Volume I
Core Technical Requirements and Site Planning
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**Volume I**  
Core Technical Requirements and Site Planning

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Volume I

Chapter 1 - Introduction

1.1 Objective

The objective of this manual is to provide guidance on the measures necessary to control the quantity and quality of stormwater produced by new development and redevelopment, such that they comply with water quality standards and contribute to the protection of beneficial uses of the receiving waters. Application of appropriate core requirements and Best Management Practices (BMPs) identified in this manual are necessary but sometimes insufficient measures to achieve these objectives. (See Section 1.7, Effects of Urbanization).

Water quality standards include:

- Chapter 173-200 of the Washington Administrative Code (WAC), Water Quality Standards for Ground Waters of the State of Washington
- Chapter 173-201A WAC, Water Quality Standards for Surface Waters of the State of Washington
- Chapter 173-204 WAC, Sediment Management Standards

This manual identifies core requirements for development and redevelopment projects of all sizes and provides guidance concerning how to prepare and implement Drainage Control Plans. These requirements are, in turn, satisfied by the application of BMPs from Volumes II through V. Projects that follow this approach will apply reasonable, technology-based BMPs and water quality-based BMPs to reduce the adverse impacts of stormwater. This manual is applicable to all types of land development – including residential, commercial, industrial, and roads. Manuals with a more-specific focus, such as a Highway Runoff Manual, may provide more appropriate guidance to the intended audience.

Where requirements in this document are also covered in any other law, ordinance, resolution, rule, regulation, or similar, the more restrictive shall govern.

If any provisions of this manual, or their application to any person or property, are amended or held to be invalid, the remainder of the provisions of this manual, in their application to other persons or circumstances, shall not be affected.

Federal, state, and local permitting authorities with jurisdiction can require more stringent measures that are deemed necessary to meet locally established goals, state water quality standards, or other established natural resource or drainage objectives.

This manual has been adopted by City of Olympia (City) ordinance and has force of law. Failure to comply may trigger administrative or enforcement action, and result in project delays, fines or criminal penalties.

The Administrator of this Manual is the City of Olympia Public Works Director or their designee. General technical questions or interpretation of this Manual should be directed to Public Works – Water Resources Program staff.

This manual contains both uniform requirements, which are normally preceded by “shall,” “will” or “must,” and situation-specific requirements, which are normally preceded by “may.” For any project, the City Stormwater Manual Administrator is authorized to determine if situation-specific requirements are applicable.

This manual can also help to identifying options for retrofitting BMPs in existing developments. Retrofitting stormwater BMPs into existing developed areas will be necessary in many cases to meet federal Clean Water Act and state Water Pollution Control Act (Chapter 90.48 RCW) requirements.
The Washington State Department of Ecology (Ecology) does not have guidance specifically for retrofit situations (not including redevelopment situations). Application of BMPs from this manual is encouraged. However, there can be site constraints that make the strict application of these BMPs difficult.

1.2 Applicability to City of Olympia

This stormwater manual applies to all of the City of Olympia (City). This manual is designed to be equivalent to Ecology’s 2012 Stormwater Management Manual for Western Washington (Ecology stormwater manual) with 2014 revisions. The Ecology stormwater manual was originally developed in response to a directive of the Puget Sound Water Quality Management Plan (PSWQA 1987 et seq.). The Puget Sound Water Quality Authority (since replaced by the Puget Sound Partnership, PSP) recognized the need for overall guidance for stormwater quality improvement. It incorporated requirements in its plan to implement a cohesive, integrated stormwater management approach through the development and implementation of programs by local jurisdictions, and the development of rules, permits and guidance by Ecology.

The Puget Sound Water Quality Management Plan included a stormwater element (SW-2.1) requiring Ecology to develop a stormwater technical manual for use by local jurisdictions. This manual was developed to meet this requirement. Ecology has found that the concepts developed for the Puget Sound Basin are applicable throughout western Washington.

Information describing how this manual relates to the Puget Sound Water Quality Management Plan (now the Puget Sound Action Agenda) is included in Section 1.6.4.

1.3 Overview of Manual Content

To accomplish the objective described in Section 1.1, the manual includes the following:

- **Core Requirements** that cover a range of issues, such as preparation of Drainage Control Plans, pollution prevention during the construction phase of a project, control of potential pollutant sources, treatment of runoff, control of stormwater flow volumes, protection of wetlands, and long-term operation and maintenance. The Core Requirements applicable to a project vary depending on the type and size of the proposed project.

- **Best Management Practices (BMPs)** that can be used to meet the core requirements. BMPs are schedules of activities, prohibitions of practices, maintenance procedures, managerial practices, or structural features that prevent or reduce pollutants or other adverse impacts to waters of Washington State. BMPs are divided into those for short-term control of stormwater from construction sites, and those addressing long-term management of stormwater at developed sites. Long-term BMPs are further subdivided into those covering management of the volume and timing of stormwater flows, prevention of pollution from potential sources, and treatment of runoff to remove sediment and other pollutants.

- **Guidance on how to prepare and implement Drainage Control Plans.** The Drainage Control Plan is a comprehensive package of plans, reports, and site drawings that describes existing site conditions, explains development plans, examines potential off-site effects, identifies applicable Core Requirements, and proposes stormwater controls for both the construction phase and long-term stormwater management. The project proponent submits the Drainage Control Plan to state and city authorities with jurisdiction, who use the plan to evaluate a proposed project for compliance with stormwater requirements.
1.3.1 Volume Content
Volume I of this manual serves as an introduction and covers several key elements of developing the Drainage Control Plan. The remaining volumes of this manual cover BMPs for specific aspects of stormwater management. Volumes II through V are organized as follows:

- Volume II covers BMPs for short-term stormwater management at construction sites.
- Volume III covers hydrologic analysis and BMPs to control flow volumes from developed sites.
- Volume IV addresses BMPs to minimize pollution generated by potential pollution sources at developed sites and post construction inspection and maintenance of stormwater facilities.
- Volume V presents BMPs to treat runoff that contains sediment or other pollutants from developed sites.

1.3.2 Organization of Volume I
Following this introduction, Volume I contains three additional chapters. Chapter 2 identifies the Core Requirements for stormwater management at all new development and redevelopment projects. Chapter 3 describes the Drainage Control Plan, and provides step-by-step guidance on how to develop these plans. Chapter 4 describes the process for selecting BMPs for long-term management of stormwater flows and quality. Appendices are included to support these topics. Volume I also includes the Glossary for all five volumes of the stormwater manual.

1.4 How to Use this Manual
This manual has applications for a variety of users. Project proponents should start by reading Chapter 3 of Volume I. It explains how to complete drainage control plans.

Note that this stormwater management manual is based on Ecology’s Stormwater Management Manual for Western Washington (2012).

Other Federal, State, and local permits may refer to the Ecology Manual or the BMPs contained in that manual. For example, the Industrial Stormwater General Permit and the Construction Stormwater General Permit refer to this manual. In those cases, affected permit-holders or applicants should use Ecology’s manual for specific guidance on how to comply with those permit conditions.

1.5 Development of Best Management Practices for Stormwater Management
1.5.1 Best Management Practices (BMPs)
The method by which the manual controls the adverse impacts of development and redevelopment is through the application of Best Management Practices.

Best Management Practices are defined as schedules of activities, prohibitions of practices, maintenance procedures, and structural and/or managerial practices, that when used singly or in combination, prevent or reduce the release of pollutants and other adverse impacts to waters of Washington State. The types of BMPs are source control, treatment, and flow control. BMPs that involve construction of engineered structures are often referred to as facilities in this manual. For instance, the BMPs referenced in the menus of Chapter 3 in Volume V are called treatment facilities.

The primary purpose of using BMPs is to protect beneficial uses of water resources through the reduction of pollutant loads and concentrations, through reduction of discharges (volumetric flow rates) causing stream channel erosion, and through reductions in deviations from natural hydrology. If it is found that, after the implementation of BMPs advocated in this manual, beneficial uses are still threatened or impaired, then additional controls may be required.
1.5.2 Source Control BMPs
Source control BMPs typically prevent pollution, or other adverse effects of stormwater, from occurring. Ecology further classifies source control BMPs as operational or structural. Examples of source control BMPs include methods as various as using mulches and covers on disturbed soil, putting roofs over outside storage areas, and berming areas to prevent stormwater run-on and pollutant runoff.

It is generally more cost effective to use source controls to prevent pollutants from entering runoff, than to treat runoff to remove pollutants. However, since source controls cannot prevent all impacts, some combination of measures will always be needed.

1.5.3 Treatment BMPs
Treatment BMPs include facilities that remove pollutants by simple gravity settling of particulate pollutants, centrifugal separation, filtration, biological uptake, and media or soil adsorption. Treatment BMPs can accomplishes significant levels of pollutant load reductions if properly designed and maintained.

1.5.4 Flow Control BMPs
Flow control BMPs typically control the volume rate, frequency, and flow duration of stormwater surface runoff. The need to provide flow control BMPs depends on whether a development site discharges to a stream system or wetland, either directly or indirectly. Stream channel erosion control can be accomplished by BMPs that detain runoff flows and also by those which physically stabilize eroding streambanks. Both types of measures may be necessary in urban watersheds. Only the former is covered in this manual.

Construction of a detention pond is the most common means of meeting flow control requirements. Construction of an infiltration facility is the preferred option but is feasible only where more porous soils are available.

The concept of detention is to collect runoff from a developed area and release it at a slower rate than it enters the collection system. The reduced release rate requires temporary storage of the excess amounts in a pond with release occurring over a few hours or days. The volume of storage needed is dependent on:

1. The size of the drainage area.
2. The extent of disturbance of the natural vegetation, topography, and soils and creation of effective impervious surfaces (surfaces that drain to a stormwater collection system).

How rapidly the water is allowed to leave the detention pond, i.e., the target release rates.

The 1992 Ecology manual focused primarily on controlling the peak flow release rates for recurrence intervals of concern – the 2, 10, and 100-year rates. This level of control did not adequately address the increased duration at which those high flows occur because of the increased volume of water from the developed condition as compared to the pre-developed conditions.

To protect stream channels from increased erosion, it is necessary to control the durations over which a stream channel experiences geomorphically significant flows such that the energy imparted to the stream channel does not increase significantly. Geomorphically significant flows are those that are capable of moving sediments. This target will translate into lower release rates and significantly larger detention ponds than the previous Ecology standard. The size of such a facility can be reduced by changing the extent to which a site is disturbed.
In regard to wetlands, the goal is to not alter the natural hydroperiod. This requires the control of input flows such that the wetland is within certain elevations at different times of the year and short-term elevation changes are within the desired limits. If the amount of surface water runoff draining to a wetland is increased because of land conversion from forested to impervious areas, it may be necessary to bypass some water around the wetland in the wet season. (Bypassed stormwater must still meet flow control and treatment requirements applicable to the receiving water.) If however, the wetland was fed by local ground water elevations during the dry season, the impervious surface additions and the bypassing practice may cause variations from the dry season elevations.

Because Ecology found it difficult to model water surface elevation changes, especially for riverine and slope wetlands, the new regulatory strategy is to simply try to match the pre-project surface and ground water inputs that drive the water surface elevations in wetlands. Estimates of what should be done to match inputs requires the use of a continuous runoff model. It remains to be seen whether the available continuous runoff models are sufficiently accurate to determine successful flow management strategies. Even if the modeling approaches are sufficient, it will be a challenge to simulate pre-project hydrology after significant development has occurred.

1.5.5 Construction Stormwater BMPs and On-site Stormwater Management BMPs

Construction stormwater BMPs can be source control, treatment, or flow control BMPs. Examples include stabilized construction entrances, silt fences, check dams, and sediment traps. Volume II contains temporary construction stormwater BMPs.

On-site stormwater management BMPs can be either treatment or flow control BMPs. BMPs in this category serve to infiltrate, disperse, and retain stormwater runoff on-site. Examples include bioretention, rain gardens, and permeable pavements in Chapter 5, of Volume V. Other examples include downspout infiltration, downspout dispersion, and perforated sub-out connections in Chapter 3, of Volume III.

1.6 Relationship of this Manual to Federal, State, and Local Regulatory Requirements

1.6.1 The Manual’s Role as Technical Guidance

This manual has been adopted by City ordinance and has force of law. Failure to comply may trigger administrative or enforcement action, and result in project delays, fines or criminal penalties.

Current law and regulations require the design, construction, operation and maintenance of stormwater systems that prevent pollution of State waters. The Manual is a guidance document which provides the City, State and Federal agencies, developers and project proponents with a stormwater management strategy to apply at the project level. If this strategy is implemented correctly, in most cases it should result in compliance with existing regulatory requirements for stormwater – including compliance with the Federal Clean Water Act, Federal Safe Drinking Water Act and State Water Pollution Control Act.

The Manual provides generic, technical guidance on measures to control the quantity and quality of stormwater runoff from new development and redevelopment projects. These measures are considered to be necessary to achieve compliance with State water quality standards and to contribute to the protection of the beneficial uses of the receiving waters (both surface and ground waters). Stormwater management techniques applied in accordance with this Manual are presumed to meet the technology-based treatment requirement of State law to provide all known available and reasonable methods of treatment, prevention and control (AKART; RCW 90.52.040 and RCW 90.48.010).
This technology-based treatment requirement does not excuse any discharge from the obligation to apply additional stormwater management practices as necessary to comply with State water quality standards. The State water quality standards include: Chapter 173-200 WAC, Water Quality Standards for Ground Waters of the State of Washington; Chapter 173-201A WAC, Water Quality Standards for Surface Waters of the State of Washington; and Chapter 173-204 WAC, Sediment Management Standards.

Following this Manual is not the only way to properly manage stormwater runoff. A municipality may adopt, or a project proponent may choose to implement other methods to protect water quality; but in those cases, they assume the responsibility of providing technical justification that the chosen methods will protect water quality (see Section 1.6.3, Presumptive versus Demonstrative Approaches to Protecting Water Quality below).

1.6.2 More Stringent Measures and Retrofitting

Federal, State, and local government agencies with jurisdiction can require more stringent measures that are deemed necessary to meet locally established goals, State water quality standards, or other established natural resource or drainage objectives. Water cleanup plans or Total Maximum Daily Loads (TMDLs) may identify more stringent measures needed to restore water quality in an impaired water body.

This Manual is not a retrofit manual, but it can be helpful in identifying options for retrofitting BMPs to existing development. Retrofitting stormwater BMPs into existing developed areas may be necessary to meet federal Clean Water Act and state Water Pollution Control Act (Chapter 90.48 RCW) requirements. The Puget Sound Action Agenda, described in Section 1.6.4, also includes prioritizing and implementing stormwater retrofits as one objective. In retrofit situations there frequently are site constraints that make the strict application of these BMPs difficult. In these instances, the BMPs presented here can be modified using best professional judgment to provide reasonable improvements in stormwater management.

1.6.3 Presumptive versus Demonstrative Approaches to Protecting Water Quality

Wherever a discharge permit or other water-quality-based project approval is required, project proponents may be required to document the technical basis for the design criteria used to design their stormwater management BMPs. This includes: how stormwater BMPs were selected; the pollutant removal performance expected from the selected BMPs; the scientific basis, technical studies, and(or) modeling which supports the performance claims for the selected BMPs; and an assessment of how the selected BMP will comply with State water quality standards and satisfy State AKART requirements and Federal technology-based treatment requirements.

The Manual is intended to provide project proponents, regulatory agencies and others with technically sound stormwater management practices, which are presumed to protect water quality and instream habitat – and meet the stated environmental objectives of the regulations described in this chapter. Project proponents always have the option of not following the stormwater management practices in this Manual. However, if a project proponent chooses not to follow the practices in the Manual then the project proponent may be required to individually demonstrate that the project will not adversely impact water quality by collecting and providing appropriate supporting data to show that the alternative approach is protective of water quality and satisfies State and federal water quality laws.

Figure 1.6.1 graphically depicts the relation between the presumptive approach (the use of this Manual) and the demonstrative approach for achieving the environmental objectives of the standards. Both the presumptive and demonstrative approaches are based on best available science and result from existing
Federal and State laws that require stormwater treatment systems to be properly designed, constructed, maintained and operated to:

1. Prevent pollution of state waters and protect water quality, including compliance with state water quality standards.
2. Satisfy state requirements for all known available and reasonable methods of prevention, control and treatment (AKART) of wastes prior to discharge to waters of the State.
3. Satisfy the federal technology based treatment requirements under 40 CFR part 125.3.

Under the demonstration approach, the timeline and expectations for providing technical justification of stormwater management practices will depend on the complexity of the individual project and the nature of the receiving environment. In each case, the project proponent may be asked to document to the satisfaction of the permitting agency or other approval authority that the practices they have selected will result in compliance with the water quality protection requirements of the permit or other local, State, or Federal water-quality-based project approval condition. This approach may be more cost effective for large, complex or unusual types of projects.

Project proponents that choose to follow the stormwater management approaches contained in Ecology approved stormwater technical manuals are presumed to have satisfied this demonstration requirement and do not need to provide technical justification to support the selection of BMPs for the project. Following the stormwater management practices in this Manual means adhering to the guidance provided for proper selection, design, construction, implementation, operation and maintenance of BMPs. This approach will generally be more cost effective for typical development and redevelopment projects.

Ecology lists approved equivalent stormwater management manuals this website: [http://www.ecy.wa.gov/programs/wq/stormwater/municipal/Phase1equivalentstormwatermanualsWestern.html](http://www.ecy.wa.gov/programs/wq/stormwater/municipal/Phase1equivalentstormwatermanualsWestern.html).

The following sub-sections will explain the relationship of the manual to various programs, permits, and planning efforts.
Both the presumptive and demonstrative approaches are based on using best available science to protect water quality. See the glossary for definitions.

Figure 1.6.1 - Relation Between Environmental Science and Standards in Regulations.

<table>
<thead>
<tr>
<th>Standards</th>
<th>Water Pollution Control Act</th>
<th>Federal Clean Water Act</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Chapter 90.48 RCW)</td>
<td>Discharges to state waters shall not cause pollution, which is defined as an alteration of the physical, chemical or biological properties of State waters which would impair beneficial uses. Requires the use of AKART and BMPs approved by Ecology.</td>
<td>Restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.</td>
<td>Endangered Species Act</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• State water quality standards (water-quality based treatment requirements)</td>
<td>Properly functioning conditions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Federal technology-based treatment requirements</td>
<td>Hydraulics Code (HPA)</td>
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<td>• NPDES permits</td>
<td>Safe Drinking Water Act (UIC)</td>
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<td></td>
<td></td>
<td>• 303(d) impaired water body list and water clean-up plans</td>
<td></td>
</tr>
</tbody>
</table>

Presumptive Approach
The Stormwater Management Manual for Western Washington provides a default set of stormwater practices based on current science which satisfy State and Federal stormwater requirements.

Considerations:
• More predictable, practices are approved across jurisdictions.
• Costly studies, etc. are not required as they may be under the demonstration approach.

Demonstrative Approach
Project sponsor and approval agency individually review and condition proposed projects to meet federal and state stormwater standards based on current science.

Considerations:
• Lacks predictability and can be very time consuming.
• For large, complex projects may reduce costs and/or improve environmental protection.

Hydrology
• When native vegetation is removed and replaced with impervious surfaces (roads or buildings) there is an increase in stormwater runoff and other drastic alterations to the natural hydrology.
• Increased flows lead to increased flooding and stream bank and stream bed erosion.
• Unless mitigated, adverse high flow impacts occur at even low levels of urban development: 4% to 10% total impervious area.
• Transportation infrastructure (including parking areas) represents between 50% and 75% of the impervious surface area within any single watershed.

Water Quality
• More than a third of the State’s urban streams, creeks, and embayments are impaired due to stormwater runoff.
• Stormwater runoff from construction activities can contain large amounts of sediments and suspended solids which are harmful to fish and other aquatic life.
• Untreated stormwater from roads and urban areas can adversely impact water quality due to sediments, toxic metals, pesticides, herbicides, oils and greases, and possible human pathogens including fecal coliform bacteria.
• Untreated stormwater runoff from roads and urban areas can be toxic to aquatic life including fish.

SCIENCE

City of Olympia Drainage Design and Erosion Control Manual
Volume I – Core Technical Requirements and Site Planning

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1-8
1.6.4 The Puget Sound Action Agenda

The Puget Sound Partnership’s 2014/2015 Action Agenda lays out the work needed to protect and restore Puget Sound into the future. It is intended to drive investment and action. The Plan identifies three strategic initiatives to help prioritize near-term actions. “Prevention of pollution from urban stormwater runoff” is one of the strategic initiatives.

The Plan includes 29 strategies to achieve recovery targets, 106 sub-strategies to provide a narrower focus for the strategies and to develop near-term actions. The plan identifies about 150 regional and 150 local near-term actions. The strategy most aligned with this manual is to “Prevent, reduce, and control the sources of contaminants entering Puget Sound.” Within that strategy, the sub-strategies and the near-term actions under these sub-strategies in which Ecology is identified as the “owner” of the action follows:

Sub-Strategy: Prevent problems from new development at the site and subdivision scale.

- NPDES Permits: Ecology will issue municipal stormwater permits for western Washington and provide financial assistance to permittees for implementation, particularly for code changes, stormwater system mapping, operations and maintenance, inspections and enforcement. This will require additional resources to Ecology for permit oversight, technical assistance, and enforcement. Ecology will provide incentives to NPDES permittees who, by interlocal agreement, lead or carry out regional or watershed scale NPDES implementation.

- Stormwater Treatment Standards: Ecology will evaluate under which circumstances (i.e., for which pollutants, from which land uses) discharges to Puget Sound should be required to provide treatment beyond sediment removal (i.e., TSS removal) to help meet 2020 recovery targets.

- Stormwater management outside permitted areas: Ecology, in coordination with DOH, will identify two high priority shellfish growing areas degraded by urban stormwater discharges and work with local governments and other key parties to reduce these impacts to the areas.

- New development under earlier stormwater programs: Ecology will initiate a process to assess projected implications and impacts of current state law concerning the level of stormwater control from new development approved under earlier stormwater programs.

Sub-Strategy: Control Sources of Pollutants

- Compliance assurance program: Ecology and local governments will increase inspection, technical assistance, and enforcement programs for high-priority businesses and at construction sites.

Sub-Strategy: Provide focused stormwater-related education, training, and assistance.

- Low Impact Development training and certification: Ecology will provide focused training for local government staff on Low Impact Development project review, and inspections and approvals, as well as to local government staff and private sector on maintenance. Develop new professional certification for stormwater maintenance specialists. Provide business staff and contractors with training on source control, spill recognition, spill response, and erosion control.

The Action Agenda includes many other stormwater-related sub-strategies and near-term actions. The Action Agenda is available at the Puget Sound Partnership website.
1.6.7 Industrial Stormwater General Permit

Facilities covered under Ecology’s Industrial Stormwater General Permit (i.e. NPDES and State Waste Discharge General Permit for Stormwater Discharges Associated With Industrial Activities) must manage stormwater in accordance with specific terms and conditions including: the development and implementation of an Industrial Stormwater Pollution Prevention Plan (Industrial SWPPP), monitoring, reporting, and ongoing adaptive management based on sampling and inspections.

The Industrial Stormwater General Permit (ISGP) requires Industrial SWPPPs to include certain mandatory Best Management Practices (BMPs), including those BMPs identified as “applicable” to specific industrial activities in Volume IV and V of the this manual. Facilities with new development or redevelopment must evaluate whether flow control BMPs are necessary. BMPs must be consistent with this manual, or other stormwater management guidance documents that are approved by Ecology and incorporated into the ISGP. Facilities may also use alternative BMPs if their Industrial SWPPP includes documentation that the BMPs selected are demonstrably equivalent to practices contained in stormwater technical manuals approved by Ecology, including the proper selection, implementation, and maintenance of all applicable and appropriate best management practices for on-site pollution control.

Ecology’s Industrial Stormwater Webpage has a fill-in-the-blank Industrial SWPPP template for use by industrial facilities.

ISGP facilities are required to update their Industrial SWPPPs and perform corrective actions if stormwater monitoring results exceed “benchmark” or indicator values. Facilities that trigger corrective actions under the ISGP, or otherwise need to update their SWPPP, should consider:

1. “Recommended” operational and structural source control BMPs listed in Volume IV.
2. Treatment BMPs listed in Volume V.
3. Erosion and sediment control BMPs listed in Volume II (e.g., if turbidity, sediment, or associated pollutants need to be addressed).
4. Treatment BMPs that have been evaluated through Ecology’s TAPE or C-TAPE program.
5. BMPs that are “demonstrably equivalent”, as defined by the ISGP.

1.6.9 Construction Stormwater General Permit

Coverage under the CSWGP is generally required for any clearing, grading, or excavating if the project site discharges:

- Stormwater from the site into surface water(s) State, or
- Into storm drainage systems that discharge to a surface water(s) of the State.

And

- Disturbs one or more acres of land area, or
- Disturb less than one acre of land area, if the project or activity is part of a larger common plan of development or sale.

Any construction activity discharging stormwater that Ecology and/or the City determines to be a significant contributor of pollutants to waters of the State may also require permit coverage, regardless of project size, at the discretion of the agency.

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 of the SWMM.
The permit also requires construction sites within Western Washington to implement stormwater BMPs contained in stormwater management manuals published or approved by Ecology, or BMPs that are demonstrably equivalent. Volume II of this manual further describes the requirements and BMPs appropriate for managing construction site stormwater.

1.6.10 Endangered Species Act

With the listing of multiple species of salmon as threatened or endangered across much of Washington State, and the probability of more listings in the future, implementation of the requirements of the Endangered Species Act impacts urban stormwater management. Provisions of the Endangered Species Act can apply to stormwater management include the Section 4(d) rules, Section 7 consultations, and Section 10 Habitat Conservation Plans (HCP).

Under Section 4(d) of the statute, the federal government issues regulations to provide for the conservation of the species. A 4(d) rule may require new development and redevelopment to comply with specific requirements.

Under Section 7 of the statute, all federal agencies must insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species (or a species proposed for listing), nor result in the destruction or adverse modification of designated critical habitat. The responsibility for initially determining whether jeopardy is likely to occur rests with the "action" agency. If an action "may affect" a listed species, the "action" agency must consult with National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries), or the U.S. Fish and Wildlife Service (USFWS) depending on the species involved, to determine whether jeopardy is likely to occur.

Where NOAA Fisheries or USFWS believes that jeopardy would result, it must specify reasonable and prudent alternatives to the action that would avoid jeopardy if any such alternatives are available. If the "action" agency rejects these, the action cannot proceed.

Under Section 10 of the ESA, through voluntary agreements with the federal government that provide protections to an endangered species, a non-federal applicant may commit an "incidental take" of individuals of that species as long as it is incidental to an otherwise lawful activity (such as developing land or building a road). This provision of the ESA may help resolve conflicts between development pressures and endangered species protection. A "Habitat Conservation Plan" (HCP) is an example of this type of agreement. Under an HCP, the applicant's plan must:

- Outline the impact that will likely result from the taking;
- List steps the applicant will take to minimize and mitigate such impacts, and funding available to implement such steps; and
- Include alternative actions the applicant considered and reasons alternative acts are not being used.

The federal government may grant a permit if it finds that the taking will be incidental; the applicant will minimize and mitigate impacts of taking; and the applicant will ensure that adequate funding for the conservation plan will be provided. The USFWS and NOAA Fisheries may require additional measures as necessary or appropriate for purposes of the plan.

1.6.11 Section 401 Water Quality Certifications

For projects that require a fill or dredge permit under Section 404 of the Clean Water Act, Ecology must certify to the permitting agency, the U.S. Army Corps of Engineers, that the proposed project will not violate water quality standards. In order to make such a determination, Ecology may do a more specific
review of the potential impacts of a stormwater discharge from the construction phase of the project and from the completed project. As a result of that review, Ecology may condition its certification to require:

- Application of the core requirements and BMPs in this manual; or
- Application of more stringent requirements.

### 1.6.12 Hydraulic Project Approvals (HPAs)

Under Chapter 77.55 RCW, the Hydraulics Act, the Washington State Department of Fish and Wildlife has the authority to require actions when stormwater discharges related to a project would change the natural flow or bed of state waters. The implementing mechanism is the issuance of a Hydraulics Project Approval (HPA) permit. In exercising this authority, Fish and Wildlife may require:

- Compliance with the provisions of this manual; or
- Application of more stringent requirements that they determine are necessary to meet their statutory obligations to protect fish and wildlife.

### 1.6.13 Aquatic Lands Use Authorizations

The Department of Natural Resources (DNR), as the steward of public aquatic lands, may require a stormwater outfall to have a valid use authorization, and to avoid or mitigate resource impacts. Through its use authorizations, which are issued under authority of Chapter 79.105-79.140 RCW, and in accordance with Chapter 332-30 WAC, DNR may require:

- Compliance with the provisions of this manual; or
- Application of more stringent requirements that they determine are necessary to meet their statutory obligations to protect the quality of the state’s aquatic lands.

### 1.6.14 Requirements Identified through Watershed/Basin Planning or Total Maximum Daily Loads

A number of the requirements of this manual can be superseded by the adoption of ordinances and rules to implement the recommendations of watershed plans or basin plans. Local governments may initiate their own watershed/ basin planning processes to identify more stringent or alternative requirements. They may also choose to develop a watershed plan in accordance with the Watershed Management Act (Chapter 90.82 RCW) that includes the optional elements of water quality and habitat. As long as the actions or requirements identified in those plans and implemented through local or state ordinances or rules comply with applicable state and federal statutes (e.g., the federal Clean Water Act and the Endangered Species Act), they can supersede the requirements in this manual. The decisions concerning whether such locally derived requirements comply with federal and state statutes rest with the regulatory agencies responsible for implementing those statutes.

A requirement of this manual can also be superseded or added to through the adoption of actions and requirements identified in a Total Maximum Daily Load (TMDL) that is approved by the EPA. However, it is likely that at least some TMDLs will require use of the BMPs in this manual.

### 1.6.15 Underground Injection Control Authorizations

According to WAC 173-218-030 UIC well is defined as “a well that is used to discharge fluids into the subsurface. A UIC well is one of the following: (1) A bored, drilled or driven shaft, or dug hole whose depth is greater than the largest surface dimension; (2) An improved sinkhole; or (3) A subsurface fluid distribution system (contains perforated pipe or similar structure).”

Depending upon the manner in which it is accomplished, the discharge of stormwater into the ground can be classified as a Class V injection well. For more information and for a listing on potential stormwater facilities that may have Class V classification refer to the memorandum available at [http://www.ecy.wa.gov/programs/wq/stormwater/municipal/resources/EPAmemoinfiltrationclassvwellspdf](http://www.ecy.wa.gov/programs/wq/stormwater/municipal/resources/EPAmemoinfiltrationclassvwellspdf).

### 1.7 Effects of Urbanization

#### 1.7.1 Background Conditions

Prior to the Euro-American settlement, western Washington primarily was forested in alder, maple, fir, hemlock and cedar. The area's bountiful rainfall supported the forest and the many creeks, springs, ponds, lakes and wetlands. The forest system provided protection by intercepting rainfall in the canopy, reducing the possibility of erosion and the deposition of sediment in waterways. The trees and other vegetative cover evapotranspirated at least 40% of the rainfall. The forest duff layer absorbed large amounts of runoff releasing it slowly to the streams through shallow ground water flow.

#### 1.7.2 Hydrologic Changes

As settlement occurs and the population grows, trees are logged and land is cleared for the addition of impervious surfaces such as rooftops, roads, parking lots, and sidewalks. Maintained landscapes that have much higher runoff characteristics typically replace the natural vegetation. The natural soil structure is also lost due to grading and compaction during construction. Roads are cut through slopes and low spots are filled. Drainage patterns are irrevocably altered. All of this results in drastic changes in the natural hydrology, including:

- Increased volumetric flow rates of runoff
- Increased volume of runoff
- Decreased time for runoff to reach a natural receiving water
- Reduced ground water recharge
- Increased frequency and duration of high stream flows and wetlands inundation during and after wet weather
- Reduced stream flows and wetlands water levels during the dry season
- Greater stream velocities
Figure 1.7.1 – Changes in Hydrology after Development

Figure 1.7.1 illustrates some of these hydrologic changes. As a consequence of these hydrology changes, stream channels are eroded by high flows and can lose summertime base flows. Increased flooding occurs. Streams lose their hydraulic complexity. Habitat is degraded and receiving water species composition is altered as explained below.

Figure 1.7.2 - Channel Stability and Land Use: Hylebos, East Lake Sammamish, Issaquah Basins
Figure 1.7.2 (Booth and Jackson, 1997) illustrates one observed relationship between the level of development in a basin (as measured by effective, not total, impervious area), the changes in the recurrence of modeled stream flows, and the resultant streambank instability and channel erosion. These data show that even a crude measure of stream degradation, “channel instability,” shows significant changes at relatively low levels of urban development. More sensitive measures, such as biological indicators (see Section 1.7.4), document degradation at even lower levels of human activity.

1.7.3 Water Quality Changes

Urbanization also causes an increase in the types and quantities of pollutants in surface and ground waters. Runoff from urban areas has been shown to contain many different types of pollutants, depending on the nature of the activities in those areas. Table 1.7.1, from an analysis of Oregon urban runoff water quality monitoring data collected from 1990 to 1996, shows mean concentrations for a limited number of pollutants from different land uses. (Strecker et al, 1997)

<table>
<thead>
<tr>
<th>Land Use</th>
<th>TSS mg/l</th>
<th>Total Cu mg/l</th>
<th>Total Zn mg/l</th>
<th>Dissolved Cu mg/l</th>
<th>Total P mg/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-pipe Industry</td>
<td>194</td>
<td>0.053</td>
<td>0.629</td>
<td>0.009</td>
<td>0.633</td>
</tr>
<tr>
<td>Instream Industry</td>
<td>102</td>
<td>0.024</td>
<td>0.274</td>
<td>0.007</td>
<td>0.509</td>
</tr>
<tr>
<td>Transportation</td>
<td>169</td>
<td>0.035</td>
<td>0.236</td>
<td>0.008</td>
<td>0.376</td>
</tr>
<tr>
<td>Commercial</td>
<td>92</td>
<td>0.032</td>
<td>0.168</td>
<td>0.009</td>
<td>0.391</td>
</tr>
<tr>
<td>Residential</td>
<td>64</td>
<td>0.014</td>
<td>0.108</td>
<td>0.006</td>
<td>0.365</td>
</tr>
<tr>
<td>Open</td>
<td>58</td>
<td>0.004</td>
<td>0.025</td>
<td>0.004</td>
<td>0.166</td>
</tr>
</tbody>
</table>

Note: In-pipe industry means the samples were taken in stormwater pipes. Instream industry means the samples were taken in streams flowing through industrial areas. Samples for all other categories were taken within stormwater pipes.

The runoff from roads and highways is contaminated with pollutants from vehicles. Oil and grease, polynuclear aromatic hydrocarbons (PAH’s), lead, zinc, copper, cadmium, as well as sediments (soil particles) and road salts are typical pollutants in road runoff. Runoff from industrial areas typically contains even more types of heavy metals, sediments, and a broad range of man-made organic pollutants, including phthalates, PAH’s, and other petroleum hydrocarbons. Residential areas contribute the same road-based pollutants to runoff, as well as herbicides, pesticides, nutrients (from fertilizers), bacteria and viruses (from animal waste). All of these contaminants can seriously impair beneficial uses of receiving waters.

Regardless of the eventual land use conversion, the sediment load produced by a construction site can turn the receiving waters turbid and be deposited over the natural sediments of the receiving water.

The pollutants added by urbanization can be dissolved in the water column or can be attached to particulates that settle in streambeds, lakes, wetlands, or marine estuaries. A number of urban bays in Puget Sound have contaminated sediments due to pollutants associated with particulates in stormwater runoff.

Urbanization also tends to cause changes in water temperature. Heated stormwater from impervious surfaces and exposed treatment and detention ponds discharges to streams with less riparian vegetation for shade. Urbanization also reduces ground water recharge, which reduces sources of cool ground water.

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inputs to streams. In winter, stream temperatures may lower due to loss of riparian cover. There is also concern that the replacement of warmer ground water inputs with colder surface runoff during colder periods may have biological impacts.

1.7.4 Biological Changes

The hydrologic and water quality changes result in changes to the biological systems that were supported by the natural hydrologic system. In particular, aquatic life is greatly affected by urbanization. Habitats are drastically altered when a stream changes its physical configuration and substrate due to increased flows. Natural riffles, pools, gravel bars and other areas are altered or destroyed. These and other alterations produce a habitat structure that is very different from the one in which the resident aquatic life evolved. For example, spawning areas, particularly those of salmonids, are lost. Fine sediments imbed stream gravels and suffocate salmon redds. The complex food web is destroyed and is replaced by a biological system that can tolerate the changes. However, that biological community is typically not as complex, is less desirable, and is unstable due to the ongoing rapid changes in the new hydrologic regime.

Significant and detectable changes in the biological community of Puget Sound lowland streams begin early in the urbanization process. May et al (1997) reported changes in the 5-10% total impervious area range of a watershed. Figure 1.7.3 from May et al (1997) shows the relationship observed between the Benthic Index of Biotic Integrity (B-IBI) developed by Kleindl (1995) and Karr (1991), and the extent of watershed urbanization as estimated by the percentage of total impervious area (% TIA). Also shown in the figure is the correlation between the abundance ratio of juvenile coho salmon to cutthroat trout (Lucchetti and Fuerstenberg 1993) and the extent of urbanization.

The biological communities in wetlands are also severely impacted and altered by the hydrological changes. Relatively small changes in the natural water elevation fluctuations can cause dramatic shifts in vegetative and animal species composition.

In addition, the toxic pollutants in the water column such as pesticides, soaps, and metals can have immediate and long-term lethal impacts. Toxic pollutants in sediments can yield similar impacts with the lesions and cancers in bottom fish of urban bays serving as a prime example.

A rise in water temperature can have direct lethal effects. It reduces the maximum available dissolved oxygen and may cause algae blooms that further reduce the amount of dissolved oxygen in the water.
1.7.5 The Role of Land Use and Lifestyles

The manual’s scope is limited to managing the surface runoff generated by a new development or redevelopment project. The manual does not intend to delve deeply into site development standards or where development should be allowed. Those are land use decisions that should not be directed by this stormwater manual. The manual applies after the decision to develop a site has been made. The manual can provide site development strategies to reduce the pollutants generated and the hydrologic disruptions caused by development.

The engineered stormwater conveyance, treatment, and detention systems advocated by this and other stormwater manuals can reduce the impacts of development to water quality and hydrology. But they cannot replicate the natural hydrologic functions of the natural watershed that existed before development, nor can they remove sufficient pollutants to replicate the water quality of pre-development conditions. Ecology understands that despite the application of appropriate practices and technologies identified in this manual, some degradation of urban and suburban receiving waters will continue, and some beneficial uses will continue to be impaired or lost due to new development. This is because land development, as practiced today, is incompatible with the achievement of sustainable ecosystems. Unless development methods are adopted that cause significantly less disruption of the hydrologic cycle, the cycle of new development followed by beneficial use impairments will continue.

In recent years, researchers (May et al, 1997) and regulators (e.g., Issaquah Creek Basin and Nonpoint Action Plan, 1996) have speculated on the amount of natural land cover and soils that should be preserved in a watershed to retain sufficient hydrologic conditions to prevent stream channel degradation, maintain base flows, and contribute to achieving properly functioning conditions for salmonids. There is some agreement that preserving a high percentage (possibly 65 to 75%) of the land cover and soils in an undisturbed state is necessary. To achieve these high percentages in urban, urbanizing, and suburban watersheds, a dramatic reduction is necessary in the amount of impervious surfaces and artificially landscaped areas to accommodate our preferred housing, play, and work environments, and most significantly, our transportation choices.
Surfaces created to provide “car habitat” comprise the greatest portion of impervious areas in land development. Therefore, to make appreciable progress in reducing impervious surfaces in a watershed, we must reduce the density of our road systems, alter our road construction standards, reduce surface parking, and rely more on transportation systems that do not require such extensive impervious surfaces (rail, bicycles, walking).

Reducing the extent of impervious surfaces and increasing natural land cover in watersheds are also necessary to solve the water quality problems of sediment, temperature, toxicants, and bacteria. Changing public attitudes toward chemical use and preferred housing are also necessary to achieve healthy water ecosystems.

Until we are successful in applying land development techniques that result in matching the natural hydrologic functions and cycles of watersheds, management of the increased surface runoff is necessary to reduce the impact of the changes. Figure 1.7.3 illustrates that significant biological impacts in streams can occur at even low levels of development associated with rural areas where stormwater runoff has not been properly managed. Improving our stormwater detention, treatment, and source control management practices should help reduce the impacts of land development in urban and rural areas. We must also improve the operation and maintenance of our engineered systems so that they function as well as possible. This manual is Ecology’s latest effort to apply updated knowledge in these areas.

The question yet to be answered is whether better management – including improved treatment and detention techniques – of the increased surface runoff from developed areas can work in combination with preservation of high percentages of natural vegetation and soils on a watershed scale to yield a minimally altered hydrologic and water quality regime that protects the water-related natural resources.

In summary, implementing improved engineering techniques and drastic changes in where and how land is developed and how people live and move across the land are necessary to achieve the goals in the federal Clean Water Act - to preserve, maintain, and restore the beneficial uses of our nation’s waters.
Chapter 2 - Core Requirements for New Development and Redevelopment

This chapter identifies the nine Core Requirements for stormwater management applicable to new development and redevelopment sites. The Core Requirements are:

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

Depending on the type and size of the proposed project, different combinations of these core requirements apply. In general, small sites are required to control erosion and sedimentation from construction activities and to apply simpler approaches to treatment and flow control of stormwater runoff from the developed site. Controlling flows from small sites is important because the cumulative effect of uncontrolled flows from many small sites can be as damaging as those from a single large site.

Large sites must provide erosion and sedimentation control during construction, permanent control of stormwater runoff from the developed site through selection of appropriate BMPs and facilities, and other measures to reduce and control the on-site and off-site impacts of the project. Sites being redeveloped must generally meet the same core requirements as new development for the new and replaced hard surfaces and pervious surfaces converted to lawn or landscaped areas. In some cases, redevelopment may be required to apply all core requirements to all surfaces (refer to Section 2.4). Redevelopment sites must also provide erosion control, source control, and on-site stormwater management for the portion of the site being redeveloped. In addition, if the redevelopment meets certain cost or space (as applied to roads) thresholds, updated stormwater management for the redeveloped pervious and hard surfaces must be provided. There may also be situations in which additional controls are required for sites, regardless of type or size, as a result of basin plans or special water quality concerns.

Development sites are to demonstrate compliance with these requirements through the preparation of Drainage Control Plans. The plans are described in detail in Chapter 3. The major components of these plans are a Construction Stormwater Pollution Prevention Plan (SWPPP), Site Development Drawings, Stormwater Site Management Plans, and Drainage Design Report. The Construction SWPPP shall identify how the project intends to control pollution generated during the construction phase only, primarily erosion and sediment. The Drainage Design Report shall identify how the project intends to provide permanent BMPs for the control of pollution from stormwater runoff after construction has been completed. Sites must submit these plans for review by the City if they add or replace 2,000 square feet or more of hard surface, or disturb 7,000 square feet or more of land.

Section 2.4 provides additional information on applicability of the Core Requirements to different types of sites.
2.1 Relationship to Municipal Stormwater Permits
Municipalities covered under the Phase I or Western Washington Phase II NPDES and State Waste Discharge Municipal Stormwater Permits should use Appendix 1 of those permits rather than the bold font statements of this chapter for determining their compliance requirements.

2.2 Exemptions
Unless otherwise indicated in this Section, the practices described in this section are exempt from the Core Requirements, even if such practices meet the definition of new development or redevelopment.

Forest practices:
Forest practices regulated under Title 222 WAC, except for Class IV General forest practices that are conversions from timber land to other uses, are exempt from the provisions of the core requirements.

Commercial agriculture:
Commercial agriculture practices involving working the land for production are generally exempt. However, the conversion from timberland to agriculture, and the construction of impervious surfaces are not exempt.

Pavement Maintenance:
The following pavement maintenance practices are exempt: pothole and square cut patching, overlaying existing asphalt or concrete pavement with asphalt or concrete without expanding the area of coverage, shoulder grading, reshaping/regrading drainage systems, crack sealing, resurfacing with in-kind material without expanding the road prism, pavement preservation activities that do not expand the road prism, and vegetation maintenance.

The following pavement maintenance practices are not categorically exempt. They are considered redevelopment. The extent to which the manual applies is explained for each circumstance.

- Removing and replacing a paved surface to base course or lower, or repairing the pavement base: If impervious surfaces are not expanded, Core Requirements #1 - #5 apply. Extending the pavement edge without increasing the size of the road prism, or paving graveled shoulders: These are considered new impervious surfaces and are subject to the core requirements that are triggered when the thresholds identified for new or redevelopment projects are met.
- Resurfacing by upgrading from dirt to gravel, asphalt, or concrete; upgrading from gravel to asphalt, or concrete; or upgrading from a bituminous surface treatment (“chip seal”) to asphalt or concrete: These are considered new impervious surfaces and are subject to the core requirements that are triggered when the thresholds identified for new or redevelopment projects are met.
- Installing curbs or sidewalks. The curbs and walks are new impervious surfaces, and if their installation concentrates previously dispersed stormwater, the entire contributing area shall comply with applicable core requirements.

Underground utility projects:
Underground utility projects that replace the ground surface with in-kind material or materials with similar runoff characteristics are only subject to Core Requirement #2, Construction Stormwater Pollution Prevention.
2.3 Definitions Related to Core Requirements

Terms that Ecology presented in this section of previous versions of the manual have been moved to the glossary. Refer to the Glossary in Appendix I-G of this volume for definitions of terms used throughout this manual.

2.4 Applicability of the Core Requirements

Not all of the Core Requirements apply to every development or redevelopment project. The applicability varies depending on the project type and size. This section identifies thresholds that determine the applicability of the Core Requirements to different projects. Use the flow charts in Figures 2.4.1 and 2.4.2 to determine which of the Core Requirements apply. The Core Requirements themselves are presented in Section 2.5.

Use the thresholds in Figures 2.4.1 and 2.4.2 at the time of application for a subdivision, plat, short plat, building permit, or other construction permit. The plat or short plat approval shall identify all stormwater BMPs that are required for each lot. For projects involving only land disturbing activities, (e.g., clearing or grading), the thresholds apply at the time of application for the permit allowing or authorizing that activity. Note the exemption in Section 2.2 for forest practices other than Class IV General.
Figure 2.4.1 – Flow Chart for Determining Requirements for New Development

Start Here

Does the site have 35% or more of existing impervious coverage?

No

Does the project result in 5,000 square feet, or greater, of new plus replaced hard surface area?

Yes

Does the project convert \( \frac{3}{4} \) acres or more of vegetation to lawn or landscaped areas, or convert 2.5 acres or more of native vegetation to pasture?

No

Yes

All Core Requirements apply to the new and replaced hard surfaces and converted vegetation areas.

Yes

No

Does the project result in 2,000 square feet, or greater, of new plus replaced hard surface area?

No

Yes

Core Requirements #1 through #5 apply to the new and replaced hard surfaces and the land disturbed.

Yes

No

Does the project have land disturbing activities of 7,000 square feet or greater?

Core Requirement #2 applies.
Figure 2.4.2 – Flow Chart for Determining Requirements for Redevelopment

```
Does the project result in 2,000 square feet, or more, of new plus replaced hard surface area?  
OR Does the land disturbing activity total 7,000 square feet or greater?

Yes

Core Requirements #1 through #5 apply to the new and replaced hard surfaces and the land disturbed.

No

Core Requirement #2 applies.

Next Question

Does the project add 5,000 square feet or more of new hard surfaces?  
OR Convert ¼ acres or more of vegetation to lawn or landscaped areas?  
OR Convert 2.5 acres or more of native vegetation to pasture?

Yes

All Core Requirements apply to new and replaced hard surfaces and the converted vegetation areas.

No

Next Question

Is this a road related project?

Yes

Is the total of new plus replaced hard surfaces 5,000 square feet or more, AND either of the following:  
(1) Do the new hard surfaces add 50% or more to the existing hard surfaces within the project site,  
OR  
(2) Does the valuation of proposed improvements – including interior improvements exceed 50% of the assessed value (or replacement value) of the existing site improvements?

Yes

Do new hard surfaces add 50% or more to the existing hard surfaces within the project limits,  
OR  
Do the project costs, excluding engineering and stormwater management costs exceed $500,000?

No

No

No additional requirements.

Yes

All Core Requirements apply to all hard surfaces and converted vegetation areas within the site. Mitigation costs for existing hard surfaces is capped at 30% of project costs.
```
2.4.1 New Development
All new development shall be required to comply with Core Requirement #2.

The following new development shall comply with Core Requirements #1 through #5 for the new and replaced hard surfaces and the land disturbed:

- Results in 2,000 square feet, or greater, of new, replaced, or new plus replaced hard surface area, or
- Has land disturbing activity of 7,000 square feet or greater.

The following new development shall comply with Core Requirements #1 through #9 for the new and replaced hard surfaces and the converted vegetation areas:

- Results in 5,000 square feet, or greater, of new plus replaced hard surface area, or
- Converts ¾ acres, or more, of vegetation to lawn or landscaped areas, or
- Converts 2.5 acres, or more, of native vegetation to pasture.
- Refer to Figure 2.4.1.

Supplemental Guidelines
For purposes of applying the above thresholds to a proposed single family residential subdivision (i.e., a plat or short plat project) assume 4,000 sq. ft. of hard surface (8,000 sq. ft. on lots of 5 acres or more) for each newly created lot, unless the project proponent has otherwise formally declared other values for each lot in the corresponding complete land division application. Where city land use regulations restrict maximum hard (or impervious) surfaces to smaller amounts, those maxima may be used.

Regional stormwater facilities may be used as an alternative method of meeting Core Requirements 6, 7, and 8, through documented engineering reports detailing how the proposed facilities meet these requirements for the sites that drain to them. Such facilities must be operational prior to and must have capacity for new development.

Basin planning is encouraged and may be used to tailor Core Requirements: #5 On-site Stormwater Management, #6 Runoff Treatment, #7 Flow Control, and / or #8 Wetlands Protection. Basin planning may be used to support alternative treatment, flow control, and/or wetland protection through construction of regional stormwater facilities. Such facilities must be operational prior to and must have capacity for new development.

Where new development projects require improvements (e.g., frontage improvements) that are not within the same threshold discharge area, the City may allow the Core Requirements to be met for an equivalent (flow and pollution characteristics) area that drains to the same receiving water.

2.4.2 Redevelopment
All redevelopment shall be required to comply with Core Requirement #2. In addition, all redevelopment that exceeds certain thresholds shall be required to comply with Core Requirements as follows.

The following redevelopment shall comply with Core Requirements #1 through #5 for the new and replaced hard surfaces and the land disturbed:

- Results in 2,000 square feet or more, of new plus replaced hard surface area, or
- Has land disturbing activity of 7,000 square feet or greater.
The following redevelopment shall comply with Core Requirements #1 through #9 for the new hard surfaces and converted pervious areas:

- Adds 5,000 square feet or more of new hard surfaces or,
- Converts ¾ acres, or more, of vegetation to lawn or landscaped areas, or
- Converts 2.5 acres, or more, of native vegetation to pasture.

If the runoff from the new impervious surfaces and converted pervious surfaces is not separated from runoff from other existing surfaces on the project site, the stormwater treatment and flow control facilities must be sized for the entire flow that is directed to them.

When redevelopment modifies an existing flow control or treatment facility, the re-constructed facility must be designed to current standards.

The City may allow the Core Requirements to be met for an equivalent (flow and pollution characteristics) area within the same site. For public roads projects, the equivalent area does not have to be within the project limits, but must drain to the same receiving water.

**Additional Requirements for the Site**

For road-related projects, runoff from all hard surfaces (including pavement, shoulders, curbs, and sidewalks) and the converted vegetated areas shall meet all the Core Requirements if the new hard surfaces total 5,000 square feet or more and add 50% or more to the existing hard surfaces within the project limits or the estimated cost of the road project, excluding engineering, contingency, and stormwater treatment costs exceed $500,000. The project limits shall be defined by the length of the project and the width of the right-of-way. The $500,000 value shall be inflation adjusted from January 2005 to current dollars as of the date of project application, using Engineering News Record (ENR) national 20-city construction cost index (the index value was 7297 January 2005).

For road projects that concentrate and redirect previously dispersed runoff, such as by installing curbs, all applicable Core Requirements apply to the total contributing area.

Other types of redevelopment projects shall comply with Core Requirements #1 through #9 for all hard surfaces and the converted vegetated areas if the total of new plus replaced hard surfaces is 5,000 square feet or more and the new hard surfaces add 50% or more to the existing hard surfaces within the project site, or if the total of new plus replaced hard surfaces is 5,000 square feet or more and the valuation of proposed improvements – including interior improvements – exceeds 50% of the assessed value of the existing site improvements. The square footage and improvement value thresholds shall be cumulative and include all projects permitted on or after January 1, 2000.

The total cost of stormwater improvements to mitigate existing hard surfaces shall be capped at 30% of the total project costs.

The City may grant a variance/exception to the application of the flow control requirements to replaced impervious surfaces if such application imposes a severe economic hardship. See Section 2.8 of this chapter.

**Objective**

Redevelopment projects have the same requirements as new development projects in order to minimize or reduce the impacts from new or replaced surfaces. To not discourage redevelopment projects, all surfaces aren’t required to be brought up to new stormwater standards unless the noted cost or space thresholds are exceeded. However, if the redevelopment project scope is sufficiently large that the cost or space criteria noted above are
exceeded, it is reasonable to require the replaced surfaces to be brought up to current stormwater standards. This is consistent with other utility standards. When a structure or a property undergoes significant remodeling, local governments often require the site to be brought up to new building code requirements (e.g., on-site sewage disposal systems, fire systems).

**Supplemental Guidelines**

If runoff from new hard surfaces, converted vegetation areas, and replaced hard surfaces (if the applicable cost or space threshold has been exceeded) is not separated from runoff from other existing surfaces within the project site or the site, the guidance in Appendix III-B of Volume III for off-site inflow shall be used to size the detention facilities.

The City may allow development projects to pay a fee-in-lieu of stormwater facilities. Please refer to Appendix I-E for the City’s permitting authority’s fee-in-lieu policy.

Underground utility projects that replace the ground surface with in-kind material or materials with similar runoff characteristics should not be subject to redevelopment requirements except construction site erosion control.

The City reviews all road projects for changes in elevations or drainage flowpath that could cause flooding, upland or stream erosion, or changes to discharges to wetlands. For example, adding curbs will result in redirecting flows and possibly causing new downstream impacts. The city will set project-specific requirements to avoid or mitigate those impacts.

### 2.5 Core Requirements

This section describes the core requirements for stormwater management at development and redevelopment sites. Section 2.4 should be consulted to determine which requirements apply to any given project. Figures 2.4.1 and 2.4.2 should be consulted to determine whether the core requirements apply to disturbed areas, new surfaces, replaced surfaces, or new and replaced surfaces. Volumes II through V of this manual present Best Management Practices (BMPs) for use in meeting the Core Requirements.

Throughout this chapter, requirements are written in bold and supplemental guidelines that serve as advice and other materials are not in bold.

#### 2.5.1 Core Requirement #1: Preparation of Drainage Control Plans

All projects meeting the thresholds in Section 2.4 shall prepare a Drainage Control Plan or an Abbreviated Drainage Plan for city review. Drainage Control Plans and Abbreviated Drainage Plans shall use site-appropriate development principles, as required and encouraged by city development codes, to retain native vegetation and minimize impervious surfaces to the extent feasible. Drainage Control Plans and Abbreviated Drainage Plans shall be prepared in accordance with Chapter 3 of this volume. Contact the local permitting authority for information on standardized drainage control plan requirements for small projects (e.g., single family and duplex residences).

**Objective**

The 2,000 square feet threshold for hard surfaces and 7,000 square foot threshold for land disturbance are chosen to capture most single-family home construction and their equivalent. Note that the scope of the drainage control plan only covers compliance with Core Requirements #2 through #5 if the thresholds of 5,000 square feet of hard surface or conversion of ¾ acre of vegetation to lawn or landscape, or conversion of 2.5 acres of vegetation to pasture are not
exceeded. When only Core Requirements #1 through #5 are triggered, applicants may submit an Abbreviated Drainage Plan per Chapter 3 of this volume.

**Supplemental Guidelines**

Projects proposed by City departments and lines of business must comply with this requirement. The City shall determine the process for ensuring proper project review, inspection, and compliance by its own departments and agencies.

The City may require the project to participate in a “scoping meeting” early in the project to discuss the development site’s conceptual stormwater approach. This meeting may also be used to identify potential problems and to outline Drainage Control Plan scope and content. Refer to Section 3.3 to determine if a project is required to schedule a stormwater scoping meeting.

### 2.5.2 Core Requirement #2: Construction Stormwater Pollution Prevention (SWPP)

#### Thresholds

All new development and redevelopment projects are responsible for preventing erosion and discharge of sediment and other pollutants into receiving waters.

Projects which result in 2,000 square feet or more of new plus replaced hard surface area (including demolition), or which disturb 7,000 square feet or more of land must prepare a Construction SWPP Plan (SWPPP) as part of the Drainage Control Plan (see Section 2.5.1).

Projects that result in less than 2,000 square feet of new plus replaced hard surface area, or disturb less than 7,000 square feet of land are not required to prepare a Construction SWPPP, but must consider all of the 13 Elements of Construction Stormwater Pollution Prevention and develop controls for all elements that pertain to the project site.

#### General Requirements

The SWPPP shall include a narrative and drawings. All BMPs shall be clearly referenced in the narrative and marked on the drawings. The SWPPP narrative shall include documentation to explain and justify the pollution prevention decisions made for the project. Each of the 13 elements must be considered and included in the Construction SWPPP unless site conditions render the element unnecessary and the exemption from that element is clearly justified in the narrative of the SWPPP.

Clearing and grading activities for developments shall be permitted only if conducted pursuant to an approved site development plan (e.g., subdivision approval) that establishes permitted areas of clearing, grading, cutting, and filling. These permitted clearing and grading areas and any other areas required to preserve critical or sensitive areas, buffers, native growth protection easements, or tree retention areas shall be delineated on the site plans and the development site.

The SWPPP shall be implemented beginning with initial land disturbance and until final stabilization. Sediment and Erosion control BMPs shall be consistent with the BMPs contained in chapters 3 and 4 of Volume II.

Seasonal Work Limitations - From October 15 through April 1, clearing, grading, and other soil disturbing activities shall only be permitted if shown to the satisfaction of the local permitting authority that silt-laden runoff will be prevented from leaving the site through a combination of the following:

1. Site conditions including existing vegetative coverage, slope, soil type and proximity to receiving waters.
2. Limitations on activities and the extent of disturbed areas.
3. Proposed erosion and sediment control measures.

Note that projects performing work under a NPDES Construction Stormwater General Permit issued by Ecology may have more restrictive seasonal work limitations. The following activities are exempt from the seasonal clearing and grading limitations:

1. Routine maintenance and necessary repair of erosion and sediment control BMPs.
2. Routine maintenance of public facilities or existing utility structures that do not expose the soil or result in the removal of the vegetative cover to soil.
3. Activities where there is one hundred percent infiltration of surface water runoff within the site in approved and installed erosion and sediment control facilities.

Project Requirements - Construction SWPPP Elements

In most cases, all of the following elements shall apply and be implemented throughout construction. Self-contained sites (discharges only to groundwater) must comply with all elements with the exception of Element 3: Control Flow Rates.

**Element 1: Preserve Vegetation/Mark Clearing Limits**

- Before beginning land disturbing activities, including clearing and grading, clearly mark all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area.
- Retain the duff layer, native top soil, and natural vegetation in an undisturbed state to the maximum degree practicable.

**Element 2: Establish Construction Access**

- Limit construction vehicle access and exit to one route, if possible.
- Stabilize access points with a pad of quarry spalls, crushed rock, or other equivalent BMPs, to minimize tracking of sediment onto public roads.
- Locate wheel wash or tire baths on site, if the stabilized construction entrance is not effective in preventing tracking sediment onto roads.
- If sediment is tracked off site, clean the affected roadway thoroughly at the end of each day, or more frequently as necessary (for example, during wet weather). Remove sediment from roads by shoveling, sweeping, or pick up and transport the sediment to a controlled sediment disposal area.
- Conduct street washing only after sediment is removed in accordance with the above bullet.
- Control street wash wastewater by pumping back on-site, or otherwise prevent it from discharging into systems tributary to waters of the State.

**Element 3: Control Flow Rates**

- Protect properties and waterways downstream of development sites from erosion and the associated discharge of turbid waters due to increases in the velocity and peak volumetric flow rate of stormwater runoff from the project site.
- Where necessary to comply with the bullet above, construct stormwater retention or detention facilities as one of the first steps in grading. Assure that detention facilities function properly before constructing site improvements (e.g. impervious surfaces).
- If permanent infiltration ponds are used for flow control during construction, protect these facilities from siltation during the construction phase.
**Element 4: Install Sediment Controls**

- Design, install, and maintain effective erosion controls and sediment controls to minimize the discharge of pollutants.
- Construct sediment control BMPs (sediment ponds, traps, filters, etc.) as one of the first steps in grading. These BMPs shall be functional before other land disturbing activities take place.
- Minimize sediment discharges from the site. The design, installation and maintenance of erosion and sediment controls must address factors such as the amount, frequency, intensity and duration of precipitation, the nature of resulting stormwater runoff, and soil characteristics, including the range of soil particle sizes expected to be present on the site.
- Direct stormwater runoff from disturbed areas through a sediment pond or other appropriate sediment removal BMP, before the runoff leaves a construction site or before discharge to an infiltration facility. Runoff from fully stabilized areas may be discharged without a sediment removal BMP, but must meet the flow control performance standard in Element #3, bullet #1.
- Locate BMPs intended to trap sediment on-site in a manner to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages.
- Where feasible, design outlet structures that withdraw impounded stormwater from the surface to avoid discharging sediment that is still suspended lower in the water column.

**Element 5: Stabilize Soils**

- Stabilize exposed and unworked soils by application of effective BMPs that prevent erosion. Applicable BMPs include, but are not limited to: temporary and permanent seeding, sodding, mulching, plastic covering, erosion control fabrics and matting, soil application of polyacrylamide (PAM), the early application of gravel base early on areas to be paved, and dust control.
- Control stormwater volume and velocity within the site to minimize soil erosion.
- Control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion.
- Soils must not remain exposed and unworked for more than the time periods set forth below to prevent erosion:
  - During the dry season (April 2 – October 14): 7 days
  - During the wet season (October 15 - April 1): 2 days
- Note that projects performing work under a NPDES Construction Stormwater General Permit issued by Ecology will have more restrictive time periods.
- Stabilize soils at the end of the shift before a holiday or weekend if needed based on the weather forecast.
- Stabilize soil stockpiles from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways and drainage channels.
- Minimize the amount of soil exposed during construction activity.
- Minimize the disturbance of steep slopes.
- Minimize soil compaction and, unless infeasible, preserve topsoil.
Element 6: Protect Slopes

- Design and construct cut-and-fill slopes in a manner to minimize erosion. Applicable practices include, but are not limited to, reducing continuous length of slope with terracing and diversions, reducing slope steepness, and roughening slope surfaces (for example, track walking).
- Divert off-site stormwater (run-on) or ground water away from slopes and disturbed areas with interceptor dikes, pipes and/or swales. Off-site stormwater should be managed separately from stormwater generated on the site.
- At the top of slopes, collect drainage in pipe slope drains or protected channels to prevent erosion.
  - Temporary pipe slope drains must handle the peak 10-minute velocity of flow from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year and 1-hour flow rate predicted by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the Western Washington Hydrology Model (WWHM) to predict flows, bare soil areas should be modeled as "landscaped" area.
  - Place excavated material on the uphill side of trenches, consistent with safety and space considerations.
  - Place check dams at regular intervals within constructed channels that are cut down a slope.

Element 7: Protect Drain Inlets

- Protect all storm drain inlets made operable during construction so that stormwater runoff shall not enter the conveyance system without first being filtered or treated to remove sediment.
- Clean or remove and replace inlet protection devices when sediment has filled one-third of the available storage (unless a different standard is specified by the product manufacturer).

Element 8: Stabilize Channels and Outlets

- Design, construct, and stabilize all on-site conveyance channels to prevent erosion from the following expected peak flows:
  - Channels must handle the peak volumetric flow rate calculated using a 10-minute time step from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate indicated by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the Western Washington Hydrology Model (WWHM) to predict flows, bare soil areas should be modeled as "landscaped" area.
  - Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream reaches at the outlets of all conveyance systems.
Element 9: Control Pollutants

- Design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants.
- Handle and dispose of all pollutants, including waste materials and demolition debris that occur on-site in a manner that does not cause contamination of stormwater.
- Provide cover, containment, and protection from vandalism for all chemicals, liquid products, petroleum products, and other materials that have the potential to pose a threat to human health or the environment. On-site fueling tanks must include secondary containment. Secondary containment means placing tanks or containers within an impervious structure capable of containing 110% of the volume contained in the largest tank within the containment structure. Double-walled tanks do not require additional secondary containment.
- Conduct maintenance, fueling, and repair of heavy equipment and vehicles using spill prevention and control measures. Clean contaminated surfaces immediately following any spill incident.
- Discharge wheel wash or tire bath wastewater to a separate on-site treatment system that prevents discharge to surface water, such as closed-loop recirculation or upland application, or to the sanitary sewer, with local sewer district approval.
- Apply fertilizers and pesticides in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Follow manufacturers’ label requirements for application rates and procedures.
- Use BMPs to prevent contamination of stormwater runoff by pH modifying sources. The sources for this contamination include, but are not limited to: bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, dewatering concrete vaults, concrete pumping and mixer washout waters.
- Adjust the pH of stormwater if necessary to prevent violations of water quality standards.
- Assure that washout of concrete trucks is performed off-site or in designated concrete washout areas only. Do not wash out concrete trucks onto the ground, or into storm drains, open ditches, streets, or streams. Do not dump excess concrete on-site, except in designated concrete washout areas. Concrete spillage or concrete discharge to surface waters of the State is prohibited.
- Obtain written approval from Ecology before using chemical treatment other than CO2 or dry ice to adjust pH.

Element 10: Control De-Watering

- Discharge foundation, vault, and trench de-watering water, which has similar characteristics to stormwater runoff at the site, into a controlled conveyance system before discharge to a sediment trap or sediment pond.
- Discharge clean, non-turbid de-watering water, such as well-point ground water, to systems tributary to, or directly into surface waters of the State, as specified in Element #8, provided the de-watering flow does not cause erosion or flooding of receiving waters. Do not route clean dewatering water through stormwater sediment ponds. Note that “surface waters of the State” may exist on a construction site as well as off site; for example, a creek running through a site.
- Handle highly turbid or otherwise contaminated dewatering water separately from stormwater.
• Other treatment or disposal options may include:
  1. Infiltration.
  2. Transport off-site in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters.
  3. Ecology-approved on-site chemical treatment or other suitable treatment technologies.
  4. Sanitary or combined sewer discharge with local sewer district approval, if there is no other option.
  5. Use of a sedimentation bag that discharges to a ditch or swale for small volumes of localized dewatering.

Element 11: Maintain BMPs
• Maintain and repair all temporary and permanent erosion and sediment control BMPs as needed to assure continued performance of their intended function in accordance with BMP specifications.
• Remove all temporary erosion and sediment control BMPs within 30 days after achieving final site stabilization or after the temporary BMPs are no longer needed.

Element 12: Manage The Project
• Phase development projects to the maximum degree practicable and take into account seasonal work limitations.
• Inspection and monitoring – Inspect, maintain and repair all BMPs as needed to assure continued performance of their intended function. Projects regulated under the Construction Stormwater General Permit must conduct site inspections and monitoring in accordance with Special Condition S4 of the Construction Stormwater General Permit.
• Maintaining an updated construction SWPPP – Maintain, update, and implement the SWPPP.
• Projects that disturb one or more acres must have site inspections conducted by a Certified Erosion and Sediment Control Lead (CESCL). Project sites disturbing less than one acre may have a CESCL or a person without CESCL certification conduct inspections. By the initiation of construction, the SWPPP must identify the CESCL or inspector, who must be present on-site or on-call at all times.
• The CESCL or inspector (project sites less than one acre) must have the skills to assess the:
  • Site conditions and construction activities that could impact the quality of stormwater.
  • Effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.
• The CESCL or inspector must examine stormwater visually for the presence of suspended sediment, turbidity, discoloration, and oil sheen. They must evaluate the effectiveness of BMPs and determine if it is necessary to install, maintain, or repair BMPs to improve the quality of stormwater discharges.
• Based on the results of the inspection, construction site operators must correct the problems identified by:
  • Reviewing the SWPPP for compliance with the 13 construction SWPPP elements and making appropriate revisions within seven (7) calendar days of the inspection.
• Immediately beginning the process of fully implementing and maintaining appropriate source control and/or treatment BMPs as soon as possible, addressing the problems not later than within 10 days of the inspection. If installation of necessary treatment BMPs is not feasible within 10 days, the construction site operator may request an extension within the initial 10-day response period.

• Documenting BMP implementation and maintenance in the site log book (sites larger than 1 acre).

• The CESCL or inspector must inspect all areas disturbed by construction activities, all BMPs, and all stormwater discharge points at least once every calendar week and within 24 hours of any discharge from the site. (For purposes of this condition, individual discharge events that last more than one day do not require daily inspections. For example, if a stormwater pond discharges continuously over the course of a week, only one inspection is required that week.) The CESCL or inspector may reduce the inspection frequency for temporary stabilized, inactive sites to once every calendar month.

**Element 13: Protect Low Impact Development BMPs**

• Protect all Bioretention and Rain Garden BMPs from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain into the Bioretention and/or Rain Garden BMPs. Restore the BMPs to their fully functioning condition if they accumulate sediment during construction. Restoring the BMP must include removal of sediment and any sediment-laden Bioretention/rain garden soils, and replacing the removed soils with soils meeting the design specification.

• Prevent compacting Bioretention and rain garden BMPs by excluding construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.

• Control erosion and avoid introducing sediment from surrounding land uses onto permeable pavements. Do not allow muddy construction equipment on the base material or pavement. Do not allow sediment-laden runoff onto permeable pavements or base materials.

• Pavement fouled with sediments or no longer passing an initial infiltration test must be cleaned using procedures in accordance with this manual or the manufacturer’s procedures.

• Keep all heavy equipment off existing soils under LID facilities that have been excavated to final grade to retain the infiltration rate of the soils.

**Objective**

To control erosion and prevent sediment and other pollutants from leaving the site during the construction phase of a project. To have fully functional stormwater facilities and BMPs for the developed site upon completion of construction.
**Supplemental Guidelines**

If a Construction SWPPP is found to be inadequate (with respect to erosion and sediment control requirements), then the Plan Approval Authority within the City shall require that other BMPs be implemented, as appropriate.

The Plan Approval Authority may allow development of generic Construction SWPPP’s that apply to commonly conducted public road activities, such as road surface replacement, that trigger this core requirement. They may also develop an abbreviated SWPPP format for project sites that will disturb less than 1 acre.

Based on the information provided and/or local weather conditions, the local permitting authority may expand or restrict the seasonal limitation on site disturbance. The local permitting authority shall take enforcement action - such as a notice of violation, administrative order, penalty, or stop-work order under the following circumstances:

- If, during the course of any construction activity or soil disturbance during the seasonal limitation period, sediment leaves the construction site causing a violation of the surface water quality standard; or
- If clearing and grading limits or erosion and sediment control measures shown in the approved plan are not maintained.

Coordination with Utilities and Other Contractors - The primary project proponent shall evaluate, with input from utilities and other contractors, the stormwater management requirements for the entire project, including the utilities, when preparing the Construction SWPPP.

### 2.5.3 Core Requirement #3: Source Control of Pollution

All known, available and reasonable source control BMPs must be applied to all projects. Source control BMPs must be selected, designed, and maintained according to this or an equivalent manual.

A project-specific Pollution Source Control Program consistent with the provisions in Volume IV shall be provided for the site. The party (or parties) responsible for implementation of the Plan shall be identified. The Pollution Source Control Program shall be an attachment to the agreement to maintain and shall 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.

**Objective**

The intent of source control BMPs is to prevent stormwater from coming in contact with pollutants. They are a cost-effective means of reducing pollutants in stormwater, and, therefore, should be a first consideration in all projects.

**Supplemental Guidelines**

An adopted and implemented basin plan or a Total Maximum Daily Load (TMDL, also known as a Water Clean-up Plan) may be used to develop more stringent source control requirements that are tailored to a specific basin.

Source Control BMPs include Operational BMPs and Structural Source Control BMPs. See Volume IV for design details of these BMPs. For construction sites, see Volume II, Chapter 4.

Structural source control BMPs should be identified in the Drainage Control Plan and should be shown on all applicable plans submitted for city review and approval.

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1 The Plan Approval Authority is defined as that department within a local government that has been delegated authority to approve Drainage Control Plans.
2.5.4 Core Requirement #4: Preservation of Natural Drainage Systems and Outfalls

Natural drainage patterns shall be maintained, and discharges from the project site shall occur at the natural location, to the maximum extent practicable. The manner by which runoff is discharged from the project site must not cause a significant adverse impact to downstream receiving waters and downgradient properties. It must have an identified overflow route that is safe and certain, and leads to the ultimate outfall location (such as a receiving water or city drainage system). All outfalls require energy dissipation.

In the Chambers Basin R-4CB zone, all improvements shall be constructed in a manner that will not impound surface or shallow groundwater nor prevent it from flowing in a manner consistent with its predevelopment natural drainage condition.

Offsite drainage is drainage from adjacent property that enters the proposed project site in other than a defined natural channel. Development projects are required to handle offsite drainage in the same manner as exists under current conditions. This means that offsite flows shall be infiltrated within or passed-through the project site at the same rates and quantities after development as before. The development’s infiltration/retention systems shall be sized to accommodate the correct proportion of offsite flows. This requirement shall not be construed as limiting a development’s legal rights regarding offsite drainage.

Where practicable, offsite pass-through flows shall be routed separately across the development site. They shall not be routed through the project’s conveyance, treatment, or retention/detention systems, unless those systems are sized as if the offsite flows were generated within the development project’s boundaries.

Objective
To preserve and utilize natural drainage systems to the fullest extent because of the multiple stormwater benefits these systems provide; and to prevent erosion at and downstream of the discharge location.

Supplemental Guidelines
Creating new drainage patterns results in more site disturbance and more potential for erosion and sedimentation during and after construction. Creating new discharge points can create significant stream channel erosion problems as the receiving water body typically must adjust to the new flows. Diversions can cause greater impacts than would otherwise occur by discharging runoff at the natural location.

Where no conveyance system exists at the adjacent downgradient property line and the discharge was previously unconcentrated flow or significantly lower concentrated flow, then measures must be taken to prevent downgradient impacts. Drainage easements from downstream property owners may be needed and should be obtained prior to approval of engineering plans.

Where no conveyance system exists at the abutting downstream property line and the natural (existing) discharge is unconcentrated, any runoff concentrated by the proposed project must be discharged as follows:

a) If the 100-year peak discharge is less than or equal to 0.2 cfs (0.3 cfs using 15 minute time steps) under existing conditions and will remain less than or equal to 0.2 cfs under developed conditions, then the concentrated runoff may be discharged onto a rock pad or to any other system that serves to disperse flows.

b) If the 100-year peak discharge is less than or equal to 0.5 cfs (0.75 cfs using 15 minute time steps) under existing conditions and will remain less than or equal to 0.5 cfs under
developed conditions, then the concentrated runoff may be discharged through a dispersal trench or other dispersal system, provided the applicant can demonstrate that there will be no significant adverse impact to downhill properties or drainage systems.

c) If the 100-year peak discharge is greater than 0.5 cfs for either existing or developed conditions, or if a significant adverse impact to downgradient properties or drainage systems is likely, then a conveyance system must be provided to convey the concentrated runoff across the downstream properties to an acceptable discharge point (i.e., an enclosed drainage system or open drainage feature where concentrated runoff can be discharged without significant adverse impact).

For (c) only, drainage easements from downstream property owners shall, if needed, be obtained prior to approval of engineering plans. If the proposed project is unable, after reasonable efforts, to obtain needed easements, the discharge approach described in (b) above may be used. Reasonable efforts to obtain needed easements along with communications regarding the alternatives shall be demonstrated through documented written correspondence.

Stormwater control or treatment structures should not be located within the expected 25-year water level elevations for salmonid-bearing waters. Such areas may provide off-channel habitat for juvenile salmonids and salmonid fry. Designs for outfall systems to protect against adverse impacts from concentrated runoff are included in Volume V, Chapter 4.

2.5.5 Core Requirement #5: On-site Stormwater Management
Projects shall employ On-site Stormwater Management BMPs in accordance with the following projects thresholds, standards, and lists to infiltrate, disperse, and retain stormwater runoff on-site to the extent feasible without causing flooding or erosion impacts.

Projects qualifying as flow control exempt in accordance with Section 2.5.7 of this chapter do not have to achieve the LID performance standard, nor consider bioretention, rain gardens, permeable pavement, and full dispersion if using List #1 or List #2. However, those projects must implement BMP T5.13; BMPs T5.10A, B, or C; and BMP T5.11 or T5.12, if feasible.

Note: For projects within the Green Cove and Chambers Basin zoning districts, refer to the City of Olympia Engineering Design and Development Standards and Olympia Municipal Code for additional design guidelines.

Project Thresholds
Projects triggering only Core Requirements #1 through #5 shall either:

a) Use On-site Stormwater Management BMPs from List #1 for all surfaces within each type of surface in List #1; or

b) Demonstrate compliance with the LID Performance Standard. Projects selecting this option cannot use Rain Gardens. They may choose to use Bioretention BMPs as described in Chapter 7 of Volume V to achieve the LID Performance Standard.

Projects triggering Core Requirements #1 through #9, must meet the requirements in Table 2.5.1.
Table 2.5.1
On-site Stormwater Management Requirements for Projects Triggering Core Requirements #1 - #9

<table>
<thead>
<tr>
<th>Project Type and Location</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>New development on any parcel within the city limits</td>
<td>Low Impact Development Performance Standard and BMP T5.13; or List #2 (applicant option).</td>
</tr>
<tr>
<td>Redevelopment on any parcel within the city limits</td>
<td>Low Impact Development Performance Standard and BMP T5.13; or List #2 (applicant option).</td>
</tr>
<tr>
<td>Public roadway development and redevelopment projects</td>
<td>Low Impact Development Performance Standard, BMP T5.13 and BMP T7.10 or BMP T7.20 or BMP T7.30. BMP T5.15 shall be used only for sidewalks.</td>
</tr>
</tbody>
</table>

Low Impact Development Performance Standard

Stormwater discharges shall match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 8% of the 2-year peak flow to 50% of the 2-year peak flow. Refer to the Standard Flow Control Requirement section in Core Requirement #7 for information about the assignment of the pre-developed condition. Project sites that must also meet Core Requirement #7 – Flow Control - must match flow durations between 8% of the 2-year flow through the full 50-year flow.

List #1: On-site Stormwater Management BMPs for Projects Triggering Core Requirements #1 through #5

For each surface, consider the BMPs in the order listed for that type of surface. Use the first BMP that is considered feasible. No other On-site Stormwater Management BMP is necessary for that surface. Feasibility shall be determined by evaluation against:

1. Design criteria, limitations, and infeasibility criteria identified for each BMP in this manual; and
2. Competing Needs Criteria listed in Chapter 5 of Volume V of this manual.

Lawn and landscaped areas:

1. Post-Construction Soil Quality and Depth in accordance with BMP T5.13 in Chapter 5 of Volume V.

Roofs:

1. Full Dispersion in accordance with BMP T5.30 in Chapter 5 of Volume V, or Downspout Full Infiltration Systems in accordance with BMP T5.10A in Section 3.1.1 in Chapter 3 of Volume III
2. Rain Gardens in accordance with BMP T5.14A in Chapter 5 of Volume V, or Bioretention in accordance with Chapter 7 of Volume V. The rain garden or bioretention facility must have a minimum horizontal projected surface area below the overflow which is at least 5% of the area draining to it.
3. Downspout Dispersion Systems in accordance with BMP T5.10B in Section 3.1.2 in Chapter 3 of Volume III.
4. Perforated Stub-out Connections in accordance with BMP T5.10C in Section 3.1.3 in Chapter 3 of Volume III.
Other Hard Surfaces:

1. Full Dispersion in accordance with BMP T5.30 in Chapter 5 of Volume V
2. Permeable pavement\(^1\) in accordance with BMP T5.15 in Chapter 5 of Volume V, or Rain Gardens in accordance with BMP T5.14 in Chapter 5 of Volume V, or Bioretention in accordance with Chapter 7 of Volume V. The rain garden or bioretention facility must have a minimum horizontal projected surface area below the overflow which is at least 5% of the area draining to it.
3. Sheet Flow Dispersion in accordance with BMP T5.12, or Concentrated Flow Dispersion in accordance with BMP T5.11 in Chapter 5 of Volume V.

List #2: On-site Stormwater Management BMPs for Projects Triggering Core Requirements #1 through #9

For each surface, consider the BMPs in the order listed for that type of surface. Use the first BMP that is considered feasible. No other On-site Stormwater Management BMP is necessary for that surface. Feasibility shall be determined by evaluation against:

1. Design criteria, limitations, and infeasibility criteria identified for each BMP in this manual; and
2. Competing Needs Criteria listed in Chapter 5 of Volume V of this manual.

Lawn and landscaped areas:

1. Post-Construction Soil Quality and Depth in accordance with BMP T5.13 in Chapter 5 of Volume V.

Roofs:

1. Full Dispersion in accordance with BMP T5.30 in Chapter 5 of Volume V, or Downspout Full Infiltration Systems in accordance with BMP T5.10A in Section 3.1.1 in Chapter 3 of Volume III
2. Bioretention (See Chapter 7 of Volume V) facilities that have a minimum horizontally projected surface area below the overflow which is at least 5% of the total surface area draining to it.
3. Downspout Dispersion Systems in accordance with BMP T5.10B in Section 3.1.2 in Chapter 3 of Volume III.
4. Perforated Stub-out Connections in accordance with BMP T5.10C in Section 3.1.3 in Chapter 3 of Volume III.

Other Hard Surfaces:

1. Full Dispersion in accordance with BMP T5.30 in Chapter 5 of Volume V
2. Permeable pavement\(^1\) in accordance with BMP T5.15 in chapter 5 of Volume V
3. Bioretention BMPs (See Chapter 7, Volume V) that have a minimum horizontally projected surface area below the overflow which is at least 5% of the total surface area draining to it.
4. Sheet Flow Dispersion in accordance with BMP T5.12, or Concentrated Flow Dispersion in accordance with BMP T5.11 in Chapter 5 of Volume V.

\(^1\) This is not a requirement to pave these surfaces. Where pavement is proposed, it must be permeable to the extent feasible unless full dispersion is employed.
Objective
To use practices distributed across a development that reduce the amount of disruption of the natural hydrologic characteristics of the site.

Supplemental Guidelines
“Flooding or erosion impacts” include flooding of septic systems, crawl spaces, living areas, outbuildings, etc.; increased ice or algal growth on sidewalks/roadways; earth movement/settlement; erosion and other potential damage.

Recent research indicates that traditional development techniques in residential, commercial, and industrial land development cause gross disruption of the natural hydrologic cycle with severe impacts to water and water-related natural resources. Based upon gross level applications of continuous runoff modeling and assumptions concerning minimum flows needed to maintain beneficial uses, watersheds must retain the majority of their natural vegetation cover and soils, and developments must minimize their disruption of the natural hydrologic cycle in order to avoid significant natural resource degradation in lowland streams.

The BMPs described in Section 3.1 of Volume III, and Section 5.3.1 of Volume V are likely insufficient by themselves to prevent significant hydrologic disruptions and impacts to streams and their natural resources. Therefore, local governments should look for opportunities to change their local development codes to minimize impervious surfaces and retain native vegetation in all development situations. Most importantly, to maintain the beneficial uses of our lowland freshwater systems will require land use planning that targets retention of a majority of a creek’s watershed in its natural condition, and retains most of the benefits of headwater areas, connected wetlands, riparian, and floodplain areas.
Figure 2.5.1 - Flow Chart for Determining LID CR #5 Requirements

Does the project discharge to Flow Control Exempt Waters (per Core Requirement [CR] #7)?

Yes

No

No, the project triggered only CR #2.

No additional requirements.

Does the project trigger only CRs #1 - #5? (Per Figure 2.4.1 or Figure 2.4.2 in this Volume)?

No, the project triggered CRs #1 - #3.

Is this project a public roadway?

Yes

No

No

Yes

Did the project developer choose to meet the LID Performance Standard?

No, project developer chose List #1.

Yes

Did the project developer choose to meet the LID Performance Standard?

No, project developer chose List #2.

Required: Implement the following BMPs where feasible:

- BMP T5.13: Post-Construction Soil Quality and Depth.
- BMP T5.10A, B, or C: Downspout Full Infiltration, Downspout Dispersion Systems, or Perforated Stub-out Connections.
- BMP T5.11 or T5.12: Concentrated Flow Dispersion or Sheet Flow Dispersion.

Not Required: Achievement of the LID Performance Standard. Applying the other BMPs in List #1 or List #2.

Required: Meet the LID Performance Standard through the use of any BMP(s) in the 2014 SWMMWWW except for Rain Gardens (the use of Bioretention is acceptable).

Required for Projects Triggering CR #1-9:

Apply BMP T5.13 Post-Construction Soil Quality and Depth.

Not Required: Applying the BMPs in List #1 or List #2.

Required: For each surface, consider the BMPs in the order listed in List #2 for that type of surface. Use the first BMP that is considered feasible.

Not Required: Achievement of the LID Performance Standard.

Required: Meet the LID Performance Standard through the use of BMP T5.30 Full Dispersion, BMP T7.10 Infiltration Basins, T7.20 Infiltration Trenches and/or T7.30 Bioretention Cells, Swales, and Planter Boxes.

If the project can't meet the LID Performance Standard, it must seek and be granted an exception/variance.

Required: Apply BMP T5.13 Post-Construction Soil Quality and Depth. Apply BMP T5.15 Permeable Pavement to sidewalks only.

Not Required: Applying the BMPs in List #1 or List #2.

*Recommended by Ecology for projects triggering CR#1-5.
2.5.6 Core Requirement #6: Runoff Treatment

Thresholds
When assessing a project against the following thresholds, only consider those hard and pervious surfaces that are subject to this core requirement as determined in Section 2.4 of this chapter.

The following require construction of stormwater treatment facilities:

- Projects in which the total of pollution-generating hard surface (PGHS) is 5,000 square feet or more in a threshold discharge area of the project, or
- Projects in which the total of pollution-generating pervious surfaces (PGPS) – not including permeable pavements – is three-quarters (3/4) of an acre or more in a threshold discharge area, and from which there will be a surface discharge in a natural or man-made conveyance system from the site.

Treatment Facility Sizing
Size stormwater treatment facilities for the entire area that drains to them, even if some of those areas are not pollution-generating, or were not included in the project site threshold decisions (Section 2.4 of this chapter) or the treatment threshold decisions of this core requirement.

Water Quality Design Storm Volume:
- The volume of runoff predicted from a 24-hour storm with a 6-month return frequency (a.k.a., 6-month, 24-hour storm). Wetpool facilities are sized based upon the volume of runoff predicted through use of the Natural Resource Conservation Service curve number equations in Chapter 2 of Volume III, for the 6-month, 24-hour storm. Alternatively, when using an approved continuous runoff model, with Thurston County enhancements, most current version, the water quality design storm volume shall be equal to the simulated daily volume that represents the upper limit of the range of daily volumes that accounts for 91% of the entire runoff volume over a multi-decade period of record.

Water Quality Design Flow Rate:
- Preceding Detention Facilities or when Detention Facilities are not required: The flow rate at or below which 91% of the runoff volume, as estimated by an approved continuous runoff model with Thurston County enhancements, most current version, or other approved continuous runoff model with local permitting authority approval, will be treated. Design criteria for treatment facilities are assigned to achieve the applicable performance goal (e.g., 80% TSS removal) at the water quality design flow rate. At a minimum, 91% of the total runoff volume, as estimated by an approved continuous runoff model, must pass through the treatment facility(ies) at or below the approved hydraulic loading rate for the facility(ies).
- Downstream of Detention Facilities: The water quality design flow rate must be the full 2-year release rate from the detention facility.

Treatment Facility Selection, Design, and Maintenance
Stormwater treatment facilities shall be:
- Selected in accordance with the process identified in Chapter 4 of Volume I, and Chapter 2 of Volume V,
- Designed in accordance with the design criteria in Volume V, and
- Maintained in accordance with the maintenance schedule in Volume IV.
Additional Requirements

Direct discharge of untreated stormwater from pollution-generating hard surfaces to ground water is prohibited, except for the discharge achieved by infiltration or dispersion of runoff through use of On-site Stormwater Management BMPs, in accordance with Chapter 5, Volume V and Chapter 7, Volume V; or by infiltration through soils meeting the soil suitability criteria in Chapter 3 of Volume III.

Objective

The purpose of runoff treatment is to reduce pollutant loads and concentrations in stormwater runoff using physical, biological, and chemical removal mechanisms so that beneficial uses of receiving waters are maintained and, where applicable, restored. When site conditions are appropriate, infiltration can potentially be the most effective BMP for runoff treatment.

A goal of runoff treatment is also to preserve and protect the water quality of the underlying drinking water aquifer and receiving surface waters.

Supplemental Guidelines

See Volume V for more detailed guidance on selection, design, and maintenance of treatment facilities. The water quality design storm volume and flow rates are intended to capture and effectively treat about 90-95% of the annual runoff volume in western Washington.

Volume V includes performance goals for Basic, Enhanced, Phosphorus, and Oil Control treatment, and a menu of facility options for each treatment type. Treatment facilities that are selected from the appropriate menu and designed in accordance with their design criteria are presumed to meet the applicable performance goals.

An adopted and implemented basin plan, or a Total Maximum Daily Load (TMDL - also known as a Water Clean-up Plan) may be used to develop runoff treatment requirements that are tailored to a specific basin. However, treatment requirements shall not be less than that achieved by facilities in the Basic Treatment Menu (see Volume V, Chapter 3). Note: Phosphorus control is required for new and redevelopment projects that, directly or via a conveyance system, discharge to Capitol Lake or Woodard Creek and meet the project thresholds in Volume I for Core Requirement #6: Runoff Treatment.

Treatment facilities applied consistent with this manual are presumed to meet the requirement of state law to provide all known available and reasonable methods of treatment (RCW 90.52.040, RCW 90.48.010). This technology-based treatment requirement does not excuse any discharge from the obligation to apply whatever technology is necessary to comply with state water quality standards, Chapter 173-201A WAC; state ground water quality standards, Chapter 173-200 WAC; state sediment management standards, Chapter 173-204 WAC; and the underground injection control program, Chapter 173-218 WAC. Additional treatment to meet those standards may be required by federal, state, or the City.

Infiltration through use of On-site Stormwater Management BMPs can provide both treatment of stormwater, through the ability of certain soils to remove pollutants, and volume control of stormwater, by decreasing the amount of water that runs off to surface water. Infiltration through engineered treatment facilities that utilize the natural soil profile can also be very effective at treating stormwater runoff, but pretreatment must be applied and soil conditions must be appropriate to achieve effective treatment while not impacting ground water resources. See Chapter 6 of Volume V for pretreatment design details.

Discharge of pollution-generating surfaces into a dry well, after pretreatment for solids reduction, can be acceptable if the soil conditions provide sufficient treatment capacity. Dry wells
into gravelly soils are not likely to have sufficient treatment capability. They must be preceded by at least a basic treatment BMP. See Volume V, Chapters 2 and 7 for details.

Impervious surfaces that are “fully dispersed” in accordance with BMP T5.30 in Volume V are not considered effective impervious surfaces. Impervious surfaces that are “dispersed” in accordance with BMPs T5.10B, T5.11, and T5.12 in Section 5.3.1 of Volume V are still considered effective surfaces though they may be modeled as pervious surfaces if flow path lengths meet the specified minima. See Volume III, Appendix III-C for a more complete description of hydrologic representation of On-site Stormwater Management BMPs.

2.5.7 Core Requirement #7: Flow Control

Applicability
Projects must provide flow control to reduce the impacts of stormwater runoff from hard surfaces and land cover conversions. The requirement below applies to projects that discharge stormwater directly, or indirectly through a conveyance system into a fresh waterbody.

Flow Control is not required for projects that discharge directly or indirectly to: Capitol Lake/Deschutes River downstream of Tumwater Falls (Thurston Co.); or the marine waters of Budd Inlet at or below the ordinary high water subject to the following restrictions:

- Direct discharge to the exempt receiving water does not result in the diversion of drainage from any perennial stream classified as Types 1, 2, 3, or 4 in the State of Washington Interim Water Typing System, or Types “S”, “F”, or “Np” in the Permanent Water Typing System, or from any category I, II, or III wetland; and
- Flow splitting devices or drainage BMPs are applied to route natural runoff volumes from the project site to any downstream Type 5 stream or category IV wetland:
  - Design of flow splitting devices or drainage BMPs will be based on continuous hydrologic modeling analysis. The design will assure that flows delivered to Type 5 stream reaches will approximate, but in no case exceed, durations ranging from 50% of the 2-year to the 50-year peak flow.
  - Flow splitting devices or drainage BMPs that deliver flow to category IV wetlands will also be designed using continuous hydrologic modeling to preserve pre-project wetland hydrologic conditions unless specifically waived or exempted by regulatory agencies with permitting jurisdiction; and
- The project site must be drained by a conveyance system that is comprised entirely of manmade conveyance elements (e.g., pipes, ditches, outfall protection) and extends to the ordinary high water line of the exempt receiving water; and
- The conveyance system between the project site and the exempt receiving water shall have sufficient hydraulic capacity to convey discharges from future build-out conditions (under current zoning) of the site, and the existing condition from non-project areas from which runoff is or will be collected; and
- Any erodible elements of the manmade conveyance system must be adequately stabilized to prevent erosion under the conditions noted above.
- A site which qualifies for the flow-control exemption may apply that same exemption to Core Requirement #5 Onsite Stormwater Management.
If the discharge is to a stream that leads to a wetland, or to a wetland that has an outflow to a stream, both this requirement and Core Requirement #8 apply.

Thresholds
When assessing a project against the following thresholds, consider only those impervious, hard, and pervious surfaces that are subject to this core requirement as determined in Section 2.4 of this chapter.

The following circumstances require achievement of the standard flow control requirement for western Washington:

- Projects in which the total of effective impervious surfaces is 10,000 square feet or more in a threshold discharge area, or
- Projects that convert ¾ acres or more of vegetation to lawn or landscape, or convert 2.5 acres or more of native vegetation to pasture in a threshold discharge area, and from which there is a surface discharge in a natural or man-made conveyance system from the site, or
- Projects that through a combination of effective hard surfaces and converted vegetation areas cause a 0.10 cubic feet per second increase in the 100-year flow frequency from a threshold discharge area as estimated using the Western Washington Hydrology Model or other approved model and one-hour time steps (or a 0.15 cfs increase using 15-minute time steps). ²

² The 0.10 cfs (one-hour time steps) or 0.15 cfs (15-minute time steps) increase should be a comparison of the post-project runoff to the existing condition runoff. For the purpose of applying this threshold, the existing condition is either the pre-project...
Standard Requirements
Stormwater discharges shall match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. Runoff and volume calculations shall be provided by the WWHM with Thurston County enhancements, most current version, or other model with local permitting authority approval.

The pre-developed condition to be matched shall be a forested land cover unless:

- Reasonable, historic information is provided that indicates the site was prairie prior to settlement (modeled as “pasture” in the Western Washington Hydrology Model); or,
- The drainage area of the immediate stream and all subsequent downstream basins have had at least 40% total impervious area since 1985. In this case, the pre-developed condition to be matched shall be the existing land cover condition. Where basin-specific studies determine a stream channel to be unstable, even though the above criterion is met, the pre-developed condition assumption shall be the “historic” land cover condition, or a land cover condition commensurate with achieving a target flow regime identified by an approved basin study.

This standard requirement is waived for sites that will reliably infiltrate all the runoff from hard surfaces and converted vegetation areas.

Western Washington Alternative Requirement
An alternative requirement may be established through application of watershed-scale hydrological modeling and supporting field observations. Possible reasons for an alternative flow control requirement include:

- Establishment of a stream–specific threshold of significant bedload movement other than the assumed 50% of the 2-year peak flow;
- Zoning and Land Clearing Ordinance restrictions that, in combination with an alternative flow control standard, maintain or reduce the naturally occurring erosive forces on the stream channel; or
- A duration control standard is not necessary for protection, maintenance, or restoration of designated and existing beneficial uses or Clean Water Act compliance.

Additional Requirement
Flow Control BMPs shall be selected and designed according to Volume III. Flow control BMPs shall be maintained according to the maintenance standards of Volume IV.

Objective
To prevent increases in the stream channel erosion rates that are characteristic of natural conditions (i.e., prior to disturbance by European settlement). The standard intends to maintain the total amount of time that a receiving stream exceeds an erosion-causing threshold based upon historic rainfall and natural land cover conditions. That threshold is assumed to be 50% of the 2-year peak flow. Maintaining the naturally occurring erosion rates within streams is vital, though by itself insufficient, to protect fish habitat and production.
Supplemental Guidelines

Reduction of flows through infiltration decreases stream channel erosion and helps to maintain base flow throughout the summer months. However, infiltration should follow the guidance in this manual to reduce the chance that ground water quality is threatened by such discharges.

Volume III includes a description of the Western Washington Hydrology Model. The model provides ways to represent On-site Stormwater Management BMPs described in Volumes III and V. Using those BMPs reduce the predicted runoff rates and volumes and thus also reduces the size of the required flow control facilities.

Application of sufficient types of On-site Stormwater Management BMPs can result in reducing the effective impervious area and the converted vegetation areas such that a flow control facility is not required. Application of “Full Dispersion”, BMP T5.30, also results in eliminating the flow control facility requirement for those areas that are “fully dispersed.”

See the guidelines in Appendix I-D for Core Requirement #8, and directions concerning use of the Western Washington Hydrology Model for information about the approach for protecting wetland hydrologic conditions.

Diversions of flow from perennial streams and from wetlands can be considered if significant existing (i.e., pre-project) flooding, stream stability, water quality, or aquatic habitat problems would be solved or significantly mitigated by bypassing stormwater runoff rather than providing stormwater detention and discharge to natural drainage features. Bypassing should not be considered as an alternative to applicable flow control or treatment if the flooding, stream stability, water quality or habitat problem to be solved would be caused by the project. In addition, the proposal should not exacerbate other water quality/quantity problems such as inadequate low flows or inadequate wetland water elevations. The existing problems and their solution or mitigation as a result of the direct discharge should be documented by a stormwater engineer or scientist after review of any available drainage design reports, basin plans, or other relevant literature. The restrictions in this core requirement on conveyance systems that transfer water to an exempt receiving water are applicable in these situations. Approvals by all regulatory authorities with relevant permits applicable to the project are necessary.

Ecology hopes to publish guidance concerning basin studies to develop basin-specific flow control strategies intended to stabilize stream channels and provide flows intended to protect and restore beneficial uses such as fish resources. The recommendations made in basin plans should be consistent with the requirements and intent of the federal Clean Water Act, the State Water Pollution Control Act, and any other applicable natural resources statutes, such as the Federal Endangered Species Act.

2.5.8 Core Requirement #8: Wetlands Protection

Applicability

The requirements below apply only to projects whose stormwater discharges into a wetland, either directly or indirectly through a conveyance system.

Thresholds

The thresholds identified in Core Requirement #6 – Runoff Treatment, and Core Requirement #7 – Flow Control shall also be applied to determine the applicability of this requirement to discharges to wetlands.
Standard Requirement
Projects shall comply with Guide Sheets #1 through #3 in Appendix I-D. The hydrologic analysis shall use the existing land cover condition to determine the existing hydrologic conditions unless directed otherwise by a regulatory agency with jurisdiction.

Additional Requirements
Stormwater treatment and flow control facilities shall not be built within a natural vegetated buffer, except for:

- Necessary conveyance systems as approved by the City; or
- As allowed in wetlands approved for hydrologic modification and/or treatment in accordance with Guide Sheet 2 in Appendix I-D.

An adopted and implemented basin plan, or a Total Maximum Daily Load (TMDL, also known as a Water Clean-up Plan) may be used to develop requirements for wetlands that are tailored to a specific basin.

Objective
To ensure that wetlands receive the same level of protection as any other waters of the state. Wetlands are extremely important natural resources which provide multiple stormwater benefits, including ground water recharge, flood control, and stream channel erosion protection. They are easily impacted by development unless careful planning and management are conducted. Wetlands can be severely degraded by stormwater discharges from urban development due to pollutants in the runoff and also due to disruption of natural hydrologic functioning of the wetland system. Changes in water levels and the frequency and duration of inundations are of particular concern.

Supplemental Guidelines
Appendix I-D Guidelines for Wetlands when Managing Stormwater shall be used for discharges to natural wetlands and wetlands constructed as mitigation. While it is always necessary to pre-treat stormwater prior to discharge to a wetland, there are limited circumstances where wetlands may be used for additional treatment and detention of stormwater. These situations are considered in Guide Sheet 2 of Appendix I-D.

Note that if selective runoff bypass is an alternative being considered to maintain the hydroperiod, the hydrologic analysis must consider the impacts of the bypassed flow. For instance, if the bypassed flow is eventually directed to a stream, the flow duration standard, Core Requirement #7, applies to the bypass.

2.5.9 Core Requirement #9: Operation and Maintenance
A Stormwater Facility Maintenance Program that is consistent with the provisions in Volume IV shall be provided for proposed stormwater facilities and BMPs, and the party (or parties) responsible for maintenance and operation shall be identified as the Program Operator. At private facilities, a copy of the operation and maintenance manual shall be retained on-site or within reasonable access to the site, and shall be transferred with the property to the new owner. For public facilities, a copy of the operation and maintenance manual shall be retained in the appropriate department. A log of maintenance activity that indicates what actions were taken shall be kept and be available for inspection by the City.
Objective
To ensure that stormwater control facilities are adequately maintained and operated properly.

Supplemental Guidelines
Inadequate maintenance is a common cause of failure for stormwater control facilities. The description of each BMP in Volumes II, III, and V includes a section on maintenance. Chapter 4 and Appendix IV-J of Volume IV include a schedule of inspection and maintenance standards for drainage facilities.

2.6 Additional Requirements
2.6.1 Financial Liability

Performance bonding or other appropriate financial guarantee equal to 125% of the stormwater system construction costs shall be required for all projects to ensure construction of drainage facilities in compliance with these standards.

The completion bond shall be released when the stormwater system is accepted by the city. As portions of the systems are accepted by the city the value of the bond can be reduced to the value of work left to be completed.

An additional performance/operation and maintenance bond or other appropriate financial guarantee, equal to 125 percent of the stormwater facility contingency plan cost, shall be required for infiltration or other stormwater facilities for which performance must be demonstrated. For bioretention swales within the right-of-way, the performance guarantee shall have a face amount equal to 125 percent of the estimated amount necessary to guarantee the maintenance and replacement of plant materials in conformance with the maintenance requirements for a period of three years from the date the certificate of occupancy is issued by the city or from the date of final plat approval. This performance guarantee shall remain in effect until satisfactory facility performance is demonstrated and/or any remediation or contingency plan implementation has been completed and its effectiveness verified. For bioretention swales within the right-of-way, the performance guarantee shall remain in effect until the City accepts the facilities following a three year plant establishment period.

After project completion, the applicant shall submit a facility monitoring and evaluation report. A licensed civil engineer shall prepare and seal the report. The report shall document field work and assess stormwater detention or retention facility performance versus design (e.g., orifice release or infiltration rates; treatment facilities are generally not subject to performance testing). The report shall specify actions needed to restore performance. The City will retain guarantees until facility actual and design performances are roughly equivalent (see Volume III Chapter 3 or Volume V for more on contingency planning and facility performance verification testing).

Objective
To ensure that development projects have adequate financial resources to fully implement stormwater management plan requirements and that liability is not unduly incurred by the City.

Supplemental Guidelines
The type of financial instrument required is less important than ensuring that there are adequate funds available in the event that non-compliance occurs.

Most developments should be able to measure performance the first wet-season after completing the project. Residential plats may take longer, as home-building can take several
years. Engineers preparing facility monitoring and evaluation reports are advised to determine the City’s monitoring requirements prior to undertaking field work or preparing reports.

2.6.2 **Off Site Analysis and Mitigation**

Development projects that discharge stormwater off-site shall submit an off-site analysis report that assesses the potential off-site water quality, erosion, slope stability, and drainage impacts associated with the project and that proposes appropriate mitigation of those impacts.

An initial qualitative analysis shall extend downstream for the entire flow path from the project site to the receiving water or up to one mile, whichever is less. If the receiving water is within one-quarter mile, the analysis shall extend within the receiving water to one-quarter mile from the project site. The analysis shall extend one-quarter mile beyond any improvements proposed as mitigation. The analysis must extend upstream to a point where any backwater effects created by the project cease. Upon review of the qualitative analysis, the City may require that a quantitative analysis be performed.

The existing or potential impacts to be evaluated and mitigated shall include:

- Conveyance system capacity problems;
- Localized flooding;
- Upland erosion impacts, including landslide hazards;
- Stream channel erosion at the outfall location;
- Violations of surface water quality standards as identified in a Basin Plan or a TMDL (Water Clean-up Plan); or violations of ground water standards in a wellhead protection area.

**Objective**

To identify and evaluate off-site water quality, erosion, slope stability, and drainage impacts that may be caused or aggravated by a proposed project, and to determine measures for preventing impacts and for not aggravating existing impacts. Aggravated shall mean increasing the frequency of occurrence and/or severity of a problem.

**Supplemental Guidelines**

Projects should be required to initially submit, with the permit application, a qualitative analysis of each downstream system leaving a site. The analysis should accomplish four tasks:

**Task 1: Define and map the study area**

Submission of a site map showing property lines; a topographic map (at a minimum a USGS 1:24000 Quadrangle Topographic map) showing site boundaries, study area boundaries, downstream flowpath, and potential/existing problems.

**Task 2: Review all available information on the study area**

This should include all available basin plans, ground water management area plans, drainage studies, floodplain/floodway FEMA maps, wetlands inventory maps, Critical Areas maps, stream habitat reports, salmon distribution reports, etc.

**Task 3: Field inspect the study area**

The design engineer should physically inspect the existing on- and off-site drainage systems of the study area for each discharge location for existing or potential problems and drainage features. An initial inspection and investigation should include:

- Investigate problems reported or observed during the resource review
- Locate existing/potential constrictions or capacity deficiencies in the drainage system
• Identify existing/potential flooding problems
• Identify existing/potential overtopping, scouring, bank sloughing, or sedimentation
• Identify significant destruction of aquatic habitat (e.g., siltation, stream incision)
• Collect qualitative data on features such as land use, impervious surface, topography, soils, presence of streams, wetlands
• Collect information on pipe sizes, channel characteristics, drainage structures
• Verify tributary drainage areas identified in task 1
• Contact the City of Olympia Water Resources, neighboring property owners, and residents about drainage problems
• Note date and weather at time of inspection

For each drainage system component (e.g., pipe, culvert, bridges, outfalls, ponds, vaults) the following should be covered in the analysis: location, physical description, problems, and field observations.

All existing or potential problems (e.g., ponding water, erosion) identified in tasks 2 and 3 above should be described. The descriptions should be used to determine whether adequate mitigation can be identified, or whether more detailed quantitative analysis is necessary. The following information should be provided for each existing or potential problem:

• Magnitude of or damage caused by the problem
• General frequency and duration
• Return frequency of storm or flow when the problem occurs (may require quantitative analysis)
• Water elevation when the problem occurs
• Names and concerns of parties involved
• Current mitigation of the problem
• Possible cause of the problem
• Whether the project is likely to aggravate the problem or create a new one.

Upon review of this analysis, the City may require mitigation measures deemed adequate for the problems, or a quantitative analysis, depending upon the presence of existing or predicted flooding, erosion, or water quality problems, and on the proposed design of the on-site drainage facilities. The analysis should repeat tasks 3 and 4 above, using quantitative field data including profiles and cross-sections.

The quantitative analysis should provide information on the severity and frequency of an existing problem or the likelihood of creating a new problem. It should evaluate proposed mitigation intended to avoid aggravation of the existing problem and to avoid creation of a new problem.

Projects required to prepare a Drainage Control Plan meeting Chapter 3 of this volume must also meet the Drainage Design Report format and content requirements of that section for offsite analysis.
2.7 Adjustments

Adjustments to the Core Requirements may be granted prior to permit approval and construction. The drainage manual administrator may grant an adjustment provided a written finding of fact is prepared, that addresses the following:

- The adjustment provides substantially equivalent environmental protection.
- The objectives of safety, function, environmental protection and facility maintenance, based upon sound engineering, are met.

2.8 Exceptions

Exceptions to the Core Requirements may be granted prior to permit approval and construction if such application of the requirements imposes a severe and unexpected economic hardship. The drainage manual administrator may grant an exception following legal public notice of an application for an exception, legal public notice of the administrator’s decision on the application, and a written finding of fact that documents the administrator’s decision to grant an exception based on the following:

- The current (pre-project) use of the site, and
- How the application of the Core Requirement(s) restricts the proposed use of the site compared to the restrictions that existed prior to the adoption of the Core Requirements; and
- The possible remaining uses of the site if the exception were not granted; and
- The uses of the site that would have been allowed prior to the adoption of the Core Requirements; and
- A comparison of the estimated amount and percentage of value loss as a result of the minimum requirements versus the estimated amount and percentage of value loss as a result of requirements that existed prior to adoption of the minimum requirements; and
- The feasibility for the owner to alter the project to apply the Core Requirements; and
- There are special physical circumstances or conditions affecting the property such that the strict application of these provisions would deprive the applicant of rights commonly enjoyed by other properties similarly situated or of all reasonable use of the parcel of land in question, and every effort to find creative ways to meet the intent of the Core Requirements has been made; or
- The site is being redeveloped and certain site investigations or installed stormwater facilities would require that existing structures be removed; or
- The site is being redeveloped and the changes are either very small or configured in such a way that in the Administrator’s or designee’s opinion some Core Requirements cannot practicably be met; or
- The project is to be completed within an existing right-of-way which is of inadequate size to install required facilities and which cannot be expanded due to encroaching structures or setbacks;

AND

- That the granting of the exception will not be detrimental to the public health and welfare, nor injurious to other properties in the vicinity and/or downstream, and to the quality of waters of the state; and
The exception is the least possible exception that could be granted to comply with the intent of the Core Requirements; and

A fee-in-lieu, based on the avoided cost or value of the exception, may be collected by the local permitting authority.

Supplemental Guidelines
The adjustment and exception provisions are an important element of the plan review and enforcement programs. They are intended to maintain a necessary flexible working relationship between City officials and applicants. Plan Approval Authorities should consider these requests judiciously, keeping in mind the need to protect off-site properties and resources from damage.

Appeals
In accordance with Olympia Municipal Code Title 18, the drainage manual administrator’s decisions on applications may be appealed to the Hearings Examiner.
Chapter 3 - Drainage Control Plan Submittal Requirements

The Drainage Control Plan is the comprehensive submittal package containing all of the technical information, analysis, site development drawings, reports, and long-term maintenance requirements necessary for the City of Olympia to evaluate a proposed new development or redevelopment project for compliance with stormwater requirements. Contents of the Drainage Control Plan will vary with the type and size of the project, and individual site characteristics.

The scope of the Drainage Control Plan also varies depending on the applicability of Core Requirements (see Section 2.4). All projects are subject to the core requirements outlined in Chapter 2, and the plan formats described in this chapter meet the requirements of the Drainage Control Plan required by Core Requirement #1. Based on the project size and proposed conditions, an applicant will have to prepare either an Abbreviated Plan or a Drainage Control Plan (outlined in Section 3.2 and 3.3).

This chapter describes the contents of a Drainage Control Plan and provides a general procedure for how to prepare the plan (Section 3.4). The specific BMPs and design methods and standards to be used are contained in Volumes II-V. The content and the procedures for preparing a Construction Stormwater Pollution Prevention Plan (Construction SWPPP) are covered in detail in Chapter 3 of Volume II. Guidelines for selecting treatment, flow control, and source control BMPs are given in Chapter 4 of this Volume, and Chapter 2 of Volume V. Information and procedures for preparing a long term Stormwater Site Management Plan covering pollution source control, inspection, operation, and maintenance of stormwater facilities is covered by Volume IV.

The goal of this chapter is to provide a framework for uniformity in plan preparation. Such uniformity will promote predictability in stormwater designs throughout the City of Olympia and help secure prompt governmental review and approval. Properly drafted engineering plans and supporting documents will also facilitate the operation and maintenance of the proposed system long after its review and approval.

State law requires that engineering work be performed by or under the direction of a professional engineer licensed to practice in Washington State. Designs and plans involving construction of treatment facilities or flow control facilities (detention ponds or infiltration basins), structural source control BMPs, or drainage conveyance systems generally involve engineering principles and shall be prepared by or under the direction of a licensed engineer. Construction Stormwater Pollution Prevention Plans (SWPPPs) that involve engineering calculations must also be prepared by or under the direction of a licensed engineer.

While the City may review and accept stormwater-related submittals as compliant with this manual’s requirements, this does not confer responsibility or liability upon the City. The project proponent and design team are responsible for ensuring that all stormwater elements are safe and effective for their intended purpose, and that all calculations, plans, specifications, construction, and as-built drawings comply with accepted engineering standards, applicable federal, state, or local laws and codes, and this manual, and demonstrate good engineering practice.

3.1 Projects and Activities Requiring Plan Submittal

Projects exceeding the thresholds of Sections 2.4 and 2.5 of Volume I are required to prepare and submit stormwater plans and reports for review. Depending on the applicability of Core Requirements of Section 2.4, the scope of the required plan submittal may vary. The three types of plan submittals required by this Manual are Construction Stormwater Pollution Prevention Plans (C-SWPPP), Abbreviated Drainage Plans (ADP), and full Drainage Control Plans (DCP). These plans and stormwater scoping meetings with City staff shall be required based on the application of Core Requirements below:
<table>
<thead>
<tr>
<th>Plan Type</th>
<th>Core Requirements</th>
<th>Stormwater Scoping Meeting Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Pollution Prevention Plan</td>
<td>#2</td>
<td>No</td>
</tr>
<tr>
<td>Abbreviated Drainage Plan</td>
<td>#1 through #5 only</td>
<td>Optional</td>
</tr>
<tr>
<td>Drainage Control Plan</td>
<td>#1 through #9</td>
<td>Yes</td>
</tr>
</tbody>
</table>

In addition, any activity that alters the approved plans for a given project (e.g., stormwater facility alteration or repair, drainage facility resizing, other project design changes to impervious surfaces or land cover) will require reapplication and approval by the City, regardless of whether the thresholds listed in Section 2.4 and Section 2.5 have been exceeded. This may include updates to the original Abbreviated Drainage Plan or Drainage Control Plan, and associated Construction SWPPP. The City may waive the requirement to update plans depending on the specific activity and associated impacts.

Abbreviated Drainage Plans and full Drainage Control Plans shall be prepared by a Washington state licensed professional civil engineer capable of performing such work. Plans and reports submitted to meet the plan requirements of this section shall be sealed and signed by a licensed engineer.

### 3.2 Abbreviated Drainage Plans

Projects that must address only Core Requirements #1 through #5 in Section 2.4 of Volume I may prepare an Abbreviated Drainage Plan to accompany their development permit application review. Projects required to prepare only a Construction Stormwater Pollution Prevention Plan (i.e., only subject to Core Requirement #2) do not need to prepare an Abbreviated Drainage Plan, but may be required to do so if the project lies within a critical area as defined by Olympia Municipal Code (OMC) Chapter 18.32, or if the City determines the project may have adverse impact to neighboring properties or downstream systems.

The purpose of an Abbreviated Plan is:

1. To assure that a project complies with the applicable core requirements.
2. To incorporate requirements that achieves the intent and purpose of the City of Olympia critical area ordinance. Flood, landslide, shoreline, wetland, and other critical areas sometimes require measures that must be depicted on Abbreviated Drainage Plan drawings to achieve compliance with these regulations.
3. To prevent development related stormwater runoff from affecting neighboring properties and downstream drainage systems.

#### 3.2.1 Abbreviated Drainage Plans – Plan Requirements

Regardless of project size and type, all Abbreviated Drainage Plans have several basic requirements that must be met and reflected in the plan drawings and documentation.

The Abbreviated Drainage Plan must demonstrate how Core Requirements #1 through #5 are being met. Note that Core Requirement #5 includes detailed requirements and decision points that can affect the project significantly, which must be reflected in the Abbreviated Drainage Plan documentation. Likewise, compliance with Core Requirement #2 will require preparation of a full Construction SWPPP.

In many situations, it will be necessary for a licensed professional to prepare components of the Abbreviated Drainage Plan. In some cases, the additional required information pertinent to the Abbreviated Drainage Plan may be available within the plat or other approved documents related to the project.

The following subsections provide further detail on the requirements for Abbreviated Drainage Plans.
3.2.2 Abbreviated Drainage Plans – Critical Areas Requirements

In addition to the core requirements for Abbreviated Drainage Plans, projects that involve work in or near critical areas must demonstrate compliance with OMC Chapter 18.32. The Abbreviated Drainage Plan must indicate any specific site design and construction requirements that implement the applicable critical area standards and requirements.

3.2.3 Abbreviated Drainage Plans – Written Summary, Supporting Documents, and Calculations

Abbreviated Drainage Plans must include all calculations and/or analyses necessary to demonstrate compliance with applicable core requirements. This may include calculations related to sizing stormwater BMPs or conveyance systems, analyses of site or downstream conditions, documentation of infeasibility issues, etc.

Abbreviated Drainage Plans shall provide a written summary of the proposed project and how it complies with the applicable stormwater management requirements. If using List #1 or List #2 (necessary for threshold discharge areas of projects that have triggered Core Requirements #1 - #9, but do not exceed the thresholds in Core Requirements #6, #7) to comply with Core Requirement #5, provide written justification, including citation of site conditions identified in a soils report, for any On-site Stormwater Management BMPs that are determined to be “infeasible” for the project site.

If the applicant elects or must use the LID performance standard option of Core Requirement #5, they shall provide design details of all BMPs that are used to help achieve the standard, and a complete computer model report including input files and output files. Projects taking an impervious surface reduction credit for newly planted or retained trees must provide those calculations and documentation on site plans for the locations of the trees. Projects using full dispersion or full downspout infiltration BMPs must provide information to confirm conformance with design requirements that allow removal of the associated drainage areas from computer model input.

3.2.4 Abbreviated Drainage Plans – Licensed Engineer Required For Roads

Abbreviated Drainage Plans that propose work on public roads, private roads, and unopened City right-of-way must be prepared by a professional engineer licensed in Washington State.

3.2.5 Abbreviated Drainage Plan – Drawing Size and Quality

Lines shall be drawn with a straight edge (with the exception of curved lines) and features shall be to scale. Drawings shall be sufficiently clear to see footprints of structures and other features described below, and shall be on 8.5 x 11-inch paper; 11 x 17-inch paper, or plan-size sheets (22 x 34-inch).

3.2.6 Abbreviated Drainage Plan – Site Development Drawings

The Abbreviated Drainage Plan site development drawings generally contain all the pertinent information necessary for construction of a project. This may include applicable drainage, grading, sediment control, and topographic survey information, as well as any applicable notes or details.

At a minimum, Abbreviated Drainage Plan drawings must contain:

- The location and type of any onsite stormwater management BMPs (e.g., soil amendment, infiltration trenches, dispersion, rain gardens, permeable pavement, etc.)
- The location and type of construction stormwater pollution prevention BMPs used for erosion and sediment control
- The location and type of other construction stormwater pollution prevention BMPs (such as refueling areas)
- Location of stormwater conveyance systems for runoff from structures
- Notes, specifications, and details related to selected BMPs
• Name, address, telephone number, and email address of the applicant
• Name, address, telephone number, and email address of the person preparing the plan
• Name, address, telephone number, and email address of the contractor, if known
• Parcel number(s)
• Scale and north arrow
• Legend if symbols are used
• Property boundaries, dimensions, and area
• Contour lines sufficient to determine contributing areas and drainage basins on NAVD88 datum
• Adjoining street names
• Existing and proposed structures and other hard surfaces such as driveways, patios, etc.
• Location of onsite sewage disposal systems and reserve areas
• Existing and proposed easements
• Established buffers, significant trees, Soil and Vegetation Protection Areas, tree tracts, and natural vegetation easements
• Natural drainage channels, wetlands, canyons, gullies, water bodies, etc.
• Clearing limits
• Areas to be graded, filled, excavated, or otherwise disturbed
• Location of known wells, and underground storage tanks
• Proposed location(s) determined for stockpiled materials, i.e., excavation wastes
• Location and details of construction entrance
• Earthwork and clearing requirements of OMC Chapter 16.48
• Applicable standard driveway approach detail (driveway approaches shall be constructed or reconstructed to meet the requirements of EDDS Chapter 4)
• Building setbacks from property lines

**When applicable, Abbreviated Drainage Plans must include survey information prepared by a registered land surveyor or other qualified professional that includes:**

• Existing public and private development, including utility infrastructure on and adjacent to the site if publicly available
• Minor hydrologic features, including seeps, springs, closed depression areas, and drainage
• Major hydrologic features including streams, wetlands, and water bodies, as well as wetland and buffer boundaries and classifications
• Flood hazard areas on or adjacent to the site
• Geologic hazard areas and associated buffer requirements on or adjacent to the site
• Aquifer and wellhead protection areas on or adjacent to the site
• Topographic features that may act as natural stormwater storage, infiltration, or conveyance
• Locations of soil surveys, soil test pits, and soil borings conducted as part of the required soils report.

In addition, if a geotechnical assessment is required by the City, any recommendations contained in the report must be incorporated into the site development drawings.
3.2.7 Abbreviated Drainage Plan – Construction SWPPP Requirements
Abbreviated Drainage Plans must include a complete Construction SWPPP. See Volume II, Chapter 3 of this manual for information on the items that shall be included as part of the Construction SWPPP narrative (i.e., report) and drawings.

3.2.8 Abbreviated Drainage Plan – Soils Report Requirements
In support of the requirements of Core Requirement #5, Abbreviated Drainage Plans must include a soils report prepared by a professional soil scientist certified by the Soil Science Society of America (or an equivalent national program), locally licensed on-site sewage designer, or by other suitably trained persons working under the supervision of a professional engineer, geologist, hydrogeologist, or engineering geologist registered in the State of Washington. The report shall include the following information:

- Soil surveys, soil test pits, soil borings, or soil grain analyses sufficient to identify underlying soils on the site. Refer to Volume III, Section 3.3 for details.
- The results of saturated hydraulic conductivity ($K_{sat}$) testing to assess infiltration capability and the feasibility of rain gardens, bioretention, and permeable pavement. Use the infiltration testing methods outlined in Volume III, Chapter 3.
- The results of testing for a hydraulic restriction layer (groundwater, soil layer with less than 0.3 in/hr $K_{sat}$, bedrock, etc.) under possible sites for a rain garden, bioretention area, or permeable pavement. Testing with a monitoring well or an excavated pit must extend to a depth at least 1 foot below the estimated bottom elevation of a rain garden/bioretention excavation and at least 1 foot below the subgrade surface of a permeable pavement. This analysis should be performed in the winter season (December 21 through March 21). Site historic information and evidence of high groundwater in the soils can also be used.
- If onsite infiltration may result in shallow lateral flow (interflow), the conveyance and possible locations where that interflow may re-emerge shall be assessed by a professional engineer, geologist, hydrogeologist, or engineering geologist registered in the State of Washington.

3.3 Drainage Control Plans
The Drainage Control Plan is the full submittal package meeting all Core Requirements per Chapter 2, Volume I. The Drainage Control Plan submittal package includes the following components, and shall be submitted as separate documents:

- Site Development Drawings
- Drainage Design Report
- Stormwater Site Management Plan
- Construction Stormwater Pollution Prevention Plan (C-SWPPP)

The four components of a complete Drainage Control Plan should be standalone documents. While they may reference each other, City review staff should be able to review each document independently from the other documents. The above components shall not be bound together in the same report.

A schematic showing the components of a typical Drainage Control Plan is presented in Figure 3.3.1. The Construction SWPPP consists of two parts: a narrative report, and drawings that are included with the other Site Development Drawings. Depending on the scope of the project, the permanent Stormwater Site Management Plan may contain up to four elements. Additional details on each component of the Drainage Control Plan are provided in the following sections.
3.3.1 Phased Project Submittals
Phased projects shall be completed in accordance with approved Drainage Control Plans and phased development requirements placed upon the development by the City. Phasing of projects shall not result in a reduction of drainage control requirements. Drawings showing the overall project, clearly delineating phase boundaries, and estimating dates of construction (if known), shall be part of any initial submittal.

3.3.2 Drainage Control Plan – Site Development Drawing Requirements
It is the responsibility of the project engineer to ensure that engineering drawings submitted for review are sufficiently clear to construct the project in proper sequence, using specified methods and materials, and with sufficient information and dimensions to fulfill the intent of the City of Olympia Engineering Design and Development Standards (EDDS) and the requirements of this manual.

The most recently adopted edition of the EDDS shall be the standards for all design and construction of drainage facilities not explicitly described herein. In the event of a conflict between the EDDS, standard drawings, and the manual, the requirements of this manual shall prevail. When required by the City, standard specifications and general provisions for construction must be submitted with any road construction plans.

Projects that involve work in or near critical areas must demonstrate compliance with the City’s Critical Areas Ordinance and Title 18 of the OMC. The Drainage Control Plan must indicate any site design and construction requirements that implement the applicable critical area standards and requirements.
The Site Development Drawings for construction purposes (i.e., construction drawings or plans) submitted to the City of Olympia shall conform to the following protocols in addition to those design and drafting requirements in Chapter 3 of the EDDS.

**Site Development Drawings – General Drawing Requirements**

- All final design, construction drawings shall be stamped, signed, and dated by a licensed professional engineer prior to review by the City.
- Vertical datum shall be based on NAVD88.
- All sheets shall have a north arrow, scale, a benchmark and datum reference, the section, township, and range. Each set of drawings shall have a legend to define map symbols. North arrow should point to the top or to the left of the sheet.
- Right-of-way, easements, tract lines, and dimensions for all existing and proposed facilities including proposed roads and intersecting roads, properly dimensioned lot lines, lot numbers, location, and dimension of all tract and easement areas.
- Parcel boundaries, street alignments, and horizontal control shall include bearings, distances and stationing as appropriate.
- All topographic features within project limits and sufficient area beyond to resolve questions of setback, slope, drainage features and paths, access onto abutting property, and road continuations.
- All ditch flow lines, all drainage structures with invert elevations, utility locations, fences, structures, existing curbing and approaches, pertinent trees and shrubbery, and other appurtenances, which would affect the construction of the project.
- Identification of all existing public roads and adjoining subdivisions when it is pertinent to the scope of the project.
- Existing features shall be ghosted or shaded so as to distinguish from proposed improvements.
- Standard City of Olympia stormwater, clearing and grading, and temporary erosion and sedimentation control notes as stated in the City’s Engineering Design and Development Standards.

**Site Development Drawings – Cover Drawing**

- Any drawing sets submitted for review and approval containing three or more sheets shall have a cover sheet.
- The cover sheet shall be sheet one of the drawing set and contain the following information:
  - A simple vicinity map, with north arrow oriented to the top of the sheet, showing project site, existing public road system and any other pertinent information.
  - An overall site plan or location map showing the project site(s) when applicable. Road and stormwater drainage system network including its connection to an existing public road or state highway. This does not have to be to scale.
  - The applicant and project engineering firm's names, address, telephone number, email address, current owner, and parcel numbers.
    - An index table of drawings.
    - Title block descriptive of project.
Site Development Drawings – Construction SWPPP Drawings

- Volume II, Section 3.2 of this manual describes the items that shall be shown on the Construction SWPPP drawings.

Site Development Drawings – Drainage/Grading/Earthwork Drawings

In addition to the general drawing requirements, the site and/or grading plan sheets shall show the following:

- The project’s existing and proposed storm drainage along with easements, tracts, drainage facilities, all buffer and screening areas, Soil and Vegetation Protection Areas, offsite and onsite existing drainage courses, flow dispersal areas and path dimensions, delineated wetlands, and associated buffers. Indicate direction of flow, size, and kind of each drainage channel, pipe, and structure. The status of existing drainage structures must be clarified on the plan. For onsite stormwater management BMPs designed to meet Core Requirement #5, provide a scale drawing of the lot or lots, and any public-right-of-way that displays the location of the BMPs and the areas served by them.
- Areas of possible significant environmental concern (gullies, ravines, swales, wetlands, steep slopes, estuaries, springs, creeks, lakes, etc.). For natural drainage features, show direction of flow.
- 100-year floodplain boundary (if applicable).
- Soil logs, soil log locations, and soils within the project site as verified by field testing (and documented in Drainage Design Report Section 3).
- Wells and wellhead protection areas – existing and proposed, onsite and on adjacent properties (both of record and not of record) within specified setbacks.
- Utilities.
- Existing paved and hard surfaces, including roads, roofs, and driveways.
- Lot dimensions and areas.
- Topographic information including contour lines of the property in its existing condition. County aerial or U.S. Geological Survey (USGS) topographic mapping must be field verified and supplemented with additional field topographic information when necessary to provide an accurate depiction of the project site.
- Topographic features that may act as natural stormwater storage, infiltration, or conveyance.
- Proposed grades.
- Property lines, parcel numbers, and ownership.
- Minimum contour intervals shall be as follows:
  - 0 percent – 15 percent: 1-foot contour interval
  - >15 percent – 40 percent slope: 2 or 5-foot contour interval
  - >40 percent slope: 10-foot contour interval.
- Grading/clearing setbacks from property lines per OMC Section 16.48.
- Earthwork/geotechnical requirements per OMC Title 16 and Volume III, Section 3.3 of this manual.
**Site Development Drawings – Plan/Profile Drawings**

**Show the following:**

- Original surface grade profile at 100-foot stations and at significant ground breaks and topographic features.
- Typical roadway/storm drainage cross-sections when applicable.
- Final surface and storm drain profile with stationing the same as the site/grading plan sheets.
- Surface grade and vertical curve data. Roads to be measured at centerline.
- Plan and profile view scales shall be consistent with the requirements of Chapter 3 of the Engineering Design and Development Standards.
- Storm structure text shall be shown in profile only, to avoid duplication of text. Number of structures shall be shown in the plan and profile views. The following information shall be shown in the profile view:
  - Type of structure
  - Structure number
  - Stationing/offsets (coordinates to be shown in the plan view)
  - Rim elevation
  - Invert elevations (in)
  - Invert elevations (out)
  - Pipe length, pipe size, material and slope (percent).
  - Utility crossings

**Site Development Drawings – Detail Drawings**

- All applicable standard notes from the City of Olympia Engineering Design and Development Standards (EDDS)
- A minimum of two cross-sections of each retention/detention pond and bioretention area showing original property lines, slope catch points, and all other pertinent information to adequately construct the pond or bioretention area.
- Details of flow control structures proposed to meet Core Requirement #7 and #8 depicting size, elevation, and orientation of all orifices, weirs, risers, etc.
- Details of all facilities intended for treatment of stormwater to meet Core Requirement #6. All pertinent flow direction, elevations, and pipe invert information should be included on the detail.
- Details of all onsite stormwater management BMPs that are used to help achieve compliance with Core Requirement #5. If distributed bioretention areas and/or storage below permeable pavement are used, provide details to confirm accurate facility representation in the runoff models (submitted as part of Drainage Design Report Section 9). Downspout infiltration and/or dispersion details should be included with appropriate sizing notes/schedule for residential lots.
- Identify locations and approximate size of all permeable pavement surfaces and bioretention areas to be installed, including those that will be installed on individual lots.
- Identify locations and species types for newly planted or retained trees for which impervious surface reduction credits are claimed. Supporting areas such as the flow paths for dispersion BMPs shall also be shown on the drawings.
- If distributed bioretention areas and/or infiltration below pollution-generating hard surfaces are used to help meet treatment requirements, provide details to confirm accurate representation in the runoff model (submitted as part of Drainage Design Report Section 9).
- Standard open conveyance system (e.g., swales, ditches, etc.) cross-sections if applicable.
• Right-of-way cross-sections as required by the City.
• Construction recommendations from a soils report if applicable.

3.3.3 Drainage Control Plan – Drainage Design Report Requirements
The Drainage Design Report is a major component of the Drainage Control Plan. The Drainage Design Report shall include data that facilitates plan and design review such as (but not limited to): drainage basin maps and areas, peak flow summaries, water surface elevations for the design storm(s), invert elevations, breaks in grade, design discharge, design velocity, design depths of reservoir course for permeable pavement, bioretention media thickness, etc. Specific components of the Drainage Design Report are described in detail below.

Copies of Drainage Design Report shall be submitted and bound in 8.5 x 11 inch size. An electronic copy of the report and hydrologic modeling files (WDM, wh2, whm) shall also be submitted on a compact disc, DVD or USB flash drive for review.

Required Components and Sections for the Drainage Design Report
The following components and sections shall be included in a complete Drainage Design Report addressing Core Requirements #1 through #9. The report organization shall follow the section order and content stated below:

Cover Sheet
The Drainage Design Report will have a cover sheet with the project name; applicant's name, address, telephone number, and email address; project engineer's name, address telephone number, and email address; date of submittal; contact's name, address, telephone number, and email address; and the name, address, telephone number, and email address of the contractor, if known.

Project Engineer's Certification
The project engineer responsible for completion of a Drainage Control Plan submittal as described herein shall be a professional engineer with a current State of Washington license. All plans and specifications, calculations, certifications, as-built drawings, and all other submittals which will become part of the permanent record of the project must be dated and bear the project engineer's official seal and signature.

The Drainage Design Report shall contain a page with the project engineer's seal with the following statement:

"I hereby certify that this Drainage Control Plan for __________________________ (name of project) has been prepared by me or under my supervision and meets minimum standards of __________________________ (jurisdiction) and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me."

Table of Contents
Show the page number for each section of the report. Show page numbers of appendices. All pages of the Drainage Design Report shall be numbered.

Maps
The Drainage Design Report shall include the following maps:

• Basin Maps. Show project boundaries, subbasin boundaries, and offsite area tributary to the project for both the predeveloped and post-developed scenarios. The project drainage basins depicted on these maps shall be the threshold discharge areas used to determine applicable core requirements in Section 2.4. Show major drainage features (such as channels
and detention facilities and floodways), and flow path to receiving waters. Use an appropriate scale for the project site for basin maps. Labeling and naming of basins on maps shall match the naming conventions used in computer modeling for the project.

- **Work Map (or maps).** On a topographic map at an appropriate scale for the project site, prepare a project map that shows:
  - Unit areas greater than 1 acre as contributing to a reach of swale or to a catch basin including offsite area. Identify all areas contributing to retention/detention facilities. Identify threshold discharge areas (TDAs) where applicable. Show the following on the work map (or on a schedule) for unit areas: total project area; total hard surfaces, pollution generating hard/impervious surface, pollution generating pervious surface, and total disturbed area; project site boundaries; average slope; and estimated ultimate infiltration rate and Natural Resource Conservation Service (NRCS), formerly SCS, Hydrologic Soil Group.
  - Conveyance data, identifier (for reference to model output), length, slope, inverts up and down.
  - Overland flow paths and distances.
  - Location of natural drainage systems and outfalls
  - Soil types.
  - Locations of soil pits and infiltration tests.
  - Spot water surface elevations, discharges and velocities for the design event.
  - Location of critical areas, wetlands, steep slopes, setbacks, protected areas, etc.
  - Characterization of onsite soils and vegetated areas

- **Schedule of Structures.** The Drainage Design Report shall include a table or “schedule” for the new storm drainage structures proposed on the project, including the following information:
  - Catch basin/manhole number
  - Stationing
  - Washington State Plane Coordinate System (i.e., Northings and Eastings) if used on site design plans
  - Street name and side located on, if applicable
  - Catch basin/manhole diameter or size
  - Invert elevations in/out
  - Pipe diameters in/out
  - Type of each structure and pipe, (i.e., Type II, concrete)

**Section 1 – Proposed Project Description**
Describe type of permit for which the applicant is applying, address and legal description of property, parcel number, property zoning, etc. Describe other permits required (hydraulic permits, USACE Section 404 Permit, wetlands, etc.) and present status.

Provide a summary of applicable Core Requirements (Section 2.4) and brief discussion of how the project complies with each requirement.

Provide a brief description of the development project (type, size, location, and for additions/remodels only, current assessed value and cost of improvements excluding land value) and the stormwater features to be installed for pollution source control, storage, runoff.
treatment, conveyance, and disposal/discharge (types, sizes, and locations). Identify which of the core requirements apply to the project, and how they are being addressed. Also include justification for those core requirements that do not apply. For Core Requirement #5, indicate whether the project used the mandatory list option, or the LID performance standard option, and complete documentation demonstrating compliance with either approach (additional guidance provided below).

Summarize calculations for all facilities in the body of the report. By threshold discharge area, include a tabulation of the current and proposed hard surfaces; new and/or replaced pollution generating pervious, impervious, and hard surfaces; effective impervious surface area and as a percentage of total site; disturbed pervious (such as landscaped areas); converted vegetation areas; and undisturbed areas. Complete engineering calculations, including hydrologic modeling analyses, conveyance designs, and documentation, must be included with the report. It is recommended that these be placed in appendices and be referenced where appropriate.

Describe the stormwater BMPs and conveyance systems incorporated into the design. Describe the detention system, outlet works, and spillways. Discuss vegetation establishment and management plans for conveyance and detention systems. Discuss any requirements or Soil and Vegetation Protection Areas and associated plans. For LID features and Core Requirement #5 specifically, describe the following:

- Project narrative showing how the project will fulfill the requirement for onsite management of stormwater to the extent feasible.
- Total area of vegetation retained.
- For projects using the list option for Core Requirement #5, an explanation and documentation, including citation of site conditions identified in a soils report, for any determination that an onsite stormwater management BMP was considered infeasible for the site. Information obtained and documented in the Existing Conditions Description (Section 2, see below) shall be used to substantiate any BMP infeasibility determinations.
- Areas of disturbed soils to be amended. (Note: All disturbed pervious, lawn, and landscaped areas are to meet requirements of soil preservation and amendment [see Volume V, BMP T5.13]).
- Retained trees and newly planted trees for which impervious reduction credits are claimed.
- For discharges of stormwater meeting the concentrated and full dispersion requirements of Volume V, provide a narrative and calculations for each discharge intended to meet the dispersion requirements. Areas tributary to each dispersion BMP shall be included or identified in the Work Map.

Section 2 – Existing Conditions Description
Existing conditions analysis results shall be submitted as part of the Drainage Control Plan – Drainage Design Report. Site analysis information and data collected as part of Step 1 of preparing a Drainage Control Plan (Section 3.4) shall be included in this section of the Drainage Design Report. Information in this section should also be used to help prepare the Construction Stormwater Pollution Prevention Plan.

Low impact development site design in particular is intended to complement the existing conditions on the site. However, not all sites are appropriate for all LID and onsite stormwater management BMPs, as site conditions often determine the feasibility of using these techniques. The existing conditions site analysis, consistent with the requirements of this section, shall determine the feasibility of using these BMPs.
Describe existing conditions and relevant hydrologic conditions including, but not limited to, the items listed below. Where subsequent report sections call for more details on these issues (e.g., soils, wells, septic systems), a brief description and reference to the specific report section is sufficient.

- Existing ground cover, including pervious (trees, shrubs, lawn, etc.), hard surface, and pollution generating areas.
- Offsite drainage to the property.
- Creeks, lakes, ponds, wetlands, ravines, gullies, steep slopes, springs, erosion hazards, freshwater designations, and other environmentally sensitive areas on or down gradient of the property.
- Location or proximity to aquifer recharge area or wellhead protection area as defined by City of Olympia Water Resources and Thurston County Environmental Health.
- Any specific requirements included in a basin plan for the area.
- Drains, channels, and swales, within the project site and immediately adjacent.
- Points of exit for existing drainage from the property.
- Any known historical drainage problems such as flooding, erosion, etc.
- Proximity to structures, property lines, onsite structures, sewers, septic tanks, septic fields and reserve areas, basements, bulkheads, closed or active landfills, and underground storage tanks.
- Summary of existing soil type, groundwater levels, and soil hydraulic conductivity (details to be covered in Section 3).
- Include references to relevant reports such as basin plans, flood studies, groundwater studies, wetland designations, sensitive area designations, environmental impact statements, environmental checklists, lake restoration plans, water quality reports, soils reports, etc. Where such reports impose additional conditions on the applicant, state these conditions and describe any proposed mitigation measures.

Section 3 – Infiltration Rates/Soils Reports
Specific infiltration testing and documentation requirements are outlined in Volume III, Chapter 3. For all sites and facilities utilizing infiltration for stormwater management, a soils report must be prepared that is stamped by a professional engineer with geotechnical expertise, a licensed geologist, an engineering geologist, a hydrogeologist, or professional soil scientist certified by the Soil Science Society of America (or an equivalent national program) that summarizes site characteristics and demonstrates that sufficient permeable soil for infiltration exists at the proposed facility location. The reporting requirements depend on the type of facility and analysis being performed. See Volume III, Chapter 3 for the detailed requirements for testing, reporting, and qualifications of testing professionals.

If a retention and/or detention facility is near the top of a slope that is regulated through ordinance, then a geotechnical assessment addressing effects of seepage and the potential for slope failure during any precipitation event through the design event is required as part of this section of the Drainage Design Report.

If the project is located in an area with contaminated soils or excavation of contaminated soils is expected, the soils report should address the extent of contamination and methods for remediation.
Section 4 – Wells and Septic Systems
The project engineer shall report the existence of wells and septic systems both of record and others on the site and on adjacent property within the setback distance for stormwater retention/detention facilities identified in Volume III. Groundwater monitoring wells shall also be identified on and near the project site. The project engineer shall inquire with the City of Olympia Water Resources – Wastewater Utility, Thurston County Environmental Health Department, and neighboring property owners as necessary to obtain location of wells and septic systems that are not of record. Wells and septic systems thus found, both active and abandoned, shall also be shown on the plans or as-builts (if found during construction).

The proper abandonment of wells is a matter regulated by state law (WAC 173-160). The Thurston County Environmental Health Department regulates drinking water and irrigation wells while the State Department of Ecology regulates resource protection wells. If a well on the site has not been properly sealed, the applicant shall be responsible for contacting Thurston County Environmental Health. The appropriate procedure shall be followed for sealing any well. Proof of proper abandonment (e.g., copies of the well log and invoice from a firm qualified to perform such work) shall be supplied to the Thurston County Environmental Health or Ecology per its requirements. If no wells or septic systems were found, indicate so.

Section 5 – Fuel Tanks
The project engineer shall report, the existence of fuel tanks, in-use or abandoned. Fuel tanks shall be shown on the plans or as-builts (if found during construction). If fuel tanks will be abandoned or removed, contact the Thurston County Environmental Health for specific instructions. If no fuel tanks are found, indicate so.

Section 6 – Subbasin Description
Describe offsite drainage tributary to the project. Describe any bypass drainage from the project that will not be controlled.

Describe the drainage system between the site and the receiving surface waters (or pothole, regional detention facility, etc.). Describe emergency services located along the flow path (e.g., fire/police stations, hospitals).

Section 7 – Floodplain Analysis
If the project is within flood hazard areas as defined in the most current FEMA Flood Insurance Rate Maps, provide FIRMs for the project area in the Drainage Design Report and, if applicable, show the 100-year flood hazard area on the plans. If the flood hazard area has not been established (or the City determines that it is in error), the City may require the applicant to establish and map the 100-year flood hazard area for the proposed project to be submitted with the Drainage Design Report. If project is determined to be in the flood hazard area, additional studies per may be required.

Section 8 – Aesthetic Considerations for Facilities
Specifically describe the effort made to make the facilities aesthetically pleasing, how facilities will provide useable open space, protect naturally vegetated areas, and how stormwater facilities will seamlessly fit into the landscaping plan for the site. Drainage facilities should be made attractive features of the urban environment. Engineers are encouraged to be creative in shaping and landscaping facilities. Include description of the type and frequency of maintenance and specific vegetation management practices that are expected for the proposed stormwater facilities (the project’s Stormwater Facility Maintenance Program needs to address maintenance frequency and costs – that discussion may be included here).
Section 9 – Facility Selection and Sizing
The project engineer shall provide calculations for the project's stormwater storage, treatment, and conveyance system components. All relevant work/calculationsshall be submitted for City review. Documentation outlining whether and how each of the core requirements have been addressed in the Drainage Design Report shall be submitted for City review. All calculations shall be keyed to numbered features shown on the work map as described above. Project submittals must include a stage-storage table that identifies the design facility stage and volume expected for the 2-, 5-, 10-, 25-, 50-, and 100-year recurrence interval flows for facilities intended to address Core Requirement #7.

If flow control facilities are proposed to comply with Core Requirement #7, provide a listing of assumptions and site parameters used in analyzing the pre-developed site hydrology. The acreage, soil types, and land covers used to determine the pre-developed flow characteristics, along with basin maps, graphics, and exhibits for each subbasin affected by the project should be included. The pre-developed condition to be matched shall be a forested land cover unless reasonable, historic information is provided that indicates the site was prairie prior to settlement. Provide a confirmation of the flow control standard being achieved (e.g., the Ecology flow duration standard). Indicate whether using the mandatory list or the LID performance standard option for Core Requirement #5. If using the LID performance standard, provide confirmation the proposed facilities meet the LID performance standard of Core Requirement #5.

If hydrologic modeling when designing facilities is required, the project engineer shall use an approved continuous simulation runoff model and document modeling methods, assumptions, parameters, data sources, and all other relevant information to the analysis. Modeling shall be performed using the most current Thurston County precipitation data and 15-minute time steps. If model parameters are used that are outside the standards of practice, or if parameters are different than those standards, justify the parameters. Guidance for modeling stormwater features and land cover types are found in Volume III. The applicant must also include digital copies of the model with files sufficient to re-run the model and include input parameters, as well as model output files to the county. Projects taking an impervious surface reduction credit for newly planted or retained trees (see tree planting and tree retention in Volume V, BMP T5.13) must provide those calculations and documentation on site plans for the locations of the trees. Projects using 65/10 (i.e., “full”) dispersion or full downspout infiltration BMPs must provide information to confirm conformance with design requirements that allow removal of the associated drainage areas from computer model input.

If treatment facilities are proposed, provide a listing of the water quality menus used (Chapter 3, Volume V).

For design of water quality treatment systems specifically, if bioretention and/or infiltration below pollution-generating hard surfaces through adequate soils (see Volume V, Chapter 5 and 7) will be used to help meet treatment requirements, the runoff model output files must include the volume of water that has been treated through those BMPs. The summation of those volumes and the volume treated through a centralized, conventional treatment system must meet or exceed 91 percent of the total stormwater runoff file. This sum of volumes must include:

- Stormwater that has infiltrated through a bioretention area, and stormwater that has infiltrated below pollution-generating hard surfaces (e.g., permeable pavement) through adequate soils.
- Stormwater that passes through a properly sized treatment facility. Note that stormwater that is re-collected below a bioretention area and routed to a centralized treatment facility should not be counted twice.
Subtraction of any stormwater that does not receive treatment due to bypass of, or overflow from a treatment facility or a bioretention area (if the overflow is not subsequently routed to a treatment facility).

For a subdivision project, provide a detailed breakdown on a lot-by-lot basis of the assumptions related to roof, driveway, and other hard surfaces that have been used in the design and sizing of facilities. This breakdown will be used to determine the allowed square footage of hard surfaces for each lot.

**Section 10 – Conveyance System Analysis and Design**

Present an analysis of any existing conveyance systems, and the analysis and design of the proposed stormwater conveyance system for the project. At a minimum, present an analysis of on-site hydrologic connectivity of surficial conveyance channels and/or pipes, and points of concentration. If an off-site analysis is required, include the results of that analysis in Section 11 below.

This information should be presented in a clear, concise manner that can be easily followed, checked, and verified. All pipes, culverts, catch basins, channels, swales, and other stormwater conveyance appurtenances must be clearly labeled and correspond directly to the engineering plans. Demonstrate that conveyance systems comply with City of Olympia Engineering Design and Development Standards (EDDS, Chapter 5 – Stormwater), such as materials, construction, and design event. Include copies of all calculations for capacity of channels, culverts, drains, gutters, etc. If applicable, include nomographs and tables indicating how they were used. Show headwater and tailwater analysis for culverts when necessary. Provide details on references and sources of information used.

Describe capacities, design flows, and velocities in each reach. Describe required materials or specifications for the design (e.g., rock lining for channels when velocity is exceeded, high density polyethylene pipe needed for steep slope).

**Section 11 – Offsite Analysis & Mitigation**

A downstream analysis of the project for a minimum of one-fourth of a mile is required when stormwater is discharged to an offsite conveyance or flows are dispersed toward downhill properties. Refer to Section 2.6.2 of this Volume for specific guidance in performing the offsite analysis.

The engineer must field inspect all existing stormwater drainage systems downstream from the project and determine that the capacity of the drainage system(s) is adequate to handle the existing flows, flows generated by the proposed project, and any overflow. Adequacy will be evaluated based on conveyance capacity, flooding problems, erosion damage or potential, amount of freeboard in channel and pipes, and storage potential within the system. When required, offsite analyses shall provide both qualitative and quantitative evaluation of the downstream flow paths following the guidance of Section 2.6.2.

If a capacity problem or stream bank erosion problem is encountered, the release rate from the project will be restricted accordingly or the applicant may correct the problem (e.g. increasing the capacity of the downstream conveyance). For naturally occurring drainage systems, drainage ditches, or undeveloped drainage courses, the engineer must take into account the hydraulic capacity of the existing drainage course and environmental considerations such as erosion, siltation, and increased water velocities or water depths.

A map showing the flow route of the onsite water for the minimum of one-fourth of a mile downstream distance must accompany the storm drainage calculations. This may be a standalone map for the downstream analysis or included in the Work Map when appropriate.
Section 12 – Utilities
Describe how utilities will be installed to ensure no conflicts with proposed stormwater quantity and quality control measures.

Section 13 – Covenants, Dedications, Easements, Agreements
Describe legal instruments needed to guarantee preservation of drainage systems and access for maintenance purposes (attach copies if not included as part of other Drainage Control Plan submittals). Describe the organization or person (Program Operator) who will be responsible for inspection, operation, and maintenance of storm drainage facilities and execution of pollution source control programs. Dedication of tracts and/or easements for stormwater facilities or conveyances should be discussed in this section. Agreement to Maintain Stormwater Facilities (Volume IV, Chapter 4) and inclusion of all items in the Stormwater Site Management Plan should be referenced in this section.

Section 14 – Other Permits or Conditions Placed on the Project
Construction of road and drainage facilities may require additional permits from other agencies. These additional permits may contain more restrictive drainage control requirements. This section should provide the title of any other necessary permits, the agencies requiring the other permits, and identify the permit requirements that affect the project.

The applicant will be responsible to coordinate joint agency drainage review, including resolution of any conflicting requirements between agencies.

Appendix
Dependent on the project scope and requirements for supplemental information and maps, the appendix may include environmental assessments, wetland studies, geotechnical reports, FEMA maps, supporting hydrologic modeling output, facility modeling schematics, manufacturer specifications for emerging technologies, and other supporting documentation for the stormwater design proposed for the project. Note that the appendix should be used for these supporting documents, and all information pertinent to design process and summary of the proposed facility designs should be included in the main body of the report (e.g., basin coverage summaries, peak flow summaries, etc. should be in the main report).

3.3.4 Drainage Control Plan - Construction SWPPP Report
Volume II, Section 3.2 of this manual describes the items that shall be included in the Construction Stormwater Pollution Prevention Plan. The Construction SWPPP is a document separate from the Drainage Design Report, and should not be included in that report document.

Note: The Construction SWPPP consists of two parts: a narrative report and drawings. A complete Construction SWPPP (both report and drawings) is required as part of the Drainage Control Plan submittal. Depending on the scope of the project, components of the Construction SWPPP may be required with an Abbreviated Plan. At a minimum, all 13 Construction Stormwater Pollution Prevention elements in accordance with Core Requirement #2 (Section 2.5.2) must be addressed.

3.3.5 Drainage Control Plan - Stormwater Site Management Plan
For a project that must comply with Core Requirement #3 and Core Requirement #9, a Stormwater Site Management Plan must be developed for projects that require a Drainage Control Plan.

The plan and included manuals must be prepared in an 8.5 x 11 inch format and must comply with the recording standards of the Thurston County Auditor. The maintenance program and pollution source control program must be prepared by a professional engineer, but must also be understandable to the typical property owner and/or person responsible for maintenance.
A complete Stormwater Site Management Plan contains the following elements and is described further in Chapter 2 of Volume IV:

- Agreement to Maintain Stormwater Facilities
- Pollution Source Control Program
- Stormwater Facility Maintenance Program
- Tree Plans or Soil and Vegetation Plans (as required)

### 3.4 Drainage Control Plan Preparation: Step-By-Step Process

The steps involved in developing a Drainage Control Plan are listed below.

1. Site Analysis: Collect and Analyze Information on Existing Conditions
2. Prepare Preliminary Development Layout
3. Perform Off-site Analysis
4. Determine Applicable Core Requirements
5. Prepare Site Development Drawings and a Drainage Design Report
6. Prepare a Construction Stormwater Pollution Prevention Plan
7. Prepare a Stormwater Site Management Plan
8. Finalize the Drainage Control Plan or Abbreviated Drainage Plan

The level of detail required depends upon the project size as explained in the individual steps. A narrative description of each of these steps follows.

#### 3.4.1 Step 1 – Site Analysis: Collect and Analyze Information on Existing Conditions

Site analysis results shall be recorded and reported as part of the Existing Conditions Summary and the Work Map(s) within the Drainage Design Report submittal (see Section 3.3.3 for format and required components to be included in the Drainage Design Report). Part of the information in this step should also be used to help prepare the Construction Stormwater Pollution Prevention Plan. The City may choose to waive certain components required in this section as appropriate.

**Purpose of the Site Analysis:** Low impact development (LID) site design is intended to complement the predevelopment conditions on the site. However, not all sites are appropriate for a complete LID project, as site conditions determine the feasibility of using LID techniques. The development context shall be established by an initial site analysis consistent with the requirements of this section.

The initial inventory and analysis process will provide baseline information necessary to design strategies that utilize areas most appropriate to evaporate, transpire, and infiltrate stormwater, and achieve the goal of minimizing the pre-development natural hydrologic conditions on the site.

The site analysis shall include, at a minimum, the following information for all projects required to meet Core Requirements 1 – 5 (Abbreviated Drainage Plans):

1. A survey prepared by a registered land surveyor (or other qualified professional) showing:
   - Existing public and private development, including utility infrastructure on and adjacent to the site if publicly available,
   - Minor hydrologic features, including seeps, springs, closed depression areas, drainage swales.
   - Major hydrologic features with a streams, wetland, and water body survey and classification report showing wetland and buffer boundaries consistent with the requirements of the jurisdiction.
Note that site visits should be conducted during winter months and after significant precipitation events to identify undocumented surface seeps or other indicators of near surface ground water.

- Flood hazard areas on or adjacent to the site, if present.
- Geologic Hazard areas and associated buffer requirements as defined by the City or Thurston County
- Aquifer and wellhead protection areas on or adjacent to the site, if present.
- Topographic features that may act as natural stormwater storage, infiltration or conveyance.
- Topographic contours meeting the site drawing requirements of Section 3.3.

2. A soils report prepared by a professional soil scientist certified by the Soil Science Society of America (or an equivalent national program), locally licensed on-site sewage designer, or by other suitably trained persons working under the supervision of a professional engineer, geologist, hydrogeologist, or engineering geologist registered in the State of Washington. The report shall identify:

   a. Underlying soils on the site utilizing soil surveys, soil test pits, soil borings, or soil grain analyses (see [http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm](http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm) for soil survey information).

   b. The results of saturated hydraulic conductivity ($K_{sat}$) testing to assess infiltration capability and the feasibility of rain gardens, bioretention, and permeable pavement. Some testing has seasonal limitations. Use the infiltration testing guidance of Volume III, Chapter 3. Post construction verification testing is required to confirm infiltration facility actual performance. If infiltration facility actual and design performances are not roughly equivalent, contingency designs must be implemented.

      **Note:** The certified soils professional or engineer can exercise discretion concerning $K_{sat}$ testing if in their judgment information exists confirming that the site is unconsolidated outwash material (high infiltration rates) and there is adequate depth to ground water (1 foot minimum from bottom of a rain garden, bioretention, or permeable pavement installation).

   c. The results of testing for an hydraulic restriction layer (ground water, soil layer with less than 0.3 in/hr $K_{sat}$, bedrock, etc) under possible sites for a rain garden, bioretention facility, or permeable pavement. Testing with a monitoring well or an excavated pit must extend to a depth at least 1 foot below the estimated bottom elevation of a rain garden/bioretention excavation and at least 1 foot below the subgrade surface of a permeable pavement. This analysis should be performed in the winter season (December 21 through March 21). The optimum time to test for depth to ground water is usually late winter and shortly after an extended wet period. Site historic information and evidence of high ground water in the soils can also be used.

3. If there are native soil and vegetation protection areas proposed for the site, provide a survey of existing native vegetation cover meeting the requirements of OMC Chapter 16.60 identifying any forest areas on the site and a plan to protect those areas. The preserved area should be placed in a separate tract or protected through recorded easements for individual lots.
The site analysis shall include, at a minimum, the following information for projects required to meet Core Requirements 1 – 9 (Drainage Control Plans):

1. A survey prepared by a registered land surveyor or civil engineer showing:
   - Existing public and private development, including utility infrastructure on and adjacent to the site if publicly available,
   - Minor hydrologic features, including seeps, springs, closed depression areas, drainage swales.
   - Major hydrologic features with a streams, wetland, and water body survey and classification report showing wetland and buffer boundaries consistent with the requirements of the jurisdiction.
     Note: Site visits should be conducted during winter months and after significant precipitation events to identify undocumented surface seeps or other indicators of near surface ground water.
   - Flood hazard areas on or adjacent to the site, if present.
   - Geologic Hazard areas and associated buffer requirements as defined by the City or Thurston County
   - Aquifer and wellhead protection areas on or adjacent to the site, if present.
   - Topographic features that may act as natural stormwater storage, infiltration or conveyance.
   - Topographic contours meeting the site drawing requirements of Section 3.3.

2. A soils report prepared by a professional soil scientist certified by the Soil Science Society of America (or an equivalent national program), or by other suitably trained persons working under the supervision of a professional engineer, geologist, hydrogeologist, or engineering geologist registered in the State of Washington. The report shall identify:
   a. Underlying soils on the site utilizing soil surveys, soil test pits, or soil grain analyses (see http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm for soil survey information).

      Prepare detailed logs for each test pit or soil boring and a map showing the location of the test pits or borings. Logs must include depth of pit or boring, soil descriptions, depth to water (if present), and presence of stratification. Depth should extend to 5 feet below estimated bottom elevation of bioretention facilities and road subgrade. Logs must substantiate whether stratification does or does not exist. The licensed professional may consider additional methods of analysis to substantiate the presence of stratification.

      Soil stratigraphy should be assessed for low permeability layers, highly permeable sand/gravel layers, depth to ground water, and other soil structure variability necessary to assess subsurface flow patterns. Soil characterization for each soil unit (soil strata with the same texture, color, density, compaction, consolidation and permeability) should include:
      - Grain size distribution
      - Textural class
      - Percent clay content
      - Cation exchange capacity
      - Color/mottling
      - Variations and nature of stratification
b. The results of saturated hydraulic conductivity (K$_{sat}$) testing to assess infiltration capability and the feasibility of bioretention, and permeable pavement. Use methods outlined in Volume III, Chapter 3.

Placement of K$_{sat}$ tests should be carefully considered to reduce cost. A few strategically placed soil test pits and saturated hydraulic conductivity test sites are generally adequate for initial site assessment and for smaller sites (e.g. less than an acre). On larger project sites, a more detailed soil assessment and additional K$_{sat}$ testing may be necessary to direct placement of impervious surfaces such as structures away from soils that can most effectively infiltrate stormwater, and placement of permeable pavement roads, parking lots, driveways, walks, and bioretention/rain gardens over those soils. Use the infiltration testing guidance of Volume III, Chapter 3. The K$_{sat}$ tests are also necessary as input to the runoff model to predict the benefits of LID BMPs that infiltrate.

**Note:** The certified soils professional or engineer can exercise discretion concerning K$_{sat}$ testing if in their judgment information exists confirming that the site is unconsolidated outwash material (high infiltration rates) and there is adequate depth to ground water (1 foot minimum from bottom of a rain garden, bioretention, or permeable pavement installation).

c. The results of testing for an hydraulic restriction layer (ground water, soil layer with less than 0.3 in/hr K$_{sat}$, bedrock, etc) under possible sites for a bioretention facility, or permeable pavement. If the general site assessment cannot confirm that the seasonal high ground water or hydraulic restricting layer will be greater than 3 feet below the bottom of the bioretention or greater than 1 foot below the bottom of the lowest gravel base course of permeable pavement monitoring wells or excavated pits should be placed strategically to assess depth to ground water. This analysis should be performed during the wet season prior to construction. Monitoring with a continuously logging censer between Dec. 21 and Mar. 21 provides the most thorough information. Monitoring for lesser time periods can be accepted but increases risk. Site historical data regarding ground water levels can be used in lieu of field testing if the data are reliable and sufficient. Also, soil evidence of historical ground water elevations may be used.

Special considerations are necessary for highly permeable gravel areas. Signs of high ground water will likely not be present in gravelly soils lacking finer grain material such as sand and silt. Test pit and monitoring wells may not show high ground water levels during low precipitation years. Accordingly, sound professional judgment, considering these factors and water quality treatment needs, is required to design multiple and dispersed infiltration facilities on sites with gravel deposits.

d. If on-site infiltration may result in shallow lateral flow (interflow), the conveyance and possible locations where that interflow may re-emerge should be assessed by a professional engineer, geologist, hydrogeologist, or engineering geologist registered in the State of Washington. This will likely require placement of ground water monitoring wells to determine existing ground water gradients and flow. In general, a minimum of three wells associated with three hydraulically connected surface or ground water features, are needed to determine the direction of flow and gradient.

3. If there are native soil and vegetation protection areas proposed for the site, provide a survey of existing native vegetation cover meeting the requirements of OMC Chapter 16.60 identifying any forest areas on the site and a plan to protect those areas. The preserved area should be placed in a separate tract or protected through recorded easements for individual lots.
3.4.2 Step 2 – Prepare Preliminary Development Layout

Based upon the analysis of existing site conditions, locate the buildings, roads, parking lots, landscaping features, on-site stormwater management BMPs, and preliminary location of stormwater treatment and retention/detention facilities for the proposed development. Consider the following points when laying out the site:

- Fit development to the terrain to minimize land disturbance; Confine construction activities to the least area necessary, and away from critical areas.
- Preserve areas with natural vegetation (especially forested areas) as much as possible.
- On sites with a mix of soil types, locate impervious areas over less permeable soil (e.g., till), try to restrict development over more porous soils or take advantage of them by locating bioretention/rain gardens and permeable pavement over them.
- Cluster buildings together.
- Minimize impervious areas.
- Maintain and utilize the natural drainage patterns.

The development layout designed here will be used for determining threshold discharge areas, for calculating whether size and flow rate thresholds under Core Requirements #6, #7, and #8 are exceeded (see Chapter 2), and for the drawings and maps required for the Drainage Control Plan. The proposed development layout should be verified for compliance with applicable sections of the Olympia Municipal Code including Chapters 16, 17, and 18.


3.4.3 Step 3 – Perform an Off-site Analysis

An offsite analysis is required for projects that add 5,000 square feet or more of new hard surface, or that convert ¾ acres of vegetation to lawn or landscaped areas, or convert 2.5 acres of forested area to pasture. An offsite or downstream analysis is also required when any discharge of stormwater is proposed beyond the project limits.

The phased off-site analysis approach outlined in Additional Requirement #2 (Section 2.6.2) is required when either of the above thresholds apply. The phased approach relies first on a qualitative analysis. If the qualitative analysis indicates a potential problem, the City may require mitigation or a quantitative analysis. For more information, see Section 2.6.2.

3.4.4 Step 4 – Determine and Read the Applicable Core Requirements

Section 2.4 establishes project size thresholds for the application of Core Requirements to new development and redevelopment projects. Figures 2.4.1 and 2.4.2 provide the same thresholds in a flow chart format. Based on the preliminary layout and a summary of coverage areas, determine whether an Abbreviated Drainage Plan can be prepared (only Core Requirements #1 through #5 apply to the project); or, whether the project requires a full Drainage Control Plan submittal (Core Requirements #1 through #9 apply).

3.4.5 Step 5 – Prepare Site Development Drawings and Drainage Design Report

This step focuses on the preparation of final site development drawings and a Drainage Design Report (for full Drainage Control Plans) or narrative summary (for Abbreviated Drainage Plans).

Select on-site stormwater control BMPs (all projects), onsite stormwater management BMPs (core requirement #5), and treatment and flow control facilities (projects subject to core requirements #1
through #9) that will serve the project site in its developed condition. The selection process for treatment and flow control facilities is presented in detail in Chapter 4 of this Volume, and Chapter 2 of Volume V. Onsite stormwater management BMPs and LID features shall be applied to the site per Section 2.5.5 of this Volume and are presented in detail in Volumes III and V.

A preliminary design of the On-site Stormwater Management BMPs and treatment/flow control facilities is necessary to determine how they will fit within and serve the preliminary development layout developed in Step 2. After a preliminary design is developed, the designer may want to reconsider the site layout to reduce the need for the construction of facilities, or the size of the facilities by reducing the amount of hard – especially impervious - surfaces created, decreasing effective impervious surfaces, and increasing the areas to be left undisturbed. After the designer is satisfied with the BMP and facilities selections, the final design information must be presented within the Drainage Design Report and on the final Site Development Drawings.

Drainage Design Reports shall be prepared and include the requirements of Section 3.3.3.

Site Development Drawings shall be prepared per the requirements of Section 3.3.2.

3.4.6 Step 6 – Prepare a Construction Stormwater Pollution Prevention Plan

The Construction SWPPP for projects subject to Core Requirement #2 and adding or replacing 2,000 square feet of hard surface or more, or clearing 7,000 square feet or more, must contain sufficient information to satisfy the City’s Plan Approval Authority that the potential pollution problems that may arise during construction have been adequately addressed for the proposed project.

An adequate Construction SWPPP includes a narrative and drawings. The narrative is a written statement to explain and justify the pollution prevention decisions made for a particular project. The narrative contains concise information concerning existing site conditions, construction schedules, and other pertinent items that are not contained on the drawings. The drawings and notes describe where and when the various BMPs should be installed, the performance the BMPs are expected to achieve, and actions to be taken if the performance goals are not achieved. To ensure it is available to contractors and city inspectors, all relevant information shall be included on the construction drawings.

The 13 Elements listed in Section 2.5.2 - Core Requirement #2 - must be considered in the development of the Construction SWPPP unless site conditions render the element unnecessary and the exemption from that element is clearly justified in the narrative of the Construction SWPPP. These elements are described in detail in Volume II, Chapter 3. They cover the general water quality protection strategies of limiting site impacts, preventing erosion and sedimentation, and managing activities and sources.

On construction sites that discharge to surface water, the primary consideration in the preparation of the Construction SWPPP is compliance with the State Water Quality Standards. The step-by-step procedure outlined in Volume II, Section 3.3 is recommended for the development of these Construction SWPPPs. A checklist is contained in Volume II, Section 3.3 that may be helpful in preparing and reviewing the Construction SWPPP.

On construction sites that infiltrate all stormwater runoff, the primary consideration in the preparation of the Construction SWPPP is the protection of the infiltration facilities from fine sediments during the construction phase and protection of ground water from other pollutants. Several of the other elements are very important at these sites as well, such as marking the clearing limits, establishing the construction access, and managing the project.

3.4.7 Step 7 – Prepare the Stormwater Site Management Plan

Stormwater Site Management Plans are intended to ensure the long-term functionality of stormwater systems proposed in the Drainage Control Plan to mitigate the effects of development. Stormwater Site Management Plans shall be prepared in accordance with Chapter 2 of Volume IV. Specific guidance for
preparation of Pollution Source Control Programs and Stormwater Facility Maintenance Programs can be found in Chapters 3 and 4 of Volume IV, respectively.

3.4.8 Step 8 – Finalize the Drainage Control Plan or Abbreviated Drainage Plan

A Drainage Control Plan or Abbreviated Drainage Plan as designed and implemented should specifically fulfill all applicable Core Requirements for the project. Plans should be reviewed against the requirements of Section 3.3 of this Volume.

The Drainage Control Plan should be reviewed to check that these requirements are satisfied prior to submittal for agency review.
Chapter 4 - BMP and Facility Selection Process for Drainage Control Plans

4.1 Purpose
The purpose of this chapter is to provide guidance for selecting permanent BMPs and facilities for new development and redevelopment sites (including retrofitting of redevelopment sites). The task of selecting BMPs and facilities is necessary to complete the Drainage Control Plan. The details for how to complete the other major component - a Construction Stormwater Pollution Prevention Plan - are included in Chapter 3 of Volume II of this manual.

The Department of Ecology’s (Ecology) pollution control strategy is to emphasize pollution prevention first, through the application of source control BMPs. Then the application of appropriate on-site, treatment, and flow control facilities fulfills the statutory obligation to provide “all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the State of Washington.” (RCW 90.48.010) This statutory requirement is generally known by an acronym – AKART.

The remainder of this chapter presents seven steps in selecting BMPs, Treatment Facilities, and Flow Control Facilities.

4.2 BMP and Facility Selection Process

Step I: Determine and Read the Applicable Core Requirements
Section 2.4 establishes project size thresholds for the application of Core Requirements to new development and redevelopment projects. Figures 2.4.1 and 2.4.2 provide the same thresholds in a flow chart format. Total new hard surfaces, replaced hard surfaces, and converted vegetation areas to determine which core requirements apply to the project.

Step II: Select Source Control BMPs
Refer to Chapter 3 of Volume IV for guidance in preparing a project specific Pollution Source Control Program. If the project involves construction of areas or facilities to conduct any of the activities described in Section 3.6 of Volume IV, the “applicable” structural source control BMPs described in that section must be constructed as part of the project. In addition, if the specific business enterprise that will occupy the site is known, the “applicable” operational source control BMPs must also be described. Structural source control BMPs should be identified in the Drainage Control Plan and should be shown on all applicable plans submitted for City review and approval.

The project may have additional source control responsibilities as a result of area-specific pollution control plans (e.g., watershed or basin plans, water clean-up plans, ground water management plans, lakes management plans), ordinances, and regulations.

Step III: Determine Threshold Discharge Areas and Applicable Requirements for Treatment, Flow Control, and Wetlands Protection
Core Requirements #6 (Runoff Treatment) and #7 (Flow Control) have size thresholds that determine their applicability (see Sections 2.5.6 and 2.5.7). Core Requirement #8 (wetlands protection) uses the same size thresholds as those used in #6 and #7. Those thresholds determine whether certain areas (called “threshold discharge areas”) of a project must use treatment and flow control facilities, designed by a professional engineer, or whether just Core Requirement #5 (On-Site Stormwater Management BMPs) applies (see Section 2.5.5).
**Step 1: Read the definitions in Appendix I-G** to become acquainted with the following terms: effective impervious surface, impervious surface, hard surface, pollution-generating impervious surface (PGIS), pollution-generating hard surface, pollution-generating pervious surface (PGPS), converted vegetation areas, and threshold discharge area.

**Step 2: Outline the threshold discharge areas** for your project site.

**Step 3: Determine the amount of pollution-generating hard surfaces (including pollution-generating permeable pavements) and pollution-generating pervious surfaces** (not including permeable pavements) in each threshold discharge area. Compare those totals to the project thresholds in Section 2.5.6 to determine where treatment facilities are necessary. Note that On-site Stormwater Management BMPs (Core Requirement #5) are always applicable.

**Step 4: Compute the totals for effective impervious surface and converted vegetation areas in each threshold discharge area.** Compare those totals to the project thresholds in Section 2.5.7 to determine if flow control facilities (Core Requirements #7 and #8) are needed. If neither threshold for flow control facilities (Core Requirement #7) is exceeded, proceed to Step 5. If one of the thresholds is exceeded, proceed to Step IV below.

**Step 5: For each threshold discharge area, use an approved continuous runoff model (e.g., WWHM, MGS Flood) to determine whether there is an increase of 0.15 cfs in the 100-year return frequency flow.** (Note: all designs must use the most recent Thurston County precipitation data in 15-minute time steps.) This requires a comparison to the 100-year return frequency flow predicted for the existing (pre-project; not the historic) land cover condition of the same area. If the above threshold is exceeded, flow control – Core Requirements #7 and #8 – is potentially required. See the “Applicability” sections of those core requirements. Note that On-site Stormwater Management BMPs (Core Requirement #5) are always applicable.

- This task requires properly representing the hard surfaces, and the converted vegetation areas in the runoff model. Hard surfaces include impervious surfaces, permeable pavements, and vegetated roofs. Impervious surface area totals are entered directly. Permeable pavements are entered as lawn/landscaping areas over the project soil type if they do not have any capability for storage in the gravel base (more typical of private walks, patios, and private residential driveways). Permeable pavements with storage capability should use the permeable pavement “element” in the model. An “element” is provided for vegetated roofs also. See Appendix III-C in Volume III, and the WWHM user’s manual for guidance concerning proper representation of LID BMPs in approved computer models.

**Step IV: Select Flow Control BMPs and Facilities**

A determination should have already been made whether Core Requirement #7, and/ or Core Requirement #8 apply to the project site. On-site Stormwater Management BMPs must be applied in accordance with Core Requirement #5. In addition, flow control facilities must be provided for discharges from those threshold discharge areas that exceed the thresholds outlined in Section 2.5.7. Use an approved continuous runoff model (e.g. the Western Washington Hydrology Model with most current Thurston County precipitation data) and the details in Chapter 3 of Volume III to size and design the facilities.

The following describes a selection process for those facilities.
**Step 1: Determine whether you can infiltrate.**

There are two possible options for infiltration.

The first option is to infiltrate through rapidly draining soils that do not meet the site characterization and site suitability criteria for providing adequate treatment. See Chapter 3 of Volume III for design criteria for infiltration facilities intended to provide flow control without treatment. In this case, a treatment facility must be provided prior to discharge to the ground for infiltration. The treatment facility could be located off-line with a capacity to treat the water quality design flow rate or volume (See Volume V, Chapter 4) to the applicable performance goal (See Volume V, Chapter 3). Volumes or flow rates in excess of the design volume or flow rate would bypass untreated into the infiltration basin. (Note that wetpool treatment facilities are always designed to be on-line.) The infiltration facility must provide adequate volume such that the flow duration standard of Core Requirement #7, or the water surface elevation requirements of Core Requirement #8 will be achieved.

The second option is to infiltrate through soils that meet the site characterization and site suitability criteria in Chapter 3 of Volume III. The facility would be designed to meet the requirements for treatment and flow control. However, since such a facility would have to be located on-line it would be quite large in order to achieve the flow duration standard of Core Requirement #7.

If infiltration facilities for flow control are planned, the flow control requirement has been met. Proceed to Step V. If infiltration facilities are not planned, proceed to Step 2.

**Step 2: Use an approved continuous simulation hydrologic model to size a detention facility.**

Refer to Chapter 2, of Volume III for an explanation of the use of the Western Washington Hydrology Model for detention facility sizing. Detailed guidance concerning proper use of the model is provided in a separate document. Ecology recommends attendance at WWHM training classes.

Note that the more the site is left undisturbed, and the less impervious surfaces are created, the smaller the detention facility. Also, the greater the use of On-site Stormwater Management BMPs, the smaller the detention facility.

**Step V: Select Treatment Facilities**

Please refer to Chapter 2 of Volume V of this manual for step-by-step guidance to selection of treatment facilities.

**Step VI: Review Selection of BMPs and Facilities**

The list of on-site, treatment and flow control facilities, and the list of source control BMPs should be reviewed. The site designer may want to re-evaluate site layout to reduce the need for construction of facilities, or the size of the facilities by reducing the amount of impervious surfaces created, making more use of On-site Stormwater Management BMPs, and increasing the areas to be left undisturbed.

**Step VII: Complete Development of Drainage Control Plan**

The design and location of the BMPs and facilities on the site must be determined using the detailed guidance in Volumes III, IV, and V. Operation and Maintenance manuals for each treatment and flow control facility are necessary. Please refer to Chapter 3 for guidance on the contents of the Drainage Control Plan submittal which includes the Site Development Drawings, Stormwater Site Management Plan, Construction Stormwater Pollution Prevention Plan, and Drainage Design Report.
Appendix I-A: Guidance for Altering the Core Requirements through Basin Planning

Basin Planning Applied to Source Control

(Core Requirement #3)

Basin plans can identify potential sources of pollution and develop strategies to eliminate or control these sources to protect beneficial uses. A basin plan can include the following source control strategies:

1. Detection and correction of illicit discharges to storm sewer systems, including the use of dry weather sampling and dye-tracing techniques;

2. Identification of existing businesses, industries, utilities, and other activities that may store materials susceptible to spillage or leakage of pollutants into the storm sewer system or to the ground via wells, drains, or sumps;

3. Elimination or control of pollutant sources identified in (2);

4. Identification and control of future businesses, industries, utilities, and other activities which may store materials susceptible to spillage or leakage of pollutants into the storm sewer system; and

5. Training and public education

Basin Planning Applied to Runoff Treatment

(Core Requirement #6)

Basin plans can develop different runoff treatment requirements and performance standards to reduce pollutant concentrations or loads based on an evaluation of the beneficial uses to be protected within or downstream of a watershed. Consideration must be given to the antidegradation provisions of the Clean Water Act and implementing state water quality standards. The evaluation should include an analysis of existing and future conditions. Basin specific requirements and performance standards can be developed based on an evaluation of pollutant loads and modeling of receiving water conditions.

The Basic Treatment Level is viewed as a minimum technology-based requirement that must be applied regardless of the quality of the receiving waters. Additional levels of control beyond the Basic Treatment Level of Core Requirement #6 may be justified in order to control the impacts of future development.

Runoff treatment requirements and performance standards developed from a basin plan should apply to individual development sites. Regional treatment facilities can be considered an acceptable substitute for on-site treatment facilities if they can meet the identified treatment requirements and performance standards. A limitation to the use of regional treatment systems is that the conveyances used to transport the stormwater to the facility must not include waters of the state that have existing or attainable beneficial uses other than drainage.

The above text describes how Basin Planning can influence requirements for new and redevelopment. Basin Planning can also be used to identify prevention, structural retrofit, and redevelopment strategies for reducing the effects of existing development on the aquatic resources.
Basin Planning Applied to Flow Control
(Core Requirement #7)

Basin planning is well-suited to control stream channel erosion for both existing and future conditions. Flow control standards developed from a basin plan may include a combination of on-site, regional, and stream protection and rehabilitation measures. On-site standards are usually the primary mechanism to protect streams from the impacts of increased high flows in future conditions. Regional flow control facilities are used primarily to correct existing stream erosion problems. Basin plans can evaluate retrofitting opportunities, such as modified outlets for, and expansion of existing stormwater detention facilities.

In-stream protection and rehabilitation measures may be applied where stream channel erosion problems exist that will not be corrected by on-site or regional facilities. However, caution is urged in the application of such measures. If the causes of the stream channel erosion problems still exist, repairs to the physical expression of those problems may be short-lived. In some instances, it may be prudent to apply in-stream measures to reduce impacts until the basin hydrology is improved.

Another potential outcome of basin planning is the identification of a different flow control standard. Ecology’s flow duration standard is based upon a generalization that the threshold of significant bedload movement in Western Washington streams occurs at 50% of the 2-year return stream flow. Through field observations and measurements, a local government may estimate a more appropriate threshold – higher or lower- for a specific stream. The alternative threshold can become the lower limit for the range of flows over which the duration standard applies. For instance, if the threshold is established at 70% of a 2-year return flow, the alternative standard would be to match the discharge durations of flows from the developed site to the range of pre-developed discharge rates from 70% of the 2-year peak flow up to the full 50-year peak flow. An alternative flow control standard must be compatible with maintaining and restoring the designated beneficial uses for that stream. If the existing stream condition is not compatible with the beneficial uses, it should not be used to determine an alternative flow control standard.

Basin Planning Applied to Wetlands and other Sensitive Areas
(Core Requirement #8)

Basin planning can be used to develop alternative protection standards for wetlands and other sensitive areas, such as landslide hazard areas, wellhead protection areas, and ground water quality management areas. These standards can include source control, runoff treatment, flow control, stage levels, and frequency and duration of inundations.
### Table B.1. 24 Hour Rainfall Amounts and Comparisons for Selected USGS Stations

<table>
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<tr>
<th>Station Name</th>
<th>6 Month Storm Inches</th>
<th>6 Month % Rainfall Volume</th>
<th>2 Year Storm Inches</th>
<th>6 Month/2 year %</th>
<th>90% Rainfall Inches</th>
<th>95% Rainfall Inches</th>
<th>Mean Annual Precip. Inches</th>
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Table B.2  24 - Hour Rainfall Amounts and Statistics

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### Table B.2  24 - Hour Rainfall Amounts and Statistics

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Appendix 1-C  Reserved
Appendix I-D  Guidelines for Wetlands when Managing Stormwater

This Appendix provides guidelines on the management of stormwater, from development and redevelopment projects, to avoid or minimize changes to wetland functions and values.

This appendix consists of seven sections:

Scope and Principles

Guide Sheet 1: Criteria for Excluding Wetlands from Serving as a Treatment or Flow Control BMP/Facility

Guide Sheet 2: Criteria for Including Wetlands as a Treatment or Flow Control BMP/Facility

Guide Sheet 3: Wetland Protection Guidelines

Guide Sheet 4: Jurisdictional Planning for Wetlands and Stormwater Management

Information Needed to Apply the Guidelines—This section contains a list of basic data needed for each of the guide sheets to perform basic analyses.

Definitions—Refer to this section for the meaning of terms throughout this appendix.

Scope and Principles

Purpose

Wetlands are important features in the landscape that provide numerous beneficial functions and values for people, fish, and wildlife. Some of these include protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters, and maintaining surface water flow during dry periods.

Development, redevelopment, and stormwater management projects may decrease the functions and values of wetlands by:

- Increasing the amount of water flow discharged to wetlands.
- Decreasing the amount of water flow discharged to wetland.
- Increasing the amount of pollutants discharged to wetland.

This can happen even if the wetland is not formally used for stormwater management purposes.

These guidelines intend to prevent decreasing the functions and values of wetlands by avoiding alterations to the structural, hydrologic, and water quality characteristics of existing wetlands to the extent possible during development, redevelopment and stormwater management projects.

Regulatory Requirements

Following these guidelines does not fulfill requirements for assessment and permitting. Every development and redevelopment project should follow the stipulations of the State Environmental Policy Act and contact the local permitting authority. Other state and federal agencies may also have jurisdiction over projects affecting wetlands such as the Washington State Departments of Ecology, Fisheries, and Wildlife; the U.S. Environmental Protection Agency; and the U.S. Army Corps of Engineers.

These guidelines do not address actions needed to enhance or restore degraded wetlands.
**Guideline Basis**

These guidelines were principally from the results of the Puget Sound Wetlands and Stormwater Management Research Program, as set forth in Sections 2 and 3 of the program’s summary publication, *Wetlands and Urbanization, Implications for the Future* (Horner et al. 1997).

**Washington State Wetland Rating System**

The wetlands in Washington State differ widely in their functions and values. Washington State’s wetland rating systems categorizes wetlands into four categories based on their sensitivity to disturbance, their rarity, our ability to replace them, and the functions they provide.

The rating system, however, does not replace a full assessment of wetland functions that may be necessary to plan and monitor a project of compensatory mitigation.


**Guide Sheet 1: Criteria that excludes wetlands from serving as a treatment or flow control BMP/facility**

The following types of wetlands are not suitable as a treatment or flow control BMPs/facilities.

Engineering structural or hydrologic changes within the wetland itself to improve stormwater flows and water quality are not allowed. Do not increase or decrease the water regime in these wetlands beyond the limits set in Guide Sheet 3. Provide these wetlands with the maximum protection from urban impacts (see Guide Sheet 3, Wetland Protection Guidelines):

1. The wetland is currently a Category I wetland because of special conditions (forested, bog, estuarine, Natural Heritage, coastal lagoon).
2. The wetland provides a high level of many functions. These are Category I and II wetlands as determined by the Washington State Wetland Rating System of Western Washington.
3. The wetland provides habitat for threatened or endangered species. Determining whether or not the conserved species will be affected by the proposed project requires a careful analysis in relation to the anticipated habitat changes. Consult with the appropriate agencies with jurisdiction over the specific threatened or endangered species on the site.

If a wetland type listed above needs to be included in a stormwater system then this activity is considered an impact. It will be treated as any other impact, and will need to be mitigated according to the rules for wetland mitigation. Project proponents will have to demonstrate that they have done everything to avoid and minimize impacts before proceeding to compensatory mitigation.

The wetlands listed above cannot receive flows from a stormwater system unless the criteria in Guide Sheets 3B and 3C are met.

**Guide Sheet 2: Criteria for including wetlands as a treatment or flow control BMP/facility**

A wetland can be physically or hydrologically altered to meet the requirements of a treatment or flow control BMP/facility if ALL of the following criteria are met:

**Modifications that alter the structure of a wetland or its soils will require permits. Existing functions and values that are lost would have to be compensated/replaced.**

1. It is classified in Category IV in the “Washington State Wetland Rating System of Western Washington,” or a Category III wetland with a habitat score of 19 points or less.
2. You can demonstrate that there will be “no net loss” of functions and values of the wetland as a result of the structural or hydrologic modifications done to provide control of runoff and water...
quality. This includes the impacts from the machinery used for the construction. Heavy equipment can often damage the soil structure of a wetland. However, the functions and values of degraded wetlands may sometimes be increased by such alterations and thus would be self-mitigating. Functions and values that are not replaced on site will have to be mitigated elsewhere.

a. Modifications that alter the structure of a wetland or its soils will require permits. Check with the agency(ies) issuing the permits for the modification(s) to determine which method to use to establish “no net loss.”

b. A wetland will usually sustain fewer impacts if the required storage capacity can be met through a modification of the outlet rather than through raising the existing overflow.

3. The wetland does not contain a breeding population of any native amphibian species.

4. The hydrologic functions of the wetland can be improved as outlined in questions 3, 4, 5 of Chart 4 and questions 2, 3, 4 of Chart 5 in the “Guide for Selecting Mitigation Sites Using a Watershed Approach,” (available here: http://www.ecy.wa.gov/biblio/0906032.html); or the wetland is part of a priority restoration plan that achieves restoration goals identified in a Shoreline Master Program or other local or regional watershed plan.

5. The wetland lies in the natural routing of the runoff, and the discharge follows the natural routing.

Guide Sheet 3: Wetland protection guidelines

This guide sheet provides information on ways to protect wetlands from changes to their ecological structure and functions that result from human alterations of the landscape. It also recommends management actions that can avoid or minimize deleterious changes to wetlands.

Although, this guide sheet is intended primarily for the protection of the wetlands listed in Guide Sheet 1; this guidance still should be applied, as practical, for wetlands listed in Guide Sheet 2 when they are modified to meet stormwater requirements.

Guide Sheet 3A: General guidelines for protecting functions and values of wetlands

1. Consult regulations issued under federal and state laws that govern the discharge of pollutants. Wetlands are classified as “Waters of the United States” and “Waters of the State” in Washington.

2. Maintain the wetland buffer required by local regulations.

3. Retain areas of native vegetation connecting the wetland and its buffer with nearby wetlands and other contiguous areas of native vegetation.

4. Avoid compaction of soil and introduction of exotic plant species during any work in a wetland.

5. Take measures to avoid general urban impacts (e.g., littering and vegetation destruction). Examples are protecting existing buffer zones; discouraging access, especially by vehicles, by plantings outside the wetland; and encouragement of stewardship by a homeowners’ association.

6. Fences can be useful to restrict dogs and pedestrian access, but they also interfere with wildlife movements. Their use should be very carefully evaluated on the basis of the relative importance of intrusive impacts versus wildlife presence. Fences should generally not be installed when wildlife would be restricted and intrusion is relatively minor. They generally should be used when wildlife passage is not a major issue and the potential for intrusive impacts is high. When wildlife movements and intrusion are both issues, the circumstances will have to be weighed to make a decision about fencing.
7. If the wetland inlet will be modified for the stormwater management project, use a diffuse flow method, (eg. BMPC206 Level Spreader Swale, Volume II, and BMP T5.10B Downspout Dispersion Systems, Volume III) to discharge water into the wetland in order to prevent flow channelization.

**Guide Sheet 3B: Protecting wetlands from impacts of changes in water flows**

Protecting wetland plant and animal communities depends on maintaining the existing wetland’s hydroperiod. This means maintaining the annual fluctuations in water depth and its timing as closely as possible. The risk of impacts to functions and values increases as the changes in water regime deviate more from the existing conditions. These changes often result from development.

Hydrologic modeling is useful to measure or estimate the aspects of the hydroperiod under existing pre-project and anticipated post-project conditions. Post-project estimates of the water regime in a watershed and wetland hydroperiod must include the cumulative effect of all anticipated watershed and wetland modifications. Perform this assessment with the aid of a qualified hydrologist.

*Provisions in these guidelines pertain to the full anticipated build-out of the wetland’s watershed as well as changes resulting from an individual development.*

Unfortunately, attempts to modify and use the standard hydrologic models for describing the flow and fluctuations of water in a stormwater pond have failed to adequately model the hydrodynamics in wetlands. It is difficult to estimate if stormwater discharges to a wetland will meet the criteria for protection developed by the Puget Sound Wetland and Stormwater Research Program. The criteria developed by that program apply only to depressional wetlands. They are not applicable to riverine, slope, or lake-fringe wetlands. Ecology does not have any hydrologic models available to characterize the hydrodynamics in these types of wetlands.

As a result, it is difficult to predict the direct impacts of changes in water flows resulting from a development. In the absence of hydrologic models that characterize all types of wetlands, criteria have to be set using information that is readily available. These criteria are based on risk to the resource rather than an actual understanding of impacts.

The following criteria will provide some protection for the valuable wetland types listed in Guide Sheet 1, but we cannot determine if they result in the complete protection of a wetland’s functions and values. The risk to wetland functions will increase as the water volumes into the wetland diverge from the pre-project conditions. The risk will be decreased if the divergence is smaller.

Use the Western Washington Hydrology Model (WWHM), or other models approved by Ecology, for estimating the increases or decreases in total flows (volume) into a wetland that can result from the development project. These total flows can be modeled for individual days or on a monthly basis. Compare the results from this modeling to the criterion below. WWHM 2012 will have the capability to compare these results with the criterion.

**Criterion 1: Total volume of water into a wetland during a single precipitation event should not be more than 20% higher or lower than the pre-project volumes.**

**Modeling algorithm for Criterion 1**

1. **Daily Volumes can be calculated for each day over 50 years for Pre- and Post-project scenarios.** Volumes are to be calculated at the inflow to the wetland or the upslope edge where surface runoff, interflow, and ground water are assumed to enter.

2. **Calculate the average of Daily Volume for each day for Pre- and Post-project scenarios.** There will be 365 values for the Pre-project scenario and 365 for the Post-project.

   **Example calculation for each day in a year (e.g., April 1):**
• If you use 50 years of precipitation data, there will be 50 values for April 1. Calculate the average of the 50, April 1, Daily Volumes for Pre- and Post-project scenarios.

• Compare the average Daily Volumes for Pre- versus Post-project scenarios for each day. The average Post-project Daily Volume for April 1 must be within +/- 20% of the Pre-project Daily Volume for April 1.

3. Check compliance with the 20% criterion for each day of year. Criterion 1 is met/passed if none of the 365 post-project daily volumes varies by more than 20% from the pre-project daily volume for that day.

**Criterion 2: Total volume of water into a wetland on a monthly basis should not be more than 15% higher or lower than the pre-project volumes.**

This needs to be calculated based on the average precipitation for each month of the year. This criterion is especially important for the summer months when a development may reduce the monthly flows rather than increase them because of reduced infiltration and recharging of ground water.

**Modeling algorithm for Criterion 2**

1. Monthly Volumes can be calculated for each calendar month over 50 years for Pre- and Post-project scenarios. Volumes are to be calculated at the inflow to the wetland or the upslope edge where surface runoff, interflow, and ground water are assumed to enter.

2. Calculate the average of Monthly Volume for each calendar month for Pre- and Post-project scenarios.

   **Example calc for each calendar month in a year (e.g., April):**
   • If you use 50 years of precipitation data, there will be 50 values for the month of April Calculate the average of the 50, April, Monthly Volumes for Pre- and Post-project scenarios.
   • Compare the Monthly Volumes for Pre- versus Post-project scenarios. Post-project Monthly Volume for April must be within +/- 15% of the Pre-project Monthly Volume for April.

3. Check compliance with the 15% criterion for each calendar month of year. Criterion 2 is met/passed if none of the post-project Monthly Volume varies by more than 15% from the pre-project Monthly Volume for every month.

**WWHM Modeling Assumption and Approach**

**Assumption** - Flow components feeding the wetland under both Pre- and Post-project scenarios are assumed to be the sum of the surface, interflow, and ground water flows from the project site.

**Approach** - Assign the wetland a point of compliance #1 (POC) number such as POC1 downstream of the project area.

• Pre-project scenario - Connect all flow components to the wetland/POC1
  ➢ **Pre-project Total Flows to POC1 = Surface + Interflow + Ground water**

• Post-project scenario - Identify flows to the wetland/POC1.
  a) Impervious surfaces send flows to wetland via (1)- surface flow.
     ▶ WWHM sub-flows to POC1 = Surface flow (+ Interflow default set in WWHM)
  b) Pervious surfaces send flows to wetland via (1)- surface, (2)- interflow, and (3)- ground.
     ▶ WWHM sub-flows to POC1 = Surface + Interflow + Ground water
  c) Infiltrating facilities send flows to wetland via ground water, and surface overflows.
(1) **Ground water** - Connect infiltrated water (Outlet 2) to ground water component of the area between facility and wetland. Use Lateral Basin downstream of the infiltrating facility and connect Outlet 2 to the ground water component of the Lateral Basin. If this area is the same area modeled in Step (b) above, use the Lateral Basin element in Step (b).
   - WWHM sub-flows to POC1 = infiltrated flows

(2) **Surface Overflow** – Connect the surface flow (Outlet 1) to wetland/POC1
   - WWHM sub-flows to POC1 = facility surface flows (Outlet 1)

   ➢ **Post-project Total Flows to POC1 = Sum of flows in (a), (b), and (c).**

If it is expected that the limits stated above could be exceeded, consider the following strategies to reduce the volume of surface flows:

- Reducing of the level of development by reducing the amount of impervious surface and/or increasing the retention of natural forest cover.
- Increasing infiltration through the use of LID BMPs and LID principles.
- Increasing storage capacity for surface runoff.
- Using selective runoff bypass around the wetland. Bypassed flow must still comply with other applicable stormwater requirements.

**Monitoring** – Modifications that alter the structure of a wetland or its soils will require permits. Conduct monitoring as required by local, state, or federal permits.

**Guide Sheet 3C: Guidelines for protecting wetlands from pollutants**

Protecting a wetland from pollutants generated by a development should include the following measures:

1. Use effective erosion control at construction sites in the wetland's drainage catchment. Refer to Volume II this manual and local jurisdiction requirements.
2. Institute a program of source control BMPs and minimize the pollutants that will enter storm runoff that drains to the wetland.
3. For wetlands the meet the criteria in Guide Sheet 1, provide a water quality control facility consisting of one or more treatment BMPs to treat runoff entering the wetland.
   - If the wetland is a Category I wetland because of special conditions (forested, bog, estuarine, Natural Heritage, costal lagoon), the facility should include a BMP with the most advanced ability to control nutrients.

**Guide Sheet 4: Jurisdictional planning for wetlands and stormwater management**

Local jurisdictions should plan and manage their resources to protect the overall function and values of wetlands, including their role in storm drainage systems.

Advanced planning can help local jurisdictions to take advantage of the most options for managing stormwater in newly developing areas.

The comprehensive planning steps, below, are based on two principles for effective environmental management:

1. The best management policies for the protection of wetlands are those that prevent or minimize impacts at their point of origin.
2. The best management strategies are self-perpetuating, that is, they do not require periodic infusions of capital and labor.

The Department of Ecology, the Puget Sound Partnership, and other groups are actively developing new tools for watershed planning that will address many of the steps outlined below. We suggest you review information that has already been developed in the region of your concern. This may significantly reduce your efforts. A good place to start is: [http://www.ecy.wa.gov/watershed/index.html](http://www.ecy.wa.gov/watershed/index.html)

**Comprehensive Planning Steps**

1. Define the landscape unit you will be using for your planning effort. See the definition of landscape unit in the [Definitions](#) section.

2. Begin the plan for the landscape unit with attention to the following general principles:
   a. Formulate the plan based on clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.
   b. Map and assess the suitability of different areas for urban uses.
   c. There are several tools available for identifying such areas. For more information visit [http://www.ecy.wa.gov/mitigation/landscapeplan.html](http://www.ecy.wa.gov/mitigation/landscapeplan.html). When appropriate, the assessment can also highlight outstanding local or regional resources that the community determines should be protected. For example, a fish run, scenic area, recreational area, threatened species habitat, farmland.

3. Maximize natural water storage and infiltration opportunities within the landscape unit and outside of existing wetlands, especially:
   a. Promote the conservation of forest cover. Develop on deforested land. This affects the water flows in a basin less than building on land that requires removing forest cover. Loss of forest cover increases peak runoff requiring expensive structural solutions.
   b. Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Implement policies and regulations to discourage the clearing, filling, and channelization of these features. Use existing drainage networks in preference to pipes, culverts, and engineered ditches as long as the flows and volumes of water in them are not increased.

4. Establish and maintain buffers surrounding wetlands and in riparian zones. Also, maintain interconnections among wetlands and other natural habitats to allow for wildlife movements.

5. Implement measures to avoid general impacts on wetlands and other water bodies (e.g., littering, vegetation destruction, human and pet intrusion harmful to wildlife).

In wetlands that are relatively unaffected by human activities, plan so the quantity or stormwater flows match the pre-project hydroperiod and hydrodynamics. In wetlands whose water flows have been disturbed, consider ways of reducing the existing changes to flows. This involves not only management of high volumes and rates of flow during the wet season, but also preventing water supply depletion during the dry season. The latter may require augmenting flows if urbanization reduces existing surface or ground water inflows. Refer to [Guide Sheet 3: Wetland Protection Guidelines](#), for details on implementing these guidelines.

6. Assess alternatives for controlling the quantities of runoff as follows:
   a. Analyze proposed development actions in terms of changes to quantity of runoff.
   b. For existing development or redevelopment, assess possible alternative solutions to adding flow controls by:
(1) Protecting health, safety, and property from flooding by removing buildings from the flood plain.

(2) Preventing stream channel erosion by stabilizing the eroding bed and/or bank area with bioengineering techniques, preferably, by using structural reinforcements that are consistent with the protection of aquatic habitats and beneficial uses of the stream (refer to Chapter 173-201A of the Washington Administrative Code (WAC) for the definition of beneficial uses).

c. For new development or redevelopment, assess different regulatory alternatives or incentives for changing common practices in land use including: density controls, clearing limits, impervious surface limits, transfer of development rights, purchase of conservation areas, etc.

d. If the alternatives considered in Step 6 above cannot solve an existing or potential problem, perform an analysis of the contributing drainage catchment to assess possible alternative solutions that can be applied on-site or on a regional scale. The most appropriate solution or combination of alternatives should be selected with regard to the specific opportunities and constraints existing in the drainage catchment. For new development or redevelopment, on-site facilities that should be assessed include, in approximate order of preference:

   (1) LID BMPs and LID principles
   (2) Infiltration basins or trenches.
   (3) Detention ponds.
   (4) Below-ground vault or tank storage.
   (5) Parking lot detention.

   Regional facilities that should be assessed for solving problems associated with new development, redevelopment, or existing development include:

   (1) LID BMPs and LID principles
   (2) Infiltration basins or trenches.
   (3) Detention ponds.
   (4) Constructed wetlands.
   (5) Bypassing a portion of the flow to an acceptable receiving water body, with treatment as required to protect water quality and other special precautions as necessary to prevent downstream impacts.

e. Consider physically altering an existing wetland for controlling water quantities only if upland alternatives are inadequate to solve the existing or potential problem. Refer to the criteria in Guide Sheet 1 and 2 to evaluate if wetlands can be altered.

7. Place strong emphasis on water resource protection during construction of new development. Establish effective erosion control programs to reduce the sediment loadings to receiving waters to the maximum extent possible. No preexisting wetland or other water body should ever be used for the sedimentation of solids in construction-phase runoff.

8. Characterize alternatives for the control of runoff water quality as follows:

   a. Analyze the contributing drainage catchment basin to assess possible alternative solutions that can be applied on-site or on a regional scale. The best alternatives are those that minimize changes to water quality resulting from development. Consider both source control BMPs, treatment BMPs, and LID BMPs as alternative solutions before considering use of existing wetlands.
b. Consider altering an existing wetland for water quality control only if upland alternatives are inadequate to solve the existing or potential problem.

Using wetlands for polishing is subject to analysis on a case-by-case basis and may be allowed only if the following conditions are met:

1. The restoration or enhancement of a previously degraded wetland is required.
2. Both improving water quality and the upgrading of other wetland functions need to be accomplished.
3. All legally adopted water quality standards for wetlands are observed.
4. Appropriate source control and treatment BMPs are applied in the contributing catchment on the basis of the analysis in Step 9a.

If these circumstances apply, refer to Guide Sheet 2: Criteria for Including Wetlands as a Treatment or Flow Control BMP/Facility.

9. Stimulate public awareness of and interest in wetlands and other water resources in order to encourage protective attitudes in the community. This program should include:

a. Education regarding the use of fertilizers and pesticides, automobile maintenance, the care of animals and the importance of retaining buffers to prevent water pollution.

b. Descriptive signboards adjacent to wetlands informing residents of the wetland type, its functions, the protective measures taken, etc.

c. If beavers are present in a wetland, educate residents about their ecological role and value and take steps to avoid human interference with beavers.

**Monitoring**

Design and carry out a program to monitor water quality if bogs and other Category I wetlands will be subject to pollutant loadings from new developments. Such wetlands are at risk if they have contributing catchments with either of the following characteristics:

1. More than 20 percent of the catchment area is committed to commercial, industrial, and/or multiple family residential land uses.
2. The combination of all urban land uses (including single family residential) exceeds 30 percent of the catchment area.

The monitoring program should include the following tasks:

1. Perform pre-project baseline sampling by collecting water quality grab samples in an open water pool of the wetland for at least one year, allocated through the year as follows:
   - November 1-March 31--4 samples
   - April 1- May 31--1 sample
   - June 1- August 31--2 samples
   - September 1- October 31--1 sample
   If the wetland is dry during any period, reallocate the sample(s) scheduled then to another time when the wetland is no longer dry.

   Analyze samples for pH; dissolved oxygen (DO); conductivity (Cond); total suspended solids (TSS); total phosphorus (TP); nitrate + nitrite-nitrogen (N); fecal coliforms (FC); and total copper (Cu), lead (Pb), and zinc (Zn). Find the median and range of each water quality variable.
2. Considering the baseline results, set water quality goals to be maintained in the post-project period. Example goals are:
   - pH--no more than “x” percent (e.g., 10%) increase (relative to baseline) in annual median and maximum or decrease in annual minimum;
   - Do--no more than “x” percent decrease in annual median and minimum concentrations.
   - Other variables--no more than “x” percent increase in annual median and maximum concentrations.
   - No increase in violations of the Washington Administrative Code (WAC) water quality criteria.

Repeat the sampling on the same schedule for at least one year after all development is complete. Compare the results to the set goals.

**Information Needed to Apply the Guidelines**

Each guide sheet requires collecting specific information. The following sections list the basic data needed for applying the Guide Sheets. As a start, obtain the relevant soil survey; the National Wetland Inventory for the watershed, topographic and land use maps, and the results of any local wetland inventory.

**Data Needed for Guide Sheet 1: Criteria for Excluding Wetlands as Part of a Stormwater System**

2. Rare, threatened, or endangered species inhabiting the wetland.
3. Presence or absence of a breeding population of native amphibians. If amphibians are found in the wetland assume they are native unless you can demonstrate the only species present are non-native.

**Data Needed for Guide Sheet 2: Criteria for Including Wetlands as Part of a Stormwater System**

1. Hydrologic modeling of the existing flows and predicted flows into the wetland.
2. A characterization of the changes to water quality coming into the wetland from the development.
3. Presence of breeding populations of native amphibian species.
4. Presence of fish species.

**Data Needed for Guide Sheet 3B: Protecting wetlands from impacts of changes in water flows**

The WWHM user manual will have a modeling procedure for estimating water flows to wetlands. Follow the modeling procedure in WWHM user manual to estimate flows and determine compliance with the wetland Criteria 1 and 2. The information needed to model water flows to a wetland in WWHM includes the following:

1. Location of the development project
2. Land use characteristics before and after development.
   a) Soil Type
   b) Surface Vegetation
   c) Land slope
   d) Land area (acres)
3. Land use characteristics between the development project area and the wetland.

Data Needed for Guide Sheet 4: Jurisdictional Planning for Wetlands and Stormwater Management

2. A map of the contributing watershed to the wetland or other landscape unit, and an estimate of its area.
3. A definition of environmental and development goals for the landscape unit subject to planning and management.
4. Existing management and monitoring plans.
5. Existing and projected land use in the landscape unit in the categories commercial, industrial, multi-family residential, single-family residential, agricultural, various categories of undeveloped, and areas subject to active logging or construction (expressed as percentages of the total watershed area).
6. Surface drainage network throughout the landscape unit.
7. Soil conditions, including soil types, infiltration rates, and elevation of water table as it changes seasonally, and the presence of any restrictive layers,
8. Ground water recharge and discharge points.

Definitions

The following terms are applicable only to this appendix (Appendix I-D).

**Baseline sampling**
Sampling performed to define the existing environmental and biological conditions present before any modification occurs.

**Bioengineering**
Bioengineering for streams and wetlands – The use of living and nonliving plant materials in combination with naturea and synthetic support materials for slope stabilization, erosion reduction, and vegetative establishment.

**Buffer**
The area (either upland, open water, or another wetland) that surrounds a wetland and that reduces adverse impacts to it from adjacent development.

**Constructed wetland**
A wetland intentionally created from a non-wetland site.

**Degraded wetland**
A wetland whose functions and values have been reduced as a result of human activities

**Enhancement**
The manipulation of the physical, chemical, or biological characteristics of a wetland site to heighten, intensify or improve specific function(s) or to change the growth stage or composition of the vegetation present. Enhancement is undertaken for specified purposes such as water quality improvement, flood water retention or wildlife habitat. Activities typically consist of planting vegetation, controlling non-native or invasive species, modifying site elevations or the proportion of open water to influence hydroperiods, or some combination of these. Enhancement results in a change in some wetland functions and can lead to a decline in other wetland functions, but does not result in a gain in wetland acres.
<table>
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<th><strong>Estuarine wetland</strong></th>
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<td><strong>Functions</strong></td>
<td>The ecological (physical, chemical, and biological) processes or attributes of a wetland. Functions are often defined in terms of the processes that provide value to society, but they can be defined on processes that are not value based. Wetland functions include food chain support, provision of ecosystem diversity and fish and wildlife habitat, flood flow alteration, ground water recharge and discharge, water quality improvement, and soil stabilization.</td>
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<td><strong>Hydrodynamics</strong></td>
<td>The science involving the energy and forces acting on water or other liquids and the resulting impact on the motion of the liquid.</td>
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<td><strong>Hydroperiod</strong></td>
<td>The seasonal occurrence of flooding and/or soil saturation; encompasses the depth, frequency, duration, and seasonal pattern of inundation.</td>
</tr>
<tr>
<td><strong>Invasive plant species</strong></td>
<td>Opportunistic plant species (either native or non-native) that colonize disturbed ecosystems and come to dominate the plant community in ways that are seen by us as reducing the values provided by the previous plant community. Most often, opportunistic plants are considered invasive if they reduce the value of an area as habitat for valuable species.</td>
</tr>
<tr>
<td><strong>Landscape unit</strong></td>
<td>An area of land that has a specified boundary used for planning purposes that defines an area of interrelated physical, chemical, and biological processes. A watershed or drainage basin is a common type of landscape unit. A ground water aquifer is another type of landscape unit.</td>
</tr>
<tr>
<td><strong>Modification, Modified (wetland)</strong></td>
<td>A wetland whose physical, hydrological, or water quality characteristics have been purposefully altered for a management purpose, such as by dredging, filling, forebay construction, and inlet or outlet control.</td>
</tr>
<tr>
<td><strong>On-site</strong></td>
<td>An action (here, for stormwater management purposes) taken within the property boundaries of the site to which the action applies.</td>
</tr>
<tr>
<td><strong>Polishing</strong></td>
<td>Additional treatment of a waste stream that has already received one or more stages of treatment by other means. This is also called advance treatment. The conditions present across a landscape after a specific stormwater management project (e.g., raising the outlet, building and outlet control structure) are placed in the wetland or a land use change that occurs in the landscape unit that will potentially affect the wetland.</td>
</tr>
<tr>
<td><strong>Post-project</strong></td>
<td>The conditions present across a landscape after a specific stormwater management project (e.g., raising the outlet, building an outlet control structure) are placed in the wetland or a land use change that occurs in the landscape unit that will potentially affect the wetland.</td>
</tr>
<tr>
<td><strong>Pre-project</strong></td>
<td>The conditions present across a landscape before a specific stormwater management project (e.g., raising the outlet, building an outlet control structure) are placed in the wetland or a land use change occurs in the landscape unit that will potentially affect the wetland.</td>
</tr>
</tbody>
</table>
**Rare, threatened, or endangered species**
Plant or animal species that are regional relatively uncommon, are nearing endangered status, or whose existence is in immediate jeopardy and is usually restricted to highly specific habitats. Threatened and endangered species are officially listed by federal and state authorities, whereas rare species are unofficial species of concern that fit the above definitions.

**Redevelopment**
Conversion of an existing development to another land use, or addition of a material improvement to an existing development.

**Regional**
An action (here, for stormwater management purposes) that involves more than one discrete property.

**Re-establishment**
Actions performed to reestablish wetland functional characteristics and processes that have been lost by alterations, activities, or catastrophic events in an area that no longer meets the definition of a wetland.

**Structure**
The physical components of an ecosystem, both the abiotic (physical and chemical) and biotic (living).

**Values**
Wetland processes or attributes that are valuable or beneficial to society (also see Functions). Wetland values include support of commercial and sport fish and wildlife species, protection of life and property from flooding, recreation, education, and aesthetic enhancement of human communities.

**Wetlands**
Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created from nonwetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from nonwetland areas to mitigate the conversion of wetlands. (Waterbodies not included in the definition of wetlands as well as those mentioned in the definition are still waters of the state.)
Appendix I-E
Fee-in-Lieu Information (Olympia only)

Introduction

The review authority may allow new development or redevelopment projects, under certain circumstances, to substitute a cash payment for required onsite stormwater management. Example situations where fees-in-lieu may be considered include but are not limited to:

- Redevelopment projects where installing stormwater facilities would result in extraordinary site disturbance or loss of use.
- Projects where a small portion of the site cannot be efficiently or cost-effectively managed. Examples are edge areas that slope away from the development site, and minor parking lot expansion, road widening, bike lane, or sidewalk projects.
- Any situation where the review authority determines that a fee-in-lieu is preferred over onsite stormwater management or stormwater management of runoff from an equivalent area.

Collected fees are deposited in a stormwater mitigation account. The City applies these funds to stormwater detention, retention, treatment, or source control projects, either within the drainage basin where the fees were collected, or as a proportionate share for projects of multiple basin/citywide benefit.

Fee-in-Lieu Calculation - General

A single approach is used for treatment, and two different approaches are offered for detention/storage: above ground (ponds) and below ground (pipes). The detention/storage approaches are based upon City-performed engineering analyses. A fee-in-lieu calculator, currently in Excel spreadsheet form, is available upon request from the City.

Treatment

Treatment fees-in-lieu are most often requested for commercial and multifamily development sites. In-ground filter practices, such as the StormFilter or Filterra manufactured by Contech Engineered Systems are the most commonly used treatment devices on such sites. The fee-in-lieu calculations shown below are based upon typical StormFilter costs (Jim Lenhart, SMI, personal communication, October 2004).

The applicant’s design engineer may propose an alternative treatment device. The City will use the cost of the proposed alternative treatment device as the basis for calculating the fee-in-lieu if applicant’s engineer satisfactorily demonstrates that the proposed alternative would: (1) be approvable on the subject site under the Olympia Municipal Code and this Manual; and (2) provide equivalent or better treatment than the StormFilter.

The treatment fee-in-lieu is calculated as:

\[
\text{Cost (\$)} = 12349 \times \ln Q + 48738, \text{ where } Q \text{ is the design treatment flow in cfs.}
\]

For results below $1000, the minimum fee shall be $1000. To accommodate inflation, all fees are tied to the Engineering News Record (ENR) national 20-city construction cost index, with January 2005 as the base index.
Above-Ground Storage

The fee is a combination of land costs and normal engineering and construction costs. The land value for fee-in-lieu calculation purposes will be the development site’s assessed, appraised, or recent/comparable sales price value, whichever best represents current market value.

The following equations were derived through curve-fitting using the shareware program CurveExpert, Version 1.3. The City has selected the “best-fit” equations.

The equation that calculates pond storage area for a given pond volume is:

\[
\text{Area (square feet)} = \frac{30,734,522 + 434,892 \cdot (\text{Volume})^{0.835}}{155,408 + (\text{Volume})^{0.835}}
\]

The fee-in-lieu equation (using $200,000 per acre as an example land value), as a function of pond storage area and volume, including all costs, is as follows:

\[
\text{Cost} = 404 \cdot (\text{Volume})^{0.419} + 4.59 \cdot \text{Area}
\]

The following table shows a good fit between engineer-estimated costs and those predicted by this equation. If a land value differs from $200,000, the $4.59 figure may be adjusted by multiplying it by the land value per acre and dividing by $200,000, or the cost-per-square-foot may be inserted in place of the $4.59 figure.

<table>
<thead>
<tr>
<th>Pond Size</th>
<th>Engineer</th>
<th>Fee-in-lieu Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 CF</td>
<td>$14,274</td>
<td>$8,669</td>
</tr>
<tr>
<td>5,000 CF</td>
<td>$30,193</td>
<td>$30,859</td>
</tr>
<tr>
<td>10,000 CF</td>
<td>$44,401</td>
<td>$47,764</td>
</tr>
<tr>
<td>50,000 CF</td>
<td>$141,529</td>
<td>$140,688</td>
</tr>
</tbody>
</table>

An example use of this equation would be:

A business wishes to add several new parking spaces. It would be impracticable to install stormwater detention/storage, so a fee-in-lieu is requested. Assume that the new parking spaces require 3,000 cubic feet of detention/storage.

First, calculate the required area:

\[
\text{Area} = \frac{30,734,522 + 434,892 \cdot (3,000)^{0.835}}{155,408 + (3,000)^{0.835}}
\]

\[
= 37,8893554 / 156209
\]

\[
= 2,426 \text{ square feet}
\]

Next, calculate the cost:

\[
\text{Cost} = 404 \cdot (3000)^{0.419} + (4.58 \cdot (2426))
\]

\[
= $11,569 + $11,135
\]

\[
= $22,704
\]

To accommodate inflation, this fee is tied to the Engineering News Record (ENR) national 20-city construction cost index, with January 2005 as the base index.
Below-Ground Storage

The fee in this case includes only normal engineering and construction costs, as there is no land cost. The fee-in-lieu equation, as a function of storage volume, including all costs, is as follows:

\[
\text{Cost} = 22.75 \times (\text{Volume})^{0.929}
\]

The following table shows a good fit between engineer-estimated costs and those predicted by this equation.

<table>
<thead>
<tr>
<th>Pipe/Vault Size</th>
<th>Engineer</th>
<th>Fee-in-lieu Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 CF</td>
<td>$13,771</td>
<td>$7,310</td>
</tr>
<tr>
<td>5,000 CF</td>
<td>$62,810</td>
<td>$62,079</td>
</tr>
<tr>
<td>10,000 CF</td>
<td>$117,106</td>
<td>$118,195</td>
</tr>
<tr>
<td>50,000 CF</td>
<td>$529,645</td>
<td>$527,160</td>
</tr>
</tbody>
</table>

This equation usually generates higher fees than above-ground storage, and will rarely be used.

To accommodate inflation, this fee is tied to the Engineering News Record (ENR) national 20-city construction cost index, with January 2005 as the base index.

Fee-in-Lieu Calculation - Yauger Park

On the deed conveying Yauger Park to the City, certain parcels\(^1\) were given a right to discharge stormwater into the Park. For most new developments, this right of discharge allows the development to convey stormwater to the Park after treatment but without detention/retention. The City is paid a fee to offset its costs of providing the in-Park stormwater management. This fee is based upon the development’s stormwater manual-required storage quantity.

The fee was originally set, in November 1994, at $39,346 per acre-foot (43,560 cubic feet) of stormwater storage required. It was to have been adjusted monthly based on changes to the Engineering News Record’s (ENR’s) Seattle Construction Cost Index, which was 519.03 at the time. Shortly thereafter, ENR ceased publication of this index. Instead, the City will now use the national 20-city average index. In November 1994 it was 5439, so that becomes the new base index. Current per-acre-foot cost is calculated as:

\[
\text{Cost} = 39,346 \times (\text{This month’s 20-city index})/5439.
\]

\(^1\) To verify whether a certain parcel has discharge rights, contact the Community Planning and Development Department at 753-8314.
Appendix I-F
Stormwater Conveyance System Design Criteria

Introduction
This appendix describes methods and criteria for sizing of storm sewers, channels, revetments, and other drainage structures in the conveyance system. Vegetated, open-channel conveyance is preferred, and should be used wherever feasible and reasonable.

Conveyance System Sizing

Design Event
Use the 25-year event for all roads except arterials, major collectors, and any other road for which the local permitting authority determines that vital services interruption would be unacceptable, in which case the 100-year event applies. Culverts for and bridges over natural channels must convey the 100-year event.

Methodology
For sizing conveyance systems, and determining catch basin spacing and water surfaces on roadways, use a continuous simulation or event-based model, or use the Rational Method and the Intensity-Duration-Frequency (IDF) curves in Figure F-1.

Water Surface On Public Streets and Roads
For the design event:
• A minimum 12-foot wide travel lane shall remain dry, except at sag/sump points.
• The maximum ponding depth at any low (sag/sump) point shall be 0.50 feet.

Design Criteria for Channels

Channel Lining
Channels must be stabilized against erosion and provide a 1.5 safety factor against failure at the design event. Table 1 provides minimum criteria to prevent damage.
Table 1  Design Criteria - Open Channels

<table>
<thead>
<tr>
<th>Channel Lining</th>
<th>Maximum Design Velocity Slope (fps)</th>
<th>Side Bank Maximum Design (H:V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetation-Lined</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Geotextile-Armored</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Lattice Block Paving Systems</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Quarry Spalls, 18” diameter</td>
<td>15**</td>
<td>2</td>
</tr>
<tr>
<td>Hand-Placed Rip Rap, 2’ thick</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Gabions</td>
<td>30</td>
<td>*</td>
</tr>
<tr>
<td>Concrete</td>
<td>30</td>
<td>Design</td>
</tr>
</tbody>
</table>

As needed, design and install geotextile or granular filter
* adhere to manufacturer’s instructions

Friction Factors
Friction factors for open channels are dependent upon the channel lining and condition. The Project Engineer may select the appropriate Manning’s n value from Table 2.

Check Structures
Check structures for purposes of velocity control in ditches may be of rock construction. The Project Engineer shall specify check structures, channel armor or other suitable means to protect channels from scour and erosion.

Culverts
Design criteria are given in the following sections.

Table 2  Manning’s "N" Values For Various Channel Linings (Channel Full)

<table>
<thead>
<tr>
<th>Channel Lining</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>0.012</td>
</tr>
<tr>
<td>Short grass</td>
<td>0.030</td>
</tr>
<tr>
<td>Stony bottom and weedy banks</td>
<td>0.035</td>
</tr>
<tr>
<td>Cobble bottom and grass banks</td>
<td>0.040</td>
</tr>
<tr>
<td>Dense weeds as high as flow</td>
<td>0.080</td>
</tr>
<tr>
<td>Dense woody brush as high as flow</td>
<td>0.120</td>
</tr>
</tbody>
</table>
Fish-Bearing Channels
Culverts for fish bearing channels shall conform to Washington State Department of Fish and Wildlife regulations.

Water Surface Elevation for the Design Event
Maximum design water surface elevation in the backwater behind culverts for the conveyance system Design Event shall be below top of channel. Maximum design water surface for culverts that convey streams shall be below the culvert crown.

Velocities Into and Out of Culverts
If velocity at design flow is greater than 5 feet per second, protect the channel and embankment from erosion as necessary.

Minimum Diameter
Minimum diameter culvert under public roads and streets is 12 inches. Check with the local government regarding minimum diameter culvert under private drives, for roadside swales and ditches. Culverts shall be sized to pass the design event.

Materials
Materials shall conform to Section 7-02 Culverts or 7-03 Structural Plate Pipe, Pipe Arch, Arch and Underpass as included in the latest edition of the Washington State Department of Transportation Standard Specifications for Roads, Bridges, and Municipal Construction—English Units. Also, check local government guidelines for allowable materials.

Trash Racks
Culverts not located in fish-bearing streams shall be outfitted with trash racks on inlet ends ranging from 18 to 48 inches equivalent diameter. Trash racks must be removable with ordinary hand tools. Trash racks shall have 0.5-inch minimum bar diameters and 4-inch maximum spacing between bars. Refer to local government standards for trash rack designs.

Stormwater Pipes
Flow Analysis
The Design Event for storm sewers is given above. If the Administrator determines that, as a result of the Project, runoff for any event through the 100-year, 24-hour event would cause damage or interrupt vital services, the Administrator may require a computer backwater (pressure sewer) analysis. Submit results in tabular and graphic format showing hydraulic and energy gradient.

Design Friction Factors
Suggested values for pipe friction factors, using the Manning formula, are shown in Table 3. If other factors are used, show justification.

Trash Racks
Storm sewer pipes shall be outfitted with trash racks on inlet ends ranging from 18 to 48 inches equivalent diameter. Trash racks must be removable with ordinary hand tools. Trash racks shall have 0.5-inch minimum bar diameters and 4-inch maximum spacing between bars. Refer to local government standards for trash rack designs.

Minimum Diameter, Slope, and Velocity
Minimum diameters:
- Private property, 4 inches.
- Public right-of-way, main line, 12 inches.
- Public right-of-way, laterals, 8 inches with local government approval

Minimum velocity is 2 fps at design flow. Pipe slope shall be as needed to achieve minimum velocity. The Administrator or designee may waive these minimums in cases where topography and existing drainage systems make it impractical to meet the standard.

Maximum Slopes and Velocities
Maximum slopes and velocities are shown in Table 4. Anchor spacings are shown in Table 5. If velocities exceed 15 fps for the conveyance system Design Event, provide anchors at bends and junctions.

Cover Requirements, Trench Design, Pipe Strength
Minimum pipe cover is 24 inches unless otherwise approved. When calculating pipe loading for pipes over 24 inches in diameter or over 10 feet in depth, submit proof of pipe suitability for the design condition. Assume pipe trench will be opened at 45 degrees to the trench bottom unless trench configuration can be predicted with certainty.

| Table 3  Manning's "N" For Pipes |
|----------------------------------|------------------|
| Pipe Material                     | "n"              |
| Concrete                          | 0.013            |
| Annular CMP or Pipe Arch          |                  |
| 2 2/3 x 1/2 corrugation           | 0.024            |
| 3 x 1 corrugation                 | 0.027            |
| 6 x 2 corrugation                 | 0.030            |
| Helical                           | 0.024            |
| Spiral Rib                        | 0.016            |
| Ductile Iron (cement lined)       | 0.013            |
| Plastic                           | 0.010            |

Source: Chow’s *Open Channel Hydraulics*, 1959 and others

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### Table 4 Maximum Pipe Slopes And Velocities

<table>
<thead>
<tr>
<th>Pipe Material</th>
<th>Pile Slope above Which Pipe Anchors Required</th>
<th>Max Slope Allowed</th>
<th>Max Velocity at Full Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC</td>
<td>20%</td>
<td>30%</td>
<td>30 fps</td>
</tr>
<tr>
<td>CMP</td>
<td>20%</td>
<td>30%</td>
<td>30 fps</td>
</tr>
<tr>
<td>Concrete/Duct. Iron</td>
<td>20%</td>
<td>20%</td>
<td>30 fps</td>
</tr>
<tr>
<td>HDPE</td>
<td>20%</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

### Table 5 Pipe Anchor Spacing

<table>
<thead>
<tr>
<th>Slope Percent</th>
<th>Greater Than</th>
<th>Less Than or Equal</th>
<th>Spacing Feet on Centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>35</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>50</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>100</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td>Design</td>
<td></td>
</tr>
</tbody>
</table>

### Manholes and Catch Basins

When design flow will be above 10 cubic feet per second (cfs), catch basin and manhole inlet capacities must be discussed in the stormwater site plan and capacities must be shown on the work map. Inlet capacity limitations may be used to divide flow between channels or gutters and storm sewers.

Refer to the latest edition of the *Washington State Department of Transportation Standard Specifications for Roads, Bridges, and Municipal Construction—English Units* Section 7-05 for construction and material requirements for catch basins and manholes. Also, see WSDOT "Standard Plans" B-1 through B-12 for detailed diagrams.

### Catch Basin Spacing

Use the following procedure to space catch basins:

1) Determine approximate locations.
2) Calculate peak design flow rate for individual catch basins. Use Rational Method or other hydrologic modeling method.
3) Determine grate inlet capacities, which have been adjusted to allow for clogging (see Table 6, below).
4) Determine flow-by for each catch basin. Flow-by is equal to peak design flow rate minus inlet capacity.
5) Add flow-by to peak design flow rate reaching each downstream catch basin to calculate net flow to each catch basin.
6) Continue downstream until maximum flow-by leaving project area is less than 0.10 cfs. Modify upstream catch basin locations to achieve this result.
7) At low points, runoff must approximate grate inlet capacity, such that no more than the allowable 0.50 feet ponding depth occurs over the grate.
8) Tabulate results.
For most catch basin grates, 20% clogging is assumed; for zero-slope (sump condition) grates, 50% clogging is assumed—Table 6 reflects these assumptions. This table is for typical 2% roadway transverse (cross) slope. If roadway transverse slope is 1%, use one-half of table values.

Grate inlet capacities may also be determined using approved modified orifice equations, or WSDOT Hydraulics Manual (Chapter 5) procedures. For weir-flow equations, use the grate width exposed to the flow for the 100% effective weir length. For orifice flow conditions and equations, use a 100% effective open area of 1.2 square feet.

For on-grade catch basins, use WSDOT catch basin type-1 structures (Standard Plan B-1).

All catch basins in low/sump points shall have a through-curb feature (Hooded Frame and Grate) and shall be used with WSDOT catch basin type 1L structures (Standard Plan B-1a).

**Anti-Dumping Message**

Each catch basin or grated manhole must have a message cast into the catch basin cover. The message shall say not to discharge pollutants into the drain because it leads to a surface or ground water. The exact message will depend upon the manufacturer and the receiving water.

In addition to casting the message into the catch basin cover or manhole grate, it shall also be depicted by depicted by an epoxy-applied 4-inch disc marker available from the City of Olympia (360) 753-8333 or other means as permitted by the Administrator

**Catch Basin/Manhole Sizing and Setting**

Storm sewer manholes shall conform to WSDOT catch basin Type 2 (Standard Plan B-1e) requirements. Diameters shall be determined by the minimum distance between knock outs in the structure as described in WSDOT Standard Plan B-1e.

**Castings**

All storm sewer manholes and catch basins shall have metal covers. Manhole covers shall meet the requirements of WSDOT manhole Ring and Cover (Standard Plan B-25) and shall have the word “DRAIN” on the outside of the cover, or as otherwise specified by the local government. Catch basin covers shall meet the requirements of WSDOT standard plans B-2a and B-2 or B-2b or B-2c or B-2d. Contact the local government for required grate types for particular settings. Note: Olympia allows B-2b or B-2c only.

Castings for metal frames shall be cast steel, gray iron or ductile iron. Castings for metal grates and covers shall be cast steel or ductile iron. All metal castings shall meet the standards of the latest edition of the Washington State Department of Transportation Standard Specifications for Roads, Bridges and

---

**Table 6  Catch Basin Grate Inlet Maximum Capacities**

<table>
<thead>
<tr>
<th>Roadway Grade ft/ft</th>
<th>On-grade grate capacity in cfs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.075 cfs</td>
</tr>
<tr>
<td>0.005</td>
<td>0.21</td>
</tr>
<tr>
<td>0.01</td>
<td>0.25</td>
</tr>
<tr>
<td>0.02</td>
<td>0.29</td>
</tr>
<tr>
<td>0.04</td>
<td>0.34</td>
</tr>
<tr>
<td>0.06 and above</td>
<td>0.36</td>
</tr>
</tbody>
</table>

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Municipal Construction – English Units and the jurisdiction’s development guidelines for allowable material types.

Unless directed otherwise by the local government, all storm sewer manholes shall be adjusted to grade, and all catch basins shall be installed flush with curb and adjusted to ¼” below grade after paving, with a reasonable taper to drain.

Flow Restrictor Manholes
Flow restrictor assemblies shall be placed in 54-inch minimum diameter manholes. Flow restrictor devices will normally be multiple orifice but other devices such as thin plate slotted weir may be specified. Orifice diameters below 2” shall be protected from plugging by trash and debris by a removable, maintainable screening device.

Changes of Pipe Size or Direction
Pipe direction or size changes are allowed only at manholes and catch basins. (On private property, for 4-inch and 6-inch diameter pipe, clean-outs at junctions are permissible). Curvilinear pipe may be installed in strict accordance with manufacturer’s instructions, which shall be provided for local government review and available for contractor and inspector use on the job site.
**Outfalls**

"Outfall" means an outfall to a natural or man-made channel or water body such as streams, lakes, salt water, ditches, wetlands, etc. Outfalls may also be subject to Washington Department of Fish and Wildlife and Department of Natural Resources regulations, the requirements of which shall take precedence where more restrictive than those stated herein.

**Design Storm Event**

Outfalls shall be designed to pass the conveyance design event and to suffer no structural damage or undercutting during the 100-year, 24-hour storm event. The Project Engineer shall present calculations showing the velocity, discharge, and flow path of the 100-year, 24-hour event.

**Outfall Design**

All outfall structures shall provide a 1.5 safety factor against failure at the design event. Outfalls with flow velocity under 12 feet per second (fps) and discharge under 2 cfs for the conveyance system design event are to be provided (at minimum) with a splash pad (e.g., rock, gabions, concrete). For flows less than 5 fps, the pad shall be composed of 8-inch minimum riprap rock, 1.5 feet thick, 8 feet long, and pipe diameter plus 6 feet wide. Between 5 and 12 fps, the pad shall be composed of 12-inch minimum riprap rock, 2 feet thick, 12 feet long, and pipe diameter plus 6 feet wide. In both cases, rock shall be placed in two layers to promote stability.

For outfalls where flow is 2 cfs or greater or velocity is 12 fps or greater for the conveyance system design event, an engineered energy dissipater is required. Examples are gabion splash blocks, stilling basins, drop pools, hydraulic jump pools, baffled aprons, bubble up structures, etc. Mechanisms that reduce velocity prior to discharge from an outfall are encouraged. Examples are drop manholes and rapid expansion into pipes of much larger diameter.

Outfalls must be protected against undercutting. Also consider scour, sedimentation, anchor damage, etc. Pipe and fittings materials shall be corrosion resistant, such as aluminum, plastic, fiberglass, high density polyethylene, etc. Galvanized or coated steel are not allowed.

**Outfalls on Steep Slopes**

Outfall pipes on steep slopes must be anchored and must be fused or butt-welded or mechanically restrained. They may not be gasketed, slip fit, or banded.

Additional outfall design guidance and technical information are available in *Volume V, Section 4.5.3, Outfall Systems*.

**Conveyance Materials**

Materials shall conform to Section 7-04 *Storm Sewers* as included in the latest edition of the *Washington State Department of Transportation Standard Specifications for Roads, Bridges, and Municipal Construction—English Units*. At local government discretion, materials not included in the WSDOT manual may be allowed. For such materials, project engineers shall submit specifications for local government consideration.
### Appendix I - Glossary and Notations

The following terms are provided for reference and use with this manual. They shall be superseded by any other definitions for these terms adopted by ordinance, unless they are defined in a Washington State WAC or RCW, or are used and defined as part of the Core Requirements for all new development and redevelopment.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AASHTO classification</td>
<td>The official classification of soil materials and soil aggregate mixtures for highway construction, used by the American Association of State Highway and Transportation Officials.</td>
</tr>
<tr>
<td>Abbreviated Drainage Plan</td>
<td>A stormwater design package including Site Development Drawings and supporting documentation to demonstrate compliance with Core Requirements #1 through #5 when a full Drainage Control Plan is not required.</td>
</tr>
<tr>
<td>Absorption</td>
<td>The penetration of a substance into or through another, such as the dissolving of a soluble gas in a liquid.</td>
</tr>
<tr>
<td>Adjacent steep slope</td>
<td>A slope with a gradient of 15 percent or steeper within five hundred feet of the site.</td>
</tr>
<tr>
<td>Adjustment</td>
<td>A variation in the application of a Core Requirement to a particular project. Adjustments provide substantially equivalent environmental protection.</td>
</tr>
<tr>
<td>Administrator</td>
<td>The local government official(s) authorized to make decisions in regard to Adjustments and Exceptions/Variances.</td>
</tr>
<tr>
<td>Adsorption</td>
<td>The adhesion of a substance to the surface of a solid or liquid; often used to extract pollutants by causing them to be attached to such adsorbents as activated carbon or silica gel. Hydrophobic, or water-repulsing adsorbents, are used to extract oil from waterways when oil spills occur. Heavy metals such as zinc and lead often adsorb onto sediment particles.</td>
</tr>
<tr>
<td>Aeration</td>
<td>The process of being supplied or impregnated with air. In waste treatment, the process used to foster biological and chemical purification. In soils, the process by which air in the soil is replenished by air from the atmosphere. In a well aerated soil, the soil air is similar in composition to the atmosphere above the soil. Poorly aerated soils usually contain a much higher percentage of carbon dioxide and a correspondingly lower percentage of oxygen.</td>
</tr>
<tr>
<td>Aerobic</td>
<td>Living or active only in the presence of free (dissolved or molecular) oxygen.</td>
</tr>
<tr>
<td>Aerobic bacteria</td>
<td>Bacteria that require the presence of free oxygen for their metabolic processes.</td>
</tr>
<tr>
<td>Aggressive plant species</td>
<td>Opportunistic species of inferior biological value that tend to out-compete more desirable forms and become dominant; applied to native species in this manual.</td>
</tr>
<tr>
<td>Algae</td>
<td>Primitive plants, many microscopic, containing chlorophyll and forming the base of the food chain in aquatic environments. Some species may create a nuisance when environmental conditions are suitable for prolific growth.</td>
</tr>
<tr>
<td>Algal bloom</td>
<td>Proliferation of living algae on the surface of lakes, streams or ponds; often stimulated by phosphate over-enrichment. Algal blooms reduce the oxygen available to other aquatic organisms.</td>
</tr>
<tr>
<td>Anadromous</td>
<td>Fish that grow to maturity in the ocean and return to rivers for spawning.</td>
</tr>
<tr>
<td>Anaerobic</td>
<td>Living or active in the absence of oxygen.</td>
</tr>
<tr>
<td>Anaerobic bacteria</td>
<td>Bacteria that do not require the presence of free or dissolved oxygen for metabolism.</td>
</tr>
<tr>
<td>Annual flood</td>
<td>The highest peak discharge on average which can be expected in any given year.</td>
</tr>
<tr>
<td>Antecedent moisture conditions</td>
<td>The degree of wetness of a watershed or within the soil at the beginning of a storm.</td>
</tr>
<tr>
<td>Anti-seep collar</td>
<td>A device constructed around a pipe or other conduit and placed through a dam, levee, or dike for the purpose of reducing seepage losses and piping failures.</td>
</tr>
<tr>
<td>Anti-vortex device</td>
<td>A facility placed at the entrance to a pipe conduit structure such as a drop inlet spillway or hood inlet spillway to prevent air from entering the structure when the pipe is flowing full.</td>
</tr>
<tr>
<td>Applicable BMPs</td>
<td>As used in Volume IV, applicable BMPs are those source control BMPs that are expected to be required by local governments at new development and redevelopment sites. Applicable BMPs will also be required if they are incorporated into NPDES permits, or they are included by local governments in a stormwater program for existing facilities.</td>
</tr>
<tr>
<td>Applicant</td>
<td>The person who has applied for a development permit or approval.</td>
</tr>
<tr>
<td>Appurtenances</td>
<td>Machinery, appliances, or auxiliary structures attached to a main structure, but not considered an integral part thereof, for the purpose of enabling it to function.</td>
</tr>
<tr>
<td>Aquifer</td>
<td>A geologic stratum containing ground water that can be withdrawn and used for human purposes.</td>
</tr>
<tr>
<td>Arterial</td>
<td>A road or street primarily for through traffic. The term generally includes roads or streets considered collectors. It does not include local access roads which are generally limited to providing access to abutting property. See also <a href="http://rcw.wa.gov/cw/35.78.010">RCW 35.78.010</a>, <a href="http://rcw.wa.gov/cw/36.86.070">RCW 36.86.070</a>, and <a href="http://rcw.wa.gov/cw/47.05.021">RCW 47.05.021</a>.</td>
</tr>
<tr>
<td>As-built drawings</td>
<td>Engineering plans which have been revised to reflect all changes to the plans which occurred during construction.</td>
</tr>
<tr>
<td>As-graded</td>
<td>The extent of surface conditions on completion of grading.</td>
</tr>
<tr>
<td>BSBL</td>
<td>See Building set back line.</td>
</tr>
<tr>
<td>Background</td>
<td>A description of pollutant levels arising from natural sources, and not because of man's immediate activities.</td>
</tr>
<tr>
<td>Backwater</td>
<td>Water upstream from an obstruction which is deeper than it would normally be without the obstruction.</td>
</tr>
<tr>
<td>Baffle</td>
<td>A device to check, deflect, or regulate flow.</td>
</tr>
<tr>
<td>Bankfull discharge</td>
<td>A flow condition where streamflow completely fills the stream channel up to the top of the bank. In undisturbed watersheds, the discharge conditions occur on average every 1.5 to 2 years and controls the shape and form of natural channels.</td>
</tr>
<tr>
<td><strong>Base flood</strong></td>
<td>A flood having a one percent chance of being equaled or exceeded in any given year. This is also referred to as the 100-year flood.</td>
</tr>
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</tr>
<tr>
<td><strong>Base flood elevation</strong></td>
<td>The water surface elevation of the base flood. It shall be referenced to the National Geodetic Vertical Datum of 1929 (NGVD).</td>
</tr>
<tr>
<td><strong>Baseline sample</strong></td>
<td>A sample collected during dry-weather flow (i.e., it does not consist of runoff from a specific precipitation event).</td>
</tr>
</tbody>
</table>
| **Basin plan**          | A plan that assesses, evaluates, and proposes solutions to existing and potential future impacts to the beneficial uses of, and the physical, chemical, and biological properties of waters of the state within a basin. Basins typically range in size from 1 to 50 square miles. A plan should include but not be limited to recommendations for:  
  • Stormwater requirements for new development and redevelopment;  
  • Capital improvement projects;  
  • Land Use management through identification and protection of critical areas, comprehensive land use and transportation plans, zoning regulations, site development standards, and conservation areas;  
  • Source control activities including public education and involvement, and business programs;  
  • Other targeted stormwater programs and activities, such as maintenance, inspections and enforcement;  
  • Monitoring; and  
  • An implementation schedule and funding strategy.  
A plan that is “adopted and implemented” must have the following characteristics:  
  • It must be adopted by legislative or regulatory action of jurisdictions with responsibilities under the plan;  
  • Ordinances, regulations, programs, and procedures recommended by the plan should be in effect or on schedule to be in effect; and,  
  • An implementation schedule and funding strategy that are in progress. |
<p>| <strong>Bearing capacity</strong>    | The maximum load that a material can support before failing. |
| <strong>Bedrock</strong>             | The more or less solid rock in place either on or beneath the surface of the earth. It may be soft, medium, or hard and have a smooth or irregular surface. |
| <strong>Bench</strong>               | A relatively level step excavated into earth material on which fill is to be placed. |
| <strong>Berm</strong>                | A constructed barrier of compacted earth, rock, or gravel. In a stormwater facility, a berm may serve as a vertical divider typically built up from the bottom. |
| <strong>Best management practice (BMP)</strong> | The schedules of activities, prohibitions of practices, maintenance procedures, and structural and/or managerial practices, that when used singly or in combination, prevent or reduce the release of pollutants and other adverse impacts to waters of Washington State. |
| <strong>Biochemical oxygen demand (BOD)</strong> | An indirect measure of the concentration of biologically degradable materials present in organic wastes. The amount of free oxygen utilized by aerobic organisms when allowed to attack the organic material in an aerobically maintained environment at a specified temperature (20°C) for a specific time period (5 days), and thus stated as BOD5. It is expressed in milligrams of oxygen utilized per liter of liquid waste volume (mg/l) or in milligrams of oxygen per kilogram of waste solution (mg/kg = ppm = parts per million parts). Also called biological oxygen demand. |
| <strong>Biodegradable</strong> | Capable of being readily broken down by biological means, especially by microbial action. Microbial action includes the combined effect of bacteria, fungus, flagellates, amoebae, ciliates, and nematodes. Degradation can be rapid or may take many years depending upon such factors as available oxygen and moisture. |
| <strong>Bioengineering</strong> | The combination of biological, mechanical, and ecological concepts (and methods) to control erosion and stabilize soil through the use of vegetation or in combination with construction materials. |
| <strong>Biofilter</strong> | A designed treatment facility using a combined soil and vegetation system for filtration, infiltration, adsorption, and biological uptake of pollutants in stormwater when runoff flows over and through. Vegetation growing in these facilities acts as both a physical filter which causes gravity settling of particulates by regulating velocity of flow, and also as a biological sink when direct uptake of dissolved pollutants occurs. The former mechanism is probably the most important in western Washington where the period of major runoff coincides with the period of lowest biological activity. |
| <strong>Biofiltration</strong> | The process of reducing pollutant concentrations in water by filtering the polluted water through biological materials. |
| <strong>Biological control</strong> | A method of controlling pest organisms by means of introduced or naturally occurring predatory organisms, sterilization, the use of inhibiting hormones, or other means, rather than by mechanical or chemical means. |
| <strong>Biological magnification</strong> | The increasing concentration of a substance along succeeding steps in a food chain. Also called biomagnification. |
| <strong>Bioretention BMP</strong> | Engineered facilities that store and treat stormwater by passing it through a specified soil profile, and either retain or detain the treated stormwater for flow attenuation. Refer to Chapter 7 of Volume V for Bioretention BMP types and design specifications. |
| <strong>Biosolids</strong> | Municipal sewage sludge that is a primarily organic, semisolid product resulting from the wastewater treatment process, that can be beneficially recycled and meets all applicable requirements under Chapter 173-308 WAC. Biosolids includes a material derived from biosolids, and septic tank sludge, also known as septage, that can be beneficially recycled and meets all applicable requirements under Chapter 173-308 WAC. For the purposes of Chapter 173-308 WAC, semisolid products include biosolids or products derived from biosolids ranging in character from mostly liquid to fully dried solids. |
| <strong>Bollard</strong> | A post (may or may not be removable) used to prevent vehicular access. |
| <strong>Bond</strong> | A surety bond, cash deposit or escrow account, assignment of savings, irrevocable letter of credit or other means acceptable to or required by the manager to guarantee that work is completed in compliance with the project's drainage plan and in compliance with all local government requirements. |
| <strong>Borrow area</strong> | A source of earth fill material used in the construction of embankments or other earth fill structures. |
| <strong>Buffer</strong> | The zone contiguous with a sensitive area that is required for the continued maintenance, function, and structural stability of the sensitive area. The critical functions of a riparian buffer (those associated with an aquatic system) include shading, input of organic debris and coarse sediments, uptake of nutrients, stabilization of banks, interception of fine sediments, overflow during high water events, protection from disturbance by humans and domestic animals, maintenance of wildlife habitat, and room for variation of aquatic system boundaries over time due to hydrologic or climatic effects. The critical functions of terrestrial buffers include protection of slope stability, attenuation of surface water flows from stormwater runoff and precipitation, and erosion control. |
| <strong>Building setback line (BSBL)</strong> | A line measured parallel to a property, easement, drainage facility, or buffer boundary, that delineates the area (defined by the distance of separation) where buildings or other obstructions are prohibited (including decks, patios, outbuildings, or overhangs beyond 18 inches). Wooden or chain link fences and landscaping are allowable within a building setback line. In this manual the minimum building setback line shall be 5 feet. |
| <strong>CIP</strong> | See Capital Improvement Project. |
| <strong>Capital Improvement Project or Program (CIP)</strong> | A project prioritized and scheduled as a part of an overall construction program or, the actual construction program. |
| <strong>Catch basin</strong> | A chamber or well, usually built at the curb line of a street, for the admission of surface water to a storm sewer or subdrain, having at its base a sediment sump designed to retain grit and detritus below the point of overflow. |
| <strong>Catchline</strong> | The point where a severe slope intercepts a different, more gentle slope. |
| <strong>Catchment</strong> | Surface drainage area. |
| <strong>Cation Exchange Capacity (CEC)</strong> | The amount of exchangeable cations that a soil can absorb. Units are milliequivalents per 100 g of soil, typically abbreviated simply as meq. Soil found to have a CEC of 5 meq at pH 7 will have CEC &lt; 5 meq when pH &lt; 7. |
| <strong>CESCL</strong> | See Certified Erosion and Sediment Control Lead. |
| <strong>Certified Erosion and Sediment Control Lead (CESCL)</strong> | An individual who has current certification through an approved erosion and sediment control training program that meets the minimum training standards established by Ecology (see BMP C160 of Volume II). A CESCL is knowledgeable in the principles and practices of erosion and sediment control. The CESCL must have the skills to assess site conditions and construction activities that could impact the quality of stormwater and, the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges. Certification is obtained through an Ecology approved erosion and sediment control course. Course listings are provided online at Ecology’s website. |</p>
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel</td>
<td>A feature that conveys surface water and is open to the air.</td>
</tr>
<tr>
<td>Channel, constructed</td>
<td>Channels or ditches constructed (or reconstructed natural channels) to convey surface water.</td>
</tr>
<tr>
<td>Channel, natural</td>
<td>Streams, creeks, or swales that convey surface/ground water and have existed long enough to establish a stable route and/or biological community.</td>
</tr>
<tr>
<td>Channel stabilization</td>
<td>Erosion prevention and stabilization of velocity distribution in a channel using vegetation, jetties, drops, revetments, and/or other measures.</td>
</tr>
<tr>
<td>Channel storage</td>
<td>Water temporarily stored in channels while enroute to an outlet.</td>
</tr>
<tr>
<td>Channelization</td>
<td>Alteration of a stream channel by widening, deepening, straightening, cleaning, or paving certain areas to change flow characteristics.</td>
</tr>
<tr>
<td>Check dam</td>
<td>Small dam constructed in a gully or other small watercourse to decrease the streamflow velocity, minimize channel scour, and promote deposition of sediment.</td>
</tr>
<tr>
<td>Chemical oxygen demand (COD)</td>
<td>A measure of the amount of oxygen required to oxidize organic and oxidizable inorganic compounds in water. The COD test, like the BOD test, is used to determine the degree of pollution in water.</td>
</tr>
<tr>
<td>Civil engineer</td>
<td>A professional engineer licensed in the State of Washington in Civil Engineering.</td>
</tr>
<tr>
<td>Civil engineering</td>
<td>The application of the knowledge of the forces of nature, principles of mechanics and the properties of materials to the evaluation, design and construction of civil works for the beneficial uses of mankind.</td>
</tr>
<tr>
<td>Clay lens</td>
<td>A naturally occurring, localized area of clay which acts as an impermeable layer to runoff infiltration.</td>
</tr>
<tr>
<td>Clearing</td>
<td>The destruction and removal of vegetation by manual, mechanical, or chemical methods.</td>
</tr>
<tr>
<td>Closed depression</td>
<td>An area which is low-lying and either has no, or such a limited, surface water outlet that during storm events the area acts as a retention basin.</td>
</tr>
<tr>
<td>Cohesion</td>
<td>The capacity of a soil to resist shearing stress, exclusive of functional resistance.</td>
</tr>
<tr>
<td>Coliform bacteria</td>
<td>Microorganisms common in the intestinal tracts of man and other warm-blooded animals; all the aerobic and facultative anaerobic, gram-negative, nonspore-forming, rod-shaped bacteria which ferment lactose with gas formation within 48 hours at 35°C. Used as an indicator of bacterial pollution.</td>
</tr>
<tr>
<td>Commercial agriculture</td>
<td>Those activities conducted on lands defined in RCW 84.34.020(2), and activities involved in the production of crops or livestock for commercial trade. An activity ceases to be considered commercial agriculture when the area on which it is conducted is proposed for conversion to a nonagricultural use or has lain idle for more than five (5) years, unless the idle land is registered in a federal or state soils conservation program, or unless the activity is maintenance of irrigation ditches, laterals, canals, or drainage ditches related to an existing and ongoing agricultural activity.</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
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</tr>
<tr>
<td><strong>Common Plan of Development or Sale</strong></td>
<td>A site where multiple separate and distinct construction activities may be taking place at different times on different schedules and/or by different contractors, but still under a single plan. Examples include: 1) phase projects and projects with multiple filings or lots, even if the separate phases or filings/lots will be constructed under separate contract or by separate owners (e.g., a development where lots are sold to separate builders); 2) a development plan that may be phased over multiple years, but is still under a consistent plan for long-term development; 3) projects in a contiguous area that may be unrelated but still under the same contract, such as construction of a building extension and a new parking lot at the same facility; and 4) linear projects such as roads, pipelines, or utilities. If the project is part of a common plan of development or sale, the disturbed area of the entire plan must be used in determine permit requirements.</td>
</tr>
<tr>
<td><strong>Compaction</strong></td>
<td>The densification, settlement, or packing of soil in such a way that permeability of the soil is reduced. Compaction effectively shifts the performance of a hydrologic group to a lower permeability hydrologic group. For example, a group B hydrologic soil can be compacted and be effectively converted to a group C hydrologic soil in the way it performs in regard to runoff.</td>
</tr>
<tr>
<td><strong>Compensatory storage</strong></td>
<td>New excavated storage volume equivalent to the flood storage capacity eliminated by filling or grading within the flood fringe. Equivalent shall mean that the storage removed shall be replaced by equal volume between corresponding one-foot contour intervals that are hydraulically connected to the floodway through their entire depth.</td>
</tr>
<tr>
<td><strong>Compost</strong></td>
<td>Organic material that has undergone biological degradation and transformation under controlled conditions designed to promote aerobic decomposition at a solid waste facility in compliance with the requirements of Chapter 173-350 WAC, or biosolids composted in compliance with Chapter 173-308 WAC. Composting is a form of organic material recycling. Natural decay of organic solid waste under uncontrolled conditions does not result in composted material. (Note: Various BMPs have restrictions on the percentage of biosolids in compost, or do not allow biosolids in compost.)</td>
</tr>
<tr>
<td><strong>Comprehensive planning</strong></td>
<td>Planning that takes into account all aspects of water, air, and land resources and their uses and limits.</td>
</tr>
<tr>
<td><strong>Conservation district</strong></td>
<td>A public organization created under state enabling law as a special-purpose district to develop and carry out a program of soil, water, and related resource conservation, use, and development within its boundaries, usually a subdivision of state government with a local governing body and always with limited authority. Often called a soil conservation district or a soil and water conservation district.</td>
</tr>
<tr>
<td><strong>Constructed wetland</strong></td>
<td>Those wetlands intentionally created on sites that are not wetlands for the primary purpose of stormwater treatment and managed as such. Constructed wetlands are normally considered as part of the stormwater collection and treatment system.</td>
</tr>
<tr>
<td><strong>Construction Stormwater Pollution Prevention Plan</strong></td>
<td>A document that describes the potential for pollution problems on a construction project and explains and illustrates the measures to be taken on the construction site to control those problems.</td>
</tr>
<tr>
<td>Contour</td>
<td>An imaginary line on the surface of the earth connecting points of the same elevation.</td>
</tr>
<tr>
<td>Converted Vegetation (Areas)</td>
<td>The surfaces on a project site where native vegetation, pasture, scrub/shrub, or unmaintained non-native vegetation (e.g., Himalayan blackberry, scotch broom) are converted to lawn or landscaped areas, or where native vegetation is converted to pasture.</td>
</tr>
<tr>
<td>Conveyance</td>
<td>A mechanism for transporting water from one point to another, including pipes, ditches, and channels.</td>
</tr>
<tr>
<td>Conveyance system</td>
<td>The drainage facilities, both natural and man-made, which collect, contain, and provide for the flow of surface and stormwater from the highest points on the land down to a receiving water. The natural elements of the conveyance system include swales and small drainage courses, streams, rivers, lakes, and wetlands. The human-made elements of the conveyance system include gutters, ditches, pipes, channels, and most retention/detention facilities.</td>
</tr>
<tr>
<td>Cover crop</td>
<td>A close-growing crop grown primarily for the purpose of protecting and improving soil between periods of permanent vegetation.</td>
</tr>
<tr>
<td>Created wetland</td>
<td>Means those wetlands intentionally created from nonwetland sites to produce or replace natural wetland habitat (e.g., compensatory mitigation projects).</td>
</tr>
<tr>
<td>Critical Areas</td>
<td>At a minimum, areas which include wetlands, areas with a critical recharging effect on aquifers used for potable water, fish and wildlife habitat conservation areas, frequently flooded areas, geologically hazardous areas, including unstable slopes, and associated areas and ecosystems.</td>
</tr>
<tr>
<td>Critical Drainage Area</td>
<td>An area with such severe flooding, drainage and/or erosion/sedimentation conditions that the area has been formally adopted as a Critical Drainage Area by rule under the procedures specified in an ordinance.</td>
</tr>
<tr>
<td>Critical reach</td>
<td>The point in a receiving stream below a discharge point at which the lowest dissolved oxygen level is reached and stream recovery begins.</td>
</tr>
<tr>
<td>Culvert</td>
<td>Pipe or concrete box structure that drains open channels, swales or ditches under a roadway or embankment. Typically with no catch-basins or manholes along its length.</td>
</tr>
<tr>
<td>Cut</td>
<td>Portion of land surface or area from which earth has been removed or will be removed by excavating; the depth below original ground surface to excavated surface.</td>
</tr>
<tr>
<td>Cut-and-fill</td>
<td>Process of earth moving by excavating part of an area and using the excavated material for adjacent embankments or fill areas.</td>
</tr>
<tr>
<td>Cut slope</td>
<td>A slope formed by excavating overlying material to connect the original ground surface with a lower ground surface created by the excavation. A cut slope is distinguished from a bermed slope, which is constructed by importing soil to create the slope.</td>
</tr>
<tr>
<td>DNS</td>
<td>See Determination of Nonsignificance.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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</tr>
<tr>
<td>Dead storage</td>
<td>The volume available in a depression in the ground below any conveyance system, or surface drainage pathway, or outlet invert elevation that could allow the discharge of surface and stormwater runoff.</td>
</tr>
<tr>
<td>Dedication of land</td>
<td>Refers to setting aside a portion of a property for a specific use or function.</td>
</tr>
<tr>
<td>Degradation</td>
<td>(Biological or chemical) The breakdown of complex organic or other chemical compounds into simpler substances, usually less harmful than the original compound, as with the degradation of a persistent pesticide. (Geological) Wearing down by erosion. (Water) The lowering of the water quality of a watercourse by an increase in the pollutant loading.</td>
</tr>
<tr>
<td>Degraded (disturbed) wetland (community)</td>
<td>A wetland (community) in which the vegetation, soils, and/or hydrology have been adversely altered, resulting in lost or reduced functions and values; generally, implies topographic isolation; hydrologic alterations such as hydroperiod alteration (increased or decreased quantity of water), diking, channelization, and/or outlet modification; soils alterations such as presence of fill, soil removal, and/or compaction; accumulation of toxicants in the biotic or abiotic components of the wetland; and/or low plant species richness with dominance by invasive weedy species.</td>
</tr>
<tr>
<td>Denitrification</td>
<td>The biochemical reduction of nitrates or nitrites in the soil or organic deposits to ammonia or free nitrogen.</td>
</tr>
<tr>
<td>Depression storage</td>
<td>The amount of precipitation that is trapped in depressions on the surface of the ground.</td>
</tr>
<tr>
<td>Design engineer</td>
<td>The professional civil engineer licensed in the State of Washington who prepares the analysis, design, and engineering plans for an applicant's permit or approval submittal.</td>
</tr>
<tr>
<td>Design storm</td>
<td>A prescribed hyetograph and total precipitation amount (for a specific duration recurrence frequency) used to estimate runoff for a hypothetical storm of interest or concern for the purposes of analyzing existing drainage, designing new drainage facilities or assessing other impacts of a proposed project on the flow of surface water. (A hyetograph is a graph of percentages of total precipitation for a series of time steps representing the total time during which the precipitation occurs.)</td>
</tr>
<tr>
<td>Detention</td>
<td>The release of stormwater runoff from the site at a slower rate than it is collected by the stormwater facility system, the difference being held in temporary storage.</td>
</tr>
<tr>
<td>Detention facility</td>
<td>An above or below ground facility, such as a pond or tank, that temporarily stores stormwater runoff and subsequently releases it at a slower rate than it is collected by the drainage facility system. There is little or no infiltration of stored stormwater.</td>
</tr>
<tr>
<td>Detention time</td>
<td>The theoretical time required to displace the contents of a stormwater treatment facility at a given rate of discharge (volume divided by rate of discharge).</td>
</tr>
<tr>
<td>Determination of Nonsignificance (DNS)</td>
<td>The written decision by the responsible official of the lead agency that a proposal is not likely to have a significant adverse environmental impact, and therefore an EIS is not required.</td>
</tr>
<tr>
<td>Development</td>
<td>Means new development, redevelopment, or both. See definitions for each.</td>
</tr>
</tbody>
</table>

City of Olympia Drainage Design and Erosion Control Manual
Volume I – Core Technical Requirements and Site Planning  
December 2016

G-9
| **Discharge** | Runoff leaving a new development or redevelopment via overland flow, built conveyance systems, or infiltration facilities. A hydraulic rate of flow, specifically fluid flow; a volume of fluid passing a point per unit of time, commonly expressed as cubic feet per second, cubic meters per second, gallons per minute, gallons per day, or millions of gallons per day. |
| **Dispersion** | Release of surface and stormwater runoff such that the flow spreads over a wide area and is located so as not to allow flow to concentrate anywhere upstream of a drainage channel with erodible underlying granular soils. |
| **Ditch** | A long narrow excavation dug in the earth for drainage with its top width less than 10 feet at design flow. |
| **Divide, Drainage** | The boundary between one drainage basin and another. |
| **Drain** | A buried pipe or other conduit (closed drain). A ditch (open drain) for carrying off surplus surface water or ground water. |
| **(To) Drain** | To provide channels, such as open ditches or closed drains, so that excess water can be removed by surface flow or by internal flow. To lose water (from the soil) by percolation. |
| **Drainage** | Refers to the collection, conveyance, containment, and/or discharge of surface and stormwater runoff. |
| **Drainage basin** | A geographic and hydrologic subunit of a watershed. |
| **Drainage channel** | A drainage pathway with a well-defined bed and banks indicating frequent conveyance of surface and stormwater runoff. |
| **Drainage course** | A pathway for watershed drainage characterized by wet soil vegetation; often intermittent in flow. |
| **Drainage Control Plan** | The complete stormwater design package containing all information, reports, plans, and long-term site management guidance for a project site. The Drainage Control Plan submittal is comprised of Site Development Drawings, a Drainage Design Report, a Stormwater Site Management Plan, and Construction Stormwater Pollution Prevention Plan. |
| **Drainage Design Report** | The comprehensive report containing all of the technical information and analysis necessary for regulatory agencies to evaluate a proposed new development or redevelopment project for compliance with stormwater requirements. Contents of the Drainage Design Report will vary with the type and size of the project, and individual site characteristics. Guidance on preparing a Drainage Design Report is contained in Chapter 3 of Volume I. |
| **Drainage easement** | A legal encumbrance that is placed against a property's title to reserve specified privileges for the users and beneficiaries of the drainage facilities contained within the boundaries of the easement. |
| **Drainage pathway** | The route that surface and stormwater runoff follows downslope as it leaves any part of the site. |
| **Drainage review** | An evaluation by Plan Approving Authority staff of a proposed project's compliance with the drainage requirements in this manual or its technical equivalent. |
| Drainage, Soil | As a natural condition of the soil, soil drainage refers to the frequency and duration of periods when the soil is free of saturation; for example, in well-drained soils the water is removed readily but not rapidly; in poorly drained soils the root zone is waterlogged for long periods unless artificially drained, and the roots of ordinary crop plants cannot get enough oxygen; in excessively drained soils the water is removed so completely that most crop plants suffer from lack of water. Strictly speaking, excessively drained soils are a result of excessive runoff due to steep slopes or low available water-holding capacity due to small amounts of silt and clay in the soil material. The following classes are used to express soil drainage: Well drained - Excess water drains away rapidly and no mottling occurs within 36 inches of the surface.  
• Moderately well drained - Water is removed from the soil somewhat slowly, resulting in small but significant periods of wetness. Mottling occurs between 18 and 36 inches.  
• Somewhat poorly drained - Water is removed from the soil slowly enough to keep it wet for significant periods but not all of the time. Mottling occurs between 8 and 18 inches.  
• Poorly drained - Water is removed so slowly that the soil is wet for a large part of the time. Mottling occurs between 0 and 8 inches.  
• Very poorly drained - Water is removed so slowly that the water table remains at or near the surface for the greater part of the time. There may also be periods of surface ponding. The soil has a black to gray surface layer with mottles up to the surface. |
<p>| Drawdown | Lowering of the water surface (in open channel flow), water table or piezometric surface (in ground water flow) resulting from a withdrawal of water. |
| Drop-inlet spillway | Overall structure in which the water drops through a vertical riser connected to a discharge conduit. |
| Drop spillway | Overall structure in which the water drops over a vertical wall onto an apron at a lower elevation. |
| Drop structure | A structure for dropping water to a lower level and dissipating its surplus energy; a fall. A drop may be vertical or inclined. |
| Dry weather flow | The combination of ground water seepage and allowed non-stormwater flows found in storm sewers during dry weather. Also that flow in streams during the dry season. |
| EIS | See Environmental Impact Statement. |
| ESC | Erosion and Sediment Control (Plan). |
| Earth material | Any rock, natural soil or fill and/or any combination thereof. Earth material shall not be considered topsoil used for landscape purposes. Topsoil used for landscaped purposes shall comply with ASTM D 5268 specifications. Engineered soil/landscape systems are also defined independently. |
| Easement | The legal right to use a parcel of land for a particular purpose. It does not include fee ownership, but may restrict the owners use of the land. |</p>
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective Impervious Surface</td>
<td>Those impervious surfaces that are connected via sheet flow or discrete conveyance to a drainage system. Impervious surfaces are considered ineffective if: 1) the runoff is dispersed through at least one hundred feet of native vegetation in accordance with BMP T5.30 – “Full Dispersion” as described in Chapter 5 of Volume V; 2) residential roof runoff is infiltrated in accordance with Downspout Full Infiltration Systems in BMP 5.10A Volume III; or 3) approved continuous runoff modeling methods indicate that the entire runoff file is infiltrated.</td>
</tr>
<tr>
<td>Embankment</td>
<td>A structure of earth, gravel, or similar material raised to form a pond bank or foundation for a road.</td>
</tr>
<tr>
<td>Emergent plants</td>
<td>Aquatic plants that are rooted in the sediment but whose leaves are at or above the water surface. These wetland plants often have high habitat value for wildlife and waterfowl, and can aid in pollutant uptake.</td>
</tr>
<tr>
<td>Emergency spillway</td>
<td>A vegetated earth channel used to safely convey flood discharges in excess of the capacity of the principal spillway.</td>
</tr>
<tr>
<td>Emerging technology</td>
<td>Treatment technologies that have not been evaluated with approved protocols, but for which preliminary data indicate that they may provide a necessary function(s) in a stormwater treatment system. Emerging technologies need additional evaluation to define design criteria to achieve, or to contribute to achieving, state performance goals, and to define the limits of their use.</td>
</tr>
<tr>
<td>Energy dissipater</td>
<td>Any means by which the total energy of flowing water is reduced. In stormwater design, they are usually mechanisms that reduce velocity prior to, or at, discharge from an outfall in order to prevent erosion. They include rock splash pads, drop manholes, concrete stilling basins or baffles, and check dams.</td>
</tr>
<tr>
<td>Energy gradient</td>
<td>The slope of the specific energy line (i.e., the sum of the potential and velocity heads).</td>
</tr>
<tr>
<td>Engineered soil/landscape system</td>
<td>This is a self-sustaining soil and plant system that simultaneously supports plant growth, soil microbes, water infiltration, nutrient and pollutant adsorption, sediment and pollutant biofiltration, water interflow, and pollution decomposition. The system shall be protected from compaction and erosion. The system shall be planted and/or mulched as part of the installation. The engineered soil/plant system shall have the following characteristics: a. Be protected from compaction and erosion. b. Have a plant system to support a sustained soil quality. c. Possess permeability characteristics of not less than 6.0, 2.0, and 0.6 inches/hour for hydrologic soil groups A, B, and C, respectively (per ASTM D 3385). D is less than 0.6 inches/hour. Possess minimum percent organic matter of 12, 14, 16, and 18 percent (dry-weight basis) for hydrologic soil groups A, B, C, and D, respectively (per ASTM D 2974).</td>
</tr>
<tr>
<td>Engineering calculations</td>
<td>Hand calculations or computer modeling necessary for the evaluation, design, or sizing of conveyances, stormwater facilities, and best management practices contained in this manual. Engineering calculations shall be performed by or under the direction of a licensed civil engineer.</td>
</tr>
<tr>
<td><strong>Engineering geology</strong></td>
<td>The application of geologic knowledge and principles in the investigation and evaluation of naturally occurring rock and soil for use in the design of civil works.</td>
</tr>
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<td>------------------------</td>
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</tr>
<tr>
<td><strong>Engineering plan</strong></td>
<td>A plan prepared and stamped by a professional civil engineer.</td>
</tr>
<tr>
<td><strong>Enhancement</strong></td>
<td>To raise value, desirability, or attractiveness of an environment associated with surface water.</td>
</tr>
<tr>
<td><strong>Environmental Impact Statement (EIS)</strong></td>
<td>A document that discusses the likely significant adverse impacts of a proposal, ways to lessen the impacts, and alternatives to the proposal. They are required by the national and state environmental policy acts when projects are determined to have significant environmental impact.</td>
</tr>
<tr>
<td><strong>Erodible granular soils</strong></td>
<td>Soil materials that are easily eroded and transported by running water, typically fine or medium grained sand with minor gravel, silt, or clay content. Such soils are commonly described as Everett or Indianola series soil types in the SCS classification. Also included are any soils showing examples of existing severe stream channel incision as indicated by unvegetated streambanks standing over two feet high above the base of the channel.</td>
</tr>
<tr>
<td><strong>Erodible or leachable materials</strong></td>
<td>Wastes, chemicals, or other substances that measurably alter the physical or chemical characteristics of runoff when exposed to rainfall. Examples include erodible soils that are stockpiled, uncovered process wastes, manure, fertilizers, oily substances, ashes, kiln dust, and garbage dumpster leakage.</td>
</tr>
<tr>
<td><strong>Erosion</strong></td>
<td>The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep. Also, detachment and movement of soil or rock fragments by water, wind, ice, or gravity. The following terms are used to describe different types of water erosion:</td>
</tr>
<tr>
<td></td>
<td>• Geological erosion - The normal or natural erosion caused by geological processes acting over long geologic periods and resulting in the wearing-away of mountains, the building up of floodplains, coastal plains, etc. Synonymous with natural erosion.</td>
</tr>
<tr>
<td></td>
<td>• Gully erosion - The erosion process whereby water accumulates in narrow channels and, over short periods, removes the soil from this narrow area to considerable depths, ranging from 1 to 2 feet to as much as 75 to 100 feet.</td>
</tr>
<tr>
<td></td>
<td>• Natural erosion - Wearing away of the earth’s surface by water, ice, or other natural agents under natural environmental conditions of climate, vegetation, etc., undisturbed by man. Synonymous with geological erosion.</td>
</tr>
<tr>
<td></td>
<td>• Normal erosion - The gradual erosion of land used by man which does not greatly exceed natural erosion.</td>
</tr>
<tr>
<td></td>
<td>• Rill erosion - An erosion process in which numerous small channels only several inches deep are formed; occurs mainly on recently disturbed and exposed soils. See Rill.</td>
</tr>
</tbody>
</table>
- **Sheet erosion** - The removal of a fairly uniform layer of soil from the land surface by runoff.
- **Splash erosion** - The spattering of small soil particles caused by the impact of raindrops on wet soils. The loosened and spattered particles may or may not be subsequently removed by surface runoff.

### Erosion classes (soil survey)
A grouping of erosion conditions based on the degree of erosion or on characteristic patterns. Applied to accelerated erosion, not to normal, natural, or geological erosion. Four erosion classes are recognized for water erosion and three for wind erosion.

### Erosion and sedimentation control
Any temporary or permanent measures taken to reduce erosion; control siltation and sedimentation; and ensure that sediment-laden water does not leave the site.

### Erosion and sediment control facility
A type of drainage facility designed to hold water for a period of time to allow sediment contained in the surface and stormwater runoff directed to the facility to settle out so as to improve the quality of the runoff.

### Escarpment
A steep face or a ridge of high land.

### Estuarine wetland
Generally, an eelgrass bed; salt marsh; or rocky, sandflat, or mudflat intertidal area where fresh and salt water mix. (Specifically, a tidal wetland with salinity greater than 0.5 parts per thousand, usually semi-enclosed by land but with partially obstructed or sporadic access to the open ocean).

### Estuary
An area where fresh water meets salt water, or where the tide meets the river current (e.g., bays, mouths of rivers, salt marshes, and lagoons). Estuaries serve as nurseries and spawning and feeding grounds for large groups of marine life and provide shelter and food for birds and wildlife.

### Eutrophication
Refers to the process where nutrient over-enrichment of water leads to excessive growth of aquatic plants, especially algae.

### Evapotranspiration
The collective term for the processes of evaporation and plant transpiration by which water is returned to the atmosphere.

### Excavation
The mechanical removal of earth material.

### Exception
Relief from the application of a Core Requirement to a project.

### Exfiltration
The downward movement of runoff through the bottom of an infiltration BMP into the soil layer or the downward movement of water through soil.

### FIRM
See [Flood Insurance Rate Map](#).

### Fertilizer
Any material or mixture used to supply one or more of the essential plant nutrient elements.

### Fill
A deposit of earth material placed by artificial means.

### Filter fabric
A woven or nonwoven, water-permeable material generally made of synthetic products such as polypropylene and used in stormwater management and erosion and sediment control applications to trap sediment or prevent the clogging of aggregates by fine soil particles.
<p>| <strong>Filter fabric fence</strong> | A temporary sediment barrier consisting of a filter fabric stretched across and attached to supporting posts and entrenched. The filter fence is constructed of stakes and synthetic filter fabric with a rigid wire fence backing where necessary for support. Also commonly referred to in the Washington Department of Transportation standard specifications as “construction geotextile for temporary silt fences.” |
| <strong>Filter strip</strong> | A grassy area with gentle slopes that treats stormwater runoff from adjacent paved areas before it concentrates into a discrete channel. |
| <strong>Flocculation</strong> | The process by which suspended colloidal or very fine particles are assembled into larger masses or flocules which eventually settle out of suspension. This process occurs naturally but can also be caused through the use of such chemicals as alum. |
| <strong>Flood</strong> | An overflow or inundation that comes from a river or any other source, including (but not limited to) streams, tides, wave action, storm drains, or excess rainfall. Any relatively high stream flow overtopping the natural or artificial banks in any reach of a stream. |
| <strong>Flood control</strong> | Methods or facilities for reducing flood flows and the extent of flooding. |
| <strong>Flood control project</strong> | A structural system installed to protect land and improvements from floods by the construction of dikes, river embankments, channels, or dams. |
| <strong>Flood frequency</strong> | The frequency with which the flood of interest may be expected to occur at a site in any average interval of years. Frequency analysis defines the &quot;n-year flood&quot; as being the flood that will, over a long period of time, be equaled or exceeded on the average once every &quot;n&quot; years. |
| <strong>Flood fringe</strong> | That portion of the floodplain outside of the floodway which is covered by floodwaters during the base flood; it is generally associated with slower moving or standing water rather than rapidly flowing water. |
| <strong>Flood hazard areas</strong> | Those areas subject to inundation by the base flood. Includes, but is not limited to streams, lakes, wetlands, and closed depressions. |
| <strong>Flood Insurance Rate Map (FIRM)</strong> | The official map on which the Federal Emergency Management Agency has delineated many areas of flood hazard, floodway, and the risk premium zones. |
| <strong>Flood Insurance Study</strong> | The official report provided by the Federal Emergency Management Agency that includes flood profiles and the FIRM. |
| <strong>Flood peak</strong> | The highest value of the stage or discharge attained by a flood; thus, peak stage or peak discharge. |
| <strong>Floodplain</strong> | The total area subject to inundation by a flood including the flood fringe and floodway. |
| <strong>Flood-proofing</strong> | Adaptations that ensure a structure is substantially impermeable to the passage of water below the flood protection elevation that resists hydrostatic and hydrodynamic loads and effects of buoyancy. |
| <strong>Flood protection elevation</strong> | The base flood elevation or higher as defined by the local government. |</p>
<table>
<thead>
<tr>
<th>Term</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Flood protection facility</td>
<td>Any levee, berm, wall, enclosure, raise bank, revetment, constructed bank stabilization, or armoring, that is commonly recognized by the community as providing significant protection to a property from inundation by flood waters.</td>
</tr>
<tr>
<td>Flood routing</td>
<td>An analytical technique used to compute the effects of system storage dynamics on the shape and movement of flow represented by a hydrograph.</td>
</tr>
<tr>
<td>Flood stage</td>
<td>The stage at which overflow of the natural banks of a stream begins.</td>
</tr>
<tr>
<td>Floodway</td>
<td>The channel of the river or stream and those portions of the adjoining floodplains that are reasonably required to carry and discharge the base flood flow. The portions of the adjoining floodplains which are considered to be &quot;reasonably required&quot; is defined by flood hazard regulations.</td>
</tr>
<tr>
<td>Flow control BMP (or facility)</td>
<td>A drainage facility designed to mitigate the impacts of increased surface and stormwater runoff flow rates generated by development. Flow control facilities are designed either to hold water for a considerable length of time and then release it by evaporation, plant transpiration, and/or infiltration into the ground, or to hold runoff for a short period of time, releasing it to the conveyance system at a controlled rate.</td>
</tr>
<tr>
<td>Flow duration</td>
<td>The aggregate time that peak flows are at or above a particular flow rate of interest. For example, the amount of time that peak flows are at or above 50% of the 2-year peak flow rate for a period of record.</td>
</tr>
<tr>
<td>Flow frequency</td>
<td>The inverse of the probability that the flow will be equaled or exceeded in any given year (the exceedance probability). For example, if the exceedance probability is 0.01 or 1 in 100, that flow is referred to as the 100-year flow.</td>
</tr>
<tr>
<td>Flow path</td>
<td>The route that stormwater runoff follows between two points of interest.</td>
</tr>
<tr>
<td>Forebay</td>
<td>An easily maintained, extra storage area provided near an inlet of a BMP to trap incoming sediments before they accumulate in a pond or wetland BMP.</td>
</tr>
</tbody>
</table>
| Forest practice             | Any activity conducted on or directly pertaining to forest land and relating to growing, harvesting, or processing timber, including but not limited to:  
  a. Road and trail construction.  
  b. Harvesting, final and intermediate.  
  c. Precommercial thinning.  
  d. Reforestation.  
  e. Fertilization.  
  f. Prevention and suppression of diseases and insects.  
  g. Salvage of trees.  
  h. Brush control. |
<p>| <strong>Forested communities (wetlands)</strong> | In general terms, communities (wetlands) characterized by woody vegetation that is greater than or equal to 6 meters in height; in this manual the term applies to such communities (wetlands) that represent a significant amount of tree cover consisting of species that offer wildlife habitat and other values and advance the performance of wetland functions overall. |
| <strong>Freeboard</strong> | The vertical distance between the highest designed water surface elevation and the elevation of the crest of the facility. For example, in pond design, freeboard is the vertical distance between the emergency overflow water surface and the top of the pond embankment. |
| <strong>Frequently flooded areas</strong> | The 100-year floodplain designations of the Federal Emergency Management Agency and the National Flood Insurance Program or as defined by the local government. |
| <strong>Frost-heave</strong> | The upward movement of soil surface due to the expansion of water stored between particles in the first few feet of the soil profile as it freezes. May cause surface fracturing of asphalt or concrete. |
| <strong>Frequency of storm (design storm frequency)</strong> | The anticipated period in years that will elapse, based on average probability of storms in the design region, before a storm of a given intensity and/or total volume will recur; thus a 10-year storm can be expected to occur on the average once every 10 years. Sewers designed to handle flows that occur under such storm conditions would be expected to be surcharged by any storms of greater amount or intensity. |
| <strong>Fully controlled limited access highway</strong> | A highway where the right of owner or occupants of abutting land or other persons to access, light, air, or view in connection with the highway is controlled to give preference to through traffic by providing access connections with selected public roads only, and by prohibiting crossings or direct private driveway connections at grade. (See WAC 468-58-010) |
| <strong>Function (wetland)</strong> | The ecological (physical, chemical, and biological) processes or attributes of a wetland without regard for their importance to society (see also values). Wetland functions include food chain support, provision of ecosystem diversity and fish and wildlife habitat, floodflow alteration, ground water recharge and discharge, water quality improvement, and soil stabilization. |
| <strong>Gabion</strong> | A rectangular or cylindrical wire mesh cage (a chicken wire basket) filled with rock and used as a protecting agent, revetment, etc., against erosion. Soft gabions, often used in streambank stabilization, are made of geotextiles filled with dirt, in between which cuttings are placed. |
| <strong>Gage or gauge</strong> | Device for registering precipitation, water level, discharge, velocity, pressure, temperature, etc. Also, a measure of the thickness of metal; e.g., diameter of wire, wall thickness of steel pipe. |
| <strong>Gaging station</strong> | A selected section of a stream channel equipped with a gage, recorder, or other facilities for determining stream discharge. |</p>
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geologist</td>
<td>A person who has earned a degree in geology from an accredited college or university or who has equivalent educational training and has at least five years of experience as a practicing geologist or four years of experience and at least two years post-graduate study, research or teaching. The practical experience shall include at least three years work in applied geology and landslide evaluation, in close association with qualified practicing geologists or geotechnical professional/civil engineers.</td>
</tr>
<tr>
<td>Geologically hazardous areas</td>
<td>Areas that because of their susceptibility to erosion, sliding, earthquake, or other geological events, are not suited to the siting of commercial, residential, or industrial development consistent with public health or safety concerns.</td>
</tr>
<tr>
<td>Geometrics</td>
<td>The mathematical relationships between points, lines, angles, and surfaces used to measure and identify areas of land.</td>
</tr>
<tr>
<td>Geotechnical professional civil engineer</td>
<td>A practicing, geotechnical/civil engineer licensed as a professional Civil Engineer with the State of Washington who has at least four years of professional employment as a geotechnical engineer in responsible charge, including experience with landslide evaluation.</td>
</tr>
<tr>
<td>Grade</td>
<td>The slope of a road, channel, or natural ground. The finished surface of a canal bed, roadbed, top of embankment, or bottom of excavation; any surface prepared for the support of construction such as paving or the laying of a conduit.</td>
</tr>
<tr>
<td>(To) Grade</td>
<td>To finish the surface of a canal bed, roadbed, top of embankment or bottom of excavation.</td>
</tr>
<tr>
<td>Gradient terrace</td>
<td>An earth embankment or a ridge-and-channel constructed with suitable spacing and an acceptable grade to reduce erosion damage by intercepting surface runoff and conducting it to a stable outlet at a stable nonerosive velocity.</td>
</tr>
<tr>
<td>Grassed waterway</td>
<td>A natural or constructed waterway, usually broad and shallow, covered with erosion-resistant grasses, used to conduct surface water from an area at a reduced flow rate. See also biofilter.</td>
</tr>
<tr>
<td>Ground water</td>
<td>Water in a saturated zone or stratum beneath the land surface or a surface waterbody.</td>
</tr>
<tr>
<td>Ground water recharge</td>
<td>Inflow to a ground water reservoir.</td>
</tr>
<tr>
<td>Ground water table</td>
<td>The free surface of the ground water, that surface subject to atmospheric pressure under the ground, generally rising and falling with the season, the rate of withdrawal, the rate of restoration, and other conditions. It is seldom static.</td>
</tr>
<tr>
<td>Gully</td>
<td>A channel caused by the concentrated flow of surface and stormwater runoff over unprotected erodible land.</td>
</tr>
<tr>
<td><strong>Habitat</strong></td>
<td>The specific area or environment in which a particular type of plant or animal lives. An organism's habitat must provide all of the basic requirements for life and should be protected from harmful biological, chemical, and physical alterations.</td>
</tr>
<tr>
<td><strong>Hardpan</strong></td>
<td>A cemented or compacted and often clay-like layer of soil that is impenetrable by roots. Also known as glacial till.</td>
</tr>
<tr>
<td><strong>Hard Surface</strong></td>
<td>An impervious surface, a permeable pavement, or a vegetated roof.</td>
</tr>
<tr>
<td><strong>Harmful pollutant</strong></td>
<td>A substance that has adverse effects to an organism including immediate death, chronic poisoning, impaired reproduction, cancer or other effects.</td>
</tr>
<tr>
<td><strong>Head (hydraulics)</strong></td>
<td>The height of water above any plane of reference. The energy, either kinetic or potential, possessed by each unit weight of a liquid, expressed as the vertical height through which a unit weight would have to fall to release the average energy possessed. Used in various compound terms such as pressure head, velocity head, and head loss.</td>
</tr>
<tr>
<td><strong>Head loss</strong></td>
<td>Energy loss due to friction, eddies, changes in velocity, or direction of flow.</td>
</tr>
<tr>
<td><strong>Heavy metals</strong></td>
<td>Metals of high specific gravity, present in municipal and industrial wastes, that pose long-term environmental hazards. Such metals include cadmium, chromium, cobalt, copper, lead, mercury, nickel, and zinc.</td>
</tr>
</tbody>
</table>
| **High-use site** | High-use sites are those that typically generate high concentrations of oil due to high traffic turnover or the frequent transfer of oil. High-use sites include:  
  • An area of a commercial or industrial site subject to an expected average daily traffic (ADT) count equal to or greater than 100 vehicles per 1,000 square feet of gross building area;  
  • An area of a commercial or industrial site subject to petroleum storage and transfer in excess of 1,500 gallons per year, not including routinely delivered heating oil;  
  • An area of a commercial or industrial site subject to parking, storage or maintenance of 25 or more vehicles that are over 10 tons gross weight (trucks, buses, trains, heavy equipment, etc.);  
  • A road intersection with a measured ADT count of 25,000 vehicles or more on the main roadway and 15,000 vehicles or more on any intersecting roadway, excluding projects proposing primarily pedestrian or bicycle use improvements. |
<p>| <strong>Highway</strong> | A main public road connecting towns and cities. |
| <strong>Hog fuel</strong> | Wood-based mulch. |
| <strong>Horton overland flow</strong> | A runoff process whereby the rainfall rate exceeds the infiltration rate, so that the precipitation that does not infiltrate flows downhill over the soil surface. |
| <strong>HSPF</strong> | Hydrological Simulation Program-Fortran. A continuous simulation hydrologic model that transforms an uninterrupted rainfall record into a concurrent series of runoff or flow data by means of a set of mathematical algorithms which represent the rainfall-runoff process at some conceptual level. |</p>
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<tr>
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<tbody>
<tr>
<td>Humus</td>
<td>Organic matter in or on a soil, composed of partly or fully decomposed bits of plant tissue or from animal manure.</td>
</tr>
<tr>
<td>Hydraulic Conductivity</td>
<td>The quality of saturated soil that enables water or air to move through it. Also known as permeability coefficient</td>
</tr>
<tr>
<td>Hydraulic gradient</td>
<td>Slope of the potential head relative to a fixed datum.</td>
</tr>
<tr>
<td>Hydrodynamics</td>
<td>Means the dynamic energy, force, or motion of fluids as affected by the physical forces acting upon those fluids.</td>
</tr>
<tr>
<td>Hydrograph</td>
<td>A graph of runoff rate, inflow rate or discharge rate, past a specific point over time.</td>
</tr>
<tr>
<td>Hydrologic cycle</td>
<td>The circuit of water movement from the atmosphere to the earth and return to the atmosphere through various stages or processes as precipitation, interception, runoff, infiltration, percolation, storage, evaporation, and transpiration.</td>
</tr>
<tr>
<td>Hydrologic Soil Groups</td>
<td>A soil characteristic classification system defined by the U.S. Soil Conservation Service in which a soil may be categorized into one of four soil groups (A, B, C, or D) based upon infiltration rate and other properties. Type A: Low runoff potential. Soils having high infiltration rates, even when thoroughly wetted, and consisting chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission. Type B: Moderately low runoff potential. Soils having moderate infiltration rates when thoroughly wetted, and consisting chiefly of moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission. Type C: Moderately high runoff potential. Soils having slow infiltration rates when thoroughly wetted, and consisting chiefly of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine textures. These soils have a slow rate of water transmission. Type D: High runoff potential. Soils having very slow infiltration rates when thoroughly wetted, and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a hardpan, till, or clay layer at or near the surface, soils with a compacted subgrade at or near the surface, and shallow soils or nearly impervious material. These soils have a very slow rate of water transmission.</td>
</tr>
<tr>
<td>Hydrology</td>
<td>The science of the behavior of water in the atmosphere, on the surface of the earth, and underground.</td>
</tr>
<tr>
<td>Hydroperiod</td>
<td>A seasonal occurrence of flooding and/or soil saturation; it encompasses depth, frequency, duration, and seasonal pattern of inundation.</td>
</tr>
<tr>
<td>Hyetograph</td>
<td>A graph of percentages of total precipitation for a series of time steps representing the total time in which precipitation occurs.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illicit discharge</td>
<td>All non-stormwater discharges to stormwater drainage systems that cause or contribute to a violation of state water quality, sediment quality or ground water quality standards, including but not limited to sanitary sewer connections, industrial process water, interior floor drains, car washing, and greywater systems.</td>
</tr>
<tr>
<td>Impact basin</td>
<td>A device used to dissipate the energy of flowing water. Generally constructed of concrete in the form of a partially depressed or partially submerged vessel, it may utilize baffles to dissipate velocities.</td>
</tr>
<tr>
<td>Impervious</td>
<td>A surface which cannot be easily penetrated. For instance, rain does not readily penetrate paved surfaces.</td>
</tr>
<tr>
<td>Impervious surface</td>
<td>A non-vegetated surface area which either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development. A non-vegetated surface area which causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development. Common impervious surfaces include, but are not limited to, roof tops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, gravel roads, packed earthen materials, and oiled, macadam or other surfaces which similarly impede the natural infiltration of stormwater. Open, uncovered retention/detention facilities shall not be considered as impervious surfaces for the purposes of determining whether the thresholds for application of core requirements are exceeded. Open, uncovered retention/detention facilities shall be considered impervious surfaces for purposes of runoff modeling.</td>
</tr>
<tr>
<td>Impoundment</td>
<td>A natural or man-made containment for surface water.</td>
</tr>
<tr>
<td>Improvement</td>
<td>Streets (with or without curbs or gutters), sidewalks, crosswalks, parking lots, water mains, sanitary and storm sewers, drainage facilities, street trees and other appropriate items.</td>
</tr>
<tr>
<td>Industrial activities</td>
<td>Material handling, transportation, or storage; manufacturing; maintenance; treatment; or disposal. Areas with industrial activities include plant yards, access roads and rail lines used by carriers of raw materials, manufactured products, waste material, or by-products; material handling sites; refuse sites; sites used for the application or disposal of process waste waters; 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 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 stormwater.</td>
</tr>
<tr>
<td>Infiltration</td>
<td>Means the downward movement of water from the surface to the subsoil.</td>
</tr>
<tr>
<td>Infiltration facility (or system)</td>
<td>A drainage facility designed to use the hydrologic process of surface and stormwater runoff soaking into the ground, commonly referred to as a percolation, to dispose of surface and stormwater runoff.</td>
</tr>
<tr>
<td><strong>Infiltration rate</strong></td>
<td>The rate, usually expressed in inches/hour, at which water moves downward (percolates) through the soil profile. Short-term infiltration rates may be inferred from soil analysis or derived from field measurements. Long-term infiltration rates are affected by variability in soils and subsurface conditions at the site, the effectiveness of pretreatment or influent control, and the degree of long-term maintenance of the infiltration facility.</td>
</tr>
<tr>
<td><strong>Ingress/egress</strong></td>
<td>The points of access to and from a property.</td>
</tr>
<tr>
<td><strong>Inlet</strong></td>
<td>A form of connection between surface of the ground and a drain or sewer for the admission of surface and stormwater runoff.</td>
</tr>
<tr>
<td><strong>Insecticide</strong></td>
<td>A substance, usually chemical, that is used to kill insects.</td>
</tr>
<tr>
<td><strong>Interception (Hydraulics)</strong></td>
<td>The process by which precipitation is caught and held by foliage, twigs, and branches of trees, shrubs, and other vegetation. Often used for &quot;interception loss&quot; or the amount of water evaporated from the precipitation intercepted.</td>
</tr>
<tr>
<td><strong>Interflow</strong></td>
<td>That portion of rainfall that infiltrates into the soil and moves laterally through the upper soil horizons until intercepted by a stream channel or until it returns to the surface for example, in a roadside ditch, wetland, spring or seep. Interflow is a function of the soil system depth, permeability, and water-holding capacity.</td>
</tr>
<tr>
<td><strong>Intermittent stream</strong></td>
<td>A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long-continued supply from melting snow or other sources. It is dry for a large part of the year, ordinarily more than three months.</td>
</tr>
<tr>
<td><strong>Invasive weedy plant species</strong></td>
<td>Opportunistic species of inferior biological value that tend to out-compete more desirable forms and become dominant; applied to non-native species in this manual.</td>
</tr>
<tr>
<td><strong>Invert</strong></td>
<td>The lowest point on the inside of a sewer or other conduit.</td>
</tr>
<tr>
<td><strong>Invert elevation</strong></td>
<td>The vertical elevation of a pipe or orifice in a pond that defines the water level.</td>
</tr>
<tr>
<td><strong>Isoplivial map</strong></td>
<td>A map with lines representing constant depth of total precipitation for a given return frequency.</td>
</tr>
<tr>
<td><strong>Lag time</strong></td>
<td>The interval between the center of mass of the storm precipitation and the peak flow of the resultant runoff.</td>
</tr>
<tr>
<td><strong>Lake</strong></td>
<td>An area permanently inundated by water in excess of two meters deep and greater than 20 acres in size as measured at the ordinary high water marks.</td>
</tr>
<tr>
<td><strong>Land disturbing activity</strong></td>
<td>Any activity that results in a change in the existing soil cover (both vegetative and nonvegetative) and/or the existing soil topography. Land disturbing activities include, but are not limited to clearing, grading, filling, and excavation. Compaction that is associated with stabilization of structures and road construction shall also be considered a land disturbing activity. Vegetation maintenance practices, including landscape maintenance and gardening, are not considered land-disturbing activity. Stormwater facility maintenance is not considered land disturbing activity if conducted according to established standards and procedures.</td>
</tr>
<tr>
<td><strong>Landslide</strong></td>
<td>Episodic downslope movement of a mass of soil or rock that includes but is not limited to rockfalls, slumps, mudflows, and earthflows. For the purpose of these rules, snow avalanches are considered to be a special case of landsliding.</td>
</tr>
<tr>
<td><strong>Landslide hazard areas</strong></td>
<td>Those areas subject to a severe risk of landslide.</td>
</tr>
<tr>
<td><strong>Leachable materials</strong></td>
<td>Those substances that, when exposed to rainfall, measurably alter the physical or chemical characteristics of the rainfall runoff. Examples include erodible soils, uncovered process wastes, manure, fertilizers, oil substances, ashes, kiln dust, and garbage dumpster leakage.</td>
</tr>
<tr>
<td><strong>Leachate</strong></td>
<td>Liquid that has percolated through soil and contains substances in solution or suspension.</td>
</tr>
<tr>
<td><strong>Leaching</strong></td>
<td>Removal of the more soluble materials from the soil by percolating waters.</td>
</tr>
<tr>
<td><strong>Legume</strong></td>
<td>A member of the legume or pulse family, <em>Leguminosae</em>, one of the most important and widely distributed plant families. The fruit is a &quot;legume&quot; or pod. Includes many valuable food and forage species, such as peas, beans, clovers, alfalfas, sweet clovers, and vetches. Practically all legumes are nitrogen-fixing plants.</td>
</tr>
<tr>
<td><strong>Level pool routing</strong></td>
<td>The basic technique of storage routing used for sizing and analyzing detention storage and determining water levels for ponding water bodies. The level pool routing technique is based on the continuity equation: Inflow – Outflow = Change in storage.</td>
</tr>
<tr>
<td><strong>Level spreader</strong></td>
<td>A temporary ESC device used to spread out stormwater runoff uniformly over the ground surface as sheet flow (i.e., not through channels). The purpose of level spreaders is to prevent concentrated, erosive flows from occurring, and to enhance infiltration.</td>
</tr>
<tr>
<td><strong>LID</strong></td>
<td>See <a href="#">Low Impact Development</a>.</td>
</tr>
<tr>
<td><strong>Local government</strong></td>
<td>Any county, city, town, or special purpose district having its own incorporated government for local affairs.</td>
</tr>
<tr>
<td><strong>Low flow channel</strong></td>
<td>An incised or paved channel from inlet to outlet in a dry basin which is designed to carry low runoff flows and/or baseflow, directly to the outlet without detention.</td>
</tr>
<tr>
<td><strong>Low Impact Development (LID)</strong></td>
<td>A stormwater and land use management strategy that strives to mimic 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.</td>
</tr>
<tr>
<td><strong>Low Impact Development (LID) Best Management Practices</strong></td>
<td>Distributed stormwater management practices, integrated into a project design, that emphasize pre-disturbance hydrologic processes of infiltration, filtration, storage, evaporation and transpiration. LID BMPs include, but are not limited to: bioretention, rain gardens, permeable pavements, roof downspout controls, dispersion, soil quality and depth, minimal excavation foundations, vegetated roofs, and water re-use.</td>
</tr>
<tr>
<td><strong>Low Impact Development (LID) Principles</strong></td>
<td>Land use management strategies that emphasize conservation, use of on-site natural features, and site planning to minimize impervious surfaces, native vegetation loss, and stormwater runoff.</td>
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<tr>
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</tr>
<tr>
<td><strong>Low permeability liner</strong></td>
<td>A layer of compacted till, compacted clay, concrete, or a geomembrane.</td>
</tr>
<tr>
<td><strong>Lowest floor</strong></td>
<td>The lowest enclosed area (including basement) of a structure. An area used solely for parking of vehicles, building access, or storage, in an area other than a basement area, is not considered a building’s lowest floor, provided that the enclosed area meets all of the structural requirements of the flood hazard standards.</td>
</tr>
<tr>
<td><strong>MDNS</strong></td>
<td>A Mitigated Determination of Nonsignificance (See DNS and Mitigation).</td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
<td>Repair and maintenance includes activities conducted on currently serviceable structures, facilities, and equipment that involves no expansion or use beyond that previously existing and results in no significant adverse hydrologic impact. It includes those usual activities taken to prevent a decline, lapse, or cessation in the use of structures and systems. Those usual activities may include replacement of dysfunctional facilities, including cases where environmental permits require replacing an existing structure with a different type structure, as long as the functioning characteristics of the original structure are not changed. One example is the replacement of a collapsed, fish blocking, round culvert with a new box culvert under the same span, or width, of roadway. Concerning stormwater facilities, maintenance includes assessment to ensure ongoing proper operation, removal of built-up pollutants (i.e., sediments), replacement of failed or failing treatment media, and other actions taken to correct defects as identified in the maintenance standards of Chapter 4, Volume V. See also Pavement Maintenance exemptions in Section 2.2 of Volume I.</td>
</tr>
</tbody>
</table>
| **Manning’s equation**                   | An equation used to predict the velocity of water flow in an open channel or pipelines:  
\[
V = \frac{1.486R^{2/3}S^{1/2}}{n}
\]  
where:  
V is the mean velocity of flow in feet per second  
R is the hydraulic radius in feet  
S is the slope of the energy gradient or, for assumed uniform flow, the slope of the channel in feet per foot; and  
n is Manning’s roughness coefficient or retardance factor of the channel lining. |
| **Mass wasting**                         | The movement of large volumes of earth material downslope.                                                                       |
| **Master drainage plan**                 | A comprehensive drainage control plan intended to prevent significant adverse impacts to the natural and manmade drainage system, both on and off-site. |
| **Mean annual water level fluctuation** | Derived as follows:  
1) Measure the maximum water level (e.g., with a crest stage gage, Reinelt and Horner 1990) and the existing water level at the time of the site visit (e.g., with a staff gage) on at least eight occasions spread through a year.  
2) Take the difference of the maximum and existing water level on each occasion and divide by the number of occasions. |
| **Mean depth** | Average depth; cross-sectional area of a stream or channel divided by its surface or top width. |
| **Mean velocity** | The average velocity of a stream flowing in a channel or conduit at a given cross-section or in a given reach. It is equal to the discharge divided by the cross-sectional area of the reach. |
| **Measuring weir** | A shaped notch through which water flows are measured. Common shapes are rectangular, trapezoidal, and triangular. |
| **Mechanical analysis** | The analytical procedure by which soil particles are separated to determine the particle size distribution. |
| **Mechanical practices** | Soil and water conservation practices that primarily change the surface of the land or that store, convey, regulate, or dispose of runoff water without excessive erosion. |
| **Metals** | Elements, such as mercury, lead, nickel, zinc, and cadmium, which are of environmental concern because they do not degrade over time. Although many are necessary nutrients, they are sometimes magnified in the food chain, and they can be toxic to life in high enough concentrations. They are also referred to as heavy metals. |
| **Microbes** | The lower trophic levels of the soil food web. They are normally considered to include bacteria, fungi, flagellates, amoebae, ciliates, and nematodes. These in turn support the higher trophic levels, such as mites and earthworms. Together they are the basic life forms that are necessary for plant growth. Soil microbes also function to bioremediate pollutants such as petroleum, nutrients, and pathogens. |
| **Mitigation** | Means, in the following order of preference:  
1) Avoiding the impact altogether by not taking a certain action or part of an action;  
2) Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps to avoid or reduce impacts;  
3) Rectifying the impact by repairing, rehabilitating or restoring the affected environment;  
4) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and  
5) Compensating for the impact by replacing, enhancing, or providing substitute resources or environments. |
| **Modification, modified (wetland)** | A wetland whose physical, hydrological, or water quality characteristics have been purposefully altered for a management purpose, such as by dredging, filling, forebay construction, and inlet or outlet control. |
| **Monitor** | To systematically and repeatedly measure something in order to track changes. |
| **Monitoring** | The collection of data by various methods for the purposes of understanding natural systems and features, evaluating the impacts of development proposals on such systems, and assessing the performance of mitigation measures imposed as conditions of development. |
| **Mulch** | A layer of organic material or aggregate applied to the surface of soil. Its purpose is any or all of the following:  
  - To conserve soil moisture or temperature  
  - To improve the fertility and health of the soil  
  - To reduce weed growth  
  - To hold fertilizer, seed, and soil in place  
  - To enhance the visual appeal of the area.  
Types of mulches used in this manual include: Chipped site vegetation, compost, hydromulch, wood-based or wood straw, wood strand, straw, and aggregate. |
<p>| <strong>NGPE</strong> | See Native Growth Protection Easement. |
| <strong>NGVD</strong> | National Geodetic Vertical Datum. |
| <strong>NPDES</strong> | The National Pollutant Discharge Elimination System as established by the Federal Clean Water Act. |
| <strong>Native Growth Protection Easement (NGPE)</strong> | An easement granted for the protection of native vegetation within a sensitive area or its associated buffer. The NGPE shall be recorded on the appropriate documents of title and filed with the County Records Division. |
| <strong>Native vegetation</strong> | Vegetation comprised of plant species, other than noxious weeds, that are indigenous to the coastal region of the Pacific Northwest and which reasonably could have been expected to naturally occur on the site. Examples include trees such as Douglas fir, Western Hemlock, Western Red Cedar, Alder, Big-leaf Maple, and Vine Maple; shrubs such as willow, elderberry, salmonberry and salal; and herbaceous plants such as sword fern, foam flower, and fireweed. |
| <strong>Natural location</strong> | Means the location of those channels, swales, and other non-manmade conveyance systems as defined by the first documented topographic contours existing for the subject property, either from maps or photographs, or such other means as appropriate. In the case of outwash soils with relatively flat terrain, no natural location of surface discharge may exist. |
| <strong>New development</strong> | Land disturbing activities, including Class IV - general forest practices that are conversions from timber land to other uses; structural development, including construction or installation of a building or other structure; creation of hard surfaces; and subdivision, short subdivision and binding site plans, as defined and applied in Chapter 58.17 RCW. Projects meeting the definition of redevelopment shall not be considered new development. |</p>
<table>
<thead>
<tr>
<th>Term</th>
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</thead>
<tbody>
<tr>
<td>Nitrate (NO$_3$)</td>
<td>A form of nitrogen which is an essential nutrient to plants. It can cause algal blooms in water if all other nutrients are present in sufficient quantities. It is a product of bacterial oxidation of other forms of nitrogen, from the atmosphere during electrical storms and from fertilizer manufacturing.</td>
</tr>
<tr>
<td>Nitrification</td>
<td>The biochemical oxidation process by which ammonia is changed first to nitrites and then to nitrates by bacterial action, consuming oxygen in the water.</td>
</tr>
<tr>
<td>Nitrogen, Available</td>
<td>Usually ammonium, nitrite, and nitrate ions, and certain simple amines available for plant growth. A small fraction of organic or total nitrogen in the soil is available at any time.</td>
</tr>
<tr>
<td>Nonpoint source pollution</td>
<td>Pollution that enters a waterbody from diffuse origins on the watershed and does not result from discernible, confined, or discrete conveyances.</td>
</tr>
<tr>
<td>Normal depth</td>
<td>The depth of uniform flow. This is a unique depth of flow for any combination of channel characteristics and flow conditions. Normal depth is calculated using Manning’s Equation.</td>
</tr>
<tr>
<td>NRCS Method</td>
<td>A single-event hydrologic analysis technique for estimating runoff based on the Curve Number method. The Curve Numbers are published by NRCS in Technical Release No. 55: Urban Hydrology for Small Watersheds, 1986. With the change in name to the Natural Resource Conservation Service, the method may be referred to as the NRCS Method.</td>
</tr>
<tr>
<td>Nutrients</td>
<td>Essential chemicals needed by plants or animals for growth. Excessive amounts of nutrients can lead to degradation of water quality and algal blooms. Some nutrients can be toxic at high concentrations.</td>
</tr>
<tr>
<td>Off-line facilities</td>
<td>Water quality treatment facilities to which stormwater runoff is restricted to some maximum flow rate or volume by a flow-splitter.</td>
</tr>
<tr>
<td>Off-site</td>
<td>Any area lying upstream of the site that drains onto the site and any area lying downstream of the site to which the site drains.</td>
</tr>
<tr>
<td>Off-system storage</td>
<td>Facilities for holding or retaining excess flows over and above the carrying capacity of the stormwater conveyance system, in chambers, tanks, lagoons, ponds, or other basins that are not a part of the subsurface sewer system.</td>
</tr>
<tr>
<td>Oil/water separator</td>
<td>A vault, usually underground, designed to provide a quiescent environment to separate oil from water.</td>
</tr>
<tr>
<td>On-line facilities</td>
<td>Water quality treatment facilities which receive all of the stormwater runoff from a drainage area. Flows above the water quality design flow rate or volume are passed through at a lower percent removal efficiency.</td>
</tr>
<tr>
<td>On-site</td>
<td>The entire property that includes the proposed development.</td>
</tr>
<tr>
<td>On-site Stormwater Management BMPs</td>
<td>As used in this manual, a synonym for Low Impact Development BMPs.</td>
</tr>
<tr>
<td>Operational BMPs</td>
<td>Operational BMPs are a type of Source Control BMP. They are schedules of activities, prohibition of practices, and other managerial practices to prevent or reduce pollutants from entering stormwater. Operational BMPs include formation of a pollution prevention team, good housekeeping, preventive maintenance procedures, spill prevention and clean-up, employee training, inspections of pollutant sources and BMPs, and record keeping. They can also include process changes, raw material/product changes, and recycling wastes.</td>
</tr>
<tr>
<td><strong>Ordinary high water mark</strong></td>
<td>The term ordinary high water mark means the line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank; shelving; changes in the character of soil destruction on terrestrial vegetation, or the presence of litter and debris; or other appropriate means that consider the characteristics of the surrounding area. The ordinary high water mark will be found by examining the bed and banks of a stream and ascertaining where the presence and action of waters are so common and usual, and so long maintained in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland, in respect to vegetation. In any area where the ordinary high water mark cannot be found, the line of mean high water shall substitute. In any area where neither can be found, the channel bank shall be substituted. In braided channels and alluvial fans, the ordinary high water mark or substitute shall be measured so as to include the entire stream feature.</td>
</tr>
<tr>
<td><strong>Organic matter</strong></td>
<td>Organic matter as decomposed animal or vegetable matter. It is measured by ASTM D 2974. Organic matter is an important reservoir of carbon and a dynamic component of soil and the carbon cycle. It improves soil and plant efficiency by improving soil physical properties including drainage, aeration, and other structural characteristics. It contains the nutrients, microbes, and higher-form soil food web organisms necessary for plant growth. The maturity of organic matter is a measure of its beneficial properties. Raw organic matter can release water-soluble nutrients (similar to chemical fertilizer). Beneficial organic matter has undergone a humification process either naturally in the environment or through a composting process.</td>
</tr>
<tr>
<td><strong>Orifice</strong></td>
<td>An opening with closed perimeter, usually sharp-edged, and of regular form in a plate, wall, or partition through which water may flow, generally used for the purpose of measurement or control of water.</td>
</tr>
<tr>
<td><strong>Outlet</strong></td>
<td>Point of water disposal from a stream, river, lake, tidewater, or artificial drain.</td>
</tr>
<tr>
<td><strong>Outlet channel</strong></td>
<td>A waterway constructed or altered primarily to carry water from man-made structures, such as terraces, tile lines, and diversions.</td>
</tr>
<tr>
<td><strong>Outwash soils</strong></td>
<td>Soils formed from highly permeable sands and gravels.</td>
</tr>
<tr>
<td><strong>Overflow</strong></td>
<td>A pipeline or conduit device, together with an outlet pipe, that provides for the discharge of portions of combined sewer flows into receiving waters or other points of disposal, after a regular device has allowed the portion of the flow which can be handled by interceptor sewer lines and pumping and treatment facilities to be carried by and to such water pollution control structures.</td>
</tr>
<tr>
<td><strong>Overflow rate</strong></td>
<td>Detention basin release rate divided by the surface area of the basin. It can be thought of as an average flow rate through the basin.</td>
</tr>
<tr>
<td><strong>Overtopping</strong></td>
<td>To flow over the limits of a containment or conveyance element.</td>
</tr>
<tr>
<td><strong>Partially controlled limited access highway</strong></td>
<td>A highway where the right of owner or occupants of abutting land or other persons to access, light, air, or view in connection with the highway is controlled to give preference to through traffic to a degree that, in addition to access connections with selected public roads, there may be some crossings and some private driveway connections at grade. (See <a href="#">WAC 468-58-010</a>)</td>
</tr>
<tr>
<td><strong>Particle Size</strong></td>
<td>The effective diameter of a particle as measured by sedimentation, sieving, or micrometric methods.</td>
</tr>
<tr>
<td><strong>Peak discharge</strong></td>
<td>The maximum instantaneous rate of flow during a storm, usually in reference to a specific design storm event.</td>
</tr>
<tr>
<td><strong>Peak-shaving</strong></td>
<td>Controlling post-development peak discharge rates to pre-development levels by providing temporary detention in a BMP.</td>
</tr>
<tr>
<td><strong>Percolation</strong></td>
<td>The movement of water through soil.</td>
</tr>
<tr>
<td><strong>Percolation rate</strong></td>
<td>The rate, often expressed in minutes/inch, at which clear water, maintained at a relatively constant depth, will seep out of a standardized test hole that has been previously saturated. The term percolation rate is often used synonymously with infiltration rate (short-term infiltration rate).</td>
</tr>
<tr>
<td><strong>Permeable pavement</strong></td>
<td>Pervious concrete, porous asphalt, permeable pavers or other forms of pervious or porous paving material intended to allow passage of water through the pavement section. It often includes an aggregate base that provides structural support and acts as a stormwater reservoir.</td>
</tr>
<tr>
<td><strong>Permeable soils</strong></td>
<td>Soil materials with a sufficiently rapid infiltration rate so as to greatly reduce or eliminate surface and stormwater runoff. These soils are generally classified as SCS hydrologic soil types A and B.</td>
</tr>
<tr>
<td><strong>Person</strong></td>
<td>Any individual, partnership, corporation, association, organization, cooperative, public or municipal corporation, agency of the state, or local government unit, however designated.</td>
</tr>
<tr>
<td><strong>Perviousness</strong></td>
<td>Related to the size and continuity of void spaces in soils; related to a soil's infiltration rate.</td>
</tr>
<tr>
<td><strong>Pervious Surface</strong></td>
<td>A surface material that allows stormwater to infiltrate into the ground. Examples include lawn, landscape, pasture, native vegetation areas, and permeable pavements.</td>
</tr>
<tr>
<td><strong>Pesticide</strong></td>
<td>A general term used to describe any substance - usually chemical - used to destroy or control organisms; includes herbicides, insecticides, algicides, fungicides, and others. Many of these substances are manufactured and are not naturally found in the environment. Others, such as pyrethrum, are natural toxins that are extracted from plants and animals.</td>
</tr>
<tr>
<td><strong>pH</strong></td>
<td>A measure of the alkalinity or acidity of a substance which is conducted by measuring the concentration of hydrogen ions in the substance. A pH of 7.0 indicates neutral water. A 6.5 reading is slightly acid.</td>
</tr>
<tr>
<td><strong>Physiographic</strong></td>
<td>Characteristics of the natural physical environment (including hills).</td>
</tr>
<tr>
<td><strong>Plan Approval Authority</strong></td>
<td>The Plan Approval Authority is defined as that department within a local government that has been delegated authority to approve drainage control plans.</td>
</tr>
<tr>
<td><strong>Planned unit development (PUD)</strong></td>
<td>A special classification authorized in some zoning ordinances, where a unit of land under control of a single developer may be used for a variety of uses and densities, subject to review and approval by the local governing body. The locations of the zones are usually decided on a case-by-case basis.</td>
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</tr>
<tr>
<td><strong>Plat</strong></td>
<td>A map or representation of a subdivision showing the division of a tract or parcel of land into lots, blocks, streets, or other divisions and dedications.</td>
</tr>
<tr>
<td><strong>Plunge pool</strong></td>
<td>A device used to dissipate the energy of flowing water that may be constructed or made by the action of flowing. These facilities may be protected by various lining materials.</td>
</tr>
<tr>
<td><strong>Point discharge</strong></td>
<td>The release of collected and/or concentrated surface and stormwater runoff from a pipe, culvert, or channel.</td>
</tr>
<tr>
<td><strong>Point of compliance</strong></td>
<td>The location at which compliance with a discharge performance standard or a receiving water quality standard is measured.</td>
</tr>
<tr>
<td><strong>Pollution</strong></td>
<td>Contamination or other alteration of the physical, chemical, or biological properties, of waters of the state, including change in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive or other substance into any waters of the state as will or is likely to create a nuisance or render such waters harmful, detrimental or injurious to the public health, safety or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life.</td>
</tr>
<tr>
<td><strong>Pollution-generating hard surface (PGHS)</strong></td>
<td>Those hard surfaces considered to be a significant source of pollutants in stormwater runoff. See the listing of surfaces under pollution-generating impervious surface.</td>
</tr>
<tr>
<td><strong>Pollution-generating impervious surface (PGIS)</strong></td>
<td>Those impervious surfaces considered to be a significant source of pollutants in stormwater runoff. Such surfaces include those which are subject to: vehicular use; industrial activities (as further defined in this glossary); or storage of erodible or leachable materials, wastes, or chemicals, and which receive direct rainfall or the run-on or blow-in of rainfall; metal roofs unless they are coated with an inert, non-leachable material (e.g., baked-on enamel coating); or roofs that are subject to venting significant amounts of dusts, mists, or fumes from manufacturing, commercial, or other indoor activities.</td>
</tr>
<tr>
<td><strong>Pollution-generating pervious surface (PGPS)</strong></td>
<td>Any non-impervious surface subject to vehicular use, industrial activities (as further defined in this glossary); or storage of erodible or leachable materials, wastes or chemicals, and that receive direct rainfall or run-on or blow-in of rainfall, use of pesticides and fertilizers, or loss of soil. Typical PGPS include permeable pavement subject to vehicular use, lawns and landscaped areas including: golf courses, parks, cemeteries, and sports fields (natural and artificial turf).</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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</tr>
<tr>
<td>Pollution Source Control Program</td>
<td>A pollution source control program identifies all the operational and structural best management practices for a site based on use and activities on the site. Implementation of a Pollution Source Control Program is intended to limit pollution at the source before potential pollutants enter stormwater runoff.</td>
</tr>
<tr>
<td>Predeveloped Condition</td>
<td>The native vegetation and soils that existed at a site prior to the influence of Euro-American settlement. The pre-developed condition shall be assumed to be forested land cover unless reasonable, historic information is provided that indicates the site was prairie prior to settlement.</td>
</tr>
<tr>
<td>Prediction</td>
<td>For the purposes of this document an expected outcome based on the results of hydrologic modeling and/or the judgment of a trained professional civil engineer or geologist.</td>
</tr>
<tr>
<td>Pretreatment</td>
<td>The removal of material such as solids, grit, grease, and scum from flows prior to physical, biological, or physical treatment processes to improve treatability. Pretreatment may include screening, grit removal, settling, oil/water separation, or application of a Basic Treatment BMP prior to infiltration.</td>
</tr>
<tr>
<td>Priority peat systems</td>
<td>Unique, irreplaceable fens that can exhibit water pH in a wide range from highly acidic to alkaline, including fens typified by Sphagnum species, <em>Ledum groenlandicum</em> (Labrador tea), <em>Drosera rotundifolia</em> (sundew), and <em>Vaccinium oxycoccos</em> (bog cranberry); marl fens; estuarine peat deposits; and other moss peat systems with relatively diverse, undisturbed flora and fauna. Bog is the common name for peat systems having the Sphagnum association described, but this term applies strictly only to systems that receive water income from precipitation exclusively.</td>
</tr>
<tr>
<td>Professional civil engineer</td>
<td>A person registered with the state of Washington as a professional engineer in civil engineering.</td>
</tr>
<tr>
<td>Program Operator</td>
<td>An individual person, entity, or corporation (e.g. a homeowner association) legally responsible for implementing Stormwater Facility Maintenance Programs and Pollution Source Control Programs for a Stormwater Management Site.</td>
</tr>
<tr>
<td>Project</td>
<td>Any proposed action to alter or develop a site. The proposed action of a permit application or an approval, which requires drainage review.</td>
</tr>
<tr>
<td>Project site</td>
<td>That portion of a property, properties, or right of way subject to land disturbing activities, new hard surfaces, or replaced hard surfaces.</td>
</tr>
<tr>
<td>Properly Functioning Soil System (PFSS)</td>
<td>Equivalent to engineered soil/landscape system. This can also be a natural system that has not been disturbed or modified.</td>
</tr>
<tr>
<td>Puget Sound basin</td>
<td>Puget Sound south of Admiralty Inlet (including Hood Canal and Saratoga Passage); the waters north to the Canadian border, including portions of the Strait of Georgia; the Strait of Juan de Fuca south of the Canadian border; and all the lands draining into these waters as mapped in Water Resources Inventory Areas numbers 1 through 19, set forth in WAC 173-500-040.</td>
</tr>
<tr>
<td><strong>R/D</strong></td>
<td>See <em>Retention/detention facility.</em></td>
</tr>
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</tr>
<tr>
<td><strong>Rain garden</strong></td>
<td>A non-engineered shallow, landscaped depression, with compost-amended native soils and adapted plants. The depression is designed to pond and temporarily store stormwater runoff from adjacent areas, and to allow stormwater to pass through the amended soil profile.</td>
</tr>
<tr>
<td><strong>Rare, threatened, or endangered species</strong></td>
<td>Plant or animal species that are regional relatively uncommon, are nearing endangered status, or whose existence is in immediate jeopardy and is usually restricted to highly specific habitats. Threatened and endangered species are officially listed by federal and state authorities, whereas rare species are unofficial species of concern that fit the above definitions.</td>
</tr>
<tr>
<td><strong>Rational method</strong></td>
<td>A means of computing storm drainage flow rates (Q) by use of the formula ( Q = CIA ), where ( C ) is a coefficient describing the physical drainage area, ( I ) is the rainfall intensity and ( A ) is the area. This method is no longer used in the technical manual.</td>
</tr>
<tr>
<td><strong>Reach</strong></td>
<td>A length of channel with uniform characteristics.</td>
</tr>
<tr>
<td><strong>Receiving Waterbody or Receiving Waters</strong></td>
<td>Bodies of water or surface water systems to which surface runoff is discharged via a point source of stormwater or via sheet flow. Ground water to which surface runoff is directed by infiltration.</td>
</tr>
<tr>
<td><strong>Recharge</strong></td>
<td>The addition of water to the zone of saturation (i.e., an aquifer).</td>
</tr>
<tr>
<td><strong>Recommended BMPs</strong></td>
<td>As used in Volume IV, recommended BMPs are those BMPs that are not expected to be mandatory by local governments at new development and redevelopment sites. However, they may improve pollutant control efficiency, and may provide a more comprehensive and environmentally effective stormwater management program.</td>
</tr>
<tr>
<td><strong>Redevelopment</strong></td>
<td>On a site that is already substantially developed (i.e., has 35% or more of existing hard surface coverage), the creation or addition of hard surfaces; the expansion of a building footprint or addition or replacement of a structure; structural development including construction, installation or expansion of a building or other structure; replacement of hard surface that is not part of a routine maintenance activity; and land disturbing activities.</td>
</tr>
<tr>
<td><strong>Regional</strong></td>
<td>An action (here, for stormwater management purposes) that involves more than one discrete property.</td>
</tr>
<tr>
<td><strong>Regional detention facility</strong></td>
<td>A stormwater quantity control structure designed to correct existing surface water runoff problems of a basin or subbasin. The area downstream has been previously identified as having existing or predicted significant and regional flooding and/or erosion problems. This term is also used when a detention facility is sited to detain stormwater runoff from a number of new developments or areas within a catchment.</td>
</tr>
<tr>
<td><strong>Release rate</strong></td>
<td>The computed peak rate of surface and stormwater runoff from a site.</td>
</tr>
<tr>
<td><strong>Replaced hard surface</strong></td>
<td>For structures, the removal and replacement of hard surfaces down to the foundation. For other hard surfaces, the removal down to bare soil or base course and replacement.</td>
</tr>
<tr>
<td><strong>Replaced impervious surface</strong></td>
<td>For structures, the removal and replacement of impervious surfaces down to the foundation. For other impervious surfaces, the removal down to bare soil or base course and replacement.</td>
</tr>
<tr>
<td><strong>Residential density</strong></td>
<td>The number of dwelling units per unit of surface area. Net density includes only occupied land. Gross density includes unoccupied portions of residential areas, such as roads and open space.</td>
</tr>
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<tr>
<td><strong>Restoration</strong></td>
<td>Actions performed to reestablish wetland functional characteristics and processes that have been lost by alterations, activities, or catastrophic events in an area that no longer meets the definition of a wetland.</td>
</tr>
<tr>
<td><strong>Retention</strong></td>
<td>The process of collecting and holding surface and stormwater runoff with no surface outflow.</td>
</tr>
<tr>
<td><strong>Retention/detention facility (R/D)</strong></td>
<td>A type of drainage facility designed either to hold water for a considerable length of time and then release it by evaporation, plant transpiration, and/or infiltration into the ground; or to hold surface and stormwater runoff for a short period of time and then release it to the surface and stormwater management system.</td>
</tr>
<tr>
<td><strong>Retrofitting</strong></td>
<td>The renovation of an existing structure or facility to meet changed conditions or to improve performance.</td>
</tr>
<tr>
<td><strong>Return frequency</strong></td>
<td>A statistical term for the average time of expected interval that an event of some kind will equal or exceed given conditions (e.g., a stormwater flow that occurs every 2 years).</td>
</tr>
<tr>
<td><strong>Rhizome</strong></td>
<td>A modified plant stem that grows horizontally underground.</td>
</tr>
<tr>
<td><strong>Riffles</strong></td>
<td>Fast sections of a stream where shallow water races over stones and gravel. Riffles usually support a wider variety of bottom organisms than other stream sections.</td>
</tr>
<tr>
<td><strong>Rill</strong></td>
<td>A small intermittent watercourse with steep sides, usually only a few inches deep. Often rills are caused by an increase in surface water flow when soil is cleared of vegetation.</td>
</tr>
<tr>
<td><strong>Riprap</strong></td>
<td>A facing layer or protective mound of rocks placed to prevent erosion or sloughing of a structure or embankment due to flow of surface and stormwater runoff.</td>
</tr>
<tr>
<td><strong>Riparian</strong></td>
<td>Pertaining to the banks of streams, wetlands, lakes, or tidewater.</td>
</tr>
<tr>
<td><strong>Riser</strong></td>
<td>A vertical pipe extending from the bottom of a pond BMP that is used to control the discharge rate from a BMP for a specified design storm.</td>
</tr>
<tr>
<td><strong>Rodenticide</strong></td>
<td>A substance used to destroy rodents.</td>
</tr>
<tr>
<td><strong>Runoff</strong></td>
<td>Water originating from rainfall and other precipitation that is found in drainage facilities, rivers, streams, springs, seeps, ponds, lakes and wetlands as well as shallow ground water. As applied in this manual, it also means the portion of rainfall or other precipitation that becomes surface flow and interflow.</td>
</tr>
<tr>
<td><strong>SCS</strong></td>
<td>Soil Conservation Service (now the Natural Resources Conservation Service), U.S. Department of Agriculture.</td>
</tr>
<tr>
<td><strong>SCS Method</strong></td>
<td>See <strong>NRCS Method</strong>.</td>
</tr>
<tr>
<td><strong>NRCS Method</strong></td>
<td>A single-event hydrologic analysis technique for estimating runoff based on the Curve Number method. The Curve Numbers are published by NRCS in Technical Release No. 55: Urban Hydrology for Small Watersheds, 1986. With the change in name to the Natural Resource Conservation Service, the method may be referred to as the NRCS Method.</td>
</tr>
<tr>
<td><strong>SEPA</strong></td>
<td>See <a href="#">State Environmental Policy Act</a>.</td>
</tr>
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<tr>
<td><strong>Salmonid</strong></td>
<td>A member of the fish family <strong>Salmonidae</strong>. Chinook, Coho, chum, sockeye and pink salmon; cutthroat, brook, brown, rainbow, and steelhead trout; Dolly Varden, kokanee, and char are examples of salmonid species.</td>
</tr>
<tr>
<td><strong>Sand filter</strong></td>
<td>A man-made depression or basin with a layer of sand that treats stormwater as it percolates through the sand and is discharged via a central collector pipe.</td>
</tr>
<tr>
<td><strong>Saturation point</strong></td>
<td>In soils, the point at which a soil or an aquifer will no longer absorb any amount of water without losing an equal amount.</td>
</tr>
<tr>
<td><strong>Scour</strong></td>
<td>Erosion of channel banks due to excessive velocity of the flow of surface and stormwater runoff.</td>
</tr>
<tr>
<td><strong>Sediment</strong></td>
<td>Fragmented material that originates from weathering and erosion of rocks or unconsolidated deposits, and is transported by, suspended in, or deposited by water.</td>
</tr>
<tr>
<td><strong>Sedimentation</strong></td>
<td>The depositing or formation of sediment.</td>
</tr>
<tr>
<td><strong>Sensitive emergent vegetation communities</strong></td>
<td>Assemblages of erect, rooted, herbaceous vegetation, excluding mosses and lichens, at least some of whose members have relatively narrow ranges of environmental requirements, such as hydroperiod, nutrition, temperature, and light. Examples include fen species such as sundew and, as well as a number of species of Carex (sedges).</td>
</tr>
<tr>
<td><strong>Sensitive life stages</strong></td>
<td>Stages during which organisms have limited mobility or alternatives in securing the necessities of life, especially including reproduction, rearing, and migration periods.</td>
</tr>
<tr>
<td><strong>Sensitive scrub-shrub vegetation communities</strong></td>
<td>Assemblages of woody vegetation less than 6 meters in height, at least some of whose members have relatively narrow ranges of environmental requirements, such as hydroperiod, nutrition, temperature, and light. Examples include fen species such as Labrador tea, bog laurel, and cranberry.</td>
</tr>
<tr>
<td><strong>Settleable solids</strong></td>
<td>Those suspended solids in stormwater that separate by settling when the stormwater is held in a quiescent condition for a specified time.</td>
</tr>
<tr>
<td><strong>Sheet erosion</strong></td>
<td>The relatively uniform removal of soil from an area without the development of conspicuous water channels.</td>
</tr>
<tr>
<td><strong>Sheet flow</strong></td>
<td>Runoff that flows over the ground surface as a thin, even layer, not concentrated in a channel.</td>
</tr>
<tr>
<td><strong>Shoreline development</strong></td>
<td>The proposed project as regulated by the Shoreline Management Act. Usually the construction over water or within a shoreline zone (generally 200 feet landward of the water) of structures such as buildings, piers, bulkheads, and breakwaters, including environmental alterations such as dredging and filling, or any project which interferes with public navigational rights on the surface waters.</td>
</tr>
<tr>
<td><strong>Short circuiting</strong></td>
<td>The passage of runoff through a BMP in less than the design treatment time.</td>
</tr>
<tr>
<td><strong>Siltation</strong></td>
<td>The process by which a river, lake, or other waterbody becomes clogged with sediment. Silt can clog gravel beds and prevent successful salmon spawning.</td>
</tr>
<tr>
<td><strong>Site</strong></td>
<td>The area defined by the legal boundaries of a parcel or parcels of land that is (are) subject to new development or redevelopment. For road projects, the length of the project site and the right-of-way boundaries define the site.</td>
</tr>
<tr>
<td><strong>Site Development Drawings</strong></td>
<td>Engineering drawings and plans containing all mapping, line work, information, notes, and details necessary for construction of a site development or roadway improvements.</td>
</tr>
<tr>
<td><strong>Slope</strong></td>
<td>Degree of deviation of a surface from the horizontal; measured as a numerical ratio, percent, or in degrees. Expressed as a ratio, the first number is the horizontal distance (run) and the second is the vertical distance (rise), as 2:1. A 2:1 slope is a 50 percent slope. Expressed in degrees, the slope is the angle from the horizontal plane, with a 90° slope being vertical (maximum) and 45° being a 1:1 or 100 percent slope.</td>
</tr>
<tr>
<td><strong>Sloughing</strong></td>
<td>The sliding of overlying material. It is the same effect as caving, but it usually occurs when the bank or an underlying stratum is saturated or scoured.</td>
</tr>
<tr>
<td><strong>Soil</strong></td>
<td>The unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. See also topsoil, engineered soil/landscape system, and properly functioning soil system.</td>
</tr>
<tr>
<td><strong>Soil and Vegetation Protection Area (SVPA)</strong></td>
<td>A separate tract of land, which may or may not be deeded as such, specifically set aside for the preservation of healthy soil and the preservation or planting of existing and/or native vegetation.</td>
</tr>
<tr>
<td><strong>Soil group, hydrologic</strong></td>
<td>A classification of soils by the Soil Conservation Service into four runoff potential groups. The groups range from A soils, which are very permeable and produce little or no runoff, to D soils, which are not very permeable and produce much more runoff.</td>
</tr>
<tr>
<td><strong>Soil horizon</strong></td>
<td>A layer of soil, approximately parallel to the surface, which has distinct characteristics produced by soil-forming factors.</td>
</tr>
<tr>
<td><strong>Soil profile</strong></td>
<td>A vertical section of the soil from the surface through all horizons, including C horizons.</td>
</tr>
<tr>
<td><strong>Soil structure</strong></td>
<td>The relation of particles or groups of particles which impart to the whole soil a characteristic manner of breaking; some types are crumb structure, block structure, platy structure, and columnar structure.</td>
</tr>
<tr>
<td><strong>Soil permeability</strong></td>
<td>The ease with which gases, liquids, or plant roots penetrate or pass through a layer of soil.</td>
</tr>
<tr>
<td><strong>Soil stabilization</strong></td>
<td>The use of measures such as rock lining, vegetation or other engineering structures to prevent the movement of soil when loads are applied to the soil.</td>
</tr>
<tr>
<td><strong>Soil Texture Class</strong></td>
<td>The relative proportion, by weight, of particle sizes, based on the USDA system, of individual soil grains less than 2 mm equivalent diameter in a mass of soil. The basic texture classes in the approximate order of increasing proportions of fine particles include: sand, loamy sand, sandy loam, loam, silt loam, silt, clay loam, sandy clay, silty clay, and clay.</td>
</tr>
<tr>
<td><strong>Sorption</strong></td>
<td>The physical or chemical binding of pollutants to sediment or organic particles.</td>
</tr>
<tr>
<td><strong>Source control BMP</strong></td>
<td>A structure or operation that is intended to prevent pollutants from coming into contact with stormwater through physical separation of areas or careful management of activities that are sources of pollutants. This manual separates source control BMPs into two types. <strong>Structural Source Control BMPs</strong> are physical, structural, or mechanical devices or facilities that are intended to prevent pollutants from entering stormwater. <strong>Operational BMPs</strong> are non-structural practices that prevent or reduce pollutants from entering stormwater. See Volume IV for details.</td>
</tr>
<tr>
<td><strong>Spill control device</strong></td>
<td>A Tee section or turn down elbow designed to retain a limited volume of pollutant that floats on water, such as oil or antifreeze. Spill control devices are passive and must be cleaned-out for the spilled pollutant to actually be removed.</td>
</tr>
<tr>
<td><strong>Spillway</strong></td>
<td>A passage such as a paved apron or channel for surplus water over or around a dam or similar obstruction. An open or closed channel, or both, used to convey excess water from a reservoir. It may contain gates, either manually or automatically controlled, to regulate the discharge of excess water.</td>
</tr>
<tr>
<td><strong>State Environmental Policy Act (SEPA) RCW 43.21C</strong></td>
<td>The Washington State law intended to minimize environmental damage. SEPA requires that state agencies and local governments consider environmental factors when making decisions on activities, such as development proposals over a certain size and comprehensive plans. As part of this process, environmental documents are prepared and opportunities for public comment are provided.</td>
</tr>
<tr>
<td><strong>Steep slope</strong></td>
<td>Slopes of 40 percent gradient or steeper within a vertical elevation change of at least ten feet. A slope is delineated by establishing its toe and top, and is measured by averaging the inclination over at least ten feet of vertical relief. For the purpose of this definition: The toe of a slope is a distinct topographic break in slope that separates slopes inclined at less than 40% from slopes 40% or steeper. Where no distinct break exists, the toe of a steep slope is the lower-most limit of the area where the ground surface drops ten feet or more vertically within a horizontal distance of 25 feet; AND The top of a slope is a distinct topographic break in slope that separates slopes inclined at less than 40% from slopes 40% or steeper. Where no distinct break exists, the top of a steep slope is the upper-most limit of the area where the ground surface drops ten feet or more vertically within a horizontal distance of 25 feet.</td>
</tr>
<tr>
<td><strong>Storage routing</strong></td>
<td>A method to account for the attenuation of peak flows passing through a detention facility or other storage feature.</td>
</tr>
<tr>
<td><strong>Storm drains</strong></td>
<td>The enclosed conduits that transport surface and stormwater runoff toward points of discharge (sometimes called storm sewers).</td>
</tr>
<tr>
<td><strong>Storm frequency</strong></td>
<td>The time interval between major storms of predetermined intensity and volumes of runoff for which storm sewers and other structures are designed and constructed to handle hydraulically without surcharging and backflooding; e.g., a 2-year, 10-year or 100-year storm.</td>
</tr>
<tr>
<td><strong>Storm sewer</strong></td>
<td>A sewer that carries stormwater and surface water, street wash and other wash waters or drainage, but excludes sewage and industrial wastes. Also called a storm drain.</td>
</tr>
<tr>
<td><strong>Stormwater</strong></td>
<td>That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes and other features of a stormwater drainage system into a defined surface body, or a constructed infiltration facility.</td>
</tr>
<tr>
<td><strong>Stormwater drainage system</strong></td>
<td>Constructed and natural features which function together as a system to collect, convey, channel, hold, inhibit, retain, detain, infiltrate, divert, treat or filter stormwater.</td>
</tr>
<tr>
<td><strong>Stormwater facility</strong></td>
<td>A constructed component of a stormwater drainage system, designed or constructed to perform a particular function, or multiple functions. Stormwater facilities include, but are not limited to, pipes, swales, ditches, culverts, street gutters, detention ponds, retention ponds, constructed wetlands, infiltration devices, catch basins, oil/water separators, and biofiltration swales.</td>
</tr>
<tr>
<td><strong>Stormwater Facility Maintenance Program</strong></td>
<td>A document containing the standards and requirements for long-term operation, inspection, maintenance, and procedures for protecting the integrity and functionality of stormwater facilities, LID best management practices, and protected vegetated areas.</td>
</tr>
<tr>
<td><strong>Stormwater Management Manual for Western Washington (SWMMWW, Ecology Stormwater Manual)</strong></td>
<td>The manual, as prepared by Ecology, which contains BMPs to prevent, control or treat pollution in stormwater and reduce other stormwater-related impacts to waters of the State. The Ecology Stormwater Manual is intended to provide guidance on measures necessary in western Washington to control the quantity and quality of stormwater runoff from new development and redevelopment. The City of Olympia Drainage Design and Erosion Control Manual (DDECM) occasionally references the SWMMWW and standards adopted from that text.</td>
</tr>
<tr>
<td><strong>Stormwater Management Site</strong></td>
<td>The portion of a site or development that has identified stormwater facilities and features requiring inspection and maintenance. The limits or area of the Stormwater Management Site is defined in the Agreement to Maintain Stormwater Facilities and the Stormwater Facility Maintenance Program contained in the Stormwater Site Management Plan.</td>
</tr>
<tr>
<td><strong>Stormwater Program</strong></td>
<td>Either the Basic Stormwater Program or the Comprehensive Stormwater Program (as appropriate to the context of the reference) called for under the Puget Sound Water Quality Management Plan.</td>
</tr>
<tr>
<td><strong>Stormwater Site Management Plan</strong></td>
<td>A comprehensive document recorded against a project site or parcels required to implement Stormwater Facility Maintenance Programs, Pollution Source Control Programs, and Soil and Vegetation Plans. The plan identifies Program Operators and requirements for long-range protection, inspection, operation, and maintenance of stormwater facilities and vegetated areas on a management site.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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</tr>
<tr>
<td>Stream gaging</td>
<td>The quantitative determination of stream flow using gages, current meters, weirs, or other measuring instruments at selected locations. See Gaging station.</td>
</tr>
<tr>
<td>Streambanks</td>
<td>The usual boundaries, not the flood boundaries, of a stream channel. Right and left banks are named facing downstream.</td>
</tr>
<tr>
<td>Streams</td>
<td>Those areas where surface waters flow sufficiently to produce a defined channel or bed. A defined channel or bed is an area that demonstrates clear evidence of the passage of water and includes, but is not limited to, indicated by hydraulically sorted sediments or the removal of vegetative litter or loosely rooted vegetation by the action of moving water. The channel or bed need not contain water year-round. This definition is not meant to include irrigation ditches, canals, stormwater runoff devices or other entirely artificial watercourses unless they are used to convey streams naturally occurring prior to construction. Those topographic features that resemble streams but have no defined channels (i.e., swales) shall be considered streams when hydrologic and hydraulic analyses done pursuant to a development proposal predict formation of a defined channel after development.</td>
</tr>
<tr>
<td>Structure</td>
<td>A catchbasin or manhole in reference to a storm drainage system.</td>
</tr>
<tr>
<td>Structural source control BMPs</td>
<td>Physical, structural, or mechanical devices or facilities that are intended to prevent pollutants from entering stormwater. Structural source control BMPs typically include:</td>
</tr>
<tr>
<td></td>
<td>• Enclosing and/or covering the pollutant source (building or other enclosure, a roof over storage and working areas, temporary tarp, etc.). Segregating the pollutant source to prevent run-on of stormwater, and to direct only contaminated stormwater to appropriate treatment BMPs.</td>
</tr>
<tr>
<td>Stub-out</td>
<td>A short length of pipe provided for future connection to a storm drainage system.</td>
</tr>
<tr>
<td>Subbasin</td>
<td>A drainage area that drains to a water-course or waterbody named and noted on common maps and which is contained within a basin.</td>
</tr>
<tr>
<td>Subcatchment</td>
<td>• A subdivision of a drainage basin (generally determined by topography and pipe network configuration).</td>
</tr>
<tr>
<td>Subdrain</td>
<td>A pervious backfilled trench containing stone or a pipe for intercepting ground water or seepage.</td>
</tr>
<tr>
<td>Subgrade</td>
<td>A layer soil used as the underlying base for a BMP.</td>
</tr>
<tr>
<td>Subsoil</td>
<td>The B horizons of soils with distinct profiles. In soils with weak profile development, the subsoil can be defined as the soil below the plowed soil (or its equivalent of surface soil), in which roots normally grow. Although a common term, it cannot be defined accurately. It has been carried over from early days when &quot;soil&quot; was conceived only as the plowed soil and that under it as the &quot;subsoil.&quot;</td>
</tr>
<tr>
<td>Substrate</td>
<td>The natural soil base underlying a BMP.</td>
</tr>
<tr>
<td>Surcharge</td>
<td>The flow condition occurring in closed conduits when the hydraulic grade line is above the crown of the sewer.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Surface and stormwater</td>
<td>Water originating from rainfall and other precipitation that is found in drainage facilities, rivers, streams, springs, seeps, ponds, lakes, and wetlands as well as shallow ground water.</td>
</tr>
<tr>
<td>Surface and stormwater management system</td>
<td>Drainage facilities and any other natural features that collect, store, control, treat and/or convey surface and stormwater.</td>
</tr>
<tr>
<td>Suspended solids</td>
<td>Organic or inorganic particles that are suspended in and carried by the water. The term includes sand, mud, and clay particles (and associated pollutants) as well as solids in stormwater.</td>
</tr>
<tr>
<td>Swale</td>
<td>A shallow drainage conveyance with relatively gentle side slopes, generally with flow depths less than one foot.</td>
</tr>
<tr>
<td>Terrace</td>
<td>An embankment or combination of an embankment and channel across a slope to control erosion by diverting or storing surface runoff instead of permitting it to flow uninterrupted down the slope.</td>
</tr>
<tr>
<td>Threshold Discharge Area</td>
<td>An on-site area draining to a single natural discharge location or multiple natural discharge locations that combine within one-quarter mile downstream (as determined by the shortest flowpath). The examples in Figure G.1 below illustrate this definition. The purpose of this definition is to clarify how the thresholds of this manual are applied to project sites with multiple discharge points.</td>
</tr>
<tr>
<td>Tightline</td>
<td>A continuous length of pipe that conveys water from one point to another (typically down a steep slope) with no inlets or collection points in between.</td>
</tr>
<tr>
<td>Tile, Drain</td>
<td>Pipe made of burned clay, concrete, or similar material, in short lengths, usually laid with open joints to collect and carry excess water from the soil.</td>
</tr>
<tr>
<td>Tile drainage</td>
<td>Land drainage by means of a series of tile lines laid at a specified depth and grade.</td>
</tr>
<tr>
<td>Till</td>
<td>A layer of poorly sorted soil deposited by glacial action that generally has very low infiltration rates.</td>
</tr>
<tr>
<td>Time of concentration</td>
<td>The time period necessary for surface runoff to reach the outlet of a subbasin from the hydraulically most remote point in the tributary drainage area.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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</tr>
<tr>
<td><strong>Topography</strong></td>
<td>General term to include characteristics of the ground surface such as plains, hills, mountains, degree of relief, steepness of slopes, and other physiographic features.</td>
</tr>
<tr>
<td><strong>Topsoil</strong></td>
<td>The upper portion of a soil, usually dark colored and rich in organic material. It is more or less equivalent to the upper portion of an A horizon in an ABC soil.</td>
</tr>
<tr>
<td><strong>Total dissolved solids</strong></td>
<td>The dissolved salt loading in surface and subsurface waters</td>
</tr>
<tr>
<td><strong>Total Petroleum Hydrocarbons (TPH)</strong></td>
<td>TPH-Gx: The qualitative and quantitative method (extended) for volatile (“gasoline”) petroleum products in water; and TPH-Dx: The qualitative and quantitative method (extended) for semi-volatile (“diesel”) petroleum products in water.</td>
</tr>
<tr>
<td><strong>Total solids</strong></td>
<td>The solids in water, sewage, or other liquids, including the dissolved, filterable, and nonfilterable solids. The residue left when the moisture is evaporated and the remainder is dried at a specified temperature, usually 130°C.</td>
</tr>
<tr>
<td><strong>Total suspended solids</strong></td>
<td>That portion of the solids carried by stormwater that can be captured on a standard glass filter.</td>
</tr>
<tr>
<td><strong>Total Maximum Daily Load (TMDL) – Water Cleanup Plan</strong></td>
<td>A calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant’s sources. A TMDL (also known as a Water Cleanup Plan) is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation must include a margin of safety to ensure that the waterbody can be used for the purposes the State has designated. The calculation must also account for seasonable variation in water quality. Water quality standards are set by states, territories, and tribes. They identify the uses for each waterbody, for example, drinking water supply, contact recreation (swimming), and aquatic like support (fishing), and the scientific criteria to support that use. The Clean Water Act, section 303, establishes the water quality standards and TMDL programs.</td>
</tr>
<tr>
<td><strong>Toxic</strong></td>
<td>Poisonous, carcinogenic, or otherwise directly harmful to life.</td>
</tr>
<tr>
<td><strong>Tract</strong></td>
<td>A legally created parcel of property designated for special nonresidential and noncommercial uses.</td>
</tr>
<tr>
<td><strong>Trash rack</strong></td>
<td>A structural device used to prevent debris from entering a spillway or other hydraulic structure.</td>
</tr>
<tr>
<td><strong>Travel time</strong></td>
<td>The estimated time for surface water to flow between two points of interest.</td>
</tr>
<tr>
<td><strong>Treatment BMP or Facility</strong></td>
<td>A BMP that is intended to remove pollutants from stormwater. A few examples of treatment BMPs are Wetponds, oil/water separators, biofiltration swales, and constructed wetlands.</td>
</tr>
<tr>
<td><strong>Treatment liner</strong></td>
<td>A layer of soil that is designed to slow the rate of infiltration and provide sufficient pollutant removal so as to protect ground water quality.</td>
</tr>
<tr>
<td><strong>Treatment train</strong></td>
<td>A combination of two or more treatment facilities connected in series.</td>
</tr>
<tr>
<td><strong>Turbidity</strong></td>
<td>Dispersion or scattering of light in a liquid, caused by suspended solids and other factors; commonly used as a measure of suspended solids in a liquid.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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</tr>
<tr>
<td>Underdrain</td>
<td>Plastic pipes with holes drilled through the top, installed on the bottom of an infiltration BMP, which are used to collect and remove excess runoff.</td>
</tr>
<tr>
<td>Undisturbed buffer</td>
<td>A zone where development activity shall not occur, including logging, and/or the construction of utility trenches, roads, and/or surface and stormwater facilities.</td>
</tr>
<tr>
<td>Undisturbed low gradient uplands</td>
<td>Forested land, sufficiently large and flat to infiltrate surface and storm runoff without allowing the concentration of water on the surface of the ground.</td>
</tr>
<tr>
<td>Unstable slopes</td>
<td>Those sloping areas of land which have in the past exhibited, are currently exhibiting, or will likely in the future exhibit, mass movement of earth.</td>
</tr>
<tr>
<td>Unusual biological community types</td>
<td>Assemblages of interacting organisms that are relatively uncommon regionally.</td>
</tr>
<tr>
<td>Urbanized area</td>
<td>Areas designated and identified by the U.S. Bureau of Census according to the following criteria: an incorporated place and densely settled surrounding area that together have a maximum population of 50,000.</td>
</tr>
<tr>
<td>U.S. EPA</td>
<td>The United States Environmental Protection Agency.</td>
</tr>
<tr>
<td>Values</td>
<td>Wetland processes or attributes that are valuable or beneficial to society (also see Functions). Wetland values include support of commercial and sport fish and wildlife species, protection of life and property from flooding, recreation, education, and aesthetic enhancement of human communities.</td>
</tr>
<tr>
<td>Variance</td>
<td>See Exception.</td>
</tr>
<tr>
<td>Vegetation</td>
<td>All organic plant life growing on the surface of the earth.</td>
</tr>
<tr>
<td>Vehicular Use</td>
<td>Regular use of an impervious or pervious surface by motor vehicles. The following are subject to regular vehicular use: roads, un-vegetated road shoulders, bike lanes within the traveled lane of a roadway, driveways, parking lots, unrestricted access fire lanes, vehicular equipment storage yards, and airport runways. The following are not considered subject to regular vehicular use: paved bicycle pathways separated from and not subject to drainage from roads for motor vehicles, restricted access fire lanes, and infrequently used maintenance access roads.</td>
</tr>
<tr>
<td>Waterbody</td>
<td>Surface waters including rivers, streams, lakes, marine waters, estuaries, and wetlands.</td>
</tr>
<tr>
<td>Water Cleanup Plan</td>
<td>See Total Maximum Daily Load</td>
</tr>
<tr>
<td>Water quality</td>
<td>A term used to describe the chemical, physical, and biological characteristics off water, usually in respect to its suitability for a particular purpose.</td>
</tr>
<tr>
<td>Water quality design storm</td>
<td>The 24-hour rainfall amount with a 6-month return frequency. Commonly referred to as the 6-month, 24-hour storm.</td>
</tr>
<tr>
<td>Water quality standards</td>
<td>Minimum requirements of purity of water for various uses; for example, water for agricultural use in irrigation systems should not exceed specific levels of sodium bicarbonate, pH, total dissolved salts, etc. In Washington, the Department of Ecology sets water quality standards.</td>
</tr>
<tr>
<td><strong>Watershed</strong></td>
<td>A geographic region within which water drains into a particular river, stream, or body of water. Watersheds can be as large as those identified and numbered by the State of Washington Water Resource Inventory Areas (WRIAs) as defined in Chapter 173-500 WAC.</td>
</tr>
<tr>
<td><strong>Water table</strong></td>
<td>The upper surface or top of the saturated portion of the soil or bedrock layer, indicates the uppermost extent of ground water.</td>
</tr>
<tr>
<td><strong>Weir</strong></td>
<td>Device for measuring or regulating the flow of water.</td>
</tr>
<tr>
<td><strong>Weir notch</strong></td>
<td>The opening in a weir for the passage of water.</td>
</tr>
<tr>
<td><strong>Wetlands</strong></td>
<td>Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from non-wetland areas to mitigate the conversion of wetlands.</td>
</tr>
<tr>
<td><strong>Wetland edge</strong></td>
<td>Delineation of the wetland edge shall be based on the U.S. Army Corps of Engineers Wetlands Delineation Manual, Technical Report Y-87-1, U.S. Army Engineers Waterways Experiment Station, Vicksburg, Miss. (1987)</td>
</tr>
<tr>
<td><strong>Wetponds and wetvaults</strong></td>
<td>Drainage facilities for water quality treatment that contain permanent pools of water that are filled during the initial runoff from a storm event. They are designed to optimize water quality by providing retention time in order to settle out particles of fine sediment to which pollutants such as heavy metals absorb, and to allow biologic activity to occur that metabolizes nutrients and organic pollutants.</td>
</tr>
<tr>
<td><strong>Wetpool</strong></td>
<td>A pond or constructed wetland that stores runoff temporarily and whose normal discharge location is elevated so as to maintain a permanent pool of water between storm events.</td>
</tr>
<tr>
<td><strong>Zoning ordinance</strong></td>
<td>An ordinance based on the police power of government to protect the public health, safety, and general welfare. It may regulate the type of use and intensity of development of land and structures to the extent necessary for a public purpose. Requirements may vary among various geographically defined areas called zones. Regulations generally cover such items as height and bulk of buildings, density of dwelling units, off-street parking, control of signs, and use of land for residential, commercial, industrial, or agricultural purposes. A zoning ordinance is one of the major methods for implementation of a comprehensive plan.</td>
</tr>
</tbody>
</table>
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