job. Use non-phosphate detergent, if possible, to reduce loadings at your local wastewater treatment plant.
- Limit the amount of water used in washing activities to reduce the potential of runoff carrying pollutants beyond the designated wash pad or capture system.
- Recycle washwater for subsequent washings.
- Implement one or more of the stormwater treatment BMPs found in Volume V.

NOTE: For discharging washwaters containing soaps and detergents, the use of infiltration, biofiltration, wet ponds, and wetlands must not result in the violation of groundwater quality standards.

S109 BMPs for Cleaning or Washing of Cooking Equipment

This activity applies to businesses that clean cooking equipment such as vent filters, grills, and grease traps outside of buildings.

Description of Pollutant Sources: Pollutants of concern consist of oil and grease, nutrients, suspended solids, biochemical oxygen demand (BOD) and chemical oxygen demand (COD).

Pollutant Control Approach: Businesses engaged in this activity that cannot connect discharges to a sanitary sewer, holding tank, or process water treatment system must contact Ecology and obtain a NPDES wastewater permit.

Required BMPs

The following BMPs or equivalent measures are required of all businesses engaged in cleaning or washing of cooking equipment:

- Illicit connections to the stormwater drainage system must be eliminated. See BMP S.1 for detailed requirements.
- Employees must be educated about the need to prevent stormwater contamination from washing operations.
- Washwater cannot be discharged to the stormwater drainage system.
- Paved washing areas must be swept daily to collect loose solid materials for proper disposal.
- Greasy buildup on cooking equipment must be removed and properly disposed of prior to washing to reduce the amount of material that can potentially contaminate runoff.
- Move the activity indoors, into either an existing building or a newly constructed building or shed, with drainage to a sanitary sewer, holding tank, or process treatment system (Figure IV-5.3). See BMP S.3 for further information on drainage alternatives. Any connection to the sanitary sewer requires the approval of the LOTT Alliance Industrial Pretreatment Program at (360) 528-5700 or your sewer service provider, if your site is not within the LOTT service area.

OR

- Use a tub or similar device to contain washwater. This water must be recycled for subsequent washing or disposed of in a holding tank or sanitary sewer.

OR

- If the washing activity cannot be moved indoors or contained in a tub, then the washing area must drain to a sanitary sewer, holding tank, or process treatment system, and provisions must be made to prevent stormwater run-on onto the washing area. If discharging to a sanitary sewer, permits must be obtained from the LOTT Alliance Industrial Pretreatment Program at (360) 528-5700 or your local sewer service provider if your site is not within the LOTT service area.

Figure IV-5.3 Cleaning and Washing Cooking Equipment Indoors.

(Photo courtesy of Seattle Public Utilities)

- If a holding tank is used for storage of washwater, the contents must be pumped out before it is full and disposed of appropriately to a sanitary sewer or wastewater treatment system.

Suggested BMPs

The following BMPs are not required but can provide additional pollution protection:

- A cover should be placed over a designated wash area to keep rain from falling on dirty equipment and producing contaminated runoff.
- Implement one or more of the treatment BMPs found in Volume V.
- For discharging washwaters containing soaps and detergents, the use of infiltration, biofiltration, wet ponds, and wetlands must not result in the violation of groundwater quality standards.

S110 BMPs for Collection and Disposal of Wastewater in Mobile Interior Washing Operations

This activity applies to businesses that wash carpets and other interior items on a mobile site-to-site basis. The typical fleet washing process includes use of machines that spray the washwater solution onto the carpet or upholstery and then vacuums the dirty solution up into a portable tank with limited capacity.

Description of Pollutant Sources: Pollutants of concern are nutrients, suspended solids, organic compounds (such as pesticides and chemicals used for flea and odor control), biochemical oxygen demand (BOD), and chemical oxygen demand (COD).

Pollutant Control Approach: Previously, common practice was to discharge the dirty solution to the ground or to a drain connected to the stormwater drainage system between site visits. **These practices are now illegal.** This point must be made clear to all employees. Wastewater from mobile washing operations may be permitted for sanitary sewer disposal if it does not contain high concentrations of toxic materials.

Required BMPs

The following BMPs are required of all businesses doing mobile interior wash activities:

Wastewater from mobile washing operations must be poured into a sanitary sewer drain at the site of collection, the business office, or at another proper location. If discharging to a sanitary sewer, permits must be obtained from the LOTT Alliance Industrial Pretreatment Program at (360) 528-5700 or your local sewer service provider.

Absolutely no wastewater from mobile interior wash activities can be disposed of outdoors, or to a drain connected to the stormwater drainage system.

Some chemicals used for flea and odor control are listed by U.S. Environmental Protection Agency (U.S. EPA) as toxics. The LOTT Alliance Industrial Pretreatment Program at (360) 528-5700 or your local sewer service provider will need to know the type of chemicals and amount of water you intend to discharge. If the discharge is approved, they will then issue a permit for your activity.

If sanitary sewer disposal is not available or not allowed, the collected wastewater must be returned to the business site for process treatment or transfer to a holding tank.

Suggested BMPs

The following BMPs are not required, but can provide additional pollution protection:

- Use the least toxic detergents and cleaners that will get the job done. Select non-phosphate detergents when possible.
- Limit the amount of water used in interior washing operations. This will save you time, money, and effort when it comes to proper disposal.
- Recycle washwater for more than one use.

Roads, Ditches, and Parking Lot Source Control BMPs

S405 BMPs for Deicing and Anti-Icing Operations for Airports

Refer to 40 CFR Part 449 for EPA effluent limitations guidelines and new source performance standards to control discharges of pollutants from airport deicing operations.

Description of Pollutant Sources: Operators use deicing and/or apply anti-icing compounds on airport runways, taxiways, and on aircraft to control ice and snow. Typically, ethylene glycol and propylene glycol are deicers used on aircraft. Deicers commonly used on runways, taxiways, and other hard surfaces include calcium magnesium acetate (CMA), calcium chloride, magnesium chloride, sodium chloride, urea, and potassium acetate. The deicing and anti-icing compounds become pollutants when conveyed to storm drains or to surface water after application. Leaks and spills of these chemicals can also occur during their handling and storage.

Pollutant Control Approach for Aircraft: Spent glycol discharges in aircraft application areas are regulated process wastewaters under Ecology's Industrial Stormwater General Permit. BMPs for aircraft de/anti-icers must be consistent with aviation safety and the operational needs of the aircraft operator.

Applicable BMPs for Aircraft:

- Conduct aircraft deicing or anti-icing applications in impervious containment areas. Collect aircraft deicer or anti-icer spent chemicals, such as glycol, draining from aircraft in deicing or anti-icing application areas and convey to a sanitary sewer, treatment, or other approved disposal or recovery method. Divert deicing runoff from paved gate areas to appropriate collection areas or conveyances for proper treatment or disposal.
- Do not discharge spent deicer or anti-icer chemicals or stormwater contaminated with aircraft deicer or anti-icer chemicals from application areas, including gate areas into storm drains. No discharge to surface water, or ground water, directly or indirectly should occur.
- Transfer deicing and anti-icing chemicals on an impervious containment pad, or equivalent spill/leak containment area, and store in secondary containment areas. (See S428 BMPs for Storage of Liquids in Permanent Aboveground Tanks).
- Note this applicable containment BMP of aircraft de/anti-icing applications, and applicable treatment BMPs for de/anti-icer spent chemicals such as glycols.

Recommended Additional BMPs for Aircraft:

- Establish a centralized aircraft de/anti-icing facility, if practicable, or in designated areas of the tarmac equipped with separate collection drains for the spent deicer liquids.
- Consider installing an aircraft de/anti-icing chemical recovery system, or contract with a chemical recycler.

Applicable BMPs for Airport Runways/Taxiways:

- Avoid excessive application of all de/anti-icing chemicals, which could contaminate stormwater.
- Store and transfer de/anti-icing materials on an impervious containment pad or an equivalent containment area and/or under cover in accordance with S429 BMPs for Storage or Transfer (Outside) of Solid Raw Materials, Byproducts, or Finished Products. Consider other material storage and transfer approaches only if the de/anti-icer material will not contaminate stormwater.

Recommended Additional BMPs for Airport Runways/Taxiways:

- Include limits on toxic materials and phosphorous in the specifications for de/anti-icers, where applicable.
- Consider using anti-icing materials rather than deicers if it will result in less adverse environmental impact.
- Select cost-effective de/anti-icers that cause the least adverse environmental impact.

S406 BMPs for Streets and Highways

Description of Pollutant Sources: These BMPs apply to the maintenance and deicing/anti-icing of streets and highways. Deicing products can be conveyed during storm events to inlets/catch basins or to receiving waters after application. Leaks and spills of these products can also occur during their handling and storage. Equipment and processes using during maintenance can contribute pollutants such as oil and grease, suspended solids, turbidity, high pH, and metals.

Pollutant Control Approach: Apply good housekeeping practices, preventative maintenance, properly train employees, and use materials that cause less adverse effects on the environment.

Applicable BMPs:

Deicing and Anti-Icing Operations

- Adhere to manufacturer's guidelines and industry standards of use and application.
- Select de and anti-icers that cause the least adverse environmental impact. Apply only as needed using minimum quantities.
- Where practicable use roadway deicers, such as calcium magnesium acetate, potassium acetate, or similar materials, that cause less adverse environmental impact than urea, and sodium chloride.
- Store and transfer de and anti-icing materials on impervious containment pads, or an equivalent spill/leak containment area in accordance with *S429 BMPs for Storage or Transfer (Outside) of Solid Raw Materials, Byproducts, or Finished Products*.

- Sweep/clean up accumulated de and anti-icing materials and grit from roads as soon as possible after the road surface clears.
- Minimize use in areas where runoff or spray from the roadway immediately enters sensitive areas such as fish-bearing streams.

Maintenance Operations

- Use drip pans or absorbents wherever concrete, asphalt, asphalt emulsion, paint product, and drips are likely to spill, such as beneath discharge points from equipment.
- Cover and contain nearby storm drains to keep runoff from entering the drainage system.
- Collect and contain all solids, slurry, and rinse water. Do not allow these to enter gutters, storm drains, or drainage ditches or onto the paved surface of a roadway or driveway.
- Designate an area onsite for washing hand tools and collect that water for disposal.
- Conduct all fueling of equipment in accordance with S419 BMPs for Mobile Fueling of Vehicles and Heavy Equipment.
- Do not use diesel fuel for cleaning or prepping asphalt tools and equipment.
- Sweep areas as frequently as needed. Collect all loose aggregate and dust for disposal. Do not hose down areas into storm drains.
- Store all fuel, paint, and other products on secondary containment.
- Conduct paint striping operations during dry weather.

Recommended Additional BMPs:

- Consider the Pacific Northwest Snowfighters Qualified Products List when selecting roadway de-icers and anti-icers.
- Intensify roadway and drainage structure cleaning in early spring to help remove particulates from road surfaces.
- Include limits on toxic metals in the specifications for de/anti-icers.
- Install catch basin inserts to collect excess sediment and debris as necessary. Inspect and maintain catch basin inserts to ensure they are working correctly.
- Research admixtures (e.g., corrosion inhibitors, surfactants) to determine what additional pollutants may be an issue. Verify with the local jurisdiction if there are any restrictions on admixtures.

S415 BMPs for Maintenance of Public and Private Utility Corridors and Facilities

Description of Pollutant Sources: Corridors and facilities at petroleum product pipelines, natural gas pipelines, water pipelines, electrical power transmission corridors, and rights-of-way can be sources of pollutants such as herbicides used for vegetation management, and eroded soil particles from unpaved access roads. At pump stations, waste materials generated during maintenance activities may be temporarily stored outside. Additional potential pollutant sources include the leaching of preservatives from wood utility poles, PCBs in older transformers, water removed from underground transformer vaults, and leaks/spills from petroleum pipelines. The following are potential pollutants: oil and grease, TSS, BOD, organics, PCBs, pesticides, and heavy metals.

Pollutant Control Approach: Implementation of spill control plans as well as control of fertilizer and pesticide applications, soil erosion, and site debris that can contaminate stormwater.

Applicable Operational BMPs:

- Minimize the amount of herbicides and other pesticides used to maintain access roads and facilities.
- Implement S411 BMPs for Landscaping and Lawn / Vegetation Management.
- Comply with WSDA Pesticide Regulations (see I-2.15 Other Requirements).
- When removing water or sediments from electric transformer vaults, determine the presence of contaminants before disposing of the water and sediments.
    - This includes inspecting for the presence of oil or sheen and determining from records or testing if the transformers contain PCBs.
    - If records or tests indicate that the sediments or water are contaminated above applicable levels, manage these media in accordance with applicable federal and state regulations, including the federal PCB rules (40 CFR 761) and the state MTCA cleanup regulations (*Chapter 173-340 WAC*).
    - Water removed from the vaults can be discharged in accordance with the federal 40 CFR 761.79, and state regulations (*Chapter 173-201A WAC* and *Chapter 173-200 WAC*), or via the sanitary sewer if the requirements, including applicable permits, for such a discharge are met. (See also Requirements for Stormwater Discharges to Public Sanitary Sewers, Septic Systems, Dead-End Sumps, and Industrial Waste Treatment Systems and Ecology Requirements for Generators of Dangerous Wastes in I-2.15 Other Requirements).
- Within utility corridors, prepare maintenance procedures to minimize the erosion of soil. An implementation schedule may provide for a vegetative, gravel, or equivalent cover that minimizes bare or thinly vegetated ground surfaces within the corridor.
- Stabilize access roads or areas of bare ground with gravel, crushed rock, or another method to prevent erosion. Use and manage vegetation to minimize bare ground/soils that may be susceptible to erosion.
- Provide maintenance practices to prevent stormwater from accumulating and draining across and/or onto roadways. Convey stormwater through roadside ditches and culverts. The road should be crowned, outsloped, water barred, or otherwise left in a condition not conducive to erosion. Appropriately maintaining grassy roadside ditches discharging to surface waters is an effective way of removing some pollutants associated with sediments carried by stormwater.
- Maintain ditches and culverts at an appropriate frequency to ensure that plugging and flooding across the roadbed, with resulting overflow erosion, does not occur.
- Apply the appropriate BMPs in this Volume for the storage of waste materials that can contaminate stormwater.

Recommended Operational BMPs:

- When selecting utility poles for a specific location, consider the potential environmental effects of the pole or poles during storage, handling, and end-use, as well as its cost, safety, efficacy, and expected life. Use wood products treated with chemical preservatives made in accordance with generally accepted industry standards such as the American Wood Preservers Association Standards (see http://www.awpa.com/standards/). Consider alternative materials or

technologies if placing poles in or near an environmentally sensitive area, such as a wetland or a drinking water well. Alternative technologies include poles constructed with material(s) other than wood such as fiberglass composites, metal, or concrete. Consider other technologies and materials, such as sleeves or caissons for wood poles, when they are determined to be practicable and available.

- As soon as practicable remove all litter from wire cutting/replacing operations.
- Implement temporary erosion and sediment control in areas cleared of trees and vegetation and during the construction of new roads.

S416 BMPs for Maintenance of Roadside Ditches

Description of Pollutant Sources: Common road debris including eroded soil, oils, vegetative particles, and heavy metals can be sources of stormwater pollutants.

Pollutant Control Approach: Maintain roadside ditches to preserve the condition and capacity for which they were originally constructed, and to minimize bare or thinly vegetated ground surfaces. Maintenance practices should provide for erosion and sediment control (see *S411 BMPs for Landscaping and Lawn / Vegetation Management*).

Additional Regulations: Note that work in wet areas may be regulated by local, state, or federal regulations that impose additional obligations on the responsible party. Check with the appropriate authorities prior to beginning work in those areas.

Applicable Operational BMPs:

- Inspect roadside ditches regularly to identify sediment accumulations and localized erosion.
- Clean ditches on a regular basis, as needed. Keep ditches free of rubbish and debris.
- Vegetation in ditches often prevents erosion and cleanses runoff waters. Remove vegetation only when flow is blocked, or excess sediments have accumulated. Conduct ditch maintenance (seeding, fertilizer application, harvesting) in late spring and/or early fall, where possible. This allows re-establishment of vegetative cover by the next wet season thereby minimizing erosion of the ditch as well as making the ditch effective as a biofilter.
- Do not apply fertilizer unless needed to maintain vegetative growth.
- In the area between the edge of the pavement and the bottom of the ditch, commonly known as the “bare earth zone,” use grass vegetation, wherever possible. Establish vegetation from the edge of the pavement, if possible, or at least from the top of the slope of the ditch.
- Maintain diversion ditches on top of cut slopes constructed to prevent slope erosion by intercepting surface drainage to retain their diversion shape and capability.
- Use temporary erosion and sediment control measures or re-vegetate as necessary to prevent erosion during ditch reshaping.
- Do not leave ditch cleanings on the roadway surfaces. Sweep, collect, and dispose of dirt and debris remaining on the pavement at the completion of ditch cleaning operations as described below:
    - Consider screening roadside ditch cleanings, not contaminated by spills or other releases and not associated with a stormwater treatment system such as a bioswale, to remove litter. Separate screenings into soil and vegetative matter (leaves, grass, needles, branches, etc.) categories. Compost or dispose of the vegetative matter in a

municipal waste landfill. Consult with the jurisdictional health department to discuss use or disposal options for the soil portion. For more information, see *Appendix IV-B: Management of Street Waste Solids and Liquids*.

- Roadside ditch cleanings contaminated by spills or other releases known or suspected to contain dangerous waste must be handled following the Dangerous Waste Regulations (*Chapter 173 303 WAC*). If testing determines materials are not dangerous waste but contaminants are present, consult with the jurisdictional health department for disposal options.

- Examine culverts on a regular basis for scour or sedimentation at the inlet and outlet, and repair as necessary. Give priority to those culverts conveying perennial and/or salmon-bearing streams and culverts near streams in areas of high sediment load, such as those near subdivisions during construction. Maintain trash racks to avoid damage, blockage, or erosion of culverts.

Recommended Treatment BMPs:

Install biofiltration swales and filter strips (see V-7 Biofiltration BMPs) to treat roadside runoff wherever practicable and use engineered topsoils wherever necessary to maintain adequate vegetation. These systems can improve infiltration and stormwater pollutant control upstream of roadside ditches.

S417 BMPs for Maintenance of Stormwater Drainage and Treatment Systems

Description of Pollutant Sources: Facilities include roadside catch basins on arterials and within residential areas, conveyance systems, detention facilities such as ponds and vaults, oil/water separators, biofilters, settling basins, infiltration systems, and all other types of stormwater treatment systems presented in Volume V. Oil and grease, hydrocarbons, debris, heavy metals, sediments and contaminated water are found in catch basins, oil and water separators, settling basins, etc.

Pollutant Control Approach: Provide maintenance and cleaning of debris, sediments, and other pollutants from stormwater collection, conveyance, and treatment systems to maintain proper operation.

Applicable Operational BMPs:

Maintain stormwater treatment facilities per the operations and maintenance (O&M) procedures presented in Appendix V-A: BMP Maintenance Tables in addition to the following BMPs:

- Inspect and clean treatment BMPs, conveyance systems, and catch basins as needed, and determine necessary O&M improvements.
- Promptly repair any deterioration threatening the structural integrity of stormwater facilities. These include replacement of clean-out gates, catch basin lids, and rock in emergency spillways.
- Ensure adequacy of storm sewer capacities and prevent heavy sediment discharges to the sewer system.
- Regularly remove debris and sludge from BMPs used for peak-rate control, treatment, etc. and discharge to a sanitary sewer if approved by the sewer authority, or truck to an appropriate local or state government approved disposal site.
- Clean catch basins when the depth of deposits reaches 60 percent of the sump depth as measured from the bottom of basin to the invert of the lowest pipe into or out of the basin. However, in no case should there be less than six inches clearance from the debris surface to the

invert of the lowest pipe. Some catch basins (for example, WSDOT's *Catch Basin Type 1L (WSDOT, 2011)*) may have as little as 12 inches sediment storage below the invert. These catch basins need frequent inspection and cleaning to prevent scouring. Where these catch basins are part of a stormwater collection and treatment system, the system owner/operator may choose to concentrate maintenance efforts on downstream control devices as part of a systems approach.

- Properly dispose of all solids, polluted material, and stagnant water collected through system cleaning. Do not decant water back into the drainage system from eductor trucks or vacuum equipment since there may be residual contaminants in the cleaning equipment. Do not jet material downstream into the public drainage system.
- Clean woody debris in a catch basin as frequently as needed to ensure proper operation of the catch basin.
- Post warning signs: "Dump No Waste - Drains to Ground Water," "Streams," "Lakes," or emboss on or adjacent to all storm drain inlets where possible.
- Disposal of sediments and liquids from the catch basins must comply with *Appendix IV-B: Management of Street Waste Solids and Liquids*.

S421 BMPs for Parking and Storage of Vehicles and Equipment

Description of Pollutant Sources: Public and commercial parking lots such as retail store, fleet vehicle (including rent-a-car lots and car dealerships), equipment sale and rental parking lots, and parking lot driveways, can be sources of toxic hydrocarbons and other organic compounds, including oils and greases, metals, and suspended solids.

Pollutant Control Approach: If the parking lot meets the site use thresholds to determine if the site is expected to generate high concentrations of oil, as defined in Step 2: Determine if an Oil Control BMP is Required in III-1.2 Choosing Your Runoff Treatment BMPs, provide oil removal equipment for the contaminated stormwater runoff.

Applicable Operational BMPs:

- If a parking lot must be washed, discharge the washwater to a sanitary sewer, if allowed by the local sewer authority, or other approved wastewater treatment system, or collect washwater for off-site disposal.
- Do not hose down the area to a storm sewer or receiving water. Vacuum sweep parking lots, storage areas, and driveways regularly to collect dirt, waste, and debris. Mechanical or hand sweeping may be necessary for areas where a vacuum sweeper cannot reach.
- Clean up vehicle and equipment fluid drips and spills immediately.
- Place drip pans below leaking vehicles (including inoperative vehicles and equipment) in a manner that catches leaks or spills, including employee vehicles. Drip pans must be managed to prevent overfilling and the contents disposed of properly.

Recommended Operational BMPs:

- Encourage employees to repair leaking personal vehicles.
- Encourage employees to carpool or use public transit through incentives.

- Encourage customers to use public transit by rewarding valid transit pass holders with discounts.
- Install catch basin inserts to collect excess sediment and oil if necessary. Inspect and maintain catch basin inserts to ensure they are working correctly.

Applicable Treatment BMPs:

Establishments subject to high-use intensity are significant sources of oil contamination of stormwater. Examples of potential high use areas include customer parking lots at fast food stores, grocery stores, taverns, restaurants, large shopping malls, discount warehouse stores, quick-lube shops, and banks.

Refer to Step 2: Determine if an Oil Control BMP is Required in III-1.2 Choosing Your Runoff Treatment BMPs for the site use thresholds that determine if an oil control BMP is required, and for a list of oil control BMPs.

S430 BMPs for Urban Streets

Description of Pollutant Sources: Urban streets can be the source of vegetative debris, paper, fine dust, vehicle liquids, tire and brake wear residues, heavy metals (lead and zinc), soil particles, ice control salts, domestic wastes, lawn chemicals, and vehicle combustion products. Street surface contaminants contain significant concentrations of particle sizes less than 250 microns (Sartor and Boyd, 1972).

Pollutant Control Approach: Conduct efficient street sweeping where and when appropriate to minimize the contamination of stormwater. Do not wash street debris into storm drains.

Facilities not covered under the Industrial Stormwater General Permit may consider a minimum amount of water washing of streets. All facilities must comply with their local stormwater requirements for discharging to storm sewers. Municipal NPDES permittees are required to limit street wash water discharges and may have special conditions or treatment requirements.

Recommended BMPs:

- For maximum stormwater pollutant reductions on curbed streets and high volume parking lots, use efficient vacuum sweepers.
- Note: High-efficiency street sweepers utilize strong vacuums and the mechanical action of main and gutter brooms combined with an air filtration system that only returns clean air to the atmosphere (i.e., filters very fine particulates). They sweep dry and use no water since they do not emit any dust.
- High-efficiency vacuum sweepers have the capability of removing 80 percent or more of the accumulated street dirt particles whose diameters are less than 250 microns (Sutherland et al., 1998). This assumes pavements under good condition and reasonably expected accumulation conditions.
- For moderate stormwater pollutant reductions on curbed streets use regenerative air sweepers or tandem sweeping operations.
- Note: A tandem sweeping operation involves a single pass of a mechanical sweeper followed immediately by a single pass of a vacuum sweeper or regenerative air sweeper.
    - A regenerative air sweeper blows air down on the pavement to entrain particles and uses a return vacuum to transport the material to the hopper.

- These operations usually use water to control dust. This reduces their ability to pick up fine particulates.

These types of sweepers have the capability of removing approximately 25 to 50 percent of the accumulated street dirt particles whose diameters are less than 250 microns. *(Sutherland et al., 1998)*. This assumes pavements under good conditions and typical accumulation conditions.

- For minimal stormwater pollutant reductions on curbed streets use mechanical sweepers.
  - *Note: The industry refers to mechanical sweepers as broom sweepers and uses the mechanical action of main and gutter brooms to throw material on a conveyor belt that transports it to the hopper.*
  - These sweepers usually use water to control dust. This reduces their ability to pick up fine particulates.

  Mechanical sweepers have the capability of removing only 10 to 20 percent of the accumulated street dirt particles whose diameters are less than 250 microns *(Sutherland et al., 1998)*. This assumes pavements under good condition and the most favorable accumulation conditions.

- Conduct vacuum sweeping at optimal frequencies. Optimal frequencies are those scheduled sweeping intervals that produce the most cost-effective annual reduction of pollutants normally found in stormwater and can vary depending on land use, traffic volume, receiving water, and rainfall patterns.
- Train operators in those factors that result in optimal pollutant removal. These factors include sweeper speed, brush adjustment and rotation rate, sweeping pattern, maneuvering around parked vehicles, and interim storage and disposal methods.
- Consider the use of periodic parking restrictions in low to medium density single-family residential areas to ensure the sweeper's ability to sweep along the curb.
- Establish programs for prompt vacuum sweeping, removal, and disposal of debris from special events that will generate higher than normal loadings.
- Disposal of street sweeping solids must comply with *Appendix IV-B: Management of Street Waste Solids and Liquids*.
- Consider developing ordinances that prohibit citizens from putting yard debris in the street gutters or doing vehicle maintenance on the street.
- Provide incentives to property owners for installing permeable pavement parking areas and driveways.
- Consider installing catch basin inserts in high use areas to remove trash and yard debris before it enters the system.
- Implement a storm drain stenciling program to label and educate the public not to dump materials into storm drains or onto sidewalks, streets, parking lots, and gutters.
- Provide household hazardous waste collection and used oil recycling for citizens to avoid illegal dumping.

IV-5.2 Soil Erosion, Sediment Control, and Landscaping Source Control BMPs

S407 BMPs for Dust Control at Disturbed Land Areas and Unpaved Roadways and Parking Lots

Note: Contact the local air quality authority for appropriate and required BMPs for dust control to implement at your project site. Use the following website to determine the air quality authority for the project site:

https://ecology.wa.gov/About-us/Our-role-in-the-community/Partnerships-committees/Clean-air-agencies

Description of Pollutant Sources: Dust can cause air and water pollution problems particularly at demolition sites and in arid areas where reduced rainfall exposes soil particles to transport by air.

Pollutant Control Approach: Minimize dust generation and apply environmentally friendly and government approved dust suppressant chemicals, if necessary.

Applicable Operational BMPs:

- Sprinkle or wet down soil or dust with water as long as it does not result in a wastewater discharge.
- Use only dust suppressant chemicals that are approved by the City of Olympia and/or state government approved dust suppressant chemicals such as those listed in Alternatives to Hazardous Materials: Techniques for Dust Prevention and Suppression (Ecology, 2016b).
- Avoid excessive and repeated applications of dust suppressant chemicals. Time the application of dust suppressants to avoid or minimize their wash-off by rainfall or human activity such as irrigation.
- Apply stormwater containment to prevent the conveyance of sediment into storm drains or receiving waters.
- Protect inlets/catch basins during application of dust suppressants.
- Ecology prohibits the use of motor oil for dust control. Take care when using lignin derivatives and other high BOD chemicals in areas susceptible to contaminating surface water or ground water.
- Consult with Ecology and the local permitting authority on discharge permit requirements if the dust suppression process results in a wastewater discharge to the ground, ground water, storm drain, or surface water.
- Street gutters, sidewalks, driveways, and other paved surfaces in the immediate area of the activity must be swept regularly to collect and properly dispose of dust, dirt, loose debris, and garbage.
- Install catch basin filter socks on site and in surrounding catch basins to collect sediment and debris. Maintain the filters regularly to prevent plugging.

Recommended Additional Operational BMPs for Roadways and Other Trafficked Areas:

- Consider limiting use of off-road recreational vehicles on dust generating land.
- Consider graveling or paving unpaved permanent roads and other trafficked areas at municipal, commercial, and industrial areas.
- Consider paving or stabilizing shoulders of paved roads with gravel, vegetation, or local government approved chemicals.
- Encourage use of alternate paved routes, if available.
- Vacuum sweep fine dirt and skid control materials from paved roads soon after winter weather ends or when needed.
- Consider using pre-washed traction sand to reduce dust emissions.

Additional Recommended Operational BMPs for Dust Generating Areas:

- Prepare a dust control plan. Helpful references include *Control of Open Fugitive Dust Sources* (Cowherd et al., 1988) and *Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures* (USEPA, 1992).
- Limit exposure of soil (dust source) as much as feasible.
- Stabilize dust-generating soil by growing and maintaining vegetation, mulching, topsoiling, and/or applying stone, sand, or gravel.
- Apply windbreaks in the soil such as trees, board fences, tarp curtains, bales of hay, etc.

Note: Construction site dust control is covered in BMP C140: Dust Control.

S408 BMPs for Dust Control at Manufacturing Areas

Note: Contact the local air quality authority for appropriate and required BMPs for dust control to implement at your project site. Use the following website to determine the air quality authority for the project site:

https://ecology.wa.gov/About-us/Our-role-in-the-community/Partnerships-committees/Clean-air-agencies

Description of Pollutant Sources: Industrial material handling activities can generate considerable amounts of dust that is typically removed using exhaust systems. Mixing cement and concrete products and handling powdered materials can also generate dust. Particulate materials that can cause air pollution include grain dust, sawdust, coal, gravel, crushed rock, cement, and boiler fly ash. Air emissions can contaminate stormwater. The objective of this BMP is to reduce the stormwater pollutants caused by dust generation and control.

Pollutant Control Approach: Prevent dust generation and emissions where feasible, regularly clean-up dust that can contaminate stormwater, and convey dust contaminated stormwater to proper treatment.

Applicable BMPs:

- Clean, as needed, powder material handling equipment and vehicles.

- Regularly sweep dust accumulation areas that can contaminate stormwater. Conduct sweeping using vacuum filter equipment to minimize dust generation and to ensure optimal dust removal.
- Use dust filtration/collection systems such as baghouse filters, cyclone separators, etc. to control vented dust emissions that could contaminate stormwater. Control of zinc dusts in rubber production is one example.
- Maintain on-site controls to prevent vehicle track-out.
- Maintain dust collection devices on a regular basis.

Recommended BMPs:

- In manufacturing operations, train employees to handle powders carefully to prevent generation of dust.
- Use water spray to flush dust accumulations to sanitary sewers where allowed by the local sewer authority or to other appropriate treatment system.
- Use approved dust suppressants such as those listed in *Methods for Dust Control* (Ecology, 2016b). Application of some products may not be appropriate in close proximity to receiving waters or conveyances close to receiving waters. For more information check with Ecology or the local jurisdiction.

Recommended Treatment BMPs

Install sedimentation basins, wet ponds, wet vaults, catch basin filters, vegetated filter strips, or equivalent sediment removal BMPs.

S411 BMPs for Landscaping and Lawn / Vegetation Management

Description of Pollutant Sources: Landscaping can include grading, soil transfer, vegetation planting, and vegetation removal. Examples include weed control on golf course lawns, access roads, and utility corridors and during landscaping; and residential lawn/plant care. Proper management of vegetation can minimize excess nutrients and pesticides.

Pollutant Control Approach: Maintain appropriate vegetation to control erosion and the discharge of stormwater pollutants. Prevent debris contamination of stormwater. Grow plant species appropriate for the site or adjust the soil properties where practicable.

Applicable BMPs:

- Install engineered soil/landscape systems to improve the infiltration and regulation of stormwater in landscaped areas.
- Select the right plants for the planting location based on proposed use, available maintenance, soil conditions, sun exposure, water availability, height, sight factors, and space available.
- Ensure that plants selected for planting are not on the noxious weed list. For example, butterfly bush often gets planted as an ornamental but is actually on the noxious weed list.
- The Washington State Noxious Weed List can be found at the following webpage: *https://www.nwcb.wa.gov/printable-noxious-weed-list*
- Do not dispose of collected vegetation into waterways or storm sewer systems.
- Do not blow vegetation or other debris into the drainage system or street.

- Dispose of collected vegetation such as grass clippings, leaves, sticks by composting or recycling.
- Remove, bag, and dispose of class A & B noxious weeds in the garbage immediately.
- Do not compost noxious weeds as it may lead to spreading through seed or fragment if the composting process is not hot enough.
- Use manual and/or mechanical methods of vegetation removal (pincer-type weeding tools, flame weeders, or hot water weeders as appropriate) rather than applying herbicides, where practical.
- Avoid weed and feed products that contain a combination of fertilizer and selective herbicides.
- Use at least an eight-inch "topsoil" layer with at least 8 percent organic matter to provide a sufficient vegetation-growing medium.
    - Organic matter is the least water-soluble form of nutrients that can be added to the soil. Composted organic matter generally releases only between 2 and 10 percent of its total nitrogen annually, and this release corresponds closely to the plant growth cycle. Return natural plant debris and mulch to the soil, to continue recycling nutrients indefinitely.
- Select the appropriate turfgrass mixture for the climate and soil type.
    - Certain tall fescues and rye grasses resist insect attack because the symbiotic endophytic fungi found naturally in their tissues repel or kill common leaf and stem-eating lawn insects.
        - The fungus causes no known adverse effects to the host plant or to humans.
        - Tall fescues and rye grasses do not repel root-feeding lawn pests such as Crane Fly larvae.
        - Tall fescues and rye grasses are toxic to ruminants such as cattle and sheep.
    - Endophytic grasses are commercially available; use them in areas such as parks or golf courses where grazing does not occur.
    - Local agricultural or gardening resources such as Washington State University Extension office can offer advice on which types of grass are best suited to the area and soil type.
- Use the following seeding and planting BMPs, or equivalent BMPs, to obtain information on grass mixtures, temporary and permanent seeding procedures, maintenance of a recently planted area, and fertilizer application rates: BMP C120: Temporary and Permanent Seeding, BMP C121: Mulching, BMP C123: Plastic Covering, and BMP C124: Sodding.
- Adjusting the soil properties of the subject site can assist in selection of desired plant species. Consult a soil restoration specialist for site-specific conditions.
- Per Olympia Municipal Code Chapter 18.32.225, within wellhead protection areas, only slow-release fertilizers shall be applied for the life of the development at a maximum amount of 4 pounds of nitrate as Nitrogen annually and no more than 1 pound per application for every 1,000 square feet of turf grass. Only fertilizer formulas with a minimum of 50% water insoluble form of nitrogen are permitted for use. Approved water insoluble forms of nitrogen include sulfur and/or polymer coated fertilizers, Isobutylidenediurea (IBDU), Methylene Urea and Ureaform, and organic fertilizers registered with Washington Department of Agriculture.

Recommended Additional BMPs:

- Conduct mulch-mowing whenever practicable.
- Use native plants in landscaping. Native plants do not require extensive fertilizer or pesticide applications. Native plants may also require less watering.

- Use mulch or other erosion control measures on soils exposed for more than one week during the dry season (May 1 to September 30) or two days during the rainy season (October 1 to April 30).
- Till a topsoil mix or composted organic material into the soil to create a well-mixed transition layer that encourages deeper root systems and drought-resistant plants.
- Apply an annual topdressing application of 3/8" compost. Amending existing landscapes and turf systems by increasing the percent organic matter and depth of topsoil can:
    - Substantially improve the permeability of the soil.
    - Increase the disease and drought resistance of the vegetation.
    - Reduces the demand for fertilizers and pesticides.
- Disinfect gardening tools after pruning diseased plants to prevent the spread of disease.
- Prune trees and shrubs in a manner appropriate for each species.
- If specific plants have a high mortality rate, assess the cause and replace with another more appropriate species.
- When working around and below mature trees, follow the most current American National Standards Institute (ANSI) ANSI A300 standards (see *http://www.tcia.org/TCIA/BUSINESS/ANSI_A300_Standards_/TCIA/BUSINESS/A300_Standards/A300_Standards.aspx?hkey=202ff566-4364-4686-b7c1-2a365af59669*) and International Society of Arboriculture BMPs to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil).
- Monitor tree support systems (stakes, guys, etc.).
    - Repair and adjust as needed to provide support and prevent tree damage.
    - Remove tree supports after one growing season or maximum of 1 year.
    - Backfill stake holes after removal.
- When continued, regular pruning (more than one time during the growing season) is required to maintain visual sight lines for safety or clearance along a walk or drive, consider relocating the plant to a more appropriate location.
- Make reasonable attempts to remove and dispose of class C noxious weeds.
- Re-seed bare turf areas until the vegetation fully covers the ground surface.
- Watch for and respond to new occurrences of especially aggressive weeds such as Himalayan blackberry, Japanese knotweed, morning glory, English ivy, and reed canary grass to avoid invasions.
- Plant and protect trees per *BMP T5.16: Tree Retention and Tree Planting*.
- Aerate lawns regularly in areas of heavy use where the soil tends to become compacted. Conduct aeration while the grasses in the lawn are growing most vigorously. Remove layers of thatch greater than ¾-inch deep.
- Set the mowing height at the highest acceptable level and mow at times and intervals designed to minimize stress on the turf. Generally mowing only 1/3 of the grass blade height will prevent stressing the turf.
    - Mowing is a stress-creating activity for turfgrass.
    - Grass decreases its productivity when mowed too short and there is less growth of roots and rhizomes. The turf becomes less tolerant of environmental stresses, more disease

prone and more reliant on outside means such as pesticides, fertilizers, and irrigation to remain healthy.

- Keep mower blades sharp to reduce tearing of grass blades.

Test soils to determine the correct fertilizer application rates.

- Evaluation of soil nutrient levels and pH through regular testing ensures the best possible efficiency and economy of fertilization.
- Fertilization needs vary by site depending on plant, soil, and climatic conditions.
- Choose organic fertilizers when possible.
- For details on soils testing, contact the local Conservation District, a soils testing professional, or a Washington State University Extension office.

Additional BMP Information:

- King County's *Best Management Practices for Golf Course Development and Operation* (King County, 1993) has additional BMPs for Turfgrass Maintenance and Operation.
- King County, Seattle Public Utilities, and the Saving Water Partnership have created the following natural lawn and garden care resources that include guidance on building healthy soil with compost and mulch, selecting appropriate plants, watering, using alternatives to pesticides, and implementing natural lawn care techniques.
  - *Natural Yard Care - Five steps to make your piece of the planet a healthier place to live* (King County and SPU, 2008)
  - *The Natural Lawn & Garden Series: Smart Watering* (Saving Water Partnership, 2006)
  - *Natural Lawn Care for Western Washington* (Saving Water Partnership, 2007)
  - *The Natural Lawn & Garden Series: Growing Healthy Soil; Choosing the Right Plants; and Natural Pest, Weed and Disease Control* (Saving Water Partnership, 2012)
- The International Society of Arboriculture (ISA) is a group that promotes the professional practice of arboriculture and fosters a greater worldwide awareness of the benefits of trees through research, technology, and education. ISA standards used for managing trees, shrubs, and other woody plants are the American National Standards Institute (ANSI) A300 standards. The ANSI A300 standards are voluntary industry consensus standards developed by the Tree Care Industry Association (TCIA) and written by the Accredited Standards Committee (ASC). The ANSI standards can be found on the ISA website: *www.isa-arbor.com/education/publications/index.aspx*
- Washington State University's *Gardening in Washington State* website at *http://gardening.wsu.edu* contains Washington State specific information about vegetation management based on the type of landscape.
- See the *Pacific Northwest Plant Disease Management Handbook* (Pscheidt and Ocamb, 2016) for information on disease recognition and for additional resources.

S425 BMPs for Soil Erosion and Sediment Control at Industrial Sites

Description of Pollutant Sources: Industrial activities on soil areas; exposed and disturbed soils; steep grading; etc. can be sources of sediments that can contaminate stormwater runoff.

Pollutant Control Approach: Limit the exposure of erodible soil, stabilize, or cover erodible soil where necessary to prevent erosion, and/or provide treatment for stormwater contaminated with TSS caused by eroded soil.

Applicable BMPs:

- Limit the exposure of erodible soil.
- Stabilize entrances/exits to prevent track-out. See BMP C105: Stabilized Construction Access.
- Stabilize or cover erodible soil to prevent erosion. Cover practice options include:
    - Use vegetative cover such as grass, trees, shrubs, on erodible soil areas.
    - Cover exposed areas with mats such as clear plastic, jute, synthetic fiber. See BMP C122: Nets and Blankets and BMP C123: Plastic Covering.
    - Preserve natural vegetation including grass, trees, shrubs, and vines when possible. See BMP C101: Preserving Natural Vegetation.
- If stabilizing or covering the erodible soil is not possible, then structural controls must beĚ implemented. Structural practice options include:
    - Vegetated swales
    - BMP C200: Interceptor Dike and Swale
    - BMP C233: Silt Fence
    - BMP C207: Check Dams
    - BMP C232: Gravel Filter Berm
    - Sedimentation basin
    - Proper grading
    - Paving

For design information refer to II-3 Construction Stormwater BMPs.

S435 BMPs for Pesticides and an Integrated Pest Management Program

Description of Pollutant Sources: Pesticides include herbicides, rodenticides, insecticides, fungicides, etc. Examples of pesticide uses include:

- Weed control on golf course lawns, access roads, utility corridors and landscaping.
- Sap stain and insect control on lumber and logs.
- Rooftop, sidewalk and lawn moss removal.
- Killing nuisance rodents.
- Fungicide application to patio decks.

It is possible to release toxic pesticides such as pentachlorophenol, carbamates, and organometallics to the environment by leaching and dripping from treated parts, container leaks, product misuse, and

outside storage of pesticide contaminated materials and equipment. Poor management of pesticides can cause appreciable stormwater contamination and unintended impacts to non-targeted organisms.

Pollutant Control Approach: Control of pesticide applications to prevent contamination of stormwater. Develop and implement an Integrated Pest Management (IPM) Plan. Carefully apply pesticides, in accordance with label requirements.

Applicable Operational BMPs:

- Train employees on proper application of pesticides and disposal practices.
- Follow manufacturers' application guidelines and label requirements.
- Do not apply pesticides in quantities that exceed the limits on the product the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) label. Avoid excessive application of chemical.
- Conduct spray applications during weather conditions as specified in the label requirements and applicable local and state regulations. Do not apply during rain or immediately before expected rain (unless the label directs such timing).
- Clean up any spilled pesticides immediately. Do not hose down to a storm drain, conveyance ditch, or water body.
- Remove weeds/vegetation in stormwater ditches, stormwater facilities, and drainage systems by hand or other mechanical means and only use pesticides as a last resort.
- Flag all sensitive areas including wells, creeks, and wetlands prior to spraying.
- Post notices and delineate the spray area prior to the application, as required by the local jurisdiction, or by Ecology.
- Refer to *S411 BMPs for Landscaping and Lawn / Vegetation Management* and use pesticides only as a last resort.
- Conduct any pest control activity at the life stage when the pest is most vulnerable. For example, if it is necessary to use a Bacillus thuringiens application to control tent caterpillars, apply it to the material before the caterpillar's cocoon or it will be ineffective. Any method used should be site-specific and not used wholesale over a wide area.
- Mix pesticides and clean the application equipment under cover in an area where accidental spills will not enter surface or ground waters and will not contaminate the soil.
- The pesticide application equipment must be capable of immediate shutoff in the event of an emergency.
- Implement a pesticide-use plan and include at a minimum:
    - A list of selected pesticides and their specific uses.
    - Brands and formulations of the pesticides.
    - Application methods and quantities to be used.
    - Equipment use and maintenance procedures.
    - Safety, storage, and disposal methods.
    - Monitoring, record keeping, and public notice procedures. All procedures shall conform to the requirements of *Chapter 17.21 RCW* and *Chapter 16-228 WAC*.
- Develop and implement an Integrated Pest Management (IPM) program if pests are present. The following steps are adapted from (Daar, 1992).
    - **Step One:** Correctly identify problem pests and understand their life cycle.

        - Learn more about the pest.
        - Observe it and pay attention to any damage that may be occurring.
        - Learn about the life cycle.
        - Many pests are only a problem during certain seasons or can only be treated effectively in certain phases of the life cycle.
    - **Step Two:** Establish tolerance thresholds for pests.
        - Decide on the level of infestation that must be exceeded before treatment needs to be considered. Pest populations under this threshold should be monitored but don't need treatment.
    - **Step Three:** Monitor to detect and prevent pest problems.
        - Monitor regularly to anticipate and prevent major pest outbreaks.
        - Conduct a visual evaluation of the lawn or landscape's condition. Take a few minutes before mowing to walk around and look for problems.
        - Keep a notebook, record when and where a problem occurs, then monitor for it at about the same time in future years.
        - Specific monitoring techniques can be used in the appropriate season for some potential problem pests, such as European crane fly.
    - **Step Four:** Modify the maintenance program to promote healthy plants and discourage pests.
        - Review your landscape maintenance practices to see if they can be modified to prevent or reduce the problem.
        - A healthy landscape is resistant to most pest problems. Lawn aeration and overseeding along with proper mowing height, fertilization, and irrigation will help the grass out-compete weeds.
        - Correcting drainage problems and letting soil dry out between waterings in the summer may reduce the number of crane-fly larvae that survive.
    - **Step Five:** If pests exceed the tolerance thresholds:
        - Consider the most effective management options concurrent with reducing impacts to the environment. This may mean chemical pesticides are the best option in some circumstances.
        - Consider the use of physical, mechanical, or biological controls.
        - Study to determine what products are available and choose a product that is the least toxic and has the least non-target impact.
    - **Step Six:** Evaluate and record the effectiveness of the control and modify maintenance practices to support lawn or landscape recovery and prevent recurrence.
        - Keep records!
        - Note when, where, and what symptoms occurred, or when monitoring revealed a potential pest problem.
        - Note what controls were applied and when, and the effectiveness of the control.
        - Monitor next year for the same problems.

Recommended Additional Operational BMPs:

- Choose the least toxic pesticide available that is capable of reducing the infestation to acceptable levels. The pesticide should readily degrade in the environment and/or have properties that strongly bind it to the soil.
- Choose pesticides categorized by EPA as reduced risk. For example, the herbicide imazamox.
- When possible, apply pesticides during the dry season so that the pesticide residue is degraded prior to the next rain event.
- Avoid weed and feed products that contain a combination of fertilizer and selective herbicides.
- If possible, do not spray pesticides within 100 feet of water bodies. Spraying pesticides within 100 feet of water bodies (and wetlands) including any drainage ditch or channel that leads to open water may have additional regulatory requirements beyond just following the pesticide product label. Additional requirements may include:
    - Obtaining a discharge permit from Ecology.
    - Obtaining a permit from the local jurisdiction.
    - Using an aquatic labeled pesticide and adjuvant.
- Use manual pest control strategies such as physically scraping moss from rooftops, high-pressure sprayers to remove moss, and rodent traps.
- Consider alternatives to the use of pesticides such as covering or harvesting weeds, substitute vegetative growth, and manual weed control/moss removal.
- Consider the use of soil amendments, such as compost, that are known to control some common diseases in plants, such as Pythium root rot, ashy stem blight, and parasitic nematodes.
- Once a pesticide is applied, evaluate its effectiveness for possible improvement. Records should be kept showing the effectiveness of the pesticides applied.
- Follow the FIFRA label requirements for disposal. If the FIFRA label does not have disposal requirements the rinsate from equipment cleaning and/or triple-rinsing of pesticide containers should be used as product or recycled into product.
- Develop an and adaptive management plan and annual evaluation procedure including: (adapted from (Daar, 1992))
    - A review of the effectiveness of pesticide applications.
    - Impact on buffers and sensitive areas, including potable wells. If individual or public potable wells are located in the proximity of commercial pesticide applications, contact the regional Ecology hydrogeologist to determine if additional pesticide application control measures are necessary.
    - Public concerns.
    - Recent toxicological information on pesticides used/proposed for use.

Additional Information

For more information, refer to the Pesticide Information Center Online (PICOL) Databases at *http://cru66.cahe.wsu.edu/LabelTolerance.html*.

Washington pesticide law requires most businesses that commercially apply pesticides to the property of another to be licensed as a Commercial Applicator from the Washington State Department of Agriculture.

S444 BMPs for the Storage of Dry Pesticides and Fertilizers

Description of Pollutant Sources: Pesticides such as pentachlorophenol, carbamates, and organometallics can be released to the environment as a result of container leaks and outside storage of pesticide-contaminated materials and equipment. Inappropriate management of pesticides or fertilizers can result in stormwater contamination. Runoff contaminated by pesticides and fertilizers can severely degrade streams and lakes and adversely affect fish and other aquatic life.

Pollutant Control Approach: Store fertilizer and pesticide properly to prevent stormwater contamination.

Applicable Structural BMPs:

Store pesticides and fertilizers in enclosed impervious containment areas that prevent precipitation or unauthorized personnel from coming into contact with the materials.

Applicable Operational BMPs:

- Containers and bags must be covered, intact, and off the ground.
- Store all material so that it cannot come into contact with water.
- Immediately clean up any spilled fertilizer or pesticides.
- Keep pesticide and fertilizer contaminated waste materials in designated covered and contained areas and dispose of properly.
- Store and maintain spill cleanup materials near the storage area.
- Sweep paved storage areas as needed. Collect and dispose of spilled materials. Do not hose down the area.
- Do not discharge pesticide contaminated stormwater or spills/leaks of pesticides to storm sewers or to the sanitary sewer. Contaminated stormwater must be collected and disposed of properly. Unused or spilled/leaked pesticides must be disposed of according to the label.
- Comply with WAC 16-228-1220 and Chapter 16-229 WAC.

S449 BMPs for Nurseries and Greenhouses

Description of Pollutant Sources: These BMPs are for use by commercial container plant, greenhouse grown, and cut foliage production operations. Common practices at nurseries and greenhouses can cause elevated levels of phosphorus, nitrogen, sediment, bacteria, and organic material which can contribute to the degradation of water quality.

Pollutant Control Approach: Minimize the pollutants that leave the site by controlling the placement of materials, stabilizing the site, and managing irrigation water.

Applicable Operational BMPs:

- Establish nursery composting areas, soil storage, and mixing areas at least 100 feet away from any stream or other surface water body and as far away as possible from drainage systems.
- Do not dispose of collected vegetation into waterways or storm sewer systems.
- Do not blow, sweep, or otherwise allow vegetation or other debris into the drainage system.

- Regularly clean up spilled potting soil to prevent its movement, especially if fertilizers and pesticides are incorporated. (Haver, 2014)
- Use soil mixing and layering techniques with composted organic material to reduce herbicide use and watering.
- Utilize soil incorporated with fertilizers and / or pesticides immediately; do not store for extended periods. (Haver, 2014)
- Cover soil storage and compost storage piles. Refer to *S429 BMPs for Storage or Transfer (Outside) of Solid Raw Materials, Byproducts, or Finished Products*.
- Dispose of pathogen-laced potting substrate and diseased plants appropriately.
- Place plants on gravel, geotextile, or weed cloth to allow infiltration and minimize erosion, including inside greenhouse structures. (Haver, 2014)
- Properly reuse, recycle, or dispose of used polyfilm, containers, and other plastic-based products so that they do not collect stormwater. (FDACS, 2014)
- Evaluate and manage irrigation to reduce runoff, sediment transport, and erosion.
    - Place irrigation inputs to keep moisture primarily in the plant's root zone. This will significantly reduce nutrient related impacts from fertilizers. (FDACS, 2014)
    - Avoid over-irrigating. This may exceed the soil's water-holding capacity and lead to runoff or leaching. (FDACS, 2014)
    - Consider and adjust as needed the uniformity of application, the amount of water retained within the potting substrate, and the amount of water that enters containers compared to that which exits the containers and / or falls between containers. (FDACS, 2014)
    - Consolidate containers and turn off irrigation in areas not in production. This may require individual on / off valves at each sprinkler head. (Haver, 2014)
    - Based on the stage of plant growth, space containers and flats as close as possible to minimize the amount of irrigation water that falls between containers. (FDACS, 2014)
    - Group plants of similar irrigation needs together. (FDACS, 2014)
    - Consider minimizing water losses by using cyclic irrigation (multiple applications of small amounts). (FDACS, 2014)
    - Consider using sub-irrigation systems (e.g., capillary mat, ebb-and-flow benches, and trays or benches with liners); these systems can conserve water and reduce nutrient loss, particularly when nutrients are supplied in irrigation water that is reused. (FDACS, 2014)
    - Refer to *S450 BMPs for Irrigation* for additional BMP considerations.
- Refer to *S443 BMPs for Fertilizer Application* and *S435 BMPs for Pesticides and an Integrated Pest Management Program*.

Applicable Structural BMPs:

- Use windbreaks or other means (e.g., pot in pot) to minimize plant blowover. (FDACS, 2014)
- Cover potting areas with a permanent structure to minimize movement of loose soil. Use a temporary structure if a permanent structure is not feasible. (Haver, 2014)
- Control runoff from central potting locations that have a watering station used to irrigate plants immediately after potting. Either:
    - Collect runoff in a small basin and reuse the runoff.

    - Or, route runoff through an onsite vegetative treatment area.
    - Or, use a graveled area and allow runoff to infiltrate.
- Surround soil storage and compost storage areas with a berm or wattles.
- Utilize a synthetic (geotextile) groundcover material to stabilize disturbed areas and prevent erosion in areas where vegetative cover is not an option. (FDACS, 2014)
- In areas with a large amount of foot traffic, use appropriate aggregate such as rock and gravel for stabilization. (FDACS, 2014)
- Store potting substrate that contains fertilizer in a dedicated area with an impermeable base. If the storage area is not under a roof to protect it from rainfall, manage runoff by directing it to a stormwater treatment area. (FDACS, 2014)

S450 BMPs for Irrigation

Description of Pollutant Sources: Irrigation consists of discharges from irrigation water lines, landscape irrigation, and lawn or garden watering. Excessive watering can lead to discharges of chlorinated potable water runoff into drainage systems; it can also cause erosion; and negatively affect plant health. Improper irrigation can encourage pest problems, leach nutrients, and make a lawn completely dependent on artificial watering. Mosquito breeding habitats may form through excessive watering.

Pollutant Control Approach: Limit the amount and location of watering to prevent runoff and discharges to drainage systems.

Applicable Operational BMPs:

- Irrigate with the minimum amount of water needed. Never water at rates that exceed the infiltration rate of the soil.
- Maintain all irrigation systems so that irrigation water is applied evenly and where it is needed.
- Ensure sprinkler systems do not overspray vegetated areas resulting in excess water discharging into the drainage system.
- Inspect irrigated areas for excess watering. Adjust watering times and schedules to ensure that the appropriate amount of water is being used to minimize runoff. Consider factors such as soil structure, grade, time of year, and type of plant material in determining the proper amounts of water for a specific area.
- Inspect irrigated areas regularly for signs of erosion and / or discharge.
- Place sprinkler systems appropriately so that water is not being sprayed on impervious surfaces instead of vegetation.
- Repair broken or leaking sprinkler nozzles as soon as possible.
- Appropriately irrigate lawns based on the species planted, the available water holding capacity of the soil, and the efficiency of the irrigation system.
    - The depth from which a plant normally extracts water depends on the rooting depth of the plant. Appropriately irrigated lawn grasses normally root in the top 6 to 12 inches of soil; lawns irrigated on a daily basis often root only in the top 1 inch of soil.
- Do not irrigate plants during or immediately after fertilizer application. The longer the period between fertilizer application and irrigation, the less fertilizer runoff occurs.
- Do not irrigate plants during or immediately after pesticide application (unless the pesticide label directs such timing).

- Reduce frequency and / or intensity of watering as appropriate for the wet season (October 1 to April 30).
- Place irrigation systems to ensure that plants receive water where they need it. For example, do not place irrigation systems downgradient of plant's root zones on hillsides.

Recommended Operational BMPs:

- Add a tree bag or slow-release watering device (e.g., bucket with a perforated bottom) for watering newly installed trees when irrigation system is not present.
- Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist.
- Use soaker hoses or spot water with a shower type wand when an irrigation system is not present.
    - Pulse water to enhance soil absorption, when feasible.
    - Pre-moisten soil to break surface tension of dry or hydrophobic soils/mulch, followed by several more passes. With this method, each pass increases soil absorption and allows more water to infiltrate prior to runoff.
- Identify trigger mechanisms for drought-stress (e.g., leaf wilt, leaf senescence, etc.) of different species and water immediately after initial signs of stress appear.
- Water during drought conditions or more often if necessary to maintain plant cover.
- Adjust irrigation frequency / intensity as appropriate after plant establishment.
- Annually inspect irrigation systems to ensure:
    - That there are no blockages of sprayer nozzles.
    - Sprayer nozzles are rotating as appropriate.
    - Sprayer systems are still aligned with the plant locations and root zones.
- Consult with the local water utility, Conservation District, or Cooperative Extension office to help determine optimum irrigation practices.
- Do not use chemigation and fertigation in irrigation systems. This will help avoid over application of pesticides and fertilizers.

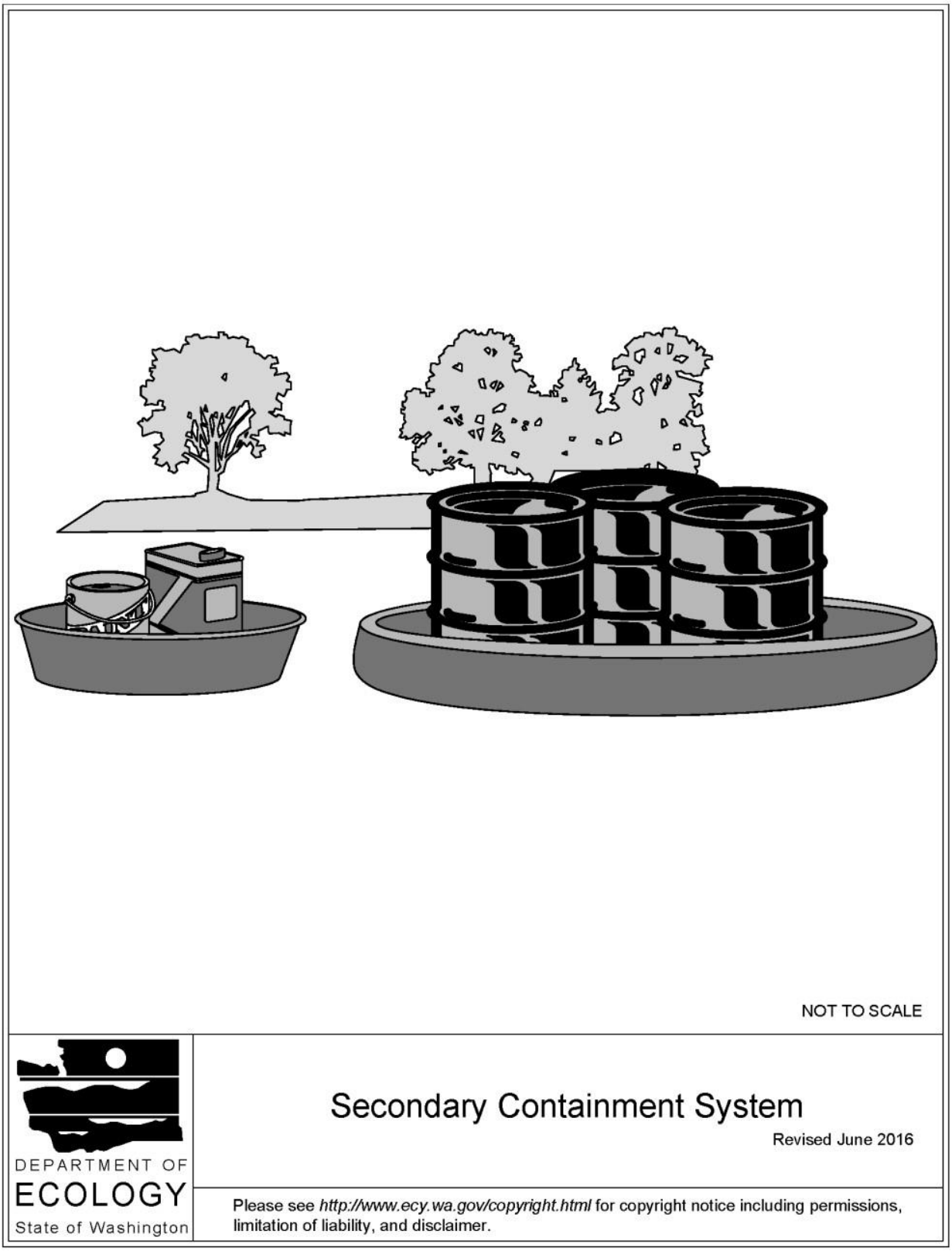
IV-5.3 Storage and Stockpiling Source Control BMPs

S427 BMPs for Storage of Liquid, Food Waste, or Dangerous Waste Containers

Description of Pollutant Sources: Steel and plastic drums with volumetric capacities of 55 gallons or less are typically used at industrial facilities for container storage of liquids and powders. The BMPs specified below apply to container(s) located outside a building. Use these BMPs when temporarily storing potential pollution generating materials or wastes. These BMPs do not apply when Ecology has permitted the business to store the wastes (see Standards for Solid Waste Containers in I-2.15 Other Requirements). Leaks and spills of pollutant materials during handling and storage are the primary sources of pollutants. Oil and grease, acid/alkali pH, BOD, COD are potential pollutant constituents.

Pollutant Control Approach: Store containers in impervious containment under a roof, or other appropriate cover, or in a building. When collection trucks directly pick up roll-containers, ensure a filet is on both sides of the curb to facilitate moving the dumpster. For storage areas on-site for less than 30 days, consider using a portable temporary secondary system like that shown in *Figure IV-5.1: Secondary Containment System* in lieu of a permanent system as described above.

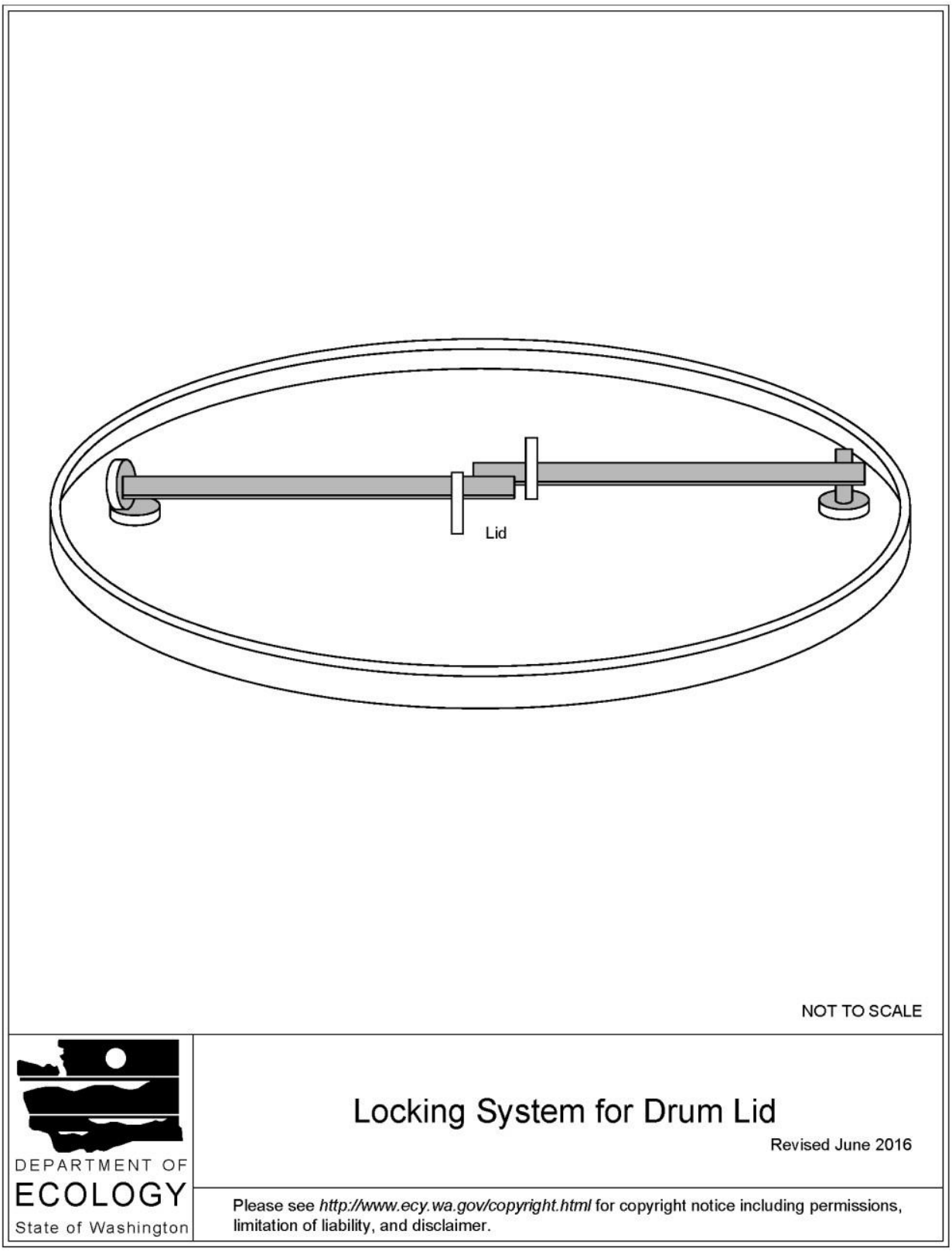
Figure IV-5.1: Secondary Containment System



Applicable Operational BMPs:

- Place tight-fitting lids on all containers.
- Label all containers appropriately. Store containers so that the labels are clearly visible.
- Place drip pans beneath all mounted container taps and at all potential drip and spill locations during filling and unloading of containers.
- Inspect container storage areas regularly for corrosion, structural failure, spills, leaks, overfills, and failure of piping systems. Check containers daily for leaks/spills. Replace containers and replace and tighten bungs in drums as needed.
- Empty drums containing residues should be stored to prevent stormwater from entering drum closures. Cover or tilt drums to prevent stormwater from accumulating on the top of empty drums and around drum closures.
- Store containers that do not contain free liquids in a designated sloped area with the containers elevated or otherwise protected from stormwater run-on. Comply with local fire code.
- Secure drums when stored in an area where unauthorized persons may gain access in a manner that prevents accidental spillage, pilferage, or any unauthorized use (see Figure IV-5.2: Locking System for Drum Lid).
- If the material is a Dangerous Waste, the business owner must comply with any additional Ecology requirements as specified in Ecology Requirements for Generators of Dangerous Wastes within I-2.15 Other Requirements.
- Storage of flammable, ignitable, and reactive chemicals and materials must comply with the stricter of local zoning codes, local fire codes, the Uniform Fire Code (UFC), UFC standards, or the National Electric Code
- Have spill kits or cleanup materials near container storage areas.
- Clean up all spills immediately.
- Cover dumpsters, or keep them under cover such as a lean-to, to prevent the entry of stormwater. Keep dumpster lids closed.
- Replace or repair leaking garbage dumpsters or install waterproof liners.
- Drain dumpsters and/or dumpster pads to sanitary sewer where approved by the sewer authority.
- When collection trucks directly pick up roll-containers, ensure a filet is on both sides of the curb to facilitate moving the dumpster.

Figure IV-5.2: Locking System for Drum Lid



Applicable Structural Source Control BMPs:

Keep containers with Dangerous Waste, food waste, or other potential pollutant liquids inside a building unless this is not feasible due to site constraints or Uniform/International Fire Code requirements.

Store containers in a designated area, which is covered, bermed or diked, paved and impervious in order to contain leaks and spills (see Figure IV-5.3: Covered and Bermed Containment Area). Slope the secondary containment to drain into a dead-end sump for the collection of leaks and small spills.

For liquid materials, surround the containers with a dike as illustrated in Figure IV-5.3: Covered and Bermed Containment Area. The dike must be of sufficient height to provide a volume of either 10 percent of the total enclosed container volume or 110 percent of the volume contained in the largest container, whichever is greater.

- Where material is temporarily stored in drums, use a containment system as illustrated, in lieu of the above system (see Figure IV-5.1: Secondary Containment System).
- Place containers mounted for direct removal of a liquid chemical for use by employees inside a containment area as described above. Use a drip pan during liquid transfer (see Figure IV-5.4: Mounted Container - With Drip Pan).

Figure IV-5.3: Covered and Bermed Containment Area

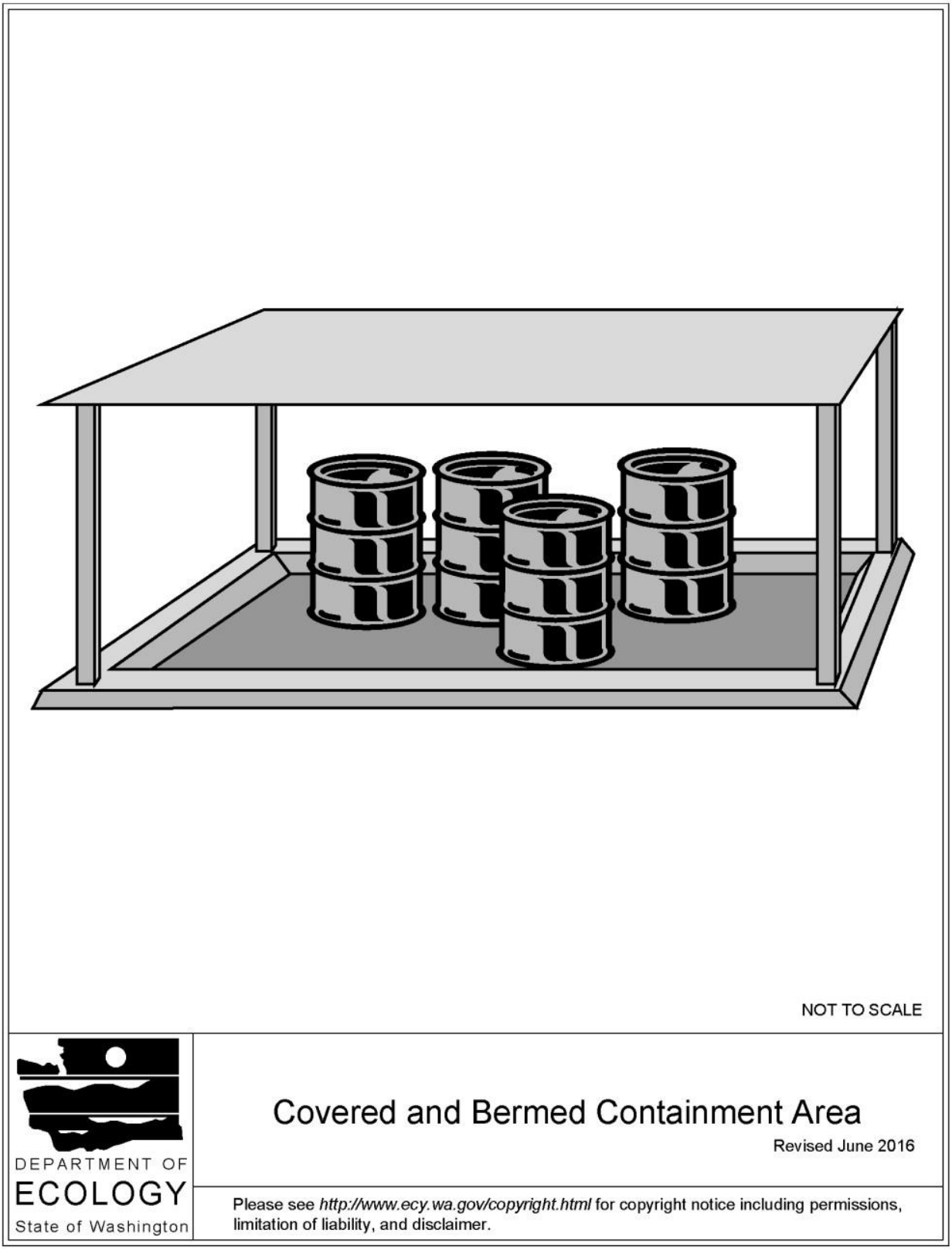
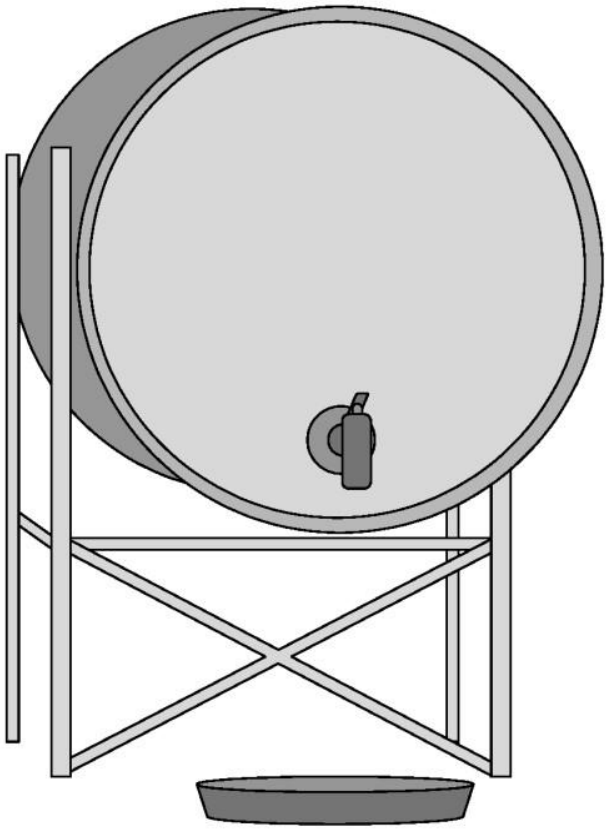


Figure IV-5.4: Mounted Container - With Drip Pan



*Note that the secondary containment is not shown in this figure

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Mounted Container - with Drip Pan

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Applicable Treatment BMP:

Note this treatment BMP is for contaminated stormwater from drum storage areas.

- For contaminated stormwater in the containment area, connect the sump outlet to a sanitary sewer, if approved by the local Sewer Authority, or to appropriate treatment such as an API or CP oil/water separator, catch basin filter or other appropriate system (see Volume V). Equip the sump outlet with a normally closed valve to prevent the release of spilled or leaked liquids, especially flammables (compliance with Fire Codes), and dangerous liquids. Open this valve only for the conveyance of contaminated stormwater to treatment.
- Another option for discharge of contaminated stormwater is to pump it from a dead-end sump or catchment to a tank truck or other appropriate vehicle for off-site treatment and/or disposal.

S428 BMPs for Storage of Liquids in Permanent Aboveground Tanks

Description of Pollutant Sources: Aboveground tanks containing liquids (excluding uncontaminated water) may be equipped with a valved drain, vent, pump, and bottom hose connection. Aboveground tanks may be heated with steam heat exchangers equipped with steam traps, if required. Leaks and spills can occur at connections and during liquid transfer. Oil and grease, organics, acids, alkalis, and heavy metals in tank water and condensate drainage can also cause stormwater contamination at storage tanks.

Pollutant Control Approach: Install secondary containment or a double-walled tank. Slope the containment area to a drain with a sump. Operators may need to discharge stormwater collected in the containment area to a Runoff Treatment BMP such as BMP T11.10: API (Baffle type) Separator or BMP T11.11: Coalescing Plate (CP) Separator, or an equivalent BMP. Add safeguards against accidental releases including protective guards around tanks to protect against vehicle or forklift damage and tagging valves to reduce human error. Tank water and condensate discharges are process wastewater that may need an NPDES Permit.

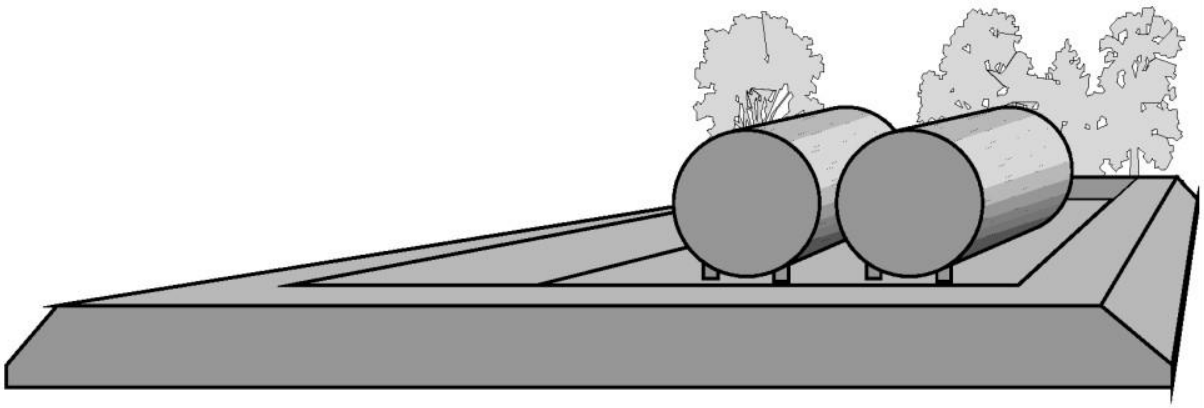
Applicable Operational BMPs:

- Inspect the tank containment areas regularly for leaks/spills, cracks, corrosion, etc. to identify problem components such as fittings, pipe connections, and valves.
- Place adequately sized drip pans beneath all mounted taps and drip/spill locations during filling/unloading of tanks. Operators may need valved drain tubing in mounted drip pans.
- Vacuum sweep and clean the tank storage area regularly, if paved.
- Replace or repair tanks that are leaking, corroded, or otherwise deteriorating.
- Storage of flammable, ignitable, and reactive chemicals and materials must comply with the stricter of local zoning codes, local fire codes, the Uniform Fire Code (UFC), UFC standards, or the National Electric Code.

Applicable Structural BMPs:

- Locate permanent tanks in impervious (Portland cement concrete or equivalent) secondary containment surrounded by dikes as illustrated in Figure IV-5.5: Above-Ground Tank Storage, or use UL Approved double-walled tanks. The dike must be of sufficient height to provide a containment volume of either 10 percent of the total enclosed tank volume or 110 percent of the volume contained in the largest tank, whichever is greater.
- Slope the secondary containment to drain to a normally closed valve, for the collection of small spills.
- Include a tank overfill protection system to minimize the risk of spillage during loading.

Figure IV-5.5: Above-Ground Tank Storage



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State of Washington

Above-Ground Tank Storage

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Applicable Treatment BMPs:

- Depending on the kind of liquid being stored, the potential and type of stormwaterĚ contamination will vary and may require specialized treatment.
- For an uncovered tank containment area, equip the outlet from the spill-containment sump withĚ a normally closed shutoff valve. Operators may open this valve manually or automatically, onlyĚ to convey contaminated stormwater to approved treatment or disposal, or to conveyĚ uncontaminated stormwater to a storm sewer. Evidence of contamination can include theĚ presence of visible sheen, color, or turbidity in the runoff, or existing or historical operationalĚ problems at the facility. Use simple pH tests with litmus or pH paper for areas subject to acid orĚ alkaline contamination.
- At petroleum tank farms, convey stormwater contaminated with floating oil or debris in theĚ contained area to a sanitary sewer with the sewer authority's approval or through BMP T11.10: API (Baffle type) Separator or BMP T11.11: Coalescing Plate (CP) Separator, or other approvedĚ treatment prior to discharge to the storm drain or surface water.

S429 BMPs for Storage or Transfer (Outside) of Solid Raw Materials, Byproducts, or Finished Products

Description of Pollutant Sources: Some pollutant sources stored outside in large piles, stacks, etc. at commercial or industrial establishments include:

- Solid raw materials
- Byproducts
- Gravel
- Sand
- Salts
- Topsoil
- Compost
- Logs
- Sawdust
- Wood chips
- Lumber
- Concrete
- Metal products

Contact between outside bulk materials and stormwater can cause leachate, and erosion of the stored materials. Contaminants may include TSS, BOD, organics, and dissolved salts (sodium, calcium, and magnesium chloride, etc.).

Pollutant Control Approach: Provide impervious containment with berms, dikes, etc. and/or cover to prevent run-on and discharge of leachate pollutant(s) and TSS.

Applicable Operational BMPs:

- Do not hose down the contained stockpile area to a storm drain or a conveyance to a storm drain, or to a receiving water.
- Maintain drainage areas in and around storage of solid materials with a minimum slope of 1.5 percent to prevent pooling and minimize leachate formation. Areas should be sloped to drain stormwater to the perimeter for collection or to internal drainage "alleyways" where no stockpiled material exists.
- Sweep paved storage areas regularly for collection and disposal of loose solid materials.
- If and when feasible, collect and recycle water-soluble materials (leachates).
- Stock cleanup materials, such as brooms, dustpans, and vacuum sweepers near the storage area.

Applicable Structural BMPs:

For stockpiles less than 5 cubic yards, place temporary plastic sheeting (polyethylene, polypropylene, hypalon, or equivalent) over the material as shown in Figure IV-5.7: Material Covered with Plastic Sheeting.

The source control BMP options listed below are applicable to:

- Stockpiles greater than 5 cubic yards of erodible or water soluble materials such as:
    - Soil
    - Road deicing salts
    - Compost
    - Unwashed sand and gravel
    - Sawdust
- Outside storage areas for solid materials such as:
    - Logs
    - Bark
    - Lumber
    - Metal products

Choose one or more of the following Source Control BMPs:

- Store in a building or paved and bermed covered area as shown in Figure IV-5.6: Covered Storage Area for Bulk Solids.
- Place temporary plastic sheeting (polyethylene, polypropylene, hypalon, or equivalent) over the material as shown in Figure IV-5.7: Material Covered with Plastic Sheeting.
- Pave the area and install a drainage system. Place curbs or berms along the perimeter of the area to prevent the run-on of uncontaminated stormwater and to collect and convey runoff to treatment. Slope the paved area in a manner that minimizes the contact between stormwater (e.g., pooling) and leachable materials in compost, logs, bark, wood chips, etc.
- For large, uncovered stockpiles, implement containment practices at the perimeter of the site and at any catch basins as needed to prevent erosion and discharge of the stockpiled material off-site or to a storm drain. Ensure that no direct discharge of contaminated stormwater to catch basins exists without conveying runoff through an appropriate treatment BMP.

Figure IV-5.6: Covered Storage Area for Bulk Solids

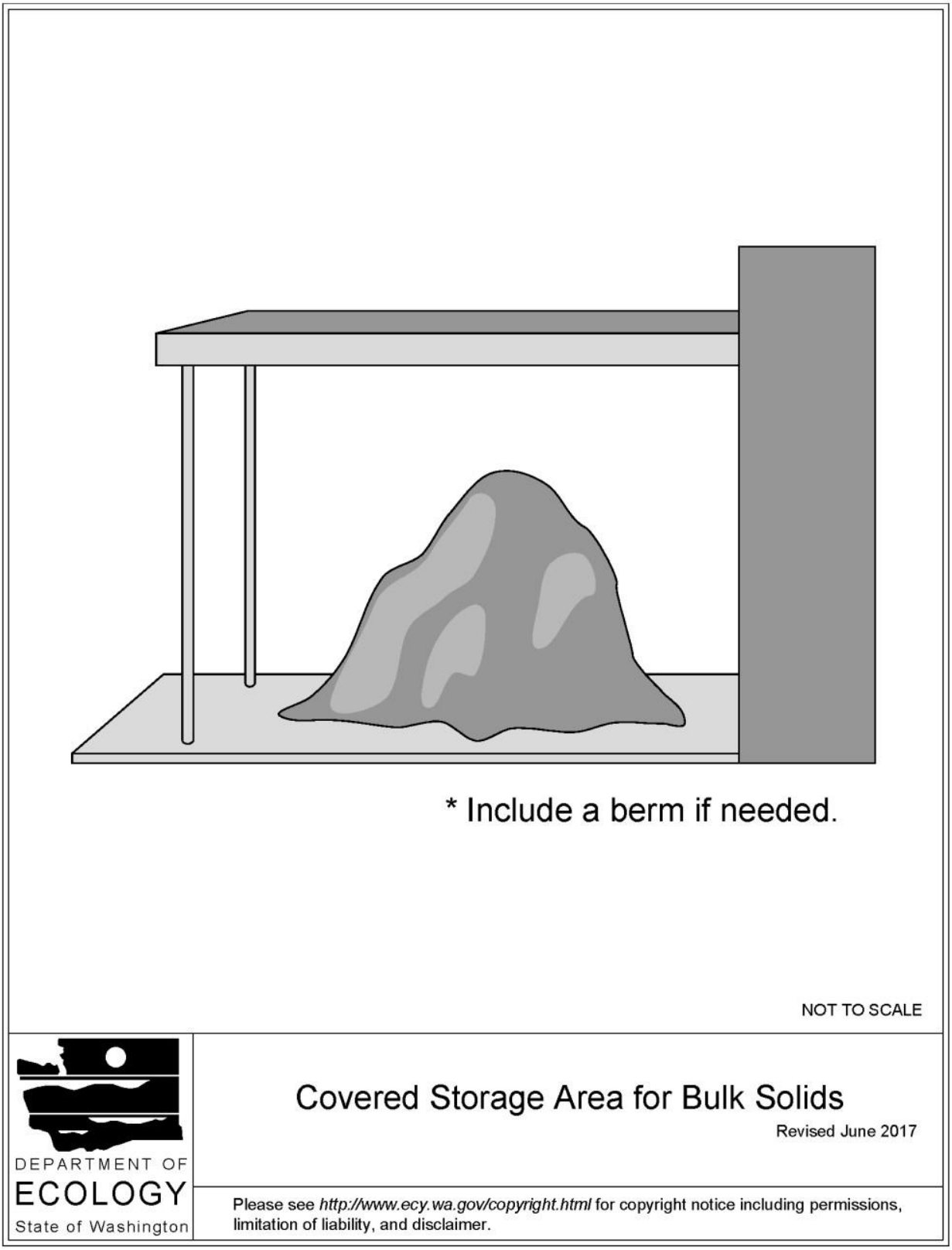
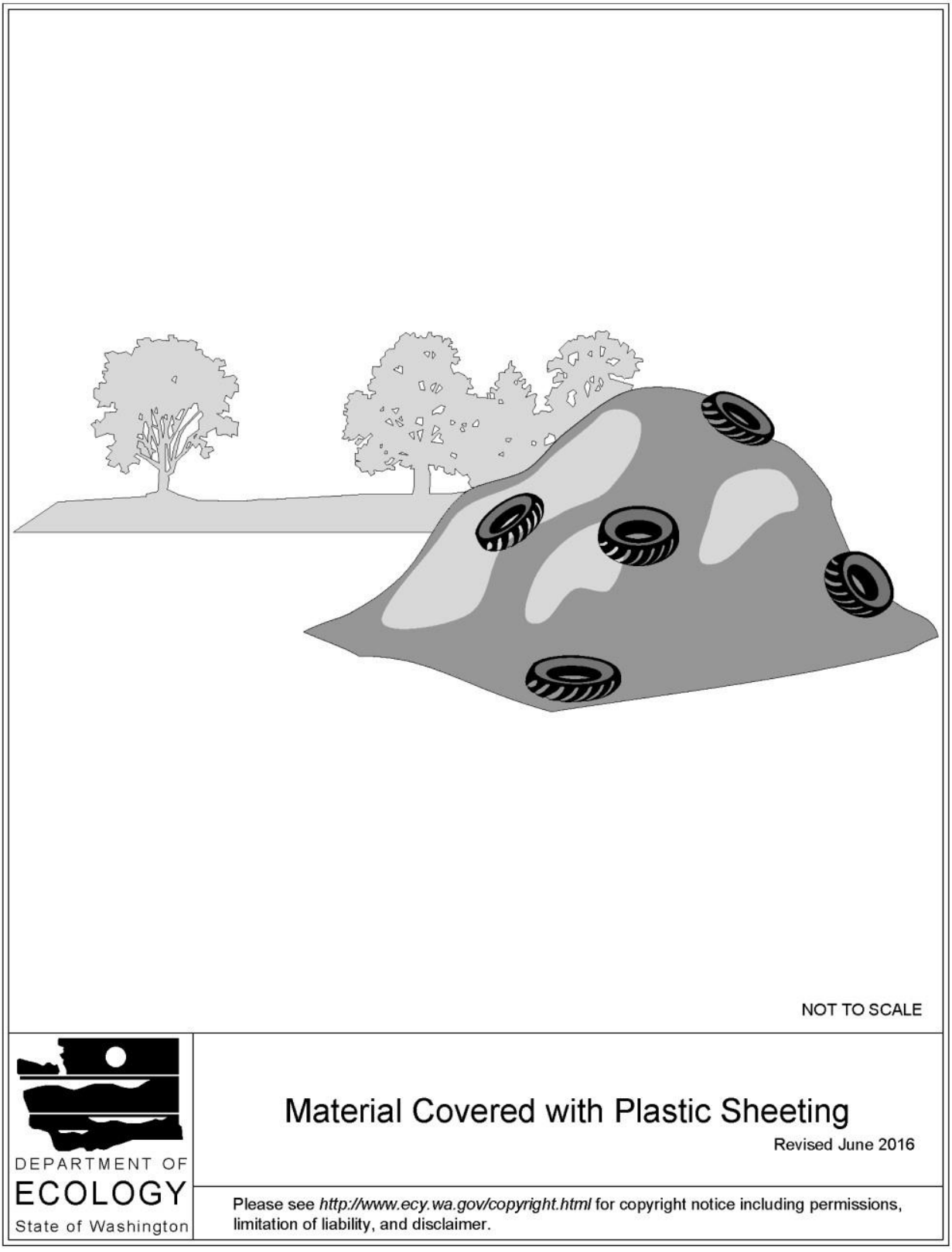


Figure IV-5.7: Material Covered with Plastic Sheeting



Applicable Treatment BMPs:

Convey contaminated stormwater from the stockpile area to:

- BMP T10.10: Wetponds - Basic and Large,
- BMP T10.20: Wetvaults,
- BMP T6.10: Presettling Basin,
- Manufactured Treatment Device (see V-10 Manufactured Treatment Devices as BMPs, or
- other appropriate treatment system depending on the contamination.

S445 BMPs for Temporary Storage or Processing of Fruits or Vegetables

Description of Pollutant Sources: This activity applies to businesses that temporarily store fruits and vegetables outdoors prior to or after packing, processing, or sale, or that crush, cut, or shred fruits or vegetables for wines, frozen juices, and other food and beverage products.

Activities involving the storage or processing of fruits, vegetables, and grains can potentially result in the delivery of pollutants to stormwater. Potential pollutants of concern from all fruit and vegetable storage and processing activities include nutrients, suspended solids, substances that increase biological oxygen demand (BOD), and color. These pollutants must not be discharged to the drainage system or directly into receiving waters.

Pollutant Control Approach: Store and process fruits and vegetables indoors or under cover whenever possible. Educate employees about proper procedures. Eliminate illicit connections to the stormwater drainage system. Cover and contain operations and apply good housekeeping and preventive maintenance practices to prevent the contamination of stormwater.

Applicable Operational BMPs:

- Educate employees on the benefits of keeping a clean storage area.
- Eliminate illicit connections to the stormwater drainage system.
- Keep fruits, vegetables, and grains stored outside for longer than a day in plastic bins or in bins lined with plastic. The edge of the plastic liner should be higher than the amount of fruit stored or should drape over the side of the bin.
- Dispose of rotten fruit, vegetables, and grains in a timely manner (typically, within a week).
- Make sure all outside materials that have the potential to leach or spill to the drainage system are covered, contained, or moved to an indoor location. For fruits, vegetables, and grains stored outside for a week or more, cover with a tarp or other waterproof material. Make sure coverings are secured from wind.
- No untreated water used to clean produce can enter the stormwater drainage system. Minimize the use of water when cleaning produce to avoid excess runoff.
- Sweep or shovel storage and processing areas daily to collect dirt and fruit and vegetable fragments for proper disposal. Keep hosing to a minimum.
- Keep cleanup materials, such as brooms and dustpans, near the storage area.
- If a holding tank is used for the storage of wastewater, pump out the contents before the tank is full and dispose of wastewater to a sanitary sewer or approved wastewater treatment system.

Applicable Structural BMPs:

- Enclose the processing area in a building or shed or cover the area with provisions for stormwater run-on prevention. Call LOTT Clean Water Alliance Industrial Pretreatment Program at 360.528.5700 for information on discharging to the sanitary sewer. Alternatively, pave and slope the area to drain to the sanitary sewer, holding tank, or process treatment system collection drain.

Optional Structural BMPs:

- Cover outdoor storage areas for fruits and vegetables.
- Use a containment curb, dike, or berm to prevent off-site runoff from storage or processing areas and to prevent stormwater run-on.

S117 BMPs for Storage of Solid Wastes and Food Wastes

Description of Pollutant Sources: This activity applies to businesses and public agencies that store solid wastes and food wastes outdoors. This includes ordinary garbage. If improperly stored, these wastes can contribute a variety of different pollutants to stormwater. Requirements for handling and storing solid waste may include a permit from the Thurston County Public Health and Social Services Department. For more information, call the Waste Management Section at (360) 786-5461.

NOTE: Dangerous solid wastes must be stored and handled under special guidelines. Businesses and agencies that store dangerous wastes must follow specific regulations outlined by Ecology and, in some cases, the county health department. Please contact Ecology at (360) 407-6300 and the Thurston County Public Health and Social Services Department at (360) 786-5581 for the specific requirements and permitting information.

Pollutants of concern include toxic organic compounds, oils and greases, heavy metals, nutrients, suspended solids, chemical oxygen demand (COD), and biochemical oxygen demand (BOD).

Pollutant Control Approach: Store wastes in suitable containers with leak proof lids. Sweep or shovel loose solids. Educate employees about the need to check for and replace leaking containers.

Required BMPs

The following BMPs are required of all businesses and public agencies engaged in storage of non-dangerous solid wastes or food wastes:

- All solid and food wastes must be stored in suitable containers. Piling of wastes without any cover is not acceptable.
- Storage containers must be checked for leaks and replaced if they are leaking, corroded, or otherwise deteriorating.
- Storage containers must have leak-proof lids or be covered by some other means (Figure IV-5.8). Lids must be kept closed at all times. This is especially important for dumpsters, as birds can pick out garbage and drop it, promoting rodent, health, and stormwater problems.

OR

- If lids cannot be provided for the waste containers, or they cannot otherwise be covered, there is another option: a designated waste storage area must be provided with a containment berm,

dike, or curb, and the designated area must drain to a sanitary sewer (contact LOTT Alliance Industrial Pretreatment Program at (360) 528-5700 or your local sewer service provider prior to any connections) or holding tank for further treatment.

Figure IV-5.8 Solid Waste Dumpsters with Properly Sealed Lids.

- Employees must be trained to frequently check storage containers for leaks and to ensure that the lids are on tightly.
- The waste storage area must be swept or otherwise cleaned frequently to collect all loose solids for proper disposal in a storage container. Do not hose the area to collect or clean solids.
- If you clean your containers, all rinse water from cleaning must be disposed of in a sanitary sewer or septic system.
- Clean out catch basins on your property that receive drainage from your waste storage area. See BMP S.9 in Section 3.6.4 for details on catch basin cleaning.

Suggested BMPs

- If the amount of waste accumulated appears to frequently exceed the capacity of the storageĚ container, then another storage container should be obtained and utilized.
- Store containers such that wind will not be able to knock them over.
- Designate a storage area, pave the area, and slope the drainage to a holding tank to preventĚ stormwater run-on or run-off. If a holding tank is used, the contents must be pumped outĚ before the tank is full and properly disposed of. See BMP S.2 for more information on disposalĚ options.
- Compost appropriate wastes. Contact City of Olympia Waste Resources at (360) 753-8333 forĚ more information on composting.
- Recycle your solid wastes. The Industrial Materials Exchange program facilitates the transfer ofĚ excess materials and wastes to those who can use them. Industrial Materials Exchange can beĚ reached at (206) 296-4899, toll free 1-888-TRY-IMEX or on the Web at: <*www.govlink.org/hazwaste/business/imex/index.html*>.

IV-5.4 Transfer of Liquid or Solid Materials Source Control BMPs

S409 BMPs for Fueling At Dedicated Stations

Description of Pollutant Sources: A fueling station is a facility dedicated to the transfer of fuels from a stationary pumping station to mobile vehicles or equipment. It includes above or underground fuel storage facilities. Fueling may occur at:

- General service gas stations
- 24-hour convenience stores
- Construction sites
- Maintenance yards
- Warehouses
- Car washes
- Manufacturing establishments
- Port facilities
- Marinas
- Boatyards
- Businesses with fleet vehicles.

Typical causes of stormwater contamination at fueling stations include leaks/spills of fuels, lubrication oils, radiator coolants, and vehicle washwater.

Pollutant Control Approach: New or substantially remodeled* fueling stations must be constructed on an impervious concrete pad under a roof to keep out rainfall and stormwater run-on. The facility must use a treatment BMP for contaminated stormwater and wastewaters in the fueling containment area.

** Substantial remodeling includes (but is not limited to) replacing the canopy or relocating or adding one or more fuel dispensers in such a way that modifies the Portland cement concrete (or equivalent) paving in the fueling area.*

Applicable Operational BMPs:

- Prepare an emergency spill response and cleanup plan (spill plan) per *S426 BMPs for Spills of Oil and Hazardous Substances*. **The Spill Control Plan shall be included as Appendix D of the site's Pollution Source Control Program.**
- Train employees on the proper use of fuel dispensers and on the spill plan.
- Have a designated trained person(s) available either on site or on call at all times to promptly and properly implement the spill plan and immediately cleanup all spills.
- If the fueling station is unattended by a trained person during operating hours, the spill plan must be visible to all customers and untrained employees using the station, and the spill kit must also be accessible and fully stocked at all times.
- The person conducting the fuel transfer must be present at the fueling pump during fuel transfer, particularly at unattended or self-serve stations.
- Keep suitable cleanup materials, such as dry adsorbent materials, on site to allow prompt cleanup of a spill.

- Do not use dispersants to clean up spills or sheens unless properly removed for disposal following application. Dispersants are not allowed to enter storm drains, surface waters, treatment systems, or sanitary sewers.
- Post signs in accordance with the requirements in the Uniform Fire Code (UFC) or International Fire Code (IFC). For example, post "No Topping Off" signs (topping off gas tanks causes spillage and vents gas fumes to the air).
- Make sure that the automatic shut-off on the fuel nozzle is functioning properly.
- Refer to *S439 BMPs for In-Water and Over-Water Fueling* for BMPs for in-water or over-water fueling operations.

Applicable Structural Source Control BMPs:

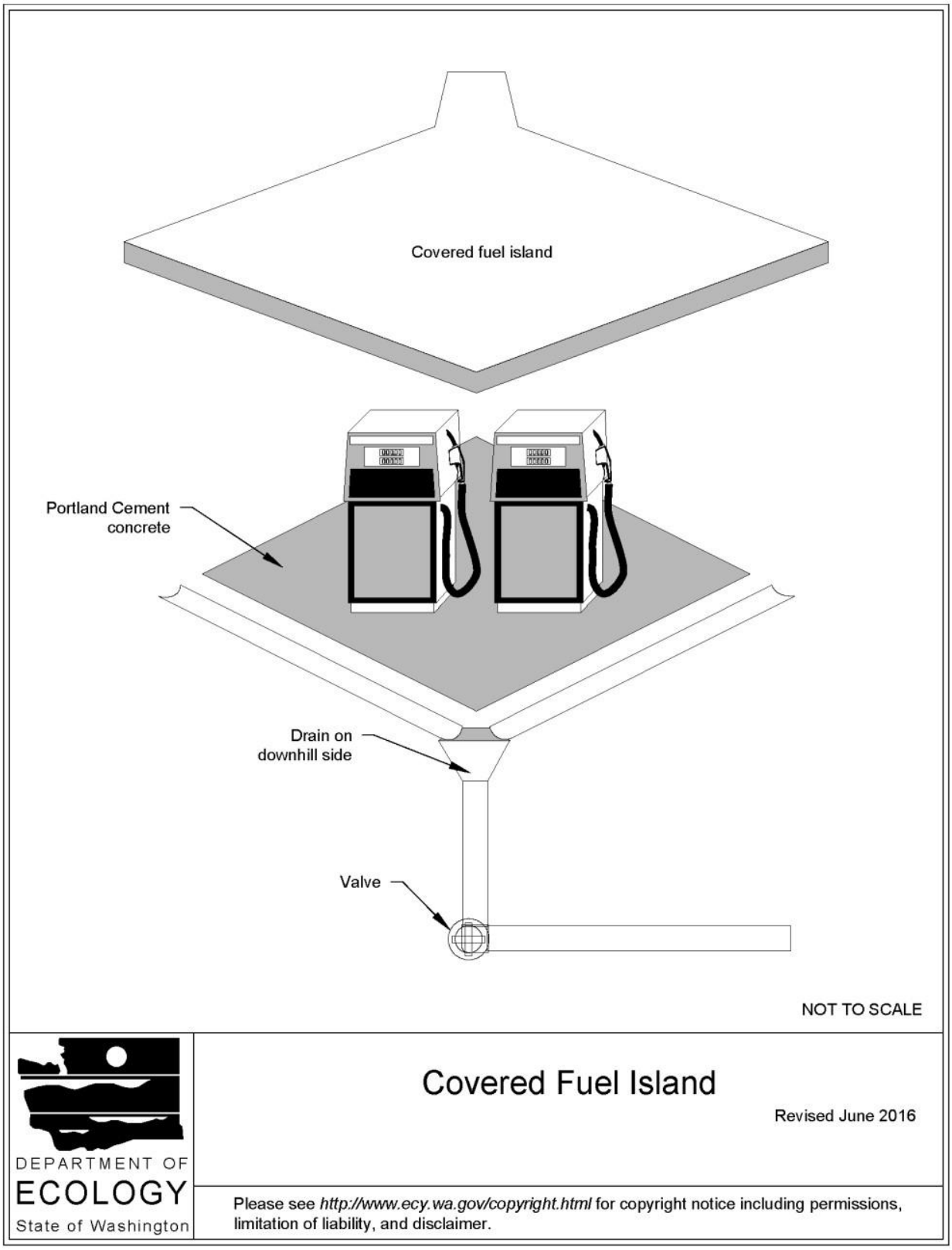
For new or substantially remodeled fueling stations:

- Design the fueling island to:
  - Minimize stormwater contamination.
  - Control spills (dead-end sump or spill control separator in compliance with the UFC or IFC).
  - Collect stormwater and/or wastewater and direct it to an appropriate treatment system.
- Slope the concrete containment pad around the fueling island toward drains; either trench drains, catch basins and/or a dead-end sump. The slope of the drains shall not be less than 1 percent (Section 7901.8 of the UFC, Section 5703.6.8 of the IFC).
- Drains from containment pads must have a normally closed shutoff valve. The valve may be opened to convey contaminated stormwater to oil removal treatment such as an API or CP oil/water separator (see V-13 Oil and Water Separator BMPs), catch basin insert, or equivalent treatment, and then to a basic treatment BMP (as described in III-1.2 Choosing Your Runoff Treatment BMPs) or to a sanitary sewer, if approved by the sewer authority. Discharges from treatment systems to storm sewer or surface water or to the ground must not display ongoing or recurring visible sheen and must not contain a significant amount of oil and grease.
- The spill control capacity must be sized in compliance with Section 7901.8 of the UFC. The spill control capacity may be acquired by either an underground system including a sump, or an above ground containment area consisting of a containment pad with berms.
- The fueling island may be designed as a spill containment pad with a sill or berm raised to a minimum of four inches (per Section 7901.8 of the UFC) to prevent the runoff of spilled liquids and to prevent run-on of stormwater from the surrounding area. All stormwater collected on the containment pad must discharge to treatment with a normally closed valve downstream of the treatment.
- The fueling pad must be paved with Portland cement concrete, or equivalent. Ecology does not consider asphalt an equivalent material.
- The fueling island must have a roof or canopy to prevent the direct entry of precipitation onto the spill containment pad (see Figure IV-5.9: Covered Fuel Island). The roof or canopy should, at a minimum, cover the spill containment pad (within the grade break or fuel dispensing area) and preferably extend 3 feet on each side for roofs and canopies 10 feet or less in height and 5 feet on each side for roofs and canopies greater than 10 feet in height. Overhangs reduce the

introduction of windblown rain. Measure the overhang relative to the berm or other hydraulic grade break for the spill containment pad.

- Convey all roof drains to storm drains outside the fueling containment area.
- Convey stormwater collected on the fuel island containment pad to a sanitary sewer system, if approved by the sanitary authority, or to an approved treatment system such as an oil/water separator and a basic treatment BMP. (Basic treatment BMPs are listed in III-1.2 Choosing Your Runoff Treatment BMPs). Discharges from treatment systems to storm drains or surface water or to the ground must not display ongoing or recurring visible sheen and must not contain oil and grease.
- Alternatively, collect stormwater from the fuel island containment pad and hold for proper off-site disposal.
- Approval from the local sewer authority is required for conveyance of any fuel-contaminated stormwater to a sanitary sewer. The discharged stormwater must comply with pretreatment regulations (WAC 173-216-060). These regulations prohibit discharges that could "cause fire or explosion." State and federal pretreatment regulations define an explosive or flammable mixture, based on a flash point determination of the mixture. Stormwater could be conveyed to a sanitary sewer system if it is determined not to be explosive.
- Transfer the fuel from the delivery tank trucks to the fuel storage tank in impervious contained areas and ensure that appropriate overflow protection is used. Alternatively, cover nearby storm drains during the filling process and use drip pans under all hose connections.

Figure IV-5.9: Covered Fuel Island



Additional BMP for Vehicles 10 feet in height or greater

A roof or canopy may not be feasible at fueling stations that regularly fuel vehicles that are 10 feet in height or greater, particularly at industrial or WSDOT sites. At those types of fueling facilities, the following BMPs apply, as well as the applicable BMPs and fire prevention (UFC requirements) of this BMP for fueling stations:

- If a roof or canopy is impractical, the concrete fueling pad must be equipped with emergency spill control including a shutoff valve for drainage from the fueling area. Maintain the valve in the closed position in the event of a spill. Clean up spills and dispose of materials off-site in accordance with *S426 BMPs for Spills of Oil and Hazardous Substances*.
- The valve may be opened to convey contaminated stormwater to a sanitary sewer, if approved by the sewer authority, or to oil removal treatment such as an API or CP oil/water separator (see V-13 Oil and Water Separator BMPs), catch basin insert, or equivalent treatment, and then to a basic treatment BMP (as described in III-1.2 Choosing Your Runoff Treatment BMPs). Discharges from treatment systems to storm sewer or surface water or to the ground must not display ongoing or recurring visible sheen and must not contain a significant amount of oil and grease.

S412 BMPs for Loading and Unloading Areas for Liquid or Solid Material

Description of Pollutant Sources: Operators typically conduct loading/unloading of liquid and solid materials at industrial and commercial facilities at shipping and receiving, outside storage, fueling areas, etc. Materials transferred can include products, raw materials, intermediate products, waste materials, fuels, scrap metals, etc. Leaks and spills of fuels, oils, powders, organics, heavy metals, salts, acids, alkalis, etc. during transfer may cause stormwater contamination. Spills from hydraulic line breaks are a common problem at loading docks.

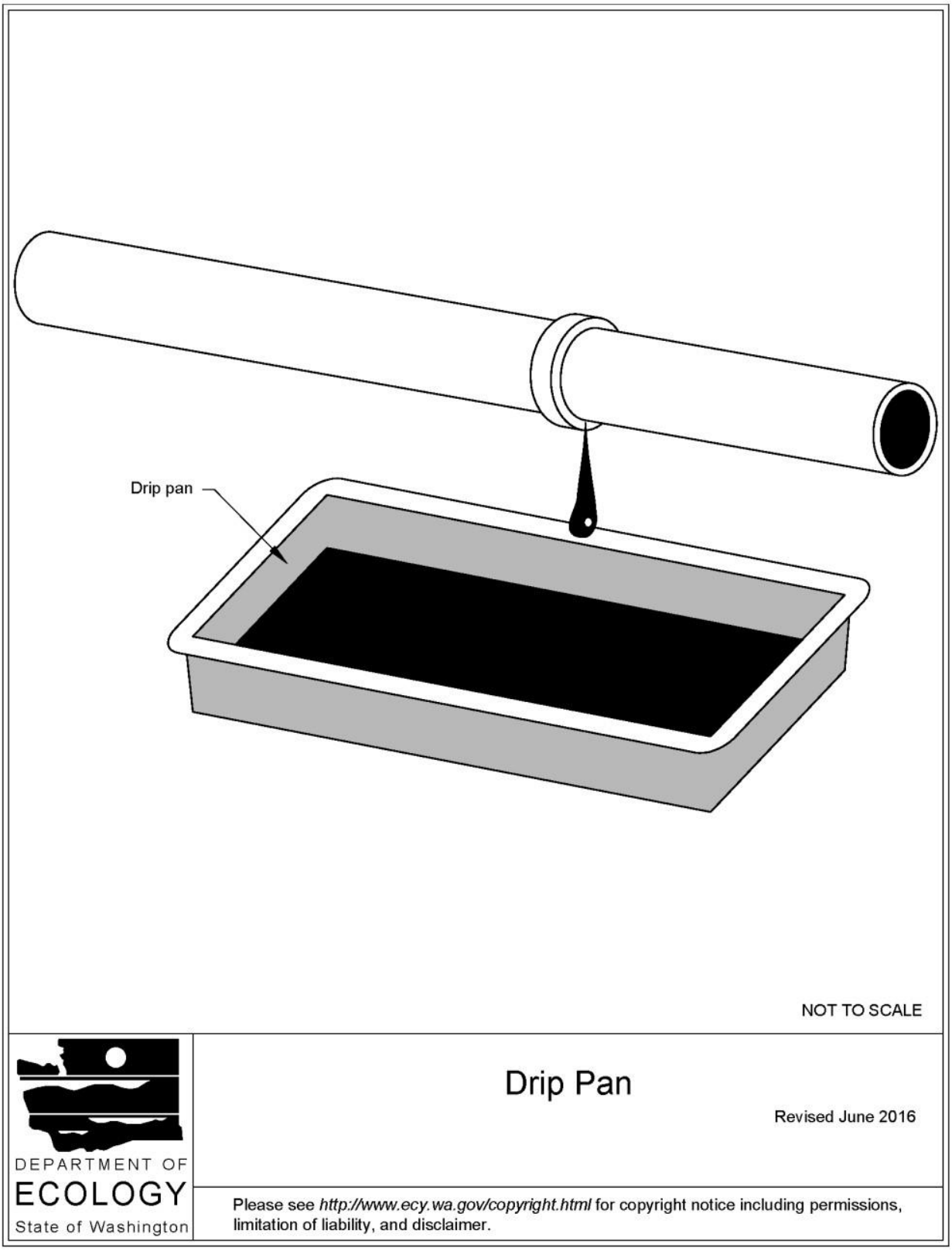
Pollutant Control Approach: Cover and contain the loading/unloading area where necessary to prevent run-on of stormwater and runoff of contaminated stormwater.

Applicable Operational BMPs:

At All Loading/ Unloading Areas

- A significant amount of debris can accumulate at outside, uncovered loading/unloading areas. Sweep these surfaces frequently to remove loose material that could contaminate stormwater. Sweep areas temporarily covered after removal of the containers, logs, or other material covering the ground.
- Place drip pans, or other appropriate temporary containment device, at locations where leaks or spills may occur such as hose connections, hose reels and filler nozzles. Always use drip pans when making and breaking connections (see Figure IV-5.10: Drip Pan). Check loading/unloading equipment such as valves, pumps, flanges, and connections regularly for leaks and repair as needed.

Figure IV-5.10: Drip Pan



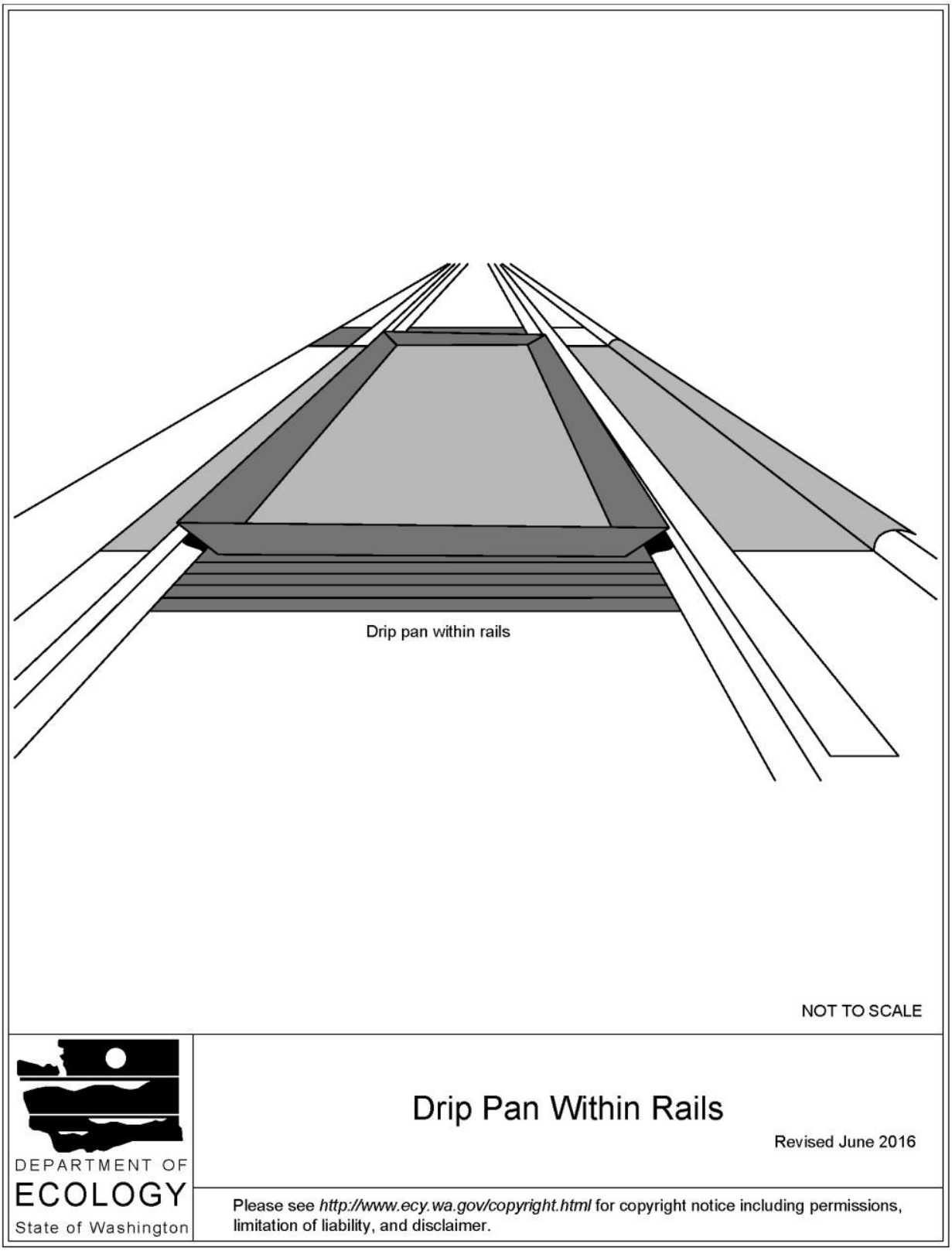
At Tanker Truck and Rail Transfer Areas to Above/Below-ground Storage Tanks

- To minimize the risk of accidental spillage, prepare an "Operations Plan" that describes procedures for loading/unloading. Train employees in its execution and post it or otherwise have it readily available to all employees.
- Report spills of reportable quantities to Ecology.
- Prepare and implement an Emergency Spill Cleanup Plan for the facility (See *S426 BMPs for Spills of Oil and Hazardous Substances*) which includes the following BMPs:
    - Ensure the cleanup of liquid/solid spills in the loading/unloading area immediately, if a significant spill occurs, and, upon completion of the loading/unloading activity, or, at the end of the working day.
    - Retain and maintain an appropriate oil spill cleanup kit on-site for rapid cleanup of material spills. (See *S426 BMPs for Spills of Oil and Hazardous Substances*).
    - Ensure that an employee trained in spill containment and cleanup is present during loading/unloading.

At Rail Transfer Areas to Above/below-ground Storage Tanks

Install a drip pan system as illustrated (see Figure IV-5.11: Drip Pan Within Rails) within the rails to collect spills/leaks from tank cars and hose connections, hose reels, and filler nozzles.

Figure IV-5.11: Drip Pan Within Rails



Loading/Unloading from/to Marine Vessels

Facilities and procedures for the loading or unloading of petroleum products must comply with Coast Guard requirements specified in Coast Guard Requirements for Marine Transfer of Petroleum Products within I-2.15 Other Requirements.

Transfer of Small Quantities from Tanks and Containers

Refer to *S428 BMPs for Storage of Liquids in Permanent Aboveground Tanks* and *S427 BMPs for Storage of Liquid, Food Waste, or Dangerous Waste Containers* for requirements on the transfer of small quantities from tanks and containers, respectively.

Applicable Structural Source Control BMPs:

At All Loading/ Unloading Areas

- Consistent with Uniform Fire Code requirements (see Uniform Fire Code Requirements within I-2.15 Other Requirements) and to the extent practicable, conduct unloading or loading of solids and liquids in a manufactured building, under a roof, or lean-to, or other appropriate cover.
- Berm, dike, and/or slope the loading/unloading area to prevent run-on of stormwater and to prevent the runoff or loss of any spilled material from the area.
- Place curbs along the edge of the shoreline or slope the edge such that the stormwater can flow to an internal storm sewer system that leads to an approved treatment BMP. Avoid draining directly to the surface water from loading areas.
- Pave and slope loading/unloading areas to prevent the pooling of water. Minimize the use of catch basins and drain lines within the interior of the paved area or place catch basins in designated "alleyways" that are not covered by material, containers, or equipment.
- Retain on-site the necessary materials for rapid cleanup of spills.

Recommended Structural Source Control BMPs:

For the transfer of pollutant liquids in areas that cannot contain a catastrophic spill, install an automatic shutoff system in case of unanticipated off-loading interruption (e.g., coupling break, hose rupture, overfill, etc.).

At Loading and Unloading Docks

- Install/maintain overhangs, or door skirts that enclose the trailer end (see Figure IV-5.12: Loading Dock with Door Skirt and Figure IV-5.13: Loading Dock with Overhang) to prevent contact with rainwater.
- Design the loading/unloading area with berms, sloping, etc., to prevent the run-on of stormwater.

Figure IV-5.12: Loading Dock with Door Skirt

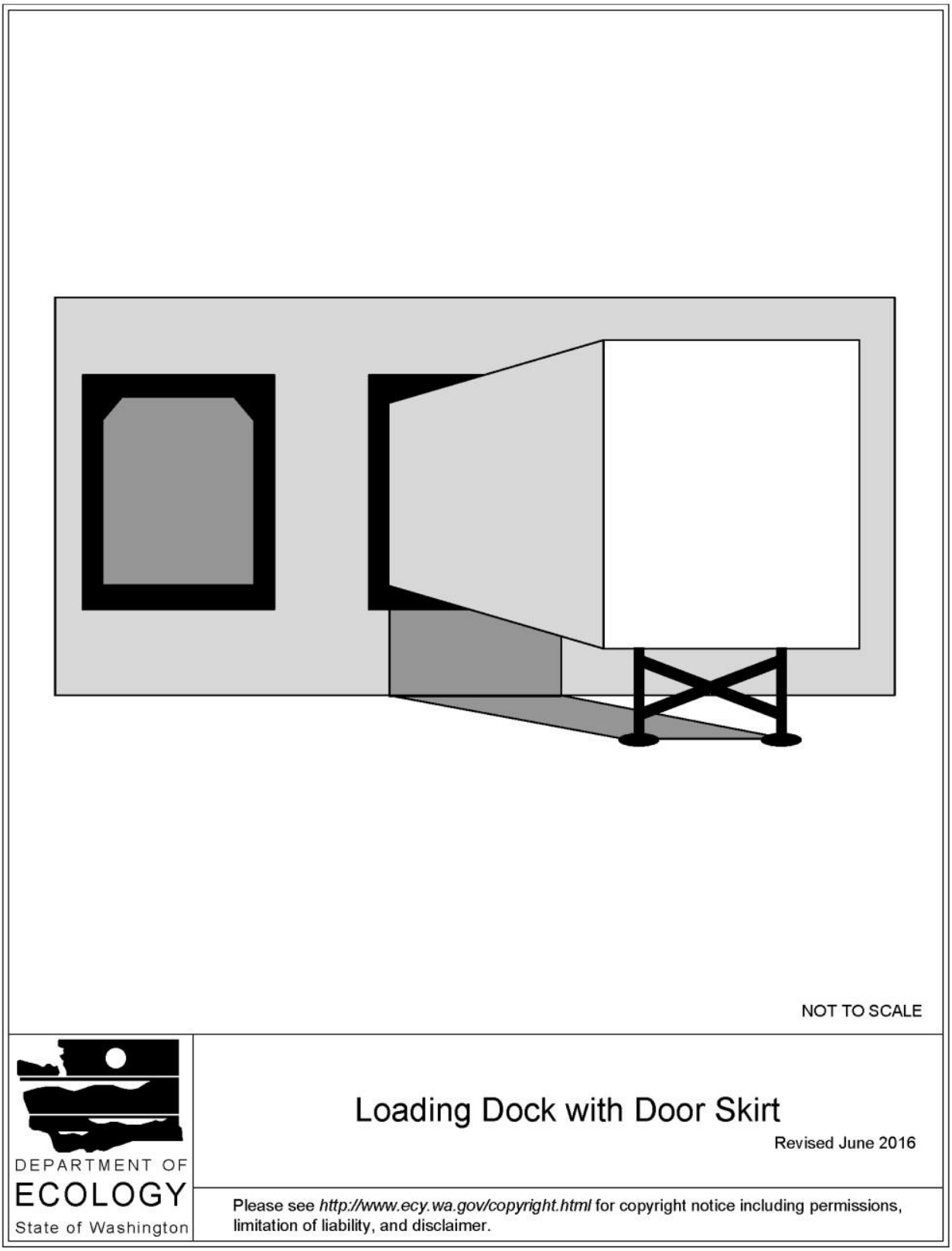
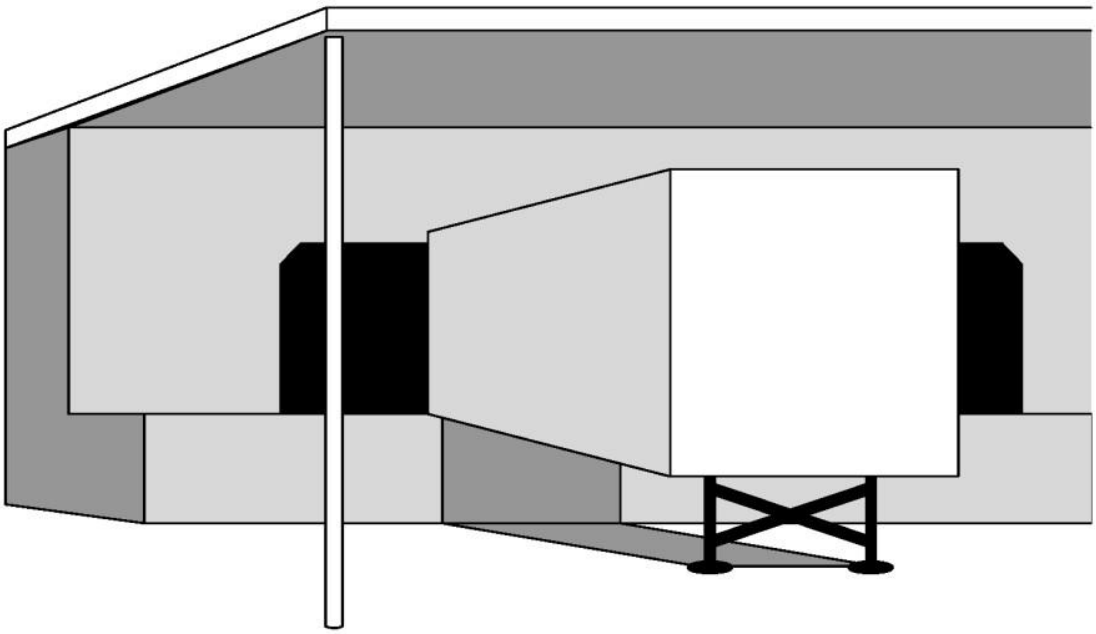


Figure IV-5.13: Loading Dock with Overhang



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State of Washington

Loading Dock with Overhang

Revised June 2016

At Tanker Truck Transfer Areas to Above/Below-Ground Storage Tanks

- Pave the area on which the transfer takes place. If any transferred liquid, such as gasoline, is reactive with asphalt, pave the area with Portland cement concrete.
- Slope, berm, or dike the transfer area to a dead-end sump, spill containment sump, a spill control oil/water separator, or other spill control device. The minimum spill retention time should be 15 minutes at the greater flow rate of the highest fuel dispenser nozzle through-put rate, or the peak flow rate of the 6-month, 24-hour storm event over the surface of the containment pad, whichever is greater. The capacity of the spill containment sump should be a minimum of 50 gallons with adequate additional capacity provided for grit sedimentation.

S419 BMPs for Mobile Fueling of Vehicles and Heavy Equipment

Description of Pollutant Sources: Mobile fueling, also known as fleet fueling, wet fueling, or wet hosing, is the practice of filling fuel tanks of vehicles by tank trucks that are driven to the yards or sites where the vehicles to be fueled are located. Diesel fuel is categorized as a Class II Combustible Liquid, whereas gasoline is categorized as a Flammable Liquid.

Note that some local fire departments may have restrictions on mobile fueling practices.

Historically organizations conducted mobile fueling for off-road vehicles operated for extended periods in remote areas. This includes construction sites, logging operations, and farms. Some organizations conduct mobile fueling of on-road vehicles commercially in the State of Washington.

Pollutant Control Approach: Fueling operators need proper training of fueling operations, the use of spill/drip control, and fuel transfer procedures.

Applicable Operational BMPs:

Organizations and individuals conducting mobile fueling operations must implement the BMPs in the following list. The operating procedures for the driver/operator should be simple, clear, effective, and their implementation verified by the organization liable for environmental and third party damage.

- Ensure that the local fire department approves all mobile fueling operations. Comply with local and Washington State fire codes.
- In fueling locations that are in close proximity to sensitive aquifers, designated wetlands, wetland buffers, or other waters of the State, approval by local jurisdictions is necessary to ensure compliance with additional local requirements.
- Ensure compliance with all 49 CFR 178 requirements for all fuel delivery vehicles or containers. Documentation from a Department of Transportation (DOT) Registered Inspector provides proof of compliance.
- Ensure the presence and the constant observation/monitoring of the driver/operator at the fuel transfer location at all times during fuel transfer and ensure implementation of the following procedures at the fuel transfer locations:
    - Locate the point of fueling at least 25 feet from the nearest storm sewer or inside an impervious containment with a volumetric holding capacity equal to or greater than 110 percent of the fueling tank volume or covering the storm sewer to ensure no inflow of

spilled or leaked fuel. Covers are not required for storm sewers that convey the inflow to a spill control separator approved by the local jurisdiction and the fire department. Potential spill/leak conveyance surfaces must be impervious and in good repair. Do not remove the drain cover if sheen is present. Properly collect and dispose of any contaminated material.

  - Place a drip pan, or an absorbent pad under each fueling location prior to and during all dispensing operations. The pan (must be liquid tight) and the absorbent pad must have a capacity of at least 5 gallons. There is no need to report spills retained in the drip pan or the pad.
  - Manage the handling and operation of fuel transfer hoses and nozzle, drip pan(s), and absorbent pads as needed to prevent spills/leaks of fuel from reaching the ground, storm sewer, and receiving waters.
  - Avoid extending the fueling hoses across a traffic lane without fluorescent traffic cones, or equivalent devices, conspicuously placed to block all traffic from crossing the fuel hose.
  - Remove the fill nozzle and cease filling the tank when the automatic shut-off valve engages. Do not lock automatic shutoff fueling nozzles in the open position.
  - Do not "top off" the fuel receiving equipment.
- Provide the driver/operator of the fueling vehicle with:
  - Adequate flashlights or other mobile lighting to view fuel fill openings with poor accessibility. Consult with local fire department for additional lighting requirements.
  - Two-way communication with his/her home base.
- Train the driver/operator annually in spill prevention and cleanup measures and emergency procedures. Make all employees aware of the significant liability associated with fuel spills.
- The responsible manager shall properly sign and date the fueling operating procedures. Distribute procedures to the operators, retain them in the organization files, and make them available in the event an authorized government agency requests a review.
- Immediately notify the local fire department (911), the appropriate regional office of the Department of Ecology, and the local jurisdiction in the event of any spill entering surface or ground waters. Establish a "call down list" to ensure the rapid and proper notification of management and government officials should any significant amount of product be lost off-site. Keep the list in a protected but readily accessible location in the mobile fueling truck. The "call down list" should also identify spill response contractors available in the area to ensure the rapid removal of significant product spillage into the environment.
- In all fueling vehicles, maintain a minimum of the following spill cleanup materials and have them readily available for use:
  - Non-water absorbents capable of absorbing at least 15 gallons of fuel.
  - A storm drain plug or cover kit.
  - A non-water absorbent containment boom of a minimum 10 feet in length with a 12-gallon minimum absorbent capacity.
  - A non-spark generating shovel (a steel shovel could generate a spark and cause an explosion in the right environment around a spill).
  - Two, five-gallon buckets with lids.
- Use automatic shutoff nozzles for dispensing the fuel. Replace automatic shut-off nozzles as recommended by the manufacturer.

- Maintain and replace equipment on fueling vehicles, particularly hoses and nozzles, at established intervals to prevent failures.
- Immediately remove and properly dispose of soils with visible surface contamination to prevent the spread of chemicals to groundwater or receiving water via stormwater runoff.
- Do not use dispersants to clean up spills or sheens unless properly removed for disposal following application. Dispersants are prohibited from use for spills on water or where the dispersant may enter storm drains, surface waters, treatment systems, or sanitary sewers.

Applicable Structural Source Control BMPs:

Include the following fuel transfer site components:

- Automatic fuel transfer shut-off nozzles.
- An adequate lighting system at the filling point.

S426 BMPs for Spills of Oil and Hazardous Substances

Description of Pollutant Sources: Washington Administrative Code requires owners or operators of facilities engaged in drilling, producing, gathering, storing, processing, transferring, distributing, refining, or consuming oil and/or oil products to have a Spill Prevention and Emergency Cleanup Plan (SPECP). The SPECP is required if the above ground storage capacity of the facility is 1,320 gallons or more of oil. Additionally, the SPECP is required if the facility, due to its location, could reasonably be expected to discharge oil in harmful quantities, as defined in 40 CFR Part 110, into or upon the navigable waters of the United States or adjoining shorelines {40 CFR 112.1 (b)}. Onshore and offshore facilities, which, due to their location, could not reasonably be expected to discharge oil into or upon the navigable waters of the United States or adjoining shorelines are exempt from these regulations {40 CFR 112.1(d)(1)(i)}. State Law requires owners of businesses that produce dangerous wastes to have a SPECP. These businesses should refer to Washington State/Federal Emergency Spill Cleanup Requirements (see I-2.15 Other Requirements). The federal definition of oil is oil of any kind or any form, including, but not limited to petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil.

Pollutant Control Approach: Maintain, update, and implement a Spill Prevention and Emergency Cleanup Plan.

Applicable Operational BMPs:

The businesses and public agencies identified in *Appendix IV-A: Urban Land Uses and Pollutant Generating Sources* required to prepare and implement a Spill Prevention and Emergency Cleanup Plan shall implement the following:

- Prepare a Spill Prevention and Emergency Cleanup Plan (SPECP), which includes:
    - A description of the facility including the owner's name and address.
    - The nature of the activity at the facility.
    - The general types of chemicals used or stored at the facility.
    - A site plan showing the location of storage areas for chemicals, the locations of storm drains, the areas draining to them, and the location and description of any devices to stop spills from leaving the site such as positive control valves.
    - Cleanup procedures.

    - Notification procedures used in the event of a spill, such as notifying key personnel. Agencies such as Ecology, local fire department(s), Washington State Patrol, and the local Sewer Authority, shall be notified.
    - The name of the designated person with overall spill cleanup and notification responsibility.
- Train key personnel in the implementation of the SPECP. Prepare a summary of the plan and post it at appropriate points in the building, identifying the spill cleanup coordinators, location of cleanup kits, and phone numbers of regulatory agencies to contact in the event of a spill.
- Update the SPECP regularly.
- Immediately notify Ecology, the local jurisdiction, and the local Sewer Authority if a spill may reach sanitary or storm sewers, ground water, or surface water, in accordance with federal and Ecology spill reporting requirements.
- Immediately clean up spills. Do not use emulsifiers for cleanup unless there is an appropriate disposal method for the resulting oily wastewater. Do not wash absorbent material down a floor drain or into a storm sewer.
- Locate emergency spill containment and cleanup kit(s) in high-potential spill areas. The contents of the kit shall be appropriate for the type and quantities of chemical liquids stored at the facility.

Recommended Additional Operational BMP:

Spill kits should include appropriately lined drums, absorbent pads, and granular or powdered materials for neutralizing acids or alkaline liquids where applicable. In fueling areas: Package absorbent material in small bags for easy use and make available small drums for storage of absorbent and/or used absorbent. Deploy spill kits in a manner that allows rapid access and use by employees.

S439 BMPs for In-Water and Over-Water Fueling

Description of Pollutant Sources: BMPs in this section apply to businesses and public agencies that operate a facility used for the transfer of fuels from a stationary pumping station to vehicles or equipment in water. This type of fueling station includes aboveground or underground fuel storage facilities, which may be permanent or temporary. Fueling stations include facilities such as, but not limited to, commercial gasoline stations, port facilities, marinas, private fleet fueling stations, and boatyards.

Typically, stormwater contamination at fueling stations is caused by leaks or spills of fuels, lubrication oils, and fuel additives. These materials contain organic compounds, oil and greases, and metals that can be harmful to humans and aquatic life.

Most fuel dock spills are small and result from overfilling boat fuel tanks, burps from air vent lines, and drips from the pump nozzle as it is being returned to the pump.

Pollutant Control Approach: Provide employees with proper training and use spill control devices to prevent the discharge of pollutants in the receiving water or the drainage system.

Applicable Operational BMPs for Fuel Docks

General

- Facilities and procedures for the loading or unloading of petroleum products must comply with U.S. Coast Guard requirements. Refer to specifications in Coast Guard Requirements for Marine Transfer of Petroleum Products.

Training and Fueling Dock Supervision

- Train staff on proper fueling procedures. Document training and maintain records.
- Have a trained employee supervise the fuel dock during fueling activities.
- Do not allow self-service on a marina dock without some means of controlling the dock activity. According to *NFPA 30A: Code for Motor Fuel Dispensing Facilities and Repair Garages*, each facility must have an attendant on duty to supervise, observe, and "control" the operation when open for business. This can be done via camera, intercom, and shutoff abilities in the office. However, this can lead to complacency, and nothing can replace having an attendant on the dock to attend to emergencies when they occur. (NFPA, 2012)

Fueling Dock Setup, Maintenance, and Inspection

- Install a tank and leak detection monitoring system that shuts off the pump and fuel line when a leak is sensed.
- Install personal watercraft floats at fuel docks to stabilize personal watercraft/jet skis while refueling.
- Provide a spill containment equipment storage area where materials are easily accessible and clearly marked.
- Use automatic shut-off nozzles and promote the use of "whistles" and fuel/air separators on air vents or tank stems of inboard fuel tanks to reduce the amount of fuel spilled into receiving waters during fueling of boats.
- Post readable refueling directions, BMPs, and emergency protocols.
- Always have a "Spills Aren't Slick" sign with emergency spill reporting numbers clearly visible. Marinas on land leased from the Washington Department of Natural Resources (DNR) are required to post these signs.
- Display "No Smoking" signs on fuel docks.
- Create a regular inspection, maintenance, and replacement schedule for fuel hoses, pipes, and tanks. Have staff walk the dock fuel lines from dispenser to tank to look for signs of leakage at joints and determine hose condition from end to end.

Fueling Practices

- Discourage operators from "topping off" (no more than 90% capacity). Fuel expands and can slosh out of the vent when temperatures rise or waters become choppy.
- When handing over the nozzle, wrap an absorbent pad around the nozzle end or plug inside the nozzle end to prevent fuel in the nozzle from spilling.
- Have the boat operator place an absorbent pad or suction cup bottle under the vent(s) to capture fuel spurts from the vent.

- Never block open the fuel nozzle trigger and always disable hands-free clips to ensure the boater remains with the nozzle to prevent overfilling. Hands-free clips are not allowed in Washington, per *WAC 296-24-33015*.
- Always keep the nozzle tip pointing up and hang the nozzle vertically when not in use.
- During fueling operations, visually monitor the liquid level indicator to prevent the tank from being overfilled.
- The maximum amount of product received must not exceed 95 percent capacity of the receiving tank.

Spill cleanup

- See *S426 BMPs for Spills of Oil and Hazardous Substances*.
- Manage petroleum-contaminated booms, pads, and absorbents in a designated collection container and properly dispose of these materials (see *S427 BMPs for Storage of Liquid, Food Waste, or Dangerous Waste Containers).*
- Ensure customers do not use soaps in the event of a spill. Use oil absorbent booms or pads instead.

Applicable Operational BMPs for Fueling by Portable Container

- Have boats fuel on shore or at a fuel dock rather than transport fuel from an upland facility to the boats. Only use hand-held fueling containers or "jerry cans" when necessary or when on shore or at dock fueling is not practical.
- Always refill portable fuel containers on the pavement or dock to ensure a good electrical ground. While the deck of the boat may seem stable, static electricity can build up and cause a spark.
- On the dock, put an absorbent pad under the container and wrap an absorbent pad around the fuel fill — this can easily be done by putting a hole in the pad.
- Ensure the nozzle stays in contact with the tank opening.
- When transferring fuel from a portable can, use a fuel siphon with a shut-off feature. If a siphon is not available, a nozzle/spout with a shut off is a good alternative.
- Since fueling boats with a portable container can take time, make sure the container is comfortable to carry, hold, and balance.
- Use a high flow funnel. Funnels can help prevent spills by making a larger opening for fueling.
- Place a plug of absorbent pad or paper towel in the nozzle when not in use to capture any extra drops that accumulate.
- Fuel slowly and pour deliberately and watch the container (especially the nozzle mechanism) for signs of wear.
- Store portable fuel tanks out of direct sunlight and keep in a cool, dry place to minimize condensation.

IV-5.5 Other Source Control BMPs

S401 BMPs for the Building, Repair, and Maintenance of Boats and Ships

Description of Pollutant Sources: Sources of pollutants for the building, repair, and maintenance of boats and ships at boatyards, shipyards, ports, and marinas include pressure washing, surface preparation, paint removal, sanding, painting, engine maintenance and repairs, and material handling and storage, if conducted outdoors.

Potential pollutants include spent abrasive grits, solvents, oils, ethylene glycol, washwater, paint over-spray, cleaners/detergents, anti-corrosion compounds, paint chips, scrap metal, welding rods, resins, glass fibers, dust, and miscellaneous trash. Pollutant constituents include suspended solids, oil and grease, organics, copper, lead, tin, and zinc.

Pollutant Control Approach: Apply good housekeeping, conduct routine preventive maintenance, and cover and contain BMPs in and around work areas.

NPDES Permit Requirements: Ecology's statewide Boatyard General Permit applies to boatyards that discharge stormwater runoff from areas with industrial activity directly to the ground, to a surface waterbody, or to a storm sewer system that drains to a surface waterbody. This general permit also regulates wastewater from pressure washing in boatyards. All boatyards in the state must apply for coverage under this permit and must comply with all conditions specified in this permit, as applicable to their facility, unless exempted. Ecology may require coverage under an individual NPDES permit for large boatyards and shipyards in Washington State not covered by the Boatyard General Permit or Industrial Stormwater General Permit (ISGP).

Applicable Operational BMPs:

- Clean regularly all accessible work, service, and storage areas to remove debris, spent sandblasting material, and any other potential stormwater pollutants.
- Whenever the boat is in the water, avoid the use of soaps, detergents and other chemicals that need to be rinsed or hosed off. If necessary, consider applying sparingly so that a sponge, towel or rag can be used to remove residuals. Consider instead washing the boat in a suitable controlled area (see *S431 BMPs for Washing and Steam Cleaning Vehicles / Equipment / Building Structures*) while it is out of the water.
- Sweep rather than hose debris on the dock. Collect and convey hose water to treatment if hosing is unavoidable,
- Collect spent abrasives regularly and store them under cover to await proper disposal.
- Dispose of greasy rags, oil filters, air filters, batteries, spent coolant, and degreasers properly.
- Drain oil filters before disposal or recycling.
- Immediately repair or replace leaking connections, valves, pipes, hoses, and other equipment that may cause the contamination of stormwater.
- Use drip pans, drop cloths, tarpaulins, or other protective devices in all paint mixing and solvent operations unless carried out in impervious contained and covered areas.

- Convey sanitary sewage to pump-out stations, portable on-site pump-outs, commercial mobile pump-out facilities, or other appropriate onshore facilities.
- Maintain automatic bilge pumps in a manner that will prevent automatic pumping of waste material into surface water.
- Prohibit uncontained spray painting, blasting or sanding activities over open water.
- Do not dump or pour waste materials down floor drains, sinks, or outdoor storm drain inlets that discharge to surface water. Plug floor drains connected to storm drains or to surface water. If necessary, install a regularly operated sump pump.
- Prohibit outside spray-painting, blasting, or sanding activities during windy conditions that render containment ineffective.
- Do not burn paint and/or use spray guns on topsides or above decks.
- Immediately clean up any spillage on the pier, wharf, boat, ship deck, or adjacent surface areas and dispose of the wastes properly.
- Apply source control BMPs for other activities conducted at the marina, boat yard, shipyard, or port facility (see *S409 BMPs for Fueling At Dedicated Stations*, *S431 BMPs for Washing and Steam Cleaning Vehicles / Equipment / Building Structures*, and *S426 BMPs for Spills of Oil and Hazardous Substances*).
- Locate spill kits so they are readily accessible on all piers and docks.

Applicable Structural Source Control BMPs:

- Use fixed platforms with appropriate plastic or tarpaulin barriers as work surfaces and for containment when performing work on a vessel in the water to prevent blast material or paint overspray from contacting stormwater or the surface water. Keep the use of such platforms to a minimum, and do not perform extensive repair, modification, surface preparation, or coating while the boat is in the water (anything in excess of 25 percent of the surface area of the vessel above the waterline).
- Use plastic or tarpaulin barriers beneath the hull and between the hull and dry dock walls to contain and collect waste and spent materials. Clean and sweep regularly to remove debris.
- Enclose, cover, or contain blasting and sanding activities to the maximum extent practicable to prevent abrasives, dust, and paint chips, from reaching storm sewers or receiving waters. Use plywood and/or plastic sheeting to cover open areas between decks when sandblasting (scuppers, railings, freeing ports, ladders, and doorways).
- Direct deck drainage to a collection system sump for settling and/or additional treatment.
- Store cracked batteries in covered secondary containers.

Recommended Additional Operational BMPs:

- Consider recycling paint, paint thinner, solvents, used oils, oil filters, pressure wash wastewater and any other recyclable materials.
- Perform paint and solvent mixing, fuel mixing, etc., on shore.

S402 BMPs for Commercial Animal Handling Areas

Description of Pollutant Sources: Animals at racetracks, kennels, fenced pens, veterinarians, and businesses that provide boarding services for horses, dogs, cats, etc., can generate pollutants from the following activities: manure deposits, animal washing, grazing, and any other animal handling activity that could contaminate stormwater. Pollutants can include coliform bacteria, nutrients, and total suspended solids. Individual Stormwater Permits covering commercial animal handling facilities include additional applicable source controls.

Pollutant Control Approach: To prevent, to the maximum extent practicable, the discharge of contaminated stormwater from animal handling and keeping areas.

Applicable Operational BMPs

- Regularly sweep and clean animal keeping areas to collect and properly dispose of droppings, uneaten food, and other potential stormwater contaminants.
- Do not hose down areas that contain potential stormwater contaminants where they drain to storm drains or to receiving waters.
- Do not discharge any washwater to storm drains or to receiving waters without proper treatment.
- If the operator keeps animals in unpaved and uncovered areas, the ground must have either vegetative cover or some other type of ground cover such as mulch.
- Surround the area where animals are kept with a fence or other means to prevent animals from moving away from the controlled area where BMPs are used.
- For outside surface areas that must be disinfected, use an unsaturated mop to spot clean the area. Do not allow wastewater runoff to enter the drainage system.
- Do not stockpile manure in areas where runoff is allowed to flow into a storm drain or to nearby receiving waters or wetlands.

S403 BMPs for Commercial Composting

Description of Pollutant Sources: Commercial composting facilities, operating outside without cover, require large areas to decompose wastes and other feedstocks. Design these facilities to separate stormwater from leachate (i.e., industrial wastewater) to the greatest extent possible. When stormwater contacts any active composting areas, including waste receiving and processing areas, it becomes leachate. Pollutants in leachate include nutrients, biochemical oxygen demand (BOD), organics, coliform bacteria, acidic pH, color, and suspended solids. Stormwater at composting facilities include runoff from areas not associated with active processing and curing, such as product storage areas, vehicle maintenance areas, and access roads.

NPDES and State Solid Waste Permit Requirements: Composting facilities are regulated under *WAC 173-350-220*. Solid Waste Regulations require the collection and containment of all leachates produced from activities at commercial composting facilities. Composting facilities that propose to discharge to surface water, municipal sewer system, or ground water must obtain the appropriate permits. Zero discharge is possible by containing all leachate from the facility (in tanks or ponds) for use early in the composting process or preventing production of leachate (by composting under a roof or in an enclosed building).

Pollutant Control Approach: Consider zero leachate discharge.

Applicable Operational, Structural, and Treatment BMPs:

- See *WAC 173-350-220*, Composting Facilities
- See *Siting and Operating Composting Facilities in Washington State: Good Management Practices* (Ecology, 2013) for common sense actions that can be implemented at a facility to help run a successful program.
- See Ecology's Organic Materials Management page for the most up-to-date information: *https://ecology.wa.gov/Waste-Toxics/Reducing-recycling-waste/Organic-materials* .
- All composting facilities shall obtain the appropriate state and local permits. Contact the City of Olympia and Thurston County Health Department for more information.
- Apply for coverage under the Industrial Stormwater General Permit (ISGP) if the facility discharges stormwater to surface water or a municipal stormwater system. If all stormwater from the facility properly infiltrates to ground water, the ISGP may not be required. There are some cases where an Individual State Waste Discharge permit is required. Check with your local Ecology office and Thurston County Health Department to discuss your permitting options.
- Screen incoming wastes for dangerous materials and solid wastes. These materials may not be accepted for composting and must be properly disposed of.
- Locate composting areas on impervious surfaces.
- Drain all leachate from composting operations to a sanitary sewer, holding tank, or on-site treatment system. Leachate may not go to the storm drain or groundwater.
- Collect the leachate with a dike or berm, or with intercepting drains placed on the down slope side of the compost area.
- Direct outside runoff away from the composting areas.
- Clean up debris from yard areas as needed to prevent stormwater contamination.

Recommended BMPs:

- Install catch basin inserts to collect excess sediment and debris if necessary. Inspect and maintain catch basin inserts to ensure they are working correctly.
- Locate stored residues in areas designed to collect leachate and limit storage time to prevent degradation and generation of leachate.

S404 BMPs for Commercial Printing Operations

Description of Pollutant Sources: Materials used in the printing process include inorganic and organic acids, resins, solvents, polyester film, developers, alcohol, vinyl lacquer, dyes, acetates, and polymers. Waste products may include waste inks and ink sludge, resins, photographic chemicals, solvents, acid and alkaline solutions, chlorides, chromium, zinc, lead, spent formaldehyde, silver, plasticizers, and used lubricating oils. With indoor printing operations, the only likely points of potential contact with stormwater are the outside temporary storage of waste materials and offloading of chemicals at external unloading bays. Pollutants can include TSS, pH, heavy metals, oil and grease, and COD.

Pollutant Control Approach: Ensure appropriate disposal and NPDES permitting of process wastes. Cover and contain stored raw and waste materials.

Applicable Operational BMPs:

- Discharge process wastewaters to a sanitary sewer, if approved by the local sewer authority, or to an approved process wastewater treatment system.
- Do not discharge process wastes or wastewaters into storm sewers or surface water.
- Determine whether any of these wastes qualify for regulation as dangerous wastes and dispose of them accordingly.
- Store raw materials or waste materials that could contaminate stormwater in covered and contained areas.
- Train all employees in pollution prevention, spill response, and environmentally acceptable materials handling procedures.
- Store materials in proper, appropriately labeled containers. Identify and label all chemical substances.
- Regularly inspect all stormwater management devices and maintain as necessary.
- Try to use press washes without listed solvents, and with the lowest volatile organic compound (VOC) content possible. Do not evaporate ink cleanup trays to the outside atmosphere.
- Place cleanup sludges into a container with a tight lid and dispose of as dangerous waste. Do not dispose of cleanup sludges in the garbage or in containers of soiled towels.

For additional information on pollution prevention, Ecology recommends *Environmental Management and Pollution Prevention: A Guide for Lithographic Printers* (Ecology, 2001).

S413 BMPs for Log Sorting and Handling

Description of Pollutant Sources: Log yards are paved or unpaved areas where logs are transferred, sorted, debarked, cut, and stored to prepare them for shipment or for the production of dimensional lumber, plywood, chips, poles, or other products. Log yards are generally maintained at sawmills, shipping ports, and pulp mills. Typical pollutants include oil and grease, BOD, settleable solids, total suspended solids (including soil), high and low pH, heavy metals, pesticides, wood-based debris, and leachate.

The following are pollutant sources:

- Log storage, rollout, sorting, scaling, and cutting areas
- Log and liquid loading areas
- Log sprinkling
- Debarking, bark bin and conveyor areas
- Bark, ash, sawdust and wood debris piles, and solid wastes
- Metal salvage areas
- Truck, rail, ship, stacker, and loader access areas
- Log trucks, stackers, loaders, forklifts, and other heavy equipment
- Maintenance shops and parking areas
- Cleaning areas for vehicles, parts, and equipment
- Storage and handling areas for hydraulic oils, lubricants, fuels, paints, liquid wastes, and other liquid materials

- Pesticide usage for log preservation and surface protection
- Application of herbicides for weed control
- Contaminated soil resulting from leaks or spills of fluids

Ecology's Baseline General Permit Requirements:

Industries with log yards or areas where logs are sorted or loaded are required to obtain coverage under the Industrial Stormwater General Permit for discharges of stormwater associated with industrial activities. The permit requires preparation and on-site retention of an Industrial Stormwater Pollution Prevention Plan (SWPPP). Required and recommended operational, structural source control, and treatment BMPs are presented in detail in *Industrial Stormwater General Permit Implementation Manual for Log Yards* (Ecology, 2016c). Ecology recommends that all log yard facilities obtain a copy of this document.

S414 BMPs for Maintenance and Repair of Vehicles and Equipment

Description of Pollutant Sources: Pollutant sources include parts/vehicle cleaning, spills/leaks of fuel and other liquids, replacement of liquids, outdoor storage of batteries/liquids/parts, and vehicle parking.

Pollutant Control Approach: Control of leaks and spills of fluids using good housekeeping and cover and containment BMPs.

Applicable Operational BMPs:

- Inspect all incoming vehicles, parts, and equipment stored temporarily outside for leaks.
- Use drip pans or containers under parts or vehicles that drip or that are likely to drip liquids, such as during dismantling of liquid containing parts or removal or transfer of liquids. Inspect drip pans regularly to prevent accumulation of stormwater or other liquids and dispose of any accumulated liquid appropriately.
- Remove batteries and liquids from vehicles and equipment in designated areas designed to prevent stormwater contamination. Store cracked batteries in a covered non-leaking secondary containment system.
- Remove liquids from vehicles retired for scrap.
- Empty oil and fuel filters before disposal. Provide for proper disposal of used oil and fuel.
- Do not pour/convey washwater, liquid waste, or other pollutants into storm drains or to surface water. Check with the local sanitary sewer authority for approval to convey water to a sanitary sewer.
- Do not connect maintenance and repair shop floor drains to storm drains or to surface water.
- To allow for snowmelt during the winter, install a drainage trench with a sump for particulate collection. Use the drainage trench for draining the snowmelt only. Do not discharge any vehicular or shop pollutants to the trench drain.
- Keep spill kits on site and accessible.
- Applicable Structural Source Control BMPs:
- Conduct all maintenance and repair of vehicles and equipment in a building, or other covered impervious containment area that is sloped to prevent run-on of uncontaminated stormwater and runoff of contaminated water.

- Operators may conduct maintenance of refrigeration engines in refrigerated trailers in the parking area. Exercise due caution to avoid the release of engine or refrigeration fluids to storm drains or surface water.
- Park large mobile equipment, such as log stackers, in a designated contained area.

Applicable Treatment BMPs:

Convey contaminated stormwater runoff from vehicle staging and maintenance areas to a sanitary sewer, if allowed by the local sewer authority, or to an API or CP oil and water separator followed by a Basic Treatment BMP (See Volume V), applicable filter, or other equivalent oil treatment system.

Note this applicable treatment BMP for contaminated stormwater.

Recommended Additional Operational BMPs:

- Store damaged vehicles inside a building or other covered containment, until successfully removing all liquids.
- Clean parts with aqueous detergent based solutions or non-chlorinated solvents such as kerosene or high flash mineral spirits, and/or use wire brushing or sand blasting whenever practicable. Avoid using toxic liquid cleaners such as methylene chloride, 1,1,1-trichloroethane, trichloroethylene or similar chlorinated solvents. Choose cleaning agents that can be recycled.
- Inspect all BMPs regularly, particularly after a significant storm. Identify and correct deficiencies to ensure that the BMPs are functioning as intended.
- Avoid hosing down work areas. Use dry methods for cleaning leaked fluids.
- Recycle greases, used oil, oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic fluids, transmission fluids, and engine oils. Contact Ecology's Hazardous Waste & Toxics Reduction Program for recommendations on recycling or disposal of waste materials. (*https://ecology.wa.gov/About-us/Get-to-know-us/Our-Programs/Hazardous-Waste-Toxics-Reduction*)
- Do not mix dissimilar or incompatible waste liquids stored for recycling.

S418 BMPs for Manufacturing Activities - Outside

Description of Pollutant Sources: Manufacturing pollutant sources include outside process areas, stack emissions, and areas where manufacturing activity has taken place in the past and significant exposed pollutant materials remain.

Pollution Control Approach: Cover and contain outside manufacturing and prevent stormwater run-on and contamination, where feasible.

Applicable Operational BMP:

- Sweep paved areas regularly, as needed, to prevent contamination of stormwater.
- Alter the activity by eliminating or minimizing the contamination of stormwater.

Applicable Structural Source Control BMPs:

- Enclose the activity (see Figure IV-16.1: Enclose the Activity). If possible, enclose the manufacturing activity in a building.

- Cover the activity and connect floor drains to a sanitary sewer, if approved by the local sewer authority. Berm or slope the floor as needed to prevent drainage of pollutants to outside areas. (See Figure IV-16.2: Cover the Activity).
- Isolate and segregate pollutants as feasible. Convey the segregated pollutants to a sanitary sewer, process treatment, or a dead-end sump depending on available methods and applicable permit requirements.

Figure IV-5.14: Enclose the Activity

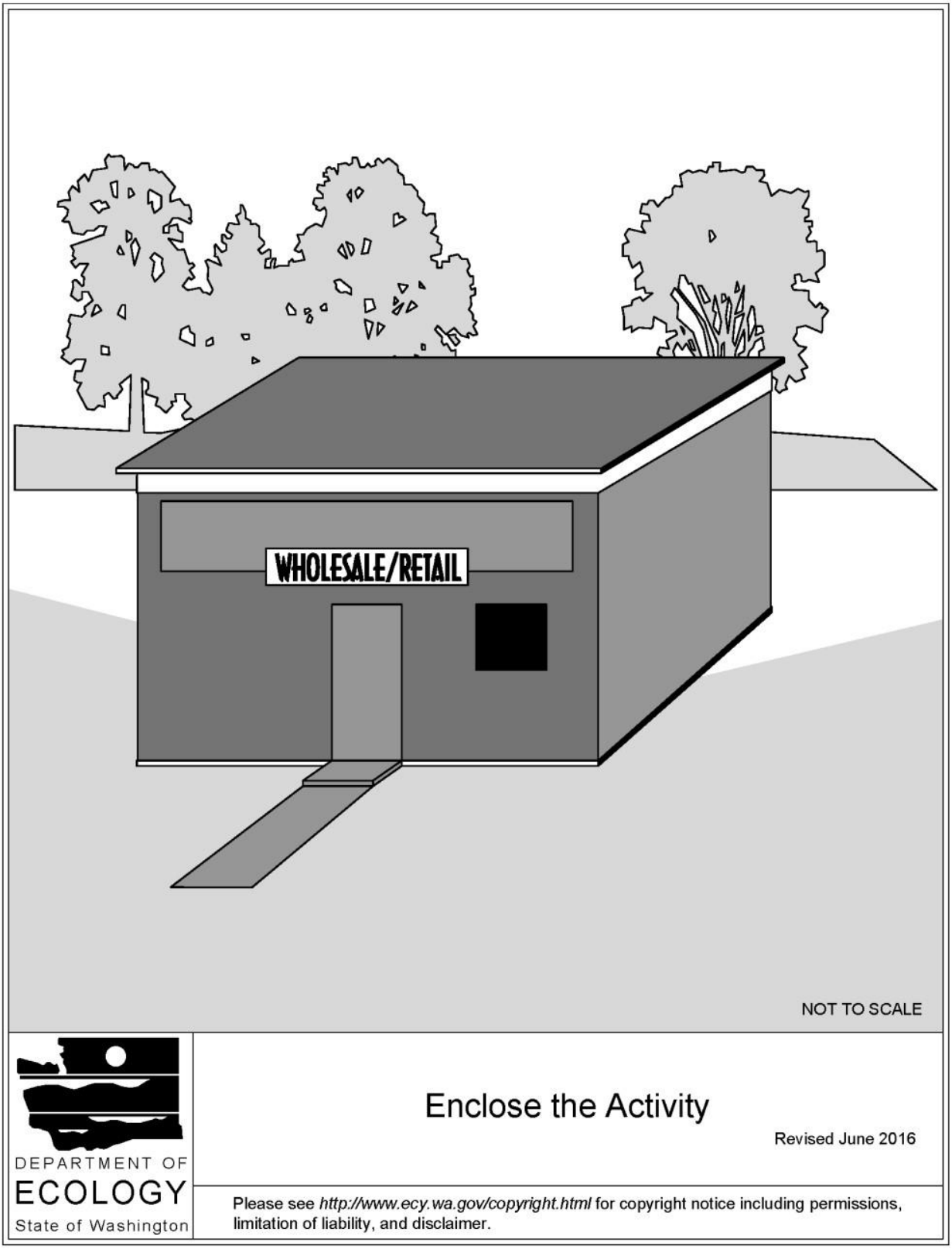
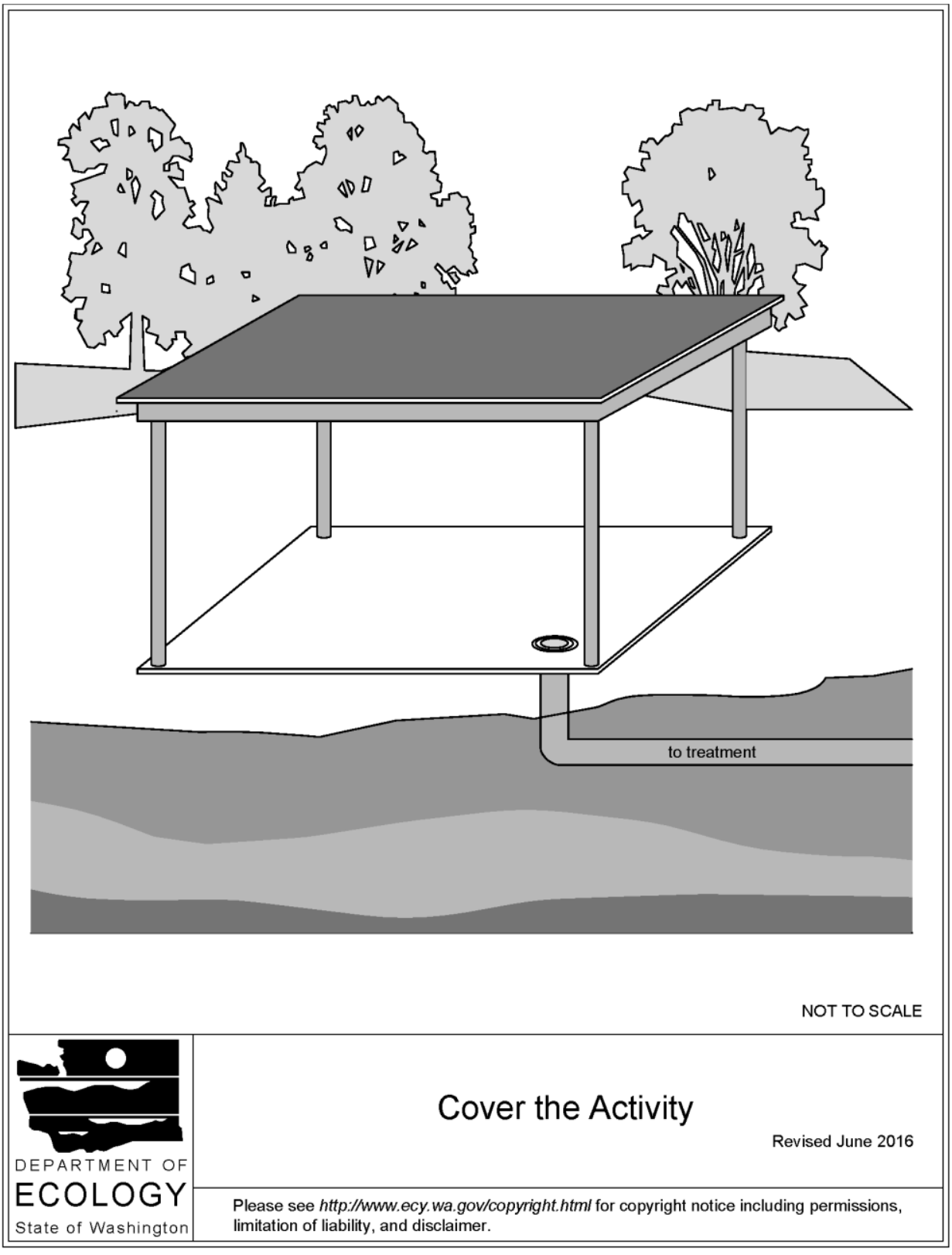


Figure IV-5.15: Cover the Activity



S420 BMPs for Painting/Finishing/Coating of Vehicles/Boats/Buildings /Equipment

Description of Pollutant Sources: Surface preparation and the application of paints, finishes, and/or coatings to vehicles, boats, buildings, and/or equipment outdoors can be sources of pollutants. Potential pollutants include organic compounds, oils and greases, heavy metals, and suspended solids.

Pollutant Control Approach: Cover and contain painting and sanding operations and apply good housekeeping and preventive maintenance practices to prevent the contamination of stormwater with painting over sprays and grit from sanding.

Applicable Operational BMPs:

- Train employees in the careful application of paints, finishes, and coatings to reduce misuse and over spray. Use drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly clean and temporarily store collected debris daily.
- Do not conduct spraying, blasting, or sanding activities over open water or where wind may blow paint into water.
- Wipe up spills with rags and other absorbent materials immediately. Do not hose down the area to a storm sewer, receiving water, or conveyance ditch.
- On dock areas sweep rather than hose down debris. Collect any hose water generated and convey to appropriate treatment and disposal.
- Use a catch basin cover, filter sock, or other effective runoff control device if dust, grit, washwater, or other pollutants may escape the work area and enter a catch basin. The containment device(s) must be in place at the beginning of the workday. Collect contaminated runoff and solids and properly dispose of such wastes before removing the containment device(s) at the end of the workday.
- Use a ground cloth, pail, drum, drip pan, tarpaulin, or other protective device for activities such as outdoor paint mixing and tool cleaning, or where spills can contaminate stormwater.
- Properly dispose of all wastes and prevent all uncontrolled releases to the air, ground, or water.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers. Do not dump pollutants collected in portable containers into a stormwater drain.
- Clean brushes and tools covered with non-water-based paints, finishes, or other materials in a manner that allows collection of used solvents (e.g., paint thinner, turpentine, xylol) for recycling or proper disposal.
- Store toxic materials under cover (tarp, etc.) during precipitation events and when not in use to prevent contact with stormwater.

Applicable Structural Source Control BMPs:

Enclose and/or contain all work while using a spray gun or conducting sand blasting and in compliance with applicable air pollution control, OSHA, and WISHA requirements. Do not conduct outside spraying, grit blasting, or sanding activities during windy conditions that render containment ineffective.

Recommended Operational BMPs:

- Recycle paint, paint thinner, solvents, pressure washwater, and any other recyclable materials.
- Use efficient spray equipment such as electrostatic, air-atomized, high volume/low pressure, or gravity feed spray equipment.
- Purchase recycled paints, paint thinner, solvents, and other products, if feasible.

S422 BMPs for Railroad Yards

Description of Pollutant Sources:

Pollutant sources can include:

- Drips/leaks of vehicle fluids onto the railroad bed
- Human waste disposal
- Litter
- Locomotive/railcar/equipment cleaning areas
- Fueling areas
- Outside material storage areas
- Erosion and loss of soil particles from the railroad bed
- Maintenance and repair activities at railroad terminals
- Switching and maintenance yards
- Herbicides used for vegetation management

Waste materials can include used oil, solvents, degreasers, antifreeze solutions, chromate and other anti-rust compounds, dyes, radiator flush, acids, brake fluids, soiled rags, oil filters, sulfuric acid and battery sludges, and machine chips with residual machining oil and toxic fluids/solids lost during transit. Potential pollutants include oil and grease, TSS, BOD, organics, pesticides, and metals.

Pollutant Control Approach: Apply good housekeeping and preventive maintenance practices to control leaks and spills of liquids in railroad yard areas.

Applicable Operational and Structural Source Control BMPs:

- Implement the applicable BMPs in this volume depending on the pollutant generating activities/sources at a railroad yard facility.
- Do not allow discharge to outside areas from toilets while a train is in transit. Use pump out facilities to service these units.
- Use drip pans at hose/pipe connections during liquid transfer and other leak-prone areas.
- When undergoing routine maintenance, discharge locomotive cooling systems only after the locomotive has stopped and at a location where the coolant can be collected, managed, and then disposed of properly.
- During maintenance, do not discard debris or waste liquids along the tracks or in railroad yards.

- Handle wastes generated from large-scale equipment cleaning, such as locomotive, track equipment, or axle cleaning operations, properly to avoid harming the environment and to comply with state and federal environmental regulations.
- Store any metal scrap generated from metal punching or other mechanical operations out of contact with stormwater. For larger metal scrap, see Applicable Treatment BMPs below.
- Do not dump, drain, or allow the discharge of any water-based coolant from multi-punch presses into storm drains.
- Place track mats under each rail/flange lubricator that is in service where track mats can be safely installed and maintained without danger to rolling stock or personnel.
- Select cost-effective rail/flange lubricant that provides safe and effective rail operation while considering adverse environmental impact. Consider both the chemical composition of the lubricant and the likelihood of transfer off of the rail during rain events.
- Inspect and replace track mats, as necessary. Routinely inspect all track mats for tears or saturation and replace as necessary.
- Install spill containment pans/trays or track mat at designated locomotive and railcar maintenance facilities and fixed fueling areas, to reduce environmental impacts from potential spills under locomotives and other track equipment. Direct spill containment pans/trays to an oil / water separator where feasible for treatment or collect spilled chemicals for proper disposal.
- During locomotive fueling operations use drip pans or secondary containment to capture any fuel or oil seepage.
- Install track mats at designated Engine Tie-Up and/or outdoor locomotive parking locations (e.g., service tracks) located in SWPP permitted areas where locomotives are unattended and idle for extended periods of time.
- Do not conduct heavy/major locomotive engine repairs on the rail line. Conduct heavy/major engine repairs at an established railroad maintenance facility.
- Store creosote-treated railroad ties in locations that reduce the potential to impact stormwater runoff.

Figure IV-5.16: Installed Railroad Track Mats

DEPARTMENT OF ECOLOGY
State of Washington

Installed Railroad Track Mats

Revised August 2017

Recommended Operational and Structural Source Control BMPs:

At each rail/flange lubricator that is in service use rain sensors to adjust the lubrication cycle accordingly to limit the amount of lubricant exposed to stormwater.

Applicable Treatment BMPs:

In areas subjected to leaks/spills of oils or other chemicals, convey stormwater to appropriate treatment such as a sanitary sewer, if approved by the appropriate sewer authority, or, to BMP T11.10: API (Baffle type) Separator, BMP T11.11: Coalescing Plate (CP) Separator, or other treatment, as approved by the local jurisdiction.

Recommended Treatment BMPs:

Store large metal scrap and materials that cannot be stored in covered areas because of their size, volume, and/or weight (for example rail and tie plates) in locations where stormwater runoff is managed, controlled, and directed to a Runoff Treatment BMP the meets the Enhanced Treatment Performance Goal.

S423 BMPs for Recyclers and Scrap Yards

Description of Pollutant Sources: Includes businesses that reclaim various materials for resale or for scrap, such as vehicles and vehicle/equipment parts, construction materials, metals, beverage containers, and papers.

Potential sources of pollutants include paper, plastic, metal scrap debris, engines, transmissions, radiators, batteries, and other materials contaminated or that contain fluids. Other pollutant sources include leachate from metal components, contaminated soil, and the erosion of soil. Activities that can generate pollutants include the transfer, dismantling, and crushing of vehicles and scrap metal; the transfer and removal of fluids; maintenance and cleaning of vehicles, parts, and equipment; and storage of fluids, parts for resale, solid wastes, scrap parts, and materials, equipment and vehicles that contain fluids; generally, in uncovered areas.

Potential pollutants typically found at vehicle recycle and scrap yards include oil and grease, ethylene and propylene glycol, PCBs, total suspended solids, BOD, heavy metals, and acidic pH.

Applicable BMPs:

- For facilities subject to Ecology's Industrial Stormwater General Permit refer to *Vehicle and Metal Recyclers: A Guide for Implementing the Industrial Stormwater General National Pollutant Discharge Elimination System Permit Requirements* (Ecology, 2011). Apply the BMPs in that guidance document to scrap material recycling facilities depending on the pollutant sources existing at those facilities.
- Check incoming scrap materials, vehicles, and equipment for potential fluid contents and batteries.
- Drain and transfer fluids from vehicles and other equipment only in a designated area with a waste collection system or over drip pans.
- Remove batteries and store on the ground in a leak proof container and under cover.

- Cover and raise any materials that may contaminate stormwater. A tarp and pallet are acceptable.
- Cover and contain stockpiles of any material that has the potential to contaminate stormwater runoff.
- All containers used to store fluids must comply with secondary containment requirements. Storage of flammable and combustible materials must comply with the appropriate Fire Codes.

Required Routine Maintenance:

- Inspect storage areas regularly and promptly clean up any leaks, spills, or contamination.
- Sweep scrap storage areas as needed. Do not hose down anything to a storm drain.
- Keep spill cleanup materials in a location known to all. Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

Recommended BMPs:

- Install catch basin inserts to collect excess sediment and debris if necessary. Inspect and maintain catch basin inserts to ensure they are working correctly.
- Conduct automobile/vehicle metal-shredding inside enclosed buildings with HEPA air filtration systems to prevent the fugitive release of heavy metals and other potentially hazardous materials into the air.

S424 BMPs for Roof / Building Drains at Manufacturing and Commercial Buildings

Description of Pollutant Sources: Stormwater runoff from roofs and sides of manufacturing and commercial buildings can be sources of pollutants caused by leaching of roofing materials, paints, caulking, building vents, and other air emission sources. Research has identified vapors and entrained liquid and solid droplets/particles as potential pollutants in roof/building runoff. Metals, solvents, acidic/alkaline pH, BOD, PCBs, and organics are some of the pollutant constituents identified.

Ecology has performed a study on zinc in industrial stormwater. The study is presented in *Suggested Practices to Reduce Zinc Concentrations in Industrial Stormwater Discharges* (Ecology, 2008). The user should refer to this document for more details on addressing zinc in stormwater.

Pollutant Control Approach: Evaluate the potential sources of stormwater pollutants and apply source control BMPs where feasible.

Applicable Operational Source Control BMPs:

- If leachates and/or emissions from buildings are suspected sources of stormwater pollutants, then sample and analyze the stormwater draining from the building.
- Sweep the area routinely to remove any residual pollutants.
- If a roof/building stormwater pollutant source is identified, implement appropriate source control measures such as air pollution control equipment, selection of materials, operational changes, material recycle, process changes, etc.

Applicable Structural Source Control BMPs:

- Paint/coat the galvanized surfaces as described in *Suggested Practices to Reduce Zinc Concentrations in Industrial Stormwater Discharges* (Ecology, 2008).

Applicable Treatment BMPs:

Treat runoff from roofs to the appropriate level. The facility may use Enhanced Treatment BMPs as described in III-1.2 Choosing Your Runoff Treatment BMPs. Some facilities regulated by the Industrial Stormwater General Permit, or local jurisdiction, may have requirements than cannot be achieved with Enhanced Treatment BMPs. In these cases, additional treatment measures may be required. A treatment method for meeting stringent requirements such as Chitosan-Enhanced Sand Filtration may be appropriate.

S432 BMPs for Wood Treatment Areas

Description of Pollutant Sources: Wood treatment includes both anti-staining and wood preserving using pressure processes or by dipping or spraying. Wood preservatives include creosote, creosote/coal tar, pentachlorophenol, copper naphthenate, arsenic trioxide, malathion, or inorganic arsenicals such as chromated copper arsenate, acid copper chromate, chromate zinc chloride, and fluor-chrome-arsenate-phenol. Anti-staining chemical additives include iodo-prophenyl-butyl carbamate, dimethyl sulfoxide, didecyl dimethyl ammonium chloride, sodium azide, 8 quinolinol; copper (II) chelate, sodium ortho-phenylphenate, 2 (thiocyanomethylthio)-benzothiazole (TCMTB) and methylene bis- (thiocyanate), and zinc naphthenate.

Pollutant sources include drips of condensate or preservative after pressurized treatment; product washwater (in the treatment or storage areas), spills and leaks from process equipment and preservative tanks, fugitive emissions from vapors in the process, blowouts and emergency pressure releases, and kick-back from lumber (phenomenon where preservative leaks as it returns to normal pressure). Potential pollutants typically include the wood treating chemicals, BOD, suspended solids, oil and grease, benzene, toluene, ethylbenzene, phenol, chlorophenols, nitrophenols, heavy metals, and PAH depending on the chemical additive used.

Pollutant Control Approach: Cover and contain all wood treating facilities and prevent all leaching of and stormwater contamination by wood treating chemicals. Wood treating facilities may be covered by the Industrial Stormwater General Permit or by an individual permit. Individual permits covering wood treatment areas include applicable source control BMPs or require the development of BMPs or a SWPPP. Facilities covered under the Industrial Stormwater General Permit must prepare and implement a SWPPP. When developing a SWPPP or BMPs, wood treating facilities should include the applicable operational and structural source control BMPs listed below.

Applicable Operational BMPs:

- Use dedicated equipment for treatment activities to prevent the tracking of treatment chemicals to other areas on the site.
- Eliminate non-process traffic on the drip pad. Scrub down non-dedicated lift trucks on the drip pad.

- Immediately remove, contain, and properly dispose of soils with visible surface contamination (green soil) to prevent the spread of chemicals to ground water and/or surface water via stormwater runoff.
- If incidental drippage is discovered in the storage yard, relocate the wood to a concrete chemical containment structure until it is drip free.

Recommended Operational BMP:

Consider using preservative chemicals that do not adversely affect receiving surface water and ground water.

Applicable Structural Source Control BMPs:

- Cover and/or enclose, and contain with impervious surfaces, all wood treatment equipment and drip pads. Slope and drain areas around dip tanks, spray booths, retorts, and any other process equipment in a manner that allows return of treatment chemicals to the wood treatment process.
- Cover storage areas for freshly treated wood to prevent contact of treated wood products with stormwater. Segregate clean stormwater from process water. Convey all process water to an approved treatment system.
- Seal any holes or cracks in the asphalt areas that are subject to wood treatment chemical contamination.
- Elevate stored and/or treated wood products to prevent contact with stormwater run-on and runoff
- Place dipped lumber over the dip tank, or on an inclined ramp for a minimum of 30 minutes to allow excess chemical to drip back to the dip tank.
- Freshly treated lumber from dip tanks or retorts must be placed on a containment area until drippage has ceased prior to placement in outside storage areas.

S433 BMPs for Pools, Spas, Hot Tubs, and Fountains

Description of Pollutant Sources: This section includes BMPs for pools, spas, hot tubs, and fountains used for recreational and/or decorative purposes that may use chemicals and/or be heated. Industrial Stormwater Permittees that use pools, spas, hot tubs, and fountains as part of an industrial process should refer to their Industrial Stormwater Permit.

Discharge from pools, spas, hot tubs, and fountains can degrade ambient water quality. The waters from these sources typically contain bacteria that contaminate the receiving waters. Chemicals lethal to aquatic life such as chlorine, bromine and algaecides can be found in pools, spas, hot tubs, and fountains. These waters may be at an elevated temperature and can have negative effects on receiving waters and to aquatic life. Diatomaceous earth backwash from swimming pool filters can clog gills and suffocate fish.

Routine maintenance activities generate a variety of wastes. Chlorinated water, backwash residues, algaecides, and acid washes are a few examples. Direct disposal of these waters to drainage systems and waters of the State is not permitted without prior treatment and approval.

The quality of any discharge to the ground after proper treatment must comply with Ecology's Ground Water Quality Standards, *Chapter 173-200 WAC*.

The Washington State Department of Health and local health authorities regulate Water Recreation facilities which include pools, spas, and hot tubs. Owners and operators of those facilities must comply with those regulations, policies and procedures. Following the guidelines here does not exempt or supersede any requirements of the regulatory authorities.

Pollutant Control Approach: Many manufacturers do not recommend draining pools, spas, hot tubs or fountains; refer to the facility's operation and maintenance manual. If the water feature must be drained, convey discharges (within hoses or pipes) to a sanitary sewer if approved by the local sewer authority or to a storm sewer following the conditions outlined below. Do not discharge to a septic system, since it may cause the system to fail. No discharge to the ground or to surface water should occur, unless permitted by the proper regulatory authority.

Applicable Operational BMPs:

- Clean the pool, spa, hot tub, or fountain regularly. Maintain proper chlorine levels and maintain water filtration and circulation. Doing so will limit the need to drain the facility.
- Manage pH and water hardness to reduce copper pipe corrosion that can stain the facility and pollute receiving waters.
- Before using copper algaecides, try less toxic alternatives. Only use copper algaecides if other alternatives do not work. Ask a maintenance service or pool chemical supplier for help resolving persistent algae problems without using copper algaecides.
- Develop, implement, and regularly update a facility maintenance plan that follows all discharge requirements.
- Dispose of unwanted chemicals properly. Many of them are hazardous wastes when discarded.
- Discharge waters originating from a pool, spa, hot tub, or fountain to a sanitary sewer, if approved by the local sewer authority, local health authority, or both. Do not discharge waters containing copper-based algaecides to storm sewer systems.
- Do not discharge water directly from a pool, spa, hot tub, fountain, process wastes, or wastewaters into storm drains except if the discharge water is:
    - Dechlorinated/debrominated to 0.1 ppm or less. Some guidance on dechlorination is provided in the Washington State Department of Health's *Water System Design Manual* (WSDOH, 2009). The *Water System Design Manual* (WSDOH, 2009) further references *C651-99: AWWA Standard for Disinfecting Water Mains* (AWWA, 1999) and *C652-02: AWWA Standard for Disinfection of Water-Storage Facilities* (AWWA, 2002) for more details. Contact a pool chemical supplier to obtain the neutralizing chemicals needed.
    - Free from sodium chloride.
    - pH-adjusted.
    - Reoxygenated if necessary.
    - Free of any coloration, dirt, suds, or algae.
    - Free of any filter media.
    - Free of acid cleaning wastes.
    - At a temperature that will prevent an increase in temperature in the receiving water. Cool heated water prior to discharge.

    - Released at a rate that can be accommodated by the receiving body (i.e., can infiltrate or be safely conveyed).
- Swimming pool cleaning wastewater and filter backwash shall not be discharged to the storm sewer.
- Bag diatomaceous earth (pool filtering agent) and dispose at a landfill.

Applicable Structural Source Control BMPs:

- Ensure that the pool, spa, hot tub, or fountain system is free of leaks and operates within the design parameters.
- Do not provide any permanent links to drainage systems. All connections should be visible and carefully controlled.
- If the dichlorination or cooling process selected requires the water to be stored for a time, it should be contained within the pool or appropriate temporary storage container.

S436 BMPs for Color Events

Description of Pollutant Sources: Color events are charity, religious, or commercial events that involve the use of powdered (typically cornstarch based) and/or liquid dyes. Because they typically occur outside, there is a high likelihood of the color material entering drainage systems and surface water unless measures are taken to prevent these illicit discharges from occurring.

“Biodegradable” and “non–toxic” do NOT mean that a substance can go into storm drains or water bodies. The dye material can harm aquatic organisms by altering water quality and chemistry. State and Federal environmental laws require local jurisdictions to prohibit non-stormwater discharges to storm drains. Dye material and any wash water are prohibited discharges.

Pollutant Control Approach: Plan for the event. Control the application areas for the powder or liquid dyes. Block off storm drain inlets prior to the event. Clean up the areas immediately after the event.

Figure IV-5.17: Powdered Dyes at Color Events

Color events typically involve the use of powdered dyes such as those pictured.

DEPARTMENT OF ECOLOGY
State of Washington

Powdered Dyes at Color Events

Revised June 2017

Applicable Operational BMPs:

Pre-Event

- Create a map of your event that includes the following:
    - Event route.
    - Nearby streams, lakes, and ponds.
    - Start and finish areas.
    - Color application stations / areas.
    - Storm drain inlets and open stormwater system features (e.g., ditches, swales, bioretention, rain gardens) at the color application, start and finish areas.
- Create a Pollution Plan that details:
    - Measures taken to ensure that NO dye material, either during or after the event, will enter the drainage system.
    - How all dye material will be removed and disposed of.
    - What will happen in the event of rain (including addressing localized flooding, runoff, and collection of the stormwater).
    - Emergency numbers for the local city or county in case dye material does enter the storm drain or water body.
- Use handheld brooms to complete the initial cleanup of paved surfaces. Follow with use of a vacuum sweeper truck on roads.
- Contract with a commercial street sweeping firm to clean paved surfaces. Have a storm drain cleaning contractor on–call for discharges to storm drains or emergency clean–up if necessary.
- Ensure that the commercial street sweeping firm has a plan in place for the proper disposal of sweepings from the event and associated air filters.
- Ensure that all clean-up will be completed prior to the next forecasted rainfall, or no later than 24-hours after the race event, and that the contractor will have enough equipment and staff on hand for the clean-up.
- Request a copy of the dye product's SDS (Safety Data Sheet) from the manufacturer or supplier. Review the SDS for potential safety and environmental hazards.
- Comply with local jurisdiction event permit requirements that contain stormwater pollution prevention BMPs. If no local event permit is required, provide to the local jurisdiction in charge of stormwater drainage and/or surface water management, in plenty of time (two weeks or more) prior to the event:
    - Copies of the map
    - Pollution prevention plan
    - Commercial cleaning contract
    - Dye SDSs
    - Names and contact information of the event officials for both during and after the event.

Preventing Runoff from Entering Drainage Systems and Water Bodies

- Protect storm drains by using berms, covering the drains, and using catch basin covers.

- Use care when removing berms, covers, and tarps to ensure no dye enters the storm drains.
- Prohibit participants from throwing dye within 100 feet of any stream or other surface waterbody.
- Prohibit participants from throwing dye within 100 feet of any open stormwater feature (e.g., ditch, swale, bioretention, rain garden, detention pond)
- Set up color stations at least 100 feet away from any surface water or open stormwater feature.
- The route, start, finish, and color application stations must be at least 100' away from any permeable pavement or the permeable pavement must be completely covered.
- If the event will be held on a small, contained area, cordon off the area and place enough covers on the ground to cover the entire site. If possible, contain the color application to grassy areas where ground covers are unnecessary.

Event Clean-Up

- Dry off tarps and stained wet pavement with towels or absorbent pads.
- Use brooms or street sweepers to clean up paved areas. The fineness of the material may require sweepers with dust control systems.
- Do not use blowers to move dye material.
- Do not use hoses or pressure washers to rinse excess dye off of tarps, sidewalks or paved areas. If it becomes necessary to use water to clean surfaces, all the water must be collected and disposed of to the sanitary sewer system, with approval from the local sewer agency.
- Call the local spill response hotline immediately (24/7) if any colored water enters a storm drain or water body.
- Dispose of the collected sweeping materials, cleaning materials, and air filters appropriately.
- All litter and debris must be picked up and properly disposed of.
- All clean-up must be done within 24-hours of the race event.

S438 BMPs for Construction Demolition

Description of Pollutant Sources: This activity applies to removal of existing buildings and other structures by controlled explosions, wrecking balls, or manual methods, and subsequent clearing of the rubble. The loose debris may contaminate stormwater.

Pollutants of concern include toxic organic compounds, hazardous wastes, high pH, heavy metals, and suspended solids. Waste from concrete sawing is of particular concern due to its effect on aquatic organisms and because it is extremely hard to settle out.

Pollutant Control Approach: Do not expose hazardous materials to stormwater. Regularly clean up debris that can contaminate stormwater. Protect the drainage system from dirty runoff and loose particles. Sweep paved surfaces daily. Educate employees about the need to control site activities.

Applicable Operational BMPs:

The following BMPs or equivalent measures are required of all businesses and public agencies engaged in building demolition:

- Identify, remove, and properly dispose of hazardous substances from the building before beginning construction demolition activities that could expose them to stormwater. Such substances could include PCBs, asbestos, lead paint, mercury switches, and electronic waste.
- Educate employees about the need to control site activities to prevent stormwater pollution, and also train them in spill cleanup procedures.
- Keep debris containers, dumpsters, and debris piles covered.
- Place storm drain covers, or a similarly effective containment device, on all nearby drains to prevent dirty runoff and loose particles from entering the drainage system.
    - Place the covers (or devices) at the beginning of the workday.
    - Collect and properly dispose of the accumulated materials before removing the covers (or devices) at the end of the workday.
    - Use dikes, berms, or other methods to protect overland discharge paths from runoff if stormwater drains are not present.
- Sweep street gutters, sidewalks, driveways, and other paved surfaces in the immediate area of the demolition at the end of each workday. Collect and properly dispose of loose debris and garbage.
- Lightly spray water (such as from a hydrant or water truck) throughout the site to help control windblown fine materials such as soil, concrete dust, and paint chips. Control the amount of dust control water so that runoff from the site does not occur, yet dust control is achieved. Do not use oils for dust control.
- Contact City of Olympia Community Planning and Development to obtain required permits.

Suggested Operational BMPs:

- Construct a screen to prevent stray building materials and dust from escaping the area during demolition. Size and orient the screen to capture wind-blown materials and contain them onsite.
- Schedule demolition to take place at a dry time of the year to prevent stormwater runoff from the demolition site.

S440 BMPs for Pet Waste

Description of Pollutant Sources: Pets and pet-care can generate pollutants from waste, animal washing, and cage or kennel cleaning. Pet waste that washes into lakes, streams or Puget Sound begins to decay, using up oxygen and releasing ammonia. Low oxygen levels and ammonia combined with warm water can kill fish. Pet waste also contains nutrients that encourage weed and algae growth, and contribute to low oxygen and high pH in waters we use for swimming, boating and fishing. Most importantly, pet waste can carry viruses and bacteria that could cause disease and lead to beach or shellfish harvesting closures.

Pollutant Control Approach: Use a plastic bag or pooper scooper to clean up after pets. Properly dispose of pet wasteby placing it in the trash.

Recommended Operational BMPs for Pet Owners

- Regularly pick up and dispose of pet waste deposited on walks and at home.
- Put pet waste in a securely closed bag and deposit it in the trash. Do not place pet waste in yard waste containers because pet waste may carry diseases, and composting may not kill disease-causing organisms.
- Do not compost or use pet waste as fertilizer. Harmful bacteria, worms, and parasites that can transmit disease can live in the soil for years even after the solid portion of the pet waste has dissolved.
- Do not dispose of unused pet pharmaceuticals in a storm drain, in a toilet, or down a sink. Check with your local refuse collector for proper disposal locations of pet medications.
- When cleaning out cages and kennels, dispose of wash water down the toilet or a mop sink. Otherwise, wash directly over lawn areas or make sure the wash water drains to a vegetated area.
- Bathe pets indoors or in a manner that wash water won't be discharged to storm drains, ditches, or surface waters of the state.

Recommended Operational BMPs for Recreation Areas and Multi-Family Properties

- Post signs at recreation areas and multi-family properties (that allow pets) reminding residents and visitors to pick up after their pets.
- Carefully consider the placement of pet waste stations at recreation sites and near multi-family properties that allow pets. Choose locations convenient for dog walkers to pick up a bag at the start of their walk and locations for them to dispose of it at mid-walk or at the end of their walk.
- Check pet waste stations on a regular basis to keep pet waste bags stocked and disposal stations empty. Consider signage to keep regular trash out of pet waste disposal stations to avoid filling them too quickly. Make sure pet waste disposal stations have a cover to keep out water.
- At multi-family properties with roof-top dog runs, ensure that stormwater from the dog run is not discharged to the stormwater system. Check with the local jurisdiction regarding roof-top dog run connections to sanitary sewer.

Figure IV-5.18: Example of a Pet Waste Station

S442 BMPs for Labeling Storm Drain Inlets On Your Property

Description of Pollutant Sources: Waste materials dumped into storm drain inlets can have severe impacts on receiving waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Pollutant Control Approach: The stencil, affixed sign, or metal grate contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain

messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Applicable Operational BMPs:

- Label storm drain inlets in residential, commercial, industrial areas, and any other areas where contributions or dumping to storm drains is likely.
- Stencil or apply storm drain markers adjacent to storm drain inlets to help prevent the improper disposal of pollutants. Or use a storm drain grate stamped with warnings against polluting.
- Place the marker in clear sight facing toward anyone approaching the inlet from either side.
- Use a brief statement and / or graphical icons to discourage illegal dumping. Examples include:
    - "No Dumping – Drains to Stream"
    - "No Pollutants – Drains to Puget Sound"
    - "Dump No Waste – Drains to Lake"
    - "No Dumping – Puget Sound Starts Here"
- Check with the City of Olympia to find out if they have approved specific signage and / or storm drain message placards for use. Consult City of Olympia stormwater staff to determine specific requirements for placard types and methods of application.
- Maintain the legibility of markers and signs. Signage on top of curbs tends to weather and fade. Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.
- When painting stencils or installing markers, temporarily block the storm drain inlet so that no pollutants are discharged from the labeling activities.

Optional Operational BMPs:

Use a stencil in addition to a storm drain marker or grate to increase visibility of the message.

Reference for this BMP: (CASQA, 2003)

Figure IV-5.19: Storm Drain Inlet Labels

DEPARTMENT OF ECOLOGY
State of Washington

Storm Drain Inlet Labels

Revised October 2017

S443 BMPs for Fertilizer Application

Description of Pollutant Sources: Poor application of fertilizers can cause appreciable stormwater contamination. Fertilizers can leach phosphorous, nitrogen, and coliform bacteria. Fertilizers can contribute to algae blooms, increase nutrient concentrations, and deplete oxygen in receiving waters.

Pollutant Control Approach: Minimize the amount of fertilizer necessary to maintain vegetation. Control the application of fertilizer to prevent the discharge of stormwater pollution.

Applicable Operational BMPs:

- Apply the minimum amount of slow-release fertilizer necessary to achieve successful plant establishment.
- Do not fertilize when the soil is dry or during a drought.
- Never apply fertilizers if it is raining or about to rain.
- Do not apply fertilizers within three days prior to predicted rainfall. The longer the period between fertilizer application and either rainfall or irrigation, the less fertilizer runoff occurs.
- Determine the proper fertilizer application for the types of soil and vegetation involved.
- Follow manufacturers' recommendations and label directions.
- Train employees on the proper use and application of fertilizers.
- Keep fertilizer granules off impervious surfaces. Clean up any spills immediately. Do not hose down to a storm drain, conveyance ditch, or water body.
- If possible, do not fertilize areas within 100 feet of water bodies including wetlands, ponds, and streams.
- Avoid fertilizer applications in stormwater ditches, stormwater facilities, and drainage systems.
- In areas that drain to sensitive water bodies, apply no fertilizer at commercial and industrial facilities, to grass swales, filter strips, or buffer areas unless approved by the local jurisdiction.
- Use slow release fertilizers such as methylene urea, isobutylidene, or resin coated fertilizers when appropriate, generally in the spring. Use of slow release fertilizers is especially important in areas with sandy or gravelly soils.
- Apply fertilizers in amounts appropriate for the target vegetation and at the time of year that minimizes losses to surface and ground waters.
- Time the fertilizer application to periods of maximum plant uptake. Ecology generally recommends application in the fall and spring, although Washington State University turf specialists recommend four fertilizer applications per year.
- Avoid weed and feed products that contain a combination of fertilizer and selective herbicides.
- Per Olympia Municipal Code Chapter 18.32.225, within wellhead protection areas, only slow release fertilizers shall be applied for the life of the development at a maximum amount of 4 pounds of nitrate as Nitrogen annually and no more than 1 pound per application for every 1,000 square feet of turf grass. Only fertilizer formulas with a minimum of 50% water insoluble form of nitrogen are permitted for use. Approved water insoluble forms of nitrogen include sulfur and/or polymer coated fertilizers, Isobutylidene Diurea (IBDU), Methylene Urea and Ureaform, and organic fertilizers registered with Washington Department of Agriculture.
- Do not use turf fertilizers containing phosphorous unless a soil sample analysis taken within the past 36 months indicates the soil of the established lawn is deficient in phosphorus. For more

information about restrictions on turf fertilizers containing phosphorus, see the following website:

- *https://agr.wa.gov/departments/pesticides-and-fertilizers/fertilizers/fertilizers-containing-phosphorus*

Recommended Operational BMPs:

Test soils to determine the correct fertilizer and lime application rates.

- Evaluation of soil nutrient levels and pH through regular testing ensures the best possible efficiency and economy of fertilization.
- Fertilization needs vary by site depending on plant, soil, and climatic conditions.
- Choose organic fertilizers when possible.
- For details on soils testing, contact the local Conservation District, a soils testing professional, or a Washington State University Extension office.

S446 BMPs for Well, Utility, Directional and Geotechnical Drilling

Description of Pollutant Sources: This activity applies to drilling water wells and utilities, environmental protection and monitoring wells, and geotechnical borings that use machinery in the drilling. It does not apply to the use of devices such as hand augers, or for large structural drilling such as drilled shafts.

Drilling activities can expose soil and contaminated soil. These activities may cause the discharge of stormwater contaminated with sediments and other contaminates. This risk increases when drilling in areas with contaminated soils.

Pollutant Control Approach: Reduce sediment runoff from drilling operations.

Applicable Operational BMPs:

- When drilling in areas of known or suspected soil contamination, test and characterize soil cuttings and accumulated sediment to determine proper management and disposal methods. If applicable, generator knowledge may be used to characterize the soil cuttings and accumulated sediment.
- Obtain permits for drilling activities, and for clearing and grading the access routes and the work site.
- Protect environmentally sensitive areas (streams, wetlands, floodplains, floodways, erosion hazards, and landslide hazards) within the area of influence of the work site.
- Mitigate potential impacts to surrounding areas and/or the drainage system.
- For horizontal directional drilling, take measures to capture and contain drilling fluids and slurry.
- Equip the driller to quickly respond to unusual conditions that may arise.
- Locate and prepare access roadways to minimize the amount of excavation and the potential for erosion.
- Contain accumulated uncontaminated water and sediment on site and pump into a storage tank or direct through a geotextile filtration system (or equivalent system) before discharging to the surrounding ground surface. Contaminants may include, but are not limited to, hydraulic fluids, contaminants in the soil and/or groundwater, polymers, and other drilling fluid additives.

- Keep all sediment-laden water out of storm drains and surface waters. If sediment-laden water does escape from the immediate drilling location, block flow to any nearby waterways or catch basins using fabric, inlet protections, sandbags, erosion fences, or other similar methods. Immediately notify Ecology and the local jurisdiction if sediment-laden water impacts the storm sewer system or surface waters.
- Divert any concentrated flows of water into the site using sandbags or check dams up-slope from the site.
- Dispose of soil cuttings and accumulated sediment appropriately. If cuttings or other soils disturbed in the drilling process are to be temporarily stockpiled on site, they must be covered and surrounded by a berm or filter device. See *S429 BMPs for Storage or Transfer (Outside) of Solid Raw Materials, Byproducts, or Finished Products*.
- Stabilize exposed soils at the end of the job, using mulch or other erosion control measures. See *S425 BMPs for Soil Erosion and Sediment Control at Industrial Sites*.
- Contain spent drilling slurry on site and allow it to dewater, or haul to an appropriate, approved disposal site.
- Restore disturbed areas with mulch (see BMP C121: Mulching) and seeding or hydroseeding (see BMP C120: Temporary and Permanent Seeding).

S447 BMPs for Roof Vents

Description of Pollutant Sources: This activity applies to processes that vent emissions to the roof and/or the accumulation of pollutants on roofs. Processes of special concern are stone cutting, metal grinding, spray painting, paint stripping, galvanizing and electroplating. Pollutants from these processes may build up on roofs and may pollute stormwater roof runoff.

Pollutant Control Approach: Evaluate the potential sources of stormwater pollutants and apply source control BMPs where feasible.

Applicable BMPs:

- Identify processes that are vented and may contribute pollutants to the roof. Pollutants of concern include and are not limited to:
    - Metal dust
    - Grease from food preparation
    - Solvents
    - Hydrocarbons
    - Fines
    - Stone dust
- Look for chemical deposition around vents, pipes, and other surfaces.
- Install and maintain appropriate source control measures such as air pollution control equipment (filters, scrubbers, and other treatment). (City of San José Environmental Services, 2004)
    - Check that your scrubber solution is appropriate for the chemistry of the fumes.
    - Install vent covers and drip pans where there are none.

    - Prevent leaks in pipefittings and containment vessels with routine maintenance.
- Consider instituting operational or process changes to reduce pollution.
- If proper installation and maintenance of air pollution control equipment does not prevent pollutant fallout on your roof, additional treatment of the roof runoff may be necessary.
    - Install/provide appropriate devices for roof runoff before it is discharged off site. This may include approved water quality treatment BMPs or structural stormwater treatment systems.
- Maintain air filters and pollution control equipment on a regular basis to ensure they are working properly. (The smell of odors from outside the building indicates that the pollution control equipment may need maintenance or evaluation.)
- When cleaning accumulated emissions from roof tops, collect the washwater and loose materials using a sump pump, wet vacuum or similar device. Discharge the collected runoff to the sanitary sewer after approval by the local sewer authority or have a waste disposal company remove it.

S451 BMPs for Building, Repair, Remodeling, Painting, and Construction

Description of Pollutant Sources: This activity refers to:

- The construction of buildings and other structures.
- Remodeling of existing buildings and houses.
- General exterior building repair work.

Pollutants of concern include toxic hydrocarbons, hazardous wastes, toxic organics, suspended solids, heavy metals, pH, oils, and greases.

Pollutant Control Approach: Educate employees about the need to control site activities. Control leaks, spills, and loose material. Utilize good housekeeping practices. Regularly clean up debris that can contaminate stormwater. Protect the drainage system from dirty runoff and loose particles.

Applicable Operational BMPs:

- Identify, remove, and properly dispose of hazardous substances from the building before beginning repairing or remodeling activities that could expose them to stormwater. Such substances could include PCBs, asbestos, lead paint, mercury switches, and electronic waste.
- Educate employees about the need to control site activities to prevent stormwater pollution, and also train them in spill cleanup procedures.
- At all times, have available at the work site spill cleanup materials appropriate to the chemicals used on site.
- Clean up the work site at the end of each workday. Put away materials (such as solvents) indoors or cover and secure them, so that unauthorized personnal will not have access to them.
- Sweep the area daily to collect loose litter, paint chips, grit, and dirt.
- Do not dump any substance on pavement, on the ground, in the storm drain, or toward the storm drain, regardless of its content, unless it is clean water only.

- Place a drop cloth, where space and access permits, before beginning wood treating activities. Use drip pans in areas where drips are likely to occur if the area cannot be protected with a drop cloth.
- Use ground or drop cloths underneath scraping and sandblasting work. Use ground cloths, buckets, or tubs anywhere that work materials are laid down.
- Clean paint brushes and other tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can subsequently be dumped into a sanitary sewer drain.
- Clean brushes and tools covered with non-water-based finishes or other materials in a manner that enables collection of used solvents for recycling or proper disposal. Do not discharge non-water-based finishes or paints or used solvents into the sanitary sewer, or any other drain.
- Use storm drain covers, or similarly effective devices, to prevent dust, grit, washwater, or other pollutants from escaping the work area. Place the cover or containment device over the storm drain at the beginning of the workday. Collect and properly dispose of accumulated dirty runoff and solids before removing the cover or device at the end of each workday.
- Refer to *S431 BMPs for Washing and Steam Cleaning Vehicles / Equipment / Building Structures* for best management practices associated with power washing buildings.

Suggested Operational BMPs:

- Lightly spray water on the work site to control dust and grit that could blow away. Do not use oils for dust control. Never spray to the point of water runoff from the site.
- Clean tools over a ground cloth or within a containment device such as a tub.
- Consider using filtered vacuuming to collect waste that may be hard to sweep, such as dust on a drop cloth.
- If conducting work in wet weather conditions, consider setting up temporary cover when scraping or pressure-washing lead-based paint.

S452 BMPs for Goose Waste

Description of Pollutant Sources: Goose waste deposited near water or in water can contribute nutrients and algae growth. Goose feces may contain pathogens and contribute to the spread of diseases. Swimmer's itch (schistosome or cercarial dermatitis) is caused by a parasite that can be spread by goose droppings, but does not mature or reproduce in humans.

Pollutant Control Approach: To help decrease geese pollution to water sources, remove waste periodically and use deterrent management practices.

Applicable Operational BMPs:

This BMP is for areas of chronic accumulation of goose waste that impact stormwater systems.

- If possible, pick up goose waste using shovels, brooms, rakes, power sweepers, and trash cans. Properly dispose of goose waste in the garbage.
- Do not blow, sweep, or wash goose waste into waterways or storm sewer systems.

- Regularly clean goose waste from areas of chronic deposition where deterrence measures are impractical.
- Do not feed wild geese or any other wild animals.
- In recreational areas post signs discouraging the feeding of geese and other wild animals.

Optional Operational BMPs:

- Change the habitat from goose friendly to goose resistant. Reduce lawn areas and increase the height of shoreline vegetation (tall grass, shrubs); as geese are reluctant to walk through tall vegetation.
- Create a natural geese barrier. 20 to 100 feet of herbaceous vegetation at least 3 feet in height to discourage geese . A narrow, winding path through the plantings will allow for beach access, while preventing geese from having a direct line of sight through the planted area.
- Make bank slopes steeper than 4:1 to discourage geese by preventing a clear view of the bank top and potential predators Or separate the beach from the grass with a few steep steps, which makes the ascent too difficult for most geese.
- Narrow ponds to limit takeoff and landing opportunities.
- Where space is limited use one or two rows of shrub plantings combined with a fence. Fences can be made from woven wire, poultry netting, plastic netting, plastic snow fencing, monofilament line, or electrified wire. Fences should be at least 24 inches tall (3 feet may be better), firmly constructed, and installed to prevent the geese from walking around the ends. Lower openings should be no larger than 4 inches from the ground to prevent goslings from walking under or through the fence.
- Construct a grid of wire or line above the water's surface to prevent geese from flying into a pond that they have been accustomed to using. The grid should be one to two feet above the water surface but may be taller if humans need access to the area under the grid. There should be no more than five feet of space between grid lines. To prevent geese from walking under the grid install a perimeter fence. Regularly monitor the grid for holes, trapped wildlife, and sagging.
- Canada geese are protected under federal and state law and a hunting license and open season are required to hunt them. Where lethal control of Canada geese is necessary outside of hunting seasons, it should be carried out only after the above nonlethal control techniques have proven unsuccessful and only under permits issued by the U.S. Fish and Wildlife Service. Currently, the only agency permitted for lethal removal is the U.S. Department of Agriculture's Wildlife Services. Lethal control techniques include legal hunting, shooting out of season by permit, egg destruction by permit, and euthanasia of adults by government officials.
- Scare geese away when they are around. Geese often learn quickly to ignore scare devices that are not a real physical danger. Vary the use, timing, and location of tactics. Take advantage of geese being fearful of new objects. Examples of harassment and scare tactics:
    - **Dog patrols:** When directed by a handler, dogs are the method of choice for large open areas. Results are often immediate. After an aggressive initial use (several times a day for one or two weeks), geese get tired of being harassed and will use adjacent areas instead. A dog can be tethered to a long lead (which may require relocating the dog and tether frequently to cover more area), be allowed to chase and retrieve a decoy thrown over a large flock of geese or be periodically released to chase the birds (if this is not against leash laws).

- **Eyespot Balloons:** Large, helium-filled balloons with large eye-like images. Tether balloons on a 20 to 40 foot monofilament line attached to a stake or heavy object. Locate balloons where they will not tangle with trees or utility lines.
- **Flags and Streamers:** Simple flags from plastic mounted on tall poles or mylar tape to make 6-foot streamers attached to the top of 8 foot long poles. Flags and streamers work best in areas where there is steady wind.
- **Scarecrows:** Effective in areas where geese view humans as dangerous predators. For maximum effect, the arms and legs should move in the wind, use bright colors, and large eyes. Large, blow-up toy snakes are reported to work as a type of scarecrow.
- **Noisemakers:** Devices that make a loud bang such as propane cannons, blanks, and whistle bombs can scare geese. Making the noise as soon as geese arrive, and persistence are the keys to success when using these devices. Consult noise ordinances and other permitting authorities (such as the local police department) before using.
- **Lasers:** Relatively low-power, long-wavelength lasers provide an effective means of dispersing geese under low light conditions. The birds view the light as a physical object or predator coming toward them and generally fly away to escape. Never aim lasers in the direction of people, roads, or aircraft.

- Geese's favorite food is new shoots of grass. Low lying grass also allows easy access to the water for protection from predators. Let grass grow to six inches or taller. Stop fertilizing and watering the lawn to reduce the palatability of the lawn.
- Minimize open sight lines for geese to less than 30 feet.
- Plant shrubs or trees along ponds to limit takeoff and landing opportunities.

Refer to: *http://www.humanesociety.org/assets/pdfs/wild_neighbors/canada_goose_guide.pdf and https://wdfw.wa.gov/species-habitats/species/branta-canadensis* for additional information.

S111 BMPs for Concrete and Asphalt Mixing and Production at Stationary Sites

Description of Pollutant Sources: This activity applies to businesses and agencies that mix raw materials onsite to produce concrete or asphalt. It also applies to subsequent uses such as pouring concrete structures and making other concrete or asphalt products. Mobile concrete pouring and asphalt application are covered under Activity S438 in this section. Requirements for stockpiling of raw materials are covered under Activity S429 Storage or Transfer (Outside) of Solid Raw Materials, By-products or Finished Products.

Pollutants of concern include toxic hydrocarbons, toxic organic compounds, oils and greases, heavy metals, and pH.

Pollutant Control Approach: Cover and contain processes where possible and prevent stormwater run-on and contamination, where feasible.

Any facility categorized under SIC Code 2951 (asphalt paving mixtures and blocks) or SIC Code 3273 (ready-mix concrete) may need to comply with Ecology's sand and gravel general permit. Contact Ecology at (360) 407-6400 for additional information.

Required BMPs

The following BMPs or equivalent measures are required of all businesses and public agencies active in concrete and asphalt mixing and production:

- Eliminate all illicit connections to the stormwater drainage system.
- All process water from production, pouring, and equipment cleaning must be discharged to a dead-end sump, process water treatment system, or sanitary sewer (subject to approval by the LOTT Alliance Industrial Pretreatment Program at (360) 528-5700 or your local sewer service provider if outside of the LOTT service area), or recycled. Never wash fresh concrete or concrete mixer washout into streets, stormwater drainage systems, streams, or other water bodies.
- A BMP maintenance schedule must be established, and employees educated about the need to prevent stormwater contamination through the use and proper maintenance of BMPs.

Suggested BMPs

- The production and pouring area should be swept at the end of each workday to collect loose chunks of aggregate and raw materials for recycling or proper disposal.
- Sweep all driveways and gutters that show accumulation of materials to minimize the amount that could be carried offsite by rain and enter the stormwater drainage system.
- Asphalt plants should use an oil/water separator to treat stormwater runoff. See Volume V of this manual, Runoff Treatment BMPs, for more information.
- Production and pouring areas shall be protected from stormwater run-on.
- Use absorbent materials in and around storm drains and catch basins to filter out contaminants. See Volume V of this manual, Runoff Treatment BMPs, for more information.
- Pave the mixing, production, and pouring areas. A sump drain in these areas is probably not advisable due to potential clogging problems but could be used in a curing area. Sweep these areas to remove loose aggregate and recycle or dispose of properly.
- Use storm drain covers or similarly effective containment devices to prevent runoff from entering the stormwater drainage system. Accumulations of dirty runoff must be disposed of properly.

Contact the City of Olympia Storm and Surface Water Utility at (360) 753-8333 for information about water quality treatment BMPs for these types of operations.

The use of any treatment BMP must not result in the violation of groundwater or surface water quality standards.

S112 BMPs for Concrete Pouring, Concrete Cutting, and Asphalt Application at Temporary Sites

Description of Pollutant Sources: This activity applies to businesses and public agencies that apply asphalt or pour or cut concrete for building construction and remodeling, road construction, sidewalk, curb and gutter repairs and construction, sealing of driveways and roofs, and other applications. These activities are typically done on a temporary site-to-site basis where permanent BMP measures do not apply. Concrete pouring activities can severely alter the pH of receiving waters slurry from aggregate washing can harden in storm pipes, reducing capacity and creating flooding problems. Concrete cutting

uses water for cooling and the fine particulates suspended in the resulting slurry are particularly hard to treat.

Pollutants of concern include toxic hydrocarbons, toxic organic compounds, oils and greases, heavy metals, suspended solids, and pH.

Pollutant Control Approach: Train employees on proper procedures, sweep or shovel aggregate chunks, collect accumulated runoff and solids, and wash equipment in designated areas.

Required BMPs

The following BMPs or equivalent measures are required of all businesses and agencies doing concrete pouring and asphalt application at temporary sites:

- Employees must be educated on the pollution hazards of concrete and asphalt application and cutting.
- Loose aggregate chunks and dust must be swept or shoveled and collected (not hosed down a storm drain) for recycling or proper disposal at the end of each workday, especially at work sites such as streets, driveways, parking lots, sidewalks, curbs, and gutters where rain can readily pick up the loose material and carry it to the nearest stormwater conveyance. Small amounts of excess concrete, grout, and mortar can be disposed of in the trash.
- Storm drain covers or similarly effective containment devices must be placed over all nearby drains at the beginning of each day. Shovel or vacuum slurry and remove from the site. All accumulated runoff and solids must be collected and properly disposed of (see BMP S.2 for disposal options) at the end of each workday, or more often if necessary.
- Exposed aggregate washing (where the top layer of unhardened concrete is hosed or scraped off to leave a rough finish) must be done with a mechanism for containment and collection of the discarded concrete slurry (such as the storm drain covers mentioned above).
- Cleaning of concrete application and mixing equipment or concrete vehicles on the work site must be done in a designated area where the rinse water is controlled to prevent any runoff to surface water features. The rinse water must either be collected for proper disposal or disposed of on site, only where depth to groundwater and soil conditions will ensure that the water can percolate away, and the solids can be captured by the soil matrix and later covered with soil or recovered and disposed of or recycled. If soils are very porous (outwash sands and gravels) with shallow (<15-ft) depth to groundwater, the rinsate area shall be lined and rinsate collected for disposal at a wastewater treatment facility.

The use of any treatment BMP must not result in the violation of groundwater or surface water quality standards.

Suggested BMPs

- Avoid the activity when rain is occurring or expected.
- If possible, portable asphalt mixing equipment should be covered by an awning, a lean-to, or another simple structure to avoid contact with rain. See BMP S.4 for further details on cover structures.
- Recycle broken concrete and asphalt. Look under Recycling Services in the Yellow Pages of the phone book to find the recycler nearest you.

S113 BMPs for Manufacturing and Post-processing of Metal Products

Description of Pollutant Sources: This activity applies to businesses such as mills, foundries, and fabricators that manufacture or postprocess metal products. A variety of activities such as machining, grinding, soldering, cutting, welding, quenching, cooling, and rinsing may take place. These businesses may be required to obtain a NPDES permit from Ecology. ote: Painting, finishing and coating of metal products is covered under S440 Painting, Finishing, and Coating of Vehicles, Boats, Buildings, and Equipment.

Pollutants of concern include toxic organic compounds, heavy metals, oils and greases, pH, suspended solids, and chemical oxygen demand (COD).

Pollutant Control Approach: Cover and contain operations. Apply good housekeeping practices such as sweeping and avoid storage where metals are exposed to rain.

Required BMPs

The following BMPs or equivalent measures are required of all businesses engaged in metals manufacturing or postprocessing:

- Eliminate illicit connections to the stormwater drainage system.
- Process wastewater including contact cooling water, filter backwash, cooling tower blow down, and stormwater runoff from activity areas, must discharge to a sanitary sewer, holding tank, or process treatment system. Such systems require an Ecology NPDES permit for discharge to surface water or storm drain. Contact the LOTT Alliance Industrial Pretreatment Program at (360) 528-5700 or your local sewer service provider if outside the LOTT service area to obtain permits for discharge to the sewer.
- Employees must be educated in proper handling to control their work with metal products to minimize pollution.
- The activity area must be swept at the end of each workday to collect and dispose of metal fragments and product residues properly.

Suggested BMPs

- Limit the amount of water used in quenching and rinsing. Recycle used water where possible.
- Cover the activity area to prevent rain from contacting the process and reduce the amount of runoff that has to be detained or treated.
- Implement a program to track purchase and consumption of lubricants, solvents, and additives. Check with operating managers for an explanation if consumption increases. Recommend action if significant equipment leaks or spills are identified.
- Refer to the BMPs under *Transfer of Liquid Materials* and *Storage and Stockpiling Activities* and utilize those BMPs which are applicable for materials storage and maintenance activities in your shop.

S114 BMPs for Agricultural Crop Production

This activity applies to farming of crops on a commercial scale. Crop farming practices can cause a large variety of pollution problems in receiving waters. Many of these practices can be altered without adversely affecting the farmers' ability to produce the same crops.

One of the most effective BMPs for stormwater pollution prevention the farmer can pursue is education. Contact the Thurston County Conservation District at (360) 754-3588. They will help develop a farm plan that covers all aspects of the farming operation, with particular care and attention to soil conservation and water resource protection. Conservation tillage and many other measures can help save money. The agencies also have access to grants to pay for conservation plantings and stream corridor fencing.

Pollutants of Concern: Toxic organic compounds, oils, heavy metals, nutrients, Biochemical oxygen demand (BOD), suspended solids (e.g., sediments), fecal bacteria.

Crop farms should implement agricultural practices proven to limit erosion. Several farming techniques aimed at reducing erosion have been proven successful. Individual farms should implement the combination of the following BMPs that best suits conditions present:

Suggested BMPs

- Maintain ground cover. Cover bare areas with material such as mulch or green manure during times when land is not in production.
- Practice conservation tillage. Implement tillage or planting systems in which at least 30 percent of the soil surface is covered by plant residue after planting.
- Practice conservation cover. Establish and maintain perennial vegetation cover to protect soil and water resources on land retired from agricultural production.
- Utilize contour farming. Plow, prepare, plant and cultivate land on contours perpendicular to the slope of the land in a terrace-like fashion, so that runoff cannot proceed directly along a row but rather is impeded by rows in its path, thus allowing for more infiltration.
- Plant critical areas. Plant vegetation such as trees, shrubs, vines, grasses, and legumes on highly erodible or critical areas to stabilize the soil.
- Plant and maintain vegetated buffers and filter strips. Maintain a strip of permanent vegetation downslope of crop fields so that sediments and associated pollutants in surface water runoff can be filtered out. These filter strips are especially important along stream banks, shorelines, and drainage ditches. Contact the Thurston County Conservation District at (360) 754-3588 and the Natural Resources Conservation Service at (360) 704-7740 for more information. In some instances, these organizations may be able to provide plant materials for such work free or for a low cost.
- Practice conservation irrigation. Replace flood irrigation systems with sprinkler head or drip irrigation systems that use less water. These irrigation methods reduce the amount of crop field runoff and thereby reduce erosion and pollutant transport.

Some other suggested BMPs to consider for your farm include the following:

- Use an IPM plan and reduce reliance on pesticides. Information on integrated pest management is available from the Washington State University/Thurston County Cooperative Extension Service. BMP S.8 provides some details on integrated pest management and in

Appendix IV-F for an example. See Activity S411 for information on BMPs for pesticide and fertilizer use.

- If possible, fertilized crops should be planted as far as possible from surface drainages. This will help keep nutrients out of water bodies.
- Contact the Natural Resources Conservation Service (formerly the Soil Conservation Service) at (360) 704-7740 for information on developing specific fertilization schedules. Applying fertilizers at the right time and in the right quantity can help minimize pollution.
- If possible, crop cultivation should be avoided on steep slopes.

S115 BMPs for Storage and Treatment of Contaminated Soils

Description of Pollutant Sources: This activity applies to businesses and agencies that store and treat soils contaminated with toxic organic compounds, petroleum products, or heavy metals. Such contamination typically comes to light when an environmental audit is done, or old underground tanks are removed. The soils are usually excavated and taken off site for treatment via aeration and perhaps chemical stabilization. Stormwater runoff that comes in contact with contaminated soil can carry those contaminants along with loose dirt into receiving waters.

Pollutants of concern include toxic organic compounds, oils and greases, and heavy metals.

Pollutant Control Approach: The Thurston County Public Health and Social Services Department at (360) 786-5581 regulates and permits businesses treating contaminated soil. In addition, a permit from ORCAA is required if the treatment method for removing soil contaminants involves forcing air through, or extracting air from, the soil. Contact these agencies for additional information regarding the appropriate pollutant control approach.

Required BMPs

The BMPs included here are intended as a supplement to other toxics regulations. The following BMPs or equivalent measures are required of all businesses engaged in storage and treatment of contaminated soils:

- The storage area for contaminated soils must be enclosed indoors, covered, or contained by a curb, dike, or berm constructed around the material storage area. If the contaminated soils are covered, stormwater run-on protection must also be provided.
- Employees must be educated on methods to prevent contamination from leaving the site.
- Cleanup materials must be stocked near the storage area.
- Gutters, storm drains, catch basins, and other drainage system features on the site must be cleaned following the completion of site work, or at least once per year, whichever comes first. Sediments from such cleaning must be disposed of properly.

Suggested BMPs

- If feasible, the storage area should be swept weekly for collection of stray soil, which can be added back to the piles or properly disposed of.
- Implement one of the following treatment BMPs from Volume V in conjunction with a runoff containment plan:
    - Vegetated biofilter
    - Wet vault
    - Equivalent BMP (see Volume V).
- The use of any treatment BMP must not result in the violation of groundwater or surface water quality standards.

S117 BMPs for Logging

Description of Pollutant Sources: This activity covers logging activities that fall under the Washington State Forest Practices Act category of Class IV general forest practices. These are situations where timber harvesting is done in the process of converting forest lands into other land uses, such as home and business construction. Stormwater runoff from bare ground exposed during logging contains large amounts of dirt and other pollutants. This material can clog ditches and stream channels, thus reducing carrying capacity and increasing flooding, as well as smothering spawning beds for fish. Simply controlling runoff and not allowing it to leave the site will prevent these harmful effects. Clearing and grading activities are covered in detail in Volume II of this manual, Construction Stormwater Pollution Prevention.

Coverage under Ecology's construction stormwater general permit is required for construction sites that result in the disturbance of one acre or more of land. Compliance with the Construction Stormwater Pollution Prevention requirements in Ecology's manual is required, as applicable. Virtually all logging operations will require a permit from the Washington State Department of Natural Resources (WDNR). Sensitive/critical areas and wetlands ordinances for the City of Olympia also contain requirements for logging activities in the vicinity of water bodies.

Pollutants of concern include suspended solids, oils and greases, biochemical oxygen demand (BOD), nutrients, toxic organic compounds, and heavy metals.

Pollutant Control Approach: Maintain required buffers adjacent to critical areas, including streams and wetlands. Keep sediments out of water bodies and off paved areas.

Required BMPs

- Vegetation along stream corridors, and adjacent to other water bodies and wetlands, must be preserved. Maintenance of a vegetated buffer enables filtration of most of the pollutants of concern for this activity. The above-mentioned ordinances contain specific requirements for buffer setbacks.
- Logging access roads must have a crushed rock or spall apron construction entrance where they join the pavement to prevent sediments from being tracked onto the pavement.
- On-site fueling and maintenance operations must follow the required BMPs as outlined in S419 Mobile Fueling; S414 Engine Repair and Maintenance.

Suggested BMPs

- Erosion potential can be reduced by avoiding logging on steep slopes.
- If access roads are constructed for logging, they should be provided with drainage ditches that divert runoff into vegetated areas or stormwater treatment systems.
- Plant vegetated buffers in areas where they are already lost downslope of proposed logging areas, with sufficient lead time to allow for effective growth.

S118 BMPS for Mining and Quarrying of Sand, Gravel, Rock, Minerals, Peat, Clay, and Other Materials

Description of Pollutant Sources: This activity applies to surface excavation and onsite storage of sand, gravel, and other materials that are mined. All mining operations that have stormwater runoff from the site are required to apply for a NPDES permit with Ecology. Ecology has specific BMPs required by the

permit. Some additional BMPs to help meet Ecology's discharge performance standards are listed below.

Pollutants of concern are suspended solids, nutrients, pH, and metals.

Pollutant Control Approach: Provide containment and or cover for any onsite storage areas to prevent run-on and discharge of suspended solids and other pollutants.

Suggested BMPs

- If the material is appropriate, use excavated spoil material to form compacted berms along downslope sides of the site to contain runoff. Berms should be seeded to promote growth of grass or other vegetation to limit erosion from the berms. Safety considerations must be examined to prevent flooding due to berm failure.
- Semi-permanent stockpiles should be seeded to promote vegetation growth to limit erosion from the stockpiles.
- Use detention ponds to promote settling of suspended solids, or infiltration basins to filter suspended solids, to cleanup runoff before it leaves the site.
- Use anchored tarps to cover stockpiles at small-scale mining operations if there is a potential for contaminated stormwater to leave the site.

IV-6 General Source Control Best Management Practices

This section describes BMPs common to one or more activities described in Section IV-5.

S102 Cover the Activity with a Roof or Awning

Not every activity can or needs to be located inside a building. In many cases, a simple roof or awning will protect the activity from coming into contact with stormwater, and usually at a lower cost than a complete building. If you do decide to build one of these structures, you will need to obtain permits from City of Olympia Community Planning and Development. They will also be able to help you with fire code requirements and zoning code provisions.

The roof structure can be designed in several ways. One option is a lean- to type of structure, where sheets of corrugated steel, fiberglass, aluminum, or similar impermeable material are attached to the wall of a building and are supported by sturdy poles. Similarly, if there is no building to attach to, roofing materials can be sufficiently supported at all four corners as a stand-alone cap, or a waterproof tent canopy can be used.

The area of the roof cover should be sufficient to prevent any precipitation from reaching the covered materials. An example of this type of structure is provided in Figure IV-6.1

Figure IV-6.1 Structure Used to Cover Manufacturing Operations.

(Photo courtesy of Seattle Public Utilities)

Another option for covering an activity is to use an overhanging awning of sufficient size to prevent rain from reaching the materials. Many of the building permit, fire code, and zoning requirements will also apply to these structures. An example of an awning overhang or cover is shown in Figure IV-6.2.

Figure IV-6.2 Loading Docks with an Overhang to Prevent Material Contact with Rainwater.

Activities such as fueling operations may be more conveniently covered by an island-type overhanging roof. This type of roof is supported by columns along the center of the structure rather than at the corners, enabling vehicles easy access underneath while still providing sufficient protection from rain. An example of this type of roof structure is shown in Figure IV-6.3.

Figure IV-6.3 Roof at Fueling Island to Prevent Stormwater Run-on.

Note that floating fuel stations (such as some used for refueling boats) cannot be covered, according to the fire code.

The particular roof cover option used at a given site is subject to the site layout and available space, affordability, and limitations imposed by other regulations. Structural cover options other than those given above can be used if they perform the same function. This BMP should usually be implemented in conjunction with sump or sanitary sewer drains and provisions for prevention of stormwater run-on into the covered area. BMPs S104 and S105 in this section present information on sump installation and run-on prevention.

S103 Cover the Activity with an Anchored Tarpaulin or Plastic Sheet

Some activities, such as stockpiling of raw materials, can be effectively covered with a sturdy tarpaulin or heavy plastic sheet made of impermeable material. Weights such as bricks, tires, or sandbags should be used to anchor the cover in place. Care should be taken to ensure that the tarpaulin or sheet covers the activity completely and that stormwater run-on does not penetrate significantly under the cover. If several sheets are used to form a cover, the sheets should be tethered together or laid in an overlapping manner. If necessary, pins or stakes should be used to anchor the tarpaulin to the ground. The tarpaulin must be inspected daily to ensure that no holes or gaps are present in the tarpaulin coverage. An example of this type of cover is shown in Figure IV-6.4.

Figure IV-17.4 Temporary Plastic Sheeting Anchored over Raw Materials Stored Outdoors.

The tarpaulin covering will be easier to keep in place and will last longer if some form of wind protection is possible. Attempts should be made to locate stockpiles adjacent to buildings where winds are reduced, but not in between buildings where a wind tunnel effect can occur.

Tarpaulins are an inexpensive and cost effective BMP for many activities. This BMP can be combined with runoff containment/run-on prevention curbs, dikes, and berms for better effectiveness.

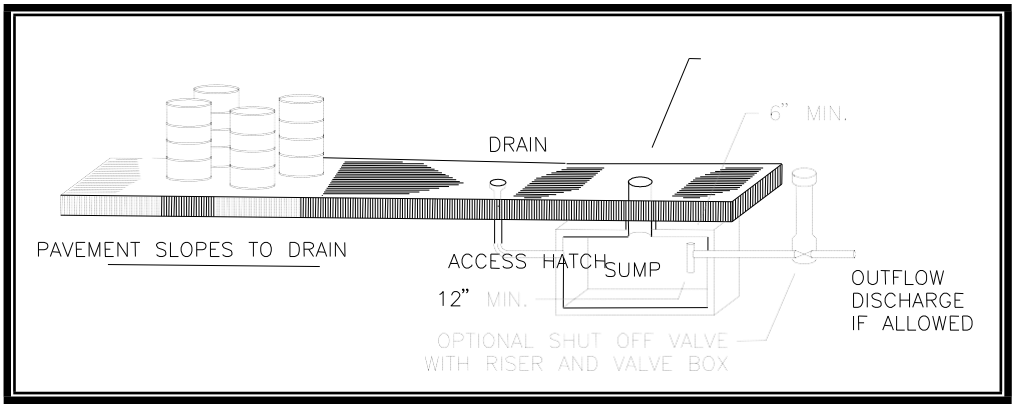
S104 Pave the Activity Area and Slope to a Sump or Holding Tank

This BMP is particularly suited to activities with the potential for leaks and spills, but that otherwise do not generate excessive amounts of polluted runoff. Examples are storage of liquid chemicals, waste oils, and solvents in portable containers such as drums; loading and unloading of liquids from trucks; and painting, finishing, and coating activities. A sump or holding tank serves to provide spill containment until the liquids can be pumped out and properly disposed of. If the activity produces large amounts of runoff, this BMP will not be very effective because the stray contaminants will overflow the sump or pass through the sump before collection and disposal are possible. To prevent run-on, the area should be enclosed with a berm, curb, or dike. The following implementation information is intended for situations where this BMP can be effective.

A designated activity area should be paved and sloped to drain to a central collection point. A sump, vault, or holding tank should be installed underneath this collection drain. Some materials, such as gasoline, can react with asphalt pavement and break it down, releasing additional pollutants. If the area is not yet paved and materials are present which may react with asphalt, the area must be paved with concrete. If the area is already paved with asphalt, an asphalt sealant can be applied which can aid in preventing pavement degradation. Whichever paving material is used, the paved surface must be free of gaps and cracks.

The sump or holding tank should have a capacity large enough to contain the entire volume of a potential spill. An example of a paved activity area with a sump drain is shown in Figure 3.6.5.

Figure 3.6.5 Paved Area with Sump Drain.



Wash pads may frequently need to use a sump arrangement like this. To keep disposal costs down, a drain cover, plug, or shutoff valve upstream of the sump should be used at times when the activity is not occurring.

The cost of constructing a sump and the disposal of accumulated contents can be high, so businesses should consider whether other allowable alternative BMPs can be used.

Commercial services that pump sumps and holding tanks are listed in the Yellow Pages of the phone directory under Environmental and Ecological Services.

S105 Surround the Activity Area with a Curb, Dike, or Berm or Elevate the Activity

This set of BMP options can be an effective means for prevention of stormwater run-on to an activity area. In addition, a curb, berm, or dike can be used for containment of spills in the activity area, or for containment of contaminated activity runoff. Generally, a containment BMP is most applicable to spill control situations; that is, sites where runoff is relatively clean, but occasional spills may occur. This BMP may be less expensive to implement than paving the activity area and providing proper drainage collection but can also be more difficult to maintain if stormwater ponding occurs inside a containment dike.

If a curb, dike, or berm is used to prevent stormwater run-on to a covered activity area, and the activity area is paved or otherwise impermeable, the berm should be placed underneath the covering so that rain will not pond inside it. Stormwater run-on can also be prevented by elevating the activity with a platform or other type of pedestal.

Containment may be achieved with concrete curbing, an earthen berm, a tub such as a plastic wading pool, or some other dike material, depending on the activity, its size, and resources available. Activities that require more space and therefore cannot be contained with a tub may need to be surrounded by a curb, dike, or berm. Aboveground storage tanks of liquids, storage of chemicals or wastes in numerous drums, and stockpiling of fertilizer are examples of activities that can be contained effectively in this manner. As the activity area gets larger, containment with an earthen berm can probably be provided less expensively than concrete curbing.

If a curb, berm, or dike is used for runoff containment, and other containment sizing regulations (such as fire codes, Ecology, City of Olympia, or Thurston County Environmental Health restrictions) do not apply, it should function so that all stormwater runoff from rain events up to the 6-month storm is

contained in the immediate activity area until it infiltrates into the ground or is properly disposed of later. This approach is applicable for activities that involve liquid material storage, and that may consequently incur spills. It is also applicable to stockpile areas where runoff is typically polluted with suspended solids. If a stormwater treatment system is presently on site, a valve should be installed in the containment dike so that excess stormwater can be drained out of the activity area and directed to the treatment system. This valve should always be kept closed unless excess stormwater is being discharged, so that any spills that occur within the activity area can be effectively contained.

Difficulties in maintenance may arise with disposal of the captured water on sites without stormwater treatment capability. The collected rainwater may need to be treated before discharge. If the activity is located on impermeable ground, then potentially contaminated water will accumulate within the containment area. If contaminated, this accumulated water cannot simply be drained from the area; it must be collected and disposed of at a licensed disposal facility. During the wet season, this course of action can lead to frequent draining that may prove costly. In addition, some type of monitoring would be needed to determine if ponded water is contaminated. Depending on the monitoring requirements, this can also be very costly.

For storage of small items, the simplest containment device is a tub or wading pool. A plastic child's wading pool may be sufficient for some activities that do not require a lot of space, such as storing painting materials, and temporary storage of wastes in drums. An example of this is shown in Figure IV-17.6. Make sure the material you are using does not react with the plastic.

Figure IV-6.6 Temporary Spill Containment.

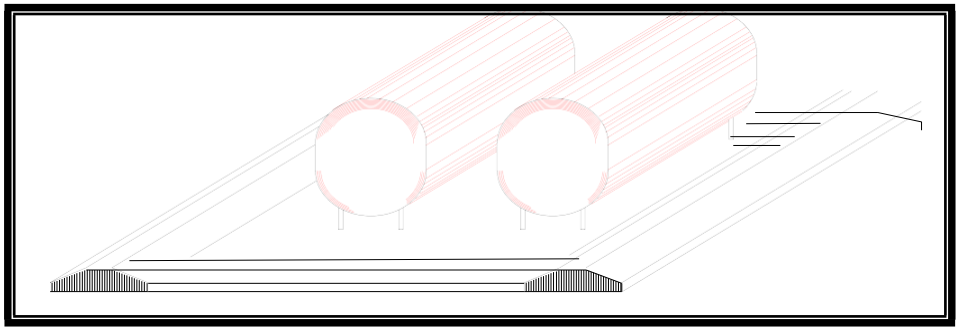
(Photo courtesy of Mark Dilley, Interstate Products, Inc.)

For larger areas, a containment curb, dike, or berm may be necessary. If an earthen berm is used, it must be seeded with grass or other vegetation so that it does not erode. Sketches of a containment berm are shown in Figure IV-6.6.

The volume of the containment area shall be the greater of either 110 percent of the volume of the largest tank, or 10% of volume of all tanks if there are multiple tanks.

It should be noted that neglect and poor maintenance can render the containment useless. Other BMPs should be considered before containment is. Commercial products are available that are a combination containment box/elevated pedestal. These effective devices prevent stormwater run-on by elevating containers off the ground and allow for collection of spills and drips inside the pedestal box. Similar arrangements can be constructed by hand as well.

Figure IV-6.7 Containment Berm Used to Control Liquid Material Leaks or Spills.



S106 Implement Integrated Pest Management (IPM) Measures

Use of herbicides, fungicides, and rodenticides should always be done with extreme caution, not only because of the potential harm to humans and pets, but also because of the potential harm to fish, wildlife, and our water resources. In light of the toxic nature of these compounds, special attention should be given to pesticide usage in all applications. The discussion below applies more to large-scale pesticide users but should be considered for backyard applications as well.

Commercial, agricultural, municipal, and other large scale pesticide users, such as golf courses and parks, should adhere to the principles of integrated pest management, a decision-making process for pest management that strives for intelligent, environmentally sound control of pests. It is a systems approach to pest management that combines agronomic, biological, chemical, and genetic information for educated decisions on the type of control to use, the timing and extent of chemical application, and whether non-chemical means can attain an acceptable level of pest control.

Integrated pest management is a preventive measure aimed at knowing the exact pests being targeted for control, the locations and times when pests will pose problems, the level of pest-induced damage that can be tolerated without taking action, the most vulnerable life stage, and control actions that are least damaging to the environment. The major components of integrated pest management are as follows:

- Monitoring and inventory of pest populations
- Determination of pest-induced injury and action levels
- Identification of priority pest problems
- Selection and timing of least toxic management tools
- Site-specific treatment with minimized chemical use
- Evaluation and adjustment of pesticide applications.

Monitoring of pest populations is a key to successful integrated pest management implementation. Pest problems are universally easier to control if the problem can be discovered early. With integrated pest management pesticides are used only as a last resort. Maximization of natural controls, including biological controls and removal of pests by hand, is always the first choice.

More information on integrated pest management is available from the Washington State Department of Agriculture and from the Washington State University Extension Service. Refer to Appendix IV-G for an example of an Integrated Pest Management Program.

S107 Clean Catch Basins

Cleaning catch basins regularly (Figure IV-6.8) is one of the most important stormwater source control measures that a business can take as they are a last line of defense before runoff enters the stormwater conveyance system.

Figure IV-6.8 Catch Basin Cleaning with a Vacuum Truck.

Catch basins are typically located under low spots in parking lots, along curbs and road edges, and where storm drainpipes combine flows. Catch basins on the surface collect runoff for storm drains that are typically located directly underneath them. Most catch basins have some storage in the bottom that never drains to an outflow pipe. This permanent storage area is intended to trap sediments, debris, and other particles that can settle out of stormwater, thus preventing clogging of downstream pipes and washing of these solids into receiving waters.

For additional information on the maintenance of catch basins, refer to Volume IV, Appendix IV-J.

Several companies offer catch basin cleaning services. Pertinent equipment dealers and cleaning services can be found in the telephone Yellow Pages under headings like “Sewer Cleaning Equipment and Supplies” and “Sewer Contractors”. All of the solids and stagnant water collected from catch basin sumps must be disposed of properly. None of the sump contents can be flushed into the catch basin outflow pipe. Depending on the nature of the pollutants in the sump, and the associated types of activities taking place on the site, the sump contents may need to be disposed of as hazardous waste.

Contractors who perform catch basin cleanout services will be required to follow specified disposal requirements.

It should be apparent that use of other BMPs, such as frequent sweeping of activity areas, covering activity areas, reducing activity occurrence, and containing runoff from activity areas will help reduce catch basin cleaning frequency, thus saving time and money. All businesses and agencies should set up maintenance schedules for all of their BMPs so that coordinated BMP maintenance efforts result in reduce catch basin cleaning frequencies.

IV-7 Best Management Practices for Single-Family Residences

The actions we take each day in and around our homes have a profound effect on surface water quality and fish habitat in this region. Stormwater goes directly to our groundwater, lakes, streams, and to Puget Sound. It does not go to the wastewater treatment plant. Any pollutants that get into the stormwater go directly to surface or groundwater. Small amounts of pollution from many different sources can significantly affect our waterways. Yard maintenance, waste storage, car washing and maintenance, and pool cleaning are some of the activities that can adversely impact water quality. Stormwater BMPs) discussed in this section are practical ways to keep stormwater from becoming polluted in the first place. It is recommended that all residents within the City of Olympia use these BMPs. **Please note that some of these procedures are required by various state, or county laws, and are noted as required BMPs.**

Below is a general list of Source Control BMPs for Olympia residents. The list includes brief information on applicability.

1. Automobile Washing

Many residents wash their cars in the driveway or on the street. Wash waters typically flow to a storm drain or ditch, which discharges stormwater directly to the underlying groundwater or to the nearest stream, lake, or Puget Sound. Soaps and detergents, even the biodegradable ones, can have immediate and long-term effects on aquatic life in water bodies. The grime washed off the car also contains a variety of pollutants that can harm fish and wildlife.

Suggested BMPs

At Home:

- Wash your car directly over your lawn or make sure the wash water drains to a vegetated area. This allows the water and soap to soak into the ground instead of running off into a local water body.
- Ideally, no soaps or detergents should be used, but if you do use one, select one without phosphates.
- Commercial products are available that allow you to clean a vehicle without water. These were developed for areas where water is scarce, so a water saving benefit is realized, as well as reduced pollution.
- Use a hose nozzle with a shut-off valve to save water.
- Do not wash your car if rain is expected.

- Pour the bucket of soapy, dirty wash water down your sink. This way the water does not pollute surface water. Instead, it is treated at the wastewater treatment plant or by your septic system.

Away from Home:

- Consider not washing your car at home. Take it to a commercial car wash that has a recycle system and discharges wastewater to the sanitary sewer for treatment.

2. Automobile Maintenance

Many of us are "weekend mechanics". We enjoy the cost savings of changing our own oil and antifreeze, topping off the battery with water, and generally making our car perform its best. There is a lot of potential for stormwater pollution associated with these activities; however, the following BMPs will help you minimize pollution while servicing your car, truck, van, or RV.

Required BMPs

- Recycle all oils, antifreeze, solvents, and batteries. Many local car parts dealers and gas stations accept used oil and oil filters. The Household Hazardous Waste facilities at the Thurston County Waste and Recovery Center accept oil, oil filters, antifreeze, and solvents.
- Never dump new or used automotive fluids or solvents on the ground, in a storm drain or street gutter, or in a water body. Eventually, it will make its way to local surface waters or groundwater, including the water we drink.
- Do not mix wastes. The chlorinated solvents in some carburetor cleaners can contaminate a huge tank of used oil, rendering it unsuitable for recycling. Always keep your wastes in separate containers that are properly labeled and store them out of the weather.

Suggested BMPs

- Fix all leaks, to keep the leaky material off streets and out of surface water.
- To dispose of oil filters, punch a hole in the top and let drain for 24 hours. This is where a large funnel in the top of your oil storage container will come in handy. After draining, wrap in two layers of plastic and dispose of in your regular garbage or recycle by taking it to the Thurston County Waste and Waste and Recovery Center. Call the City of Olympia Department of Public Works at (360) 753-8333 for up-to-date information on the appropriate disposal of consumer products.
- Use care in draining and collecting antifreeze to prevent accidental spills. Spilled antifreeze tastes sweet and can be deadly to animals they ingest it.
- Perform your service activities on concrete or asphalt or over a plastic tarpaulin to make spill cleanup easier. Keep a bag of kitty litter on hand to absorb spills. If there is a spill, sprinkle a good layer on the spill, let it absorb for a little while and then sweep it up. Place the contaminated litter in a plastic bag, tie it up, and dispose of it in your regular garbage. Take care not to leave kitty litter out in the rain; it will form a sticky goop that is hard to clean up.
- If you are doing body work outside, be sure to use a tarpaulin to catch material resulting from grinding, sanding, and painting. Dispose of this waste by double bagging in plastic and placing in your garbage.

3. Storage of Solid and Food Wastes

Improper storage of food and solid waste at residences can lead to not only water pollution problems, but problems with neighborhood pets and vermin as well. Following the BMPs listed below can help keep your property a clean and healthy place to live.

Suggested BMPs

- Recycle as much as you can. City of Olympia residents have access to curbside pickup for yard waste and recyclable materials. Also, look under "recycling" in the phone book for firms that take other recyclables.
- All waste containers kept outside should have lids. If your lid is damaged, please call the City of Olympia Waste Resources department at (360) 753-8340.
- Leaking waste containers should be replaced. If your container is damaged, please call your local solid waste hauler.
- Store waste containers under cover if possible, or on grassy areas.
- Inspect the storage area regularly to pick up loose scraps of material and dispose of them properly.
- Purchase products which have the least amount of packaging materials.
- Compost biodegradable materials such as grass clippings and vegetable scraps instead of throwing them away. Call City of Olympia Waste ReSources department at (360)753-8340 for more information on composting or information on yard waste collections. See the section on composting for BMPs relating to that activity.
- A fun alternative to traditional composting is worm composting. You can let worms do all the work for you by keeping a small vermiculture box just outside your kitchen. For more information on getting started with worms, call the number listed above.

4. Composting

Composting is an earth-friendly activity as long as some common sense rules outlined below are followed. If you choose to compost, the following BMPs should be utilized.

Suggested BMPs

- Compost piles must be located on an unpaved area where runoff can soak into the ground or be filtered by grass and other vegetation. Compost piles should be located in an area of your yard not prone to water ponding during storms, and should be kept well away from wetlands, streams, lakes, and other drainage paths.
- Compost piles must be maintained and turned over regularly to work properly. Large piles of unattended compost may create odor and vermin problems.
- Avoid putting hazardous, inorganic, plastics or metal waste in the compost pile.
- Cover the compost pile (See Figure IV-18.1) for two reasons:
    1. To keep stormwater from washing nutrients into waterways.
    2. To keep excess water from cooling the pile. This slows down the rate of decomposition.
- Build bins of wood, chicken wire, or fencing material to contain compost so it can't be washed away. Call City of Olympia Department of Public Works at (360) 754-4581 to get free composter designs and materials lists or visit the City website at *http://olympiawa.gov/city-utilities/garbage-and-recycling/organics-and-yard-waste/organics-backyard-composting.aspx*
- Building a small earthen dike around your compost pile is an effective means of preventing nutrient-rich compost drainage from reaching stormwater paths.

Figure IV-7.1 Covered Compost Bin

(photo courtesy of Green Culture)

5. Yard Maintenance and Gardening

This section deals with the normal yard maintenance activities we all perform at our homes. Over watering, over fertilizing, improper herbicide application, and improper disposal of trimmings and clippings can all contribute to serious water pollution problems. Following the BMPs listed below will help alleviate pollutant runoff.

Required BMPs

Follow the manufacturer's directions exactly for mixing and applying herbicides, fungicides, and pesticides, and use them sparingly. Never apply when it is windy or when rain is expected. Never apply over water, within 100 feet of a well-head, or adjacent to streams, wetlands, or other water bodies. Triple-rinse empty containers, using the rinsate for mixing your next batch of spray, and then double-bag and dispose of the empty container in your regular garbage. Never dispose of grass clippings or other vegetation in or near storm drains, streams, lakes, or Puget Sound.

Suggested BMPs

- Use natural, organic soil amendments when possible. The excellent soil conditioning properties of the organic matter aid water retention in lighter soils and help to break up and aerate heavier soils, so roots can grow better, and less watering is needed. It contains both readily available and long term nitrogen and other nutrients commonly lacking in Northwest soils. The slow release of nitrogen better matches the needs of plants. Thus, there is much less potential for nitrates to leach into surface or groundwater due both to less “excess nitrogen” and less water use. Better vegetative growth can also reduce erosion and runoff.
- Follow manufacturer's directions when applying fertilizers. More is not better, either for your lawn or for local water bodies. Never apply fertilizers over water or adjacent to ditches, streams,

or other water bodies. Remember that organic fertilizers have a slow release of nitrogen, and less potential to pollute then synthetic fertilizers.

- Save water and prevent pollution problems by watering your lawn sensibly. Lawns and gardens typically need the equivalent of 1 inch of rainfall per week. You can check on how you're doing by putting a wide mouth jar out where you're sprinkling and measure the water with a small plastic ruler. Overwatering to the point of runoff can carry polluting nutrients to the nearest water body.
- Consider planting a vegetated buffer zone adjacent to streams or other water bodies on your property. Call the City of Olympia Water Resources - Environmental Services section for advice and assistance in developing a planting plan.
- Reduce the need for pesticides and fertilizers on lawns by improving the health of the soil. Aerating, thatching, and topdressing with compost will improve soil health and help desired grasses compete with weeds and moss. Contact the City of Olympia Water Resources - Environmental Services section for more information about the City's Natural Lawn Care program.
- Make sure all fertilizers and pesticides are stored in a covered location. Rain can wash the labels off bottles and convert 50 pounds of boxed fertilizer into either a solid lump or a river of nutrients.
- Use a mulching mower and mow higher to improve soil/grass health and reduce or eliminate pesticide use.
- Compost all yard clippings or use them as mulch to save water and keep down weeds in your garden. See Composting section for more information.
- Practice organic gardening and virtually eliminate the need to use pesticides and fertilizers.
- Pull weeds instead of spraying and get some healthy exercise, too. If you must spray, use the least toxic formulations that will get the job done.
- Work fertilizers into the soil instead of letting them lie on the ground surface exposed to the next rainstorm.
- Plant native vegetation that is suited to Northwest conditions, they require less water and little to no fertilizers and pesticides.
- Contact your local waste disposal company for curbside pickup and recycling of yard waste.
- Invasive weeds and insect pests are a common nuisance to for yards. Consider generating an Integrated Pest Management Plan to control weeds and pests with the least amount of pollution potential.

Test soils to determine the correct fertilizer and lime application rates.

- Evaluation of soil nutrient levels and pH through regular testing ensures the best possible efficiency and economy of fertilization.
- Fertilization needs vary by site depending on plant, soil, and climatic conditions.
- Choose organic fertilizers when possible.
- For details on soils testing, contact the local Conservation District, a soils testing professional, or a Washington State University Extension office.

6. Swimming Pool and Spa Cleaning and Maintenance

Despite the fact that we immerse ourselves in it, the water from pools and spas is far from chemically clean. Nutrients, pH, and chlorine can adversely affect fish and wildlife in water bodies. Following these BMPs will ensure the cleanliness of your pool and the environment.

Required BMPs

- Pool and spa water must be dechlorinated to 0.1 mg/L if it is to be emptied into a ditch or to the stormwater drainage system. Contact your pool chemical supplier to obtain the neutralizing chemicals you will need. The rate of flow into the ditch or drainage system must be regulated so that it does not cause problems such as erosion, surcharging, or flooding. Water discharged to the ground, or a lawn must not cross property lines and must not produce runoff.
- If pool and spa water cannot be dechlorinated, it must be discharged to the sanitary sewer. Prior to draining, the City of Olympia at (360) 753-8333 must be notified to ensure they are aware of the volume of discharge and the potential effects of chlorine levels. A pool service company can help you determine the frequency of cleaning and backwash of filters.
- Diatomaceous earth used in pool filters cannot be disposed of in surface waters, on the ground, or into stormwater drainage systems or septic systems. Dry it out as much as possible, bag it in plastic, and dispose of at the landfill.

Suggested BMPs

- Hire a professional pool service company to collect all pool water for proper disposal. Make sure to ask them where they will dispose of it and the kind of permits they hold to do so.

7. Household Hazardous Material Use, Storage, and Disposal

Once we really start looking around our houses, the amount of hazardous materials we have on site is a real eye-opener. Oil-based paints and stains, paint thinner, gasoline, charcoal starter fluid, cleaners, waxes, pesticides, fingernail polish remover, and wood preservatives are just a few hazardous materials that most of us have around the house.

When products such as these are dumped on the ground or in a storm drain, they can be washed directly to receiving waters where they can harm fish and wildlife. They can also infiltrate into the ground and contaminate drinking water supplies. The same problem can occur if they are disposed of with your regular garbage; the containers can leak at the landfill and contaminate groundwater. The same type of contamination can also occur if hazardous products are poured down a sink or toilet into a septic system. Don't pour them down the drain if you're on municipal sewers, either. Many compounds can “pass through” the wastewater treatment plant without treatment and contaminate receiving waters, or they can harm the biological process used at the treatment plant, reducing overall treatment efficiency.

With such a diversity of hazardous products present in all homes in City of Olympia, a large potential for serious environmental harm exists if improper methods of storage, usage, and disposal are employed. Using the following BMPs will help keep these materials out of our soils, sediments, and waters.

Required BMPs

- Hazardous Materials must be used in accordance with the manufacturer recommendation or guidelines as shown on the label.

- Always store hazardous materials in properly labeled containers, never in food or beverage containers which could be misinterpreted by a child as something to eat or drink.
- Dispose of hazardous materials and their containers properly. Never dump products labeled as poisonous, corrosive, caustic, flammable, inflammable, volatile, explosive danger, warning, caution, or dangerous outdoors, in a storm drain, or into sinks, toilets or drains. Call the City of Olympia Department of Public Works at (360) 753-8333 for information on disposal methods, collection events, and alternative products. Household hazardous wastes from City of Olympia residents and non-residents are accepted at the HazoHouse, at the Thurston County Waste and Recovery Center in Hawks Prairie at 2418 Hogum Bay Road NE.
- Check hazardous material containers frequently for signs of leakage. If a container is rusty and has the potential of leaking soon, place it in a secondary container before the leak occurs and prevent a cleanup problem.
- Hazardous materials should be stored out of the reach of children.
- Store hazardous materials containers under cover and off the ground. Keep them out of the weather to avoid rusting, freezing, cracking, labels being washed off, etc.
- Keep appropriate spill cleanup materials on hand. Kitty litter is good for many oil-based spills.
- Ground cloths and drip pans must be used under any work outdoors which involves hazardous materials such as oil-based paints, stains, rust removers, masonry cleaners, and others bearing label warnings as outlined above (Figure 3.6.29).
- Latex paints are not a hazardous waste, but are not accepted in liquid form at the landfill. To dispose of, leave uncovered in a protected place until dry, then place in the garbage. If your can is at least half full, you can take it to the HazoHouse to be placed in Swap Shop area. If you wish to dry waste paint quickly, mix kitty litter or sawdust in the can to absorb the paint. Once paint is dry, leave the lid off when you place it in the garbage so your garbage collector can see that it is no longer liquid.
- Use less toxic products whenever possible. Ecology maintains a hotline at 1-800- RECYCLE, or see information online at https://fortress.wa.gov/ecy/recycle/
- If an activity involving the use of a hazardous material can be moved indoors out of the weather, then do so. Make sure you can provide proper ventilation, however.
- Follow manufacturers' directions in the use of all materials. Over-application of yard chemicals, for instance, can result in the washing of these compounds into receiving water bodies. Never apply pesticides when rain is expected.
- When hazardous materials are in use, place the container inside a tub or bucket to minimize spills and store materials above the local base flood elevation (BFE).

Figure IV-7.2 Drip Pan for Capturing Spills and Drips during Engine Repair and Maintenance.

8. Pet Waste Management

Pet waste that washes into lakes, streams or Puget Sound begins to decay, using up oxygen and releasing ammonia. Low oxygen levels and ammonia combined with warm water can kill fish. Pet waste also contains nutrients that encourage weed and algae growth in waters we use for swimming, boating and fishing. Most importantly, in many urban areas, pet and animal waste is the largest source of bacterial loading to streams. It can carry diseases that could make water unsafe for contact and lead to beach closures or affect shellfish harvest.

These include:

- Campylobacteriosis—bacterial infection
- Salmonellosis—bacterial infection
- Toxocariasis—roundworm infection
- Toxoplasmosis—protozoan parasite infection
- Giardiasis—protozoan parasite infection
- Fecal Coliform—bacteria in feces, indicates contamination
- *E. coli*—bacteria in feces, may cause disease.

Cleaning up after your pet can be as simple as taking a plastic bag or pooper-scooper along on your next walk. Then choose one of the following:

Suggested BMPs

- Bag it – Put waste in a securely closed bag and deposit it in the trash. Do not put it in your yard waste container because pet waste may carry diseases, and yard waste treatment may not kill disease organisms.
- Bury it – Bury waste at least 1 foot deep and cover with soil in your yard or garden (not in food-growing areas).
- Flush it – Only flush pet wastes if your home is served by a sanitary sewer which goes to a sewage treatment plant. Water from your toilet goes through a treatment process that removes pollutants before it is discharged into the environment. To prevent plumbing problems, don't flush debris or cat litter. Cat feces may be flushed, but used litter should be put in a securely closed bag in the trash. Septic systems are not designed to accommodate the high pollutant load of pet waste. To prevent premature failure or excessive maintenance costs do not flush pet wastes to your septic system.
- Compost it – waste from small animals other than dogs and cats (rabbits, rodents, etc.), can be put in your compost bin.

9. Activities in Wetlands and Wetland Buffers

Wetlands and associated buffers are vegetated ecosystems through which water passes. These areas usually have a high water table and are often subject to periodic flooding. Wetlands can be very effective in removing sediments, nutrients and other pollutants from stormwater.

Maintaining wetlands and associated buffers helps to slow stormwater runoff, trap sediments and other pollutants and reduce the volume of runoff by allowing infiltration to occur. Reducing the velocity of runoff reduces soil erosion and increases contact time with soil and vegetation. Increasing contact of stormwater with soils and vegetation in a wetland or riparian area can be effective in removing sediments, nutrients and other pollutants from stormwater runoff.

Buffer areas are important to both the wetland and the upland areas as habitat for aquatic wetland-dependent wildlife and as buffers during extreme weather events. Other functions of buffer areas that contribute to water quality include shading, flood attenuation and shoreline stabilization.

Persons responsible for maintenance of wetland areas are encouraged to call City of Olympia Community Planning & Development (360)753-8314 prior to performing work in wetlands or their buffers.

Required BMPs

- Removal by hand of manmade litter and control of noxious weeds that are included on the state noxious weed list (Washington Administrative Code [WAC] 16-750) or invasive plant species as identified by City of Olympia. Control may be conducted by clipping, pulling, over-shading with native tree and shrub species, or non-mechanized digging. Alternative methods such as mechanical excavation, barrier installation, or herbicide use may be allowed, but may require special permits with the City of Olympia.
- Check with City of Olympia Community Planning & Development on guidelines for vegetation and hazardous tree removal in critical areas.

Suggested BMPs

- To prevent possible contamination, limit fertilizer and herbicide use around wetlands and their buffers.
- Limit access to wetlands and their buffers. To avoid compaction do not establish trails within the wetland areas

10. Illicit Discharge Detection and Elimination

A common problem with City of Olympia's stormwater drainage system is illegal hook-ups to the system. Many residences hooked internal building drains, sump overflows, and even sanitary sewer and septic system piped to the storm drain in the past, allowing a variety of pollutants to flow directly to receiving waters instead of the sanitary sewer or septic system. Frequently, these connections are unknown to the current owner, and do not appear on any plans for the site. Because of the pollution potential these connections represent, the Environmental Protection Agency, under the mandate of the NPDES stormwater permits, has made elimination of illegal connections a top priority.

All residences in City of Olympia must examine their plumbing systems to determine if illegal connections exist. We recommend starting with site plans to better understand what piping systems were initially installed, making piping that does not appear on the plan a priority for investigation. Wherever toilets, sinks, appliances, showers and bathtubs, floor drains, or other indoor activities are connected to the stormwater drainage system, immediately reroute them to the sanitary or septic system or holding tanks.

If sanitary facilities (such as toilets) are connected to the stormwater drainage system, you must obtain a permit from the City of Olympia and reroute them to the sanitary sewer. Contact City of Olympia Community Planning & Development for permit and connection information.

Dye Testing

Dye testing with a non-toxic dye is one way to determine where a pipe or structure drains if not obvious by observations or on plans. The dye is put into the structure and flushed with some water. Observations are then made at ends-of-pipes, drainage ditches, catch basins, and manholes to look for the color coming through. Contact City of Olympia Public Works - Wastewater Operations if you need assistance in locating structures adjacent to your property.

Smoke Testing

Smoke testing can also help detect illegal connections and is best done by qualified personnel. To conduct smoke testing, shut off all indoor discharges, place a smoke bomb or other smoke-generating device in a storm drain manhole, and force air in after it. Station personnel at each suspect drain location to observe if smoke is coming out. Identify smoking drains for future rerouting.

Plugging or Rerouting Illicit Discharges

Drains that are found to connect to the stormwater drainage system must either be permanently plugged or disconnected and rerouted as soon as possible. Plug unused drains with concrete or similar permanent materials. If a drainpipe is to be rerouted and a sanitary sewer services the property, then the City of Olympia Community Planning and Development Department must be contacted. It is the responsibility of the property owner to follow through on rerouting illicit storm drainage connections to the sanitary sewer.

If the property is not served by a sanitary sewer, alternate measures will be necessary. If the discharge is simply domestic waste, a septic system may be feasible. If it is necessary to install a septic system, the proper permits will need to be obtained from the City of Olympia Community Planning and Development. If the discharge is anything other than domestic waste, then a holding tank or onsite treatment will be necessary.

11. Pests and Noxious Weeds

Invasive weeds and insect pests are a common problem for many yards and gardens in the City of Olympia. Effective management of these pests in the least toxic method requires careful planning and implementation. Developing an *Integrated Pest Management Plan* is often the best solution for managing pests and reducing pollution of ground and surface water bodies.

Introduction

Integrated Pest and Vegetation Management (IPM) is a natural, long-term, ecologically-based systems approach to controlling pest populations. IPM is used to reduce pest populations, maintain them at levels below those causing health concerns or economic damage. The goals of IPM are to both encourage optimal selective pesticide use (away from prophylactic, broad spectrum use), and to maximize natural controls to minimize environmental side effects.

True integrated pest and vegetation management is a powerful approach that anticipates and prevents most problems through appropriate cultural practices and careful observation. Knowledge of the life cycles of host plants and both beneficial and pest organisms is also important. The integrated pest management section of this guidance is adapted from *Least Toxic Pest Management for Lawns* by Sheila Daar. Following the integrated pest management process gives you the information you need to minimize damage by weeds, diseases, and pests and to treat those problems with the least toxic approaches.

The IPM Process

Step One: Correctly identify problem pests and understand their life cycle.

Learn more about the pest. Observe it and pay attention to any damage that may be occurring. Learn about the life cycle. Many pests are only a problem during certain seasons, or can only be treated effectively in certain phases of the life cycle.

Step Two: Establish tolerance thresholds for pests.

Every landscape has a population of some pest insects, weeds, and diseases. This is good because it supports a population of beneficial species that keep pest numbers in check. Beneficial organisms may compete with, eat, or parasitize disease or pest organisms. Decide on the level of infestation that must be exceeded before treatment needs to be considered. Pest populations under this threshold should be monitored but don't need treatment. For instance, European crane flies usually don't do serious damage to a lawn unless there are 25 to 40 larvae per square foot feeding on the turf in February (in normal weather years). Also, most people consider a lawn healthy and well maintained even with up to 20 percent weed cover, so treatment, other than continuing good maintenance practices, is generally unnecessary.

Step Three: Monitor to detect and prevent pest problems.

Regular monitoring is a key practice to anticipate and prevent major pest outbreaks. It begins with a visual evaluation of the lawn or landscape's condition. Take a few minutes before mowing to walk around and look for problems. Keep a notebook, record when and where a problem occurs, then monitor for it at about the same time in future years. Specific monitoring techniques can be used in the appropriate season for some potential problem pests, such as European crane fly.

Step Four: Modify the maintenance program to promote healthy plants and discourage pests.

A healthy landscape is resistant to most pest problems. Lawn aeration and over-seeding along with proper mowing height, fertilization, and irrigation will help the grass out-compete weeds. Correcting drainage problems and letting soil dry out between waterings in the summer may reduce the number of crane-fly larvae that survive.

Step Five: If pests exceed the tolerance thresholds…

Use cultural, physical, mechanical, or biological controls first. If those prove insufficient, use the chemical controls described below that have the least non-target impact. When a pest outbreak strikes (or monitoring shows one is imminent), implement integrated pest management then consider control options that are the least toxic, or have the least non-target impact. Here are two examples of an integrated pest management approach:

- **Red thread disease** is most likely under low nitrogen fertility conditions and most severe during slow growth conditions. Mow and bag the clippings to remove diseased blades. Fertilize lightly to help the grass recover, then begin grasscycling and change to fall fertilization with a slow-release or natural-organic fertilizer to provide an even supply of nutrients. Chemical fungicides are not recommended because red thread cannot kill the lawn.
- **Crane fly damage** is most prevalent on lawns that stay wet in the winter and are irrigated in the summer. Correct the winter drainage and/or allow the soil to dry between irrigation cycles; larvae are susceptible to drying out, so these changes can reduce their numbers. It may also be possible to reduce crane fly larvae numbers by using a power de-thatcher on a cool, cloudy day when feeding is occurring close to the surface. Studies are being conducted using beneficial nematodes that parasitize the crane fly larvae; this type of treatment may eventually be a reasonable alternative.
- Only after trying suitable non-chemical control methods or determining that the pest outbreak is causing too much serious damage, should chemical controls be considered. If chemical controls prove necessary, determine what products are available and choose a product that is the least toxic and has the least non-target impact. Refer to the operational BMPs for the use of pesticides below for guidelines on choosing, storing, and using lawn and garden chemicals.

Step Six: Evaluate and record the effectiveness of the control, and modify maintenance practices to support lawn or landscape recovery and prevent recurrence.

Keep records! Note when, where, and what symptoms occurred, or when monitoring revealed a potential pest problem. Note what controls were applied and when, and the effectiveness of the control. Monitor next year for the same problems. Review your landscape maintenance and cultural practices to see if they can be modified to prevent or reduce the problem.

A comprehensive integrated pest management program should also include the proper use of pesticides as a last resort, and vegetation/fertilizer management to eliminate or minimize the contamination of stormwater.

IV-8 Maintenance Standards for Stormwater Facilities

This Section of Volume IV of this DDECM specifically addresses maintenance standards for the stormwater controls and Best Management Practices (BMPs) found in Volumes III and V of this DDECM. While each BMP in Volumes III and V may have sections regarding suggested maintenance as drafted by Ecology, this Section and the referenced appendices shall govern where there is conflict. The standards set forth in this section are to be viewed as the core requirements for the inspection and maintenance of stormwater controls, protected vegetated areas, and BMPs. Additional inspection, maintenance, and cleaning may be necessary due to site-specific conditions.

IV-8.1 Inspection and Maintenance Responsibility

All facilities and Best Management Practices designed and constructed for stormwater collection, conveyance, flood prevention, and water quality treatment must be inspected and maintained to ensure proper facility function to comply with the Washington State Department of Ecology Phase II NPDES Permit held by the City of Olympia.

Owners of stormwater sites and facilities should have a maintenance program that addresses every component of the stormwater system. The purpose of the operation and maintenance program is to ensure the system does not lose its intended capability to manage stormwater and continues to operate as designed.

Program Operators who are responsible for executing Pollution Source Control Programs and Stormwater Facility Maintenance Programs shall submit an annual report of activities, trainings, inspections, and maintenance actions taken by May 15th of each year. The City is required to inspect and enforce maintenance of stormwater facilities and systems (public and private) to comply with the Phase II NPDES permit from Ecology.

IV-8.2 Stormwater Facility Maintenance Programs

Projects and sites subject to *Core Requirement 9 – Operation and Maintenance* in Volume I shall use this section in preparation of **Stormwater Facility Maintenance Programs** to fulfill this requirement. Stormwater Facility Maintenance Programs shall be included in the overall **Stormwater Site Management Plan** and as Attachment "A" of the Agreement to Maintain Stormwater Facilities in Appendix IV-H. Preparation of Stormwater Site Management Plans is addressed in Section 2 of this Volume.

IV-8.3 Preparing a Stormwater Facility Maintenance Program

Stormwater Facility Maintenance Programs shall include the following sections and components in order to be deemed complete and thus meeting Core Requirement 9 – Operation and Maintenance. Templates for program creation are provided in Appendix IV-I. This document will be recorded with the Thurston County Auditor, and all requirements for recorded documents shall apply to formatting of this program.

Cover Sheet

The cover sheet for the Stormwater Facility Maintenance Program shall include the project or site information for which the program was prepared and all pertinent information regarding parties responsible for maintenance and inspection:

- Project or plat name
- Tax Parcel Numbers for properties that have applicable stormwater facilities or improvements, or those properties whose owners are responsible for maintenance
- The Program Operator responsible for maintenance; this may be a single individual, business, or organized group such as a Homeowners Association
- Contact phone number and email for the Program Operator

Table of Contents

The table of contents shall reference all sections and appendices to the Stormwater Facility Maintenance Program.

Stormwater Management Site Description

The description provided in this section should accurately describe the stormwater management site and all facilities and features requiring inspection, maintenance, and protection. The following sub-sections and maps should be included:

Site narrative generally describing the flow of stormwater runoff. Discussion should include types of stormwater controls and facilities used to manage stormwater onsite. Use terminology consistent with the facility maintenance checklists in Appendix IV-J and elsewhere in the Manual.

Description of the destination of runoff from the site. If a site is not completely self-contained (i.e., utilizes 100% infiltration for flow control), the receiving water body and watershed should be identified.

A Key Map covering the entire management site, which clearly identifies the boundaries, stormwater structures, facilities, stormwater easements, and features to be inspected and maintained. Maintained green space, tree tracts, Soil and Vegetation Protection Areas (SVPA), and vegetated flow dispersal areas should also be delineated on the Key Map. Each component of the system should be clearly identified on the plan so it may be easily located by the Program Operator or inspection staff. Naming conventions used on the Key Map should match the BMP naming in the facility descriptions and checklists in Appendix IV-J. If stormwater will be discharged from the site in the developed condition, all discharge points must be shown on the Key Map.

Itemized list or summary of stormwater management BMPs and quantities of each BMP or component found on the site and their intended function.

Annual Cost of Maintenance

A worksheet or table listing the itemized cost of activities and materials associated with maintaining stormwater facilities on the site shall be included in the program. Items to include are those that require replacement (e.g., media filter cartridges), estimates for labor associated with vegetation management (e.g., ponds and bioretention), and cleaning activities (e.g., removal of sediment from catch basins and cleaning permeable pavements).

Maintaining Stormwater Facilities and Controls

This section provides Program Operators and property owners with stormwater management guidance and explanations for the typical types of stormwater facilities and their importance. Standard language for these sections has been included in the template provided in Appendix IV-I:

- Stormwater Runoff Prevention
- Collection and Conveyance Systems
- Stormwater Quantity Controls
- Stormwater Quality Controls
- Low Impact Development Controls and Features

- Soil and Vegetation Management

How to Perform Inspections and Maintenance

This section provides Program Operators, property owners, and tenants with guidance on how to inspect their facilities, identify problems, perform routine maintenance, typical tools and equipment needed, and requirements for reporting maintenance activities to the City of Olympia. Standard language for this section has been included in the template provided in Appendix IV-I.

Appendix

The following items shall be included in the appendix:

Stormwater Facility Descriptions and Maintenance Checklists that describe the required inspection frequency, conditions that require maintenance, and methods of correcting issues. Maintenance checklists for various BMPs, stormwater system components, and other maintained areas are located in Appendix IV-J.

A blank **Stormwater Facility Inspection Form** for the site that includes all stormwater structure, facility, and feature types found onsite. The standard City of Olympia form is located in Appendix IV-K. The most current version of this form is available on the City of Olympia website.

A blank **Inspection and Maintenance Log Sheet** for record keeping by the Program Operator. A sample Log Sheet can be found in Appendix IV-K. The most current version of this form is available on the City of Olympia website.

IV-8.4 Stormwater Maintenance Standards

This chapter and the facility checklists of Appendix IV-J define the operational and maintenance standards for stormwater management BMPs found in Volumes III and V of this manual. Included by reference to this chapter are the following publications:

- Low Impact Development Technical Guidance Manual for Puget Sound, WSU Extension/Puget Sound Partnership, December 2012
- Guidance Document: Western Washington Low Impact Development Operation & Maintenance, Herrerra Environmental Consultants, July 2013

IV-8.4.1 Components Requiring Maintenance

All permanent stormwater features, BMPs, vegetated areas, and conveyance systems that have been identified on the engineering plans and in the Drainage Design Report as a facility designated to convey, treat, store, or manage stormwater shall be included in the Stormwater Facility Maintenance Program. A listing of stormwater features and facilities requiring inspection and maintenance can be found in Appendix IV-J.

IV-8.4.2 Inspection and Maintenance Intervals

The facility descriptions and inspection checklists found in Appendix IV-J contain recommended inspection intervals for specific parts of the applicable BMP.

Annually – A

Inspections of these components shall be conducted annually at minimum. This annual inspection may coincide with other inspections completed throughout the year and is not required to occur on a specific date or site condition. Annual inspections should, however, occur when the facility is entirely accessible and not inundated with stormwater.

Bi-annually – B

Inspection of these stormwater components shall be conducted twice a year at a minimum. Biannual inspections are generally performed at least once during the rainy season or after a major storm event, and once during the dry season when the entire facility is accessible.

Wet Season – W

It is recommended that at least one inspection occur during the wet season – preferably after trees have lost their leaves – for stormwater components that have a W designation.

Major Storm Events - E

BMPs and facilities with an E designation are recommended to have additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident which causes contaminant release). Stormwater conveyance, detention, and flow control facilities should be monitored during peak storm events to assess proper functionality. These inspections are critical in identifying malfunctioning systems and correcting immediate issues prior to the next storm event.

Dry Season – D

Inspection and maintenance of some facilities should occur during dry weather (summer/early fall) prior to rainy season. Facilities that are routinely filled with water (e.g., detention ponds) should limit maintenance activities to the dry season when access to the entire facility is unimpeded by stormwater.

Routine Cleaning and Maintenance

Facility descriptions preceding inspection and maintenance checklists in Appendix IV-J have recommendations and guidance for routine maintenance activities that may be necessary to maintain functionality. Some components may only require maintenance when certain criteria are met (e.g., the level of sediment in a catch basin sump), whereas other facilities may require routine maintenance more frequently (e.g., weeding bioretention areas).

IV-8.5 Level of Service for Stormwater Facilities

The standards found in this chapter and Appendix IV-J are considered the core requirements for properly maintaining stormwater facilities and BMPs contained in this manual. Some facilities may require more frequent inspections, cleaning, or maintenance based on site specific conditions or loading. In general, the standards presented by this chapter represent a level of service necessary to maintain the quality and function of stormwater facilities and controls. Site owners and Program Operators may choose to maintain facilities at a higher level of service for aesthetic benefit where desired. Aesthetic enhancement of stormwater facilities shall not impede the function of the facility.

Engineered stormwater facilities designated to meet Core Requirement #6 – Runoff Treatment, Core Requirement #7 – Flow Control, and stormwater conveyance systems shall be considered the highest

priority for inspection and execution of a Stormwater Facility Maintenance Program. When evaluating maintenance activities and budget for repairing systems, deficient facilities causing property damage, safety concerns, a risk to human health or downstream aquatic habitat should be made a priority for repair.

IV-8.5.1 Vegetation Management

All vegetation associated with engineered stormwater facilities and protected vegetation areas should be maintained in a manner that protects the primary function of the system as designed. Facility descriptions and checklists found in Appendix IV-J provide additional BMP specific guidance beyond this section.

Appendix IV-A: Urban Land Uses and Pollutant Generating Sources

Use this appendix to identify pollutant-generating sources at various land uses (manufacturing, transportation, communication, wholesale, retail, service - based on the *North American Industry Classification System* (United States Census Bureau, 2017), and public agencies). Applicable operational and structural source control and treatment BMPs for each pollutant source may then be selected by referring to Volume IV. Other land uses not included in this appendix should also consider implementing applicable (mandatory) BMPs for their pollutant sources. Note that potentially polluting operations may not be limited to those examples identified with NAICS codes.

1. Manufacturing Businesses

Cement

NAICS 3273XX: *Cement and Concrete Product Manufacturing*

Description: These businesses primarily produce Portland cement, the binder used in concrete for paving, buildings, pipe, and other structural products. The three basic steps in cement manufacturing are: 1) proportioning, grinding, and blending raw materials; 2) heating raw materials to produce a hard, stony substance known as clinker; and 3) combining the clinker with other materials and grinding the mixture into a fine powdery form. The raw materials include limestone, silica, alumina, iron, chalk, oyster shell marl, or shale. Waste materials from other industries are often used such as slag, fly ash and spent blasting sand. Raw materials are crushed, mixed and heated in a kiln to produce the correct chemical composition. Kilns typically are coal, gas, or oil fired. The output of the kiln is a clinker that is ground to produce the final product.

The basic process may be wet or dry. In the wet process water is mixed with the raw ingredients in the initial crushing operation and in some cases is used to wash the material prior to use. Water may also be used in the air pollution control scrubber. The most significant waste material from cement production is the kiln dust. Concrete products may also be produced at ready-mix concrete facilities. Refer to Concrete Products for a description of the BMPs appropriate to these activities.

Potential Pollutant Generating Sources: Stormwater contamination may occur during the crushing, grinding, storage, and handling of kiln dust, limestone, shale, clay, coal, clinker, gypsum, anhydrite, slag, sand, and product and at the vehicle and equipment maintenance, fueling, and cleaning areas. Aluminum, iron, heavy metals, chemical oxygen demand (COD), pH, potassium, sulfate, oil & grease, and total suspended solids (TSS) are some of the potential pollutants.

Chemical Manufacturing

NAICS 325XXX: *Chemical Manufacturing*

Description: This group is engaged in the manufacture of chemicals, or products based on chemicals such as acids, alkalis, inks , chlorine, industrial gases, pigments, chemicals used in the production of synthetic resins, fibers and plastics, synthetic rubber, soaps and cleaners, pharmaceuticals, cosmetics, paints, varnishes, resins, photographic materials, chemicals, organic chemicals, agricultural chemicals, adhesives, and sealants.

Potential Pollutant Generating Sources: Activities that can contaminate stormwater include bagging, blending, packaging, crushing, milling, shredding, granulation, grinding, storage, distribution,

loading/unloading, and processing of materials; equipment storage; application of fertilizers; foundries; lime application; use of machinery; material handling and warehousing; cooling towers; fueling; boilers; dangerous waste treatment, storage and disposal; wastewater treatment; areas of past industrial activity; access roads and tracks; drum washing, and maintenance and repair.

Chemical businesses in the Seattle area surveyed for dangerous wastes were found to produce waste caustic solutions, soaps, heavy metal solutions, inorganic and organic chemicals, solvents, acids, alkalis, paints, varnishes, pharmaceuticals, and inks. The potential pollutants include biological oxygen demand (BOD), COD, oil & grease, pH, total phosphorus, ammonia,nitrates, nitrites, total Kjeldahl nitrogen (TKN), TSS, specific organics, and heavy metals.

Concrete Products

NAICS 3273XX: *Cement and Concrete Product Manufacturing*

NAICS 3274XX: *Lime and Gypsum Product Manufacturing*

Description: Businesses that manufacture ready-mix concrete, gypsum products, concrete blocks and bricks, concrete sewer or drainage pipe, septic tanks, and prestressed concrete building components. Concrete is prepared on-site and poured into molds or forms to produce the desired product. The basic ingredients of concrete are sand, gravel, Portland cement, crushed stone, clay, and reinforcing steel for some products. Admixtures including fly ash, calcium chloride, triethanolamine, lignosulfonic acid, sulfonated hydrocarbon, fatty acid glyceride, or vinyl acetate, may be added to obtain desired characteristics such as slower or more rapid curing times.

The first stage in the manufacturing process is proportioning cement, aggregate, admixtures and water, and then transporting the product to a rotary drum, or pan mixer. The mixture is then fed into an automatic block-molding machine that rams, presses, or vibrates the mixture into its final form. The final product is then stacked on iron framework cars where it cures in four hours. After being mixed in a central mixer, concrete is molded in the same manner as concrete block. The concrete cures in the forms for a number of hours. Forms are washed for reuse, and the concrete products are stored until they can be shipped.

Potential Pollutant Generating Sources: Pollutant generating activities/sources include stockpiles of raw materials; washing of waste concrete from trucks, forms, equipment, and the general work area; and water from the curing of concrete products. Besides the basic ingredients for making concrete products, chemicals used in the curing of concrete and the removal of forms may end up in stormwater. These chemicals can include latex sealants, bitumastic coatings and release agents. Trucks and equipment maintained on-site may generate waste oil and solvents, and other waste materials. Potential pollutants include COD, BOD, TSS, total dissolved solids (TDS), pH, iron, lead, zinc, and oil & grease.

Electrical Products

NAICS 33324x: *Industrial Machinery Manufacturing*

NAICS 33331x: *Commercial and Service Industry Machinery Manufacturing*

NAICS 33341x: *Ventilation, Heating, Air Conditioning, and Commercial Refrigeration Equipment Manufacturing*

NAICS 3339xx: *Other General Purpose Machinery Manufacturing*

NAICS 334xxx: *Computer and Electronic Product Manufacturing*

NAICS 335xxx: *Electrical Equipment, Appliance, And component Manufacturing*

NAICS 336xxx: *Transportation Equipment Manufacturing*

NAICS 339xxx: *Miscellaneous Manufacturing*

Description: A variety of products are produced including electrical transformers and switchgear, motors, generators, relays, and industrial controls; communications equipment for radio and TV stations and systems; electronic components and accessories including semiconductors; printed board circuits; electromedical and electrotherapeutic apparatus; and electrical instrumentation. Manufacturing processes include electroplating, machining, fabricating, etching, sawing, grinding, welding, and parts cleaning. Materials used include metals, ceramics, quartz, silicon, inorganic oxides, acids, alkaline solutions, arsenides, phosphides, cyanides, oils, fuels, solvents, and other chemicals.

Potential Pollutant Generating Sources: Most of the actual manufacturing and processing activity at the types of facilities discussed here normally occur indoors and will not be exposed to stormwater. The types of activities where exposure to stormwater may occur consist primarily of loading/ and unloading activities, and the storage and handling of raw materials, by-products, final products, or waste products. A wide variety of materials are used at these facilities, including metals, acids used for chemical etching, alkaline solutions, solvents, various oils and fuels, and miscellaneous chemicals. Tanks or drums of these materials may be exposed to stormwater during loading/ and un-loading operations, or through outdoor storage or handling.

Liquid wastes which may be exposed at least temporarily include spent solvents and acids, miscellaneous chemicals, and oily wastes. These wastes may be contaminated with a variety of heavy metals and chlorinated hydrocarbons. Used equipment, scrap metal and wire, soiled rags, and sanding materials may also be exposed to stormwater and constitute a potential source of pollutants. In addition, some facilities may have dumpsters containing nonhazardous wastes or manufacturing debris that may be exposed to stormwater.

Wastewater consists of solutions and rinses from electroplating operations and the wastewaters from cleaning operations. Water may also be used to cool saws and grinding machines. Sludges are produced by the wastewater treatment process. Potential pollutants include BOD, COD, oil & grease, organics, pH, TSS, TKN, nitrate and nitrite nitrogen, copper, lead, silver, and zinc.

Food and Kindred Products

NAICS 115114: *Postharvest Crop Activities (except Cotton Ginning)*

NAICS 311xxx: *Food Manufacturing*

NAICS 312xxx: *Beverage and Tobacco Product Manufacturing*

Description: Businesses in this category include facilities manufacturing or processing foods, beverages, and related products for human consumption, and prepared feeds for animals and fowls. Facilities engaged in manufacturing cigarettes, cigars, and other tobacco products are also included. Food processing typically occurs inside buildings. Exceptions are meat packing plants where live animals may be kept outside, and fruit and vegetable plants where the raw material may be temporarily stored outside. Meat production facilities include stockyards, slaughtering, cutting and deboning, meat processing, rendering, and materials recovery. Dairy production facilities include receiving stations, clarification, separation, and pasteurization followed by culturing, churning, pressing, curing, blending, condensing, sweetening, drying, milling, and packaging. Canned frozen and preserved fruits and vegetables are typically produced by washing, cutting, blanching, and cooking followed by drying, dehydrating, and freezing.

Grain mill products are processed during washing, milling, debranning, heat treatment, screening, shaping, and vitamin and mineral supplementing. Bakery products processing includes mixing, shaping, of dough, cooling, and decorating. Operations at an edible oil manufacturer include refining, bleaching, hydrogenation, fractionation, emulsification, deodorization, filtration, and blending. Beverage production includes brewing, distilling, fermentation, blending, and packaging. Wine processors often crush grapes outside the process building and/or store equipment outside when not in use. Some wine producers use juice from grapes crushed elsewhere. Some vegetable and fruit processing plants use caustic solutions.

Potential Pollutant Generating Sources: The nature of the business, and the required sanitary conditions, require that raw and processed materials be protected from stormwater. As such, the contamination of stormwater from these activities is primarily from the loading and unloading of products and raw materials; spillage and leaks from tanks and containers stored outdoors; waste management practices; pest control; and improper connections to the storm sewer. The following are the pollutants typically expected from this industry segment: BOD, fecal coliform, oil & grease, pH, TKN, TSS, copper, manganese, and pesticides.

Glass Products

NAICS 32721x: *Glass and Glass Product Manufacturing*

Description: The produced glass form may be flat or window glass, safety glass, container glass, tubing, glass wool, or fibers. The raw materials are sand mixed with a variety of oxides such as aluminum, antimony, arsenic, copper, cobalt oxide, barium, and lead. The raw materials are mixed and heated in a furnace. Processes that vary with the intended product shape the resulting molten material. The cooled glass may be edged, ground, polished, annealed and/or heat-treated to produce the final product. Air emissions from the manufacturing buildings are scrubbed to remove particulates.

Potential Pollutant Generating Sources: Raw materials are generally stored in silos except for crushed recycled glass and materials washed off recycled glass. Contamination of stormwater and/or ground water can be caused by raw materials lost during unloading operations, errant flue dust, equipment/vehicle maintenance and engine fluids from mobile lifting equipment that is stored outside. The maintenance of the manufacturing equipment will produce waste lubricants and cleaning solvents. The flue dust is likely to contain heavy metals such as arsenic, cadmium, chromium, mercury, and lead. Potential pollutants include oil & grease, high/low pH, lead, and heavy metals such as arsenic, cadmium, chromium, mercury, and lead.

Industrial Machinery & Equipment, Trucks & Trailers, Aircraft, Aerospace, & Railroad

NAICS 333xxx: *Machinery Manufacturing*

NAICS 336xxx: *Transportation Equipment Manufacturing*

Description: This category includes the manufacture of a variety of equipment including engines and turbines, farm and garden equipment, construction and mining machinery, metal working machinery, pumps, computers and office equipment, automatic vending machines, refrigeration and heating equipment, and equipment for the manufacturing industries. This group also includes many small machine shops, and the manufacturing of trucks, trailers and parts, airplanes and parts, missiles, spacecraft, and railroad equipment and instruments.

Manufacturing processes include various forms of metal working and finishing, such as electroplating, anodizing, chemical conversion coating, etching, chemical milling, cleaning, machining, grinding, polishing, sand blasting, laminating, hot dip coating, descaling, degreasing, paint stripping, painting, and the production of plastic and fiberglass parts. Raw materials include ferrous and non-ferrous metals, such as aluminum, copper, iron, steel, and their alloys, paints, solvents, acids, alkalis, fuels, lubricating and cutting oils, and plastics.

Potential Pollutant Generating Sources: Potential pollutant sources include spills and leaks from fueling, maintenance shops, loading/unloading of materials, and outside storage of gasoline, diesel, cleaning fluids, equipment, solvents, paints, wastes, detergents, acids, other chemicals, oils, metals, and scrap materials. Air emissions from stacks and ventilation systems are potential areas for exposure of materials to rainwater.

Metal Products

NAICS 331xxx: *Primary Metal Manufacturing*

NAICS 332xxx: *Fabricated Metal Product Manufacturing*

NAICS 337124: *Metal Household Furniture Manufacturing*

NAICS 337214: *Office Furniture (except Wood) Manufacturing*

NAICS 339xxx: *Miscellaneous Manufacturing*

Description: This group includes mills that produce basic metals and primary products, as well as foundries, electroplaters, and fabricators of final metal products. Basic metal production includes aluminum, copper, and steel. Mills that transform metal billets, either ferrous or nonferrous such as aluminum, to primary metal products are included. Primary metal forms include sheets, flat bar, building components such as columns, beams and concrete reinforcing bar, and large pipe.

Steel mills in the Pacific Northwest primarily use recycled metal and electric furnaces. The molten steel is cast into billets or ingots that may be reformed on site or taken to rolling mills that produce primary products. As iron and steel billets may sit outside before reforming, surface treatment to remove scale may occur prior to reforming. Foundries pour or inject molten metal into a mold to produce a shape that cannot be readily formed by other processes. The metal is first melted in a furnace. The mold is made of sand or metal die blocks that are locked together to make a complete cavity. The molten metal is ladled in, and the mold is cooled. The rough product is finished by quenching, cleaning and chemical treatment. Quenching involves immersion in a plain water bath or water with an additive.

Businesses that fabricate metal products from metal stock provide a wide range of products. The raw stock is manipulated in a variety of ways including machining of various types, grinding, heating, shearing, deformation, cutting and welding, soldering, sand blasting, brazing, and laminating. Fabricators may first clean the metal by sand blasting, descaling, or solvent degreasing. Final finishing may involve electroplating, painting, or direct plating by fusing or vacuum metalizing. Raw materials, in particular recycled metal, are stored outside prior to use, as are billets before reforming. The descaling process may use salt baths, sodium hydroxide, or acid (pickling).

Primary products often receive a surface coating treatment. Prior to the coating the product surface may be prepared by acid pickling to remove scale or byalkaline cleaning to remove oils and greases. The two major classes of metallic coating operations are hot and cold coating. Aluminum, tin, and zinc coatings are applied in molten metal baths. Chromium and tin are usually applied electrolytically from plating solutions.

Potential Pollutant Generating Sources: Potential pollutant generating sources include outside storage of chemicals, metal feedstock, byproducts (fluxes), finished products, fuels, lubricants, waste oil, sludge, waste solvents, dangerous wastes, piles of coal, coke, dusts, fly ash, baghouse waste, slag, dross, sludges, sand refractory rubble, and machining waste; unloading of chemical feedstock and loading of waste liquids such as spent pickle liquor by truck or rail; material handling equipment such as cranes, conveyors, trucks, and forklifts; particulate emissions from scrubbers, baghouses or electrostatic precipitators; fugitive emissions; maintenance shops; erosion of soil from plant yards; and floor, sink, and process wastewater drains.

Paper, Pulp, and Paperboard Mills

NAICS 3221xx: *Pulp, Paper, and Paperboard Mills*

Description: Large industrial complexes in which pulp and/or paper, and/or paperboard are produced. Products also include newsprint, bleached paper, glassine, tissue paper, vegetable parchment, and industrial papers. Raw materials include wood logs, chips, wastepaper, jute, hemp, rags, cotton linters, bagasse, and esparto. The chips for pulping may be produced on-site from logs, and/or imported.

The following manufacturing processes are typically used: raw material preparation, pulping, bleaching, and papermaking. All of these operations use a wide variety of chemicals including caustic soda, sodium and ammonium sulfites, chlorine, titanium oxide, starches, solvents, adhesives, biocides, hydraulic oils, lubricants, dyes, and many chemical additives.

Potential Pollutant Generating Sources: The large process equipment used for pulping is not enclosed. Thus, precipitation falling over these areas may become contaminated. Maintenance of the process equipment produces waste products similar to that produced from vehicle and mobile equipment maintenance. Logs may be stored, debarked and chipped on site. Large quantities of chips are stored outside. Although this can be a source of pollution, the volume of stormwater flow is relatively small because the chip pile retains the majority of the precipitation. Mobile equipment such as forklifts, log stackers, and chip dozers are sources of leaks/spills of hydraulic fluids. Vehicles and equipment are fueled and maintained on-site.

Paper Products

NAICS 3222xx: *Converted Paper Product Manufacturing*

Description: Included are businesses that take paper stock and produce basic paper products such as cardboard boxes and other containers, and stationery products such as envelopes and bond paper. Wood chips, pulp, and paper can be used as feedstock.

Potential Pollutant Generating Sources: Potential pollutant generating sources include outside loading and unloading orf solid and/or liquid materials; outside storage and handling of dangerous wastes, liquid, and/or solid materials; maintenance and fueling activities for forklifts and other vehicles and equipment; and outside processing activities related to paper production.

Petroleum Products

NAICS 3241xx: *Petroleum and Coal Products Manufacturing*

Description: The petroleum refining industry manufactures gasoline, kerosene, distillate and residual oils, lubricants, and related products from crude petroleum, and asphalt paving and roofing materials. Although petroleum is the primary raw material, petroleum refineries also use other materials such as

natural gas, benzene, toluene, chemical catalysts, caustic soda, and sulfuric acid. Wastes may include filter clays, spent catalysts, sludges, and oily water.

Asphalt paving products consist of sand, gravel and petroleum-based asphalt that serves as the binder. Raw materials include stockpiles of sand and gravel and asphalt emulsions stored in aboveground tanks.

Potential Pollutant Generating Sources: Potential pollutant generating sources include outside processing such as distillation, fractionation, catalytic cracking, solvent extraction, coking, desulfuring, reforming, and desalting; petrochemical and fuel storage and handling; outside liquid chemical piping and tankage; mobile liquid handling equipment such, as tank trucks, forklifts, etc.; maintenance and parking of trucks and other equipment; waste piles, and handling and storage of asphalt emulsions, cleaning chemicals, and solvents; and waste treatment and conveyance systems.

The following are potential pollutants at oil refineries: oil & grease, BOD, COD, total organic carbon (TOC), phenolic compounds, polyaromatic hydrocarbons (PAH), ammonia nitrogen, TKN, sulfides, TSS, low and high pH, and chromium (total and hexavalent).

Printing

NAICS 323xxx: *Printing and Related Support Activities*

Description: This industrial category includes the production of newspapers, periodicals, commercial printing materials and by businesses that do their own printing and those that perform services for the printing industry, for example bookbinding. Processes include typesetting, engraving, photoengraving, and electrotyping.

Potential Pollutant Generating Sources: Various materials used in modifying the paper stock include inorganic and organic acids, resins, solvents, polyester film, developers, alcohol, vinyl lacquer, dyes, acetates, and polymers. Waste products may include waste inks, ink sludge, resins, photographic chemicals, solvents, acid and alkaline solutions, chlorides, chromium, lead, silver, zinc, spent formaldehyde, plasticizers, and used lubricating oils. As the printing operations occur indoors, the only likely points of potential contact with stormwater are the outside temporary storage of waste materials, offloading of chemicals at external unloading bays, and vehicle/equipment repair and maintenance. Pollutants of concern include COD, heavy metals, oil & grease, pH, and TSS.

Rubber and Plastic Products

NAICS 3252xx: *Resin, Synthetic Rubber, and Artificial and Synthetic Fibers and Filaments Manufacturing*

NAICS 326xxx: *Plastics and Rubber Products Manufacturing*

Description: Products in this category include rubber tires, hoses, belts, gaskets, seals, plastic sheet, film, tubes, pipes, bottles, cups, ice chests, packaging materials, and plumbing fixtures. The rubber and plastics industries use a variety of processes ranging from polymerization to extrusion using natural or synthetic raw materials. These industries use natural or synthetic rubber, plastics components, pigments, adhesives, resins, acids, caustic soda, zinc, paints, fillers, and curing agents.

Potential Pollutant Generating Sources: Pollutant generating sources/activities include storage of liquids, other raw materials or by-products, scrap materials, oils, solvents, inks and paints; unloading of liquid materials from trucks or rail cars; washing of equipment; waste oil and solvents produced by cleaning manufacturing equipment; used equipment that could drip oil and residual process materials; and maintenance shops.

Potential pollutants are BOD, COD, nitrate and nitrite nitrogen, TKN, total phosphorus, TSS, pH, trichloroethane, methylene chloride, toluene, zinc, and oil & grease.

Ship and Boat Building and Repair Yards

NAICS 3366xx: *Ship and Boat Building*

Description: Businesses that build or repair ships and boats. Typical activities include hull scraping, sandblasting, finishing, metal fabrication, electrical repairs, engine overhaul, welding, fiberglass repairs, hydroblasting, and steam cleaning.

Potential Pollutant Generating Sources: Outside boatyard activities that can be sources of stormwater pollution include pressure washing, surface preparation, paint removal, sanding, painting, engine/vessel maintenance and repairs, and material handling and storage.

Secondary sources of stormwater contaminants are cooling water, pump testing, gray water, sanitary waste, washing down the work area, and engine bilge water. Engine room bilge water and oily wastes are typically collected and disposed of through a licensed contracted disposal company. Two prime sources of copper are leaching of copper from anti-fouling paint and wastes from hull maintenance. Wastes generated by boatyard activities include spent abrasive grits, spent solvent, spent oils, fuel, ethylene glycol, washwater, paint overspray, various cleaners/detergents and anti-corrosive compounds, paint chips, scrap metal, welding rods, wood, plastic, resins, glass fibers, dust, and miscellaneous trash such as paper and glass.

Ecology, local shipyards, and METRO have sampled pressure-wash wastewater. The effluent quality has been variable and frequently exceeded water quality criteria for copper, lead, tin, and zinc. From monitoring results received to date, metal concentrations typically range from 5 to 10 mg/L but have gone as high as 188 mg/L copper with an average 55 mg/L copper.

Wood

NAICS 321xxx (except 321114): *Wood Product Manufacturing (except Wood Preservation)*

Description: This group includes sawmills, and all businesses that make wood products using cut wood, with the exception of wood treatment businesses. Wood treatment as well as log storage and sorting yards are covered in other sections of this appendix. Included in this group are planing mills, millworks, and businesses that make wooden containers and prefab building components, mobile homes, and glued-wood products like laminated beams, office and home furniture, partitions, and cabinets. All businesses employ cutting equipment whose by-products are chips and sawdust. Finishing is conducted in many operations.

Potential Pollutant Generating Sources: Businesses may have operations that use paints, solvents, wax emulsions, melamine formaldehyde, and other thermosetting resins, and produce waste paints, paint thinners, turpentine, shellac, varnishes and other waste liquids. Outside storage, trucking, and handling of these materials can also be pollutant sources.

Potential pollutants are BOD, COD, nitrate and nitrite nitrogen, TKN, total phosphorus, TSS, arsenic, copper, total phenols, oil & grease, and pH.

Wood Treatment

NAICS 321114: *Wood Preservation*

Description: This group includes both anti-staining and wood preserving. Some wood trimming may occur. After treatment, the lumber is typically stored outside. Forklifts are used to move both the raw and finished product. Wood treatment consists of a pressure process using the chemicals described below. Anti-staining treatment is conducted using dip tanks or by spraying. Wood preservatives may include creosote, creosote/coal tar, pentachlorophenol, copper naphthenate or inorganic arsenicals such as chromated copper arsenate dissolved in water. The use of pentachlorophenol is declining in the Puget Sound region.

Potential Pollutant Generating Sources: Potential pollutant generating sources/activities include the retort area, handling of the treated wood, outside storage of treated materials and products, equipment/vehicle storage and maintenance, and the unloading, handling, and use of the preservative chemicals. Based on (USEPA, 1995) the following stormwater contaminants have been reported: BOD, COD, TSS, and the specific pesticide(s) used for the wood preservation.

Other Manufacturing Businesses

NAICS 313xxx: *Textile Mills*

NAICS 314xxx: *Textile Product Mills*

NAICS 315xxx: *Apparel Manufacturing*

NAICS 316xxx: *Leather and Allied Product Manufacturing*

NAICS 3253xx: *Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing*

NAICS 327xxx: *Nonmetallic Mineral Product Manufacturing*

Description: Includes manufacturing of textiles and apparel, agricultural fertilizers, leather products, clay products such as bricks, pottery, bathroom fixtures; and nonmetallic mineral products.

Potential Pollutant Generating Sources: Pollutant generating sources at facilities in these categories include fueling, loading & unloading, material storage and handling (especially fertilizers), and vehicle and equipment cleaning and maintenance. Potential pollutants include BOD, COD, oil & grease, TSS, heavy metals and fertilizer components including nitrates, nitrites, ammonia nitrogen, TKN, and phosphorous compounds.

2. Transportation and Communication

Airfields and Aircraft Maintenance

NAICS 481xxx: *Air Transportation*

NAICS 4881xx: *Support Activities for Air Transportation*

Description: Industrial activities include vehicle and equipment fueling, maintenance and cleaning, and aircraft/runway deicing.

Potential Pollutant Generating Sources: Fueling is accomplished by tank trucks at the aircraft and is a source of spills. Dripping of fuel and engine fluids from the aircraft and at vehicle and equipment maintenance/ cleaning areas, and application of deicing materials to the aircraft and the runways are potential sources of stormwater contamination. Aircraft maintenance and cleaning produces a wide variety of waste products, similar to those found with any vehicle or equipment maintenance, including: used oil and cleaning solvents, paints, oil filters, soiled rags, and soapy wastewater. Deicing materials used on aircraft and/or runways include ethylene and propylene glycol, and urea. Other chemicals

currently considered for ice control are sodium and potassium acetates, isopropyl alcohol, and sodium fluoride. Pollutant constituents include BOD, COD, oil & grease, pH, TSS, TKN, and specific deicing components such as glycol and urea.

Fleet Vehicle Yards

NAICS 484xxx: *Truck Transportation*

NAICS 485xxx: *Transit and Ground Passenger Transportation*

NAICS 4871xx: *Scenic and Sightseeing Transportation, Land*

NAICS 4884xx: *Support Activities for Road Transportation*

NAICS 492xxx: *Couriers and Messengers*

NAICS 5321xx: *Automotive Equipment Rental and Leasing*

NAICS 621910: *Ambulance Services*

Description: Includes all businesses that own, operate and maintain or repair large vehicle fleets, including cars, buses, trucks and taxis, as well as the renting or leasing of cars, trucks, and trailers.

Potential Pollutant Generating Sources: Potential pollutant generating sources include spills/leaks of fuels, used oils, oil filters, antifreeze, solvents, brake fluid, and batteries, sulfuric acid, battery acid sludge, and leaching from empty contaminated containers and soiled rags; leaking underground storage tanks that can cause ground water and/or soil contamination; dirt, oils, and greases from outside steam cleaning and vehicle washing; dripping of liquids from parked vehicles; solid and liquid wastes that are not properly stored outside; and loading and unloading areas.

Potential pollutants from this section may include BOD, heavy metals, oil & grease, TSS, organics, and pH.

Railroads

NAICS 482xxx: *Rail Transportation*

NAICS 4882xx: *Support Activities for Rail Transportation*

Description: Railroad activities are spread over a large geographic area: along railroad lines, in switching yards, and in maintenance yards. Railroad activity occurs on both property owned or leased by the railroad and at the loading or unloading facilities of its customers. Employing BMPs at commercial or public loading and unloading areas is the responsibility of the particular property owner.

Potential Pollutant Generating Sources: The following are potential sources of pollutants: dripping of vehicle fluids onto the road bed, leaching of wood preservatives from the railroad ties, human waste disposal, litter, locomotive sanding areas, locomotive/railcar/equipment cleaning areas, fueling areas, outside material storage areas, the erosion and loss of soil particles from the bed, and herbicides used for vegetation management.

Maintenance activities include maintenance shops for vehicles and equipment, track maintenance, and ditch cleaning. In addition to the railroad stock, the maintenance shops service highway vehicles and other types of equipment. Waste materials can include waste oil, solvents, degreasers, antifreeze, radiator flush, acid solutions, brake fluids, soiled rags, oil filters, sulfuric acid and battery sludge, and machine chips with residual machining oil and any toxic fluids or solids lost during transit. The following are potential pollutants at railyards: BOD, heavy metals, oil & grease, TSS, organics, and pesticides.

Warehouses and Mini-Warehouses

NAICS 493xxx: *Warehousing and Storage*

Description: Businesses that store goods in buildings and other structures.

Potential Pollutant Generating Sources: The following are potential pollutant sources from warehousing operations: Loading and unloading areas, outside storage of materials and equipment, and fueling and maintenance areas. Potential pollutants include oil & grease and TSS.

Other Transportation and Communication

NAICS 2211xx: *Electric Power Generation, Transmission, and Distribution*

NAICS 515xxx: *Broadcasting (except Internet)*

NAICS 517xxx: *Telecommunications*

NAICS 518xxx: *Data Processing, Hosting, and Related Services*

NAICS 519xxx: *Other Information Services*

NAICS 5615xx: *Travel Arrangement and Reservation Services*

Description: This group includes travel agencies, communication services such as TV and radio stations, cable companies, and electric and gas services. It does not include railroads, airplane transport services, airlines, pipeline companies, and airfields.

Potential Pollutant Generating Sources: Gas and electric services are likely to own vehicles that are washed, fueled and maintained on site. Communication service companies can generate used oils and dangerous wastes. The following are the potential pollutants: BOD, heavy metals, oil & grease, and TSS.

3. Retail and Wholesale Businesses

Gas Stations

NAICS 447xxx: *Gasoline Stations*

Refer to S409 BMPs for Fueling At Dedicated Stations to select applicable BMPs.

Recyclers and Scrap Yards

NAICS 423140: *Motor Vehicle Parts (Used) Merchant Wholesalers*

NAICS 423930: *Recyclable Material Merchant Wholesalers*

Refer to S423 BMPs for Recyclers and Scrap Yards

Commercial Composting

NAICS 325314: *Fertilizer (Mixing Only) Manufacturing*

Description: This typically applies to businesses that have numerous compost piles that require large open areas to break down the wastes. Composting can contribute nutrients, organics, coliform bacteria, low pH, color, and suspended solids to stormwater runoff.

Potential Pollutant Generating Sources: The compost must be contained but may be a cause for concern during loading and unloading. Compost can have high levels of nutrients, organics, coliform bacteria, low pH, color concerns and suspended solids. Composting requires heavy equipment such as trucks and loaders. The equipment can generate oil & grease.

Restaurants/Fast Food

NAICS 711110: *Theater Companies and Dinner Theaters*

NAICS 722xxx: *Food Services and Drinking Places*

Description: Businesses that provide food service to the general public, including drive through facilities.

Potential Pollutant Generating Sources: Potential pollutant sources include high-use customer parking lots, outdoor used grease storage, and garbage dumpsters. The cleaning of roofs and other outside areas of restaurant and cooking vent filters into the parking lot can cause cooking grease to be discharged to the storm drains. The discharge of washwater or grease to storm drains or surface water is not allowed.

Retail/General Merchandise

NAICS 442xxx: *Furniture and Home Furnishings Stores*

NAICS 443xxx: *Electronics and Appliance Stores*

NAICS 444xxx: *Building Material and Garden Equipment And Supplies Dealers*

NAICS 445xxx: *Food and Beverage Stores*

NAICS 446xxx: *Health and Personal Care Stores*

NAICS 447xxx: *Gasoline Stations*

NAICS 448xxx: *Clothing and Clothing Accessories Stores*

NAICS 451xxx: *Sporting Goods, Hobby, Musical Instrument, and Book Stores*

NAICS 452xxx: *General Merchandise Stores*

NAICS 453xxx: *Miscellaneous Store Retailers*

NAICS 454xxx: *Nonstore Retailers*

Description: This group includes general merchandising stores such as department stores, shopping malls, variety stores, 24-hour convenience stores, and general retail stores that focus on a few product types such as clothing and shoes. It also includes furniture and appliance stores.

Potential Pollutant Generating Sources: Of particular concern are the high-use parking lots of shopping malls and 24-hour convenience stores. Furniture and appliance stores may provide repair services in which dangerous wastes may be produced.

Retail/Wholesale Vehicle and Equipment Dealers

NAICS 423110: *Automobile and Other Motor Vehicle Merchant Wholesalers*

NAICS 4238xx: *Machinery, Equipment, and Supplies Merchant Wholesalers*

NAICS 441xxx: *Motor Vehicle and Parts Dealers*

NAICS 453930: *Manufactured (Mobile) Home Dealers*

NAICS 5321xx: *Automotive Equipment Rental and Leasing*

NAICS 5324xx: *Commercial & Industrial Machinery & Equipment Rental & Leasing*

Description: This group includes all retail and wholesale businesses that sell, rent, or lease cars, trucks, boats, trailers, mobile homes, motorcycles and recreational vehicles. It includes both new and used vehicle dealers. It also includes sellers of heavy equipment for construction, farming, and industry. These businesses generally have large parking lots. Most retail dealers that sell new vehicles and large equipment also provide repair and maintenance services.

Potential Pollutant Generating Sources: Oil and other materials that have dripped from parked vehicles can contaminate stormwater at high-use parking areas. Vehicles are washed regularly generating vehicle grime and detergent pollutants. The storm or washwater runoff will contain oils and various organics, metals, and phosphorus. Repair and maintenance services generate a variety of waste liquids and solids including used oils and engine fluids, solvents, waste paint, soiled rags, and dirty used engine parts. Many of these materials are dangerous wastes.

Retail/Wholesale Nurseries and Building Materials

NAICS 4233xx: *Lumber and Other Construction Materials Merchant Wholesalers*

NAICS 4237xx: *Hardware and Plumbing and Heating Equipment and Supplies Merchant Wholesalers*

NAICS 4238xx: *Machinery, Equipment, and Supplies Merchant Wholesalers*

NAICS 424930: *Flower, Nursery Stock, & Florists' Supplies Merchant Wholesalers*

NAICS 444xxx: *Building Equipment and Garden Equipment and Supplies Dealers*

Description: These businesses are in a separate group because they are likely to store much of their merchandise outside of the main building. They include nurseries, and businesses that sell building and construction materials and equipment, paint, and hardware.

Potential Pollutant Generating Sources: Some businesses may have small fueling capabilities for forklifts and may also maintain and repair their vehicles and equipment. Some businesses may have unpaved areas, with the potential to contaminate stormwater by leaching of nutrients, pesticides, and herbicides. Businesses in this group surveyed in the Puget Sound area for dangerous wastes were found to produce waste solvents, paints and used oil. Storm runoff from exposed storage areas can contain suspended solids, and oil & grease from vehicles, forklifts, and high-use customer parking lots. Runoff from nurseries may contain nutrients, pesticides and/or herbicides.

Retail/Wholesale Chemicals and Petroleum

NAICS 4246xx: *Chemical and Allied Products Merchant Wholesalers*

NAICS 4247xx: *Petroleum and Petroleum Products Merchant Wholesalers*

NAICS 447xxx: *Gasoline Stations*

NAICS 454310: *Fuel Dealers*

Description: These businesses sell plastic materials, chemicals and related products. This group also includes the bulk storage and selling of petroleum products such as diesel oil, automotive fuels, etc.

Potential Pollutant Generating Sources: The general areas of concern are the spillage of chemicals or petroleum during loading and unloading, and the washing and maintenance of tanker trucks and other vehicles. Also, the fire code requires that vegetation be controlled within a tank farm to avoid a fire hazard. Herbicides are typically used. The concentration of oil in untreated stormwater has been known to exceed the water quality effluent guideline for oil and grease. Runoff is also likely to contain significant concentrations of benzene, chloroform, phenol, lead, and zinc.

Retail/Wholesale Foods and Beverages

NAICS 4244xx: *Grocery and Related Product Merchant Wholesalers*

NAICS 4248xx: *Beer, Wine, & Distilled Alcoholic Beverage Merchant Wholesalers*

NAICS 445xxx: *Food and Beverage Stores*

NAICS 447110: *Gasoline Stations with Convenience Stores*

NAICS 4523xx: *General Merchandise Stores, including Warehouse Clubs and Supercenters*

NAICS 4542xx: *Vending Machine Operators*

NAICS 454390: *Other Direct Selling Establishments*

Description: Included are businesses that provide retail food including general groceries, fish and seafood, meats and meat products, dairy products, poultry, soft drinks, and alcoholic beverages.

Potential Pollutant Generating Sources: Vehicles may be fueled, washed and maintained at the business. Spillage of food and beverages may occur. Waste food and broken contaminated glass may be temporarily stored in containers located outside. High-use customer parking lots may be sources of oil and other contaminants.

Other Retail/Wholesale Businesses

NAICS 423xxx: *Merchant Wholesalers, Durable Goods*

NAICS 424xxx: *Merchant Wholesalers, Nondurable Goods*

NAICS 425xxx: *Wholesale Electronic Markets and Agents and Brokers*

NAICS 441xxx: *Motor Vehicle and Parts Dealers*

NAICS 442xxx: *Furniture and Home Furnishing Stores*

NAICS 443xxx: *Electronic and Appliance Stores*

NAICS 444xxx: *Building Material and Garden Equipment and Supplies Dealers*

NAICS 446xxx: *Health and Personal Care Stores*

NAICS 448xxx: *Clothing and Clothing Accessories Stores*

NAICS 451xxx: *Sporting Goods, Hobby, Musical Instrument, and Book Stores*

NAICS 452xxx: *General Merchandise Stores*

NAICS 453xxx: *Miscellaneous Store Retailers*

Description: Businesses in this group include sellers of vehicle parts, tires, farm supplies, hand and garden tools, furniture and home furnishings, photographic and office equipment, electrical goods, sporting goods and toys, paper products, drugs, and apparel.

Potential Pollutant Generating Sources: Pollutant sources include loading/unloading areas, high-use parking lots, and delivery vehicles that may be fueled, washed, and maintained on premises.

4. Service Businesses

Animal Care Services

NAICS 1152xx: *Support Activities for Animal Production*

NAICS 45391x: *Pet and Pet Supplies Stores*

NAICS 54194x: *Veterinary Services*

NAICS 711212: *Racetracks*

NAICS 71329x: *Other Gambling Industries*

NAICS 81291x: *Pet care (except Veterinary) Services*

Description: This group includes racetracks, kennels, fenced pens, veterinarians and businesses that provide boarding services for animals including horses, dogs, and cats.

Potential Pollutant Generating Sources: The primary sources of pollution include animal manure, washwaters, waste products from animal treatment, runoff from pastures where larger livestock may roam, and vehicle maintenance and repair shops. Pastures may border streams and direct access to the stream may occur. Both surface water and ground water may be contaminated. Potential stormwater contaminants include BOD, fecal coliform, nutrients, oil & grease, and TSS.

Commercial Car and Truck Washes

NAICS 48849x: *Other Support Activities for Road Transportation*

NAICS 488999: *All Other support Activities for Transportation*

NAICS 811192: *Car Washes*

Description: Facilities include automatic systems found at individual businesses or at gas stations and 24-hour convenience stores, as well as self-service. There are three main types: tunnels, rollovers and hand-held wands. The tunnel wash, the largest, is housed in a long building through which the vehicle is pulled. At a rollover wash the vehicle remains stationary while the equipment passes over. Wands are used at self-serve car washes. Some car washing businesses also sell gasoline.

Potential Pollutant Generating Sources: Wash wastewater may contain detergents and waxes. Wastewater should be discharged to sanitary sewers. In self-service operations a drain is located inside each car bay. Although these businesses discharge the wastewater to the sanitary sewer, some washwater can find its way to the storm drain, particularly with the rollover and wand systems. Rollover systems often do not have air-drying. Consequently, as it leaves the enclosure the car sheds water to the pavement. With the self-service system, washwater with detergents can spray outside the building and drain to storm sewer. Users of self-serve operations may also clean engines and change oil, dumping the used oil into the storm drain. Potential pollutants include BOD, detergents, oil & grease, soaps, and TSS.

Equipment Repair

NAICS 532xxx: *Rental and Leasing Services*

NAICS 8112xx: *Electronic and Precision Equipment Repair and Maintenance*

NAICS 8113xx: *Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance*

NAICS 8114xx: *Personal and Household Goods Repair and Maintenance*

Description: This group includes several businesses that specialize in repairing different equipment including communications equipment, radio, TV, household appliances, and refrigeration systems. Also included are businesses that rent or lease heavy construction equipment as miscellaneous repair and maintenance may occur on site.

Potential Pollutant Generating Sources: Potential pollutant sources include storage and handling of fuels, waste oils and solvents, and loading/unloading areas. Potential pollutants include oil & grease, low/high pH, and TSS.

Laundries and Other Cleaning Services

NAICS 5612xx: *Facilities Support Services*

NAICS 56174x: *Carpet and Upholstery Cleaning Services*

NAICS 8123xx: *Drycleaning and Laundry Services*

Description: This category includes all types of cleaning services such as laundries, linen suppliers, diaper services, coin-operated laundries, dry cleaners, and carpet and upholstery services. Wet washing may involve the use of acids, bleaches and/or multiple organic solvents. Dry cleaners use an organic-based solvent, although small amounts of water and detergent are sometimes used. Solvents may be recovered and filtered for further use. Carpets and upholstery may be cleaned with dry materials, hot water extraction process, or in-plant processes using solvents followed by a detergent wash.

Potential Pollutant Generating Sources: Wash liquids are discharged to sanitary sewers. Stormwater pollutant sources include: loading and unloading of liquid materials, particularly at large commercial operations, disposal of spent solvents and solvent cans, high-use customer parking lots, and outside storage and handling of solvents and waste materials. Potential stormwater contaminants include chlorinated and other solvents, oil & grease, soaps and detergents, low/high pH, and TSS.

Marinas and Boat Clubs

NAICS 713930: *Marinas*

Description: Marinas and yacht clubs provide moorage for recreational boats. Marinas may also provide fueling and maintenance services. Other activities include cleaning and painting of boat surfaces, minor boat repair, and pumping of bilges and sanitary holding tanks. Not all marinas have a system to receive pumped bilge water.

Potential Pollutant Generating Sources: Both solid and liquid wastes are produced as well as stormwater runoff from high-use customer parking lots. Waste materials include sewage and bilge water. Maintenance by the tenants will produce used oils, oil filters, solvents, waste paints and varnishes, used batteries, and empty contaminated containers and soiled rags. Potential stormwater contaminants include heavy metals, oil & grease, low/high pH, and TSS.

Golf and Country Clubs

NAICS 713910: *Golf Courses and Country Clubs*

Description: Public and private golf courses and parks are included.

Potential Pollutant Generating Sources: Maintenance of grassed areas and landscaped vegetation has historically required the use of fertilizers and pesticides. Golf courses contain small lakes that are sometimes treated with algaecides and/or mosquito larvicides. The fertilizer and pesticide application process can lead to inadvertent contamination of nearby surface waters by overuse, misapplication, or the occurrence of storms shortly after application. Heavy watering of surface greens in golf courses may cause pesticides or fertilizers to migrate to surface and shallow ground water resources. The use of pesticides and fertilizers generates waste containers. Equipment must be cleaned and maintained.

Miscellaneous Services

NAICS 54192x: *Photographic Services*

NAICS 5617xx: *Services to Buildings and Dwellings*

NAICS 562xxx: *Waste Management and Remediation Services*

NAICS 712xxx: *Museums, Historical Sites, And Similar Institutions*

NAICS 713xxx: *Amusement, Gambling, and Recreation Industries*

NAICS 8122xx: *Death Care Servies*

NAICS 8129xx: *Other Personal Services*

Description: This group includes photographic studios, commercial photography, funeral services, amusement parks, furniture and upholstery repair, pest control services, and other professional offices. Pollutants from these activities can include pesticides, waste solvents, heavy metals, pH, suspended solids, soaps and detergents, and oil & grease.

Potential Pollutant Generating Sources: Leaks and spills of materials from the following businesses can be sources of stormwater pollutants:

1. Building maintenance produces wash and rinse solutions, oils, and solvents.
2. Pest control produces rinsewater with residual pesticides from washing application equipment and empty containers.
3. Outdoor advertising produces photographic chemicals, inks, waste paints, and organic paint sludges containing metals.
4. Funeral services produce formalin, formaldehyde, and ammonia.
5. Upholstery and furniture repair businesses produce oil, stripping compounds, wood preservatives and solvents.

Professional Services

NAICS 52xxxx: *Finance and Insurance*

NAICS 54xxxx: *Professional, Scientific, and Technical Services*

NAICS 55xxxx: *Management of Companies and Enterprises*

NAICS 561xxx: *Administrative and Support Services*

NAICS 61xxxx: *Education Services*

NAICS 62xxxx: *Health Care and Social Assistance*

NAICS 71xxxx: *Arts, Entertainment, And Recreation*

NAICS 72xxxx: *Accommodation and Food Services*

NAICS 8121xx: *Personal Care Services*

NAICS 8129xx: *Other Personal Services*

NAICS 813xxx: *Religious, Grantmaking, Civic, Professional, & Similar Organization*

Description: The remaining service businesses include theaters, hotels/motels, finance, banking, hospitals, medical/dental laboratories, medical services, nursing homes, schools/universities, and legal, financial and engineering services. Stormwater from parking lots will contain undesirable concentrations of oil & grease, suspended particulates, and metals such as lead, cadmium and zinc. Dangerous wastes might be generated at hospitals, nursing homes and other medical services.

Potential Pollutant Generating Sources: The primary concern is runoff from high use parking areas, spills from vehicle or equipment fueling or repair at maintenance shops, loading/unloading areas, and storage and handling of dangerous wastes.

Vehicle Maintenance and Repair

NAICS 8111xx: *Automotive Repair and Maintenance*

NAICS 8113xx: *Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance*

Description: This category includes businesses that paint, repair and maintain automobiles, motorcycles, trucks, and buses and battery, radiator, muffler, lube, tune-up and tire shops, excluding those businesses listed elsewhere in this manual.

Potential Pollutant Generating Sources: Pollutant sources include storage and handling of vehicles, solvents, cleaning chemicals, waste materials, vehicle liquids, batteries, and washing and steam cleaning of vehicles, parts, and equipment. Potential pollutants include waste oil, solvents, degreasers, antifreeze, radiator flush, acid solutions with cadmium, chromium, copper, lead, and zinc, brake fluid, soiled rags, oil filters, sulfuric acid and battery sludge, and machine chips in residual machining oil.

Multifamily Residences

NAICS 53111x: *Lessors of Residential Buildings and Dwellings*

NAICS 531311: *Residential Property Managers*

NAICS 7213xx: *Rooming and Boarding Houses, Dormitories, and Workers' Camps*

Description: Multifamily residential buildings such as apartments and condominiums. The activities of concern are vehicle parking, vehicle washing, oil changing, minor repairs, and temporary storage of garbage.

Potential Pollutant Generating Sources: Stormwater contamination can occur at vehicle parking lots and from washing of vehicles. Runoff from parking lots may contain undesirable concentrations of oil & grease, TSS, and metals such as cadmium, lead, and zinc.

Construction Businesses

NAICS 23xxxx: *Construction*

NAICS 5617xx: *Services to Buildings and Dwellings*

NAICS 562xxx: *Waste Management and Remediation Services*

Description: This category includes builders of homes, commercial and industrial buildings, and heavy equipment as well as plumbing, painting, paper hanging, carpentry, electrical, roofing and sheet metal, wrecking and demolition, stonework, drywall, and masonry contractors. It does not include construction sites.

Potential Pollutant Generating Sources: Potential pollutant sources include leaks/spills of used oils, solvents, paints, batteries, acids, strong acid/alkaline wastes, paint/varnish removers, tars, soaps, coatings, asbestos, lubricants, anti-freeze compounds, litter, and fuels at the headquarters, operation, staging, and maintenance/repair locations of the businesses.

Demolition contractors may store reclaimed material before resale. Roofing contractors generate residual tars and sealing compounds, spent solvents, kerosene, and soap cleaners, as well as non-dangerous waste roofing materials. Sheet metal contractors produce small quantities of acids and solvent cleaners such as kerosene, metal shavings, adhesive residues, enamel coatings, and asbestos residues that have been removed from buildings. Asphalt paving contractors are likely to store application equipment such as dump trucks, pavers, tack coat tankers and pavement rollers at their businesses. Stormwater passing through this equipment may be contaminated by the petroleum residuals. Potential pollutants include BOD, COD, heavy metals, oil & grease, organic compounds, pH, TSS, etc.

5. Public Agency Activities

Introduction

Local, state, and federal governments conduct many of the pollutant generating activities conducted at business facilities. Local governments include cities and counties, also single-purpose entities such as fire, sewer and water districts.

Public Facilities and Streets

Description: Included in this group are public buildings. Also included are maintenance (deicing), and repair of streets and roads.

Potential Pollutant Generating Sources: Wastes generated include deicing and anti-icing compounds, solvents, paint, acid and alkaline wastes, paint and varnish removers, and debris. Large amounts of scrap materials are also produced throughout the course of construction and street repair. Potential pollutants include suspended solids, oil & grease, and low/high pH.

Maintenance of Open Public Space Areas

Description: The maintenance of large open spaces covered by expanses of grass and landscaped vegetation. Examples are zoos and public cemeteries. Golf courses and parks are covered in *S411 BMPs for Landscaping and Lawn / Vegetation Management*.

Potential Pollutant Generating Sources: Maintenance of grassed areas and landscaped vegetation has historically required the use of fertilizers and pesticides. Golf courses contain small lakes that are sometimes treated with algaecides and/or mosquito larvicides. The application of pesticides can lead to inadvertent contamination of nearby surface waters by overuse, misapplication, or the occurrence of storms shortly after application. Heavy watering of surface greens in golf courses may cause pesticides or fertilizers to migrate to surface and shallow ground water resources. The application of pesticides and fertilizers generates waste containers. Equipment must be cleaned and maintained. Maintenance shops where the equipment is maintained must comply with the BMPs specified under *S414 BMPs for Maintenance and Repair of Vehicles and Equipment*.

Maintenance of Public Stormwater Pollutant Control Facilities

Description: Facilities include roadside catch basins on arterials and within residential areas, conveyance pipes, detention facilities such as ponds and vaults, oil and water separators, biofilters, settling basins, infiltration systems, and all other types of stormwater Runoff Treatment BMPs presented in Volume V.

Potential Pollutant Generating Sources: Research has shown that roadside catch basins can remove from 5 to 15 percent of the pollutants present in stormwater. However, to be effective they must be cleaned. Research has indicated that once catch basins are about 60 percent full of sediment, they cease removing sediments. Generally, in urban areas, catch basins become 60 percent full within 6 to 12 months.

Water and solids produced during the cleaning of stormwater treatment systems, including oil/water separators, can adversely affect both surface and ground water quality if disposed improperly. Ecology has documented water quality violations and fish kills due to improper disposal of decant water (water that is removed) and catch basin sediments from maintenance activities. Disposal of decant water and solids shall be conducted in accordance with local, state, and federal requirements.

Historically, decant water from trucks has been placed back in the storm drain. Solids have been disposed in permitted landfills and in unpermitted vacant land including wetlands. Research has shown that these residuals contain pollutants at concentrations that exceed water quality criteria. For example, limited sampling by King County and the Washington State Department of Transportation of sediments removed from catch basins in residential and commercial areas has found the petroleum hydrocarbons to frequently exceed 200 mg/gram. Above this concentration, regulations require disposal at a lined landfill.

Water and Sewer Districts and Departments

Description: The maintenance of water and sewer systems can produce residual materials that, if not properly handled, can cause short-term environmental impacts in adjacent surface and/or ground waters. With the exception of a few simple processes, both water and sewage treatment produce residual sludge that must be disposed properly. However, this activity is controlled by other Ecology regulatory programs and is not discussed in this manual. Larger water and sewer districts or departments may service their own vehicles.

Potential Pollutant Generating Sources: Maintenance operations of concern include the cleaning of sewer, water lines, and water reservoirs, general activities around treatment plants, disposal of sludge, and the temporary shutdown of pump stations for either normal maintenance or emergencies. During the maintenance of water transmission lines and reservoirs, water district/departments must dispose of wastewater, both when the line or reservoir is initially emptied, as well as when it is cleaned and then sanitized. Sanitation requires chlorine concentrations of 25 to 100 ppm, considerably above the normal concentration used to chlorinate drinking water. These waters are discharged to sanitary sewers where available.

However, transmission lines from remote water supply sources often pass through both rural and urban-fringe areas where sanitary sewers are not available. In these areas, chlorinated water may need to be discharged to a nearby stream or storm drain, particularly since the emptying of a pipe section occurs at low points that frequently exist at stream crossings. Although prior to disposal the water is dechlorinated using sodium thiosulfate or a comparable chemical, malfunctioning of the dechlorination system can kill fish and other aquatic life. The drainage from reservoirs located in unsewered areas is conveyed to storm drains. The cleaning of sewer lines and maintenance holes generates sediments. These sediments contain both inorganic and organic materials and may be contaminated with microorganisms and heavy metals. Activities around sewage treatment plants can be a source of non-point pollution. Besides the normal runoff of stormwater from paved surfaces, grit removed from the headworks of the plant is stored temporarily in dumpsters that may be exposed to the elements. Maintenance and repair shops may produce waste paints, used oil, cleaning solvents, and soiled rags.

Port Districts

Description: The port districts considered here include the following business activities: recreational boat marinas and launch ramps, airfields, container trans-shipment, bulk material import/export including farm products, lumber, logs, alumina, cement; and break-bulk (piece) material such as machinery, equipment, and scrap metals. Port districts frequently have tenants whose activities are not marine-dependent.

Potential Pollutant Generating Sources: Marine terminals require extensive use of mobile equipment that may drip liquids. Waste materials associated with containers/vehicle/equipment washing/steam cleaning, maintenance and repair may be generated at a marine terminal. Debris can accumulate in loading/unloading or open storage areas, providing a source of stormwater contamination. Wooden debris from the crating of piece cargo crushed by passing mobile loading equipment leaches soluble pollutants when in contact with pooled stormwater. Log sorting yards produce large quantities of bark that can be a source of suspended solids and leached pollutants. Potential pollutants include oil & grease, heavy metals, organics, and TSS.

Appendix IV-B: Management of Street Waste Solids and Liquids

Introduction

This appendix addresses street waste as defined in *chapter 173-350 WAC*, Solid waste handling standards. *WAC 173-350* is the governing rule for management of typical street waste solids. Ecology adopted revisions to this rule that became effective September 1, 2018, in part to provide clarity on managing soils impacted by release of contaminants, such as street waste. Ecology has solid waste guidance to help ensure handlers of street waste manage it in accordance with *WAC 173-350*. End users and other authorities may have their own requirements for street waste reuse and handling.

Per *WAC 173-350*:

- **"Street waste"** means solids or dewatered materials collected from stormwater catch basins and similar stormwater treatment and conveyance structures, and materials collected during street and parking lot sweeping.

"Street waste," as defined here, does not include solids and liquids from street washing using detergents, cleaning of electrical vaults, vehicle wash sediment traps, restaurant grease traps, industrial process waste, sanitary sewage, mixed process, or combined sewage/stormwater wastes. Wastes from oil/water separators at sites that load fuel are not included as street waste. Street waste also does not include flood debris, landslide debris, and chip seal gravel.

Regulations for Street Waste Management

Street waste is solid waste. While street waste from routine road maintenance is likely not dangerous waste, it is presumed to be solid waste under *WAC 173-350*. This Rule classifies Street Waste as a likely "contaminated soil," which is included in the definition of "solid waste." Since stormwater conveyance structures are places where contaminants from streets can accumulate at concentrations that could be harmful for indiscriminate placement, material from such structures is presumed to be "contaminated soil."

- Per *WAC 173-350*:
  - **"Contaminated soil"** means soil containing one or more contaminants from a release and when moved from one location to another for placement on or into the ground:
    a. Contains contaminants at concentrations that exceed a cleanup level under *chapter 173-340 WAC*, Model Toxics Control Act—Cleanup, that would be established for existing land use at the location where soil is placed; or
    b. Contains contaminants that affect pH, and pH of the soil is below 4.5 or above 9.5 or is not within natural background pH limits that exist at the location where soil is placed.

    Unless excluded in *WAC 173-350-020*, contaminated soil is solid waste and must be managed at a solid waste handling facility in conformance with this chapter or *chapter 173-351 WAC*, Criteria for municipal solid waste landfills. Characterization of material may be required based on solid waste facility acceptance standards. Examples of potentially contaminated soil may include, but are not limited to, street waste, petroleum contaminated soil, engineered soil, and soil likely to have contaminants from a release associated with industrial or historical activities.

Based on test results, street waste to contain contaminants at concentrations that would require either disposal at a permitted solid waste disposal facility, or treatment at a permitted solid waste handling facility for use.

Owners/operators storing or treating street waste prior to disposal or use are typically subject to permitting under the section in *WAC 173-350* dealing with "piles used for storage and treatment," since most storage and treatment takes place in outdoor piles. Indoor or other storage or treatment is subject to permitting under the section dealing with "transfer stations and drop boxes." To obtain a permit, an owner/operator will need to meet design standards, operating requirements, including characterization procedures and concentration limits if propose to use materials, and record keeping and reporting.

Note: Decant facilities are not subject to solid waste permitting if they will not have intermediate storage or treatment of decanted solids between the decant part of a facility operating in conformance with water quality rules and placement into transfer vehicles going to permitted solid waste facilities.

Street waste solids may contain contaminants at levels too high to allow unrestricted use. Street waste will need to meet the definition in *WAC 173-350* for "clean soil" in order for its management or use outside of permitted solid waste handling facilities. "Clean soil" is tied to meeting contaminant concentrations so as not to create a cleanup site where placement of materials would occur.

Per *WAC 173-350*:

- **"Clean soil"** means soil that does not contain contaminants from a release. It also includes soil that contains one or more contaminants from a release and when moved from one location to another for placement on or into the ground:
    a. Does not contain contaminants at concentrations that exceed a cleanup level under *chapter 173-340 WAC*, Model Toxics Control Act—Cleanup, that would be established for existing land use at the location where soil is placed; or
    b. Contains contaminants that affect pH, but pH of the soil is between 4.5 and 9.5 or within natural background pH limits that exist at the location where soil is placed.
    c. Examples of potentially clean soil may include, but are not limited to, soil from undeveloped lands unlikely to have impacts from release of contaminants associated with area-wide or local industrial or historical activities. This includes similar soils over which development may have occurred, but land use is unlikely to have led to a release, such as use for residential housing, or over which development provided protection from impacts from a release, such as coverage by pavement. Soil with substances from natural background conditions, as natural background is defined in *WAC 173-350-100*, is clean soil under this section.

Street waste that will go directly to a permitted landfill or transfer station is not subject to the standards of *WAC 173-350*, though operators will need to adhere to receiving facility acceptance criteria. For street waste that will not go directly to a permitted landfill or transfer station, an operator needs to consult with their jurisdictional health department to see what solid waste regulations apply to street waste management. In Washington, *chapter 70.95 RCW*, Solid waste management – Reduction and recycling, gives jurisdictional health departments primary authority over solid waste handling and permitting.

As stated earlier, guidance will be available soon with more specificity on how to manage "contaminated soil" under the recently revised *WAC 173-350*.

Contaminants in Street Waste Solids

Street waste does not typically classify as dangerous waste. The owner of the stormwater facility and/or collector of street waste is considered the waste generator and responsible for deciding whether the waste designates as dangerous waste. However, sampling has historically shown that material from routine maintenance of roads and stormwater facilities does not classify as dangerous waste.

It is possible that street waste from spill sites has high enough concentration of contaminants to classify it as dangerous waste. Street waste suspected to be dangerous waste should not be collected with other street waste to avoid creating a larger volume of dangerous waste. Street waste with obvious contamination (unusual color, staining, corrosion, unusual odors, fumes, and oily sheen) should be left in place or segregated until tested. Base testing activities on probable contaminants. If collecting potentially dangerous waste because of emergency conditions, or if the waste becomes suspect after it is collected, an owner/operator should handle and store it separately until a determination as to proper disposal is made. Dangerous waste must be handled following *chapter 173-303 WAC*, Dangerous waste regulations.

Test results from sampling street waste show that it contains contaminants including total petroleum hydrocarbons (TPH), carcinogenic polycyclic aromatic hydrocarbons (c-PAHs), and several metals. These contaminants can be at concentrations high enough to be harmful to human health and the environment unless managed appropriately. The following tables provide a summary of some past test results.

Table IV-B.1: Typical TPH Levels in Street Sweeping and Catch Basin Solids

Reference	Street Sweeping (mg/kg)	Catch Basin Solid (mg/kg)
Snohomish County (1) (Landau, 1995)	390 - 4300	
King County (1) (Herrera, 1995)		123 - 11049 (Median 1036)
Snohomish County & Selected Cities (1) (W&H Pacific, 1994)	163 - 1500 (Median 760)	163 -1562 (Median 760)
City of Portland (2) (Bretsch, 2000)		MDL - 1830 (Median 208)
City of Seattle - Diesel Range (2) (Seattle Public Utilities and Herrera, 2009)	330 - 520	780 - 1700
City of Seattle - Motor Oil (2) (Seattle Public Utilities and Herrera, 2009)	2000 - 2800	3500 - 7000
Oregon (1) (Collins, 1998)	1600 - 2380	
Oregon (3) (Collins, 1998)	98 - 125	

Reference	Street Sweeping (mg/kg)	Catch Basin Solid (mg/kg)
(1) Method WTPH 418.1; does not incorporate new methods to reduce background interference due to vegetative material (2) Method NWTPH-Dx (3) Method WTPH - HCID		

Table IV-B.2: Typical c-PAH Values in Street Waste Solids and Related Materials

Sample Source	City of Everett					WSDOT	
Analyte	**Street Sweepings**	**Soil**	**3-Way Topsoil**	**Vactor Solids**	**Leaf & Sand**	**Sweepings - Fresh**	**Sweepings - Weathered**
Benzo(a)anthracene	0.1U	0.076U	0.074U	0.21	0.45	0.56	0.40
Chrysene	0.14	0.09	0.074U	0.32	0.53	0.35	0.35
Benzo(b)fluoranthene	0.11	0.076U	0.074U	0.27	0.52	0.43	0.51
Benzo(k)fluoranthene	0.13	0.076U	0.074U	0.25	0.38	0.39	0.40
Benzo(a)pyrene	0.13	0.076U	0.074U	0.26	0.5	0.41	0.33U
Indeno(1,2,3-cd)pyrene	0.1U	0.076U	0.074U	0.19	0.39	NR	NR
Dibenzo(a,h)anthracene	0.1U	0.076U	0.074U	0.081	0.12	0.39	0.33U
Revised MTCA Benzo(a)pyrene [ND=PQL]	0.215	0.134	0.134	0.388	0.727	0.708	0.597
Benzo(a)pyrene [ND = 1/2 PQL]	0.185	0.069	0.067	0.388	0.727	0.708	0.366
Benzo(a)pyrene [See * below]	0.185	0.069	0	0.388	0.727	0.708	0.366
Benzo(a)pyrene [ND = 0]	0.155	0.001	0	0.388	0.727	0.708	0.135
* If the analyte was not detected for any PAH, then ND=0; If analyte was detected in at least 1 PAH, then ND=1/2PQL; If the average concentration (using ND=1/2 PQL) is greater than the maximum detected value, then ND=Maximum value.							

Table IV-B.3: Typical Metals Concentrations in Catch Basin Sediments

PARAMETER	Ecology 1993	Thurston 1993	King County 1995	King county 1995	City of Seattle 2003 through 2011
Metals: Total (mg/kg)	(Min - Max)	(Min - Max)	(Min - Max)	Mean	Min - Max (Mean)
As	< 3 - 24	.39 - 5.4	4 -56	0.250	<5 - 50 (9.3)
Cd	0.5 - 2.0	< 0.22 - 4.9	0.2 - 5.0	0.5	
Cr	19 - 241	5.9 - 71	13 - 100	25.8	
Cu	18 - 560	25 - 110	12 - 730	29	9.1 - 3,280 (166)
Pb	24 - 194	42 - 640	4 - 850	80	3 - 3,690 (154)
Ni	33 - 86	23 - 51	14 - 41	23	
Zn	90 - 558	97 - 580	50 - 2000	130	44 - 4170 (479)
Hg	0.04 - 0.16	0.24 - 0.193			<0.03 - 3.8 (0.16)

Table IV-B.4: Pollutants in Catch Basin Solids - Comparison to Dangerous Waste Criteria

PARAMETER	Range of Values in Catch Basin Waste	Range of Values in Catch Basin Waste	Dangerous Waste Criteria
METALS	Total Metals (mg/kg)	TCLP Metals (mg/kg)	TCLP values (mg/l)
As	<3 - 56	< 0.02 - 0.5	5.0
Cd	< 0.22 - 5	0.0002 - 0.03	1.0
Cr	5.9 - 241	0.0025 - 0.1	5.0
Cu	12 - 730	0.002 - 0.88	none
Pb	4 - 850	0.015 - 3.8	5.0
Ni	23 - 86	< 0.01 - 0.36	none
Zn	50 - 2,000	0.04 - 6.7	none
Hg	0.02 - 0.19	0.0001 - 0.0002	0.2
Data from (Thurston County, 1993), (Herrera, 1995) and (Serdar, 1993)			

Street Waste Liquids

General Procedures:

Street waste collection should emphasize retention of solids in preference to liquids. Street waste solids are the principal objective in street waste collection and are substantially easier to store and treat than liquids.

Street waste liquids require treatment before their discharge. Street waste liquids, which include eductor and street sweeping truck decant and drainage from piles and containers, usually contain high amounts of suspended and total solids and adsorbed metals. Treatment requirements depend on the discharge location.

The entity responsible for operation and maintenance of the system must approve discharges to sanitary sewer and storm sewer systems. Ecology will not generally require waste discharge permits for discharge of stormwater decant to sanitary sewers or to stormwater treatment BMPs constructed and maintained in accordance with this manual.

Listed below is the required order of preference for disposal of liquid from collection of Street Wastes.

1. **Discharge of Street Waste liquids to a municipal sanitary sewer connected to a Public Owned Treatment Works (POTW).** Discharge to a municipal sanitary sewer requires the approval of the sewer authority. Approvals for discharge to a POTW will likely contain pretreatment, quantity, and location conditions to protect the POTW. Following the local sewer authority's conditions is a permit requirement.
2. **Discharge of Street Waste liquids may be allowed into a Basic or Enhanced Runoff Treatment BMP, if option 1 is not available.** Only discharge street waste liquid into the storm sewer system under the following conditions:
    - The preferred disposal option of discharge to sanitary sewer is not reasonably available.
    - The discharge is to a Basic or Enhanced Runoff Treatment BMP. If pretreatment does not remove visible sheen from oils, the Runoff Treatment BMP must be able to prevent the discharge of oils causing a visible sheen.
    - The discharge from the eductor truck is as near to the inlet of the Runoff Treatment BMP as practical, to minimize contamination or recontamination of the collection system.
    - The storm sewer system owner/operator has granted approval and has determined that the Runoff Treatment BMP will accommodate the increased loading. Part of the approval process may include pretreatment conditions to protect the Runoff Treatment BMP. Following local pretreatment conditions is a requirement of this permit.
    - Ecology must approve in advance flocculants for the pretreatment of street waste liquids. The liquids must be non-toxic under the circumstances of use.

    The discharger shall determine if reasonable availability of sanitary sewer discharge exists, by evaluating such factors as distance, time of travel, load restrictions, and capacity of the Runoff Treatment BMP.
3. **Operators may return water removed from stormwater ponds, vaults, and oversized catch basins to the storm sewer system.** Stormwater ponds, vaults, and oversized catch basins contain

substantial amounts of liquid, which hampers the collection of solids and poses problems in hauling the removed waste away from the site. Water removed from these facilities may be discharged back into the pond, vault, or catch basin provided:

- Operators may discharge clear water removed from a stormwater treatment structure directly to a down gradient cell of a treatment pond or into the storm sewer system.
- Turbid water may be discharged back into the structure it was removed from if the removed water has been stored in a clean container (eductor truck, Baker tank, or other appropriate container used specifically for handling stormwater or clean water); and there will be no discharge from the treatment structure for at least 24 hours.
- The storm sewer system owner/operator must approve the discharge.

Table IV-B.5: Typical Street Waste Decant Values Compared to Surface Water Quality Criteria

PARAMETER	State Surface Water Quality Criteria		Range of Values Reported	
METALS	**Freshwater Acute (ug/l - dissolved metals)**	**Freshwater Chronic (ug/l - dissolved metals)**	**Total Metals (ug/l)**	**Dissolved Metals (ug/l)**
Arsenic	360	188	100 - 43,000	60 - 100
Cadmium*	2.73	0.84	64 - 2,400	2 - 5
Chromium (total)			13 - 90,000	3 - 6
Chromium (III)*	435	141		
Chromium (VI)	0.5	10		
Copper*	13.04	8.92	81 - 200,000	3 - 66
Lead*	47.3	1.85	255 - 230,000	1 - 50
Nickel*	1114	124	40 - 330	20 - 80
Zinc*	90.1	82.3	401 - 440,000	1,900 - 61,000
Mercury	2.10	0.012	0.5 - 21.9	
**Hardness dependent; hardness assumed to be 75 mg/L*				

Table IV-B.6: Typical Values for Conventional Pollutants in Street Waste Decant

PARAMETER	Ecology 1993	(Min - Max)	King County 1995	(Min - Max)
Values as mg/l; except where stated	**Mean**		**Mean**	
pH	6.94	6.18 - 7.98	8	6.18 - 11.25
Conductivity (umhos/cm)	364	184 - 1,110	480	129 - 10,100
Hardness (mg/l CaCO3)	234	73 - 762		
Fecal Coliform (MPN/100 ml)	3,000			

PARAMETER	Ecology 1993	(Min - Max)	King County 1995	(Min - Max)
Values as mg/l; except where stated	**Mean**		**Mean**	
BOD	151	28 - 1,250		
COD	900	120 - 26,900		
Oil & Grease	11	7.0 - 40	471	15 - 6,242
TOC	136	49 - 7,880	3,670	203 - 30,185
Total Solids	1,930	586 - 70,400		
Total Dissolved Solids	212	95 - 550		
Total Suspended Solids	2,960	265 - 111,000		
Settleable Solids (ml/l/hr)	27	2 - 234	57	1 - 740
Turbidity (ntu)	1,000	55 - 52,000	4,673	43 - 78,000

Table IV-B.7: Street Waste Decant Values Following Settling

PARAMETER; Total Metals in mg/l	Portland - Inverness Site Min - Max	King County - Renton Min - Max	METRO Pretreatment Discharge Limits
Arsenic	0.0027 - 0.015	< MDL - 0.12	4
Cadmium	0.0009 - 0.0150	< MDL - 0.11	0.6
Chromium	0.0046 - 0.0980	0.017 - 0.189	5
Copper	0.015 - 0.8600	0.0501 - 0.408	8
Lead	0.050 - 6.60	0.152 - 2.83	4
Nickel	0.0052 - 0.10	0.056 - 0.187	5
Silver	0.0003 - 0.010	< MDL	3
Zinc	0.130 - 1.90	0.152 - 3.10	10
Settleable Solids; ml/L	No Data	0.02 - 2.0	7
Nonpolar FOG	5.7 - 25	5 - 22	100
Ph (std)	6.1 - 7.2	6.74 - 8.26	5.0 - 12.0
TSS	2.8 - 1310		
Recorded Total Monthly Flow; Gallons	Data not available	31,850 - 111,050	
Recorded Max. Daily Flow; Gallons	Data not available	4,500 - 18,600	25,000 GPD

PARAMETER; Total Metals in mg/l	Portland - Inverness Site Min - Max	King County - Renton Min - Max	METRO Pretreatment Discharge Limits
Calculated Average Daily Flow; GPD	Data not available	1,517 - 5,428	
1) Data from King County's Renton Facility (data from 1998 - 1999) and the City of Portland's Inverness Site (data from 1999 - 2001); detention times not provided			

Collection Site Assessment

Ecology suggests a collection site assessment to identify spills or locations that potentially contain dangerous wastes.

The collection site assessment will aid in determining if waste is a dangerous waste and in deciding what to test for if dangerous waste is suspected. The collection site assessment will also help determine if the waste meets the requirements of the receiving facility.

There are three steps to a collection site assessment:

1. A **historical review** of the site for spills, previous contamination and nearby cleanup sites or dangerous waste facilities.

   The historical review will be easier if done on an area wide basis prior to scheduling any waste collection. The historical review should be more thorough for operators who have never collected waste at the site before. At a minimum, the historical review should include operator knowledge of the area's collection history or records from previous waste collections.

   Private operators should ask the owner of the site for records of previous contamination and the timing of the most recent cleaning. Ecology's Hazardous Substance Information Office maintains a Toxic Release Inventory and a Facility/Site Database, tracking more than 15,000 sites.

   Ecology's online Facility/Site Database is available at *www.ecy.wa.gov/fs/*.

   The database allows anyone with web-access to search for facility information by address, facility name, town, zip code, and SIC code, etc. It lists why Ecology is tracking each one (NPDES, TSCA, RCRA, Clean Air Act, etc.), as well as who to call within Ecology to find out more about the given facility. EPA's toxic release website is *http://iaspub.epa.gov/triexplorer/tri_release.chemical*

2. A **visual inspection** for potential contaminant sources such as a past fire, leaking tanks and electrical transformers, and surface stains.

   Take a look at the area for contaminant sources prior to collection of the waste. If the inspection finds a potential contaminant source, delay the waste collection until the potential contaminant is assessed.

   A second portion of the visual inspection is a good housekeeping assessment of the area. Locations with poor housekeeping commonly cut corners in less obvious places. Inspect these sites in greater detail for illegal dumping and other contamination spreading practices.

3. **Sweeping route, catch basin, waste, and container inspection** before and during collection.

   The inspection of the waste and catch basin or vault is the last and perhaps most critical step in the collection site assessment.

For example, if the stormwater facility has an unusual color in or around it, then it is possible someone dumped something near it or into it. Some colors to be particularly wary of are yellow/green from antifreeze dumping and black and rainbow sheen from oil and/or grease dumping. In addition, if the inspector observes any staining or corrosion, then a solvent may have been dumped.

Fumes are also good indicators of potential contamination. Avoid deliberate smelling of catch basins for worker safety, but suspicious odors may be encountered from catch basins thought to be safe. Some suspicious odors are rotten eggs (hydrogen sulfide is present), gasoline or diesel fumes, or solvent odors. If unusual odors are noted, contact a dangerous waste inspector before cleaning the basin.

Finally, operator experience is the best guide to avoid collection of contaminated waste.

Appendix IV-C1:

Residential Pollution Source Control Program Template

Pollution Source Control Program

A Pollution Prevention Manual For Residents of

[Plat or Neighborhood Name]

Date: *[Date the program was prepared]*

Legal Description: *[abbreviated form; include lot numbers, blocks, etc.; may use assessor's tax parcel number if not part of a plat, such as a single lot]*

Program Operator*: [The person or group, such as a Home Owner Association, responsible for administering the program]*

Watershed*: [Enter the Watershed or Basin the property is located within]*

Program Document Prepared by*: [The person or company preparing this plan]*

Table of Contents

1.0 Introduction

About this Manual

Thurston County's water resources – its streams, lakes, wetlands, groundwater, and Puget Sound – play an important role in the quality of life we enjoy. They provide us with recreation, drinking water, support tourism and salmon, and are used by industry. These waters, however, are vulnerable to pollution from a wide variety of human activities.

This manual applies to those residential properties and activities within the City of Olympia and its Urban Growth Area (UGA) that have the potential to contribute pollutants to stormwater runoff or directly to receiving waters. Stormwater runoff may seep into the ground, empty into a storm drain or a drainage ditch, or flow over the ground surface. Regardless of the way runoff leaves your site, it ends up in a stream river, lake, wetland, groundwater, or Puget Sound.

Contaminated stormwater can negatively affect every water body it enters. Therefore, this manual provides detailed information on what you can do to reduce the contamination of surface water, groundwater, and stormwater from your property.

Many of our water pollution problems are due in large part to pollutants washed off the land surface by storms. The quality of "stormwater" from residential properties is an increasing concern nationwide. Many people believe that stormwater is "clean" and does not harm water quality. This perception is understandable since the amount of pollution from any one place is not usually significant by itself. However, when all these small amounts are combined, they can cause significant pollution problems.

The federal Clean Water Act mandates that cities and counties control the quality of stormwater runoff. One way to achieve this is to implement pollution prevention measures on individual properties. By following the "Best Management Practices" described in this manual you can do your part to protect our streams, groundwater, and Puget Sound.

Best Management Practices … What are They?

Best Management Practices (BMPs) are a set of activities designed to reduce stormwater pollution. BMPs are separated into two broad categories: ***source control*** and ***treatment***.

Source Control BMPs

Source control **BMPs** prevent contaminants from entering stormwater runoff by controlling them at the source. Some source control BMPs are operational, such as checking regularly for leaks and drips from equipment and vehicles, covering materials that have potential to add pollutants to surface water if rainwater comes in contact with the materials, cleaning up pet waste, and minimizing use of pesticides, fertilizers, and insecticides. Other source control BMPs require use of a structure to prevent rainwater from contacting materials that will contaminate stormwater runoff such as provide a covered area or berm to prevent clean stormwater from entering work or storage areas.

Treatment BMPs

In contrast, ***treatment*** **BMPs** are structures that treat stormwater to remove contaminants. Treatment BMPs typically require elaborate planning, engineering design, and construction. A stormwater pond for your subdivision is an example of a *treatment BMP.* No treatment BMP is capable of removing 100 percent of the contaminants in stormwater; the less contaminant in stormwater prior to the treatment BMP, the more effective the BMP is.

Also remember that, just because there is a stormwater collection system where you live, it does not necessarily mean that the stormwater is treated. Many developments were created prior to requirements to treat stormwater. The runoff from your property may go directly or indirectly to a stream or wetland without any treatment.

This manual will focus on *source control* BMPs applicable to the routine practices of most owners of a single-family residence.

What is in This Manual?

This manual has been developed for the owners of single-family residences. If you are trying to get a building permit to construct a new home you may be required to submit a copy of this manual, or its equivalent, as part of your permit application and then record it with the Thurston County Auditor's office prior to receiving final approval of your project.

The manual is divided into three sections as follows:

- **Introduction**
- **General Principles of Pollution Prevention**
- **Best Management Practices for Single-Family Residences**

The general principles and best management practices described are based on the requirements of the *City of Olympia Drainage Design and Erosion Control Manual*, Volume IV.

This plan focuses on *source control* BMPs applicable to the routine practices and activities expected for a typical single-family residence.

2.0 Stormwater Facilities in Your Neighborhood and on Your Lot

[Use this section to provide a description of the site/plat/lot and the stormwater structures and facilities found in the subdivision or on individual lots (such as rain gardens or LID features). This description should include the areas that the program covers and locations of the permanent stormwater structures and inlets should be identified. The ultimate destination of stormwater runoff, the tributary watershed, or potential pollutants should be clearly described. The location of natural and/or man-made drainage paths where pollutants may potentially leave the site shall be included here. Provide maps, drawings, or figures of the site as an attachment to this program if necessary. If applicable, include a sample plot plan for individual residences/lots. This plot plan is especially important for lots with LID stormwater features such as rain gardens, dispersal areas, and downspout infiltration, as these features are part of the overall stormwater management system and design for the site.]

3.0 General Principles of Pollution Prevention

This section describes simple pollution prevention principles that every homeowner should consider. Most of these are common sense, "housekeeping" types of solutions. With collective action by individuals throughout the City of Olympia implementing these principles, the improvement in water quality can be substantial. There are 15 general principles of pollution prevention.

1. Avoid the activity or reduce its occurrence

Avoid potentially polluting activity or do it less frequently, especially if it takes place outdoors. Apply lawn care chemicals following directions and only as needed. Do not apply herbicides right before it rains.

2. Move the activity indoors

Move a potentially polluting activity indoors out of the weather. This prevents runoff contamination and provides more control for a cleanup if a spill occurs. For example, unload and store chemicals inside a garage area or shed instead of outside. Be safe and ensure any storage area is well ventilated and required building and fire code requirements are met.

3. Cleanup spills quickly

Promptly contain and cleanup solid and liquid pollutant leaks and spills on any exposed soil, vegetation, or paved area. Use readily available absorbents such as kitty litter to absorb spills and then sweep up the material and dispose of it in the garbage. Promptly repair or replace leaking connections, pipes, hoses, valves, etc. on vehicles and equipment you own.

4. Use less material

Do not buy or use more material than you really need. Not only does this help keep potential disposal, storage, and pollution problems to a minimum, but may save money too.

5. Use the least toxic materials available

Investigate the use of materials that are less toxic. For example, replace a caustic-type detergent or solvent with a more environmentally friendly product. Even if you do switch to a biodegradable product, remember that only uncontaminated water is allowed to enter the stormwater drainage system.

6. Create and maintain vegetated areas near activity locations

Vegetation can filter pollutants out of stormwater. Route stormwater from parking and work areas through vegetated areas. Remember that wastewater other than stormwater runoff, such as wash water, must be discharged to a wastewater collection system (sewer or septic system), and may not be discharged to a storm drainage system.

7. Locate activities as far as possible from surface drainage paths

Activities located as far as possible from known drainage paths such as ditches, streams, other water bodies, and storm drains will be less likely to pollute, since it will take longer for material to reach the drainage features. This give more time to react to a spill, or if it is a "housekeeping" issue, may protect the local waters long enough for you to clean up the area around the activity. Do not forget that groundwater protection is important throughout the City of Olympia and Thurston County, no matter where the activity is located, so the actions you take on a day-to-day basis area are always important, even in dry weather.

8. Maintain stormwater drainage systems

Pollutants can concentrate over time in storm drainage facilities such as catch basins, ditches, and storm drains. When a large storm event occurs, turbulent runoff can mobilize these pollutants and carry them to receiving waters. By performing regular maintenance on stormwater facilities located on your property, you can prevent this from occurring. Also, repair or replace cracked or otherwise damaged pavement in parking areas and any other drainage areas that are subject to pollutant material leaks or spills.

9. Reduce, reuse, and recycle as much as possible

Look for ways to recycle instead of just disposing. This saves money and keeps hazardous and non-hazardous materials out of landfills. Contact City of Olympia Waste Resources for more information on recycling and organic disposal opportunities.

10. Be an advocate for stormwater pollution prevention

Help friends, neighbors, and business associates find ways to reduce stormwater pollution in their activities. Most people want clean water and do not pollute intentionally. Share your ideas and the BMPs in this manual to get them thinking about how their everyday activities affect water quality.

11. Report problems

We all must do our part to protect water, fish, wildlife, and our own health by implementing proper BMPs, and reporting water quality problems that we observe. In the City of Olympia, call the Water Resources Division of the Public Works Department at (360)753-8333 to report dumping to storm drains or ditches.

12. Provide oversight and training

Talk to the members of your family, or if you are a landlord talk to your tenants, to ensure they understand the pollution prevention source control measures and BMPs described in this manual. If you are a landlord monitor the activities of your tenants to ensure that they are carrying out the principles of this manual.

13. Dust control

Sweep paved parking and storage areas regularly to collect and dispose of dust and debris that could contaminate stormwater. Do not hose down pollutants from any area to the ground, storm drain, conveyance ditch or any receiving water (stream, wetland, lake, etc.). Do not use used oils or other petroleum products for dust control. Volumes of water used for light watering for dust control of dirt driveways or gravel roads should be conducted to prevent any runoff of stormwater from the surface.

14. Eliminate illicit connections

A common problem with the stormwater drainage system for most communities is the existence of illicit connections of wastewater to the storm drainage system. Many businesses and residences have internal building drains, sump overflows, sump pumps, garage and outdoor sinks and showers, and even sanitary sewer and septic system pipes that were inadvertently connected to the nearby storm drainage system in the past.

Examine the plumbing system for your home to determine if illicit connections exist. Any time it is found that toilets, sinks, appliances, showers and bathtubs, floor drains, industrial process waters, and/or other indoor activities are connected to the stormwater drainage system; these connections must be immediately rerouted to the sanitary or septic system, holding tanks, or process treatment system. For assistance in methods to detect and eliminate illicit connections contact the City of Olympia Public Works - Water Resources Division at (360)753-8333.

15. Dispose of waste properly

Every business and residence in City of Olympia must dispose of solid and liquid wastes and contaminated stormwater properly. There are generally four options for disposal depending on the type of materials. These options include:

- Sanitary sewer
- Recycling facilities
- Municipal solid waste disposal facilities
- Hazardous waste treatment, storage and disposal facilities.

Prior to disposing of any wastes to the City of Olympia sanitary sewer system, you should verify the material is not listed as a Prohibited Discharge under Olympia Municipal Code, Section 13.20.050.

4.0 Best Management Practices for Single Family Residences

The actions we take each day in and around our homes have a profound effect on surface water quality and fish habitat. Stormwater goes directly to our groundwater, lakes, streams, and Puget Sound. It does not go to the wastewater treatment plant – any pollutants that get into stormwater can go directly to surface or ground water. Small amounts of pollution from many different sources can significantly affect our waterways.

Stormwater BMPs discussed in this section are practical ways to keep stormwater from becoming polluted in the first place. It is recommended that all residents in the City of Olympia use these BMPs. **Please note that some of these procedures are required by various state, county, or city laws, and are noted as required BMPs.**

This section provides a general list of activities typically conducted by homeowners and describes the BMPs that may be required or recommended to prevent stormwater pollution. The list includes brief information on applicability. More detailed information for the BMPs described in this section can be found in the City of Olympia Drainage Design and Erosion Control Manual, Volume IV or by contacting the City of Olympia Water Resources section of Public Works at (360)753-8333. BMPs for the following activities are described in this section:

1. Automobile Washing
2. Automobile Maintenance
3. Storage of Solid Wastes and Food Wastes
4. Composting
5. Yard Maintenance and Gardening
6. Swimming Pool and Spa Cleaning and Maintenance
7. Household Hazardous Material use, Storage, and Disposal
8. Pet Waste Management
9. Activities in Streams, Wetlands, and Wetlands Buffers
10. Illicit Discharge Detection and Elimination
11. Pest Management and Noxious Weeds

1. Automobile Washing

Many residents wash their cars in the driveway or on the street. Wash waters typically flow to a storm drain or ditch, which discharges stormwater directly to the underlying groundwater or to the nearest

stream, lake, or Puget Sound. Soaps and detergents, even the biodegradable ones, can have immediate and long-term effects on aquatic life in water bodies. The grime washed off the car also contains a variety of pollutants that can harm fish and wildlife.

Suggested BMPs

At Home:

- Wash your car directly over your lawn or make sure the wash water drains to a vegetated area. This allows the water and soap to soak into the ground instead of running off into a local water body.
- Ideally, no soaps or detergents should be used, but if you do use one, select one without phosphates.
- Commercial products are available that allow you to clean a vehicle without water. These were developed for areas where water is scarce, so a water saving benefit is realized, as well as reduced pollution.
- Use a hose nozzle with a shut-off valve to save water.
- Do not wash your car if rain is expected.
- Pour the bucket of soapy, dirty wash water down your sink. This way the water does not pollute surface water. Instead, it is treated at the wastewater treatment plant or by your septic system.

Away from Home:

- Consider not washing your car at home. Take it to a commercial car wash that has a recycle system and discharges wastewater to the sanitary sewer for treatment.

2. Automobile Maintenance

Many of us are “weekend mechanics”. We enjoy the cost savings of changing our own oil and antifreeze, topping off the battery with water, and generally making our car perform its best. There is a lot of potential for stormwater pollution associated with these activities; however, the following BMPs will help you minimize pollution while servicing your car, truck, van, or RV.

Required BMPs

- Recycle all oils, antifreeze, solvents, and batteries. Many local car parts dealers and gas stations accept used oil and oil filters. The Household Hazardous Waste facilities at the Thurston County Waste and Recovery Center accept oil, oil filters, antifreeze, and solvents.
- Never dump new or used automotive fluids or solvents on the ground, in a storm drain or street gutter, or in a water body. Eventually, it will make its way to local surface waters or groundwater, including the water we drink.
- Do not mix wastes. The chlorinated solvents in some carburetor cleaners can contaminate a huge tank of used oil, rendering it unsuitable for recycling. Always keep your wastes in separate containers that are properly labeled and store them out of the weather.

Suggested BMPs

- Fix all leaks, to keep the leaky material off streets and out of surface water.
- To dispose of oil filters, punch a hole in the top and let drain for 24 hours. This is where a large funnel in the top of your oil storage container will come in handy. After draining, wrap in two layers of plastic and dispose of in your regular garbage or recycle by taking it to the Thurston County Waste and Waste and Recovery Center. Call the City of Olympia Department of Public Works at (360) 753-8333 for up-to-date information on the appropriate disposal of consumer products.
- Use care in draining and collecting antifreeze to prevent accidental spills. Spilled antifreeze tastes sweet and can be deadly to animals they ingest it.
- Perform your service activities on concrete or asphalt or over a plastic tarpaulin to make spill cleanup easier. Keep a bag of kitty litter on hand to absorb spills. If there is a spill, sprinkle a good layer on the spill, let it absorb for a little while and then sweep it up. Place the contaminated litter in a plastic bag, tie it up, and dispose of it in your regular garbage. Take care not to leave kitty litter out in the rain; it will form a sticky goop that is hard to clean up.
- If you are doing body work outside, be sure to use a tarpaulin to catch material resulting from grinding, sanding, and painting. Dispose of this waste by double bagging in plastic and placing in your garbage.

3. Storage of Solid and Food Wastes

Improper storage of food and solid waste at residences can lead to not only water pollution problems, but problems with neighborhood pets and vermin as well. Following the BMPs listed below can help keep your property a clean and healthy place to live.

Suggested BMPs

- Recycle as much as you can. City of Olympia residents have access to curbside pickup for yard waste and recyclable materials. Also, look under “recycling” in the phone book for firms that take other recyclables.
- All waste containers kept outside should have lids. If your lid is damaged, please call the City of Olympia Waste Resources department at (360) 753-8340
- Leaking waste containers should be replaced. If your container is damaged, please call your local solid waste hauler.
- Store waste containers under cover if possible, or on grassy areas.
- Inspect the storage area regularly to pick up loose scraps of material and dispose of them properly.
- Purchase products which have the least amount of packaging materials.
- Compost biodegradable materials such as grass clippings and vegetable scraps instead of throwing them away. Call City of Olympia Waste ReSources department at (360)753-8340 for more information on composting or information on yard waste collections. See the section on composting for BMPs relating to that activity.
- A fun alternative to traditional composting is worm composting. You can let worms do all the work for you by keeping a small vermiculture box just outside your kitchen. For more information on getting started with worms, call the number listed above.

4. Composting

Composting is an earth-friendly activity as long as some common sense rules outlined below are followed. If you choose to compost, the following BMPs should be utilized.

Suggested BMPs

- Compost piles must be located on an unpaved area where runoff can soak into the ground or be filtered by grass and other vegetation. Compost piles should be located in an area of your yard not prone to water ponding during storms, and should be kept well away from wetlands, streams, lakes, and other drainage paths.
- Compost piles must be maintained and turned over regularly to work properly. Large piles of unattended compost may create odor and vermin problems.
- Avoid putting hazardous, inorganic, plastics or metal waste in the compost pile.
- Cover the compost pile (See Figure) for two reasons:
    - To keep stormwater from washing nutrients into waterways.
    - To keep excess water from cooling the pile. This slows down the rate of decomposition.
- Build bins of wood, chicken wire, or fencing material to contain compost so it can't be washed away. Visit the City of Olympia website *olympiawa.gov* or contact Olympia Public Works at (360) 753-8333 to get free composter designs and materials lists.
- Building a small earthen dike around your compost pile is an effective means of preventing nutrient-rich compost drainage from reaching stormwater paths.

5. Yard Maintenance and Gardening

This section deals with the normal yard maintenance activities we all perform at our homes. Over watering, over fertilizing, improper herbicide application, and improper disposal of trimmings and clippings can all contribute to serious water pollution problems. Following the BMPs listed below will help alleviate pollutant runoff.

Required BMPs

- Follow the manufacturer's directions exactly for mixing and applying herbicides, fungicides, and pesticides, and use them sparingly. Never apply when it is windy or when rain is expected. Never apply over water, within 100 feet of a well-head, or adjacent to streams, wetlands, or other water bodies. Triple-rinse empty containers, using the rinsate for mixing your next batch of spray, and then double-bag and dispose of the empty container in your regular garbage. Never dispose of grass clippings or other vegetation in or near storm drains, streams, lakes, or Puget Sound.

Suggested BMPs

- Use natural, organic soil amendments when possible. The excellent soil conditioning properties of the organic matter aid water retention in lighter soils and help to break up and aerate heavier soils, so roots can grow better and less watering is needed. It contains both readily available and long term nitrogen and other nutrients commonly lacking in Northwest soils. The slow release of nitrogen better matches the needs of plants. Thus, there is much less potential for nitrates to leach into surface or groundwater due both to less “excess nitrogen” and less water use. Better vegetative growth can also reduce erosion and runoff.
- Follow manufacturer's directions when applying fertilizers. More is not better, either for your lawn or for local water bodies. Never apply fertilizers over water or adjacent to ditches, streams, or other

water bodies. Remember that organic fertilizers have a slow release of nitrogen, and less potential to pollute than synthetic fertilizers.

- Save water and prevent pollution problems by watering your lawn sensibly. Lawns and gardens typically need the equivalent of 1 inch of rainfall per week. You can check on how you're doing by putting a wide mouth jar out where you're sprinkling, and measure the water with a small plastic ruler. Overwatering to the point of runoff can carry polluting nutrients to the nearest water body.
- Consider planting a vegetated buffer zone adjacent to streams or other water bodies on your property. Call the City of Olympia Water Resources - Environmental Services section for advice and assistance in developing a planting plan.
- Reduce the need for pesticides and fertilizers on lawns by improving the health of the soil. Aerating, thatching, and topdressing with compost will improve soil health and help desired grasses compete with weeds and moss. Contact the City of Olympia Water Resources - Environmental Services section for more information about the City's Natural Lawn Care program.
- Make sure all fertilizers and pesticides are stored in a covered location. Rain can wash the labels off bottles and convert 50 pounds of boxed fertilizer into either a solid lump or a river of nutrients.
- Use a mulching mower and mow higher to improve soil/grass health and reduce or eliminate fertilizer and pesticide use.
- Compost all yard clippings, or use them as mulch to save water and keep down weeds in your garden. See Composting section for more information.
- Practice organic gardening and virtually eliminate the need to use pesticides and fertilizers.
- Pull weeds instead of spraying and get some healthy exercise, too. If you must spray, use the least toxic formulations that will get the job done.
- Work fertilizers into the soil instead of letting them lie on the ground surface, exposed to the next rainstorm.
- Plant native vegetation that is suited to Northwest conditions, they require less water and little to no fertilizers and pesticides.
- Contact your local waste disposal company for curbside pickup and recycling of yard waste.
- Invasive weeds and insect pests are a common nuisance to for yards. Consider generating an Integrated Pest Management Plan to control weeds and pests with the least amount of pollution potential.

6. Swimming Pool and Spa Cleaning and Maintenance

Despite the fact that we immerse ourselves in it, the water from pools and spas is far from chemically clean. Nutrients, pH, and chlorine can adversely affect fish and wildlife in water bodies. Following these BMPs will ensure the cleanliness of your pool and the environment.

Required BMPs

- Pool and spa water must be dechlorinated to 0.1 mg/L if it is to be emptied into a ditch or to the stormwater drainage system. Contact your pool chemical supplier to obtain the neutralizing chemicals you will need. The rate of flow into the ditch or drainage system must be regulated so that it does not cause problems such as erosion, surcharging, or flooding. Water discharged to the ground or a lawn must not cross property lines and must not produce runoff.
- If pool and spa water cannot be dechlorinated, it must be discharged to the sanitary sewer. Prior to draining, your local sewer provider must be notified to ensure they are aware of the volume of discharge and the potential effects of chlorine levels. A pool service company can help you determine the frequency of cleaning and backwash of filters.
- Diatomaceous earth used in pool filters cannot be disposed of in surface waters, on the ground, or into stormwater drainage systems or septic systems. Dry it out as much as possible, bag it in plastic, and dispose of at the landfill.

Suggested BMPs

- Hire a professional pool service company to collect all pool water for proper disposal. Make sure to ask them where they will dispose of it and the kind of permits they hold to do so.

7. Household Hazardous Material Use, Storage and Disposal

Once we really start looking around our houses, the amount of hazardous materials we have on site is a real eye-opener. Oil-based paints and stains, paint thinner, gasoline, charcoal starter fluid, cleaners, waxes, pesticides, fingernail polish remover, and wood preservatives are just a few hazardous materials that most of us have around the house.

When products such as these are dumped on the ground or in a storm drain, they can be washed directly to receiving waters where they can harm fish and wildlife. They can also infiltrate into the ground and contaminate drinking water supplies. The same problem can occur if they are disposed of with your regular garbage; the containers can leak at the landfill and contaminate groundwater. The same type of contamination can also occur if hazardous products are poured down a sink or toilet into a septic system. Don't pour them down the drain if you're on municipal sewers, either. Many compounds can “pass through” the wastewater treatment plant without treatment and contaminate receiving waters, or they can harm the biological process used at the treatment plant, reducing overall treatment efficiency.

With such a diversity of hazardous products present in all homes in City of Olympia, a large potential for serious environmental harm exists if improper methods of storage, usage, and disposal are employed. Using the following BMPs will help keep these materials out of our soils, sediments, and waters.

Required BMPs

- Hazardous Materials must be used in accordance with the manufacturer recommendation or guidelines as shown on the label.
- Always store hazardous materials in properly labeled containers, never in food or beverage containers which could be misinterpreted by a child as something to eat or drink.
- Dispose of hazardous materials and their containers properly. Never dump products labeled as poisonous, corrosive, caustic, flammable, inflammable, volatile, explosive danger, warning, caution, or dangerous outdoors, in a storm drain, or into sinks, toilets or drains. Call the City of Olympia Department of Public Works at (360) 753-8333 for information on disposal methods, collection

events, and alternative products. Household hazardous wastes from City of Olympia residents and non-residents are accepted at the HazoHouse, at the Thurston County Waste and Recovery Center in Hawks Prairie at 2418 Hogum Bay Road NE.

- Check hazardous material containers frequently for signs of leakage. If a container is rusty and has the potential of leaking soon, place it in a secondary container before the leak occurs and prevent a cleanup problem.
- Hazardous materials should be stored out of the reach of children.
- Store hazardous materials containers under cover and off the ground. Keep them out of the weather to avoid rusting, freezing, cracking, labels being washed off, etc.
- Keep appropriate spill cleanup materials on hand. Kitty litter is good for many oil-based spills.
- Ground cloths and drip pans must be used under any work outdoors which involves hazardous materials such as oil-based paints, stains, rust removers, masonry cleaners, and others bearing label warnings as outlined above (See Figure).
- Latex paints are not a hazardous waste, but are not accepted in liquid form at the landfill. To dispose of, leave uncovered in a protected place until dry, then place in the garbage. If your can is at least half full, you can take it to the HazoHouse to be placed in Swap Shop area. If you wish to dry waste paint quickly, mix kitty litter or sawdust in the can to absorb the paint. Once paint is dry, leave the lid off when you place it in the garbage so your garbage collector can see that it is no longer liquid.
- Use less toxic products whenever possible. Ecology maintains a hotline at 1-800- RECYCLE, or see information online at https://fortress.wa.gov/ecy/recycle/
- If an activity involving the use of a hazardous material can be moved indoors out of the weather, then do so. Make sure you can provide proper ventilation, however.
- Follow manufacturers' directions in the use of all materials. Over-application of yard chemicals, for instance, can result in the washing of these compounds into receiving water bodies. Never apply pesticides when rain is expected.
- When hazardous materials are in use, place the container inside a tub or bucket to minimize spills and store materials above the local base flood elevation (BFE).

8. Pet Waste Management

Pet waste that washes into lakes, streams or Puget Sound begins to decay, using up oxygen and releasing ammonia. Low oxygen levels and ammonia combined with warm water can kill fish. Pet waste also contains nutrients that encourage weed and algae growth in waters we use for swimming, boating and fishing. Most importantly, in many urban areas, pet and animal waste is the largest source of bacterial loading to streams. It can carry diseases that could make water unsafe for contact and lead to beach closures or affect shellfish harvest. These include:

- Campylobacteriosis—bacterial infection
- Salmonellosis—bacterial infection
- Toxocariasis—roundworm infection
- Toxoplasmosis—protozoan parasite infection
- Giardiasis—protozoan parasite infection
- Fecal Coliform—bacteria in feces, indicates contamination
- *E. coli*—bacteria in feces, may cause disease.

Cleaning up after your pet can be as simple as taking a plastic bag or pooper-scooper along on your next walk. Then choose one of the following.

Suggested BMPs

- **Bag it** – Put waste in a securely closed bag and deposit it in the trash. Do not put it in your yard waste container because pet waste may carry diseases, and yard waste treatment may not kill disease organisms.
- **Bury it** – Bury waste at least 1 foot deep and cover with soil in your yard or garden (not in food-growing areas).
- **Flush it** – Only flush pet wastes if your home is served by a sanitary sewer which goes to a sewage treatment plant. Water from your toilet goes through a treatment process that removes pollutants before it is discharged into the environment. To prevent plumbing problems, don't flush debris or cat litter. Cat feces may be flushed, but used litter should be put in a securely closed bag in the trash. Septic systems are not designed to accommodate the high pollutant load of pet waste. To prevent premature failure or excessive maintenance costs do not flush pet wastes to your septic system.
- **Compost it** – waste from small animals **other than dogs and cats** (rabbits, rodents, etc.), can be put in your compost bin.

9. Activities in Wetlands and Wetland Buffers

Wetlands and associated buffers are vegetated ecosystems through which water passes. These areas usually have a high water table and are often subject to periodic flooding. Wetlands can be very effective in removing sediments, nutrients and other pollutants from stormwater.

Maintaining wetlands and associated buffers helps to slow stormwater runoff, trap sediments and other pollutants and reduce the volume of runoff by allowing infiltration to occur. Reducing the velocity of runoff reduces soil erosion and increases contact time with soil and vegetation. Increasing contact of stormwater with soils and vegetation in a wetland or riparian area can be effective in removing sediments, nutrients and other pollutants from stormwater runoff.

Buffer areas are important to both the wetland and the upland areas as habitat for aquatic wetland-dependent wildlife and as buffers during extreme weather events. Other functions of buffer areas that contribute to water quality include shading, flood attenuation and shoreline stabilization.

Persons responsible for maintenance of wetland areas are encouraged to call City of Olympia Community Planning & Development (360)753-8314 prior to performing work in wetlands or their buffers.

Required BMPs

- Removal by hand of manmade litter and control of noxious weeds that are included on the state noxious weed list (Washington Administrative Code [WAC] 16-750) or invasive plant species as identified by City of Olympia. Control may be conducted by clipping, pulling, over-shading with native tree and shrub species, or non-mechanized digging. Alternative methods such as mechanical excavation, barrier installation, or herbicide use may be allowed, but may require special permits with the City of Olympia.
- Check with City of Olympia Community Planning & Development on guidelines for vegetation and hazardous tree removal in critical areas.

Suggested BMPs

- To prevent possible contamination, limit fertilizer and herbicide use around wetlands and their buffers.
- Limit access to wetlands and their buffers. To avoid compaction do not establish trails within the wetland areas.

10. Illicit Discharge Detection and Elimination

A common problem with City of Olympia's stormwater drainage system is illegal hook-ups to the system. Many businesses and residences hooked internal building drains, sump overflows, and even sanitary sewer and septic system piped to the storm drain in the past, allowing a variety of pollutants to flow directly to receiving waters instead of the sanitary sewer or septic system. Frequently, these connections are unknown to the current owner, and do not appear on any plans for the site. Because of the pollution potential these connections represent, the Environmental Protection Agency, under the mandate of the NPDES stormwater permits, has made elimination of illegal connections a top priority.

All businesses and residences in City of Olympia must examine their plumbing systems to determine if illegal connections exist. We recommend starting with site plans to better understand what piping systems were initially installed, making piping that does not appear on the plan a priority for investigation. Wherever toilets, sinks, appliances, showers and bathtubs, floor drains, or other indoor activities are connected to the stormwater drainage system, immediately reroute them to the sanitary or septic system or holding tanks.

If sanitary facilities (such as toilets) are connected to the stormwater drainage system, you must obtain a permit from the City of Olympia and reroute them to the sanitary sewer. Contact City of Olympia Community Planning & Development for permit and connection information.

Dye Testing

Dye testing with a non-toxic dye is one way to determine where a pipe or structure drains if not obvious by observations or on plans. The dye is put into the structure and flushed with some water. Observations are then made at ends-of-pipes, drainage ditches, catch basins, and manholes to look for the color coming through. Contact City of Olympia Public Works - Wastewater Operations if you need assistance in locating structures adjacent to your property.

Smoke Testing

Smoke testing can also help detect illegal connections and is best done by qualified personnel. To conduct smoke testing, shut off all indoor discharges, place a smoke bomb or other smoke-generating device in a storm drain manhole, and force air in after it. Station personnel at each suspect drain location to observe if smoke is coming out. Identify smoking drains for future rerouting.

Plugging or Rerouting Illicit Discharges

Drains that are found to connect to the stormwater drainage system must either be permanently plugged or disconnected and rerouted as soon as possible. Plug unused drains with concrete or similar permanent materials. If a drainpipe is to be rerouted and a sanitary sewer services the property, then the local sewer provider must be contacted. It is the responsibility of the property owner to follow through on rerouting illicit storm drainage connections to the sanitary sewer.

If the property is not served by a sanitary sewer, alternate measures will be necessary. If the discharge is simply domestic waste, a septic system may be feasible. If it is necessary to install a septic system, the proper permits will need to be obtained from the City of Olympia Community Planning and Development. If the discharge is anything other than domestic waste, then a holding tank or onsite treatment will be necessary.

11. Pests and Noxious Weeds

Invasive weeds and insect pests are a common problem for many yards and gardens in Thurston County. Effective management of these pests in the least toxic method requires careful planning and implementation. Developing an *Integrated Pest Management Plan* is often the best solution for managing pests and reducing pollution of ground and surface water bodies.

Introduction

Integrated Pest and Vegetation Management (IPM) is a natural, long-term, ecologically-based systems approach to controlling pest populations. IPM is used to reduce pest populations, maintain them at levels below those causing health concerns or economic damage. The goals of IPM are to both encourage optimal selective pesticide use (away from prophylactic, broad spectrum use), and to maximize natural controls to minimize environmental side effects.

True integrated pest and vegetation management is a powerful approach that anticipates and prevents most problems through appropriate cultural practices and careful observation. Knowledge of the life cycles of host plants and both beneficial and pest organisms is also important. The integrated pest management section of this guidance is adapted from *Least Toxic Pest Management for Lawns* by Sheila Daar. Following the integrated pest management process gives you the information you need to minimize damage by weeds, diseases, and pests and to treat those problems with the least toxic approaches.

The IPM Process

Step One: *Correctly identify problem pests and understand their life cycle.*

Learn more about the pest. Observe it and pay attention to any damage that may be occurring. Learn about the life cycle. Many pests are only a problem during certain seasons, or can only be treated effectively in certain phases of the life cycle.

Step Two: *Establish tolerance thresholds for pests.*

Every landscape has a population of some pest insects, weeds, and diseases. This is good because it supports a population of beneficial species that keep pest numbers in check. Beneficial organisms may compete with, eat, or parasitize disease or pest organisms. Decide on the level of infestation that must be exceeded before treatment needs to be considered. Pest populations under this threshold should be monitored but don't need treatment. For instance, European crane flies usually don't do serious damage to a lawn unless there are 25 to 40 larvae per square foot feeding on the turf in February (in normal weather years). Also, most people consider a lawn healthy and well maintained even with up to 20 percent weed cover, so treatment, other than continuing good maintenance practices, is generally unnecessary.

Step Three: *Monitor to detect and prevent pest problems.*

Regular monitoring is a key practice to anticipate and prevent major pest outbreaks. It begins with a visual evaluation of the lawn or landscape's condition. Take a few minutes before mowing to walk around and look for problems. Keep a notebook, record when and where a problem occurs, then monitor for it at about the same time in future years. Specific monitoring techniques can be used in the appropriate season for some potential problem pests, such as European crane fly.

Step Four: *Modify the maintenance program to promote healthy plants and discourage pests.*

A healthy landscape is resistant to most pest problems. Lawn aeration and over-seeding along with proper mowing height, fertilization, and irrigation will help the grass out-compete weeds. Correcting drainage problems and letting soil dry out between waterings in the summer may reduce the number of crane-fly larvae that survive.

Step Five: *If pests exceed the tolerance thresholds.*

Use cultural, physical, mechanical, or biological controls first. If those prove insufficient, use the chemical controls described below that have the least non-target impact. When a pest outbreak strikes (or monitoring shows one is imminent), implement integrated pest management then consider control options that are the least toxic, or have the least non-target impact. Here are two examples of an integrated pest management approach:

1. **Red thread disease** is most likely under low nitrogen fertility conditions and most severe during slow growth conditions. Mow and bag the clippings to remove diseased blades. Fertilize lightly to help the grass recover, then begin grasscycling and change to fall fertilization with a slow-release or natural-organic fertilizer to provide an even supply of nutrients. Chemical fungicides are not recommended because red thread cannot kill the lawn.
2. **Crane fly damage** is most prevalent on lawns that stay wet in the winter and are irrigated in the summer. Correct the winter drainage and/or allow the soil to dry between irrigation cycles; larvae are susceptible to drying out, so these changes can reduce their numbers. It may also be possible to reduce crane fly larvae numbers by using a power de-thatcher on a cool, cloudy day when feeding is occurring close to the surface. Studies are being conducted using beneficial nematodes that parasitize the crane fly larvae; this type of treatment may eventually be a reasonable alternative.

Only after trying suitable non-chemical control methods or determining that the pest outbreak is causing too much serious damage, should chemical controls be considered. If chemical controls prove necessary, determine what products are available and choose a product that is the least toxic and has the least non-target impact. Refer to the operational BMPs for the use of pesticides below for guidelines on choosing, storing, and using lawn and garden chemicals.

Step Six: *Evaluate and record the effectiveness of the control, and modify maintenance practices to support lawn or landscape recovery and prevent recurrence.*

Keep records! Note when, where, and what symptoms occurred, or when monitoring revealed a potential pest problem. Note what controls were applied and when, and the effectiveness of the control. Monitor next year for the same problems. Review your landscape maintenance and cultural practices to see if they can be modified to prevent or reduce the problem.

A comprehensive integrated pest management program should also include the proper use of pesticides as a last resort, and vegetation/fertilizer management to eliminate or minimize the contamination of stormwater.

Appendix IV-C2:

Commercial Pollution Source Control Program Template

Pollution Source Control Program

[Site or Business Name]

Located at: ***[****Street Address]*

Assessor's Tax Parcel Number(s): *[11 digit APN, separate by commas if more than one]*

Program Operator/Property Owner*: [The person responsible for administering the program]*

Program Document Prepared by: *[The person or company preparing this plan]*

Date: *[Date the program was prepared]*

Table of Contents

1.0 Introduction

1.1 Objectives of This Program

To implement and maintain best management practices (BMPs) that identify, reduce, eliminate, and/or prevent the discharge of stormwater pollutants.

To prevent violations of surface water quality, groundwater quality, and sediment management standards.

To eliminate the discharges of un-permitted process wastewater, domestic wastewater, non-contact cooling water and other illicit discharges to stormwater drainage systems.

1.2 About This Program

All commercial and industrial properties and activities, including multi-family residential complexes (i.e. apartments, condominiums), non-residential special uses, and government facilities in the **City of Olympia** that have the potential to contribute pollutants to stormwater runoff or directly to receiving waters are required to implement stormwater pollution prevention source control measures. Stormwater runoff may seep into the ground, drain to a storm drain or a drainage ditch, or flow over the ground. Regardless of the way runoff leaves your site, it ends up in a stream river, lake, wetland, groundwater, or Puget Sound.

All known, available and reasonable source control BMPs shall be applied to your site. Source control BMPs shall be selected, designed, and maintained in accordance with Volume IV of the City of Olympia Drainage Design and Erosion Control Manual (DDECM).

Many people believe that stormwater runoff is "clean" and does not harm water quality. This perception is understandable since the amount of pollution from any one place is not usually significant by itself. However, when all these small amounts are combined, they can cause significant pollution problems. Contaminated stormwater can negatively affect every water body it enters. Therefore, this plan provides detailed information to reduce the contamination of surface water, groundwater, and stormwater from your property and/or business.

The federal Clean Water Act mandates that cities and counties control the quality of stormwater runoff. One way to achieve this is to implement pollution prevention measures on individual properties. By following the "Best Management Practices" for your business or stormwater management site as described in this program, you can do your part to protect our streams, groundwater, and Puget Sound.

1.3 What Are Best Management Practices?

Best Management Practices (BMPs) are a set of activities designed to reduce stormwater pollution. BMPs are separated into two broad categories: *source control* and *treatment.* Applicable BMPs for your business have been selected from the most recent published edition of the City of Olympia Drainage Design and Erosion Control Manual, Volume IV.

1.3.1 Source Control BMPs

Source control BMPs prevent contaminants from entering stormwater runoff by controlling them at the source. Some source control BMPs are *operational,* meaning they are tasks or actions such as checking regularly for leaks and drips from equipment and vehicles, covering materials that have potential to add pollutants to surface water if rainwater comes in contact with the materials, and minimizing use of

pesticides, fertilizers, and insecticides. Other source control BMPs require use of a *structure* to prevent rainwater from contacting materials that will contaminate stormwater runoff such as providing a covered area or berm to prevent clean stormwater from entering work or storage areas.

1.3.2 Treatment BMPs

In contrast, **treatment BMPs** are structures that treat stormwater to remove contaminants. Treatment BMPs typically require planning, engineering design, and construction. A stormwater treatment pond is an example of a *treatment BMP.* No treatment BMP is capable of removing 100 percent of the contaminants in stormwater and the less contaminant in the stormwater the more effective the treatment BMP is.

Just because there is a stormwater collection system serving your property, it does not necessarily mean that the stormwater is treated. Many sites were developed prior to requirements to treat stormwater. Runoff from your property may go directly or indirectly to a stream or wetland without any treatment.

This plan focuses on *source control* BMPs applicable to the routine practices of your business and/or property.

1.4 What is in This Document?

This plan has been customized for your business and/or property relevant to operations that may occur. Changes to site use or types of activities that take place on your property may require an update to this program.

The plan is divided as follows:

Sections

- Introduction
- Your Stormwater Facilities
- Principles of Pollution Prevention
- General Source Control BMPs
- Specific BMPs for Your Site
- Implementing this Pollution Source Control Program

Appendices

- A – Commercial and Industrial Activities Worksheet
- B – Applicable Facility Activity Sheets
- C – Annual Report Checklist
- D – Spill Control Plan (If applicable)
- E – Integrated Pest Management Plan (If applicable)

2.0 Your Stormwater Facilities

[Use this section to provide a description of the site/business and the stormwater structures and facilities found on site. This description should include the areas that the program covers, the types of pollutants expected, and uses of the site. Locations of the permanent stormwater structures and inlets should be identified. The ultimate destination of stormwater runoff or potential pollutants should be clearly described. The location of natural and/or man-made drainage paths where pollutants may potentially leave the site shall be included here. Provide maps, drawings, or figures of the site as an attachment to this program if necessary.]

3.0 Principles of Pollution Prevention

This section describes the 15 general principles of pollution prevention that every business owner should consider. Most of these practices are common sense, "housekeeping" types of solutions to pollution prevention.

1. Avoid the activity or reduce its occurrence

Avoid potentially polluting activity or do it less frequently. Apply lawn/landscape care chemicals following directions and only as needed. Do not apply herbicides right before it rains.

2. Move the activity indoors

Move a potentially polluting activity indoors out of the weather. This prevents runoff contamination and provides more control for a cleanup if a spill occurs.

3. Cleanup spills quickly

Promptly contain and cleanup solid and liquid pollutant leaks and spills on exposed soil, vegetation, or paved areas. Use readily available absorbents such as kitty litter to absorb spills and then sweep up the material and dispose of it properly. Repair leaks on vehicles and equipment.

4. Use less material

Do not buy or use more material than you really need. This not only helps keep potential disposal, storage and pollution problems to a minimum, but will probably save you money.

5. Use the least toxic materials available

Investigate the use of materials that are less toxic. For example, replace a caustic-type detergent or solvent with a more environmentally friendly product. If you do switch to a biodegradable product, remember that only uncontaminated water is allowed to enter the stormwater drainage system.

6. Create and maintain vegetated areas near activity locations

Vegetation can filter pollutants out of stormwater. Route stormwater from parking and work areas through vegetated areas. Remember that wastewater other than stormwater runoff, such as wash water, must be discharged to a wastewater collection system (sewer or septic system).

7. Locate activities as far as possible from surface drainage paths

Locate activities away from storm drains, ditches, streams, and other water bodies to reduce the potential to pollute. It will take longer for material to reach the drainage features providing more time to react to a spill, or "housekeeping" issue and protect local waters long enough to cleanup.

8. Maintain stormwater drainage systems

Pollutants concentrate over time in catch basins, ditches, and storm drains. When a storm event occurs, turbulent runoff can mobilize these pollutants and carry them to receiving waters. Perform regular maintenance on stormwater facilities to prevent this from occurring.

9. Reduce, reuse, and recycle as much as possible

Look for ways to recycle. This saves money and keeps hazardous and non-hazardous materials out of landfills. Contact the City of Olympia Waste Resources division for more information on recycling opportunities in the City.

10. Be an advocate for stormwater pollution prevention

Help friends, neighbors, and business associates find ways to reduce stormwater pollution in their activities. Most people want clean water and do not pollute intentionally. Share your ideas and the BMPs in this plan to get them thinking about how their everyday activities affect water quality.

11. Report problems

We all must do our part to protect water, fish, wildlife, and our own health by implementing proper BMPs, and reporting water quality problems that we observe. Call the City of Olympia Storm and Surface Water Utility at 360.753.8333 to report dumping to storm drains or ditches.

12. Provide oversight and training

Talk to your employees, or if you are a landlord talk to your tenants, to ensure they understand the pollution prevention source control measures and BMPs described in this program. If you are a landlord, you are still responsible for the activities of your tenants. Monitor the activities of your tenants to ensure that they are carrying out the principles of this program. See Section 6.0 of this document regarding implementation of this program.

13. Dust control

Sweep parking and storage areas regularly to collect and dispose of dust and debris that could contaminate stormwater. Do not hose down pollutants from any area to the ground, storm drain, conveyance ditch or any receiving water (stream, wetland, lake, etc.). Do not use oil or other petroleum products for dust control. Only light watering of dirt or gravel roads or parking areas should be conducted to prevent any runoff of stormwater from the surface.

14. Eliminate illicit connections

Occasionally businesses have internal building drains, sump overflows, sump pumps, outdoor sinks and showers, and even sanitary sewer and septic system pipes that were inadvertently connected to the storm drainage system in the past.

Examine the plumbing system for your business to determine if illicit connections exist. Toilets, sinks, appliances, showers, bathtubs, floor drains, industrial process waters, and other indoor activities found to be connected to the stormwater drainage system must be immediately rerouted to the sanitary sewer or septic system, holding tanks, or process treatment system. For assistance in methods to detect and eliminate illicit connections contact the City of Olympia Storm and Surface Water Utility.

15. Dispose of waste properly

Every business and residence in City of Olympia must dispose of solid and liquid wastes and contaminated stormwater properly. There are generally four options for disposal depending on the type of materials. These options include:

- Sanitary sewer and septic systems.
- Recycling facilities
- Municipal solid waste disposal facilities
- Hazardous waste treatment, storage and disposal facilities.

4.0 General and Applicable (Mandatory) to All Sites Source Control Best Management Practices

This section briefly summarizes source control BMPs and corrective actions that are applicable to all types of sites, not just your property and include both general source control BMPs and those that are applicable (mandatory) to all sites. (See DDECM Volume IV, Section IV-4 (Source Control BMPs Applicable (Mandatory) to All sites and Section IV-6 for General Source Control Best Management Practices.)

In the next section, BMPs specific to your business will be identified, but these general BMPs should be implemented at all times regardless of site-specific activities. In some cases, the Activity Sheets in Appendix B will reference the BMPs in this section.

Table 1: General Source Control and Applicable (Mandatory) to All Sites Source Control BMPs

BMP CATEGORY	DESCRIPTION
APPLICABLE (MANDATORY) TO ALL SITES	
S410 Eliminate Illicit Stormwater Drainage System Connections	1. Use building and site plans and examine plumbing systems to determine if illegal connections exist. 2. Consider dye testing to determine where a pipe or structure drains. 3. Consider smoke testing (best done by qualified professional). 4. Contact City of Olympia Storm & Surface Water Utility for assistance. 5. Plug, disconnect or reroute to sewer/septic system any drains found connected to the stormwater drainage system.
S453 Formation of a Pollution Prevention Team	Refer to Section 6.1 below for details.
S454 Preventive Maintenance/Good Housekeeping	1. Prevent the discharge of unpermitted liquid or solid wastes, process wastewater, and sewage to ground or surface waters. 2. Promptly contain and clean up leaks and spills. 3. If a contaminated surface must be pressure washed, collect the resulting washwater. 4. Do not hose down pollutants to the ground, storm drains, conveyance ditches, or receiving water. 5. Do not connect floor drains in potential pollutant source areas to storm drains.
S455 Spill Prevention and Cleanup	1. Clearly label or mark all containers. 2. Use drip pans. 3. Develop and implement a spill plan and update it annually. 4. Designate spill response staff to be on-site during business activities. 5. Store all cleanup kits near areas with a high potential for spills. 6. Stop, contain and clean up all spills immediately upon discovery.
S456 Employee Training	Refer to Section 6.2 below for details.

BMP CATEGORY	DESCRIPTION
APPLICABLE (MANDATORY) TO ALL SITES	
S457 Inspections	Refer to Section 6.3 below for details.
S458 Record Keeping	Refer to Section 6.4 below for details
S100 Dispose of Collected Runoff and Waste Materials Properly	1. Discharge liquid wastes and contaminated stormwater to the sanitary sewer – contact LOTT or local sewer provider for restrictions. 2. Use sumps or holding tanks for temporary storage. 3. Consider recycling materials where feasible. 4. Dispose of solid wastes to City of Olympia Waste Resources. 5. Dispose of dangerous or hazardous wastes at permitted facility. 6. Contact City of Olympia Waste Resources for disposal options.
S101 Connect Process Water Discharges to Sanitary Sewer, Holding Tank, or Water Treatment System	1. Required for all industrial and commercial activities that generate contaminated process wastewater. 2. Discharge to sanitary sewer - contact LOTT or local sewer provider for restrictions. 3. Discharge to sumps or holding tanks for temporary storage – have tanks pumped for proper disposal. 4. Construct wastewater treatment system – contact Ecology for permitting requirements. 5. If activity is conducted outdoors cover the activity and/or construct curbs, dikes or berms to prevent stormwater run-on.
S102 Cover the Activity with a Roof or Awning	1. Construct simple roof or awning to prevent contact with stormwater. 2. Contact City of Olympia Community Planning and Development for information on permits. 3. The area of roof cover should be sufficient to prevent precipitation from reaching the covered materials.
S103 Cover the Activity with an Anchored Tarpaulin or Plastic Sheet	1. Use where raw materials are stockpiled outdoors. 2. Use weights such as bricks, tires, or sandbags to anchor the cover. 3. Use pins or stakes to anchor tarpaulin to the ground. 4. Locate stockpile to provide wind protection (leeward side of buildings, landscaping, etc.) 5. Inspect daily.
S104 Pave the Activity Area and Slope to a Sump or Holding Tank	1. Apply to activities that cannot be covered adequately but that may be susceptible to spills such as chemical storage areas. 2. Enclose area within a dike, curb or berm. 3. Provide a sump or holding tank to contain spills until the liquids can be pumped out and disposed properly. 4. Ensure paving is compatible with stored material, e.g. gasoline can breakdown asphalt – use concrete paving.

BMP CATEGORY	DESCRIPTION
APPLICABLE (MANDATORY) TO ALL SITES	
S105 Surround the Activity Area with a Curb, Dike, or Berm or elevate the Activity	1. Containment is most applicable to spill control situations. 2. If used to prevent run-on to a covered activity area place the berm underneath the covering so rainwater will not pond inside it. 3. Size containment area for 6-month storm unless other containment sizing restrictions apply. 4. Install a valve in storm drainage line from area so that excess clean stormwater can be drained from area. 5. For storage of small items, consider a tub, wading pool, or specially manufactured containment systems. 6. For spill control the volume of the containment should be the greater of either 110% of the volume of the largest tank, or 10% of the volume of all tanks if there are multiple tanks.
S106 Implement Integrated Pest Management (IPM)Measures	1. An IPM plan may be required by Thurston County Environmental Health. 2. Commercial, agricultural, municipal and other large-scale pesticide users should adhere to integrated pest management principles. 3. Guidance information is available from Thurston County Environmental Health, the Washington State Department of Agriculture and Washington State University Extension Service. 4. If an IPM plan is required, include as Attachment E.
S107 Clean Catch Basins	1. Catch basins should be cleaned regularly. 2. Several companies offer catch basin cleaning services; check the yellow pages under “sewer cleaning equipment and supplies.” 3. Do not flush catch basin sumps into the catch basin outlet pipe. 4. Check your Stormwater Facility Maintenance Plan for additional information on catch basin cleaning frequency and inspection requirements.

5.0 Specific BMPs for Your Site

Every business in the City of Olympia is required to use the BMPs described in the City of Olympia Drainage Design and Erosion Control Manual to control stormwater pollution.

Table 2 on the following pages contains a summary list of all activities identified on the worksheet (Appendix A – Activities Worksheet) as occurring on your site. This table should be posted in an appropriate location for employees to see. Full descriptions of the source control BMPs specified in Table 2 can be found in Appendix B – Activity Sheets and in DDECM Volume IV.

[This Area Intentionally Blank]

[Insert Business Name, Same As Cover]

Table 2 – Operational Source Control Practices Summary

[Note: S434 is listed as an example and can be removed if not applicable. Complete similar entries for all applicable activities. Add or delete rows to table as necessary to complete the table.]

[Note: S411 is required for stormwater facilities located within City drinking water (wellhead) protection areas. It is optional for stormwater facilities not located within a wellhead protection area.]

ACTIVITY	SOURCE CONTROL BMPS (SEE ACTIVITY SHEET IN ATTACHMENT B FOR MORE INFORMATION)	√
S411 ***Landscaping and Lawn/Vegetation Management***	***Required practice for stormwater facilities located within a designated drinking water (wellhead) protection area:*** *1. Only slow-release fertilizers shall be applied for the life of the development at a maximum amount of 4 pounds of nitrate as Nitrogen annually and no more than 1 pound per application for every 1,000 square feet of turf grass. Only fertilizer formulas with a minimum of 50% water insoluble form of nitrogen are permitted for use. Approved water insoluble forms of nitrogen include sulfur and/or polymer coated fertilizers, Isobutylidene Diurea (IBDU), Methylene Urea and Ureaform, and organic fertilizers registered with Washington Department of Agriculture. (OMC 18.32.225)*	
S108 ***Cleaning or Washing Tools, Engines, and Manufacturing Equipment***	***Required Practices:*** *1. Eliminate illicit connections to storm drain system* *2. Train employees to control washing operations* *3. Washwater should never discharge to stormwater system* *4. Pressure wash only in designated area provided with sump drain* ***Suggested Practices:*** *1. Use least toxic cleaner capable of doing the job.* *2. Limit amount of water used* *3. Recycle washwater if possible*	

ACTIVITY	SOURCE CONTROL BMPS (SEE ACTIVITY SHEET IN ATTACHMENT B FOR MORE INFORMATION)	√

6.0 Implementing this Pollution Source Control Program

This section provides general guidance for implementation of this Pollution Source Control Program for your site. While not a comprehensive list of steps to implement this program, the following information will assist in using this document effectively. Inspection tasks, record keeping, and reporting should be completed in conjunction with your Stormwater Facility Maintenance Program, if applicable to your site.

6.1 Formation of a Pollution Prevention Team (S453)

The person designated as Program Operator for the site or business shall be responsible for stormwater pollution control. The Program Operator – or their designee – will hold regular meetings with the team to review the overall operation of the BMPs in this program. The Program Operator will establish responsibilities for inspections, operation, maintenance, and for emergencies. The Program Operator will be responsible for training all team members and employees in the operation, maintenance, inspection of BMPs, and reporting procedures. The Program Operator will be the primary contact for the City of Olympia regarding this Pollution Source Control Program and its implementation.

6.2 Employee Training (S456)

Training programs may be tailored as necessary by the Program Operator. At a minimum, all employees that work in pollutant source areas shall have training in:

- Identifying pollutant sources
- Understanding pollutant control measures and BMPs
- Responding to spills
- Pollutant handling practices that are environmentally acceptable. Particularly those related to vehicle/equipment liquids such as fuels, and vehicle/equipment cleaning.

6.3 Inspections (S457)

Qualified personnel shall conduct visual inspections monthly. Inspectors shall make and maintain a record of each inspection on-site. Inspections shall:

- Verify the accuracy of the pollutant source descriptions in this program.
- Verify the performance of the stormwater operational and structural source controls and treatment BMPs.
- Reflect current conditions on the site.
- Include written observations of the presence of floating materials, suspended solids, oil and grease, discoloration, turbidity and odor in the stormwater discharges; in outside vehicle maintenance/repair; and liquid handling, and storage areas. In areas where acid or alkaline materials are handled or stored use a simple litmus or pH paper to identify those types of stormwater contaminants where needed.
- Eliminate or obtain a permit for unpermitted non-stormwater discharges to storm drains or receiving waters, such as process wastewater and vehicle/equipment washwater.

When site inspections warrant or activities on the site are no longer applicable to the BMPs found in this program, this Pollution Source Control Program document shall be revised by the Program Operator as necessary to comply with local, state, and federal water quality requirements. For assistance in revising your Pollution Source Control Program, contact City of Olympia Water Resources – Storm and Surface Water Utility for guidance.

6.4 Record Keeping (S458)

Program Operators shall retain the following reports for five years:

- Visual inspection reports which should include:
  - Time and date of the inspection
  - Locations inspected
  - Statement on status of compliance with your permit (if you hold a NPDES Permit with Washington State Department of Ecology)
  - Summary report of any remediation activities required
  - Name, title, and signature of person conducting the inspection
- Reports on spills of oil or hazardous substances in greater than Reportable Quantities (Code of Federal Regulations Title 40 Parts 302.4 and 117). Report spills of the following: antifreeze, oil, gasoline, or diesel fuel, that cause:
  - A violation of the State of Washington's Water Quality Standards
  - A film, sheen, or discoloration of the waters of the State or adjoining shorelines
  - A sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines
- ***To report a spill or to determine if a spill is a substance of a Reportable Quantity, call the Washington State Department of Ecology regional office and ask for an oil spill operations or a dangerous waste specialist:***

  Northwest Region (425) 649-7000
  Southwest Region (360) 407-6300
  Eastern Region (509) 329-3400
  Central Region (509) 575-2490

  In addition, call the Washington Emergency Management Division at 1-800-258-5990 or 1-800-OILS-911 AND the National Response Center at 1-800-424-8802.

  Also, refer to Emergency Spill Response in Washington State, Publication # 97-1165-CP.

- Maintain records of all related pollutant control and pollutant generating activities such as training, materials purchased, material use and disposal, maintenance performed, etc.

APPENDIX A

Commercial and Industrial Activities Worksheet

This worksheet and the associated BMPs are organized by business activity. The goal of BMPs is to ensure that **only uncontaminated stormwater is discharged** into any stormwater drainage system.

Complete the entire worksheet by checking the appropriate boxes for all activities that occur at your workplace. If you checked off any of the activities **that are being performed outdoors or can drain to the stormwater drainage system**, use the activity code on the worksheet to find the BMPs recommended for you in Volume IV of the *City of Olympia Drainage Design and Erosion Control Manual*. If you perform an activity indoors and control all discharges from the activity (e.g., process water, washwater, lubricants, solvents, fugitive dust, granular material, blow down waste) so that no stormwater exposure occurs, you do not have to institute BMPs for that activity.

If you have questions, please contact the City of Olympia Storm & Surface Water Utility at (360) 753-8333. They can provide assistance over the phone and at your business site.

BMP #	Type of Activity	Check if You Are Involved in This	
		Indoor	Outdoor
Cleaning and Washing Activities			
S108	Cleaning or Washing of Tools, Engines, and Manufacturing Equipment • Includes parts washers and all types of manufactured equipment components.		
S109	Cleaning or Washing of Cooking Equipment • Includes vents, filters, pots and pans, grills, and related items.		
S431	Washing, Pressure Washing, and Steam Cleaning of Vehicles/Equipment/Building Structures • Includes cleaning and washing at all types of establishments, including fleet vehicle yards, car dealerships, car washes, and maintenance facilities.		
S110	Collection and Disposal of Wastewater from Mobile Interior Washing Operations • Includes carpet cleaners, upholstery cleaners, and drapery cleaners.		
Transfer of Liquid or Solid Materials			
S412	Loading and Unloading Areas for Liquid or Solid Material • Includes raw materials, intermediate products, finished products, waste, or fuel.		
S409	Fueling at Dedicated Stations • Includes gas stations, pumps at fleet vehicle yards or shops, and other privately owned pumps.		
S414	Engine Repair and Maintenance • This covers oil changes and other engine fluids.		
S419	Mobile Fueling of Vehicles and Heavy Equipment • Includes fleet fueling, wet fueling, and wet hosing.		

BMP #	Type of Activity	Check if You Are Involved in This	
		Indoor	Outdoor
Production and Application Activities			
S111	Concrete and Asphalt Mixing and Production at Stationary Sites • Applies to mixing of raw materials on site to produce concrete or asphalt.		
S112	Concrete Pouring, Concrete Cutting, and Asphalt Application at Temporary Sites • Includes construction sites, and driveway and parking lot resurfacing.		
S113	Manufacturing and Post-processing of Metal Products • Includes machining, grinding, soldering, cutting, welding, quenching, rinsing, etc.		
S432	Wood Treatment Areas • Includes wood treatment using pressure processes or by dipping or spraying.		
S403	Commercial Composting • Includes commercial composting facilities operating outside.		
S411	Landscaping and Vegetation Management Activities, Including Vegetation Removal, Herbicide and Insecticide Application, Fertilizer Application, Irrigation, Watering, Gardening, and Lawn Care • Includes businesses involved in landscaping, applying pesticides and managing vegetation. • Includes specific requirements for stormwater facilities located within a City drinking water (wellhead) protection area.		
S420	Painting, Finishing, and Coating of Vehicles, Boats, Buildings, and Equipment • Includes surface preparation and the applications of paints, finishes, and/or coatings.		
S404	Commercial Printing Operations • Includes materials used in the printing process.		
S418	Manufacturing Activities – Outside • Includes outdoor manufacturing areas.		
S114	Agricultural Crop Production • Includes commercial scale farming.		
S435	Application of Pesticides, Herbicides, Fungicides and Rodenticides for purposes other than landscaping • Includes moss removal and outdoor insect extermination.		
Storage and Stockpiling Activities			
S429	Storage or Transfer (Outside) of Solid Raw Materials, By-products, or Finished Products		
S115	Storage and Treatment of Contaminated Soils • This applies to contaminated soils that are excavated and left on site.		

BMP #	Type of Activity	Check if You Are Involved in This	
		Indoor	Outdoor
S444	Temporary Storage or Processing of Fruits or Vegetables • Includes processing activities at wineries, fresh and frozen juice makers, and other food and beverage processing operations.		
S117	Storage of Solid Wastes and Food Wastes • Includes regular garbage and all other discarded non-liquid items.		
S423	Recyclers and Scrap Yards • Includes scrapped equipment, vehicles, empty metal drums, and assorted recyclables.		
S446	Treatment, Storage, or Disposal of Dangerous Wastes • Refer to Ecology for more information		
S427	Storage of Liquid, Food Waste, or Dangerous Waste Containers • Includes containers located outside a building and used for temporary storage.		
S428	Storage of Liquids in Permanent Aboveground Tanks • Includes all liquids in aboveground tanks.		
S421	Parking and Storage for Vehicles and Equipment • Includes public and commercial parking lots.		
S444	Storage of Pesticides, Fertilizers, or other products that can leach pollutants		
Construction and Demolition Activities			
S438	Demolition of Buildings • Applies to removal of existing buildings and subsequent clearing of the rubble.		
S451	Building Repair, Remodeling, and Construction • Applies to construction of buildings, general exterior building repair work and remodeling of buildings.		
Dust Control and Soil and Sediment Control			
S407	Dust Control at Disturbed Land Areas and Unpaved Roadways and Parking Lots		
S408	Dust Control at Manufacturing Sites • Includes grain dust, sawdust, coal, gravel, crushed rock, cement, and boiler fly ash.		
S425	Soil Erosion and Sediment Control (ESC) at Industrial Sites • Includes industrial activities that take place on soil.		
Other Activities			
S402	Commercial Animal Handling Areas • Includes kennels, fenced pens, veterinarians, and businesses that board animals.		
S413	Log Sorting and Handling • Applies to log yards typically located at sawmills, ports, and pulp mills.		
S401	Boat Building, Mooring, Maintenance, and Repair • Includes all types of maintenance, repair, and building operations.		

BMP #	Type of Activity	Check if You Are Involved in This	
		Indoor	Outdoor
S117	Logging • Applies to logging activities that fall under Class IV general forest practices.		
S118	Mining and Quarrying of Sand, Gravel, Rock, Minerals, Peat, Clay, and Other Materials • This does not include excavation at construction sites.		
S433	Swimming Pool and Spa Cleaning and Maintenance • Includes every swimming pool and spa not at a single family residence. Commercial pool cleaners are included here for all pools.		
S405	De-icing and Anti-icing Operations for Airports and Streets • Includes aircraft, runways/taxiways, streets and highways.		
S424	Roof and Building Drains at Manufacturing and Commercial Buildings • These sites will be referred to ORCAA.		
S430	Urban Streets • BMPs for addressing pollutants found on paved surfaces, including street sweeping.		
S422	Railroad Yards		
S415	Maintenance of Public and Private Utility Corridors and Facilities • Includes public and private utility maintenance activities.		
S416	Maintenance of Roadside Ditches		
S417	Maintenance of Stormwater Drainage and Treatment Facilities		
S426	Spills of Oil and Hazardous Substances		

APPENDIX B

Activity Sheets

Best Management Practices for Commercial and Industrial Activities

This Appendix coordinates with the worksheet in Appendix A. That worksheet and the BMPs listed are organized by the different activities that businesses perform. Use the Activity Sheets in Volume IV of the City of Olympia Drainage Design and Erosion Control Manual to prepare a summary of the applicable required and suggested BMPs for inclusion in Table 2 of this document.

If you checked the column for activities performed outdoors, match the number from the worksheet to the activities listed in DDECM Volume IV, Section IV-5 to find the suggested BMPs you should implement. **You may make photocopies of the applicable Activity Sheets and insert them in this section.**

Explanation of Required BMPs

Every business in City of Olympia is required to use the BMPs described in the DDECM to control stormwater pollution. In some instances, there are BMPs mandated by various federal, state, or county laws. If you are subject to those laws and regulations via another permit or formal regulatory approval, you are encouraged, but not required to use additional BMPs to further protect water quality.

The BMPs outlined in this section are focused on source control: that is, methods to prevent pollution from reaching stormwater in the first place. The use of source control BMPs is always the first line of defense in stormwater pollution prevention.

[Attach Applicable Activity Sheets From The City Of Olympia Drainage Design And Erosion Control Manual, Volume IV. Photocopies Are Acceptable Here.]

APPENDIX C

Annual Report Checklist

SOURCE CONTROL ANNUAL REPORT CHECKLIST

Your stormwater pollution prevention plan should be reviewed at least annually and updated as required. The following checklist should be completed and submitted to City of Olympia along with the annual report required as part of your Stormwater Maintenance Agreement with City of Olympia. If your project did not require a Stormwater Maintenance Agreement and Maintenance Plan then submittal of this annual report is not required. If submittal is required, it should be mailed to: City of Olympia Water Resources – Environmental Services; PO Box 1967, Olympia, WA 98507. The report may also be delivered directly to Olympia City Hall at 601 4th Avenue East, Olympia WA 98507.

Annual reporting for stormwater facility inspections is due to the City of Olympia by August 31.

Business Name: _____

Address: _____

_____

Assessor Tax Parcel Number: _____

Completed By: _____

Signature: _____

Date: _____

√	Activity	Notes
	Review Activity Checklist (Appendix A) – Verify still current. List any new activities.	
	Review and Update Appendix B if new activities are identified.	

√	Activity	Notes
	Review and Update Table 2 for New Activities	
	Was any employee training held? If so describe.	
	Review Table 2 and verify compliance. Attach copy indicating each item has been checked.	
	Describe any significant events such as spills, illicit discharges detected/fixed, etc.	
	Was catch basin cleaning conducted? If so when, and by what company?	

√	Activity	Notes
	Conduct visual inspection of property for evidence of leaks, improper operations, etc. Note any items requiring attention.	
	Is a copy of Table 2 posted where visible to employees?	
	Have any additional structural or treatment BMPs been implemented on the site since the last annual report was submitted? If so describe.	

√	Activity	Notes
	Any other items related to stormwater source control not noted above. Describe.	

√	Activity	Notes
	Do you desire any technical assistance from City of Olympia related to stormwater issues? If so, indicate contact person and phone number.	

APPENDIX D

Spill Control Plan

[Note: If Required, Attach The Completed Spill Control Plan. See Appendix IV-D: Regulatory Requirements That Impact Stormwater Programs Otherwise This Appendix May Be Removed]

Spill Control Planning Guidance

If required to prepare and implement an Emergency Spill Cleanup Plan, follow the appropriate guidance required for your activity. General guidelines for implementing an Emergency Spill Cleanup Plan include:

- Prepare an Emergency Spill Control Plan (SCP), which includes:
  - A description of the facility including the owner's name and address and the name of the designated person with spill cleanup and notification responsibility.
  - The nature of the activity at the facility;
  - The general types of chemicals used or stored at the facility;
  - A site plan showing the location of storage areas for chemicals, the locations of storm drains, the areas draining to them, and the location and description of any devices to stop spills from leaving the site such as positive control valves;
  - Cleanup procedures;
  - Notification procedures to be used in the event of a spill, such as notifying key personnel, the fire department, Ecology, State Patrol, and the local Sewer Authority.
- Train key personnel. Prepare a summary of the plan and post it at appropriate points in the building, identifying the spill cleanup coordinators, location of cleanup kits, and phone numbers of regulatory agencies to be contacted in the event of a spill;
- Update the SCP regularly;
- Immediately notify Ecology and the local Sewer Authority if a spill may reach sanitary or storm sewers, ground water, or surface water, in accordance with spill reporting requirements;
- Immediately clean up spills. Do not use emulsifiers unless an appropriate disposal method for the resulting oily wastewater is implemented. Absorbent material shall not be washed down a floor drain or storm sewer; and,
- Locate emergency spill containment and cleanup kit(s) in high potential spill areas. The contents of the kit shall be appropriate for the type and quantities of chemical liquids stored at the facility.

Spill Kit Contents: Spill kits should include appropriately lined drums, absorbent pads, and granular or powdered materials for neutralizing acids or alkaline liquids where applicable. In fueling areas: absorbent should be packaged in small bags for easy use and small drums should be available for storage of absorbent and/or used absorbent. Spill kits should be deployed in a manner that allows rapid access and use by employees.

[Attach Spill Control Plan]

APPENDIX E

Integrated Pest Management Plan

[Note: If You Are Required To Prepare An Integrated Pest Management Plan Attach The Completed Plan To This Section. If No IPMP Is Required For Your Project, This Section May Be Removed.] See https://www.co.thurston.wa.us/health/ehipm/ipm_developer.html

Integrated Pest Management Guidance

Integrated Pest and Vegetation Management (IPM) is a natural, long-term, ecologically-based systems approach to controlling pest populations. IPM is used to reduce pest populations, maintain them at levels below those causing health concerns or economic damage. The goals of IPM are to both encourage optimal selective pesticide use (away from prophylactic, broad spectrum use), and to maximize natural controls to minimize environmental side effects.

Thurston County requires Integrated Pest Management Plans for certain land use projects located in Category I or II Aquifer Recharge Areas, where drinking water sources are vulnerable to contamination. These include:

1. Subdivisions of 10 lots or greater (excluding large lots).
2. Any land use project that incorporates maintained open space totally more than five acres.
3. All land use projects located within a delineated wellhead capture zone for a Group A public water supply.

For more information on Thurston County's IPM policy, visit the County web site at: *http://www.co.thurston.wa.us/health/ehipm/index.html*

Introduction

True integrated pest and vegetation management is a powerful approach that anticipates and prevents most problems through appropriate cultural practices and careful observation. Knowledge of the life cycles of host plants and both beneficial and pest organisms is also important. The integrated pest management section of this guidance is adapted from *Least Toxic Pest Management for Lawns* by Sheila Daar. Following the integrated pest management process gives you the information you need to minimize damage by weeds, diseases, and pests and to treat those problems with the least toxic approaches.

The IPM Process

Step One: Correctly identify problem pests and understand their life cycle.

Learn more about the pest. Observe it and pay attention to any damage that may be occurring. Learn about the life cycle. Many pests are only a problem during certain seasons or can only be treated effectively in certain phases of the life cycle.

Step Two: Establish tolerance thresholds for pests.

Every landscape has a population of some pest insects, weeds, and diseases. This is good because it supports a population of beneficial species that keep pest numbers in check. Beneficial organisms may compete with, eat, or parasitize disease or pest organisms. Decide on the level of infestation that must be exceeded before treatment needs to be considered. Pest populations under this threshold should be monitored but don't need treatment. For instance, European crane flies usually don't do serious damage to a lawn unless there are 25 to 40 larvae per square foot feeding on the turf in February (in normal

weather years). Also, most people consider a lawn healthy and well maintained even with up to 20 percent weed cover, so treatment, other than continuing good maintenance practices, is generally unnecessary.

Step Three: Monitor to detect and prevent pest problems.

Regular monitoring is a key practice to anticipate and prevent major pest outbreaks. It begins with a visual evaluation of the lawn or landscape's condition. Take a few minutes before mowing to walk around and look for problems. Keep a notebook, record when and where a problem occurs, then monitor for it at about the same time in future years. Specific monitoring techniques can be used in the appropriate season for some potential problem pests, such as European crane fly.

Step Four: Modify the maintenance program to promote healthy plants and discourage pests.

A healthy landscape is resistant to most pest problems. Lawn aeration and over-seeding along with proper mowing height, fertilization, and irrigation will help the grass out-compete weeds. Correcting drainage problems and letting soil dry out between waterings in the summer may reduce the number of crane-fly larvae that survive.

Step Five: If pests exceed the tolerance thresholds …

Use cultural, physical, mechanical, or biological controls first. If those prove insufficient, use the chemical controls described below that have the least non-target impact. When a pest outbreak strikes (or monitoring shows one is imminent), implement integrated pest management then consider control options that are the least toxic, or have the least non-target impact. Here are two examples of an integrated pest management approach:

1. **Red thread disease** is most likely under low nitrogen fertility conditions and most severe during slow growth conditions. Mow and bag the clippings to remove diseased blades. Fertilize lightly to help the grass recover, then begin grasscycling and change to fall fertilization with a slow-release or natural-organic fertilizer to provide an even supply of nutrients. Chemical fungicides are not recommended because red thread cannot kill the lawn.

2. **Crane fly damage** is most prevalent on lawns that stay wet in the winter and are irrigated in the summer. Correct the winter drainage and/or allow the soil to dry between irrigation cycles; larvae are susceptible to drying out, so these changes can reduce their numbers. It may also be possible to reduce crane fly larvae numbers by using a power de-thatcher on a cool, cloudy day when feeding is occurring close to the surface. Studies are being conducted using beneficial nematodes that parasitize the crane fly larvae; this type of treatment may eventually be a reasonable alternative.

Only after trying suitable non-chemical control methods or determining that the pest outbreak is causing too much serious damage, should chemical controls be considered. If chemical controls prove necessary, determine what products are available and choose a product that is the least toxic and has the least non-target impact. Refer to the operational BMPs for the use of pesticides below for guidelines on choosing, storing, and using lawn and garden chemicals.

Step Six: Evaluate and record the effectiveness of the control, and modify maintenance practices to support lawn or landscape recovery and prevent recurrence.

Keep records! Note when, where, and what symptoms occurred, or when monitoring revealed a potential pest problem. Note what controls were applied and when, and the effectiveness of the control. Monitor next year for the same problems. Review your landscape maintenance and cultural practices to see if they can be modified to prevent or reduce the problem.

A comprehensive integrated pest management program should also include the proper use of pesticides as a last resort, and vegetation/fertilizer management to eliminate or minimize the contamination of stormwater.

[Attach Integrated Pest Management Plan]

Appendix IV-D: Recycling/Disposal of Vehicle Fluids/Other Wastes*

	Recommended Management
Antifreeze	Store separately for resale. Separate ethylene glycol from propylene glycol for off-site recycling. If not recyclable, send to Treatment, Storage, and Disposal Facility (TSDF) for disposal.
Batteries	INTACT: Accumulate under cover prior to sale, deliver to recycler, or return to manufacturer. BROKEN: Accumulate acid from broken batteries in resistant containers with secondary containment. Send to TSDF for disposal.
Brake fluid	Accumulate in separate, marked, closed container. Do not mix with waste oil. Recycle.
Fuel	Store gasoline, and diesel separately for use or resale. Mixtures of diesel, gasoline, oil, and other fluids may not be recyclable and may require expensive disposal.
Fuel filters	Drain fluids for use as product. With approval of local landfill operator, dispose to dumpster, if needed.
Oil filters	Puncture the filter dome and drain it for 24 hours. Put oil drained from filters into a "USED OIL ONLY" container. Keep drained filters in a separate container marked "USED OIL FILTERS ONLY." Locate a scrap metal dealer who will pick up and recycle filters. With approval of local landfill operator, dispose of drained filters to dumpster.
Paint	Accumulate oil-based and water-based paints separately for use or resale. If not recyclable, send accumulations to TSDF for disposal.
Power steering fluid	Same as for used oils
Shop towels/oily rags	Use cloth towels that can be laundered and reused. Accumulate used shop towels in a closed container. Sign up with an industrial laundry service that can recycle towels.
Solvents	Consider using less hazardous solvents or switching to a spray cabinet that doesn't use solvent. Accumulate solvents separately. Consider purchasing a solvent still and recycling solvent on site. Do not mix with used oil. Do not evaporate as a means of disposal.
Transmission oil, differential and rear end fluids	Accumulate in a "USED OIL ONLY" container. Arrange for pickup for off-site recycling.
Used oils; including, crankcase oil, transmission oil, power steering fluid and differential/rear end oil	Keep used oil in a separate container marked "USED OIL ONLY." Do not mix with brake fluid, or used antifreeze. Do not mix with any other waste if burning for heating. Arrange for pickup for off-site recycling.
Windshield washer fluid	Accumulate separately for use or resale. Discharge to on-site sewage disposal, or, if acceptable by the local sewer authority, discharge to sanitary sewer.

* Ecology's Hazardous Waste Program developed this information. The Hazardous Waste Service Directory is now available online at: http://apps.ecy.wa.gov/hwsd/default.htm

Appendix IV-E: Regulatory Requirements That Impact Stormwater Programs

R.1 Stormwater Discharges to Public Sanitary Sewers, Septic Systems, Dead-End Sumps, and Industrial Waste Treatment Systems

Stormwater Discharges to Sanitary Sewers. Discharging stormwater to a public sanitary sewer is normally prohibited, as this tends to overload the sewage treatment plant during storm events when flows are already high. Direct discharge of relatively uncontaminated or treated stormwater from businesses typically poses less of a threat to the environment than pass through of solids due to "wash out" at the sewage treatment plant during storm events. Such discharges require the approval of the local Sewer Authority if the Department of Ecology (Ecology) has delegated the authority to set pretreatment requirements. If the Sewer Authority has not received such authority, the business or public agency that wishes to discharge stormwater to the sanitary sewer must also apply for a State Waste Discharge Permit.

In setting pretreatment requirements, the local Sewer Authority or Ecology must operate within state regulations (Chapter 173-216 WAC – State Waste Water Discharge Permit Program) which in turn must comply with federal regulations (40 CFR Part 403.5 – National Pretreatment). These regulations specifically prohibit discharge of any materials which:

- Pass through the municipal treatment plant untreated or interfere with its operation.
- Create a fire or explosion hazard, including, but not limited to, waste-streams with a closed cup flash point of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 261.21.
- Will cause corrosive structural damage to the Publicly Owned Treatment Works (POTW), but in no case Discharges with pH lower than 5.0, or greater than 11, unless the works is specifically designed to accommodate such Discharges; and the discharge authorized by a permit issued under Chapter 173-216 WAC. (See WAC 173-216-060 (2) (iv)).
- Solid or viscous pollutants in amounts that will cause obstruction to the flow in the POTW resulting in interference.
- Heat in amounts that will inhibit biological activity in the POTW resulting in interference, but in no case heat in such quantities that the temperature at the POTW Treatment Plant exceeds 40 degrees Centigrade (104 degrees Fahrenheit) unless the system is specifically designed to accommodate such discharge, and the discharge is authorized by a permit under Ch 173-216 WAC. (See WAC 173-216-060 (2) (v)).
- Petroleum oil, nonbiodegradable cutting oil or products of mineral oil origin in amounts that will cause interference or pass through the treatment plant.
- Pollutants that result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity that may cause acute worker health and safety problems.
- Any trucked or hauled pollutants, except at discharge points designated by the POTW.
- Any discharge which would violate the dangerous waste regulations, Chapter 173-303 WAC (see WAC 173-216-060(1)).

- Any of the following discharges, unless approved by the department under extraordinary circumstances, such as lack of direct discharge alternatives due to combined sewer service or need to augment sewage flows due to septic conditions: (WAC 173-216-060(2)(vii)):
  - Noncontact cooling water in significant volumes.
  - Stormwater, and other direct inflow sources.
  - Wastewater significantly affecting system hydraulic loading, which do not require treatment or would not be afforded a significant degree of treatment by the system.

Discharges of stormwater authorized under Chapter 173-216 WAC, typically limit flows entering the sanitary sewer based on the available hydraulic capacity of the collection system or the treatment plant by the combined flow of sanitary sewage and stormwater. The allowable concentrations of particular materials such as metals and grease vary with the particular sewer system. Discharges must comply with all local government limits. Please contact both the POTW and the regional water quality program to find out what discharge limits apply to a particular sewerage system.

Stormwater Discharges to an Industrial Waste Treatment System: Operators may process treatment to dispose of polluted stormwater depending on the NPDES permit constraints of the particular business.

Stormwater Discharges to Dead-end Sumps: Do not discharge substances that causes a violation of water quality standards to a septic system, surface water, or ground water. If a sanitary or industrial wastewater treatment system is not available, an alternative is the use of a dead-end sump. Sumps are tanks with drains that can be periodically pumped for appropriate disposal. Depending on the composition of the waste, it may or may not be considered Dangerous Waste.

For more information on disposal requirements for sumps, see Step By Step: Fact Sheets for Hazardous Waste Generators, publication #91-12, available from Ecology's Regional Offices.

R.2 Uniform Fire Code Requirements

Storage of flammable, ignitable, and reactive chemicals and materials must comply with the stricter of local zoning codes, local fire codes, the Uniform Fire Code, Uniform Fire Code standards or the National Electric Code.

R.3 Ecology Requirements for Generators of Dangerous Wastes

The State's Dangerous Waste Regulations (Chapter 173-303 WAC) cover accumulation, storage, transportation, treatment and disposal of dangerous wastes. Of interest to this manual are those businesses or public agencies that accumulate the waste at their building until taken from the site by a contract hauler.

For more information on applicable requirements for dangerous wastes, see Step By Step: Fact Sheets for Hazardous Waste Generators, publication #91-12, available from Ecology's Regional Offices.

R.4 Standards for Solid Waste Containers

Standards for solid waste containers are identified in WAC 173-350-300, On-site Storage, Collection, and Transportation Standards.

R.5 Coast Guard Requirements For Marine Transfer of Petroleum Products

Federal regulations 33 CFR Parts 153, 154 and 155 cover, respectively, general requirements on spill response, spill prevention at marine transfer facilities, and spill prevention for vessels. These regulations specify technical requirements for transfer hoses, loading arms, closure, and monitoring devices. The regulations also cover small discharge containment: they require the use of "fixed catchments, curbing, and other fixed means" at each hose handling and loading arm area and each hose connection manifold area. Operators can use portable containment in exceptional situations where fixed containment is not feasible. The capacity of the containment area varies from the volume of 1 to 4 barrels depending on the size of the transfer hoses.

The regulations also require an operations plan and specify its general contents. The plan shall describe the responsibilities of personnel, nature of the facility, hours of operation, sizes and numbers of vessels using the facility, nature of the cargo, procedures if spills occur, and petroleum transfer procedures. The plan must also include a description and location of equipment for monitoring, containment, and fire fighting. *See also, NFPA 30A Automotive and Marine Service Station Code, American National Standard Institute and the National Fire Protection Association.*

R.6 Washington State/Federal Emergency Spill Cleanup Requirements

Washington State Requirements:
The Oil and Hazardous Substance Spills Act of 1990 and the Oil Spill Prevention and Response Act of 1991 (Chapter 90.56 RCW) authorized Ecology to develop effective oil spill response regulations.

The Facility Contingency Plan and response Contractor Standards (Chapter 173-182 WAC):

This Ecology regulation applies to all oil handling facilities (including pipelines) that are on or near navigable waters and transfer bulk oil by tank, ship, or pipeline. It contains the following elements:

- Standards for contingency plan content
- Procedures to determine the adequacy of contingency plans
- Requirements for periodic review
- Standards for cleanup and containment contractors

The Oil Handling Training and Certification Rule (Chapter 173-180 WAC) establishes oil spill training and certification requirements for key facility personnel including applicable contractors involved in oil handling, transfer, storage, and monitoring operations.

In accordance with WAC 173-303-350 of Ecology's Dangerous Waste Regulations, generators of dangerous wastes must have a Contingency Plan that includes:

- Actions to be taken in the event of spill
- Descriptions of arrangements with local agencies
- The name of the owner's Emergency Coordinator
- A list of emergency equipment available
- An evaluation plan for business personnel

For more information on disposal requirements for solid and dangerous wastes, see Step By Step: Fact Sheets for Hazardous Waste Generators, publication #91-12, available from Ecology's Regional Offices.

Federal Requirements:

The Oil Pollution Act of 1990 is a comprehensive federal law that addresses marine oil spill issues including contingency plans, financial responsibility, marine safety regulations, etc.

Spill Prevention Control and Countermeasure (SPCC) Plans:

Federal Regulations require that owners or operators of facilities engaged in drilling, producing, gathering, storing, processing, refining, transferring, or consuming oil and oil products are required to have a Spill Prevention and Control Plan (SPCC), provided that the facility is non-transportation related; and, that the above-ground storage of a single container is in excess of 660 gallons, or an aggregate capacity greater than 1,320 gallons, or a total below-ground capacity in excess of 42,000 gallons. The Plan must:

- Be well thought out in accordance with good engineering;
- Achieve three objectives - prevent spills, contain a spill that occurs, and clean up the spill;
- Identify the name, location, owner, and type of facility;
- Include the date of initial operation and oil spill history;
- Name the designated person responsible;
- Show evidence of approval and certification by the person in authority; and
- Contain a facility analysis.

R.7 WSDA Pesticide Regulations

The Washington State Department of Agriculture (WSDA) administers pesticide laws, under the Washington Pesticide Control Act (Chapter 15.58 RCW), Washington Pesticide Application Act (Chapter 17.21 RCW), and regulations under Chapter 16-228 WAC. The requirements relevant to water quality protection are:

Licenses are required for persons who apply pesticides except:

- People who use general-use pesticides on their own or their employer's property;
- Grounds maintenance people using only general-use pesticides on an occasional basis not amounting to a regular occupation;
- Governmental employees who apply general-use pesticides without utilizing any kind of motorized or pressurized apparatus;
- Employees of a commercial applicator or a government agency who are under direct on-site supervision by a licensed applicator.

Licensed applicators must undergo 40 hours of continuing education to keep their license.

No person shall pollute streams, lakes, or other water supplies while loading, mixing or applying pesticides.

No person shall transport, handle, store, load, apply, or dispose of any pesticide, pesticide container, or apparatus in such a manner as to pollute water supplies or waterways, or cause damage or injury to land, including humans, desirable plants, and animals.

For more information on pesticide application and disposal requirements the following publications may be useful:

- *"Hazardous Waste Pesticides: A Guide for Growers, Applicators, Consultants and Dealers," Ecology Publication #89-41, August 1989, available from Ecology's Regional Offices.*

- *"Suspended, Canceled and Restricted Pesticides," EPA, available from the EPA Region 10 Office in Seattle.*
- *"Best Management Practices for Agricultural Chemicals-A Guide for Pesticide Secondary Containment," Ecology Publication #94-189.*
- *"Site Evaluation-A Guide for Pesticide Secondary Containment," Ecology Publication #94-188.*
- *"Reducing and Managing Wastes From Catchbasins-A Guide for Pesticide Secondary Containment," Ecology Publication #94-186.*
- *"Spill Reporting and Cleanup in Washington State-A Guide for Pesticide Secondary Containment," Ecology Publication #94-187.*
- *"Pesticide Container Cleaning and Disposal," Ecology Publication #96-431.*
- *"Step By Step: Fact Sheets for Hazardous Waste Generators," Ecology Publication #91-12.*

R.8 Air Quality Regulations

Regulation of air pollutant emissions in Washington is controlled by seven local air pollution control agencies, three Ecology regional offices and two Ecology programs (Central Program's Industrial Section, and Nuclear and Mixed Waste Program). All of the local air pollution agencies and the regional offices enforce local, state and federal air pollution regulations. The Industrial Section of Ecology's Central Program enforces state and federal air pollution regulations at chemical pulp mills and aluminum reduction facilities. The Nuclear and Mixed Waste Program enforces state and federal air pollution regulation on the Hanford Nuclear Reservation.

Whether it is to control the generation of fugitive emissions or point source (smoke stack) emissions, new and existing sources of air pollutants must comply with the requirements contained in their air pollution permits, regulatory orders, and local, state, and federal air pollution regulations. This will minimize the effects of each facility's emissions on stormwater.

Fugitive Particulate Matter Emissions: The local and state air pollution control agencies require that all reasonable precautions be taken to prevent fugitive particulate matter (windblown dust) from becoming airborne when handling, loading, transporting, and storing particulate material. Particulate materials of concern can include grain and grain dust, saw dust, coal, gravel and crushed rock, cement, and boiler fly ash.

Some of the local authorities take the general requirement to control fugitive emissions further. For example, the Puget Sound and Benton County Air Pollution Control Agencies have defined what "reasonable precautions" means for various dust causing activities in their jurisdictions.

Some actions that have been defined as "reasonable precautions" to prevent fugitive particulate emissions include paving of parking and storage areas, minimizing the area of land that has been cleared for housing development, various housekeeping activities such as sweeping paved areas, minimization of the accumulation of mud and dust and preventing mud and dust being tracked onto public roads, and stabilization of materials piles and open, cleared land areas with water sprays, chemical stabilizers or other means that minimize dust generation. All air authorities require sand blasting and spray painting activities be performed indoors with proper air pollution controls in use or, if that is not possible, out of doors but within acceptable, temporary enclosures.

Gaseous Air Pollutant Emissions: Gaseous air pollutants are controlled at the point of origin through add-on emission controls or pollution prevention measures. Each emission point at a plant generally has emission limits that must be complied with.

Sources of gaseous air pollutants can include petroleum storage tank breather and pressure release systems, combustion units (boilers and heaters), commercial printers, can manufacturers, steel mills, pulp and paper plants, auto body repair shops, etc. Examples of gaseous air pollutants that can be emitted include acetone, methylene chloride, styrene, nitrogen oxides, benzene, carbon monoxide, alcohol, organic sulfides and petroleum, and chlorinated solvents.

Some gaseous pollutants can be washed out of the air during rainstorms and enter stormwater. Others are photochemically degraded or converted in the air to other compounds that can be removed by rainfall or by settling on the ground. Gaseous air pollutants such as sulfur dioxide react in the air to generate acidic particulate matter. These particulates are usually removed from the atmosphere by settling out or being washed out of the air. In the case of sulfur oxides, this removal usually occurs at some distance (tens to hundreds of miles) from the facility that emitted the pollutant.

R.9 Ecology Waste Reduction Program

The 1990 Hazardous Waste Reduction Act, Chapter 70.95C RCW, established a goal to reduce dangerous waste generation by 50 percent. The primary means for achieving this goal is through implementation of a pollution prevention-planning program, also established in the Act. Facilities that generate in excess of 2,640 pounds of dangerous waste per year, or who are required to report under the Toxic Release Inventory (TRI) of Title III of the Superfund Amendments and Reauthorization Act (SARA), are subject to this law. Some 650 facilities in Washington currently participate in this planning program.

Pollution prevention planning is an activity that involves:

- Inventorying substances used and dangerous waste generated;
- Identifying opportunities to prevent pollution;
- Analyzing the feasibility of these prevention opportunities; and
- Setting goals for hazardous substance use reduction and dangerous waste reduction, recycling and treatment.

Ecology promotes pollution prevention through initiatives other than planning. Several campaigns targeting specific industries have been conducted and more are being planned. These campaigns have a joint focus of pollution prevention and regulatory compliance, and help target future technical assistance. Ecology provides technical assistance through its regional offices, with emphasis on the reduction of hazardous substance use and dangerous waste generation. Site visits, phone consultations, and workshops are some of the ways assistance is provided to businesses and governmental entities.

Pollution prevention has emerged as a key strategy for protecting the environment. Business, industry and government alike recognize the benefits of prevention rather than end of pipe controls. Many factors, including regulatory compliance, cost savings, worker safety and reduced liabilities help validate pollution prevention as an approach to be incorporated into all business practices.

R.10 Washington State Ground Water Quality Standards

In December 1990, the state of Washington adopted ground water quality standards to prevent ground water pollution and protect both current and future beneficial uses of the resource. Beneficial uses of ground water include drinking water, irrigation, and support of wildlife habitat. These standards apply to any activity, including point and non-point, which has a potential to contaminate ground water. The standards protect all ground water within the saturated zone throughout the State of Washington and do not distinguish ground water that is isolated, seasonal, or artificial from that which is extensive and

naturally occurring. The standards incorporate an existing part of state water quality law: the antidegradation policy, which is an integral part of both the ground and surface water quality standards.

The standards consist of both numeric criteria and narrative standards designed to protect both current and future beneficial uses of ground water. The numeric criteria for primary, secondary, and radionuclide contaminants have been adopted from the Federal Safe Drinking Water Act of 1971. Numeric criteria for carcinogenic compounds are based upon human health criteria. These criteria represent the maximum allowable contaminant concentration in ground water within the aquifer. However, the antidegradation policy requires that ground water quality be protected to the greatest extent possible prior to contaminant concentrations reaching those specified within the numeric criteria. To address this requirement, narrative standards were developed which are based upon background water quality and use of treatment technologies and are site specific in nature. Under these standards, specific early warning and enforcement limits are set at a point of compliance which must be met by a facility or activity if enforcement action is to be avoided. All facilities or activities within the State of Washington must first attempt to meet these narrative standards. The determination of specific limits is outlined in *Implementation Guidance for the Ground Water Quality Standards, Ecology publication #96-02 (Ecology, 1996).*

In addition to using background ground water quality as a basis for determining specific early warning and enforcement limits, Washington law requires that all activities with the potential to contaminate water implement practices known as AKART – short for "all known available and reasonable methods of prevention, control and treatment." AKART must be used regardless of the quality of the receiving waters. As technology and preventive controls are refined to better protect water quality, AKART is also redefined. In individual cases where AKART fails to protect water quality, the activity must apply additional controls.

State law requires the permitting of any industrial, commercial, or municipal operation, which discharges waste material into ground and/or surface waters. These permits, issued by Ecology, set limits and conditions for discharges. Underground injection activities, while exempt from the State Waste Discharge Program, Chapter 173-216 WAC, are required to meet the ground water quality standards and may be permitted under Chapter 173-218 WAC, Underground Injection Control Program. Guidance for permit development will describe how an industry or commercial or municipal operation must conduct its activities in order to protect ground water quality.

The ground water quality standards provide for several exemptions. One of these exceptions provides that the standards do not apply in the root zone of saturated soils where agricultural pesticides or nutrients have been applied at agronomic rates for agricultural purposes. The standards do apply below the crop's root zone. State approved BMPs may be considered one type of AKART for agriculture, and other point and non-point sources. Another exemption applies to any remedial or clean-up activity conducted under federal CERCLA or state Model Toxics Control Act.

Appendix IV-F: NPDES Stormwater Discharge Permits

Summary:
The Environmental Protection Agency's (EPA) National Pollutant Discharge Elimination System Permit (NPDES) regulations for stormwater (40 CFR Parts 122, 123, and 124) became effective on November 16, 1990. Because Washington is an NPDES delegated state, it issues NPDES permits for designated industries, construction sites, and municipalities.

Industrial Stormwater Permits:
USEPA regulations list certain industrial activities (Reference: 40 CFR 122.26(b)(14) which may need to have a stormwater discharge permit. The following categories (1 through 10) of facilities are considered to be engaging in "industrial activity." They are required by EPA to have a stormwater NPDES permit if they have a stormwater discharge to surface water.

1) Facilities subject to stormwater effluent limitations guidelines, new source performance standards, or toxic pollutant effluent standards under 40 CFR subchapter N (except facilities with toxic pollutant effluent standards under category 11 below).
2) Facilities classified by the Standard Industrial Classification (SIC) system as:
   - 24 - Lumber and Wood Products except Furniture (except 2434- Wood Kitchen Cabinets)
   - 26 - Paper and Allied Products (except 265-Paperboard Containers and Boxes, and except 267-Converted Paper and Paperboard Products except Containers and Boxes)
   - 28 - Chemicals and Allied Products (except 283-Drugs; and 285- Paints, Varnishes, Lacquers, Enamels, and Allied Products)
   - 29 - Petroleum Refining and Related Industries
   - 311- Leather Tanning and Finishing
   - 32 - Stone, Clay, Glass and Concrete Products (except 323-Glass Products, made of Purchased Glass)
   - 33 - Primary Metal Industries
   - 3441 -Fabricated Structural Metal Products
   - 373- Ship and Boat Building and Repair
3) Facilities classified by the Standard Industrial Classification (SIC) system as:
   - 10 - Metal Mining
   - 12 - Coal Mining
   - 13 - Oil and Gas Extraction
   - 14 - Mining and Quarrying of Nonmetallic Minerals, except Fuels (Includes active or inactive mining operations (except for areas of coal mining operations no longer meeting the definition of a reclamation area under 40 CFR 434.11(1) or except for areas of non-coal mining operations which have been released from applicable state or federal reclamation requirements by December 17, 1990) and oil and gas exploration, production, processing or treatment operations, or transmission facilities that discharge storm water that has come into contact with any overburden, raw material, intermediate products, finished products, byproducts or waste products located on the site of such operation.

4) Dangerous waste treatment, storage, or disposal facilities, including those that are operated under interim status or a permit under subtitle C of RCRA.

5) Landfills, land application sites and open dumps that receive or have received any industrial wastes (waste that is received from any of the facilities described under this subsection) including those that are subject to regulation under subtitle D of RCRA.

6) Facilities involved in the recycling of materials including metal scrap yards, battery reclaimers, salvage yards and automobile junkyards, including but not limited to those classified as SIC 5015-Wholesale Trade Activities of Motor Vehicle Parts, Used; and SIC 5093-Scrap and Waste Materials.

7) Steam electric power generating facilities, including coal-handling sites.

8) Transportation facilities classified under the following SIC codes, which have vehicle maintenance shops, equipment-cleaning operations, and airport deicing operations.

   40 Railroad Transportation

   41 Local and Suburban Transit and Interurban Highway Passenger Transportation

   42 Motor Freight Transportation and Warehousing (except 4221- Farm Product Warehousing and Storage, 4222-Refrigerated Warehousing and Storage, and 4225-General Warehousing and Storage)

   43 United States Postal Service

   44 Water Transportation

   45 Transportation by Air

   5171 Petroleum Bulk Stations and Terminals

9) Treatment works treating domestic sewage or any other sewage sludge or wastewater treatment device or system, used in the storage treatment, recycling, and reclamation of municipal or domestic sewage, including land dedicated to the disposal of sewage sludge that are located within the confines of the facility, with a design flow of 1.0 MGD or more, or required to have an approved pretreatment program under 40 CFR part 403. Not included are farmlands, domestic gardens or lands used for sludge management where sludge is beneficially reused and which are not physically located in the confines of the facility, or areas that are in compliance with section 405 of the Clean Water Act.

10) Construction activity including clearing, grading and excavation activities except: operations that result in the disturbance of less than one acre of total land area which are not part of a larger common plan of development or sale. (See “Construction Stormwater Permits” below)

11) Facilities under the following SIC classifications need to apply for a stormwater NPDES permit only if they are engaged in an “industrial activity” which is exposed to stormwater and they have a point source stormwater discharge to surface water.

   20 Food and Kindred Products

   21 Tobacco Products

   22 Textile Mill Products

   23 Apparel and Other Finished Products made from Fabrics and Similar Materials Wood Kitchen Cabinets

   25 Furniture and Fixtures

   265 Paperboard Containers and Boxes

267 Converted Paper and Paperboard Products, Except Containers and Boxes

27 Printing, Publishing and Allied Industries

283 Drugs

285 Paints, Varnishes, Lacquers, Enamels, and Allied Products

30 Rubber and Miscellaneous Plastic Products

31 Leather and Leather Products (except 311, Leather Tanning and Finishing)

323 Glass Products made of Purchased Glass

34 Fabricated Metal Products, Except Machinery and Transportation Equipment (except 3441, Fabricated Structural Metal Products)

35 Industrial and Commercial Machinery and Computer Equipment

36 Electronic and Other Electrical Equipment and Components, Except Computer Equipment

37 Transportation Equipment (except 373, Ship and Boat Building and Repair)

38 Measuring, Analyzing, and Controlling Instruments, Photographic, Medical and Optical Goods, Watches and Clocks

39 Miscellaneous Manufacturing Industries

4221 Farm Product Warehousing and Storage

4222 Refrigerated Warehousing and Storage

4225 General Warehousing and Storage

For the industries identified in SIC categories (1) through (10), a permit is necessary if there is a point source stormwater discharge to a surface water, storm drain which discharges to surface water directly or indirectly, or a municipal storm sewer from any of the following areas of industrial activity: industrial plant yards; immediate access roads and rail lines used or traveled by carriers of raw materials, manufactured products, waste material, or by-products used or created by the facility; material handling sites; refuse sites; sites used for the application or disposal of process waste waters (as defined at 40 CFR part 401); sites used for the storage and maintenance of material handling equipment; sites used for residual treatment, storage, or disposal; shipping and receiving areas; manufacturing buildings; storage areas (including tank farms) for raw materials, and intermediate and finished products; and areas where industrial activity has taken place in the past and significant materials remain and are exposed to storm water.

Industries in Categories 1 through 9 can submit an application and qualify for a Conditional “No Exposure” Certificate.

For the industries identified in SIC category (11), a permit is required for point source discharges from any of the areas that are listed above (except access roads and rail lines of SIC category 11 industries), only if material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, or industrial machinery are exposed to stormwater. However, they must submit a “No Exposure” Certificate to be excused from the permit.

How and When Do I Apply for A Permit?

Three types of permits are possible. Each has a different application process.

General Permit for Industrial Activities: An application for coverage under the Industrial Stormwater General Permit, referred to as a Notice of Intent (NOI), must be submitted to Ecology.

Individual Permit: An industrial facility that is required to have a stormwater permit may volunteer or be required to apply for an individual permit. An individual permit is a permit that is written for and issued to a specific facility. EPA regulations require that industries not covered under a general permit must apply for an individual stormwater permit. Individual permit applicants for discharges composed entirely of stormwater, must comply with 40 CFR 122.21, and complete EPA forms 1 and 2F. Ecology is prepared to issue individual permits for facilities not already under permit only for exceptional circumstances.

Industry-Specific General Permits: Ecology will consider development of industry-specific general permits, as needed. An industry-specific permit is a permit that can apply to all industries of a similar type. Examples of industry-specific general permits that include stormwater are Sand and Gravel, and Boatyards.

What Does The Industrial Stormwater General Permit Require Industries To Do?

The development of an Industrial Stormwater Pollution Prevention Plan (SWPPP) by each industry is a key Permit requirement. The Industrial SWPPP requirements include:

- Identifying the potential sources of pollutants that may contaminate stormwater.
- A description and implementation of operational and structural source control BMPs to reduce the stormwater pollutants and comply with the stormwater general permit.

The permit also includes requirements for:

- Effluent limitations for certain types of industrial facilities, and certain discharges to 303(d) impaired waterbodies;
- Monitoring: All facilities are required to conduct quarterly monitoring and sampling. There are additional monitoring requirements for certain, identified industry groups;
- Application of additional source control and treatment BMPs to control pollutants further if certain “benchmark” levels of pollutants, as identified in the permit, are exceeded;
- Reporting and Recordkeeping;
- Operation and Maintenance

Municipalities May Have To Apply for an Industrial Stormwater Permit or Other General Permit

Some municipalities own or operate an “industrial activity.” If that industrial activity has a stormwater discharge to surface waters or storm drains tributary to surface waters, the municipality must apply for the Industrial Stormwater General Permit (or applicable industry-specific general permit, e.g., Sand & Gravel General Permit, Boatyard General Permit, etc.) unless the site qualifies for a Conditional “No Exposure” Certificate. In the latter case, a “no exposure” application form should be submitted.

Examples of industrial activities conducted by municipalities include, but may not be limited to: sand and gravel mining; crushed and broken stone operations; rip rap mining and quarrying; landfills, recycling facilities, land application sites, and open dumps that receive or have received industrial waste; transportation facilities which have vehicle maintenance shops; equipment cleaning; airport de-icing operations; and sewage treatment plants with a design flow above one million gallons per day; and power plants.

Construction Stormwater Permits

Construction sites that will disturb one acre or more and will have a discharge of stormwater from the project site to surface water must apply for Ecology's Construction Stormwater General Permit. The permit requires application of stabilization and structural practices to reduce the potential for erosion and the discharge of sediments from the site. The stabilization and structural practices cited in the

permit are similar to the core requirements for sedimentation and erosion control in Volume I and II of the SWMM; refer to the Construction Stormwater General Permit for specific requirements.

Municipal Stormwater Permits

NPDES Permit Program for Municipal Stormwater Discharges

Phase I. Ecology has issued stormwater discharge general permits to the cities of Seattle and Tacoma; the counties of King, Pierce, Clark, and Snohomish; and the discharges from state highways managed by the Department of Transportation within those jurisdictions. These permits contain conditions for compliance with both federal and state requirements and are issued as combined NPDES and State Wastewater Discharge Permits. Ecology reissued the Phase I general permit in 2007 and plans to reissue the next permit in 2012.

Phase II. The EPA adopted Phase II stormwater regulations in December 1999. Those rules identify additional municipalities as subject to NPDES municipal stormwater permitting requirements. Over 100 municipalities in Washington are subject to the requirements. Federal regulations required issuance of Phase II permits by December 2002, and required the Phase II communities to submit their stormwater programs to comply with permit requirements by March 2003. Ecology issued the Phase II permits for Eastern Washington and Western Washington in 2007 and plans to reissue these two general permits in 2012.

Appendix IV-G: Example of an Integrated Pest Management Program

Integrated Pest Management (IPM) is a natural, long-term, ecologically based systems approach to controlling pest populations. This system uses techniques either to reduce pest populations or maintain them at levels below those causing economic injury, or to so manipulate the populations that they are prevented from causing injury. The goals of IPM are to encourage optimal selective pesticide use (away from prophylactic, broad spectrum use), and to maximize natural controls to minimize the environmental side effects.

A step-by-step comprehensive Integrated Pest Management (IPM) Program is provided below as a guide:

Introduction

This section provides a sound cultural approach to managing lawns and landscapes and minimizing runoff. Many homeowners or property managers will be able to implement most or all of this approach, others will wish to hire these services out. For the do-it yourselfer, an array of resources are available to assist in the effort. Landscaping businesses, agricultural extensions, local agencies, master gardener programs, local nurseries and even the library can all provide assistance. Landscaping professionals (businesses) are particularly encouraged to practice IPM.

Definition

"Integrated pest management, or IPM, is an approach to pest control that uses regular monitoring to determine if and when treatments are needed, and employs physical, mechanical, cultural, and biological tactics to keep pest numbers low enough to prevent intolerable damage or annoyance. Least-toxic chemical controls are used as a last resort."

True IPM is a powerful approach that anticipates and prevents most problems through proper cultural practices and careful observation. Knowledge of the life cycles of the host plants and both beneficial and pest organisms is also important. The IPM section of this study guide is adapted from Least Toxic Pest Management for Lawns by Sheila Daar, Following the IPM process gives you the information you need to minimize damage by weeds, diseases and pests and to treat those problems with the least toxic approaches.

The Integrated Pest Management Process

Step One: Correctly identify problem pests and understand their life cycle.
Learn more about the pest. Observe it and pay attention to any damage that may be occurring. Learn about the life cycle. Many pests are only a problem during certain seasons, or can only be treated effectively in certain phases of the life cycle.

Step Two: Establish tolerance thresholds for pests.
Every landscape has a population of some pest insects, weeds, and diseases. This is good because it supports a population of beneficial species that keep pest numbers in check. Beneficial organisms may compete with, eat, or parasitize disease or pest organisms. Decide on the level of infestation that must be exceeded before treatment needs to be considered. Pest populations under this threshold should be monitored but don't need treatment. For instance, European crane flies usually don't do serious damage to a lawn unless there are between 25 – 40 larvae per square foot feeding on the turf in February (in normal weather years). Also, most people consider a lawn healthy and well maintained even with up to 20% weed cover, so treatment, other than continuing good maintenance practices, is generally unnecessary.

Step Three: Monitor to detect and prevent pest problems.
Regular monitoring is a key practice to anticipate and prevent major pest outbreaks. It begins with a visual evaluation of the lawn or landscape's condition. Take a few minutes before mowing to walk around and look for problems. Keep a notebook, record when and where a problem occurs, then monitor for it at about the same time in future years. Specific monitoring techniques can be used in the appropriate season for some potential problem pests, such as European crane fly.

Step Four: Modify the maintenance program to promote healthy plants and discourage pests.
A healthy landscape is resistant to most pest problems. Lawn aeration and overseeding along with proper mowing height, fertilization, and irrigation will help the grass out-compete weeds. Correcting drainage problems and letting soil dry out between waterings in the summer may reduce the number of crane-fly larvae that survive.

Step Five: If pests exceed the tolerance thresholds
Use cultural, physical, mechanical or biological controls first. If those prove insufficient, use the chemical controls described below that have the least non-target impact. When a pest outbreak strikes (or monitoring shows one is imminent), implement IPM then consider control options that are the least toxic, or have the least non-target impact. Here are two examples of an IPM approach:

1. **Red thread disease** is most likely under low nitrogen fertility conditions and most severe during slow growth conditions. Mow and bag the clippings to remove diseased blades. Fertilize lightly to help the grass recover, then begin grasscycling and change to fall fertilization with a slow-release or natural-organic fertilizer to provide an even supply of nutrients. Chemical fungicides are not recommended because red thread cannot kill the lawn.

2. **Crane fly damage is** most prevalent on lawns that stay wet in the winter and are irrigated in the summer. Correct the winter drainage and/or allow the soil to dry between irrigation cycles; larvae are susceptible to drying out so these changes can reduce their numbers. It may also be possible to reduce crane fly larvae numbers by using a power de-thatcher on a cool, cloudy day when feeding is occurring close to the surface. Studies are being conducted using beneficial nematodes that parasitize the crane fly larvae; this type of treatment may eventually be a reasonable alternative.

Only after trying suitable non-chemical control methods, or determining that the pest outbreak is causing too much serious damage, should chemical controls be considered. Study to determine what products are available and choose a product that is the least toxic and has the least non-target impact. Refer to the Operational BMPs for the use of Pesticides below for guidelines on choosing, storing and using lawn and garden chemicals.

Step Six: Evaluate and record the effectiveness of the control, and modify maintenance practices to support lawn or landscape recovery and prevent recurrence.

Keep records! Note when, where, and what symptoms occurred, or when monitoring revealed a potential pest problem. Note what controls were applied and when, and the effectiveness of the control. Monitor next year for the same problems. Review your landscape maintenance and cultural practices to see if they can be modified to prevent or reduce the problem.

A comprehensive IPM Program should also include the proper use of pesticides as a last resort, and vegetation/fertilizer management to eliminate or minimize the contamination of stormwater.

Appendix IV-H1 - Residential:

Agreement to Maintain Stormwater Facilities *Template*

(RESIDENTIAL SUBDIVISION VERSION)

AGREEMENT TO MAINTAIN
STORMWATER FACILITIES AND TO IMPLEMENT A
POLLUTION SOURCE CONTROL PLAN
BY AND BETWEEN THE CITY OF OLYMPIA
(HEREINAFTER "THE CITY") AND
_____, AND
ITS HEIRS, SUCCESSORS, OR ASSIGNS
(HEREINAFTER "OWNER")

The upkeep and maintenance of stormwater facilities and the implementation of pollution source control best management practices (BMPs) is essential to the protection of water resources in the City of Olympia and Puget Sound. All property owners are expected to conduct business in a manner that promotes environmental protection. This Agreement contains specific provisions with respect to maintenance of stormwater facilities and use of pollution source control BMPs. The authority to require maintenance and pollution source control is provided by ordinance.

LEGAL DESCRIPTION:

Whereas, Owner has constructed improvements, including but not limited to, buildings, pavement, and stormwater facilities on the property described above. In order to further the goals of the City to ensure the protection and enhancement of City water resources, the City and Owner hereby enter into this Agreement. The responsibilities of each party to this Agreement are identified below.

OWNER SHALL:

(1) Implement the Stormwater Facility Maintenance Program included herein as Attachment "A".

(2) Implement the Pollution Source Control Program included herein as Attachment "B".

(3) Maintain a record (in the form of a log book) of steps taken to implement the programs referenced in (1) and (2) above. The log book shall be available for inspection by City staff at Owner's business during normal business hours. The log book shall catalog the action taken, who took it, when it was done, how it was done, and any problems encountered or follow-on actions recommended. Maintenance items ("problems") listed in Attachment "A" shall be inspected on a monthly or more frequent basis as necessary. Owner is encouraged to photocopy the individual checklists in Attachment A and use them to complete the monthly inspections. These completed checklists would then, in combination, comprise the monthly log book.

(4) Submit an annual report to the City regarding implementation of the programs referenced in (1) and (2) above. The report must be submitted on or before August 31 of each calendar year and shall contain, at a minimum, the following:

(a) Name, address, and telephone number of the business, the person, or the firm responsible for plan implementation, and the person completing the report.

(b) Time period covered by the report.

(c) A chronological summary of activities conducted to implement the programs referenced in (1) and (2) above. A photocopy of the applicable sections of the log book, with any additional explanation needed, shall normally suffice. For any activities conducted by paid parties not affiliated with Owner, include a copy of the invoice for services.

(d) An outline of planned activities for the next year.

(5) Prevent any unauthorized modifications to stormwater facilities, including protected soil or vegetated areas serving a stormwater management function, and prevent them from being dismantled, revised, altered, or removed except as necessary for maintenance, repair, or replacement. Any such maintenance actions will be reported and covered under item 4 above and shall be approved of by the City of Olympia. Modifications to the stormwater quantity control and stormwater quality system must be approved in advance by the City and may require the submittal of revised design drawings, supporting calculations, modifications to maintenance agreements, and applications for permits.

THE CITY WILL, AS RESOURCES ALLOW:

(1) Provide technical assistance to Owner in support of its operation and maintenance activities conducted pursuant to its maintenance and source control programs. Said assistance shall be provided upon request and at no charge to Owner.

(2) Review the annual report and conduct occasional site visits to discuss performance and problems with Owner.

(3) Review this agreement and program attachments with Owner and modify as necessary.

(4) The City will supplement maintenance of bioretention facilities installed for stormwater code compliance within the right-of-way. The City will enter bioretention facilities in the City's maintenance program after the first three (3) years of plant establishment. The Owner is solely responsible for the first three years of plant establishment. City maintenance focuses on function, not aesthetics and includes removal of noxious weeds and rehabilitating the system should the ponded area hold water for more than 48 hours past the end of a rain event. Maintenance for aesthetic purposes is the responsibility of the adjacent property owner. *(Include this item only with developments constructing bioretention facilities associated with frontage improvements)*

REMEDIES:

(1) If the City determines that maintenance or repair work is required to be done to the stormwater facility existing on the Owner property, the City shall give the Owner within

which the drainage facility is located, and the person or agent in control of said property if different, notice of the specific maintenance and/or repair required. The City shall set a reasonable time in which such work is to be completed by the persons who were given notice. If the above required maintenance and/or repair is not completed within the time set, written notice will be sent to the persons who were given notice stating the City's intention to perform such maintenance and bill the Owner for all incurred expenses. The expenses charged to the Owner shall become a charge on the Owner's stormwater utility bill and may be collected by the City in the manner authorized for collection of such utility bills.

(2) If at any time the City determines that the existing system creates any imminent threat to public health or welfare, the City may take immediate measures to remedy said threat. No notice to the persons listed in (1), above, shall be required under such circumstances.

(3) The Owner grants authority to the City for access to any and all stormwater system features for the purpose of inspection, and performing maintenance or repair as may become necessary under Remedies (1) and/or (2). For stormwater facilities located within a City drinking water (wellhead) protection area, authority for access is also granted for purposes of providing pollution prevention outreach to residents, employees, and contractors. Access may include but is not limited to: interpretive sign installation, model home displays, demonstration sites, conducting interviews and surveys, observing practices, and distributing informational materials.

(4) The persons listed in (1) above shall assume all responsibility for the cost of any maintenance and for repairs to the stormwater facility. Such responsibility shall include reimbursement to the City within 30 days of the receipt of the invoice for any such work performed. Overdue payments will require payment of interest at the current legal rate for liquidated judgments. If legal action ensues, any costs or fees incurred by the City will be borne by the parties responsible for said reimbursements.

(5) The owner hereby grants to the City a lien against the above-described property in an amount equal to the cost incurred by the City to perform the maintenance or repair work described herein.

This Agreement is intended to protect the value and desirability of the real property described above and to benefit all the citizens of the City. It shall run with the land and be binding on all parties having or acquiring from Owner or their successors any right, title, or interest in the property or any part thereof, as well as their title, or interest in the property or any part thereof, as well as their heirs, successors, and assigns. They shall inure to the benefit of each present or future successor in interest of said property or any part thereof, or interest therein, and to the benefit of all citizens of the City.

Dated at _____, Washington, this _____ day of _____, _____.

OWNER

By:_____
Authorized Agent for Owner

_____

STATE OF WASHINGTON)
) ss
COUNTY OF THURSTON)

On this day and year above personally appeared before me, a Notary Public in and for the State of Washington duly commissioned and sworn, personally appeared _____, to me known to be the _____ of _____ and acknowledge the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that _____ is authorized to execute the said instrument and that the seal affixed is the corporate seal of said corporation.

WITNESS my hand and official seal the day and year first above written.

_____

Notary Public in and for the State of
Washington, residing in _____

My Commission Expires: _____

Dated at _____, Washington, this _____ day of _____, _____.

CITY OF OLYMPIA

By:_____
Authorized Agent for City

STATE OF WASHINGTON)
) ss
COUNTY OF THURSTON)

On this day and year above personally appeared before me, _____, to me known to be acting as Authorized Agent for_____, a Municipal Corporation,

who executed the foregoing instrument and acknowledged the said instrument to be the free and voluntary act and deed of said Municipal Corporation for the uses and purposes therein mentioned and on oath states s/he is authorized to execute the said instrument.

Given under my hand and official seal this _____ day of _____, _____.

_____
Notary Public in and for the State of Washington, residing in _____

My Commission Expires: _____

APPROVED AS TO FORM:

_____
City Attorney

Appendix IV-H2 - Corporate:

Agreement to Maintain Stormwater Facilities Template

(CORPORATE VERSION)

AGREEMENT TO MAINTAIN
STORMWATER FACILITIES AND TO IMPLEMENT A
POLLUTION SOURCE CONTROL PLAN
BY AND BETWEEN THE CITY OF OLYMPIA
(HEREINAFTER "THE CITY") AND
_____, AND
ITS HEIRS, SUCCESSORS, OR ASSIGNS
(HEREINAFTER "OWNER")
Any and all owners are equally and fully responsible for the entire system as a more particularly described below.

The upkeep and maintenance of stormwater facilities and the implementation of pollution source control best management practices (BMPs) is essential to the protection of water resources in the City of Olympia and Puget Sound. All property owners are expected to conduct business in a manner that promotes environmental protection. This Agreement contains specific provisions with respect to maintenance of stormwater facilities and use of pollution source control BMPs. The authority to require maintenance and pollution source control is provided by ordinance.

LEGAL DESCRIPTION:

Whereas, Owner has constructed improvements, including but not limited to, buildings, pavement, and stormwater facilities on the property described above. In order to further the goals of the City to ensure the protection and enhancement of City water resources, the City and Owner hereby enter into this Agreement. The responsibilities of each party to this Agreement are identified below.

OWNER SHALL:

(1) Implement the Stormwater Facility Maintenance Program included herein as Attachment "A".

(2) Implement the Pollution Source Control Program included herein as Attachment "B".

(3) Maintain a record (in the form of a log book) of steps taken to implement the programs referenced in (1) and (2) above. The log book shall be available for inspection by City staff at Owner's business during normal business hours. The log book shall catalog the action taken, who took it, when it was done, how it was done, and any problems encountered or follow-on actions recommended. Maintenance items ("problems") listed in Attachment "A" shall be inspected on a monthly or more frequent basis as necessary. Owner is encouraged to photocopy the individual checklists in Attachment A and use them to complete the monthly

inspections. These completed checklists would then, in combination, comprise the monthly log book.

(4) Submit an annual report to the City regarding implementation of the programs referenced in (1) and (2) above. The report must be submitted on or before August 31 of each calendar year and shall contain, at a minimum, the following:

(a) Name, address, and telephone number of the business, the person, or the firm responsible for plan implementation, and the person completing the report.

(b) Time period covered by the report.

(c) A chronological summary of activities conducted to implement the programs referenced in (1) and (2) above. A photocopy of the applicable sections of the log book, with any additional explanation needed, shall normally suffice. For any activities conducted by paid parties not affiliated with Owner, include a copy of the invoice for services.

(d) An outline of planned activities for the next year.

(5) Prevent any unauthorized modifications to stormwater facilities, including protected soil or vegetated areas serving a stormwater management function, and prevent them from being dismantled, revised, altered, or removed except as necessary for maintenance, repair, or replacement. Any such maintenance actions will be reported and covered under item 4 above and shall be approved of by the City of Olympia. Modifications to the stormwater quantity control and stormwater quality system must be approved in advance by the City and may require the submittal of revised design drawings, supporting calculations, modifications to maintenance agreements, and applications for permits.

THE CITY WILL, AS RESOURCES ALLOW:

(1) Provide technical assistance to Owner in support of its operation and maintenance activities conducted pursuant to its maintenance and source control programs. Said assistance shall be provided upon request and at no charge to Owner.

(2) Review the annual report and conduct occasional site visits to discuss performance and problems with Owner.

(3) Review this agreement and program attachments with Owner and modify as necessary.

(4) The City will supplement maintenance of bioretention facilities installed for stormwater code compliance within the right-of-way. The City will enter bioretention facilities in the City's maintenance program after the first three (3) years of plant establishment. The Owner is solely responsible for the first three years of plant establishment. City maintenance focuses on function, not aesthetics and includes removal of noxious weeds and rehabilitating the system should the ponded area hold water for more than 48 hours past the end of a rain event. Maintenance for aesthetic purposes is the responsibility of the adjacent property owner. *(Include this item only with developments constructing bioretention facilities associated with frontage improvements)*

REMEDIES:

(1) If the City determines that maintenance or repair work is required to be done to the stormwater facility existing on the Owner property, the City shall give the Owner within which the drainage facility is located, and the person or agent in control of said property if different, notice of the specific maintenance and/or repair required. The City shall set a reasonable time in which such work is to be completed by the persons who were given notice. If the above required maintenance and/or repair is not completed within the time set, written notice will be sent to the persons who were given notice stating the City's intention to perform such maintenance and bill Owner for all incurred expenses. The expenses charged to the Owner shall become a charge on the Owner's stormwater utility bill and may be collected by the City in the manner authorized for collection of such utility bills.

(2) If at any time the City determines that the existing system creates any imminent threat to public health or welfare, the City may take immediate measures to remedy said threat. No notice to the persons listed in (1), above, shall be required under such circumstances.

(3) The Owner grants authority to the City for access to any and all stormwater system features for the purpose of inspection, and performing maintenance or repair as may become necessary under Remedies (1) and/or (2). For stormwater facilities located within a City drinking water (wellhead) protection area, authority for access is also granted for purposes of providing pollution prevention outreach to residents, employees, and contractors. Access may include but is not limited to: interpretive sign installation, model home displays, demonstration sites, conducting interviews and surveys, observing practices, and distributing informational materials.

(4) The persons listed in (1) above shall assume all responsibility for the cost of any maintenance and for repairs to the stormwater facility. Such responsibility shall include reimbursement to the City within 30 days of the receipt of the invoice for any such work performed. Overdue payments will require payment of interest at the current legal rate for liquidated judgments. If legal action ensues, any costs or fees incurred by the City will be borne by the parties responsible for said reimbursements.

(5) The owner hereby grants to the City a lien against the above-described property in an amount equal to the cost incurred by the City to perform the maintenance or repair work described herein.

This Agreement is intended to protect the value and desirability of the real property described above and to benefit all the citizens of the City. It shall run with the land and be binding on all parties having or acquiring from Owner or their successors any right, title, or interest in the property or any part thereof, as well as their title, or interest in the property or any part thereof, as well as their heirs, successors, and assigns. They shall inure to the benefit of each present or future successor in interest of said property or any part thereof, or interest therein, and to the benefit of all citizens of the City.

Dated at _____, Washington, this _____ day of _____, _____.

OWNER

By:_____
Authorized Agent for Owner

_____

STATE OF WASHINGTON)
) ss
COUNTY OF THURSTON)

On this day and year above personally appeared before me, a Notary Public in and for the State of Washington duly commissioned and sworn, personally appeared _____, to me known to be the _____ of _____ and acknowledge the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that _____ is authorized to execute the said instrument and that the seal affixed is the corporate seal of said corporation.

WITNESS my hand and official seal the day and year first above written.

_____

Notary Public in and for the State of Washington, residing in _____

My Commission Expires: _____

Dated at _____, Washington, this _____ day of _____, _____.

CITY OF OLYMPIA

By:_____
Authorized Agent for City

STATE OF WASHINGTON)

) ss
COUNTY OF THURSTON)

On this day and year above personally appeared before me, _____, to me known to be acting as Authorized Agent for_____, a Municipal Corporation, who executed the foregoing instrument and acknowledged the said instrument to be the free and voluntary act and deed of said Municipal Corporation for the uses and purposes therein mentioned and on oath states he is authorized to execute the said instrument.

Given under my hand and official seal this _____ day of _____, _____.

_____
Notary Public in and for the State of
Washington, residing in _____

My Commission Expires: _____

APPROVED AS TO FORM:

_____
City Attorney

Appendix IV-I:

Template for Stormwater Facility Maintenance Programs

The document presented in this appendix is intended to be a starting point for preparation of a Stormwater Facility Maintenance Program intended to fulfill Core Requirement #9 – Operation and Maintenance. All maintenance programs shall be prepared using the format and content requirements of Section 4.2.1 of this Volume.

This template contains sample language and content that will assist in program preparation and provide Program Operators with a consistent, user-friendly format to aid in the inspection, operation, and maintenance of their facilities. Programs prepared using this format will also facilitate review by City staff and maintenance inspectors. Project proponents and preparers of maintenance programs are encouraged to edit the template to fit their specific site requirements and types of facilities.

The most current version of this template, as well as pertinent maintenance checklists, may also be obtained electronically from the City of Olympia Public Works – Water Resources department, the City's Manual Administrator, or on the City of Olympia website.

Attachment 'A'

Stormwater Facility Maintenance Program

A manual for inspecting, operating, and maintaining your stormwater system

[Project, Site, or Plat Name]	
Located at:	*[Street Address]*
Assessor's Tax Parcel Number(s) containing stormwater facilities:	*[11 digit APN, separate by commas if more than one]*
Program Operator/Property Owner*:*	*[The person responsible for administering the program]*
Program Document Prepared by:	*[person or company preparing this plan]*
Date:	*[Date the program was prepared]*

Table of Contents

1.0 Stormwater Management Site Description

1.1 What is a Stormwater Management Site?

Within the City of Olympia, property owners are responsible for maintaining stormwater management structures and facilities that they own. These include all different types of stormwater facilities, vegetative features, and best management practices (BMPs) located on private property.

The City of Olympia Storm and Surface Water Utility employs Operation and Maintenance crews that maintain the stormwater infrastructure on public property and within public street right-of-way. Maintenance of this infrastructure (the 'utility') is funded by stormwater utility rates paid by the citizens of Olympia. Utility rates paid to the City do not cover the maintenance of your Stormwater Management Site.

A **Stormwater Management Site** is the portion of a privately owned site or development that has identified stormwater management facilities. These facilities help manage stormwater runoff from the development and may include natural areas for preservation. Stormwater management facilities are designed by a civil engineer licensed by the State of Washington. The stormwater system and associated facilities were required by City of Olympia Municipal Code, and State and Federal stormwater standards. To ensure proper function of the stormwater system, these engineered facilities require routine inspection and maintenance. If a stormwater system fails because of negligence to maintain the system, the property owner could be liable for any pollution, flooding, or damage that could result. Therefore, pollution prevention practices and stormwater system maintenance by the owners and residents are extremely important – both for the protection of property and of the environment.

A **Stormwater Site Management Plan** has been prepared for your development. The plan includes both a **Stormwater Pollution Prevention Program** and this **Stormwater Facility Maintenance Program**. The Stormwater Pollution Prevention Program is site-specific guidance for practices and behaviors that limit pollution before it comes in contact with stormwater. The responsible party for managing these programs is the **Program Operator**.

Purpose of this Program:

Owners of Stormwater Management Sites or stormwater systems should have a Stormwater Facility Maintenance Program that addresses every component of the stormwater system and other areas designated for protection. The purpose of the maintenance program is to ensure the management site and facilities do not lose their intended capability to manage stormwater.

All facilities and Best Management Practices designed and constructed for stormwater collection, conveyance, flood prevention, and water quality treatment must be inspected and maintained to comply with the federal Clean Water Act and the Washington State Department of Ecology Phase II National Pollution Discharge Elimination System (NPDES) Permit held by the City of Olympia.

1.2 Getting to Know Your Stormwater Facilities

[The description provided in this section should accurately describe the stormwater management site and all facilities and features requiring inspection, maintenance, and protection.

Site narrative generally describing the flow of stormwater runoff within the site. Discussion should include types of stormwater controls and facilities used to manage stormwater onsite. Be descriptive, but intended audience is the general public. Use terminology consistent with the facility maintenance checklists in Appendix IV-J and elsewhere in the DDECM.

Description of the destination of runoff from the site. If a site is not completely self-contained (i.e. utilizes 100% infiltration for flow control), the receiving water body and watershed should be identified here.]

1.3 Components Requiring Inspection and Maintenance

It is important to know where your stormwater facilities are located and what type of maintenance they require. Some facilities may require very little maintenance and only annual inspection. Others may require frequent monitoring and upkeep to make sure they are functioning as designed.

The list of stormwater features, controls, and facilities below have been identified on your Stormwater Management Site Key Map in Section 1.4. Each of these items has specific inspection intervals and maintenance requirements. These requirements for inspection and maintenance can be found in Appendix A of this program.

[The following table should be edited as necessary to include only stormwater facilities that are actually on the site. Add additional rows and number as necessary. Use appropriate units in the quantity column.]

Key Map ID Number	Stormwater Facility Type
1	Catch Basins
2	Wetpond
3	Detention Pond
4	Flow Control Structure

1.4 Stormwater Facility Key Map

[Include and explain the Stormwater Facility Key Map for the project in this section. Key maps should be formatted to fit an 8.5x11 page with 1" margins, and may require multiple maps for large sites. All text, numbering, and callouts shall be a minimum of 8-point font height. Drawing scales shall be such that identified features are easy to distinguish and locate on the plan.]

2.0 Maintaining Stormwater Facilities and Controls

To help understand your stormwater facility maintenance requirements, it is useful to have a general knowledge of how they function. Some maintenance needs are common to all types of facilities, while others depend on the specific facility.

Six major components of stormwater management include stormwater runoff prevention, stormwater collection/conveyance, stormwater quantity control (detention/retention), stormwater quality control (treatment), low impact development controls, and soil and vegetation management. While they are listed separately here, you should think of each of them as belonging to a larger interdependent system that works together to take care of stormwater on your site. This section describes general stormwater management theories and goals. Specific stormwater facility descriptions and maintenance requirements are provided in Appendix A.

2.1 Stormwater Runoff Prevention

Stormwater runoff can be described as the *excess* rainfall that does not immediately infiltrate into the ground or that is trapped on vegetation during a storm event. The primary practice of stormwater management focuses on managing this excess surface runoff.

Some soils are more accepting of rainfall and water infiltrates regularly – such as gravelly or sandy soils. Other soils do not allow much infiltration of rainfall – such as fine grained soils like silts and clays. Where this excess rainwater does not infiltrate, the excess *runs off* the surface. Vegetation covering a native soil landscape can aid in preventing runoff. Vegetation can intercept rainfall on its branches, leaves, and needles which prevents that water from becoming runoff. Trees and plants can also absorb a great deal of water from surrounding soils – this also prevents stormwater runoff and helps manage stormwater.

Preventing stormwater runoff or a goal of "zero discharge" means implementing site improvements that result in no off site runoff compared to predeveloped conditions. This is achieved by reducing impervious areas, implementing low impact development techniques, and preserving vegetated areas to achieve no increase in offsite runoff.

2.2 Collection and Conveyance Systems

Stormwater collection and conveyance systems intercept stormwater and transport it away from buildings, roadways, and other areas where accumulated water could be a nuisance. Conveyance systems typically consist of inlets that collect water and pipes or open channels (swales and ditches). Conveyance systems are in many instances the gateway to the rest of your stormwater management site – other stormwater facilities that manage the volume of water and the removal of pollutants are downstream.

Stormwater conveyance systems are designed to provide capacity for a specific maximum flow rate. Typical failures include reduced capacity due to clogged surface grates and pipes. Plugging commonly occurs due to sediment and large debris (e.g., leaves, trash, etc.) washed from adjacent surfaces. Reduced conveyance system capacity results in localized flooding and possible property damage if not corrected.

2.3 Stormwater Quantity Controls

The intent of stormwater *quantity* control facilities is to slow down stormwater flow discharged to the environment from developed sites. Impervious surfaces, such as roads and roofs, quicken the rate of stormwater runoff into natural streams that can create flooding. Stormwater

quantity control facilities mitigate the increased runoff by providing temporary storage and controlling the release rate from the site to prevent flooding and erosion. Detention and retention facilities may be designed as ponds or underground facilities.

Detention facilities function by providing temporary storage of stormwater runoff to be released at a controlled rate. The intent of the detention facility is to match the pre-developed runoff rates for several specific storm events in the developed condition.

Retention facilities are typically located in areas where water soaks easily into the ground. Retention facilities provided temporary storage while allowing the water to soak into the ground, mimicking natural conditions. There is typically no release of stormwater to other pipes offsite or water bodies.

2.4 Stormwater Quality Controls

There are a several Best Management Practices (BMPs) utilized for stormwater *quality* control. These systems provide **stormwater treatment** through a combination of filtration, sediment settling, plant nutrient uptake, and physical separation. These systems range in complexity and operational needs.

The most common treatment systems include oil/water separators, biofiltration swales, grass filter strips, bioretention areas, and wetponds. There are also proprietary treatment systems that use specialize media to remove stormwater pollutants. The intent of all stormwater treatment facilities is to remove oils, chemicals, metals, nutrients (e.g. nitrogen and phosphorus), and sediment from stormwater runoff prior to being discharged to ground or surface waters. These systems are essential to protection of our environment.

Stormwater treatment facilities have a limited pollutant removal capability and are not intended to replace proper site management. The most effective technique for reducing pollutant discharge from the site is to provide good housekeeping through source control Best Management Practices (BMPs) as provided in your Stormwater Pollution Prevention Program.

2.5 Low Impact Development Controls and Features

As local governments in western Washington implement the Washington State Department of Ecology (Ecology) National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater permits (Permits), our region will increasingly rely on low impact development (LID) practices to protect water quality and aquatic natural resources.

LID is a stormwater and land use management strategy that strives to mimic the pre-disturbance hydrologic processes of infiltration, filtration, storage, evaporation and transpiration by emphasizing conservation, use of on-site natural features, site planning, and distributed stormwater management practices that are integrated into a project design. LID best management practices (BMPs) - such as bioretention/rain gardens and permeable pavements - are also commonly known as green stormwater infrastructure, integrated management practices, and on-site stormwater management BMPs.

If your Stormwater Management Site uses LID features to manage stormwater, they will be identified on the Key Map in this program. In many cases, LID features will seamlessly fit into the natural landscape or layout of your site. They will be vegetated areas or depressions with special soil mixes designed to capture pollutants. Because LID practices for managing stormwater are so integrated into the site, they often get over looked for proper maintenance –

yet are some of the most important components of your overall stormwater system. These systems should be identified early in your maintenance program to assure proper management.

2.6 Soil and Vegetation Management

As described earlier in Section 2.1, good soil and healthy vegetation can do a lot for preventing stormwater runoff on your property. Before much of this area was populated with homes, streets, businesses, and parking lots, the amount of rainfall that turned to runoff was much less that we see today. While often overlooked when managing stormwater, protecting your exposed soils and the vegetation that covers the landscape can contribute a tremendous amount to managing stormwater and preventing issues.

If your Stormwater Management Site has a dedicated tract – a protected parcel of land – set aside for preservation of soils and natural vegetation, it will be noted on your program Key Map and the facility inventory. Additional requirements for some preservation areas may be included in a separate plan found in the Appendix. If your management site has a designated Soil and Vegetation Protection Area (SVPA) as required when your development was permitted with the City of Olympia, these areas are to be managed in accordance with the City of Olympia Urban Forestry Manual and applicable sections of the Olympia Municipal Code. For assistance in maintaining these SVPAs, contact the City of Olympia's Urban Forester or Public Works – Environmental Services section for more information.

3.0 How to Perform Inspections and Maintenance

This section provides Program Operators, property owners, and tenants with guidance on how to inspect their facilities, identify problems, perform routine maintenance, typical tools and equipment needed, and requirements for reporting maintenance activities to the City of Olympia.

3.1 Inspection Frequency

Different components of your stormwater management site will require different kinds of inspections and during different times of the year. It is important to perform inspections in a manner that does not put your personal safety at risk. The facility checklists and maintenance standards found in Appendix A identify when and how frequently inspections should occur. You should note that not all components of the Stormwater Management Site may be inspected at the same time – proper inspection may need to occur on multiple occasions throughout the year to assess functionality. If you have questions about how and when to perform inspections, contact the City of Olympia Public Works – Water Resources Private Maintenance Inspection staff assigned to your site for assistance.

3.2 Tools and Skills

[This section should be completed to reflect the type of work and tools necessary to maintain the stormwater management site. It is best to list the BMP that requires maintenance and following it describe the tools for performing inspections or maintaining the facility. For LID BMPs, the LID O&M Guidance document prepared for Ecology has sections for each BMP that gives examples of tools and skills. Since different components of the system have differing levels of skill and equipment needs, it is important to identify those where possible so the Program Operator can plan accordingly.]

3.3 Record Keeping and Reporting

Program Operators shall keep records of inspections performed on the Stormwater Management Site and document all deficiencies found. Program Operators will need to document how corrective actions or maintenance work was completed for the site. If an outside contractor was hired to complete large tasks – such as non-routine maintenance – copies of receipts and invoices should be retained for records.

Program Operators who are responsible for executing Pollution Source Control Programs and Stormwater Facility Maintenance Programs shall submit an annual report of activities, trainings, inspections, and maintenance actions taken by May 15th of each year.

Information for reporting maintenance activities and inspections can be found on the City of Olympia website. Program Operators should work closely with City of Olympia Public Works – Water Resources inspection staff for coordination of their inspections and submittal of their annual reports.

4.0 Annual Cost of Maintenance

In accordance with Section 4.2.1 of Volume IV of the 2016 City of Olympia Drainage Design and Erosion Control Manual (DDECM), an estimate of the average annual cost of maintenance for the ***[insert plat or project name]*** Stormwater Management Site has been included in this maintenance program.

Program Operators and property owners should always budget for the maintenance activities associated with their system. **Failure to maintain your system is a violation of the Agreement to Maintain Stormwater Facilities entered between the property owner, and its successors, and the City of Olympia** (see specific enforcement language for maintenance activities in the Agreement).

Cost of Construction

[Provide an estimate of the cost of construction for only the stormwater system portion of the project. This may have been completed as part of the project permitting to obtain a maintenance bond, if so, this may be indicated and the construction estimate attached.]

Facilities Inventory

[List all stormwater facilities associated with the project including data necessary to estimate costs such as pond bottom area and lineal feet of swale. Use the same list generated for Section 1.3 of this program, but add additional columns for quantities using appropriate units (e.g., sf, lf, ea, etc.)]

Assumptions

[State overall assumptions. Include in this section what the assumed labor rate is, inflation rate, interest rate, cost of sediment disposal, whether inspections/minor maintenance will be volunteer labor or contracted, whether a maintenance/landscape contract is to be used, how frequently CB's are to be vactored, streets swept, wet pond and detention pond sediment removed, etc. This section should also note what year the annual cost estimate was last prepared.]

Non-Contracted Routine Inspections & Maintenance

[Identify and estimate the cost and time associated with inspections and maintenance which will be performed by the Property Owners Association (or property owner for commercial projects) and administration.

a. List estimated annual hours for inspections and administration

b. Cost of complying with reporting requirements

c. Apply appropriate labor rate to estimate.

d. Equipment or supplies purchased to support routine maintenance.]

Contracted Routine Maintenance

[Identify and estimate the cost of routine maintenance items that will likely be performed by an outside contractor such as a landscape company, sewer maintenance service, or other contracted entity. Note: Routine maintenance is maintenance that is anticipated to be performed annually, or more frequently. Including, but not limited to:

a. Landscape contractor – mowing, trimming, pruning, weeding, etc.

b. Street sweeping (especially for porous pavements)

c. Catch Basin pumping

d. Fence maintenance and repair

e. Inlet/outlet protection refurbishment (riprap installation, fix erosion problems)

g. Replacement of filter media for proprietary water quality devices

f. Swale/ditch maintenance (seeding, sodding, fix erosion problems)

g. Removal of trash and debris – include cost of disposal

h. Removal of invasive plants (e.g. scotch broom, alder, cattails)

i. Proprietary device maintenance contract costs]

Non-Routine Maintenance

[Identify major maintenance items that will be performed infrequently (i.e. greater than annually) and provide an estimate of cost and estimated frequency of occurrence. Convert to an annual amount by dividing cost by frequency. Cost of infrequent maintenance such as pond sediment removal; fence repair, replacement and painting; pipe replacements; catch basin and control structure replacement; infiltration pond and bioretention facility refurbishment, etc.

a. Indicate anticipated frequency of activity.

b. Provide a breakdown of cost of the infrequent activity

i. Mobilization cost

ii. Cost of sediment excavation and disposal

iii. Cost of replanting or restoration

iv. Assume a sediment depth and actually calculated estimated sediment volume for removal/disposal.

c. Divide the estimated cost by the estimated frequency to annualize the cost.]

Facility Replacement Fund

[Establish a replacement fund to allow for future major restoration or replacement of stormwater facilities. A target for the replacement fund is to have 20% of the cost of construction available after 20 years. This amount should be set aside to provide for unexpected costs and major repair/replacement of facilities.]

Appendix IV-J: Stormwater Facility Descriptions and Maintenance Checklists

[These pages will be recorded with Thurston County Auditor: 1” margins all sides, 8pt minimum font height]

Links to Stormwater Facility Descriptions

Catch Basins, Manholes, and Grate Inlets

Debris Barriers (e.g. Trash Racks)

Energy Dissipaters

Detention Ponds

Infiltration Ponds

Infiltration Galleries/Trenches

Flow Control Structures/Flow Restrictors

Closed Detention Systems (Tanks/Vaults)

Basic Biofiltration Swale

Wet Biofiltration Swale

Filtration Strips

Wetponds

Wet Vaults

Manufactured Media Filters

Baffle Oil/Water Separators (API Type)

Coalescing Plate Oil/Water Separators

Catch Basin Inserts

Media Filter Drain (MFD)

Compost Amended Vegetated Filter Strip (CAVFS)

Vegetated Roofs

Downspout Full Infiltration Systems

Downspout, Sheet Flow, and Concentrated Dispersion Systems

Compost-Amended Soils

Rain Gardens

Bioretention Facilities

Permeable Pavements

Catch Basins, Manholes, and Grate Inlets

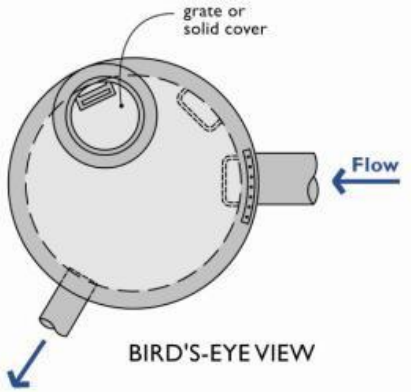
Catch basins are underground concrete structures typically provided with a slotted grate to collect stormwater runoff and route it through underground pipes. Catch basins can also be used as a junction in a pipe system and may have a solid lid. There are two catch basin types.

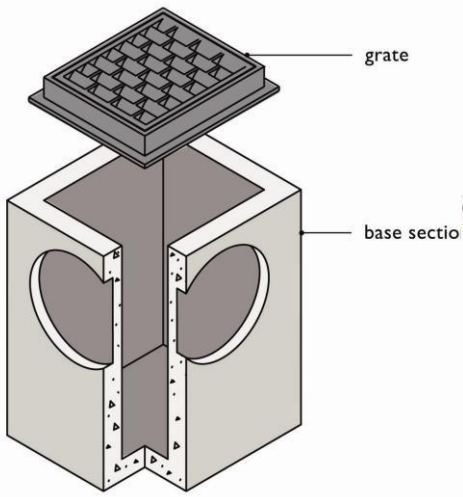
A Type 1 catch basin is a rectangular box with approximate dimensions of 3‟x2‟x5‟. Type 1 catch basins are utilized when the connected conveyance pipes are less than 18 inches in diameter and the depth from the gate to the bottom of the pipe is less than 5 feet.

Type 2 catch basins, also commonly referred to as storm manholes, are round concrete structures ranging in diameter of 4 feet to 8 feet. Type 2 catch basins typically have manhole steps mounted on the side of the structure to allow for access. Type 2 catch basins or manholes can have either a solid access cover or a slotted grate inlet similar to a Type I catch basin.

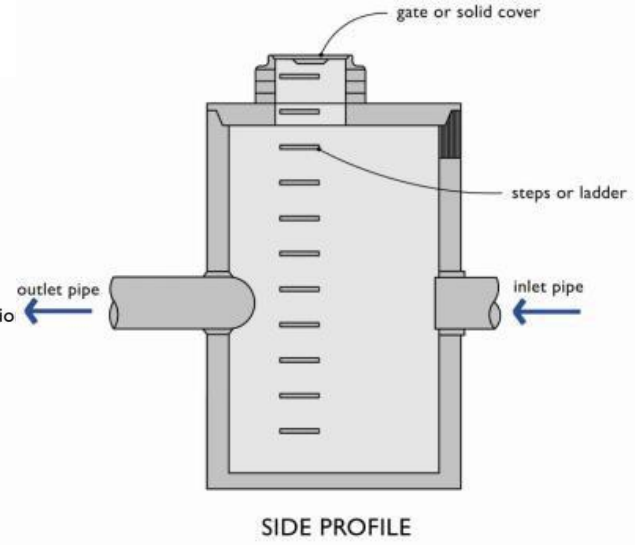
Both catch basin types typically provide a storage volume (sump) below the outlet pipe to allow sediments and debris to settle out of the stormwater runoff. Some catch basins are also provided with a spill control device (inverted elbow on outlet pipe) intended to contain large quantities of grease or oils within the basin.

The most common cleaning method for catch basins is to utilize a truck with a tank and vacuum hose (vactor truck) to remove sediment and debris from the sump. Catch basins may be an enclosed space where harmful chemicals and vapors can accumulate. Therefore, if the inspection and maintenance requires entering a catch basin, it should be conducted by an individual with training and certification in working in hazardous confined spaces.





Type I



Type 2

Catch Basins, Manholes, and Grate Inlets

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Cleaning				
Standing water	As needed	Standing water present during maintenance activities.	Yes No	Remove/dispose with other material in accordance with state and federal regulations. Do not pump to downstream stormwater system.
Trash, debris, sediment, vegetation	A2	Accumulated material within 6 inches of the bottom of the lowest pipe entering or exiting the structure or filling greater than 60 percent of the sump depth.	Yes No	Remove/dispose in accordance with state and federal regulations.
	A	Sediment, debris, or vegetation blocking 1/3 the diameter of any pipe.	Yes No	Remove/dispose in accordance with state and federal regulations.
	B, W, E	Vegetation/debris blocking 10 percent or more of inlet grate capacity.	Yes No	Clean and dispose of material
	A	Dead animals or vegetation that could generate odors and cause complaints or dangerous gases (e.g., methane).	Yes No	Remove/dispose
Pollution	A2, E	Any visible accumulation of oil, gas, paint, or other contaminant (includes concrete debris or slurry).	Yes No	Remove/dispose in accordance with state and federal regulations. If possible, identify and control source
Structure				
Frame and/or top slab	A	Corner extends more than 0.75 inches past curb face or street surface (where applicable).	Yes No	Repair so frame even with curb
	A	Holes greater than 2 inches or cracks greater than 0.25 inches in top slab.	Yes No	Repair to water tight condition
	A	Frame not flush with top slab (separation >0.75 inches) or not securely attached.	Yes No	Repair

Catch Basins, Manholes, and Grate Inlets

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Catch Basin structure	A	Cracks wider than 0.5 inches and longer than 1 foot, missing bricks, evidence of water of soil entering, or judged to be structurally unsound by maintenance personnel.	Yes No	Repair; Grout where feasible; Catch basin may require replacement where found to be structurally unsound
	A	Cracks wider than 0.5 inches and longer than 1 foot at pipe inlet/outlet.	Yes No	Regrout and reseal pipe at basin wall
Cover/Grate Inlet	A	Cover/grate missing, damaged, or only partially in place.	Yes No	Repair/replace
	A	Grate openings are wider than 7/8 inch.	Yes No	Replace
	A	Cannot be opened by one person. Locking bolts missing, damaged, or have less than ½ inch of thread.	Yes No	Repair/replace
	A	Buried.	Yes No	Expose and restore to surface grade
Ladder	A	Ladder rungs damaged, missing, or misaligned.	Yes No	Repair/replace

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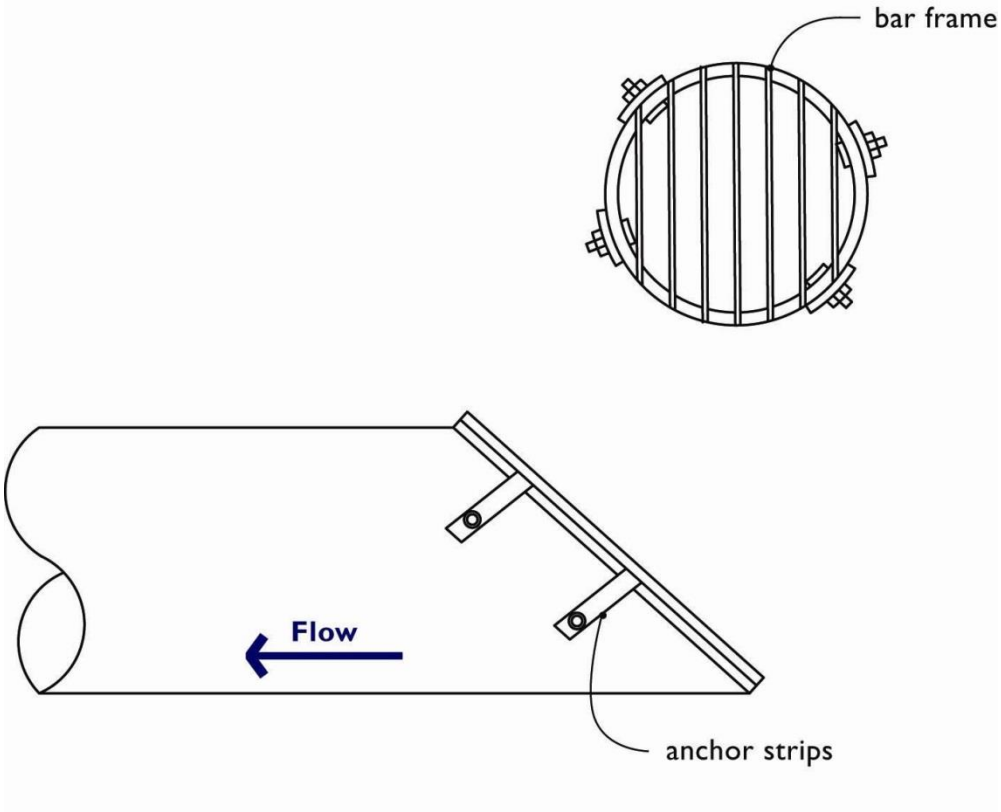
W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves;
E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident which causes contaminant release).

[2] Minimum requirement is for annual inspections. More frequent inspections and maintenance may be required depending on site conditions.

Debris Barriers (e.g. Trash Racks)

Debris barriers consist of bar grates over the open end of a culvert or conveyance pipe. The intent of a debris barrier is to prevent large materials from entering a closed pipe system. Debris barriers are typically located on the outlet pipe from a detention pond to the control structure. If a debris barrier is not located on the outlet pipe, one should be provided to prevent plugging of the control structure and possible flooding.

Access barriers are similar to debris barriers but are included on all pipe ends that exceed 18 inches in diameter. Their function is to prevent debris and unauthorized access into the storm conveyance pipe. Removing debris and maintenance to the debris barrier when there is flow through the conveyance pipe should be performed by qualified personnel only. Ideally, inspection of debris barriers should occur during summer and autumn months when there are minimal or no flows through the pipe.



Debris Barriers (e.g. Trash Racks)

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Trash and Debris	B, W	Trash or debris that is plugging more than 20% of the openings in the barrier.	Yes No	Safely remove debris from rack inlet.
Metal	A2	Bars are bent out of shape more than 3 inches.	Yes No	Bar repair with no bends more than 3/4 inch.
	A	Bars are missing or entire barrier missing.	Yes No	Replace bars or supply replacement barrier.
	B, W, E	Bars are loose and rust is causing 50% deterioration to any part of barrier.	Yes No	Barrier replaced or repaired to design standards.
	A	Debris barrier missing or not attached to pipe	Yes No	Barrier firmly attached to pipe

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[2] Minimum requirement is for annual inspections. More frequent inspections and maintenance may be required depending on site conditions.

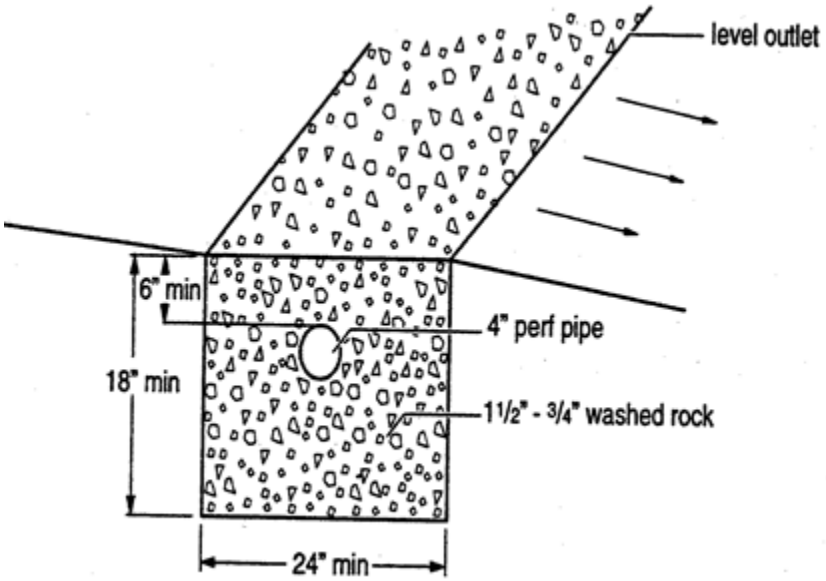
Energy Dissipaters

Energy dissipaters are provided on the inlet and outlet to a closed pipe system to prevent erosion at these locations. Design of an energy dissipater can vary significantly from highly engineered systems (concrete or rock gabion structures) to the more commonly used rock pad.

The rock pad is typically constructed of 4- to 12-inch diameter rocks a minimum of 12 inches thick and is often lined with filter fabric. The rock pad should extend above the top of the pipe a minimum of 1 foot. Rock pad type energy dissipaters typically extend at least 5 to 10 feet beyond the outfall of a pipe. The actual size of the rock pad depends on the amount and velocity of water leaving the pipe.

Dispersion trenches are a special type of dissipater that includes a trench filled with drain rock and sometimes a weir board. The goal of a dispersion trench is to spread flows over a wide area to eliminate erosion impacts or to more closely mimic natural stormwater flow conditions.

Gravel Flow Dispersion Trench



Energy Dissipaters

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
External:				
Rock Pad				
Missing or Moved Rock	A	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.	Yes No	Rock pad replaced to design standards.
Erosion	A, E	Soil erosion in or adjacent to rock pad.	Yes No	Rock pad replaced to design standards.
Dispersion Trench				
Pipe Plugged with Sediment	A	Accumulated sediment that exceeds 20% of the design depth.	Yes No	Pipe cleaned/flushed so that it matches design.
Not Discharging Water Properly	A, E	Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow" of water along trench). Intent is to prevent erosion damage.	Yes No	Trench redesigned or rebuilt to standards.
Perforations Plugged.	A	Over 1/2 of perforations in pipe are plugged with debris and sediment.	Yes No	Perforated pipe cleaned or replaced.
Water Flows Out Top of "Distributor" Catch Basin.	A, E	Maintenance person observes or receives credible report of water flowing out during any storm less than the design storm or its causing or appears likely to cause damage.	Yes No	Facility rebuilt or redesigned to standards.
Receiving Area Over-Saturated	A, E	Water in receiving area is causing or has potential of causing landslide problems.	Yes No	No danger of landslides.

Energy Dissipaters

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Internal:				
Manhole/Chamber				
Worn or Damaged Post, Baffles, Side of Chamber	A	Structure dissipating flow deteriorates to 1/2 of original size or any concentrated worn spot exceeding one square foot which would make structure unsound.	Yes No	Structure replaced to design standards.

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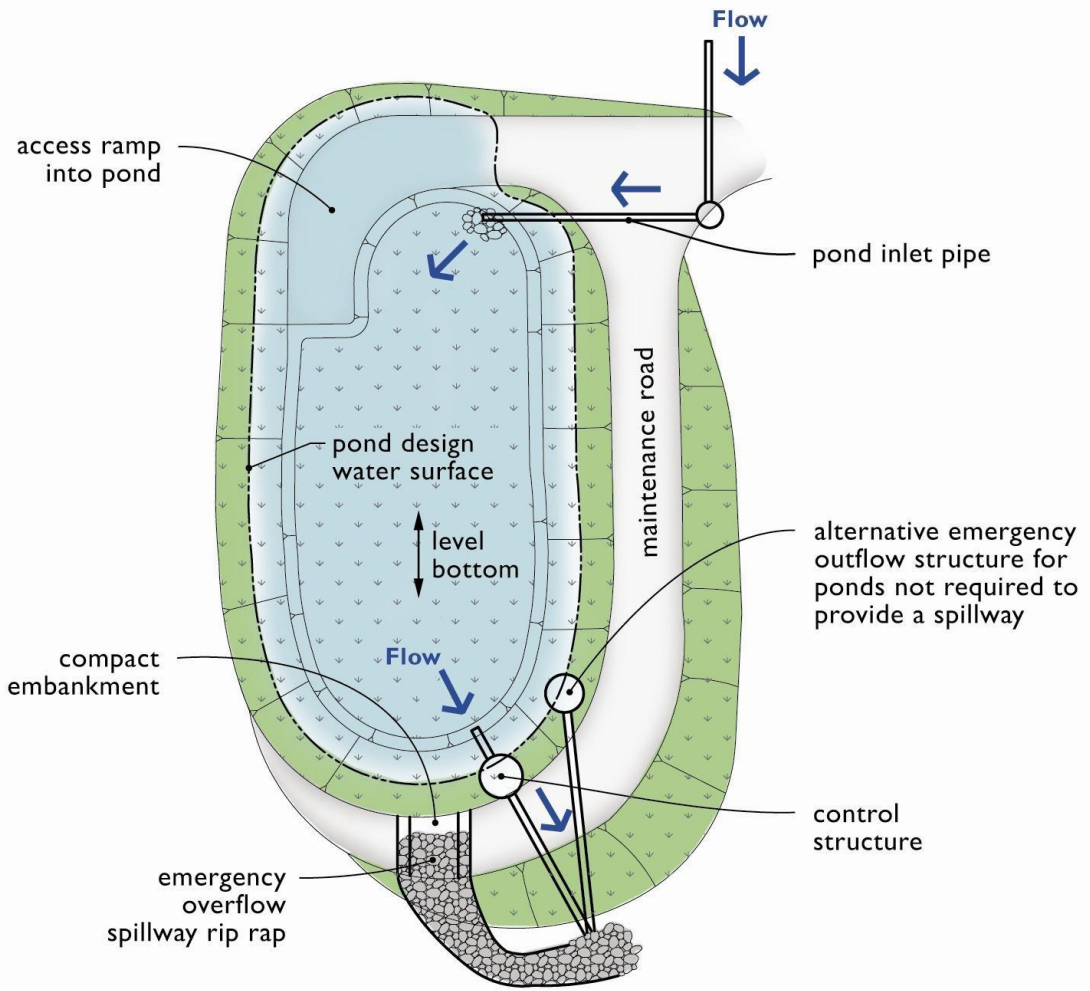
[2] Minimum requirement is for annual inspections. More frequent inspections and maintenance may be required depending on site conditions.

Detention Ponds

Stormwater detention ponds are open basins built by excavating below existing ground or by constructing above-ground berms (embankments). The detention pond temporarily stores excess stormwater runoff during rain events and slowly releases it through an outlet (flow control structure). Detention ponds are typically designed to drain out completely within 24-48 hours after a storm event. Detention ponds are specially designed to hold a specific volume of water based on the land area draining to it. Changes or reductions to the volume or holding capacity of a pond can cause pond failure, flooding, and property damage.

Components that are typically associated with a detention pond include the following: inlet pipes, manhole or catch basin structures, a flow control structure/flow restrictor, debris barrier (e.g. trash rack), energy dissipaters, maintenance access road, and fence. These items are covered by separate checklists.

Management of vegetation is of special concern when inspecting and maintaining detention ponds. Some vegetation in your pond may provide aesthetic landscape and screening function, or have erosion control benefits. At a minimum, vegetation should be managed to ensure the flood control functionality of your detention pond remains intact.



Detention Ponds

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
General				
Trash & Debris	B, W, E	Any trash and debris which exceed 5 cubic feet per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size garbage can). In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Yes No	Trash and debris cleared from site.
Poisonous Vegetation and noxious weeds	A2	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).	Yes No	Clear danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with City of Olympia Water Resources) Complete eradication of noxious weeds may not be possible. Compliance with State or City eradication policies required
Contaminants and Pollution	B, E	Any evidence of oil, gasoline, contaminants or other pollutants	Yes No	Clean up contaminants or pollutants. (Coordinate removal/cleanup with City of Olympia Water Resources).
Rodent Holes	B	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Yes No	Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)
Beaver Dams	B	Dam results in change or function of the facility.	Yes No	Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies).
Insects	A	When insects such as wasps and hornets interfere with maintenance activities.	Yes No	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies.

Detention Ponds

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Vegetation, Tree Growth, and Hazard Trees	A, D	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove.	Yes No	Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood).
	A, D	If dead, diseased, or dying trees are identified (Use a certified Arborist to determine health of tree or removal requirements).	Yes No	Remove Hazard Trees in accordance with the City of Olympia Urban Forestry Manual.
	A, D	Significant amounts of dead or dying vegetation in pond area. Decomposing vegetation releases nutrient pollutants.	Yes No	Remove excess or dead vegetation.
Side Slopes of Pond and Storage Area				
Erosion	B, E	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.	Yes No	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.
	B, E	Any erosion observed on a compacted berm embankment.	Yes No	If erosion is occurring on compacted berms a licensed civil engineer should be consulted to resolve source of erosion.
Sediment	A[2], D	Accumulated sediment that exceeds 10% (typically 6" to 12") of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility.	Yes No	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
Liner (If Applicable)	A, D	Liner in pond bottom is visible and has more than three 1/4-inch holes in it.	Yes No	Repair or replace liner; Completely cover liner with soil/vegetation per design.

Detention Ponds

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Pond Berms/Dikes				
Settlements	B, W, E	Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.	Yes No	Dike is built back up to the design elevation.
Piping/Seepage	B, W, E	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Yes No	Piping or seepage eliminated. Erosion potential resolved. Resolution may require reconstruction of the berm at the direction of a geotechnical engineer.
Emergency Overflow Spillway or Outlet				
Vegetation or Tree Growth	A	Vegetation or tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.	Yes No	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed civil engineer should be consulted for proper berm/spillway restoration.
Spillway Surface	A	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. (Rip-rap on inside slopes need not be replaced.)	Yes No	Rocks and pad depth are restored to design standards.

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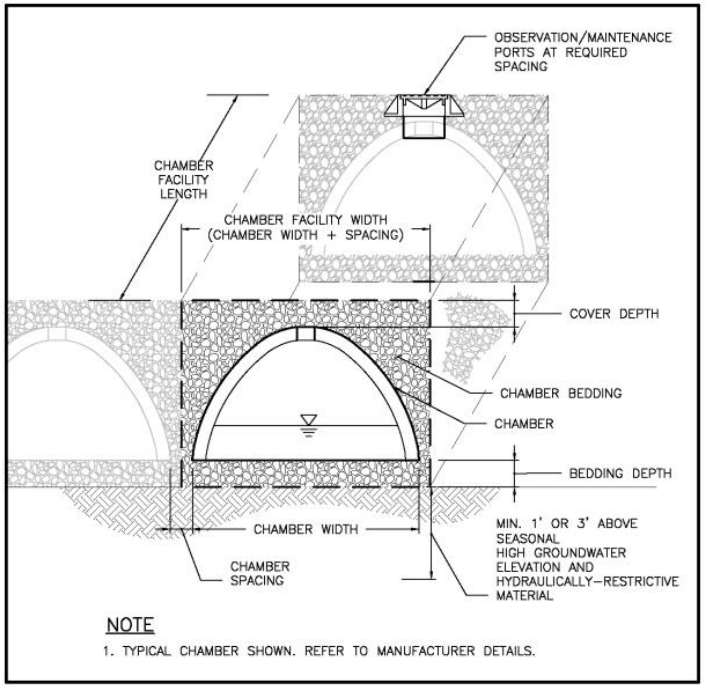
Infiltration Galleries/Trenches

The term “infiltration galleries” refers to manufactured detention structures, commonly referred to as “infiltration chambers,” within a broad gravel trench. Infiltration chambers are buried structures, typically arch-shaped, within which collected stormwater is temporarily stored and then infiltrated into the underlying soil. Infiltration chambers create an underground cavity that can provide a greater void volume than infiltration trenches and often require a smaller footprint. Infiltration galleries may be allowed on a case-by-case basis and must be sized per the manufacturer’s guidance.

Infiltration trenches are generally at least 24 inches wide, and are backfilled with a coarse stone aggregate, allowing for temporary storage of stormwater runoff in the voids of the aggregate material. Stored runoff then gradually infiltrates into the surrounding soil. The surface of the trench can be covered with grating and/or consist of stone, gabion, sand, or a grassed or asphalt area with a surface inlet. Perforated rigid pipe of at least 8-inch diameter can also be used to distribute the stormwater in an infiltration trench.



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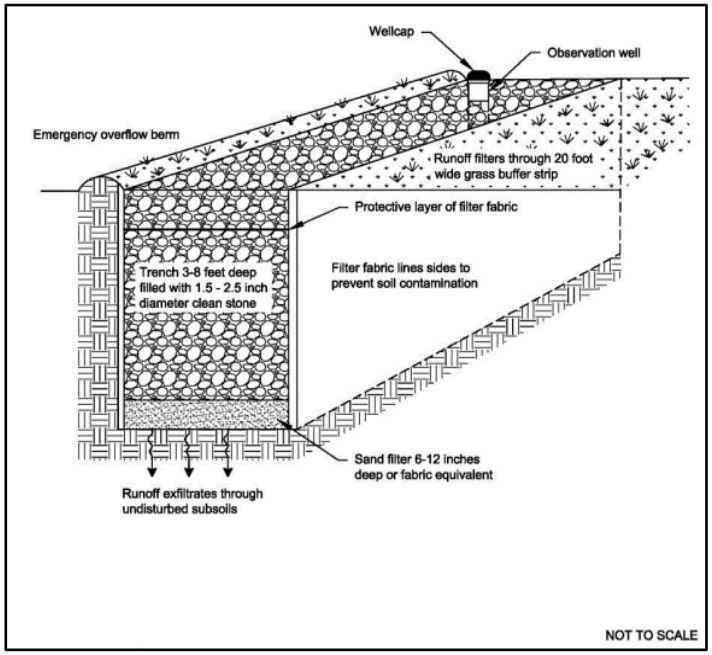

Infiltration Galleries/Trench

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
General				
Sediment	A, E, D	buildup in aggregate or gallery using observation well/access points	Yes No	Sediment is removed and/or facility is cleaned so that infiltration system works according to design. Sediment should be removed when deposits approach within 6 inches of the invert heights of connecting pipes.
Grated Inlets	A, E ,D	Trash and debris collecting in sump of inlets	Yes No	Clear and clean out inlets of any trash and debris
Clean Outs	A, E ,D	Lids damaged, water standing in pipe after rain event, sediment build up.	Yes No	Replaced damaged lids. Remove sediment
Risers	A, E, D	Lids damaged, water standing in pipe after rain event, sediment build up.	Yes No	Replaced damaged lids. If measured sediment build up is between 5%-20% of the pipe diameter, cleaning should be considered; if sediment build up exceeds 20%, cleaning should be performed at the earliest opportunity.

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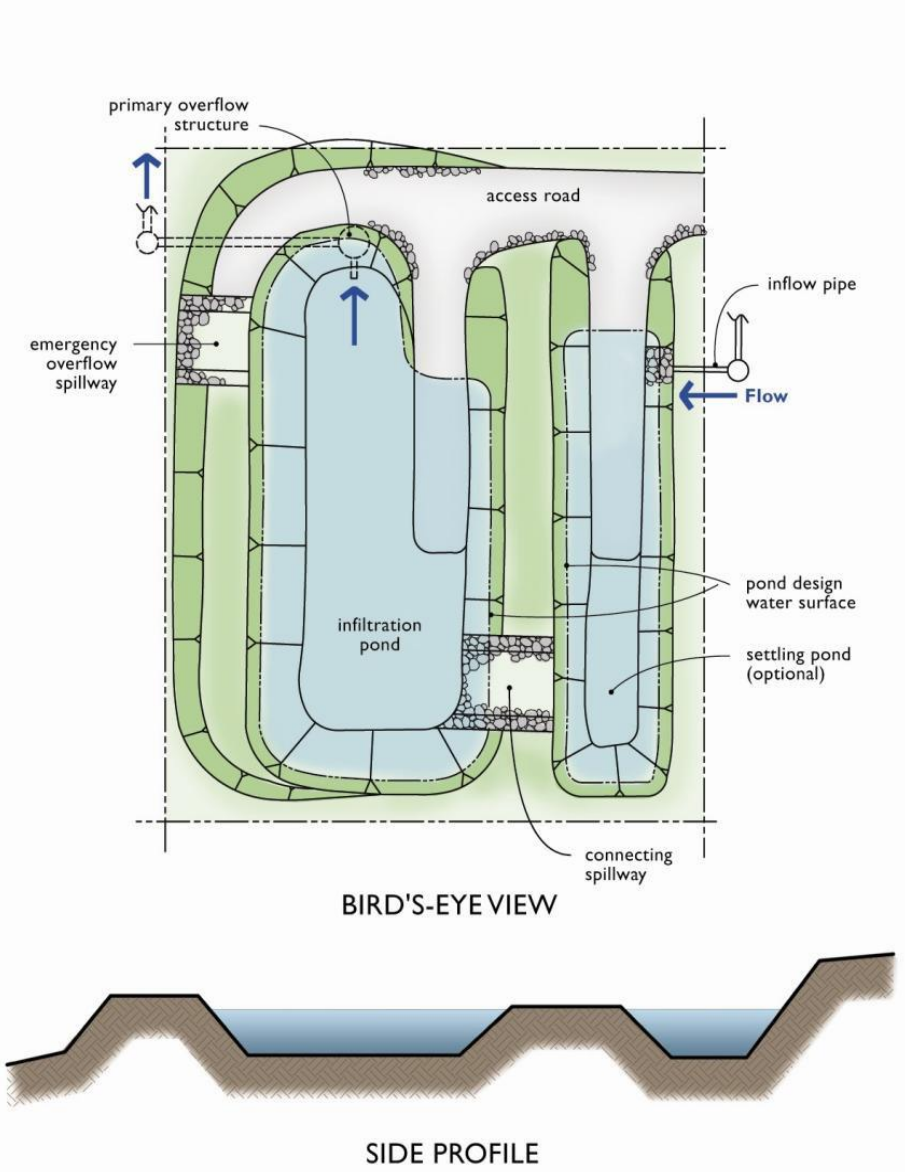
Infiltration Ponds

Stormwater infiltration ponds are open basins built by excavating below existing ground or by constructing above-ground berms (embankments). An infiltration pond temporarily stores excess stormwater runoff during rain events, but unlike the detention pond, the infiltration pond does not discharge to a downstream conveyance system or nearby surface water. Instead, the infiltration pond relies on the ability of the site soils to absorb and infiltrate the stormwater into the ground.

Components that are typically associated with an infiltration pond include the following: energy dissipaters, access road, and fence. In cases where a pond cannot infiltrate all stormwater onsite, a flow control structure may be provided to meter the release of stormwater offsite like a detention pond.

Infiltration ponds are typically designed to drain out completely within 24-48 hours after a storm event. Infiltration ponds are specially designed to hold a specific volume of water based on the land area draining to it and the rate at which the site soils are able to infiltrate water to the ground. Changes or reductions to the volume or holding capacity of a pond can cause pond failure, flooding, and property damage.

Management of vegetation is of special concern when inspecting and maintaining infiltration ponds. Some vegetation in your pond may provide aesthetic landscape and screening function, or have erosion control benefits. At a minimum, vegetation should be managed to ensure the flood control functionality of your infiltration pond remains intact. Because stormwater leaves an infiltration pond by infiltrating downward into the native soils, protection of the infiltrative surface soils at the pond bottom is critical. Too much sediment in the pond or soil consolidation can slow the rate at which stormwater can infiltrate and possibly cause failure of your storm pond.



Infiltration Ponds

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
General				
Trash & Debris	B, W, E	Any trash and debris which exceed 5 cubic feet per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size garbage can). In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Yes No	Trash and debris cleared from site.
Poisonous Vegetation and noxious weeds	A[2]	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).	Yes No	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department) Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required. ***Use of herbicides and pesticides is prohibited in groundwater protection areas.***
Trees and other Vegetation	A, D	Trees or vegetation exists to a point that the infiltration pond does not drain out within 48 hours or that the storage volume of the pond has reduced by presence of vegetation.	Yes No	Remove vegetation as necessary to restore storage volume and function.
Contaminants and Pollution	B, E	Any evidence of oil, gasoline, contaminants or other pollutants	Yes No	No contaminants or pollutants present. (Coordinate removal/cleanup with local water quality response agency).
Rodent Holes	B	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Yes No	Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)
Insects	A	When insects such as wasps and hornets interfere with maintenance activities.	Yes No	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies.

Infiltration Ponds

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Tree Growth and Hazard Trees	A, D	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove.	Yes No	Remove trees where they do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood).
	A, D	If dead, diseased, or dying trees are identified (Use a certified Arborist to determine health of tree or removal requirements)	Yes No	Remove hazard Trees
Side Slopes of Pond and Storage Area				
Erosion	B, E	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.	Yes No	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.
	B, E	Any erosion observed on a compacted berm embankment.	Yes No	If erosion is occurring on compacted berms a licensed civil engineer should be consulted to resolve source of erosion.
Sediment	A[2], E, D	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events. (A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. Test every 2 to 5 years. If two inches or more sediment is present, remove).	Yes No	Sediment is removed and/or facility is cleaned so that infiltration system works according to design. Infiltration testing verification may be necessary after major reconstructive maintenance.
Pre-settling Ponds and Vaults	B, W, E	Facility or sump filled with sediment or debris. Removed at 6" depth, or the design depth of sediment trap.	Yes No	Remove sediment to design depth/bottom of facility.

Infiltration Ponds

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Pond Berms/Dikes				
Settlements	B, W, E	Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.	Yes No	Dike is built back to the design elevation.
Piping and seepage	B, W, E	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair.	Yes No	Piping or seepage eliminated. Erosion potential resolved.
Emergency Overflow Spillway or Outlet				
Vegetation or Tree Growth	A	Vegetation or tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.	Yes No	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed civil engineer should be consulted for proper berm/spillway restoration.
Spillway Surface	A	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. (Rip-rap on inside slopes need not be replaced.)	Yes No	Rocks and pad depth are restored to design standards.

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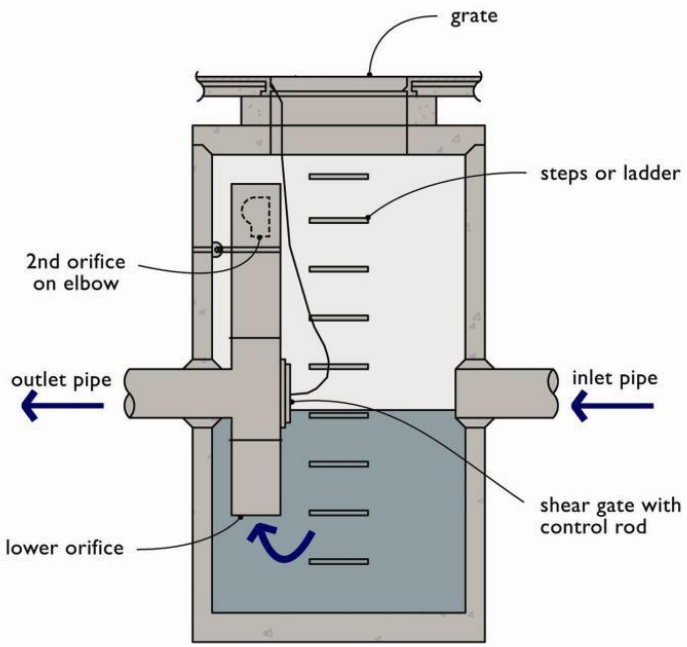
[3] Minimum requirement is for annual inspections. More frequent inspections and maintenance may be required depending on site conditions.

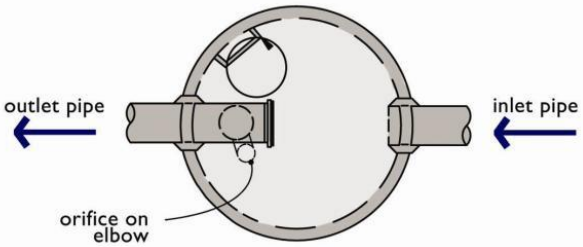
Flow Control Structures/Flow Restrictors

Flow control structures/flow restrictors are located on the outlet pipe of a detention system. The control structure is typically a Type 2 concrete catch basin with a riser (vertical pipe). The control structure reduces the discharge rate of stormwater from a detention facility to the rate at which water was leaving the site prior to development. The flow is regulated by a combination of orifices (holes in the riser pipe with specifically sized diameters) and weirs (rectangular or V-shaped notches in the riser pipe or a separate plate). Lack of maintenance of the control structure can result in the plugging of an orifice. This can result in a backup of stormwater in the detention facility, flooding of the stormwater system, and/or an increase in the rate of discharge from the site potentially damaging downstream property.

Flow control structures are an essential component to the function of a detention pond to limit downstream flooding, undue erosion and stream degradation, and function of the storm and surface water infrastructure maintained by the City of Olympia. While it may be unnerving to watch the water level in a pond fill up dramatically during a major storm event and water slowly trickle out, this is the designed intent of the detention pond and flow control device. Removing the flow restrictor to alleviate pond levels should never be attempted as this will cause downstream damage and flooding. Damage, plugging, or removal of flow control devices is the leading cause of failed detention facilities and flooding.



BIRD'S-EYE VIEW



SECTION PROFILE

Flow Control Structures/Flow Restrictors

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
General				
Trash and Debris (Includes Sediment)	A	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Yes No	Control structure orifice is not blocked. All trash and debris removed.
Structural Damage	A	Structure is not securely attached to manhole wall.	Yes No	Structure securely attached to wall and outlet pipe.
	A	Structure is not in upright position (allow up to 10% from plumb).	Yes No	Structure in correct position.
	A	Connections to outlet pipe are not watertight and show signs of rust.	Yes No	Connections to outlet pipe are water tight; structure repaired or replaced and works as designed.
	A	Any holes--other than designed holes--in the structure.	Yes No	Structure has no holes other than designed holes.
Cleanout Gate				
Damaged or Missing	A	Cleanout gate is not watertight or is missing.	Yes No	Gate is watertight and works as designed.
	A	Gate cannot be moved up and down by one maintenance person.	Yes No	Gate moves up and down easily and is watertight.
	A	Chain/rod leading to gate is missing or damaged.	Yes No	Chain is in place and works as designed.
	A	Gate is rusted over 50% of its surface area.	Yes No	Gate is repaired or replaced to meet design standards.
Orifice Plate				
Damaged or Missing	B, D	Control device is not working properly due to missing, out of place, or bent orifice plate.	Yes No	Plate is in place and works as designed.

Flow Control Structures/Flow Restrictors

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Obstructions	B, D	Any trash, debris, sediment, or vegetation blocking the plate.	Yes No	Plate is free of all obstructions and works as designed.
Overflow Pipe				
Obstructions	A	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Yes No	Pipe is free of all obstructions and works as designed.

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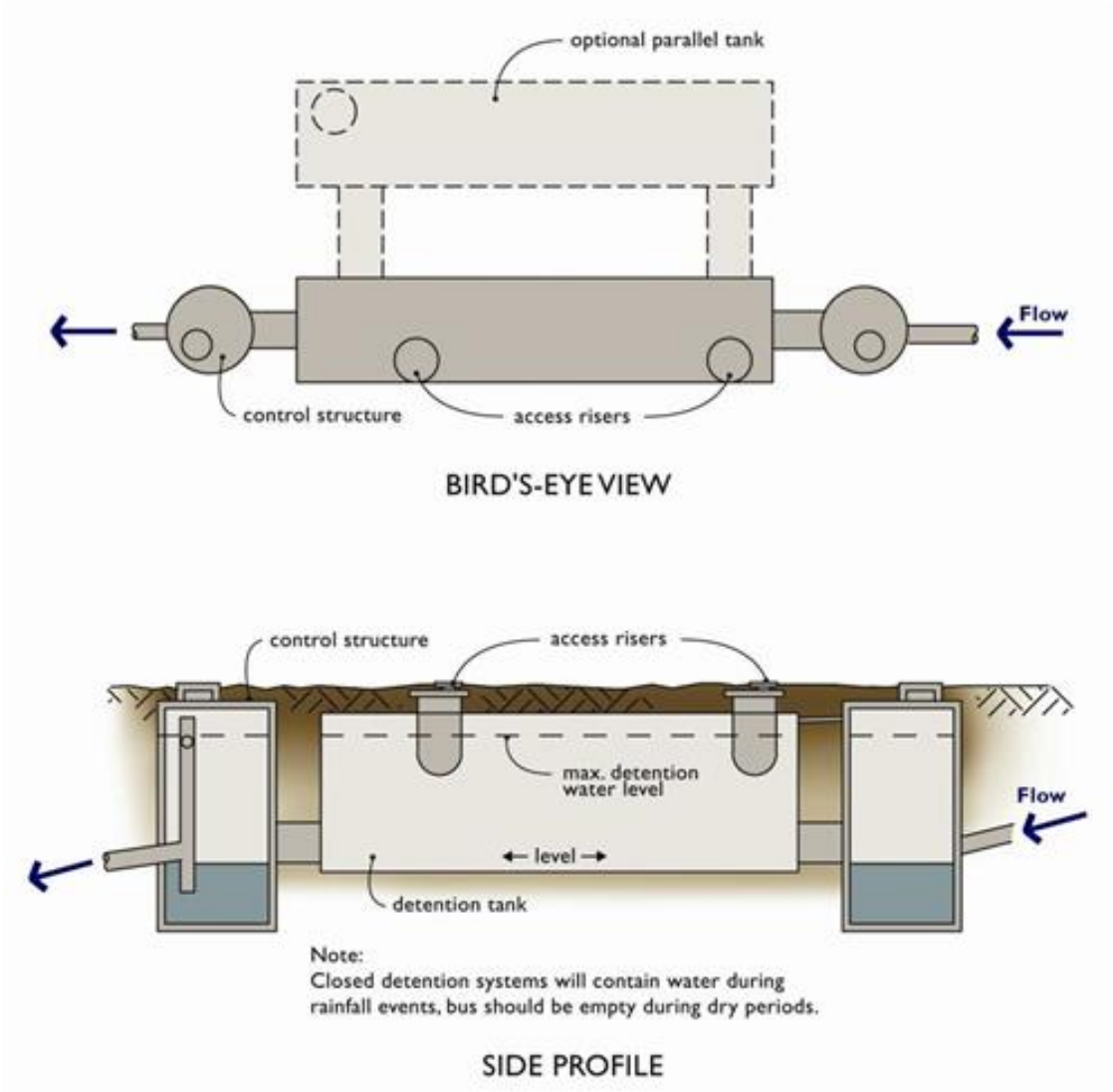
Closed Detention Systems (Tanks/Vaults)

Closed detention systems function similar to detention ponds with the temporary storage volume provided by an underground structure to regulate the storm discharge rate from the site. The structure is typically constructed of large diameter pipe (48” diameter or greater) or a concrete box (Vault). These systems are typically utilized for sites that do not have space available for an open, above-ground system and are more commonly associated with commercial sites.

Underground detention systems are an enclosed space where harmful chemicals and vapors can accumulate. Therefore, the inspection and maintenance of these facilities should be conducted by an individual with training and certification in working in hazardous confined spaces.

Access to detention vaults and tanks can be made through access risers and inspection ports. Flow control devices may be located within a detention vault or in a separate downstream manhole.

Detention tanks/vaults are designed to drain out completely within 48 hours of a storm event. Facilities that continue to hold water well beyond a storm event should be inspected for damage or blockages at the outlet structure.



Closed Detention Systems (Tanks/Vaults)

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Storage Area				
Plugged Air Vents	A	One-half of the cross section of a vent is blocked at any point or the vent is damaged.	Yes No	Vents open and functioning.
Debris and Sediment	A[2]	Accumulated sediment depth exceeds 10% of the diameter of the storage area for 1/2 length of storage vault or any point depth exceeds 15% of diameter. (Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.)	Yes No	All sediment and debris removed from storage area.
Joints Between Tank/Pipe Section	A	Any openings or voids allowing material to be transported into facility. (Will require engineering analysis to determine structural stability).	Yes No	All joint between tank/pipe sections are sealed.
Tank Pipe Bent Out of Shape	A	Any part of tank/pipe is bent out of shape more than 10% of its design shape. (Review required by engineer to determine structural stability).	Yes No	Tank/pipe repaired or replaced to design.
Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	A	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound.	Yes No	Vault replaced or repaired to design specifications and is structurally sound.
	A	Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	Yes No	No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.
Manhole				
Cover Not in Place	B	Cover is missing or only partially in place. Any open manhole requires maintenance.	Yes No	Manhole is closed.
Locking Mechanism Not Working	A	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Yes No	Mechanism opens with proper tools.

Closed Detention Systems (Tanks/Vaults)

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Cover Difficult to Remove	A	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Yes No	Cover can be removed and reinstalled by one maintenance person.
Ladder Rungs Unsafe	A	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Yes No	Ladder meets design standards. Allows maintenance person safe access.
Catch Basins or Manholes				
See "Catch Basins"	A	See "Catch Basins"	Yes No	See "Catch Basins"

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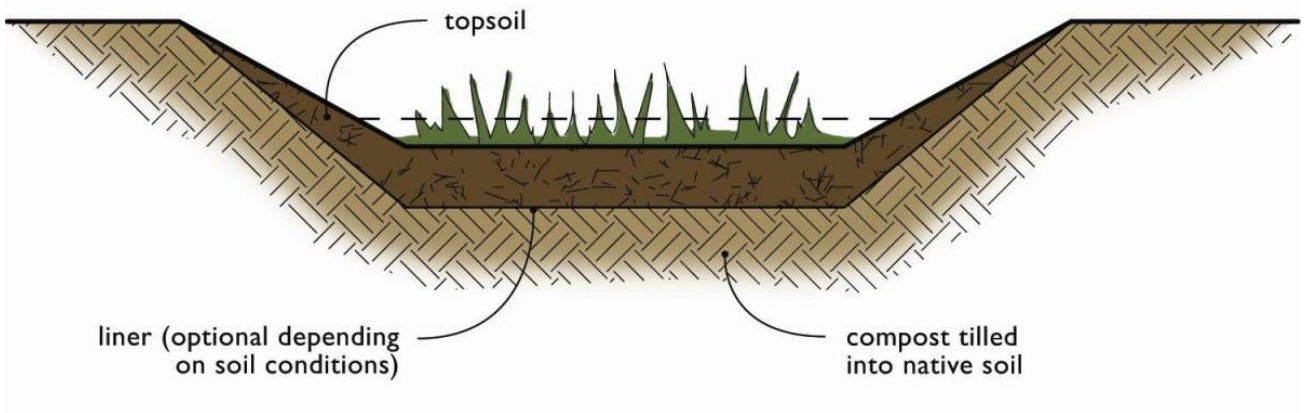
Basic Biofiltration Swale

Biofiltration swales are engineered grass-lined open channels with moderate centerline slope similar in appearance to typical ditches, except swales have a generally trapezoidal shape with a flat bottom and specific vegetation needs. Biofiltration facilities – or biofilters – are a form of permanent stormwater runoff treatment. Biofiltration swales are appropriate for low stormwater flows from sites with low pollution generating potential (e.g. residential sites).

Biofiltration uses vegetation in conjunction with slow and shallow-depth flow for runoff treatment. As stormwater runoff passes through the vegetation, pollutants are removed through the combined effects of filtration, infiltration, and settling. These effects are aided by the reduction of the velocity of stormwater as it passes through the vegetation in the biofilter. Typically, biofiltration swales are not constructed with a compost-amended soil lining unless native soils are incapable of supporting plant life.

Ponding or standing water within biofiltration swales is not acceptable; prolonged periods of inundation can cause grasses to die off rendering the treatment swale useless. Biofiltration swales need established vegetation to function as designed.

Biofiltration swales provide stormwater quality control (treatment), but do not provide stormwater quantity control (detention/retention).



Basic Biofiltration Swale

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
General				
Sediment Accumulation on Grass	A[2]	Sediment depth exceeds 2 inches.	Yes No	Remove sediment deposits on grass treatment area of the bio-swale. When finished, swale should be level from side to side and drain freely toward outlet. There should be no areas of standing water once inflow has ceased.
Standing Water	A, E	When water stands in the swale between storms and does not drain freely.	Yes No	Any of the following may apply: remove sediment or trash blockages, improve grade from head to foot of swale, remove clogged check dams, add underdrains or convert to a wet biofiltration swale.
Flow spreader	A	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire swale width.	Yes No	Level the spreader and clean so that flows are spread evenly over entire swale width.
Constant Baseflow	A	When small quantities of water continually flow through the swale, even when it has been dry for weeks, and an eroded, muddy channel has formed in the swale bottom.	Yes No	Add a low-flow pea-gravel drain the length of the swale or by-pass the baseflow around the swale.
Poor Vegetation Coverage	A	When grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.	Yes No	Determine why grass growth is poor and correct that condition. Re-plant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals. Or re-seed into loosened, fertile soil.
Vegetation	A	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Yes No	Mow vegetation or remove nuisance vegetation so that flow not impeded. Grass should be mowed to a height of 3 to 4 inches. Remove grass clippings.
Excessive Shading	A	Grass growth is poor because sunlight does not reach swale.	Yes No	If possible, trim back over-hanging limbs and remove brushy vegetation on adjacent slopes.

Basic Biofiltration Swale

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Inlet/Outlet	A, E	Inlet/outlet areas clogged with sediment and/or debris.	Yes No	Remove material so that there is no clogging or blockage in the inlet and outlet area.
Trash and Debris Accumulation	B	Trash and debris accumulated in the bio-swale.	Yes No	Remove trash and debris from bioswale.
Erosion/Scouring	B, E	Eroded or scoured swale bottom due to flow channelization, or higher flows.	Yes No	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large, generally greater than 12 inches wide, the swale should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.

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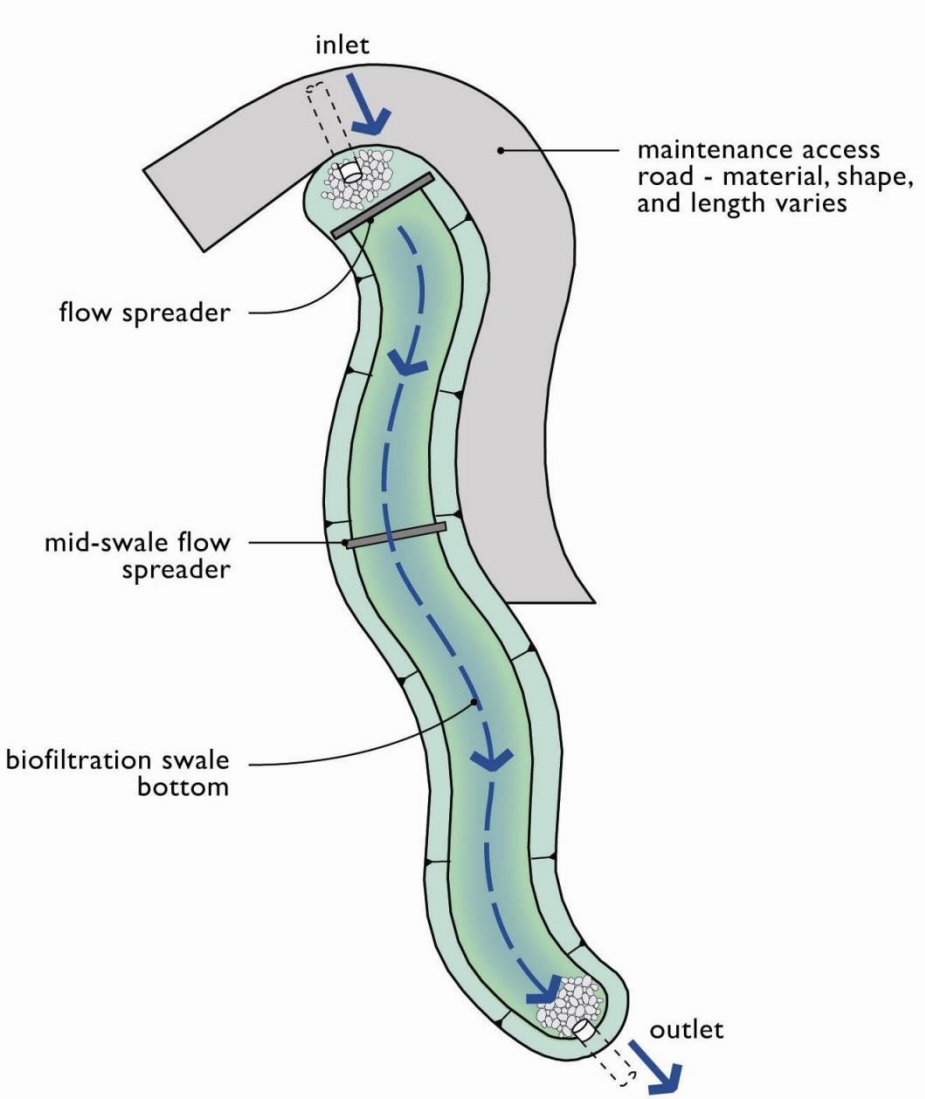
[2] Minimum requirement is for annual inspections. More frequent inspections and maintenance may be required depending on site conditions

Wet Biofiltration Swale

Biofiltration swales are engineered grass-lined open channels with moderate centerline slope similar in appearance to typical ditches, except swales have a generally trapezoidal shape with a flat bottom and specific vegetation needs. Biofiltration facilities – or biofilters – are a form of permanent stormwater runoff treatment. Biofiltration swales are appropriate for low stormwater flows from sites with low pollution generating potential (e.g. residential sites). Biofiltration uses vegetation in conjunction with slow and shallow-depth flow for runoff treatment. As stormwater runoff passes through the vegetation, pollutants are removed through the combined effects of filtration, infiltration, and settling. These effects are aided by the reduction of the velocity of stormwater as it passes through the vegetation in the biofilter. Typically, biofiltration swales are not constructed with a compost-amended soil lining unless native soils are incapable of supporting plant life.

A wet biofiltration swale is a variation of a basic biofiltration swale for use where the centerline slope is slight, groundwater tables are high, or a continuous low base flow is likely to result in wet soil conditions for long periods. Where continuously wet soil conditions exceeds about 2 weeks, typical grasses will die. Thus, swale vegetation specifically adapted to wet soil conditions is needed. Different vegetation in turn requires modification of several of the design and maintenance requirements from the basic biofiltration swale.



Wet Biofiltration Swale

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
General				
Sediment Accumulation	A[2]	Sediment depth exceeds 2-inches in 10% of the swale treatment area.	Yes No	Remove sediment deposits in treatment area.
Water Depth	A	Water not retained to a depth of about 4 inches during the wet season.	Yes No	Build up or repair outlet berm so that water is retained in the wet swale.
Wetland Vegetation	A	Vegetation becomes sparse and does not provide adequate filtration, OR vegetation is crowded out by very dense clumps of cattail, which do not allow water to flow through the clumps.	Yes No	Determine cause of lack of vigor of vegetation and correct. Replant as needed. For excessive cattail growth, cut cattail shoots back and compost off-site. Note: normally wetland vegetation does not need to be harvested unless die-back is causing oxygen depletion in downstream waters.
Inlet/Outlet	A	Inlet/outlet area clogged with sediment and/or debris.	Yes No	Remove clogging or blockage in the inlet and outlet areas.
Trash and Debris Accumulation	B	Trash or debris impedes the function of the swale	Yes No	Remove trash and debris from wet swale.
Erosion/Scouring	A, E	Swale has eroded or scoured due to flow channelization, or higher flows.	Yes No	Check design flows to assure swale is large enough to handle flows. By-pass excess flows or enlarge swale. Replant eroded areas with fibrous-rooted plants such as Juncus effusus (soft rush) in wet areas or snowberry (Symphoricarpos albus) in dryer areas.

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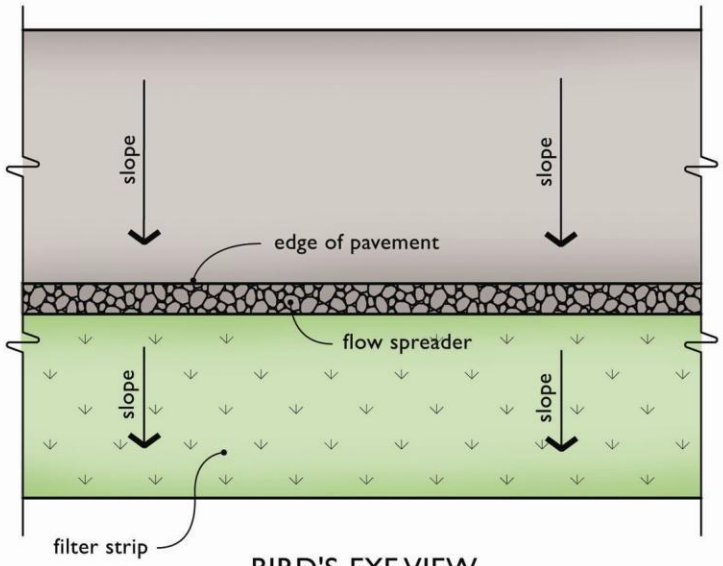
Filter Strips

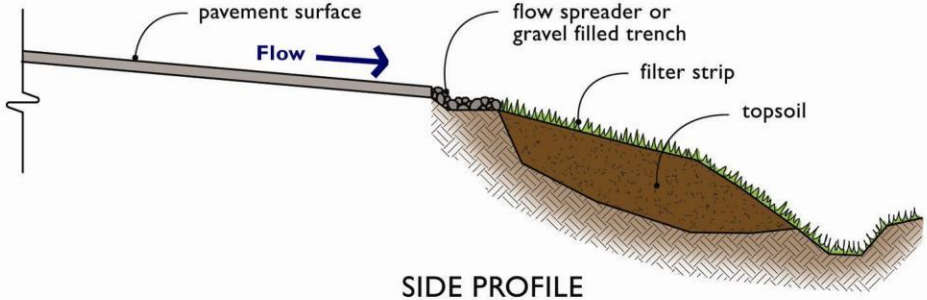
A basic filter strip consists of a vegetated, grass slope area that provides the same treatment function as a biofiltration swale. Biofiltration facilities use vegetation in conjunction with slow and shallow-depth flow for runoff treatment. As stormwater runoff passes through the vegetation, pollutants are removed through the combined effects of filtration, infiltration, and settling. These effects are aided by the reduction of the velocity of stormwater as it passes through the vegetation in the biofilter.

Polluted stormwater runoff – typically from a parking area or street – is distributed as shallow flow across the top width of a biofilter strip through a flow spreader device or curb cuts at the edge of a paved area. The flow spreader device typically consists of a gravel filled trench and a board or concrete curb with a level top to evenly distribute the stormwater runoff across the entire length of the filter strip. Most filter strips have a collection ditch at the base to collect and route the treated runoff to a detention/retention facility or downstream conveyance system.

As with other biofiltration treatment facilities, maintenance of the grass treatment area is the highest priority for retaining the function of a filter strip. Typical maintenance functions are mowing and grass reestablishment.



BIRD'S-EYE VIEW



SIDE PROFILE

Filter Strips

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
General				
Sediment Accumulation on Grass	A[2]	Sediment depth exceeds 2 inches.	Yes No	Remove sediment deposits, re-level so slope is even and flows pass evenly through strip.
Vegetation	A	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Yes No	Mow grass, control nuisance vegetation, such that flow not impeded. Grass should be mowed to a height between 3-4 inches.
Trash and Debris Accumulation	B	Trash and debris accumulated on the filter strip.	Yes No	Remove trash and Debris from filter.
Erosion/Scouring	A, E	Eroded or scoured areas due to flow channelization, or higher flows.	Yes No	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the filter strip should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident.
Flow spreader	A	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire filter width.	Yes No	Level the spreader and clean so that flows are spread evenly over entire filter width.

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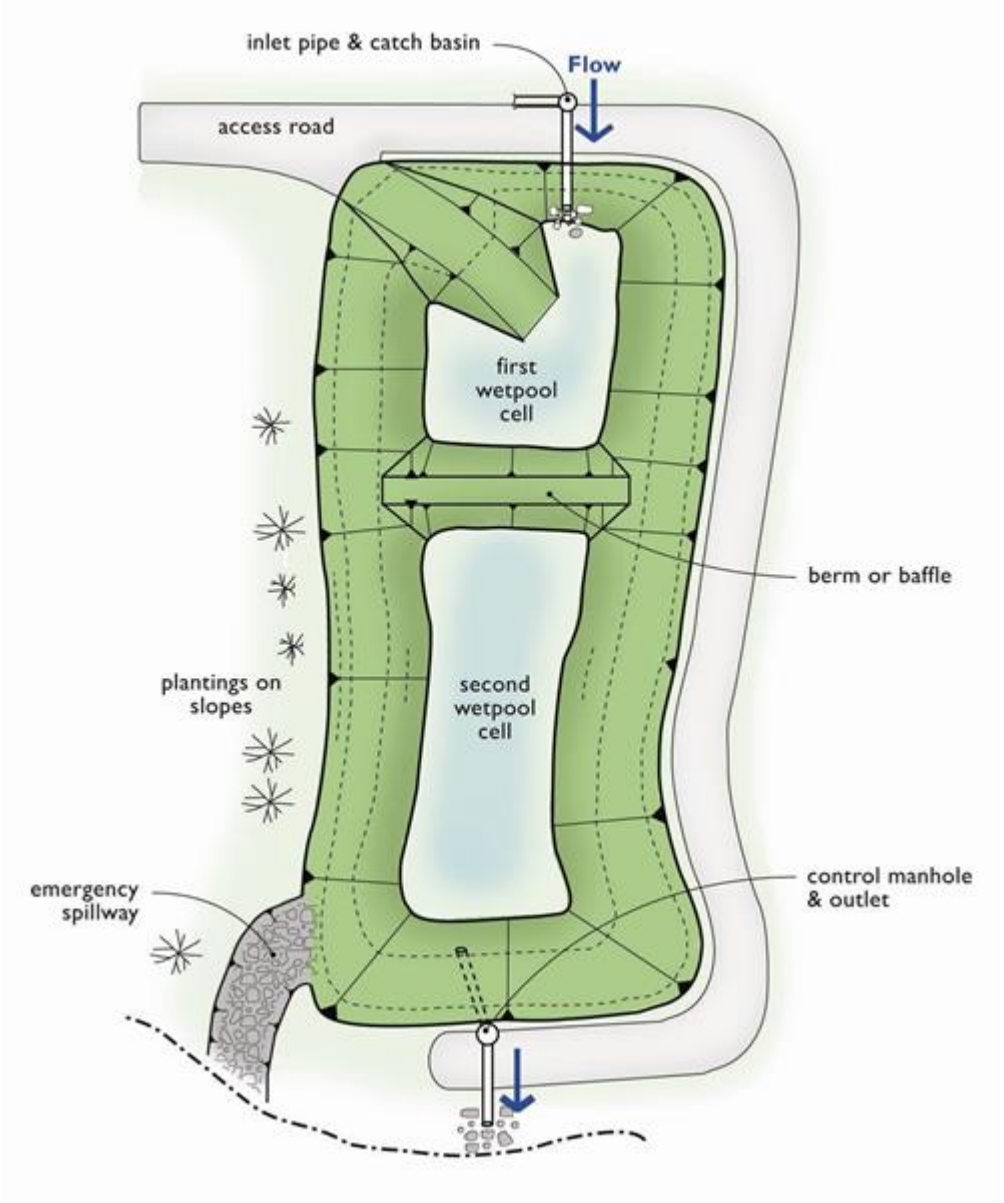
Wetponds

A wetpond is an open basin that retains a permanent pool of water (wetpool) year round or only during the wet season. The designed volume of water in the wetpool and the pond geometry allows sediment and other pollutants to settle out of the stormwater. Wetland vegetation is typically planted within the wetpond to provide aesthetic benefits and some additional treatment through nutrient (i.e. nitrogen) removal.

Detention and flow control can be provided with additional temporary storage volume above the permanent pool elevation – this type of facility is classified as a 'combined wetpond/detention pond'. Those facilities are subject to the maintenance standards for both wetponds and detention ponds.

The volume of the wetpond is critical to the facility functioning properly. Reduction of the pond volume can occur by sediment accumulation, invasive and uncontrolled plant growth, and dead or decaying plant matter accumulation in the pond. Emergent wetland vegetation in a wetpond should be kept from growing out of control to avoid pond volume reduction and leaching of nutrient pollutants (i.e. nitrogen, phosphorus, etc.) from dead or decaying plant matter.

Wetponds have an impermeable liner that helps retain the permanent pool of water in the pond. When mechanically removing sediment, care should be taken to not disturb or puncture the liner of the pond.



Wetponds

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
General				
Water level	A, W	First cell is empty, doesn't hold water.	Yes No	Line the first cell to maintain at least 4 feet of water. Although the second cell may drain, the first cell must remain full to control turbulence of the incoming flow and reduce sediment resuspension.
Trash and Debris	B	Accumulation that exceeds 1 CF per 1000-SF of pond area.	Yes No	Trash and debris removed from pond.
Inlet/Outlet Pipe	A, D	Inlet/Outlet pipe clogged with sediment and/or debris material.	Yes No	No clogging or blockage in the inlet and outlet piping.
Sediment Accumulation in Pond Bottom	A[2], D	Sediment accumulations in pond bottom that exceeds the depth of sediment zone plus 6-inches, usually in the first cell.	Yes No	Sediment removed from pond bottom.
Oil Sheen on Water	A, E	Prevalent and visible oil sheen.	Yes No	Oil removed from water using oil-absorbent pads or vactor truck. Source of oil located and corrected. If chronic low levels of oil persist, plant wetland plants such as Juncus effusus (soft rush) which can uptake small concentrations of oil.
Erosion	A[2], E	Erosion of the pond's side slopes and/or scouring of the pond bottom, that exceeds 6-inches, or where continued erosion is prevalent.	Yes No	Slopes stabilized using proper erosion control measures and repair methods.
Settlement of Pond Dike/Berm	A	Any part of these components that has settled 4-inches or lower than the design elevation, or inspector determines dike/berm is unsound.	Yes No	Dike/berm is repaired to specifications.
Internal Berm	A	Berm dividing cells should be level.	Yes No	Berm surface is leveled so that water flows evenly over entire length of berm.
Overflow Spillway	A	Rock is missing and soil is exposed at top of spillway or outside slope.	Yes No	Rocks replaced to specifications.

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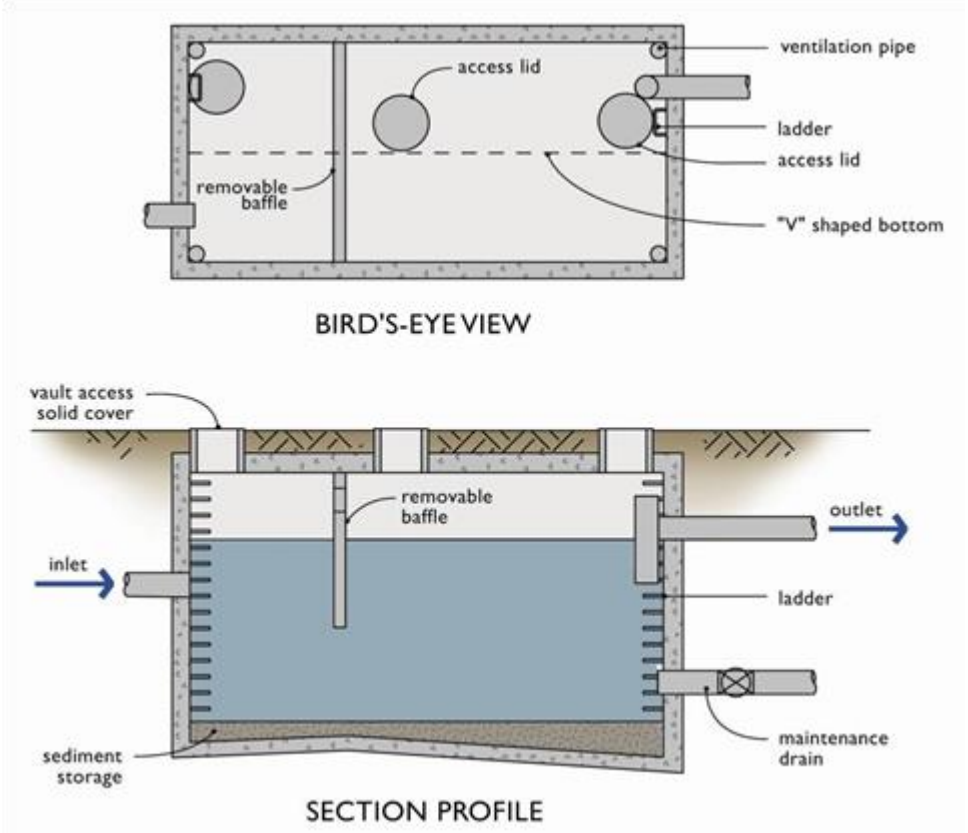
Wet Vaults

A wet vault is an underground structure that maintains a permanent pool of water (wetpool) which dissipates energy and improves the removal and settling of sediment and other pollutants. The designed volume of water in the wetpool and the vault geometry allows sediment and other pollutants to settle out of the stormwater. Some wet vault configurations will include a baffle design to trap floatable pollutants such as oil and hydrocarbons in the vault. Sediment levels and debris accumulation are highest concern for inspection and vault maintenance.

Wet vaults are typically serviced by a vactor or pump truck to remove sediment and debris. Access to vaults can be made through access risers. Wet vaults are a closed space where harmful chemicals and gasses can accumulate. Therefore, the inspection and maintenance of these facilities should be conducted by an individual with training and certification in working in hazardous confined spaces.



Wetvaults

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
General				
Trash/Debris Accumulation	A	Trash and debris accumulated in vault, pipe or inlet/outlet (includes floatables and non-floatables).	Yes No	Remove trash and debris from vault.
Sediment Accumulation in Vault	A[2]	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6-inches.	Yes No	Remove sediment from vault.
Damaged Pipes	A	Inlet/outlet piping damaged or broken and in need of repair.	Yes No	Pipe repaired and/or replaced.
Access Cover Damaged/Not Working	B	Cover cannot be opened or removed, especially by one person.	Yes No	Pipe repaired or replaced to proper working specifications.
Ventilation	A	Ventilation area blocked or plugged.	Yes No	Blocking material removed or cleared from ventilation area. A specified % of the vault surface area must provide ventilation to the vault interior (see design specifications).
Vault Structure Damage - Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab	A	Maintenance/inspection personnel determine that the vault is not structurally sound.	Yes No	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
	A	Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Yes No	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
Baffles	A	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection staff.	Yes No	Baffles repaired or replaced to specifications.
Access Ladder Damage	A	Ladder is corroded or deteriorated, not functioning properly, not attached to structure wall, missing rungs, has cracks and/or misaligned. Confined space warning sign missing.	Yes No	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel. Replace sign warning of confined space entry requirements. Ladder and entry notification complies with OSHA standards.

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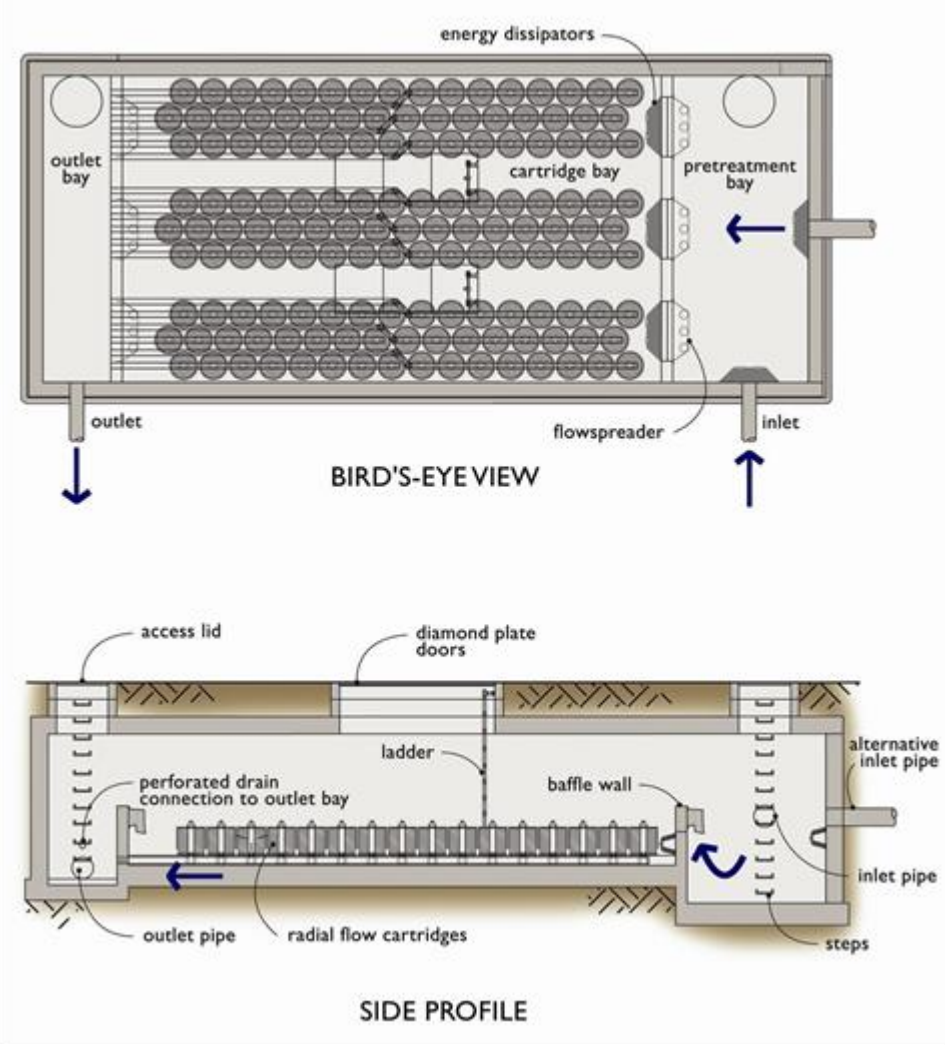
Manufactured Media Filters

A manufactured media filter is a special device or vault that achieves removal of pollutants from stormwater using a proprietary design and special media. The media that polluted stormwater passes through and subsequently removes pollutants – can come in many forms and installations. Media can be as layers in a concrete vault, contained in vertical media cartridges, or other configurations that direct stormwater to move through the media for treatment.

Media filters are continuously evolving and improving on past designs, and all emerging technologies for stormwater treatment must be evaluated and approved by the Washington State Department of Ecology to assure they meet minimum pollutant removal standards.

Manufactured media filter devices and vaults are sometimes preferred over conventional wetponds or swales because they save space on a development site. These technologies, however, often require more intensive maintenance schedule and have increased cost of maintenance depending on the product or configuration.

The following maintenance checklist applies to all types of manufactured media filters. Your *Stormwater Facility Maintenance Program* should include this checklist and a separate product specific checklist for the media filter(s) on your site. When replacing media or media contained in cartridges, it is important to replace them with the same media specified on the design plans/as-built drawings. Different media mixes target different pollutants for removal.



Example of a Contech StormFilter Vault

Manufactured Media Filters

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Below Ground Vault				
Sediment Accumulation on Media.	A[2], D	Sediment depth exceeds 0.25-inches.	Yes No	No sediment deposits which would impede permeability of the compost media.
Sediment Accumulation in Vault	A[2], D	Sediment depth exceeds 6-inches in first chamber.	Yes No	No sediment deposits in vault bottom of first chamber.
Trash/Debris Accumulation	A	Trash and debris accumulated on compost filter bed.	Yes No	Trash and debris removed from the compost filter bed.
Sediment in Drain Pipes/Clean-Outs		When drain pipes, clean-outs, become full with sediment and/or debris.	Yes No	Sediment and debris removed.
Damaged Pipes	A	Any part of the pipes that are crushed or damaged due to corrosion and/or settlement.	Yes No	Pipe repaired and/or replaced.
Access Cover Damaged/Not Working	B	Cover cannot be opened; one person cannot open the cover using normal lifting pressure, corrosion/deformation of cover.	Yes No	Cover repaired to proper working specifications or replaced.
Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	A	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Yes No	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
	A	Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Yes No	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.

Manufactured Media Filters

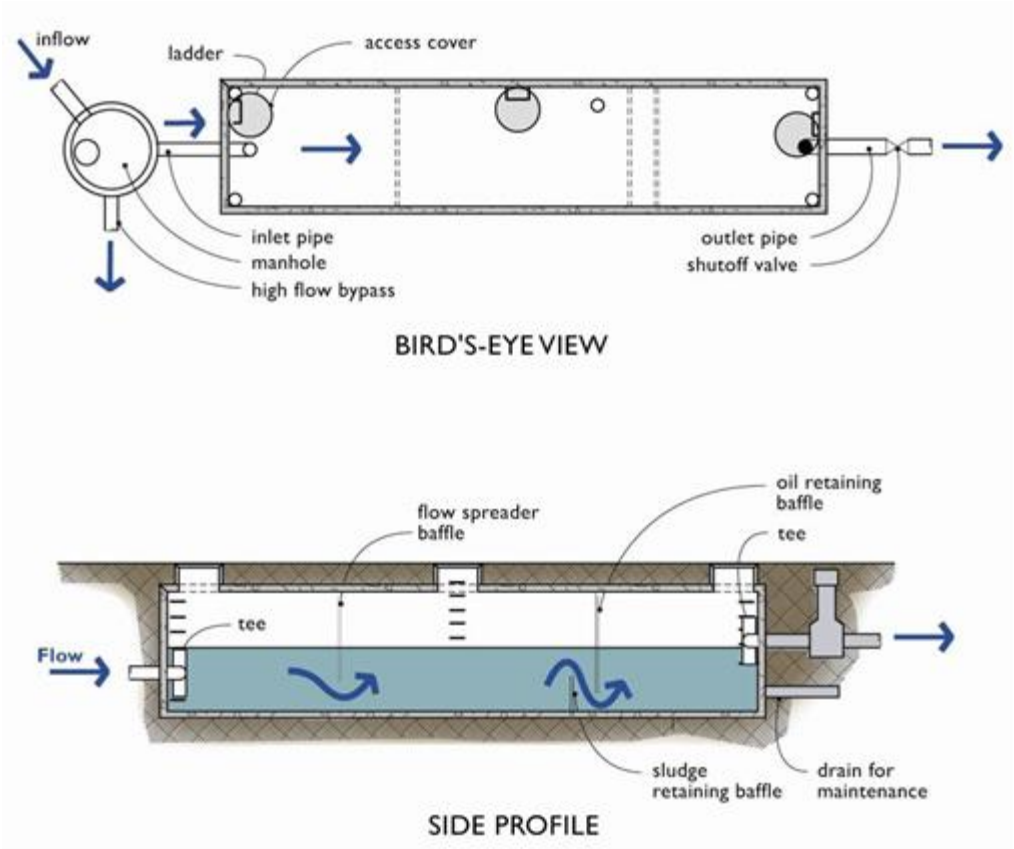
Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Baffles	A	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.	Yes No	Baffles repaired or replaced to specifications.
Access Ladder Damaged	A	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Yes No	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.
Below Ground Cartridge Type				
Media	A[2]	Drawdown of water through the media takes longer than 1 hour, and/or overflow occurs frequently.	Yes No	Media cartridges replaced.
Short Circuiting	E	Flows do not properly enter filter cartridges.	Yes No	Filter cartridges replaced.

[1] Inspection frequency:
A = Annually;
B = Biannually (twice per year);
W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves;
E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident which causes contaminant release).

[2] Minimum requirement is for annual inspections. More frequent inspections and maintenance may be required depending on site conditions.

Baffle Oil/Water Separator (API Type)

American Petroleum Institute (API) oil/water separators consist of an underground vault separated into three bays by a series of partial divider walls (baffles). The three bays consist of a forebay, separator section, and the afterbay. Oil/water separators are typically utilized in locations where high oil concentrations in the stormwater runoff are anticipated (i.e. service and fuel stations). Oil/water separators are most commonly used as the first *pre-treatment* facility in a series of stormwater treatment facilities ("treatment train").



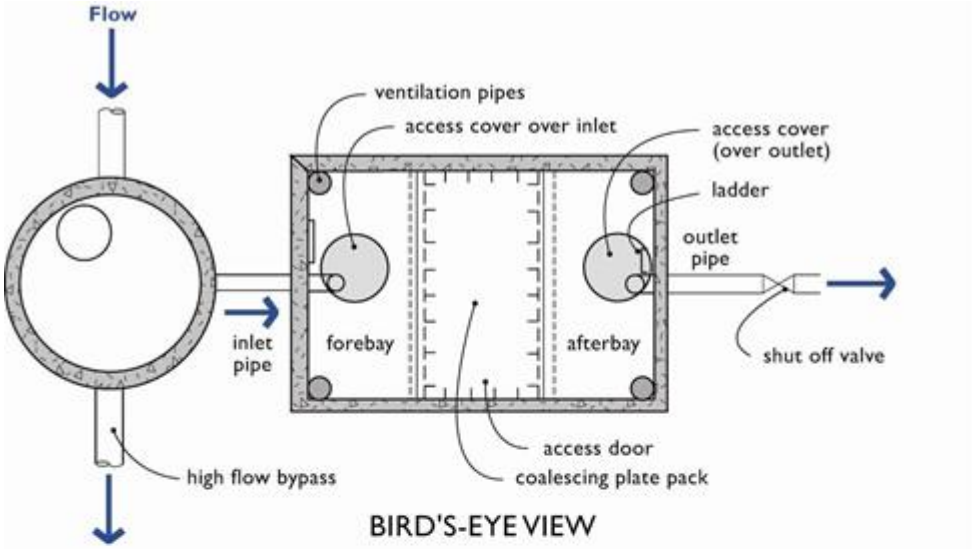
Baffle Oil/Water Separators (API Type)

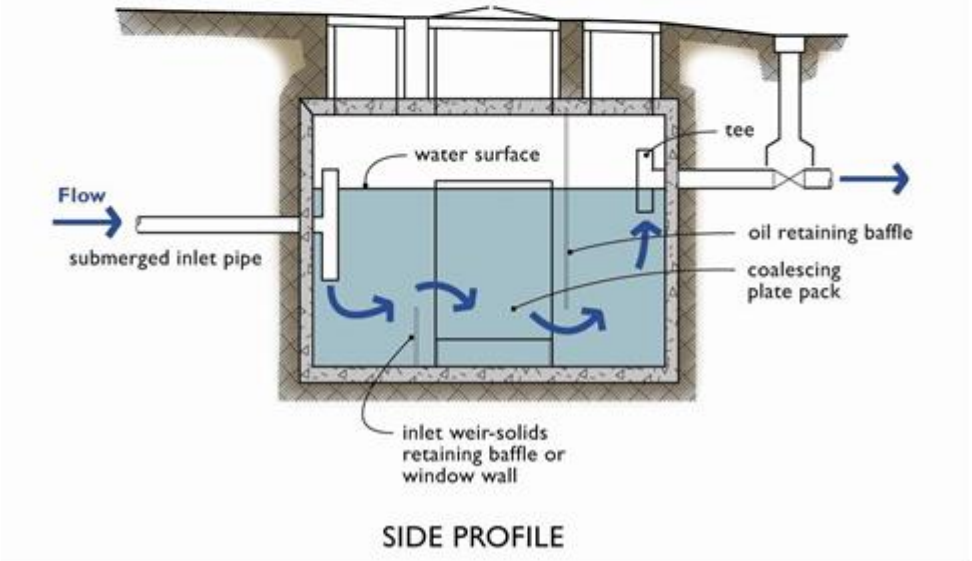
Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
General				
Monitoring	E	Inspection of discharge water for obvious signs of poor water quality.	Yes No	Effluent discharge from vault should be clear without thick visible sheen.
Sediment Accumulation	A[2]	Sediment depth in bottom of vault exceeds 6-inches in depth.	Yes No	No sediment deposits on vault bottom that would impede flow through the vault and reduce separation efficiency.
Trash and Debris Accumulation	A[2]	Trash and debris accumulation in vault, or pipe inlet/outlet, floatables and non-floatables.	Yes No	Trash and debris removed from vault, and inlet/outlet piping.
Oil Accumulation	A[2]	Oil accumulations that exceed 1-inch, at the surface of the water.	Yes No	Extract oil from vault by vactoring. Disposal in accordance with state and local rules and regulations.
Damaged Pipes	A	Inlet or outlet piping damaged or broken and in need of repair.	Yes No	Pipe repaired or replaced.
Access Cover Damaged/Not Working	B	Cover cannot be opened, corrosion/deformation of cover.	Yes No	Cover repaired to proper working specifications or replaced.
Vault Structure Damage - Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab	A	See “Catch Basins”	Yes No	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
	A	Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Yes No	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
Baffles	A	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Yes No	Baffles repaired or replaced to specifications.

Coalescing Plate Oil/Water Separators

Oil/water separators consist of an underground vault typically utilized in locations where high oil concentrations in the stormwater runoff are anticipated (i.e. service and fuel stations). Oil/water separators are most commonly used as the first *pre-treatment* facility in a series of stormwater treatment facilities ("treatment train"). The oil/water separator is divided into three section: the forebay where stormwater enters, the plate pack, and the afterbay which precedes the discharge pipe from the structure.

Coalescing plate separators include a series of parallel plates in the separation bay (2nd bay) that increase the oil removal efficiency of the separator.





Coalescing Plate Oil/Water Separators

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
General				
Monitoring	E	Inspection of discharge water for obvious signs of poor water quality.	Yes No	Effluent discharge from vault should be clear with no thick visible sheen.
Sediment Accumulation	A[2]	Sediment depth in bottom of vault exceeds 6-inches in depth and/or visible signs of sediment on plates.	Yes No	No sediment deposits on vault bottom and plate media, which would impede flow through the vault and reduce separation efficiency.
Trash and Debris Accumulation	A[2]	Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.	Yes No	Trash and debris removed from vault, and inlet/outlet piping.
Oil Accumulation	A[2]	Oil accumulation that exceeds 1-inch at the water surface.	Yes No	Oil is extracted from vault using vactoring methods. Coalescing plates are cleaned by thoroughly rinsing and flushing. Should be no visible oil depth on water.
Damaged Coalescing Plates	A	Plate media broken, deformed, cracked and/or showing signs of failure.	Yes No	A portion of the media pack or the entire plate pack is replaced depending on severity of failure.
Damaged Pipes	A	Inlet or outlet piping damaged or broken and in need of repair.	Yes No	Pipe repaired and or replaced.
Baffles	A	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Yes No	Baffles repaired or replaced to specifications.
Vault Structure Damage - Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab	A	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Yes No	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
	A	Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Yes No	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
Access Ladder Damaged	A	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Yes No	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

[1] Inspection frequency:
A = Annually;
B = Biannually (twice per year);
W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves;
E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident which causes contaminant release).

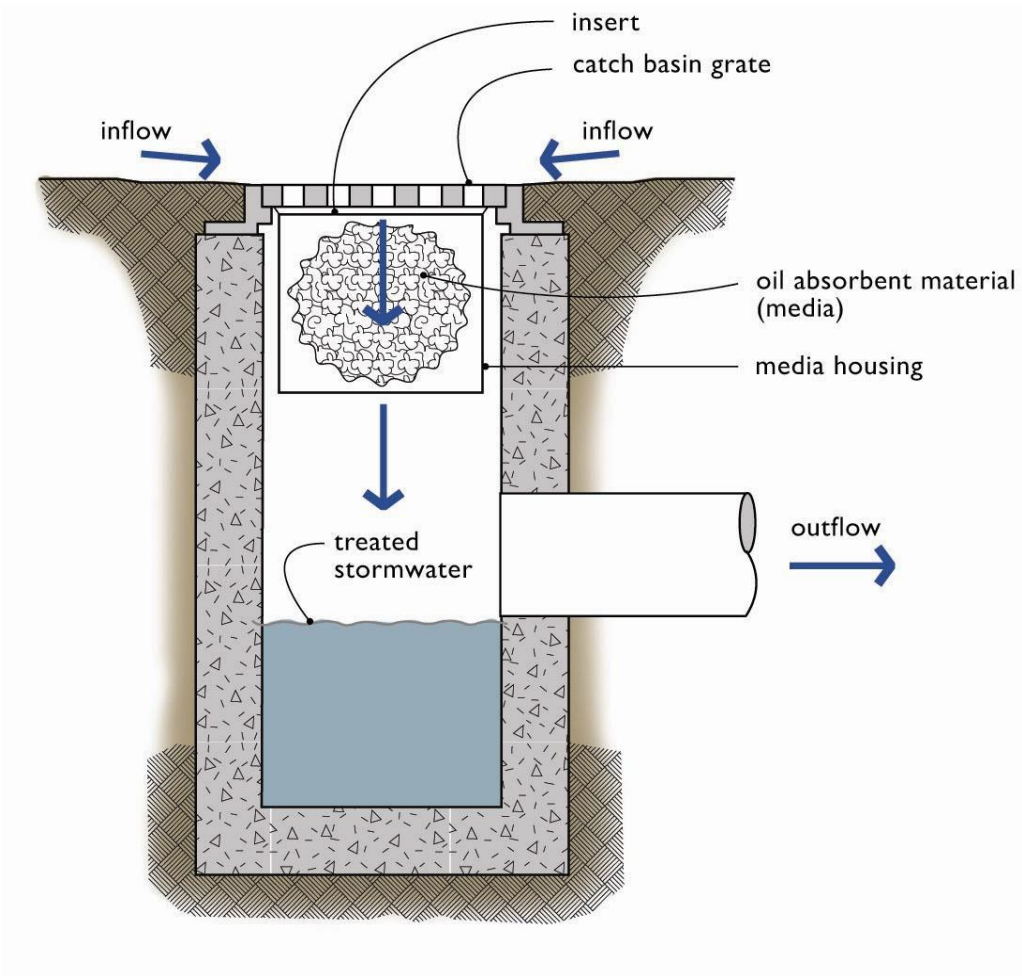
[2] Minimum requirement is for annual inspections. More frequent inspections and maintenance may be required depending on site conditions.

Catch Basin Inserts

Catch basin inserts have been under development for many years in the Puget Sound Basin. Inserts are placed directly in a standard catch basin beneath the grate, and they are intended to serve as a pre-treatment device (i.e. a method for limiting the pollutant load on other downstream drainage systems or facilities). Catch basin inserts are generally maintenance intensive and require replacement of the treatment media or entire insert annually. Inspection, maintenance, and replacement intervals will vary from site to site and depend on the actual loading of pollutants entering the catch basin.

Catch basin inserts typically consist of the following components:

- A structure (screened box, brackets, etc.) which contains a pollutant removal medium
- A means of suspending the structure in a catch basin
- A filter medium such as sand, carbon, fabric, etc.
- A primary inlet and outlet for the stormwater
- A secondary outlet for bypassing flows that exceed design flow



Catch Basin Inserts

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
General				
Sediment Accumulation	B[2], W	When sediment forms a cap over the insert media of the insert and/or unit.	Yes No	No sediment cap on the insert media and its unit.
Trash and Debris Accumulation	B[2]	Trash and debris accumulates on insert unit creating a blockage/restriction.	Yes No	Trash and debris removed from insert unit. Runoff freely flows into catch basin.
Media Insert Not Removing Oil	B[2], E	Effluent water from media insert has a visible sheen.	Yes No	Effluent water from media insert is free of oils and has no visible sheen.
Media Insert Water Saturated	B[2]	Catch basin insert is saturated with water and no longer has the capacity to absorb.	Yes No	Remove and replace media insert
Media Insert-Oil Saturated	B[2]	Media oil saturated due to petroleum spill that drains into catch basin.	Yes No	Remove and replace media insert.
Media Insert Use Beyond Normal Product Life	B[2]	Media has been used beyond the typical average life of media insert product.	Yes No	Remove and replace media at regular intervals, depending on insert product.

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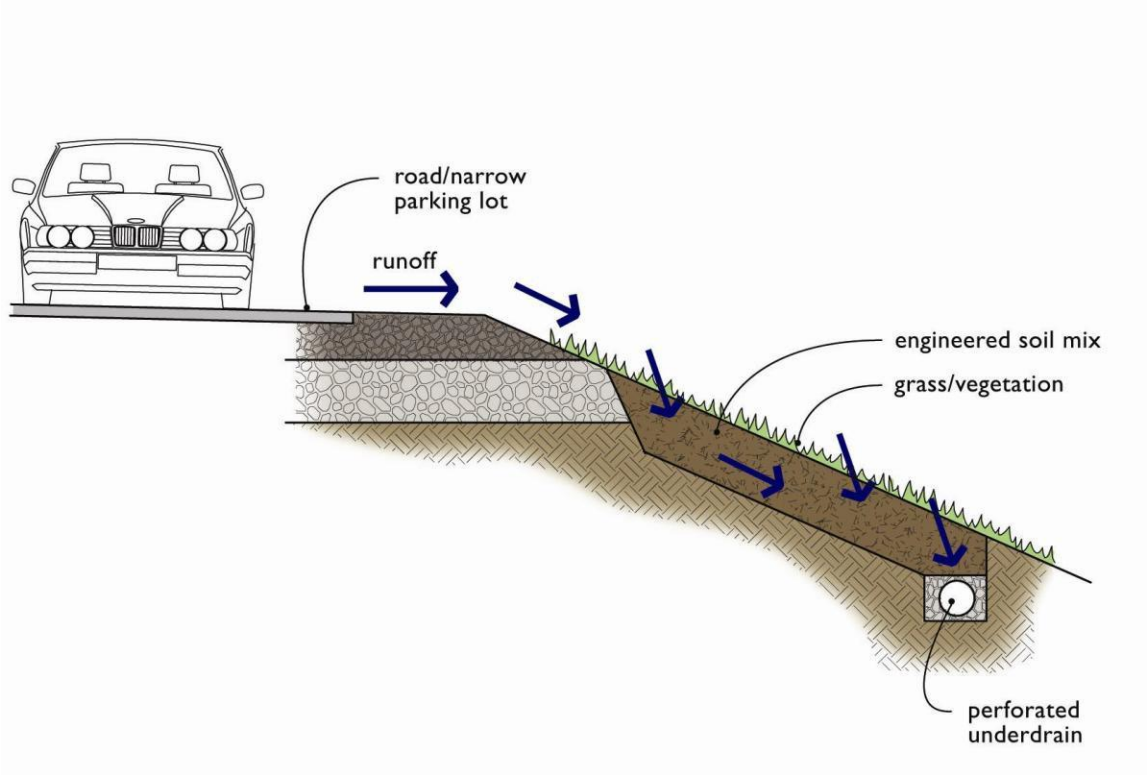
W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves;
E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident which causes contaminant release).

[2] Minimum requirement is for annual inspections. More frequent inspections and maintenance may be required depending on site conditions.

Media Filter Drain (MFD)

A Media Filter Drain – also sometimes referred to as an Ecology Embankment – is an engineering soil and vegetated filter designed for water quality treatment of impervious areas with flow paths of 30 feet or less that can drain along their widest dimension to grassy areas. Typical applications of Media Filter Drains are for roads with limited right-of-way widths or for narrow parking strips.



Media Filter Drain (MFD)

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
General				
Sediment accumulation on grass filter strip	A[2], D	Sediment depth exceeds 2 inches or creates uneven grading that interferes with sheet flow.	Yes No	Remove sediment deposits on grass treatment area of the embankment. When finished, embankment should be level from side to side and drain freely toward the toe of the embankment slope. There should be no areas of standing water once inflow has ceased.
No-vegetation zone/flow spreader	A	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire embankment width.	Yes No	Level the spreader and clean to spread flows evenly over entire embankment width.
Poor vegetation coverage	A	Grass is sparse or bare, or eroded patches are observed in more than 10% of the grass strip surface area.	Yes No	Determine why grass growth is poor and correct the offending condition. Reseed into loosened, fertile soil or compost; or, replant with plugs of grass from the upper slope.
Vegetation	B	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Yes No	Mow vegetation or remove nuisance vegetation to not impede flow. Mow grass to a height of 6 inches.
Media filter drain mix replacement	A	Water is seen on the surface of the media filter drain mix long after the storms have ceased. Typically, the 6-month, 24-hour precipitation event should drain within 48 hours. More common storms should drain within 24 hours. Maintenance also needed on a 10-year cycle and during a preservation project.	Yes No	Excavate and replace all of the media filter drain mix contained within the media filter drain.
Excessive shading	A	Grass growth is poor because sunlight does not reach embankment.	Yes No	If possible, trim back overhanging limbs and remove brushy vegetation on adjacent slopes.
Trash and debris	B	Trash and debris have accumulated on embankment.	Yes No	Remove trash and debris from embankment.
Flooding of Media filter drain	B, E	When media filter drain is inundated by flood water	Yes No	Evaluate media filter drain material for acceptable infiltration rate and replace if media filter drain does not meet long-term infiltration rate standards.

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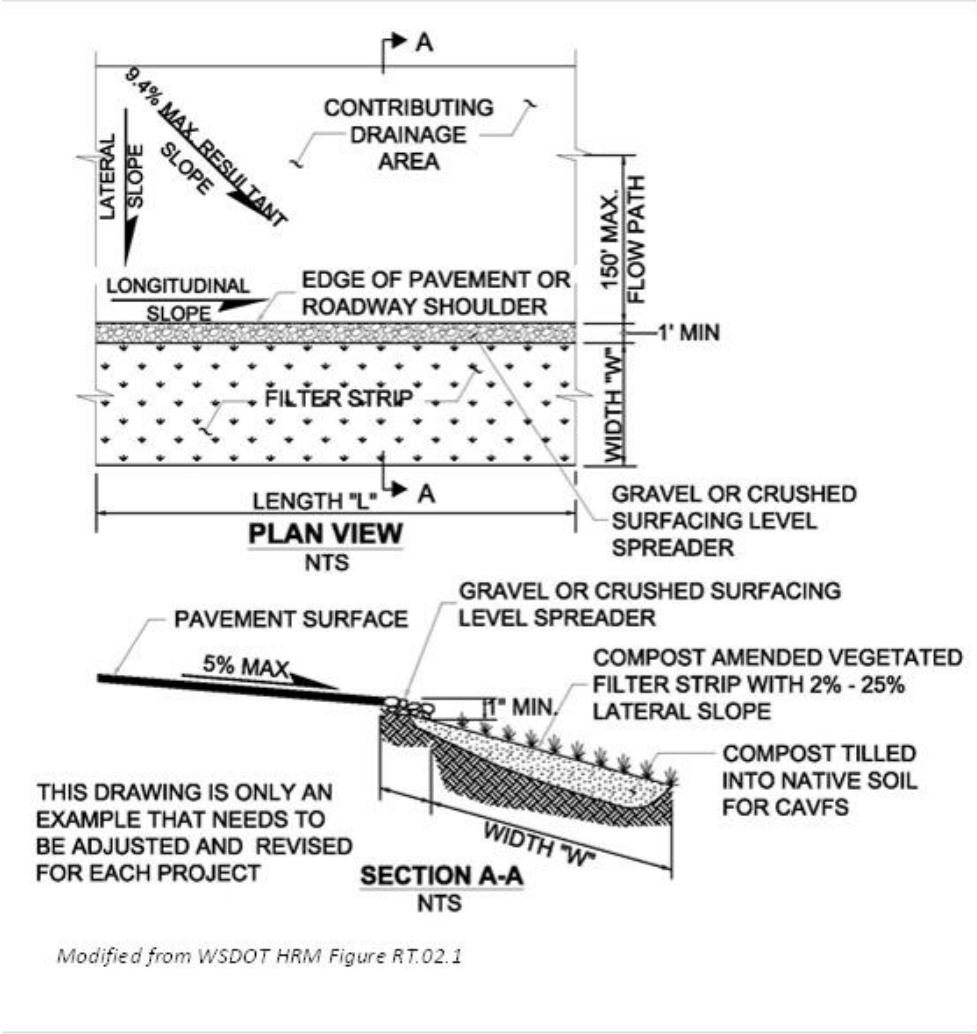
B = Biannually (twice per year);
W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves;
E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident which causes contaminant release).

[2] Minimum requirement is for annual inspections. More frequent inspections and maintenance may be required depending on site conditions.

Compost Amended Vegetated Filter Strips (CAVFS)

A compost amended vegetated filter strip (CAVFS) is a variation of the basic vegetated filter strip that adds soil amendments to a roadside or parking lot embankment. The soil amendments improve infiltration characteristics, increase surface roughness (which minimized erosion), and improve plant sustainability. CAVFS installations that are properly maintained can provide high levels of pollutant removal including removal of sediments, petroleum and oils, metals, and nutrients.

Compost-amended systems have somewhat higher construction costs due to more expensive materials, but require less land area for runoff treatment, which can reduce overall costs. Once plant establishment is complete, CAVFS systems require typical plant maintenance and occasional removal of sediment or replacement of compost amended soils.



Modified from WSDOT HRM Figure RT.02.1

Compost Amended Vegetated Filter Strip (CAVFS)

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
General				
Sediment accumulation on grass	A[2]	Sediment depth exceeds 2 inches.	Yes No	Remove sediment deposits. Relevel so slope is even and flows pass evenly through strip.
Vegetation	B	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Yes No	Mow grass and control nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 6 inches.
Trash and debris	B	Trash and debris have accumulated on the vegetated filter strip.	Yes No	Remove trash and debris from filter.
Erosion/scouring	B, E	Areas have eroded or scoured due to flow channelization or high flows.	Yes No	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with a 50/50 mixture of crushed gravel and compost. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the vegetated filter strip should be regraded and reseeded. For smaller bare areas, overseed when bare spots are evident.
Flow spreader	A	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire filter width.	Yes No	Level the spreader and clean so that flows are spread evenly over entire filter width .

[1] Inspection frequency:
A = Annually;
B = Biannually (twice per year);
W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves;
E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident which causes contaminant release).

[2] Minimum requirement is for annual inspections. More frequent inspections and maintenance may be required depending on site conditions.

Vegetated Roofs

Vegetated roofs (also known as ecoroofs or green roofs) are thin layers of engineered soil and vegetation constructed on top of a conventional roof. Vegetated roofs consist of four basic components: a waterproof membrane, drainage layer, lightweight growth medium, and vegetation. Deeper installations – referred to as "intensive" roofs – are comprised of at least 6 inches of growth media and are planted with groundcovers, grasses, shrubs and sometimes trees. These intensive systems require regular landscape maintenance. Shallower installations – referred to as "extensive" roofs – are comprised of less than 6 inches of growth media and use a planting palette of drought-tolerant, low maintenance groundcovers. Your Stormwater Facility Maintenance Program should explain the type of system you have and the requirements for vegetation, growth media, and other design features.

Key Maintenance Considerations

The main components of vegetated roof facilities are listed below with descriptions of their function and key maintenance considerations. Components are listed in the order of installation from the roof deck upwards.

- ***Waterproof membrane****:* Waterproof membranes are installed on the roof deck below the vegetated roof system. Systems also include a protection layer and root barrier to preserve the integrity of the waterproof membrane.
- ***Drainage layer***: All vegetated roofs have a drainage component that routes excess water to the roof drain system. Usually this takes the form of a manufactured drain mat or granular drainage media.
- ***Growth media***: Vegetated roofs use a light-weight growth medium with adequate fertility and drainage capacity to support plant growth and allow infiltration and storage of water.
- ***Vegetation***: The plants on vegetated roofs are typically succulents, grass, herbs, and/or wildflowers adapted to the harsh conditions (minimal soils, seasonal drought, high winds, and strong sun exposure) prevalent on rooftops.
- ***Structural drainage elements***: The roof drainage system routes water from the vegetated roof drainage layer to a nearby drainage system.
- ***Border zone:*** This zone forms an area, composed of gravel and devoid of vegetation, around the perimeter of the vegetated roof, typically used as a fire prevention method and to prevent water damage.
- ***Gravel stops:*** These are sheet metal edges, typically installed outside of the border zone, along the perimeter of the roof to prevent growth medium from blowing or washing off the roof.

Vegetated Roofs

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Growth Medium Area				
Growth Medium	A b	Water does not permeate growth media (runs off soil surface) or crusting is observed.	Yes No	Aerate (e.g., rake) or replace medium taking care not to damage the waterproof membrane.
	A	Growth medium thickness is less than design thickness (due to erosion and plant uptake).	Yes No	Supplement growth medium to design thickness.
	B, W	Fallen leaves or debris are present.	Yes No	Remove/dispose.
	A, W, S	Growth media erosion/scour is visible (e.g., gullies).	Yes No	Take steps to repair or prevent erosion. Fill, hand tamp, or lightly compact, and stabilize with additional soil substrate/growth medium (similar in nature to the original material) and additional plants.
Erosion control measures	B c	Mat or other erosion control is damaged or depleted during plant establishment period.	Yes No	Repair/replace erosion control measures until 90% vegetation coverage attained. Avoid application of mulch on extensive vegetated roofs.
System Drainage and Structural Components				
Roof Drain	B, S	Sediment, vegetation, or debris reducing capacity of inlet structure.	Yes No	Clear blockage. Identify and correct any problems that led to blockage.
	A	Pipe is clogged.	Yes No	Remove roots or debris.
	A	Inlet pipe is in poor condition.	Yes No	Repair/replace.
Border zone	A	Vegetation is encroaching into border zone aggregate.	Yes No	Remove and dispose of weeds and transplant desirable vegetation to growth medium area
Flashing, gravel stops, utilities, or other structures on roof.	A	Flashing, utilities or other structures on roof are deteriorating (can serve as source of metal pollution in vegetated roof runoff).	Yes No	Repair (e.g., recoat) or replace to eliminate potential pollutant source. Note that any work done around flashings and drains should be done with care to protect the waterproof membrane.

Vegetated Roofs

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Access and safety	B	Insufficient egress/ingress routes and fall Protection.	Yes No	Maintain egress and ingress routes to design standards and fire codes. Ensure appropriate fall protection.
Vegetation				
Plant coverage	B	Vegetative coverage falls below 90% (unless design specifications stipulate less than 90% coverage).	Yes No	• Plant bare areas with vegetation. • If necessary, install erosion control measures until percent coverage goal is attained.
Sedums	A	Extensive roof with low-density sedum population.	Yes No	• Mulch mow sedums- creating cuttings from existing plants to encourage colonization.
Dead Plants	Fall and Spring	Dead vegetation is present.	Yes No	Normally dead plant material can be recycled on the roof; however, specific plants or aesthetic considerations may warrant removing and replacing dead material (see manufacturer's recommendations).
Trees and Shrubs – intensive vegetated roof.		Pruning as needed.	Yes No	All pruning of mature trees should be performed under the direct guidance of an ISA certified arborist.
Fertilization– extensive vegetated roof	A	Poor plant establishment and possible nutrient deficiency in growth medium.	Yes No	• Allow organic debris to replenish and maintain long-term nutrient balance and growth medium structure. • Conduct annual soil test 2-3 weeks prior to the spring growth flush to assess need for fertilizer. Utilize test results to adjust fertilizer type and quantity appropriately. • Apply minimum amount slow-release fertilizer necessary to achieve successful plant establishment. • Apply fertilizer only after acquiring required approval from facility owner and operator. Note that extensive vegetated roofs are designed to require zero to minimal fertilization after establishment (excess fertilization can contribute to nutrient export).
Fertilization– intensive vegetated roof	A	Fertilization may be necessary during establishment period or for plant health and survivability after establishment.	Yes No	• Conduct annual soil test 2-3 weeks prior to the spring growth flush to assess need for fertilizer. Utilize test results to adjust fertilizer type and quantity appropriately.

Vegetated Roofs

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Fertilization– intensive vegetated roof				• Apply minimum amount slow-release fertilizer necessary to achieve successful plant establishment. • Apply fertilizer only after acquiring required approval from facility owner and operator. • Intensive vegetated roofs may require more fertilization than extensive vegetated roofs.
Weeds	As needed	Weeds are present.	Yes No	• Remove weeds with their roots manually with pincer-type weeding tools, flame weeders, or hot water weeders as appropriate. • Follow IPM protocols for weed management (see "Additional Maintenance Resources" for more information on IPM protocols).
Noxious weeds	As needed	Listed noxious vegetation is present (refer to current county noxious weed list).	Yes No	• By law, class A & B noxious weeds must be removed, bagged and disposed as garbage immediately. • Reasonable attempts must be made to remove and dispose of class C noxious weeds. • It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions.
Irrigation System (or Watering)				
Irrigation System (if any)	As needed	Irrigation System Present.	Yes No	Follow manufacturer's instructions for operation and maintenance.
Summer watering – extensive vegetated roof.		Once every 1-2 weeks as needed during prolonged dry periods.	Yes No	Water weekly during periods of no rain to ensure plant establishment (30 to 50 gallons per 100 square feet).
		As needed.	Yes No	Water during drought conditions or more often if necessary to maintain plant cover (30 to 50 gallons per 100 square feet).

Vegetated Roofs

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Summer watering – intensive vegetated roof.		Once every 1-2 weeks as needed during prolonged dry periods.	Yes No	• Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist. • Use soaker hoses or spot water with a shower type wand when irrigation system not present.
		As needed.	Yes No	Water during drought conditions or more often if necessary to maintain plant cover.
Pest Control				
Mosquitoes	B, S	Standing water remains for more than 3 days after the end of a storm.	Yes No	• Identify the cause of the standing water and take appropriate actions to address the problem (e.g., aerate or replace medium, unplug drainage). • Manually remove standing water and direct to storm drainage system. • Do not use pesticides or *Bacillus thuringiensis israelensis* (Bti).
Nuisance animals	As needed	Nuisance animals causing erosion, damaging plants, or depositing large volumes of feces.	Yes No	• Reduce site conditions that attract nuisance species. • Place predator decoys. • Follow IPM protocols for specific nuisance animal issues (see "Additional Maintenance Resources" in Bioretention Facilities section for more information on IPM protocols).

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least once during the wet season (for debris/clog related maintenance, this visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

[c] Inspection should occur during plant establishment period (typically first 2 years).

IPM – Integrated Pest Management, ISA – International Society of Arboriculture

Downspout Full Infiltration Systems

Downspout full infiltration systems include infiltration trenches or drywells intended only for use in infiltrating runoff from roof downspout drains. Infiltration trenches and drywells are backfilled with washed drain rock, allowing for temporary storage of stormwater runoff in the voids of the drain rock material. Stored runoff gradually infiltrates into the surrounding soil.

Key Maintenance Considerations

The main components of downspout full infiltration systems are listed below with descriptions of their function and key maintenance considerations.

- ***Rock trench/well:*** Trenches and drywells are excavated depressions filled with uniformly graded washed drain rock. Non-woven geotextile fabric may be used along the walls, bottom, and top of the drain rock. The surface of the trench can be covered with grating, pavement, and/or consist of stone, gabion, sand, or a grassed covered area with a surface inlet. To allow inspection of the drain rock trench/well, some facilities have an observation port (typically installed during construction) that allows monitoring of the water levels in the drain rock bed to determine if the facility is dewatering properly.
- ***Inlet:*** Stormwater runoff is typically routed to a trench/well with a solid-wall pipe and then distributed into the drain rock bed using a perforated or slotted subsurface pipe. Some trenches are designed to receive sheet flow that enters the facility by infiltrating through a top course of drain rock or sand. Maintenance must be performed to ensure inlets (e.g., pipes) are unobstructed and that surface sheet flow first passes through a grass buffer strip to remove larger sediment particles.
- ***Storage sump:*** Trenches and drywells designed to receive concentrated flows (e.g., piped flow) typically include a storage sump to settle particulates from inflow. Concentrated flows must be distributed into the aggregate using a perforated or slotted subsurface pipe. The sump must be maintained to remove accumulated sediment.

Downspout Full Infiltration Systems

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Rock Trench/Well				
Surface of trench/well (i.e., water enters through exposed aggregate)	Fall and Spring	Accumulated trash, debris, or sediment on drain rock surface impedes sheet flow into facility	Yes No	Remove/dispose in accordance with local solid waste requirements.
	A	Vegetation/moss present on drain rock surface impedes sheet flow into facility	Yes No	Maintain open, freely draining drain rock surface.
Drain Rock	Fall and Spring	• If water enters the facility from the surface, inspect to see if water is ponding at the surface during storm events • If buried drain rock, observe drawdown through observation port or cleanout	Yes No	• Clear piping through facility when ponding occurs. • Replace rock/sand reservoirs as necessary. • Tilling of subgrade below reservoir may be necessary (for trenches) prior to backfill.
Inlet/Outlet Pipe Conveyance				
Pipes)	A, W	Accumulation of trash, debris, or sediment in roof drains, gutters, driveway drains, area drains, etc.	Yes No	Remove/ dispose.
	A, W	Pipe from sump to trench or drywell has accumulated sediment or is plugged.	Yes No	Clear sediment from inlet/outlet pipe screen and inlet/outlet pipe.
	A, W	Cracked, collapsed, broken, or misaligned drain pipes.	Yes No	• Repair/seal cracks. • Replace when repair is insufficient.
Roof downspout	B, W	Splash pad missing or damaged.	Yes No	Repair/ replace.
	A, W	Leaves or other debris plugging downspout.	Yes No	Remove/ dispose.
Storage/Sump				
Sump	A	Sediment in the sump	Yes No	Remove/ dispose in accordance with local solid waste requirements
Access Lid	A	Cannot be easily opened	Yes No	Repair/ replace

Downspout Full Infiltration Systems

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
	A	Buried	Yes No	Refer to record drawings for design intent. If the access lid was designed to be exposed, expose and restore to surface grade
	A	Cover missing	Yes No	Replace

[1] Frequency: A= Annually; B= Biannually (twice per year); W= At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves).

Downspout, Sheet Flow, and Concentrated Dispersion Systems

Dispersion of stormwater reduces peak flows by slowing the runoff entering into the conveyance system, allowing some infiltration, and providing some water quality benefits. The following three types of dispersion systems are covered in this section:

Downspout dispersion systems: Splash blocks or gravel-filled trenches, which serve to spread roof runoff over vegetated pervious areas.

Sheet flow dispersion systems: Sheet flow dispersion is the simplest method of runoff control. This method can be used for any impervious or pervious surface that is graded to avoid concentrating flows. Because flows are already dispersed as they leave the surface, they need only traverse a narrow band of adjacent vegetation for effective flow reduction and treatment.

Concentrated dispersion systems: Dispersion of concentrated flows from driveways or other pavement through a vegetated pervious area.

Key Maintenance Considerations

The main components of dispersion systems are listed below with descriptions of their function and key maintenance considerations. For dispersion practices to be effective, the dispersion area must remain covered with dense, well-established vegetation. Site uses should protect vegetation and avoid compaction of soils.

- ***Splash block (downspout dispersion):*** Splash blocks are used to spread stormwater runoff from a downspout drain over vegetated pervious area. A downspout extension may be included if the ground is fairly level, if the structure includes a basement, or if foundation drains are proposed.
- ***Dispersion trench (downspout dispersion):*** Gravel-filled trenches are also used to spread stormwater runoff from a downspout drain over a vegetated pervious area. Downspout drains are routed to a trench via a perforated or slotted pipe. The trench typically includes a notched grade board or other device to distribute flow equally along the length of the trench. This board must be maintained at a level grade to prevent concentrated flow. Downspout drains are directed to the trench via a storage sump that must be maintained to remove accumulated sediment.
- ***Transition zone (sheet flow dispersion):*** A 2-foot-wide transition zone is typically included to discourage channeling between the edge of the impervious surface (or building eaves) and the downslope vegetation. This transition zone may consist of an extension of subgrade material (crushed rock), modular pavement, drain rock, or other material.
- ***Rock pad at discharge point (concentrated flow dispersion):*** A rock pad must be maintained at any point that a concentrated flow enters a dispersion area.
- ***Dispersal area:*** Stormwater is dispersed to an area vegetated with well-established lawn or pasture, landscaping with well-established groundcover, or native vegetation with natural groundcover. The required vegetated flow path is 50 feet for splash blocks and concentrated dispersion, 25 feet when using a dispersion trench, and varies for sheet flow dispersion. The groundcover for the extent of the flow must be maintained to be dense enough to help disperse and infiltrate flows and to prevent erosion.

Downspout, Sheet Flow, and Concentrated Dispersion Systems

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Splash Block (Downspout Dispersion)				
Splash Block	B	Water is being directed towards building structure.	Yes No	Reconfigure/ repair blocks to direct water away from building structure.
	B	Water disrupts soil media.	Yes No	Reconfigure/ repair blocks.
Transition Zone (Sheet Flow Dispersion)				
Transition Zone	A	Adjacent soil erosion; uneven surface creating concentrated flow discharge; or less than 2 foot of width.	Yes No	Repair/replace transition zone to meet design criteria and eliminate concentrated flows.
Dispersion Trench (Downspout Dispersion)				
Dispersion trench	A	Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow" from edge of trench; intent is to prevent erosion damage).	Yes No	• Remove debris from trench surface, if necessary. • Realign notched grade board or other distributor type, if possible. • Rebuild trench to standards, if necessary.
Surface of trench	Fall and Spring	Accumulated trash, debris, or sediment on drain rock surface impedes sheet flow from facility.	Yes No	• Remove/dispose in accordance with local solid waste requirements.
	A, W	Vegetation/moss present on drain rock surface impedes sheet flow from facility.	Yes No	• Maintain open, freely draining drain rock surface.
Pipe(s) to trench	A, W	Accumulation of trash, debris, or sediment in roof drains, gutters, driveway drains, area drains, etc.	Yes No	• Remove/ dispose.
	A, W	Pipe from sump to trench or drywell has accumulated sediment or is plugged.	Yes No	• Clear sediment from inlet/outlet pipe screen and inlet/outlet pipe.
	A, W	Cracked, collapsed, broken, or misaligned drain pipes.	Yes No	• Repair/seal cracks. • Replace when repair is insufficient.

Downspout, Sheet Flow, and Concentrated Dispersion Systems

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Sump	A	Sediment in the sump.	Yes No	• Remove/ dispose in accordance with local solid waste requirements. • Clear sediment from inlet/outlet pipe screen and/or inlet/outlet pipe.
Access Lid	A	Cannot be easily opened.	Yes No	• Repair/ replace.
	A	Buried.	Yes No	• Refer to record drawings for design intent. If the access lid was designed to be exposed, expose and restore to surface grade.
	A	Cover missing.	Yes No	• Replace.
Rock Pad (Concentrated Flow Dispersion)				
Rock Pad	A	Only one layer of rock exists above native soil in area 6 square feet or larger, or any exposure of native soil.	Yes No	• Replace/ repair rock pad to meet design standards. • Enlarge pad size or add additional courses of rock, if necessary.
	A	Soil erosion in or adjacent to rock pad.	Yes No	Repair/replace rock pad to meet design standards.
Dispersal Area				
Dispersal Area	B, S	Erosion (gullies/ rills) greater than 2 inches deep in dispersal area.	Yes No	Eliminate cause of erosion and stabilize damaged area (regrade, rock, revegetate).
	B, S	Accumulated sediment or debris to extent that blocks or channelizes flow path.	Yes No	• Remove excess sediment or debris • Identify and control the sediment source (if feasible).
Ponded Water	B, S	Standing surface water in dispersion area remains for more than 3 days after the end of a storm event.	Yes No	• Identify the cause of the standing water (e.g., grade depressions, compacted soil) and take appropriate actions to address the problem (e.g., regrade to eliminate depressions or aerate/ amend soils).

Downspout, Sheet Flow, and Concentrated Dispersion Systems

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Plant establishment	B	Dispersal area vegetation in establishment period (1-2 years, or additional 3rd year during extreme dry weather).	Yes No	Water weekly during periods of no rain to ensure plant establishment.
Vegetation	As Needed	Poor vegetation cover such that erosion is occurring.	Yes No	• Ensure proper care (e.g., watering). • Assess for nutrient deficiencies. • Replant as needed with appropriate plant species for the soil and moisture conditions. • Consider amending soils to promote plant health.
	B, S	Vegetation inhibits dispersed flow along flow path.	Yes No	Trim, weed or replant to restore dispersed flow path.
Storage Sump				
Sump	A	Accumulated sediment in the sump	Yes No	• Remove/ dispose in accordance with local solid waste requirements. • Clear sediment from inlet/outlet pipe screen and/or inlet/outlet pipe.
Access lid	A	Cannot be easily opened	Yes No	Repair/ replace.
	A	Buried	Yes No	Expose and restore to surface grade.
	A	Cover missing	Yes No	Replace.
Pest Control				
General Pests	As Needed	Signs of pest infestations (IPM protocol threshold(s) are exceeded).	Yes No	• Follow IPM protocols for weed and pest management (see "Additional Maintenance Resources" in Bioretention Facilities section for more information on IPM protocols).

Downspout, Sheet Flow, and Concentrated Dispersion Systems

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Mosquitoes	B, S	Standing surface water in dispersion area remains for more than 3 days after the end of a storm.	Yes No	• Identify the cause of the standing water and take appropriate actions to address the problem (see "Ponded water"). • Do not use pesticides or *Bacillus thuringiensis israelensis* (Bti).
Rodents	As Needed	Rodent holes or mounds disturb dispersion flow paths	Yes No	Fill and compact soil around the holes and vegetate to restore flow path.

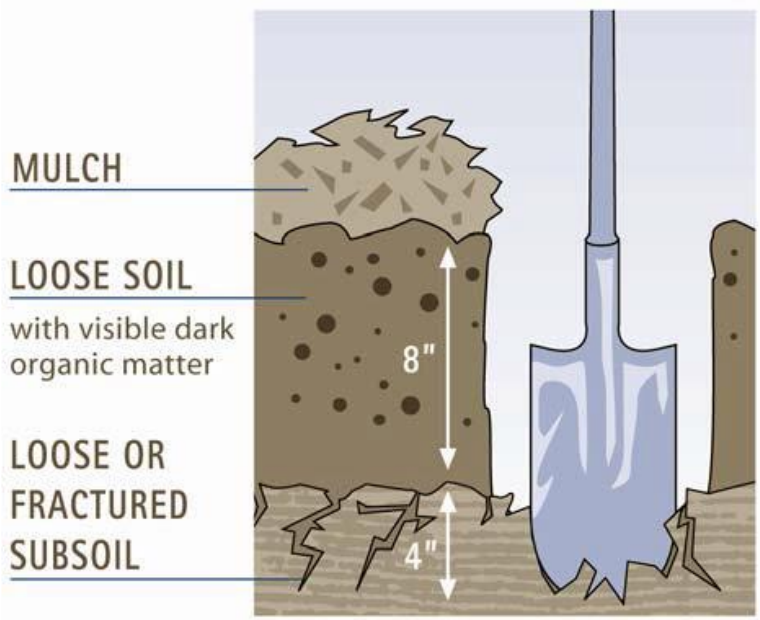
[a] Frequency: A= Annually; B= Biannually (twice per year); W = At least once during the wet season (for debris/clog related maintenance, this visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during plant establishment period (1-2 years, or additional 3rd year during extreme dry weather).

Compost-Amended Soils

Naturally occurring (undisturbed) soil and vegetation provide important stormwater functions including: water infiltration; nutrient, sediment, and pollutant adsorption; sediment and pollutant biofiltration; water interflow storage and transmission; and pollutant decomposition. Compaction from construction can reduce the soils natural ability to provide these functions. Establishing a minimum soil quality and depth in the post-development landscape can regain some of these stormwater functions including increased treatment of pollutants and sediments that result from development and habitation, and minimizes the need for some landscaping chemicals. Sufficient organic content is a key to soil quality. Soil organic matter can be attained through numerous amendments such as compost, composted woody material, biosolids, and forest product residuals.

City of Olympia development standards require that all disturbed pervious areas be conditioned with compost-amended soils to demonstrate an 8-inch minimum depth of loose soil with visible dark organic matter, covered by 4-inches of organic mulch.



Key Maintenance Considerations

Key maintenance considerations for compost-amended soils include the replenishment of soil media as needed (as a result of erosion) and addressing compacted, poorly draining soils. The full benefits of compost-amended soils are realized when desired soil media depths are maintained and soil compaction is minimized. Care should be taken to prevent compaction of soils via vehicular loads and/or excessive foot traffic, especially during wet conditions.

Compost-Amended Soils

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
General				
Soil media (maintain high organic soil content).	A	Vegetation not fully covering ground surface or vegetation health is poor.	Yes No	• Maintain 2 to 3 inches of mulch over bare areas in landscape beds. • Add plants if sufficient space. • Re-seed bare turf areas until the vegetation fully covers ground surface.
		None (routine maintenance)	Yes No	Return leaf fall and shredded woody materials from the landscape to the site when possible in order to replenish soil nutrients and structure.
		None (routine maintenance)	Yes No	On turf areas, "grasscycle" (mulch-mow or leave the clippings) to build turf health.
		None (routine maintenance)	Yes No	Avoiding use of pesticides (bug and weed killers), like "weed & feed", which damage the soil.
		None (routine maintenance)	Yes No	• Where fertilization is needed (mainly turf and annual flower beds), a moderate fertilization program should be used which relies on compost, natural fertilizers or slow-release synthetic balanced fertilizers. • Follow IPM protocols for fertilization procedures (see "Additional Maintenance Resources" in Bioretention Facilities section for more information on IPM protocols).
Soil media (maintain infiltration)	Ab	Soils become waterlogged, do not appear to be infiltrating.	Yes No	• To remediate compaction, aerate soil, till to at least 8-inch depth, or further amend soil with compost and re-till. • If areas are turf, aerate compacted areas and topdress them with 1/4 to 1/2 inch of compost to renovate them. • If drainage is still slow, consider investigating alternative causes (e.g., high wet season groundwater levels, low permeability soils). • Also consider site use and protection from compacting activities.

Compost-Amended Soils

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Erosion/ Scouring	A, W, S	Areas of potential erosion are visible.	Yes No	• Identify and address cause of erosion (e.g., concentrate flow entering area, channelization of runoff) and stabilize damaged area (regrade, rock, vegetation, erosion control matting). • For deep channels or cuts (over 3 inches in ponding depth), temporary erosion control measures should be put in place until permanent repairs can be made.
Grass/ Vegetation		Less than 75% of planted vegetation is healthy with a generally good appearance.	Yes No	• Take appropriate maintenance actions (e.g., remove/ replace plants). • If problem persists, evaluate if vegetation is appropriate for the location (e.g., exposure, soil, soil moisture).
Noxious weeds	B	Listed noxious vegetation is present (refer to current county noxious weed list).	Yes No	• By law, class A & B noxious weeds must be removed, bagged and disposed as garbage immediately. • Reasonable attempts must be made to remove and dispose of class C noxious weeds. • Watch for and respond to new occurrences of especially aggressive weeds such as Himalayan blackberry, Japanese knotweed, morning glory, English ivy, and reed canary grass to avoid invasions. • It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions.
Weeds	B	Weeds are present.	Yes No	• Remove weeds with their roots manually with pincer-type weeding tools, flame weeders, or hot water weeders as appropriate. • Follow IPM protocols for weed management(see "Additional Maintenance Resources" in Bioretention Facilities section for more information on IPM protocols).

[a] Frequency: A= Annually; B= Biannually (twice per year); M = monthly; S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).; W = At least one inspection/maintenance visit should occur during the wet season (for debris/clog related maintenance, this maintenance visit should occur in the early fall, after deciduous trees have lost their leaves).

[b] Inspection should occur during storm event

IPM – Integrated Pest Management

Rain Gardens

Rain gardens are non-engineered, shallow, landscaped depressions with compost-amended soils and adapted plants. The depression temporarily stores stormwater runoff from adjacent areas. Some or all of the influent stormwater passes through the amended soil profile and into the underlying native soil. Stormwater that exceeds the storage capacity is designed to overflow to an adjacent drainage system.

Key Maintenance Considerations

The main components of rain gardens (and the associated maintenance considerations) are very similar to those listed for bioretention facilities. However, rain gardens do not require an engineered soil mix (native soils may be amended) and usually do not have underdrains or other control structures. Fertilizer use should be avoided in rain gardens, particularly those located in watersheds draining to phosphorous limited water bodies.

- ***Inlet**:* Stormwater can flow into a rain garden in a number of ways including: dispersed flow across vegetated areas, sheet flow across impervious areas, or piped from a roof downspout. Inlets must be maintained to be unobstructed to ensure that stormwater enters the garden as designed. Erosion control measures must also be maintained in areas of concentrated flows (e.g., piped inlets).
- ***Facility footprint**:* The facility footprint is typically an earthen depression or another type of basin (e.g., concrete planter box) that provides surface storage for stormwater before it infiltrates into the underlying soil. If the facility is located on a slope, low permeability check dams may be included (oriented perpendicular to the slope) to encourage ponding.
- Rain gardens are designed to infiltrate all ponded water within a 24-to 48-hour drawdown time after the end of a storm. This allows the soil to dry out periodically in order to restore the capacity of the system and prevent conditions supportive of mosquito breeding. Slower drawdown times may indicate that the underdrain (if present) is plugged or the amended soil is overly compacted or clogged.
- ***Mulch**:* The amended soil is covered by a layer of mulch, comprised of arborist wood chips, compost, and/or rocks. Mulch reduces weed establishment. Organic mulches regulate soil temperatures and moisture, and add organic matter to soil. The mulch layer must be supplemented regularly.
- ***Vegetation**:* Bioretention systems rely on vegetation (i.e., grasses, shrubs, and sometimes trees) to intercept, uptake, and evapotranspire stormwater. In addition, plant roots improve soil structure and increase infiltration capacity. Regular maintenance activities associated with vegetation include weeding and pruning. Plants also require irrigation during the first 2 to 3 years of establishment and during extended dry periods.
- ***Overflow**:* Flows exceeding the capacity of the facility are discharged via an overflow structure (e.g., pipe, curb cut, earthen channel). It is important to maintain clear outlet pipes and overflow structures to ensure that stormwater can be safely conveyed to a designated discharge point (e.g., storm drain system).

Rain gardens must be protected from foot traffic, vehicles and other loads, particularly during wet conditions, to prevent compaction of the amended soil and preserve infiltration capacity. Signage can also be used to identify the vegetated area as a stormwater management area and inform maintenance crews and the general public about protecting the rain garden's function (e.g., no walking in the garden).

Rain Gardens

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Rain Garden Footprint				
Earthen side slopes	B (during the wet season)	Persistent soil erosion on slopes.	Yes No	If erosion persists, water may be flowing into the garden too rapidly. In this case, the slope of the pipe or swale directing water to the garden, or the amount of water may need to be reduced (see "Erosion control at inlet").
Rockery sidewalls	A	Rockery side walls are insecure.	Yes No	Stabilize rockery sidewalls (may require consultation with engineer, particularly for walls 4 feet or greater in height).
Rain garden footprint		Trash and debris present.	Yes No	Clean out trash and debris.
Rain garden bottom area	A	Visible sediment deposition in the rain garden that reduces drawdown time of water in the rain garden.	Yes No	Remove sediment accumulation. If sediment is deposited from water entering the rain garden, determine the source and stabilize the area.
		Accumulated leaves in rain garden (may reduce infiltration capacity of rain garden or clog overflow).	Yes No	Remove leaves.
Ponded water	B, S	Excessive ponding water: Ponded water remains in the basin more than 3 days after the end of a storm.	Yes No	Confirm leaf, debris or sediment buildup in the bottom of the rain garden is not impeding infiltration. If necessary, remove leaf litter/debris/sediment. If this does not solve the problem, consultation with a professional with rain garden expertise is recommended to evaluate the following: • Check for other water inputs (e.g., groundwater, illicit connections). • Verify that the facility is sized appropriately for the contributing area. Confirm that the contributing area has not increased. • Determine if the soil is clogged by sediment accumulation at the surface or if the soil has become overly compacted.

Rain Gardens

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Inlets/Outlets/Pipes				
Splash block inlet	A	Water is not being directed properly to the rain garden and away from the building.	Yes No	Reconfigure/ repair blocks to direct water to the rain garden and away from building.
Pipe inlet/ outlet	A	Pipe capacity is reduced by sediment or debris (can cause backups and flooding).	Yes No	Clear pipes of sediment and debris.
Pipe inlet/outlet (cont'd)	A	Damaged/cracked drain pipes.	Yes No	• Repair/seal cracks. • Replace when repair is insufficient.
Erosion control at inlet	A	Rock or cobble is removed or missing and concentrated flows are contacting soil.	Yes No	Maintain a cover of rock or cobbles to protect the ground where concentrated water flows into the rain garden from a pipe or swale.
Vegetation				
Vegetation		Dying, dead, or unhealthy plants.	Yes No	• Maintain a healthy cover of plants. • Remove any diseased plants or plant parts and dispose of in commercial landfill to avoid risk of spreading the disease to other plants. • Disinfect gardening tools after pruning to prevent the spread of disease. • Re-stake trees if they need more support, but plan to remove stakes and ties after the first year. • Cars can damage roots – protect root areas of trees and plants from vehicle traffic.
		Vegetation inhibits sight distances and sidewalks.	Yes No	Keep sidewalks and sight distances on roadways clear.
		Broken, dead, or sucker vegetation is present.	Yes No	Remove broken or dead branches and suckers.
		Vegetation is crowding inlets and outlets.	Yes No	Keep water inlets and outlets in the rain garden clear of vegetation.
		Broken, dead, or sucker vegetation is present.	Yes No	Remove broken or dead branches and suckers.
		Vegetation is crowding inlets and outlets.	Yes No	Keep water inlets and outlets in the rain garden clear of vegetation.

Rain Gardens

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Vegetation	One time March through June	• Yellowing: possible Nitrogen (N) deficiency • Poor growth: possible Phosphorous (P) deficiency. • Poor flowering, spotting or curled leaves, or weak roots or stems: possible Potassium (K) deficiency.	Yes No	• Test soil to identify specific nutrient deficiencies. • Consult with a professional knowledgeable in the area of natural amendments or refer to Natural Lawn and Garden Care resources and avoid synthetic fertilizers. • Consider selecting different plants for soil conditions.
Weeds		Problem weeds are present.	Yes No	• Remove weeds by hand, especially in spring when the soil is moist and the weeds are small. • Dig or pull weeds out by the roots before they go to seed. • Apply mulch after weeding (see "Mulch").
Mulch				
Mulch		Bare spots (without mulch cover) are present or mulch depth less than 2 inches.	Yes No	• Supplement mulch with hand tools to a depth of 2 to 3 inches • Use coarse compost in the bottom of the rain garden and arborist wood chips on side slopes and rim (above typical water levels) • Keep all mulch from being in contact with woody stems.
Watering				
Summer watering (first year)		Tree, shrubs and groundcovers in first year of establishment period	Yes No	• 10 to 15 gallons per tree to 5 gallons per shrub • gallons water per square foot for groundcover areas • Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist • Use soaker hoses or spot water with a shower type wand when irrigation system is not present • Add a tree bag or slow-release watering device (e.g., bucket with a perforated bottom) for watering newly installed trees when irrigation system is not present

Rain Gardens

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Summer watering (second and third years)		Tree, shrubs and groundcovers in second or third year of establishment period	Yes No	• 10 to 15 gallons per tree • to 5 gallons per shrub • gallons water per square foot for groundcover areas • Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist • Use soaker hoses or spot water with a shower type wand when irrigation system is not present
Summer watering (after establishment)		Established vegetation (after 3 years)	Yes No	• Water during drought conditions or more often if necessary to maintain plant cover • Identify trigger mechanisms for drought-stress (e.g., leaf wilt, leaf senescence, etc.) of different rain garden species and water immediately after initial signs of stress appear.
Pest Control				
Mosquitoes	B, S	Standing water remains for more than 3 days after the end of a storm	Yes No	• Identify the cause of the standing water and take appropriate actions to address the problem (see "Ponded water") • Do not use pesticides or *Bacillus thuringiensis israelensis* (Bti)

[a] Frequency: A = Annually; B = Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

Bioretention Facilities

Bioretention facilities are engineered facilities that store and treat stormwater by filtering it through a specified soil profile. Water that enters the facility ponds in an earthen depression or other basin (e.g., concrete planter) before it infiltrates into the underlying bioretention soil. Stormwater that exceeds the surface storage capacity overflows to an adjacent drainage system. Treated water is either infiltrated into the underlying native soil or collected by an underdrain and discharged.

Key Maintenance Considerations

The main components of bioretention facilities are listed below with descriptions of their function and key maintenance considerations.

***Inlet**:* Stormwater can flow into a bioretention facility in a number of ways including dispersed flow across vegetated areas, sheet flow across impervious areas, or concentrated flow through curb cuts and/or piped flow inlets. Inlets must be maintained to be unobstructed to ensure that stormwater enters the facility as designed.

***Facility footprint**:* The facility footprint is typically an earthen depression or another type of basin (e.g., concrete planter box) that provides surface storage for stormwater before it infiltrates into the underlying bioretention soil. If the facility is located on a slope, low permeability check dams may be included (oriented perpendicular to the slope) to encourage ponding.

***Bioretention soil mix**:* Infiltration of stormwater through the engineered bioretention soil mix provides water quality treatment. All maintenance activities must be performed in a manner to prevent compaction of the bioretention soil.

***Mulch**:* The bioretention soil is covered by a layer of mulch, comprised of arborist wood chips, compost, and/or rocks. Mulch reduces weed establishment. Organic mulches regulate soil temperatures and moisture, and add organic matter to soil. The mulch layer must be supplemented regularly.

***Vegetation**:* Bioretention systems rely on vegetation (i.e., grasses, shrubs, and sometimes trees) to intercept, uptake, and evapotranspire stormwater. In addition, plant roots improve soil structure and increase infiltration capacity. Regular maintenance activities associated with vegetation include weeding and pruning. Plants also require irrigation during the first 2 to 3 years of establishment and during extended dry periods.

***Overflow**:* Flows exceeding the capacity of the facility are discharged via an overflow structure (e.g., pipe, curb cut, earthen channel). It is important to maintain clear outlet pipes and overflow structures to ensure that stormwater can be safely conveyed to a designated discharge point (e.g., storm drain system).

***Underdrains (optional)**:* Underdrains are optional components of a bioretention facility that may be included in bioretention systems where, for example, infiltration to underlying soil is not prudent or feasible. Underdrains are installed under the bioretention soil layer to collect and convey treated water. An underdrain system can be comprised of perforated or slotted pipe, wrapped in an aggregate blanket. It is important to maintain clear drains so that water moves through system as designed.

For a bioretention system to function properly, stormwater must infiltrate freely through the bioretention soil. The soil infiltration rate can be reduced if the soil is subject to compaction (e.g., foot and vehicle traffic loads), and therefore these types of traffic should be avoided.

Bioretention Facilities

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Facility Footprint				
Earthen side slopes and berms	B, S	Erosion (gullies/ rills) greater than 2 inches deep around inlets, outlet, and alongside slopes	Yes No	• Eliminate cause of erosion and stabilize damaged area (regrade, rock, vegetation, erosion control matting) • For deep channels or cuts (over 3 inches in ponding depth), temporary erosion control measures should be put in place until permanent repairs can be made. • Properly designed, constructed and established facilities with appropriate flow velocities should not have erosion problems except perhaps in extreme events. If erosion problems persist, the following should be reassessed: (1) flow volumes from contributing areas and bioretention facility sizing; (2) flow velocities and gradients within the facility; and (3) flow dissipation and erosion protection strategies at the facility inlet.
	A	Erosion of sides causes slope to become a hazard	Yes No	Take actions to eliminate the hazard and stabilize slopes.
	A, S	Settlement greater than 3 inches (relative to undisturbed sections of berm)	Yes No	Restore to design height.
	A, S	Downstream face of berm wet, seeps or leaks evident	Yes No	Plug any holes and compact berm (may require consultation with engineer, particularly for larger berms)
	A	Any evidence of rodent holes or water piping in berm	Yes No	• Eradicate rodents (see "Pest control") • Fill holes and compact (may require consultation with engineer, particularly for larger berms)
Concrete sidewalls	A	Cracks or failure of concrete sidewalls	Yes No	• Repair/ seal cracks • Replace if repair is insufficient
Rockery sidewalls	A	Rockery side walls are insecure	Yes No	Stabilize rockery sidewalls (may require consultation with engineer, particularly for walls 4 feet or greater in height)

Bioretention Facilities

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Facility Area		Trash and debris present	Yes No	Clean out trash and debris
Facility bottom area	A, S	Accumulated sediment to extent that infiltration rate is reduced (see "Ponded water") or surface storage capacity significantly impacted	Yes No	• Remove excess sediment • Replace any vegetation damaged or destroyed by sediment accumulation and removal • Mulch newly planted vegetation • Identify and control the sediment source (if feasible) • If accumulated sediment is recurrent, consider adding presettlement or installing berms to create a forebay at the inlet
		Accumulated leaves in facility	Yes No	Remove leaves if there is a risk to clogging outlet structure or water flow is impeded.
Low Permeability Check dams and weirs	A, S	Sediment, vegetation, or debris accumulated at or blocking (or having the potential to block) check dam, flow control weir or orifice.	Yes No	Clear the blockage.
	A, S	Erosion and/or undercutting present.	Yes No	Repair and take preventative measures to prevent future erosion and/or undercutting.
	A	Grade board or top of weir damaged or not level.	Yes No	Restore to level position.

Bioretention Facilities

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Ponded water	B, S	Excessive ponding water: Water overflows during storms smaller than the design event or ponded water remains in the basin 48 hours or longer after the end of a storm.	Yes No	Determine cause and resolve in the following order: 1. Confirm leaf or debris buildup in the bottom of the facility is not impeding infiltration. If necessary, remove leaf litter/debris. 2. Ensure that underdrain (if present) is not clogged. If necessary, clear underdrain. 3. Check for other water inputs (e.g., groundwater, illicit connections). 4. Verify that the facility is sized appropriately for the contributing area. Confirm that the contributing area has not increased. If steps #1-4 do not solve the problem, the bioretention soil is likely clogged by sediment accumulation at the surface or has become overly compacted. Dig a small hole to observe soil profile and identify compaction depth or clogging front to help determine the soil depth to be removed or otherwise rehabilitated (e.g., tilled). Consultation with an engineer is recommended.
Inlets/Outlets/Pipes				
Bioretention soil media	As needed	Bioretention soil media protection is needed when performing maintenance requiring entrance into the facility footprint	Yes No	• Minimize all loading in the facility footprint (foot traffic and other loads) to the degree feasible in order to prevent compaction of bioretention soils. • Never drive equipment or apply heavy loads in facility footprint. • Because the risk of compaction is higher during saturated soil conditions, any type of loading in the cell (including foot traffic) should be minimized during wet conditions. • Consider measures to distribute loading if heavy foot traffic is required or equipment must be placed in facility. As an example, boards may be placed across soil to distribute loads and minimize compaction. • If compaction occurs, soil must be loosened or otherwise rehabilitated to original design state.

Bioretention Facilities

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Splash block inlet	A	Water is not being directed properly to the facility and away from the inlet structure	Yes No	Reconfigure/ repair blocks to direct water to facility and away from structure
Curb cut inlet/outlet	M (during the wet season and before severe storm is forecasted)	Accumulated leaves at curb cuts	Yes No	Clear leaves (particularly important for key inlets and low points along long, linear facilities)
Pipe inlet/outlet	A	Pipe is damaged	Yes No	Repair/ replace
	W	Pipe is clogged	Yes No	Remove roots or debris
	A, S	Sediment, debris, trash, or mulch reducing capacity of inlet/outlet	Yes No	• Clear the blockage • Identify the source of the blockage and take actions to prevent future blockages
		Accumulated leaves at inlets/outlets	Yes No	Clear leaves (particularly important for key inlets and low points along long, linear facilities)
		Maintain access for inspections	Yes No	• Clear vegetation (transplant vegetation when possible) within 1 foot of inlets and outlets, maintain access pathways • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
	A	Concentrated flows are causing erosion	Yes No	Maintain a cover of rock or cobbles or other erosion protection measure (e.g., matting) to protect the ground where concentrated water enters the facility (e.g., a pipe, curb cut or swale)
Trash rack	S	Trash or other debris present on trash rack	Yes No	Remove/dispose
	A	Bar screen damaged or missing	Yes No	Repair/replace
Overflow	A, S	Capacity reduced by sediment or debris	Yes No	Remove sediment or debris/dispose

Bioretention Facilities

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Underdrain pipe	Clean pipe as needed	• Plant roots, sediment or debris reducing capacity of underdrain • Prolonged surface ponding (see "Ponded water")	Yes No	• Jet clean or rotary cut debris/roots from underdrain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly.
Vegetation				
Facility bottom area and upland slope vegetation	Fall and Spring	Vegetation survival rate falls below 75% within first two years of establishment (unless project O&M manual or record drawing stipulates more or less than 75% survival rate).	Yes No	• Determine cause of poor vegetation growth and correct condition. • Replant as necessary to obtain 75% survival rate or greater. Refer to original planting plan, or approved jurisdictional species list for appropriate plant replacements (See Appendix 3 - Bioretention Plant List, in the LID Technical Guidance Manual for Puget Sound). • Confirm that plant selection is appropriate for site growing conditions. • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants.
Vegetation (general)	As needed	Presence of diseased plants and plant material	Yes No	• Remove any diseased plants or plant parts and dispose of in an approved location (e.g., commercial landfill) to avoid risk of spreading the disease to other plants. • Disinfect gardening tools after pruning to prevent the spread of disease • See Pacific Northwest Plant Disease Management Handbook for information on disease recognition and for additional resources • Replant as necessary according to recommendations provided for "facility bottom area and upland slope vegetation".

Bioretention Facilities

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Trees and shrubs		Pruning as needed	Yes No	• Prune trees and shrubs in a manner appropriate for each species. Pruning should be performed by landscape professionals familiar with proper pruning techniques • All pruning of mature trees should be performed by or under the direct guidance of an ISA certified arborist.
	A	Large trees and shrubs interfere with operation of the facility or access for maintenance	Yes No	• Prune trees and shrubs using most current ANSI A300 standards and ISA BMPs. • Remove trees and shrubs, if necessary.
	Fall and Spring	Standing dead vegetation is present	Yes No	• Remove standing dead vegetation • Replace dead vegetation within 30 days of reported dead and dying plants (as practical depending on weather/planting season) • If vegetation replacement is not feasible within 30 days, and absence of vegetation may result in erosion problems, temporary erosion control measures should be put in place immediately. • Determine cause of dead vegetation and address issue, if possible • If specific plants have a high mortality rate, assess the cause and replace with appropriate species. Consultation with a landscape architect is recommended.
	Fall and Spring	Planting beneath mature trees	Yes No	• When working around and below mature trees, follow the most current ANSI A300 standards and ISA BMPs to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil). • Planting of small shrubs or groundcovers beneath mature trees may be desirable in some cases; such plantings should use mainly plants that come as bulbs, bare root or in 4-inch pots; plants should be in no larger than 1-gallon containers.

Bioretention Facilities

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
	Fall and Spring	Presence of or need for stakes and guys (tree growth, maturation, and support needs).	Yes No	• Verify location of facility liners and underdrain (if any) prior to stake installation in order to prevent liner puncture or pipe damage. • Monitor tree support systems: Repair and adjust as needed to provide support and prevent damage to tree. • Remove tree supports (stakes, guys, etc.) after one growing season or maximum of 1 year. • Backfill stake holes after removal.
Trees and shrubs adjacent to vehicle travel areas (or areas where visibility needs to be maintained).	A	Vegetation causes some visibility (line of sight) or driver safety issues.	Yes No	• Maintain appropriate height for sight clearance. • When continued, regular pruning (more than one time/ growing season) is required to maintain visual sight lines for safety or clearance along a walk or drive, consider relocating the plant to a more appropriate location. • Remove or transplant if continual safety hazard. • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants.
Flowering plants	As needed	Dead or spent flowers present.	Yes No	Remove spent flowers (deadhead).
Perennials	As needed	Spent plants.	Yes No	Cut back dying or dead and fallen foliage and stems.
Emergent vegetation	As needed	Vegetation compromises conveyance.	Yes No	• Hand rake sedges and rushes with a small rake or fingers to remove dead foliage before new growth emerges in spring or earlier only if the foliage is blocking water flow (sedges and rushes do not respond well to pruning)
Ornamental grasses (perennial)	As needed	Dead material from previous year's growing cycle or dead collapsed foliage.	Yes No	• Leave dry foliage for winter interest. • Hand rake with a small rake or fingers to remove dead foliage back to within several inches from the soil before new growth emerges in spring or earlier if the foliage collapses and is blocking water flow.

Bioretention Facilities

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Ornamental grasses (evergreen)	As needed	Dead growth present in spring.	Yes No	• Hand rake with a small rake or fingers to remove dead growth before new growth emerges in spring. • Clean, rake, and comb grasses when they become too tall. • Cut back to ground or thin every 2-3 years as needed.
Noxious weeds	As needed	Listed noxious vegetation is present (refer to current county noxious weed list).	Yes No	• By law, class A & B noxious weeds must be removed, bagged and disposed as garbage immediately. • Reasonable attempts must be made to remove and dispose of class C noxious weeds. • It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions. • Apply mulch after weed removal (see "Mulch").
Weeds	As needed	Weeds are present	Yes No	• Remove weeds with their roots manually with pincer-type weeding tools, flame weeders, or hot water weeders as appropriate • Follow IPM protocols for weed management (see "Additional Maintenance Resources" section for more information on IPM protocols)
Excessive vegetation	As needed	Low-lying vegetation growing beyond facility edge onto sidewalks, paths, or street edge poses pedestrian safety hazard or may clog adjacent permeable pavement surfaces due to associated leaf litter, mulch, and soil.	Yes No	• Edge or trim groundcovers and shrubs at facility edge • Avoid mechanical blade-type edger and do not use edger or trimmer within 2 feet of tree trunks • While some clippings can be left in the facility to replenish organic material in the soil, excessive leaf litter can cause surface soil clogging.

Bioretention Facilities

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Excessive vegetation	As needed	Excessive vegetation density inhibits stormwater flow beyond design ponding or becomes a hazard for pedestrian and vehicular circulation and safety.	Yes No	• Determine whether pruning or other routine maintenance is adequate to maintain proper plant density and aesthetics. • Determine if planting type should be replaced to avoid ongoing maintenance issues (an aggressive grower under perfect growing conditions should be transplanted to a location where it will not impact flow.) • Remove plants that are weak, broken or not true to form; replace in-kind. • Thin grass or plants impacting facility function without leaving visual holes or bare soil areas. • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants.
	As needed	Vegetation blocking curb cuts, causing excessive sediment buildup and flow bypass.	Yes No	• Remove vegetation and sediment buildup.
Mulch				
Mulch	As needed	Bare spots (without mulch cover) are present or mulch depth less than 2 inches		• Supplement mulch with hand tools to a depth of 2 to 3 inches. • Replenish mulch per O&M manual. Often coarse compost is used in the bottom of the facility and arborist wood chips are used on side slopes and rim (above typical water levels). • Keep all mulch away from woody stems.
Watering				
Irrigation system (if any)		Irrigation system present.		• Follow manufacturer's instructions for O&M
	A	Sprinklers or drip irrigation not directed/located to properly water plants.		• Redirect sprinklers or move drip irrigation to desired areas

Bioretention Facilities

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Summer watering (first year)		Trees, shrubs and groundcovers in first year of establishment period.		• 10 to 15 gallons per tree. • 3 to 5 gallons per shrub. • 2 gallons water per square foot for groundcover areas. • Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist. • Use soaker hoses or spot water with a shower type wand when irrigation system is not present. • Pulse water to enhance soil absorption, when feasible. • Pre-moisten soil to break surface tension of dry or hydrophobic soils/mulch, followed by several more passes. With this method , each pass increases soil absorption and allows more water to infiltrate prior to runoff. • Add a tree bag or slow-release watering device (e.g., bucket with a perforated bottom) for watering newly installed trees when irrigation system is not present.

Summer watering (second and third years)		Trees, shrubs and groundcovers in second or third year of establishment period.		• 10 to 15 gallons per tree
				• to 5 gallons per shrub
				• gallons water per square foot for groundcover areas
				• Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist
				• Use soaker hoses or spot water with a shower type wand when irrigation system is not present
				  ○ Pulse water to enhance soil absorption, when feasible.
				  ○ Pre-moisten soil to break surface tension of dry or hydrophobic soils/mulch, followed by several more passes. With this method , each pass increases soil absorption and allows more water to infiltrate prior to runoff.

Bioretention Facilities

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Summer watering (after establishment)		Established vegetation (after 3 years).		• Plants are typically selected to be drought tolerant and not require regular watering after establishment; however, trees may take up to 5 years of watering to become fully established. • Identify trigger mechanisms for drought-stress (e.g., leaf wilt, leaf senescence, etc.) of different species and water immediately after initial signs of stress appear. • Water during drought conditions or more often if necessary to maintain plant cover.
Pest Control				
Mosquitoes	B, S	Standing water remains for more than 3 days after the end of a storm.		• Identify the cause of the standing water and take appropriate actions to address the problem (see "Ponded water"). • To facilitate maintenance, manually remove standing water and direct to the storm drainage system (if runoff is from non pollution-generating surfaces) or sanitary sewer system (if runoff is from pollution-generating surfaces) after getting approval from sanitary sewer authority. • Do not use pesticides or *Bacillus thuringiensis israelensis* (Bti).
Nuisance animals	As needed	Nuisance animals causing erosion, damaging plants, or depositing large volumes of feces.		• Reduce site conditions that attract nuisance species where possible (e.g., plant shrubs and tall grasses to reduce open areas for geese, etc.) • Place predator decoys • Follow IPM protocols for specific nuisance animal issues (see "Additional Maintenance Resources" section for more information on IPM protocols) • Remove pet waste regularly • For public and right-of-way sites consider adding garbage cans with dog bags for picking up pet waste.

Bioretention Facilities

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Insect pests	Every site visit associated with vegetation mgmt.	Signs of pests, such as wilting leaves, chewed leaves and bark, spotting or other indicators.		• Reduce hiding places for pests by removing diseased and dead plants. • For infestations, follow IPM protocols (see "Additional Maintenance Resources" section for more information on IPM protocols).

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

IPM – Integrated Pest Management

ISA – International Society of Arboriculture

Permeable Pavements

Permeable pavements allow water to infiltrate into layers of gravel placed below the paving surface and then into soil and groundwater below. By infiltrating most of the storm water on-site, the amount of water and pollution flowing into storm drains and directly to rivers and streams is greatly reduced. This, in turn, protects water quality, maintains more stable base flows to streams, reduces flood peaks, and reduces stream bank erosion. With infiltration, groundwater is recharged and streams are replenished with cool, clean groundwater in a more natural way. Permeable pavements are one component of Low Impact Development (LID).

Key Maintenance Considerations

The main components of permeable pavement facilities are listed below with descriptions of their function and key maintenance considerations.

Wearing course: The surface layer of any permeable pavement system is the wearing course. A critical component of a successful maintenance program is regular removal of sediment and debris, excessive moss from the facility surface to prevent clogging of the permeable wearing course. Categories of wearing courses include:

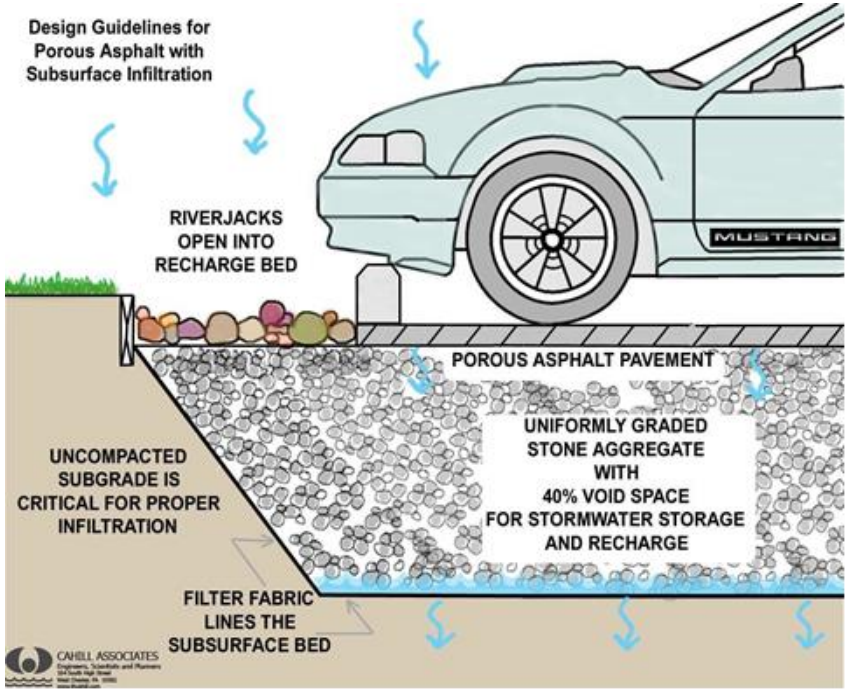
- *Porous asphalt:* A flexible pavement similar to standard asphalt that uses a bituminous binder to adhere aggregate. However, the fine material (sand and finer) is reduced or eliminated, resulting in the formation of voids between the aggregate in the pavement surface that allows water to infiltrate to the underlying aggregate base.
- *Pervious concrete:* A rigid pavement similar to conventional concrete that uses a cementitious material to bind aggregate together. However, the fine aggregate (sand) component is reduced or eliminated in the gradation, resulting in the formation of voids between the aggregate in the pavement surface that allows water to infiltrate to the underlying aggregate base.
- *Interlocking concrete paver blocks:* Solid, precast, manufactured modular units. Pavements constructed with these units create joints that are filled with permeable aggregate and installed on an open-graded aggregate base.
- *Aggregate Pavers (or Pervious Pavers):* Modular precast paving units made with uniformly sized aggregates and bound with Portland cement concrete using a high strength adhesive. Unlike concrete paver blocks, these pavers are permeable. Pavements constructed with these units create joints that are filled with permeable aggregate and installed on an open-graded aggregate base.
- *Open-celled paving grid with gravel:* Concrete or plastic grids that are filled with permeable aggregate. The system can be installed on an open-graded aggregate base.
- *Open-celled paving grid with grass:* Concrete or plastic grids that are filled with a mix of sand, gravel, and topsoil for planting vegetation. The cells can be planted with a variety of non-turf forming grasses or low-growing groundcovers. The system can be installed on an open-graded aggregate base.

Permeable Pavements (cont.)

Inlet (optional): While permeable pavement facilities often manage only the rain falling directly on the pavement surface, they may also be designed to accept stormwater runoff from additional areas (e.g., adjacent impervious areas, nearby rooftops). Runoff can be directed to the facility by two main methods:

- *Sheet flow to the surface:* Surface areas of the facility receiving runoff contributions will likely be prone to clogging due to sediment inputs, particularly in areas of concentrated inflow. These areas should be carefully inspected and corrective maintenance should be performed as necessary to maintain the function of the pavement at these sites. In addition, the source of the sediment loads should be evaluated to determine if modifications to features in the drainage area landscape (e.g., stabilization of adjacent planted areas) would help to prevent clogging.
- *Piped flow into the aggregate base*: Pipes dispersing water into the aggregate bed should be designed with cleanout access to allow pipe maintenance. Runoff that is piped into the aggregate base should be pretreated for sediment removal (e.g., screens, sumps) to protect the subbase from sedimentation and clogging. The pretreatment system must be maintained to remove accumulated sediment.

Aggregate Base / Storage Reservoir: Stormwater passes through the wearing course to an underlying aggregate storage reservoir where it is stored prior to infiltration into the underlying soil. This aggregate bed also provides the structural function of supporting design loads (e.g., vehicle loading) for flexible pavement systems. To allow inspection of the aggregate course, some facilities have an observation port (typically installed during construction) that allows monitoring of the water levels in the aggregate bed to determine if the facility is draining properly.



Overflow: Unless designed to provide full infiltration of stormwater, permeable pavement facilities have an overflow. Facility overflow can be provided by subsurface slotted drain pipe(s) (elevated in the aggregate bed) routed to an inlet or catch basin structure or by lateral flow through the storage reservoir to a daylighted drainage system.

Underdrain with flow restrictor (optional): A slotted drain pipe with flow restrictor assembly may be installed at the bottom of or elevated within the aggregate storage reservoir. Permeable

pavement facilities with underdrains and flow restrictors operate as underground detention systems with some infiltration.

Permeable Pavements (cont.)

Key Operations to Preserve Facility Function

There are several permeable pavement operational actions that can limit the likelihood of corrective maintenance actions or replacement including the following:

- Prohibiting use of sealant on porous asphalt
- Protecting from construction site runoff with proper temporary erosion and sediment controls and flow diversion measures
- Modifying utility cut procedures for permeable pavements. Protocols should recommend restoring permeable pavement section in-kind, where feasible, and require restoring permeable pavement section in-kind where replacement with conventional pavement would affect overall facility function. Replacing permeable pavement with conventional pavement is acceptable if it is a small percentage of the total facility area and does not affect the overall facility function. That determination should be made by a licensed engineer with approval by the City.
- Modifying snow removal procedures such as:
    - Using a snow plow with skids or rollers to slightly raise the blade above permeable pavers or open-celled paving grid systems to prevent loss of top course aggregate and damage to paver blocks or grids
    - Avoiding stockpiling plowed snow (i.e., dirty snow) directly on top of permeable pavement
    - Avoiding application of sand to pervious pavement and adjacent streets where vehicles may track it onto the pervious pavement. If sand is applied, on an emergency basis during snowy conditions, vacuum sweep surface as soon as possible after the sand is no longer needed.
    - Use alternative deicers in moderation (e.g., salt, molasses-based and chemical deicers).
- Protecting the surface from stockpiles of landscaping materials (e.g., mulch, soil, compost) being used for adjacent pervious areas
- Stabilizing adjacent landscaped areas to avoid eroding soil and clogging surfaces or sloping adjacent landscaped areas away from permeable pavement , if possible.
- Signage or pavement marking can also be used to identify permeable pavement as a stormwater BMP and inform maintenance crews and the general public about protecting the facility's function (e.g., no stockpiling of soils or mulch on pavement surface).

Permeable Pavements

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Surface/Wearing Course				
Permeable Pavements, all	A, S	Runoff from adjacent pervious areas deposits soil, mulch or sediment on paving.	Yes No	• Clean deposited soil or other materials from permeable pavement or other adjacent surfacing. • Check if surface elevation of planted area is too high, or slopes towards pavement, and can be regraded (prior to regrading, protect permeable pavement by covering with temporary plastic and secure covering in place). • Mulch and/or plant all exposed soils that may erode to pavement surface.
Porous asphalt or pervious concrete		None (routine maintenance)	Yes No	Clean surface debris from pavement surface using one or a combination of the following methods: • Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves). • Vacuum/sweep permeable paving installation using: o Walk-behind vacuum (sidewalks). o High efficiency regenerative air or vacuum sweeper (roadways, parking lots). o ShopVac or brush brooms (small areas). • Hand held pressure washer or power washer with rotating brushes. Follow equipment manufacturer guidelines for when equipment is most effective for cleaning permeable pavement. Dry weather is more effective for some equipment.

Permeable Pavements

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Porous asphalt or pervious concrete	A[b]	Surface is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate).	Yes No	• Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility). • Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, but not less than 1 test per 2,500 square feet. • If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability. To clean clogged pavement surfaces, use one or combination of the following methods: • Combined pressure wash and vacuum system calibrated to not dislodge wearing course aggregate. • Hand held pressure washer or power washer with rotating brushes. • Pure vacuum sweepers. Note: If the annual/biannual routine maintenance standard to clean the pavement surface is conducted using equipment from the list above, corrective maintenance may not be needed.
	A	Sediment present at the surface of the pavement.	Yes No	• Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding then see above. • Determine source of sediment loading and evaluate whether or not the source can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).

Permeable Pavements

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Porous asphalt or pervious concrete	Summer	Moss growth inhibits infiltration or poses slip safety hazard.	Yes No	• Sidewalks: Use a stiff broom to remove moss in the summer when it is dry • Parking lots and roadways: .Pressure wash, vacuum sweep, or use a combination of the two for cleaning moss from pavement surface. May require stiff broom or power brush in areas of heavy moss.
	A	Major cracks or trip hazards and concrete spalling and raveling.	Yes No	• Fill potholes or small cracks with patching mixes. • Large cracks and settlement may require cutting and replacing the pavement section. Replace in-kind where feasible. Replacing porous asphalt with conventional asphalt is acceptable if it is a small percentage of the total facility area and does not impact the overall facility function. • Take appropriate precautions during pavement repair and replacement efforts to prevent clogging of adjacent porous materials.

Interlocking concrete paver blocks and aggregate pavers		None (routine maintenance)	Yes
			No
				Clean pavement surface using one or a combination of the following methods:
				• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves).
				• Vacuum/sweep permeable paving installation using:
				  ○ Walk-behind vacuum (sidewalks).
				  ○ High efficiency regenerative air or vacuum sweeper (roadways, parking lots).
				  ○ ShopVac or brush brooms (small areas).

Permeable Pavements

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Interlocking concrete paver blocks and aggregate pavers		None (routine maintenance)	Yes No	Note: Vacuum settings may have to be adjusted to prevent excess uptake of aggregate from paver openings or joints. Vacuum surface openings in dry weather to remove dry, encrusted sediment.
	A [b]	Surface is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)].	Yes No	Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility). Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, but not less than one test per 2,500 square feet. If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability. Clogging is usually an issue in the upper 2 to 3 centimeters of aggregate. Remove the upper layer of encrusted sediment, and fines, and/or vegetation from openings and joints between the pavers by mechanical means and/or suction equipment (e.g., pure vacuum sweeper). Replace aggregate in paver cells, joints, or openings per manufacturer's recommendations.
	A	Sediment present at the surface of the pavement.	Yes No	Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding, then see above. Determine source of sediment loading and evaluate whether or not the source can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).

Permeable Pavements

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Interlocking concrete paver blocks and aggregate pavers	Summer	Moss growth inhibits infiltration or poses slip safety hazard.	Yes No	Sidewalks: Use a stiff broom to remove moss in the summer when it is dry. Parking lots and roadways: Vacuum sweep or stiff broom/power brush for cleaning moss from pavement surface.
	A	Paver block missing or damaged.	Yes No	Remove individual damaged paver blocks by hand and replace or repair per manufacturer's recommendations.
	A	Loss of aggregate material between paver blocks.	Yes No	Refill per manufacturer's recommendations for interlocking paver sections.
	A	Settlement of surface.	Yes No	May require resetting.
Open-celled paving grid with gravel		None (routine maintenance)	Yes No	• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves). • Follow equipment manufacturer guidelines for cleaning surface.
	A b	Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)].	Yes No	• Use vacuum truck to remove and replace top course aggregate. • Replace aggregate in paving grid per manufacturer's recommendations.
	A	Paving grid missing or damaged.	Yes No	• Remove pins, pry up grid segments, and replace gravel. • Replace grid segments where three or more adjacent rings are broken or damaged. • Follow manufacturer guidelines for repairing surface.
	A	Settlement of surface.	Yes No	May require resetting

Permeable Pavements

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Open-celled paving grid with gravel	A	Loss of aggregate material in paving grid.	Yes No	Replenish aggregate material by spreading gravel with a rake (gravel level should be maintained at the same level as the plastic rings or no more than 1/4 inch above the top of rings). See manufacturer's recommendations.
		Weeds present.	Yes No	• Manually remove weeds. • Presence of weeds may indicate that too many fines are present (refer to Actions Needed under "Aggregate is clogged" to address this issue).
Open-celled paving grid with grass		None (routine maintenance)	Yes No	• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves). • Follow equipment manufacturer guidelines for cleaning surface.
	A b	Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)].	Yes No	• Rehabilitate per manufacturer's recommendations.
	A	Paving grid missing or damaged.	Yes No	• Remove pins, pry up grid segments, and replace grass. • Replace grid segments where three or more adjacent rings are broken or damaged. • Follow manufacturer guidelines for repairing surface.
	A	Settlement of surface.	Yes No	• May require resetting.
	A	Poor grass coverage in paving grid.	Yes No	• Restore growing medium, reseed or plant, aerate, and/or amend vegetated area as needed. • Traffic loading may be inhibiting grass growth; reconsider traffic loading if feasible.

Permeable Pavements

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Open-celled paving grid with grass		None (routine maintenance)	Yes No	• Use a mulch mower to mow grass.
		None (routine maintenance)	Yes No	• Sprinkle a thin layer of compost on top of grass surface (1/2" top dressing) and sweep it in. • Do not use fertilizer.
		Weeds present	Yes No	• Manually remove weeds. • Mow, torch, or inoculate and replace with preferred vegetation.
Inlets/Outlets/Pipes				
Inlet/outlet pipe	A	Pipe is damaged.	Yes No	Repair/replace.
	A	Pipe is clogged.	Yes No	Remove roots or debris.
Underdrain pipe	Clean pipe as needed	Plant roots, sediment or debris reducing capacity of underdrain (may cause prolonged drawdown period).	Yes No	• Jet clean or rotary cut debris/roots from underdrain(s). • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly.
Raised subsurface overflow pipe	Clean pipe as needed	Plant roots, sediment or debris reducing capacity of underdrain.	Yes No	• Jet clean or rotary cut debris/roots from under-drain(s). • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly.
Outlet structure	A, S	Sediment, vegetation, or debris reducing capacity of outlet structure.	Yes No	• Clear the blockage. • Identify the source of the blockage and take actions to prevent future blockages.
Overflow	B	Native soil is exposed or other signs of erosion damage are present at discharge point.	Yes No	Repair erosion and stabilize surface.

Permeable Pavements

Component	Required Inspection Frequency[1]	Issue or Condition Requiring Maintenance (Standards)	Issue Exists?	Corrective Action (Procedures)
Aggregate Storage Reservoir				
Observation Port	A, S	Water remains in the storage aggregate longer than anticipated by design after the end of a storm.	Yes No	If immediate cause of extended ponding is not identified, schedule investigation of subsurface materials or other potential causes of system failure.
Vegetation				
Adjacent large shrubs or trees		Vegetation related fallout clogs or will potentially clog voids.	Yes No	• Sweep leaf litter and sediment to prevent surface clogging and ponding. • Prevent large root systems from damaging subsurface structural components.
		Vegetation growing beyond facility edge onto sidewalks, paths, and street edge.	Yes No	Edging and trimming of planted areas to control groundcovers and shrubs from overreaching the sidewalks, paths and street edge improves appearance and reduces clogging of permeable pavements by leaf litter, mulch and soil.
Leaves, needles, and organic debris		Accumulation of organic debris and leaf litter.	Yes No	Use leaf blower or vacuum to blow or remove leaves, evergreen needles, and debris (i.e., flowers, blossoms) off of and away from permeable pavement.

[a] Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

2022 Stormwater Facility Maintenance Summary Form

Please print clearly and fill out all fields below

Date:_____ Site Address: _____

Site Occupant:_____ Site Phone # _____

Manager/Contact:_____ Phone #:_____ Cell#: _____

Email: _____

Mailing Address: ☐ Same as site address

Street/P.O. Box:_____ City:_____ Zip Code: _____

Property Owner: _____

Address: _____

Phone #:_____ Cell#:_____ Email: _____

Mailing Address: ☐ Same as site address

Street/P.O. Box:_____ City:_____ Zip Code: _____

Contractor(s) Information: ***Note:*** *you may need more than one contractor, depending on services needed on your site.*

Name:_____ Phone #:_____ Cell#: _____

Email: _____

Street/P.O. Box:_____ City:_____ Zip Code: _____

Name:_____ Phone #:_____ Cell#: _____

Email: _____

Street/P.O. Box:_____ City:_____ Zip Code: _____

Complete this form by August 31 ***(including checklists, invoices, and any photos)*** **and return to:**

City of Olympia | Attn. Kane Osstifin
PO Box 1967
Olympia, WA 98507-1967

Email: kosstifi@ci.olympia.wa.us

Questions: 360.753.8579

2022 Stormwater Facility Maintenance Table

Fill out sections applicable to your system

Catch Basins, Maintenance holes and Control Structures	**Inspection Date: _____**		
Number Inspected:_____ Control structures:_____ **Control structure type(s): _____**	**Okay**	**Needs Work**	**Date Maintenance Completed**
Access to structure			
Structure sound			
Standing water below pipe level after a 24-48 hour dry period			
Clear of contamination, pollution or debris			
Inlets/outlets free of obstructions			
Clear of sediment (not to exceed 1/3 of the sump depth)			
Control Structure only:			
Overflow clear of obstruction			
Orifice/Gate functioning			
Other:			
Other:			
Comments: (*briefly describe issues and how addressed)*			

Underground Vaults, Tanks and Galleries	**Inspection Date: _____**		
Number Inspected:_____ Type(s):_____	**Okay**	**Needs Work**	**Date Maintenance Completed**
Access to clean outs/structure			
Structure sound			
Clear of contamination, pollution or debris			
Inlets/outlets free of obstructions			
Ventilation clear of blockage			
Baffle structure sound			
Detention Only:			
Less than 4 inches of sediment			
Standing water below pipe level after a 24-48 hour dry period			
Infiltration Only:			
No sediment/perforations clear			
Drains after 24-48 hour dry period			
Other:			
Other:			
Comments: (*briefly describe issues and how addressed)*			

2022 Stormwater Facility Maintenance Table

Fill out sections applicable to your system

Ponds	**Inspection Date: _____**		
Number Inspected:_____ Types:_____	**Okay**	**Needs Work**	**Date Maintenance Completed**
Maintain overgrown vegetation, removing noxious and invasive plants.			
Free of trees growing in bottom and slopes of pond.			
Inlet/outlet pipes clear of excess sediment/vegetation/trash			
Sediment level less than 10% of design depth			
Energy dissipaters free of erosion & sediment			
Clear of trash/yard waste			
Access/signage/fence/security			
Debris barriers secure, free of obstructions			
Free of animal/insect damage			
Wet Pond only:			
No exposed liners, holes or bubbles			
Less than 25% cattails			
Infiltration or Dry Pond only:			
Drains in a 24-48 hour dry period			
Other:			
Other:			
Comments: (*briefly describe issues and how addressed)*			

Swales, Ditches, Conveyance _____	**Inspection Date: _____**		
Number Inspected:_____	**Okay**	**Needs Work**	**Date Maintenance Completed**
Inlet/outlet pipes clear of excess sediment/vegetation/trash			
Maintained vegetation, removed noxious and invasive plants			
Energy dissipation free of erosion, sediment buildup less than 10%			
No ponding during dry periods			
Dispersion free flowing, dispersing correctly			
Free flowing, dispersing correctly			
Debris barriers secure, structurally sound, free of debris/ obstruction			
Other:			
Other:			
Comments: (*briefly describe issues and how addressed)*			

2022 Stormwater Facility Maintenance Table

Fill out sections applicable to your system

Bioretention	**Inspection Date: _____**		
Number Inspected:_____ Type:_____	**Okay**	**Needs Work**	**Date Maintenance Completed**
Access to underdrain (If applicable)			
Free of animal/insect damage			
No ponding during dry periods			
Health of plants/irrigation			
Energy dissipation - no sediment buildup, erosion or scouring			
Free of weeds, invasives and noxious plants			
Inlets/outlets clear of blockage/vegetation/trash			
Media functioning, not compacted/maintain mulch cover			
Flow control/check dams/weirs functioning (if applicable)			
Other:			
Other:			
Comments: (*briefly describe issues and how addressed)*			

Treatment Vaults	**Inspection Date: _____**		
Number Inspected:_____ Type_____	**Okay**	**Needs Work**	**Date Maintenance Completed**
Baffle structure sound			
Inlets & outlets clear of trash and debris			
Sediment in vaults must be less than 4 inches			
High sediment water line in vault at or above filter height			
Standing water in vaults should drain in a 24-48 hour dry period			
Access to structure			
Structure sound			
Filters only:			
Sediment on filters must be less than ¼ inch			
Filter media clean			
Other:			
Other:			
Comments: (*briefly describe issues and how addressed)*			

2022 Stormwater Facility Maintenance Table

Fill out sections applicable to your system

Other: ___________________________________	**Inspection Date: ___________**		
Number Inspected:________	**Okay**	**Needs Work**	**Date Maintenance Completed**
Other:			
Other:			
Other:			
Comments: (*briefly describe issues and how addressed)*			

Other: ____________________________________	**Inspection Date: ___________**		
Number Inspected:________	**Okay**	**Needs Work**	**Date Maintenance Completed**
Other:			
Other:			
Other:			
Comments: (*briefly describe issues and how addressed)*			

Other: ___________________________________	**Inspection Date: ___________**		
Number Inspected:________	**Okay**	**Needs Work**	**Date Maintenance Completed**
Other:			
Other:			
Other:			
Comments: (*briefly describe issues and how addressed)*			