

CHAPTER 2

STORMWATER MANAGEMENT

REVISED SEPTEMBER 11, 2002



WHATCOM COUNTY DEVELOPMENT STANDARDS

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WHATCOM COUNTY DEVELOPMENT STANDARDS CHAPTER 2 - STORMWATER MANAGEMENT

PURPOSE

Washington State Law mandates that stormwater discharge resulting from development activities be controlled and treated to provide available and reasonable methods of erosion prevention, flood control, and water quality treatment. To help protect adjacent landowners from downstream flooding, erosion and pollution, Whatcom County has adopted the following requirements for both temporary and long-term stormwater management. These standards are intended to set out the regulatory requirements, the exemptions, the administrative and submittal requirements, and the design requirements for stormwater management in Whatcom County.

PART 1: ADMINISTRATIVE PROVISIONS

Section 201 - REGULATORY AUTHORITY [Title 20.80.630 WCC]

The State of Washington has enacted regulations and delegated powers to Whatcom County to control and regulate activities effecting stormwater management. These regulations and powers are set forth in:

- RCW 36.70 Planning Enabling Act
- RCW 36.70A Growth Management Planning
- RCW 90.70 Puget Sound Water Quality Authority

The authority for this chapter is derived by the adoption of Title 20.80.630 of the Whatcom County Code several County ordinances, including:

- Whatcom County Ordinance #94-018 Development Standards
- Whatcom County Ordinance #94-022 Stormwater Drainage Ordinance
- Title 21 Whatcom County Subdivision Regulations
- Chapter 10.8.7 of the Critical Areas Ordinance (CAO)

On this basis, all development within Whatcom County is subject to the stormwater management provisions of this chapter unless specifically exempted.

Section 202 - TECHNICAL ADMINISTRATOR

Whatcom County has designated the County Engineer as the Technical Administrator to review and enforce both the administrative and technical aspects of the stormwater management ordinances. The County Engineer may delegate various review and technical functions. The Technical Administrator's authority is limited to the requirements established in this chapter.

Section 203 - GENERAL EXEMPTIONS

Whatcom County ordinances recognize certain circumstances when the requirements of this chapter would be inappropriate, including when there is a minimal level of development or when activities fall under other ordinances and regulations. For this reason, the applicable County ordinances fully or partially exempt certain development activities from the requirements of this chapter. In most cases, these activities include:

- A. Single-Family & Duplex Residences and Clearing not associated with Development** (Unless otherwise required to meet these standards: see section 221 Stormwater Special District and Chapter 3, LAND CLEARING, Section 304,G.)
- B. Development** undertaken by the Washington State Department of Transportation in State Highway rights-of-way when regulated by Chapter 173-270 WAC, the Puget Sound Runoff Program.
- C. Agricultural Activities** as defined in this text.
- D. Forest Practices** (except Class IV General Forest Practices).

Because these exemptions are general in nature, owners are encouraged to discuss proposed projects with County staff to determine which regulations and requirements apply.

PART 2: TEMPORARY EROSION AND SEDIMENT CONTROL (TESC)

Purpose: Whatcom County requires all development to contain erosion and sediment on site. When erosion, sediment, or siltation escapes the site, the owner is expected to immediately install additional erosion and sediment controls to remedy the problem. If the owner fails to provide such controls, the County may do so at the owner's expense.

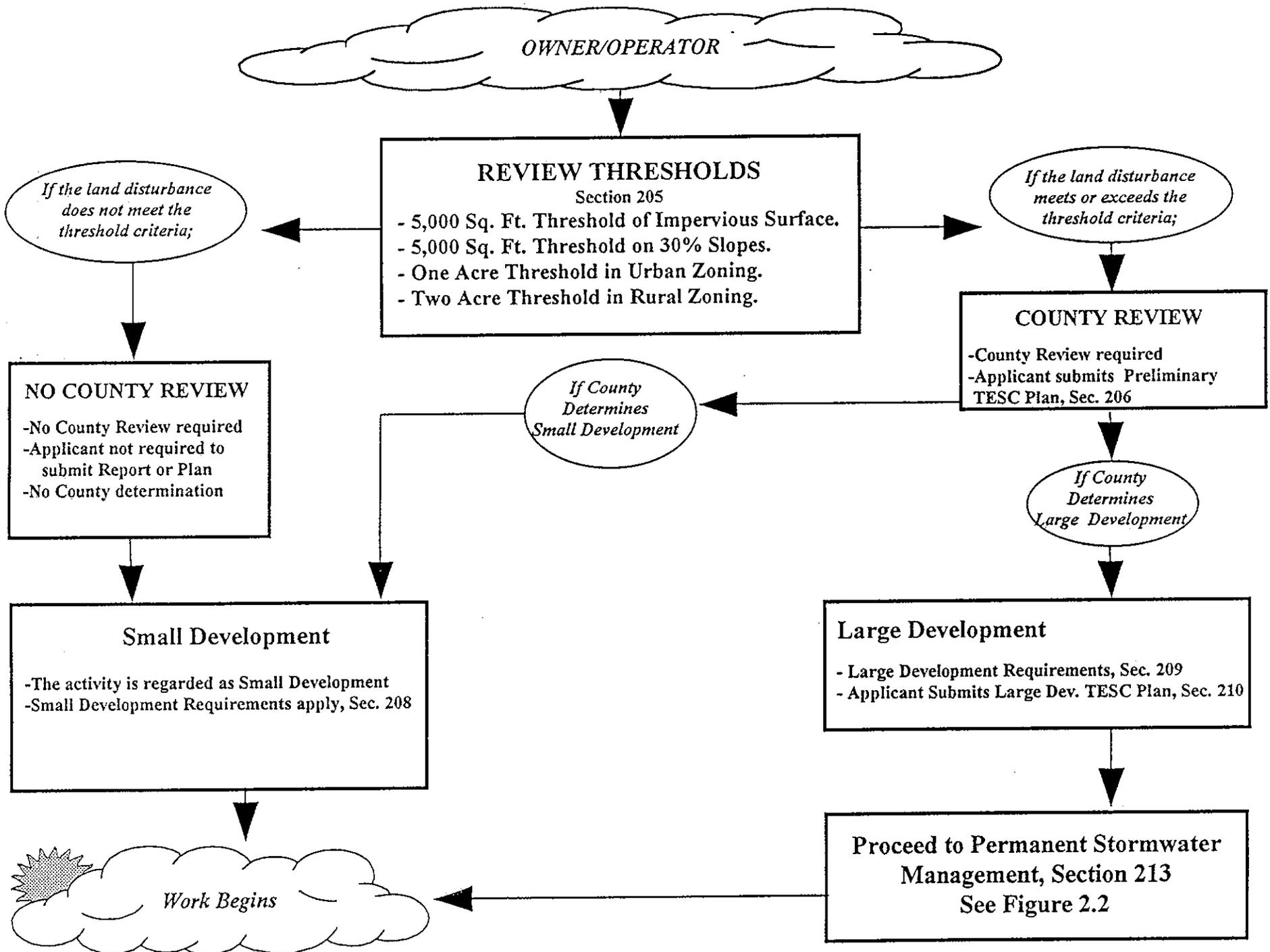
Temporary erosion and sediment control is intended to establish standard design and construction parameters and requirements, both general and specific, with the objectives of: protecting properties adjacent to developing land from increased amounts of storm- water runoff, sediment, erosion, or by increasing unstable geologic conditions, and controlling water quality degradation to preserve and protect the County's watercourses, its receiving waters, wetlands and other bodies of water; and the integrity and safety of County roads and rights-of-way.

Section 204 - TESC SMALL/LARGE DEVELOPMENT REQUIREMENTS

Purpose: Whatcom County has two sets of requirements for the control of temporary erosion and sediment: Small Development Requirements and Large Development Requirements. The underlying logic for this split is that the likelihood of significant off-site erosion/sediment from Large Development activity is sufficiently high as to warrant County review to ensure the use of good management practices. The County's threshold to help distinguish between these two types of development are as follows (See also Section 205 and Figure 2.1 for flow chart):

- A. Small Development** Project proposals not meeting the threshold criteria found in Section 205, Land Clearing Activity, are activities regarded as a Small Development and do not require a review process. However, the owner must comply with Section 208, Small Development Minimum Requirements. Violation of these requirements is punishable pursuant to 20.94 of the Whatcom County Zoning Ordinance, Title 20.
- B.** If the **Land Clearing Activity** meets or exceeds the threshold found in Section 205, the activity is subject to County review and the owner must submit a Preliminary Erosion and Sediment Control Plan pursuant to Section 206. On the basis of the County's review, the County will then determine whether the proposal must comply with Small Development Minimum Requirements, Section 208, or Large Development Minimum Requirements, Section 209.

Figure 2.1 TEMPORARY EROSION/SEDIMENT CONTROL



Section 205 - LAND CLEARING ACTIVITY REQUIRING COUNTY REVIEW

County review and approval of a land clearing activity is required when any of the following land clearing thresholds have been reached:

- A. 5,000 Square Foot Threshold for Impervious Surface:** The Technical Administrator will review all proposed land clearing that results in the creation or addition of 5,000 sq. ft. of impervious surface area or more.
- B. 5,000 Square Feet on 30% Slopes:** The Technical Administrator will review all proposed land clearing activities that are 5,000 square feet (accumulative area) or more on slopes greater than 30% in gradient.
- C. One Acre in Urban Zoning Districts:** The Technical Administrator will review all proposed land clearing activities in urban zoning districts that are one acre or more and located on slopes less than 30% in gradient.
- D. Two Acres in Rural Zoning Districts:** The Technical Administrator will review all proposed land clearing activities in rural zoning districts that are two acres or more and located on slopes less than 30% in gradient.

Section 206 - PRELIMINARY TEMPORARY EROSION AND SEDIMENT CONTROL (TESC) PLAN

Land clearing activity that meets or exceeds the thresholds found in Section 205 is subject to County review. The owner must submit a Preliminary TESC Plan to the Technical Administrator, who will determine whether the proposal will be subject to Small Development Minimum Requirements (Section 208) or Large Development Minimum Requirements (Section 209). The components of the TESC Plan are to include the following:

A. Project Information

1. Owner and applicant name, address, telephone number, contact person, vicinity map.

B. Existing Site Conditions

1. Topography (slope)
2. Drainage Patterns (swales, ditches, pipe systems)
3. Soils (types and stability)
4. Ground cover (vegetation type and extent)
5. General proximity to environmentally sensitive areas (lakes, streams, wetlands, fish habitat)
6. Proximity to environmentally hazardous areas (steep slopes, alluvial fans)

7. Adjacent land use (residential, industrial, agricultural, etc)
- 8 Existing development (buildings and facilities)
9. On and off-site utilities (roadways, utility corridors)

C. Proposed Project Site Plan

1. Size, boundary dimensions
2. Timing of land clearing activity
3. Clearing limits
4. Proposed methods of temporary erosion and sediment control(TESC)

Section 207 - DETERMINATION OF DEVELOPMENT REQUIREMENTS

The Technical Administrator will review the Preliminary TESC Plan and determine whether the proposal will be subject to Small Development Minimum Requirements (Section 208) or Large Development Minimum Requirements (Section 209).

A. If the Technical Administrator determines that a project proposal is a **Small Development:**

1. A permanent stormwater management plan shall not be required.
2. The project proposal shall be subject to Small Development Minimum Requirements (Section 208).

B. If the Technical Administrator determines that a project proposal is a **Large Development:**

1. A permanent stormwater management plan shall be required.
2. The project proposal shall be subject to Large Development Minimum Requirements (Section 209).

Section 208 - SMALL DEVELOPMENT - MINIMUM REQUIREMENTS: TESC

When a determination has been made that Small Development Requirements apply, the following erosion and sediment control requirements shall be implemented without County review:

A. Site Containment: Erosion, sedimentation, and other impacts shall be restricted to the site. The following Small Development Requirements shall be strictly adhered to:

1. **Small Development Requirement #1 - CONSTRUCTION ACCESS ROUTE:** Construction vehicle access will be, whenever feasible, limited to one route. Access surfaces shall be stabilized to minimize the tracking of sediment onto adjacent roads. See Series 300 for Standard Drawings of some alternative techniques.
 2. **Small Development Requirement #2 - STABILIZATION OF DISTURBED AREAS:** All exposed soils subject to erosion shall be stabilized through such soil stabilization measures as seed, sod or other vegetation application, plastic covering, mulching, or application of gravel base. Other measures may include fill and cut slope treatment, heavy equipment tracking, temporary interceptor dikes and swales, or erosion control blankets. See Series 300 for Standard Drawings of some alternative techniques.
 3. **Small Development Requirement #3 - CONTAINMENT OF SEDIMENT ON-SITE:** Adjacent properties must be protected from sediment deposition through such protection measures as vegetative buffer strips, sediment barriers or filters, dikes or mulching, or by a combination of soil stabilization measures. See Series 300 for Standard Drawings of some alternative techniques.
 4. **Small Development Requirement #4 - CONTROLLING OFF-SITE DAMAGE:** Properties and waterways downstream from clearing sites shall be protected from damage resulting from increased stormwater runoff.
 5. **Small Development Requirement #5 - MAINTENANCE:** To ensure the continued performance of their intended purpose, all erosion and sediment control measures shall be regularly maintained by the owner.
- B. Hazards:** Land clearing activities shall not result in off-site damage nor pose a danger or hazard to life or property, either on or off-site.
- C. Slash Removal in Urban Zoning Districts:** Slash in urban zoning districts (as defined in these standards) shall be managed in one of the following ways:
1. Removed from the site in a manner consistent with standards administered by Whatcom County Public Works, Solid Waste Division.
 2. Burned in compliance with the Whatcom County Fire Marshal and the Washington State Northwest Air Pollution Authority.
 3. Chipped and spread across the site.

Section 209 - LARGE DEVELOPMENT - MINIMUM REQUIREMENTS: TESC

When a determination has been made that Large Development Requirements apply, the following erosion and sediment control requirements shall be implemented with County review.

- A. Site Containment:** Erosion, sedimentation, and other impacts shall be restricted to the site. The following Large Development Requirements shall be strictly adhered to.
1. **Large Development Requirement #1 - CONSTRUCTION ACCESS ROUTES:** Whenever construction vehicle access routes intersect off-site roads, provisions must be made to minimize the transport of sediment (mud) onto the off-site road. Access onto off-site roads shall be protected by the installation of a minimum of 100 feet of quarry spall or other methods approved by the Technical Administrator. If sediment is transported onto a road surface, the roads shall be routinely cleaned during the day and thoroughly cleaned at the end of each day. Sediment shall be removed from roads by shoveling or sweeping and transported to a controlled sediment disposal area. Street washing shall be allowed only after sediment is removed in this manner. See Series 300 for Standard Drawings of some alternative techniques.
 2. **Large Development Requirement #2 - STABILIZATION OF DISTURBED AREAS:** All exposed soils subject to erosion shall be stabilized through such soil stabilization measures as seed, sod or other vegetation application, plastic covering, mulching, or application of gravel base. Other measures may include fill slope treatment, heavy equipment tracking, temporary interceptor dikes and swales, or erosion control blankets. See Series 300 for Standard Drawings of some alternative techniques.
 3. **Large Development Requirement #3 - CONTAINMENT OF SEDIMENT ON-SITE:** Adjacent properties must be protected from sediment deposition and erosion by appropriate use of vegetative buffer strips, sediment barriers or filters, dikes or mulching, or by a combination of soil stabilization measures. Prior to leaving the site, concentrated stormwater runoff shall pass through a sediment pond or sediment trap, or other appropriate sediment trapping methods. See Series 300 for Standard Drawings of some alternative techniques.
 4. **Large Development Requirement #4 - CONTROLLING OFF-SITE DAMAGE:** Properties and waterways downstream from clearing sites shall be protected from damage resulting from increased stormwater runoff.
 5. **Large Development Requirement #5 - DELINEATING CLEARING AND EASEMENT LIMITS:** Prior to clearing, establish and mark on site clearing limits and other critical site features as appropriate.
 6. **Large Development Requirement #6 - TIMING AND STABILIZATION OF SITE CONTAINMENT:** Prior to other land disturbance activities, all erosion and sedimentation control methods shall be in place.

7. **Large Development Requirement #7 - CUT AND FILL SLOPES:** Cut and fill slopes shall be stabilized. See Series 300 for Standard Drawings of some alternative techniques.
 8. **Large Development Requirement #8 - STORM DRAIN INLET PROTECTION:** Storm drain inlets made operable during construction shall be protected so that unfiltered and/or untreated stormwater runoff shall not enter the conveyance system. See Series 300 for Standard Drawings of some alternative techniques.
 9. **Large Development Requirement #9: STABILIZATION OF TEMPORARY CONVEYANCE CHANNELS AND OUTLETS:** All temporary on-site conveyance channels shall be designed, constructed and stabilized to convey the peak flow from a one year, 24-hour frequency storm with no appreciable erosion. Stabilization adequate to prevent erosion of outlets, adjacent streambanks, slopes and downstream reaches shall be provided at the outlets of all conveyance systems.
 10. **Large Development Requirement #10: DE-WATERING CONSTRUCTION SITES:** All de-watering devices shall discharge into a sediment trap or sediment pond.
 11. **Large Development Requirement #11 - MAINTENANCE:** Temporary sediment control measures must be satisfactorily maintained until the clearing and/or construction is completed, permanent drainage facilities are operational, and the potential for on-site erosion has passed. It shall be the obligation and responsibility of the persons required to provide such temporary erosion-sedimentation control facilities to maintain them in a satisfactory condition and remove them when no longer needed.
 12. **Large Development Requirement #12 - REMOVAL OF TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES:** All temporary non-biodegradable erosion and sediment control measures shall be removed within 30 days after final site stabilization is achieved or after the temporary measures are no longer needed. Trapped sediment shall be removed or stabilized on site. Disturbed soil areas resulting from removal shall be permanently stabilized.
- B. Hazards:** Land clearing activities shall not result in off-site damage nor pose a danger or a hazard to life or property either on or off-site.
- C. Site Specific Requirements:** After a site visit by the Technical Administrator, additional site specific requirements may be established where consistent with state and local law. These requirements shall be based on specific site conditions, weather conditions and limited to additional temporary erosion and sedimentation control and/or the mitigation of hazardous or potentially hazardous site conditions.
- D. Slash Removal in Urban Zoning Districts:** Slash in urban zoning districts (as defined in these standards) shall be managed in one of the following ways:

1. Removed from the site in a manner consistent with standards administered by Whatcom County Public Works, Solid Waste Division.
2. Burned in compliance with the Whatcom County Fire Marshal and the Washington State Northwest Air Pollution Authority.
3. Chipped and spread across the site.

Section 210 - LARGE DEVELOPMENT TESC

When Large Development Minimum Requirements apply the owner is required to prepare, submit, and implement a Large Development TESC Plan that incorporates the minimum requirements pursuant to Section 209.

- A.** At a minimum, the **Large Development TESC Plan** will show and clearly label the following:
1. All required and proposed TESC facilities
 2. Locations, elevations and dimensions of the proposed facilities
 3. Proposed measures and specifications for controlling erosion and sediment
 4. Maintenance provision notes for erosion & sediment control facilities (until permanent site stability has been established)
 5. Clearing limits - identify areas to remain undisturbed
 6. Existing site conditions - topography, soils, vegetation, and drainage
 7. Erosion and Sediment Control BMPs - perimeter protection, cover measures, and traffic area stabilization
 8. Cut and fill slopes - indicate top/bottom of slope catch lines
 9. Conveyance Systems - grass lined swales, interceptor trenches or ditches, and pipes.
- B. Licensed Civil Engineer:** The Large Development TESC Plan shall be prepared by a Professional Civil Engineer, licensed in the State of Washington. The plan shall contain the following statement:

ENGINEER'S DECLARATION

"I, _____, a Professional Engineer registered in the State of Washington as a Civil Engineer, do hereby declare that this Temporary Erosion and Sediment Control Plan was prepared by, or under my personal supervision, and that said plan was prepared in accordance with generally accepted engineering practices. I hereby affirm that, to the best of my knowledge, information and belief, this plan was prepared in full compliance with the Whatcom County Stormwater Ordinance, Whatcom County #94-022, and in compliance with the Whatcom County Development Standards and all Technical Standards adopted thereunder; EXCEPT as specifically set forth under "Exceptions to Whatcom County Standards," set forth hereon.

ENGINEER'S SEAL

Engineer's Name and
Registration Number

Registration
Expiration

Date _____, 19 __

- C.** When the **TESC Plan** is submitted as a part of a the Stormwater Management Plans and Specifications, Section 216, only one ENGINEERS DECLARATION will be required.

Section 211 - MAINTENANCE OF TESC

Maintenance of TESC facilities shall take place as follows:

- A.** All temporary sediment control BMPs shall be satisfactorily maintained and repaired until the clearing and/or construction is complete; the permanent stormwater facilities are operational; and the potential for erosion has passed.
- B.** A TESC Supervisor shall be designated by the owner to be responsible for maintenance and review of TESC and for compliance with all permit conditions relating to TESC.
- C.** The name, address, and phone number of the TESC supervisor shall be supplied to the county prior to the start of construction.

Section 212 - TESC ASSURANCE OF PERFORMANCE

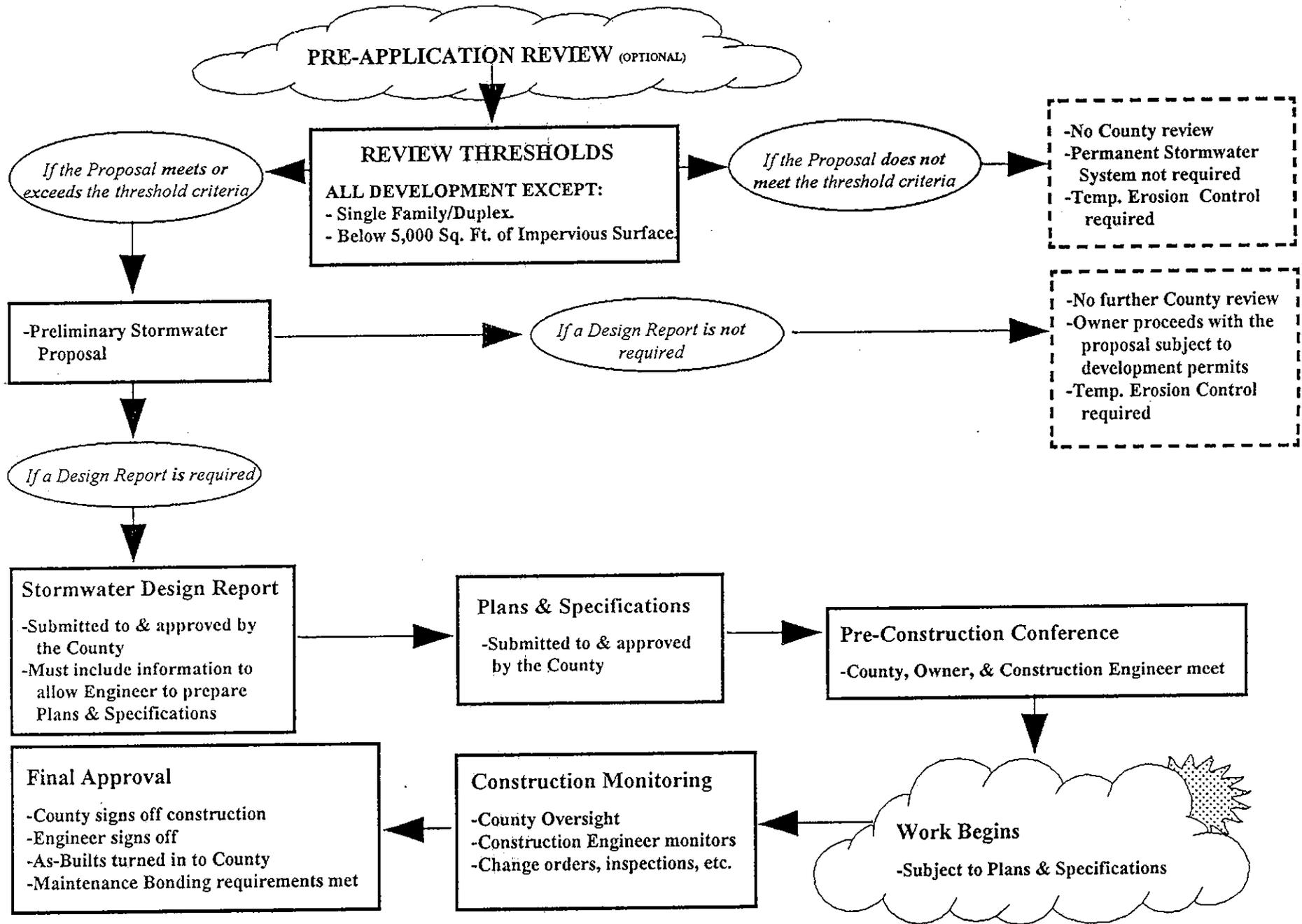
TESC assurance of performance shall be incorporated when and where under the following conditions:

- A.** The County may require financial assurance for the proper performance and maintenance of TESC facilities when it is determined that there is a likelihood that sensitive or identified critical areas could be significantly impacted as a result of the

project. The performance security is to guarantee site stabilization.

- B.** The form and percentage of the performance security will comply with Section 218, BONDING AND SECURITIES, A & B. The amount needed to stabilize the project site shall be indicated.

Figure 2.2 PERMANENT STORMWATER MANAGEMENT



PART 3: PERMANENT STORMWATER MANAGEMENT

In cases where the management of stormwater requires the installation and maintenance of stormwater facilities, Whatcom County has developed both administrative and technical requirements to ensure that these facilities are installed and maintained properly. Figure 2.2 provides a summary of the administrative process necessary to begin work on a proposal that includes permanent stormwater management.

Section 213 - ADMINISTRATIVE REQUIREMENTS FOR PERMANENT STORMWATER MANAGEMENT

Purpose: In order to protect public health and safety, Whatcom County has the responsibility to review development that may effect stormwater flows. To facilitate this review, Whatcom County requires that all applications for development fulfill specific Administrative Requirements. These same requirements may also serve as a guide to the owner.

A. Format: The County's Administrative Requirements generally differ in format from that suggested by the Washington State Department of Ecology. The County's format is drafted to follow the development and construction phases of a project. In general, the County will ask only for conceptual data during the early, planning phases of a project. During the design and construction phases, the County will require appropriate levels of detail to ensure that the applicable provisions of the Development Standards are implemented. Figure 2.2 provides a schematic "flow chart" of the typical stormwater Administrative Requirements for a project.

The County Administrative Requirements allow exemptions and abbreviated approval procedures. However, a permit will not be issued until all appropriate Stormwater Administrative Requirements are reviewed and approved by the County's Technical Administrator.

B. Pre-Application Review: Prior to formally submitting a project proposal, any plans, or reports, the owner is encouraged to contact the Technical Administrator to discuss the overall feasibility, scope, and standards relevant to the project and provide the applicant with a general idea of the requirements that must be met.

C. Review Thresholds: County review and approval of permanent stormwater management shall be required when any of the following occurs:

1. The development proposal includes 5,000 square feet or more impervious surface.
2. The development proposal results in an accumulative area of onsite impervious surface measuring 5,000 square feet or more.
3. The development proposal is determined to be a Large Development pursuant to Section 209.

- D. Submittal Requirements, Review, and Action for Project Proposals, Reports, and Plans:** Pursuant to Section 213.C, when County review and approval is required, the owner will submit an appropriate level of data about the project and its impacts. Permits will not be issued until the applicable proposals, reports, and plans have been approved.

There are three different submittal levels, each requiring specific information to address differing types and scales of development proposals and intended to eliminate unnecessary submittal requirements and redundant review. Submittal levels are as follows:

1. **Preliminary Stormwater Proposal** (see Section 214)
 - a) *Purpose:* The Preliminary Stormwater Proposal is intended to provide the County a general overview as related to a proposed project. This preliminary stormwater information will be used by the Technical Administrator to determine which regulations apply and whether to require a more detailed Stormwater Design Report.
 - b) *Submittal Requirements:* All development proposals shall be required to submit a Preliminary Stormwater Proposal, pursuant to Section 214, unless otherwise indicated in Section 203, Exemptions, or Section 213.C, Review Thresholds.
 - c) *Review and Action by County:* Upon review by the Technical Administrator, one of the following actions will be taken:
 - i. Accept the preliminary submission as final and issue the appropriate permits. In such cases, the owner may proceed with the proposal as approved.
 - ii. Request additional information.
 - iii. Notify the owner that a detailed Stormwater Design Report is required. The owner may submit a Stormwater Design Report in lieu of the Preliminary Stormwater Proposal.

2. **Stormwater Design Report** (see Section 215)
 - a) *Purpose:* The Stormwater Design Report is intended to provide detailed design information sufficient to allow an engineer to adequately prepare the final construction plans and specifications for the project in a manner that is in compliance with minimum Federal, State, and County regulations for stormwater management.
 - b) *Submittal Requirements:* A Stormwater Design Report as provided in Section 215 will be required for all developments meeting any of the following criteria:
 - i. When the Technical Administrator's review of a Preliminary Stormwater Proposal determines that a Stormwater Design Report is required to protect the public health and safety.
 - ii. When the proposed development will add 20,000 sq. ft. or more of impervious surface.
 - iii. When the proposed development will create three or more lots in urban zoning districts and six or more lots in rural zoning districts.
 - iv. When any stream or drainage course will be significantly impacted by the construction of new or modification of existing

drainage facilities.

- c) *Review and Action by County:* Upon review by the Technical Administrator, one of the following actions will be taken:
 - i. Request additional information and/or corrections.
 - ii. Approve the Stormwater Design Report and allow submittal of plans and specifications.

3. **Stormwater Management Plans & Specifications** (see Section 216)

- a) *Purpose:* Final plans and specifications ensure that the requirements and recommendations set forth in the Design Report are those which are proposed for construction. The final plans and specifications must be of sufficient detail to communicate to the contractor all the necessary information for constructing the facility, structures and/or systems.
- b) *Submittal Requirements:* When a Stormwater Design Report requires construction of stormwater management facilities, stormwater management plans & specifications will be required pursuant to Section 216.
- c) *Review and Action by County:* Upon review the Technical Administrator will take one of the following actions:
 - i. Request additional information and/or corrections.
 - ii. Approve the Stormwater Management Plans & Specifications.

E. Review and Approval Timing of Proposals and Reports: Consistent with the time periods and conditions established by legislative authority, the Technical Administrator shall review and approve/disapprove all proposals and reports, and return the same to the owner. The time period for the average review and approval process is as follows:

1. **Preliminary Stormwater Proposal:** Seven (7) working days from receipt of complete proposal.
2. **Stormwater Design Report:** Fifteen (15) working days from receipt of complete report.

In the event that additional information is required, the review process, including the timing, may be repeated.

Section 214 - REQUIRED COMPONENTS OF A PRELIMINARY STORMWATER PROPOSAL

Purpose: The Preliminary Stormwater Proposal is intended to provide Whatcom County with a general overview of the proposed stormwater proposal related to a proposed project. This preliminary stormwater information will be used by the County to determine which regulations apply and whether a more detailed Stormwater Design Report (Section 215) will be required.

A. General Submittal Requirements: When the County determines that the proposal meets the threshold requirements found in Section 213, the owner must submit a Preliminary Stormwater Proposal.

1. The Preliminary Stormwater Proposal will clearly indicate the relationship

between the proposed development and the local drainage related features.

2. Preliminary Stormwater Proposals that do not adequately fulfill the purpose and general submittal requirements listed in 214.C, below, will be returned to the owner with requests for specific additional information.
- B. Required Scope:** The scope, content, format and presentation of the Preliminary Stormwater Proposal must be of sufficient detail and clarity to allow the County to review the general scope of the proposed project, anticipated drainage problems, and proposed stormwater management solutions.
- C. Preliminary Proposal Submittal Requirements:** A Preliminary Stormwater Proposal submittal shall include a site plan and narrative description, which at a minimum, must provide the following information:
1. **Project Information:** Name, address, telephone number of owner and contact person. Vicinity map (showing location with respect to county/city map) and tax parcel number of the site.
 2. **Project Description:** Show on a map at appropriate scale and provide a brief written description of the project. Include the location and size of proposed structures and impervious surfaces, and the location of utilities and road access. Identify the location, nature and extent of land alteration activities associated with the development including areas to be cleared and graded.
 3. **Existing Conditions:** Show on a map at an appropriate scale and provide a brief written description of the existing site conditions including structures, natural drainage, bogs, swamps, wet areas, fish habitat, channels, drainage facilities (including facilities within one quarter of a mile downstream), soils, vegetative cover, parking areas, and other impervious surfaces, general steepness and the direction of land slopes.
 4. **Proposed Stormwater Systems:** Show on a map at an appropriate scale and provide a brief written description of the proposed stormwater management system, including ditches, drainlines, detention/retention facilities and stormwater treatment facilities. Include a description of potential downstream impacts.
 5. **Erosion And Sediment Control:** Show proposed methods for controlling erosion and sediment during and after construction. (see Section 204)

Section 215 - REQUIRED COMPONENTS OF A STORMWATER DESIGN REPORT

Purpose: Whatcom County has established minimum requirements for development. The Stormwater Design Report must include detailed design information sufficient to allow an engineer to adequately prepare the final construction plans and specifications for the project.

- A. General Submittal Requirements:** Whatcom County's minimum requirements mandate that any proposed stormwater system must be designed in accordance with Best Management Practices (BMP), Section 219, generally accepted engineering principles, and all legal requirements. Additionally, the Stormwater Design Report must provide the County with sufficient data for the review and approval of the report. Based on these factors, this report must include (at a minimum):
1. A clear description of the proposed project.
 2. A clear description of the project environment.
 3. A clear definition of the design objectives.
 4. A complete and clear presentation of engineering analyses, calculations, graphs, charts, maps and plans, which demonstrate that the proposed plan elements, structures and systems, when constructed, will satisfy the design objectives.
- B. Licensed Civil Engineer:** When required by Section 213.C, the Stormwater Design Report shall be prepared and submitted to the Technical Administrator by a Professional Civil Engineer, licensed in the State of Washington, and shall contain the following statement:

ENGINEER'S DECLARATION

"I, _____, a Professional Engineer registered in the State of Washington as a Civil Engineer, do hereby declare that the Stormwater Design Report titled _____, and dated _____, 19____, was prepared by, or under my personal supervision, and that said Report was prepared in accordance with generally accepted engineering practices. I hereby affirm that, to the best of my knowledge, information and belief, subject Report was prepared in full compliance with the Whatcom County Stormwater Ordinance, Whatcom County #94-022, and in compliance with the Whatcom County Development Standards and all Technical Standards adopted thereunder; EXCEPT as specifically set forth under "Exceptions to Whatcom County Standards," page ____ of this report."

ENGINEER'S SEAL

Engineer's Name and
Registration Number

Registration
Expiration

Date _____, 19 __

- C. Required Scope:** By their nature, Stormwater Design Reports are highly specific to both existing conditions and to the proposed design. Because of the number of factors involved, the County cannot provide any single format that will ensure that all required items are analyzed and reviewed. Therefore, the County must rely on the owner's engineer to provide an accurate, complete and comprehensive Stormwater Design Report. Stormwater Design Reports that do not adequately fulfill the purpose and

general submittal requirements listed above will be returned to the engineer with requests for specific additional information.

D. Design Report Checklist: The following is a checklist intended to provide a general guideline to engineers preparing a Stormwater Design Report:

1. Background Data

- a) *General Information*, at a minimum, clearly provide and identify:
 - i. Name of project
 - ii. City, County, State of project
 - iii. Client name, address, contact person, telephone number
 - iv. Engineering company name, address, contact person, telephone number
- b) *Project Information*, at a minimum, clearly provide and identify:
 - i. Location of project site
 - ii. 1/4 Section, Township, Range
 - iii. Tax parcel number
 - iv. Vicinity location map
- c) *Existing Site Conditions*, at a minimum, clearly provide and identify:
 - i. Description of site
 - ii. Total acreage
 - iii. Description of existing land use
 - iv. Zoned land use
 - v. Topographic data
 - vi. Slope and direction, and character of terrain
 - vii. Description of vegetative cover
 - viii. U.S. Department of Agriculture Natural Resources Conservation Service (NRCS formerly SCS) description and classification of on-site soils
- d) *Proposed Conditions*, at a minimum, clearly provide and identify:
 - i. Description of proposed site development
 - ii. Proposed site development plan
 - iii. Description of proposed construction activities
- e) *Existing Drainage Basin Data*, at a minimum, clearly provide and identify:
 - i. Name and description of effected watersheds
 - ii. Description of on-site drainage
 - iii. Description of upstream off-site drainage and hydrology
 - iv. Description of downstream off-site drainage and hydrology
 - v. Description of known drainage problems
- f) *Drainage Basin Map*, at a minimum, clearly provide and identify:
 - i. Basin demarcation
 - ii. Time of concentration flow line location
 - iii. Topographic information
 - iv. Streets
 - v. Landmarks
 - vi. Water features
 - vii. Drainage ways and water courses
 - viii. Swamps, bogs, and wet areas

2. Design Data

- a) *General Site and Area Data*, at a minimum, clearly provide and identify:
 - i. Drainage maps
 - ii. Schematic flow diagrams
 - iii. General drainage data
 - iv. Soils data
 - v. Land use maps
- b) *Proposed Parcel Drainage Data*, at a minimum, clearly provide and identify:
 - i. Description of on-site drainage systems for proposed project
- c) *Design Criteria and Objectives* (see Section 219.C), at a minimum, clearly provide and identify:
 - i. Compliance with local, State, and Federal regulations
 - ii. Temporary erosion and sediment control design
 - iii. Conveyance system design
 - iv. Detention/Retention facility design
 - v. Emergency overflow design
 - vi. Water quality management
 - vii. Special emphasis on innovative and cost effective solutions
 - viii. Reference to, and summary of, special reports and studies

3. Specific Design Conclusions

- a) *Stormwater Management*, at a minimum, clearly provide and identify:
 - i. Purpose
 - ii. Methodology
 - iii. Conclusions
 - iv. Resultant site flows
 - v. Conveyance system analysis and design recommendations
 - vi. Detention/Retention facility analysis and design recommendations
 - vii. Control structure/restrictor analysis and design recommendations
 - viii. Emergency overflow analysis and design recommendations
- b) *Stormwater Quality Assurance*, at a minimum, clearly provide and identify:
 - i. Purpose
 - ii. Methodology
 - iii. Conclusions
- c) *Temporary Erosion and Sediment Control*, at a minimum, clearly provide and identify:
 - i. Purpose
 - ii. Methodology
 - iii. Conclusions

E. Recommended Technical Guidelines for Stormwater Design Report

1. **The report should provide narrative descriptions** of how the proposed system will meet the design objectives, and contain necessary technical data, including:
 - a) *Assumptions, parameters, and input data* used in the hydrologic model. This includes the curve numbers, soils types, land use, areas, and times

- of concentration of all sub-basins, if the NRCS (formerly SCS) method is employed, and comparable data if other methods are used.
- b) *Hydraulic performance data* (stage, storage, discharge) for elements of the hydrologic system, whether existing or proposed, including lakes, ponds, swamps and bogs. This data shall be used to route inflow hydrographs to produce outflow hydrographs.
 - c) *Flow data* for existing and proposed conveyance facilities, including streams, swales, pipes, and ditches which will support the proposed system.
 - d) *Floodplain analysis* identifying flows, velocities, and extent of flooding for the existing and proposed conditions. Other backwater analysis required to determine existing and proposed conveyance capacity within the project and downstream of the project.
 - e) *Erosion analysis* of on-site and downstream open-drainage systems, identifying flows, velocities, areas of existing and future deposition and channel erosion, and characterization of sediment.
 - f) *Geotechnical analysis* of the site and proposed improvements which specifically addresses soils and slope stability for proposed lakes/ponds, road alignments, channel/ravine conditions, building setbacks from steep slopes, vegetative preservation and controls, existing and proposed drainage facilities, and downstream system stability.
 - g) *Appropriateness of, and method and conceptual design* for, maintaining existing flow regimes in any swales/ravines that may be altered by the development.
 - h) *Appropriateness of, method, conceptual design, and location* of water quality compensating facilities that may replace naturally occurring "biofiltration" functions of site vegetation, i.e. provision and/or preservation of vegetated swales.
 - i) *Description of maintenance design features and provisions* that will ensure reliable and long-term facility operation.
 - j) *Input and output files* from hydrologic and/or hydraulic computer models may be included as an appendix.
 - k) *Provide construction phasing plan* that will ensure stormwater/erosion control during development of individual sub-basins.
2. **Plans and Mapping:** A conceptual or preliminary plan of the proposed drainage collection, detention and water quality control systems, based upon photogrammetric or field topographic mapping and geologic and soils data, should be provided, along with appropriate cross-sections and details necessary to identify system elements. Mapping must be of adequate scale and detail for definition and location of system elements, both on-site and off-site, and must provide support for hydrologic model characterization. In general, the following is required:
- a) *Delineation of sub-basins* of appropriate size and land use for computer model characterization and hydraulic analysis of all tributary flows.
 - b) *Location and size of all existing and proposed hydrologic features and facilities in the basins.* This includes lakes, ponds, swamps, bogs, swales, streams, pipes, and culverts.
 - c) *Preliminary plan/profile and cross-sections of conveyance systems* for

- existing and developed conditions.
- d) *Identify areas of in-stream erosion, sediment and/or unstable slopes.*
- e) *Identify general required building setbacks and clearing limits in areas of steep slopes and drainage features.*
- f) *Site soils identification and preliminary analysis for controlling erosion during construction and for use in hydrologic modeling.*

Section 216 - STORMWATER MANAGEMENT PLANS AND SPECIFICATIONS

Purpose: The preparation of final Plans and Specifications ensures that the requirements and recommendations set forth in the Design Report are those which are proposed for construction. The final Plans and Specifications must be of sufficient detail to communicate to the contractor all the information concerning the facility, structures and/or systems which are needed to build the improvements.

The horizontal and vertical location, size and materials to be used, and all other information and detail which specifically and uniquely define the proposed improvements shall be shown on the plans and/or within the specifications.

The final plans and specifications must contain sufficient detail and definition, including supporting computational addendum, to allow the reviewing engineer to determine that the proposed facilities meet the objectives set forth in the design report, and satisfy all Whatcom County regulations and administrative development standards. Plans which do not meet the purpose set forth herein shall be returned to the design engineer with written comment specifying deficiencies contained therein.

- A. General:** Design and construction Plans, Specifications and Details are required for all stormwater management systems. Management systems include temporary erosion control facilities, detention/retention systems, gravity and pressure pipe systems, open channels including road ditches, stormwater treatment facilities, and all combinations thereof.

Standard Construction Specifications for all Stormwater Management Construction shall be the current edition of the Standard Specifications for Road, Bridge and Municipal Construction (WSDOT/APWA), together with appropriate special provisions and addenda.

Standard design and construction details, charts and reference notes are shown in Appendix III of this chapter.

- B. Submittal Procedure:** Stormwater Management Plans and Specifications and supporting design calculations shall be prepared and attested to by a professional Civil Engineer, licensed in the State of Washington. Where drainage construction is required on private property, a complete set of horizontal plans (and vertical plans, if appropriate) will be submitted to the Technical Administrator for review and approval. All final plans shall be approved by the Technical Administrator. Construction activity and/or the recordation of any land subdivision is prohibited until all final plans have been approved.

- C. General Formatting:** General formatting, copying, and submittal process for stormwater plans shall be in accordance with Appendix I.
- D. Approvals:** The Technical Administrator shall receive and review all plan submittals and:
1. Determine the sufficiency of submittal and notify the design engineer of the determination within seven working days following submittal;
 2. Upon receipt of plans deemed to be sufficient, the Technical Administrator will conduct a plan review and check in sufficient detail to ensure compliance with the Development Standards. The Technical Administrator will prepare a set of "marked-up" review plans noting comments, questions, and any deficiencies contained therein, and must transmit the review plans to the design engineer within 15 working days from receipt of plans deemed to be sufficient.
 3. In the event that additional information is required, the review process, including the timing, may be repeated.
- E. Contents:** Stormwater Management Plans and Specifications shall include a plan-profile of the stormwater systems prepared in accordance with generally accepted engineering practices and shall contain, at a minimum, the following information:
1. **Site Plan:** Site plans shall be prepared, incorporating appropriate stormwater quality and quantity control measures required in these standards and the BMPs found in Section 219. The location, type, and size of existing and proposed stormwater facilities both on and off-site shall be shown;
 2. **Control and Topographic Surveys:** All control and topographic surveys shall be conducted under the direction of a Professional Land Surveyor, registered in the State of Washington;
 3. **Control and Topographic Maps/Reports:** All control and topographic maps/reports shall bear the seal and signature of the land surveyor, and shall state that the required survey procedures, precision and mapping standards have been achieved;
 4. **Horizontal and Vertical Control Datum:** All horizontal positions shown on the plans shall be referenced to the Washington State Co-ordinate System (Lambert Grid-North Zone), **IF** existing horizontal survey control monumentation exists within one mile of the proposed project;

All vertical positions shown on the Plans shall be based upon the National Geodetic Vertical Datum, or other published datum, **IF** existing bench marks are located within two miles of the proposed project.
 5. **Control and Mapping Survey Standards:**
 - a) *Horizontal control surveys* shall meet or exceed 4th Order Standards and procedures;

- b) *Vertical Control surveys* shall meet or exceed 3rd Order Standards and procedures;
 - c) *Topographical and Planimetric Mapping* may be performed by ground or aerial methods, and shall meet or exceed the standards and procedures set forth by the American Congress on Surveying and Mapping, (ACSM), for the specified mapping type, and contour map interval required;
 - d) *All projects shall establish a minimum of two (2) on-site permanent survey control monuments* which establish coordinate position and elevation. The control monuments shall be shown on the plans.
6. **Detailed Topography:** Show existing and proposed contours at two-foot intervals (five-foot intervals for slopes greater than 15 percent, ten-foot intervals for slopes greater than 40 percent) contour maps shall show sufficient spot elevations to delineate the perimeter and depth of specific features (swamps, bogs, wet areas, swales, floodplains, streams, depressions, channels, etc.). If photogrammetric methods are employed, the surveyor shall field verify all roadway and stream centerlines, floodplains and along drainage tracts, easements, and conveyance systems. Contours shall extend 50 feet beyond property lines to resolve questions of setback, cut and fill slopes, drainage swales, ditches, and access or drainage to adjacent property.
7. **Surface Water Discharge:** Provide ground surface elevations for a reasonable "fan" around points of discharge extending at least 50 feet downstream of all point discharge outlets.
8. **Location of Existing and Proposed Stormwater Improvements:** Show the type, size and location of all existing and proposed stormwater facilities; include both on-site and off-site systems.
9. **Plan View - General:** (at a minimum, show and clearly label)
- a) *Property boundaries*
 - b) *Structures within 25 feet of property boundaries and all structures within the proposed site*
 - c) *Dimensions of easements*
 - d) *Dimensions and area of total property*
 - e) *Roads and rights-of-way*
 - f) *Sanitary sewers and water utilities*
 - g) *Other pipeline and transmission line utilities*
 - h) *Common open space*
 - i) *North arrow*
 - j) *Bar scale*
 - k) *Grid coordinates*
 - l) *Control monuments and benchmarks*
 - m) *Horizontal and vertical datum*
 - n) *Engineer's certificate/ seal*
10. **Plan View - Drainage Conveyance:** (at a minimum, show and clearly label)
- a) *All catch basins and curb inlets* (sequentially numbered, starting from the furthest downstream structure)

- b) *Existing storm drainage facilities* (represented in dashed or half-toned lines and labeled as existing)
 - c) *Existing storm drainage facilities* (noted as "existing to be removed" where applicable)
 - d) *Slope, length, diameter, class and material* for all pipes, culverts and stub-outs. Material may be noted in the plan notes.
 - e) *Catch basins* (clearly labeled as to size and type or indicate in the plan notes)
 - f) *Downspout or footing drain stub-out locations* to all lots intending to connect to the storm drainage detention/retention system. Stub-outs should be located to allow gravity flow from proposed structures and impervious surfaces, and connect to a storm drainage system.
 - g) *Horizontal and vertical datum, benchmark locations and elevations* (included on each plan sheet)
 - h) *Stub-out locations for known future pipe connections*
 - i) *Drainage easements, tracts, access easements, buffers, and building setback lines.* Show dimensions, type of restriction and use.
 - j) Using arrows, *indicate drainage direction of hydraulic conveyance systems*
 - k) *Horizontal scale/Bar scale*
11. **Profiles - Drainage:** (at a minimum, show and clearly label)
- a) *Existing and proposed center line profiles* at 50-foot stations and at significant ground breaks and topographic features
 - b) *Size, type and location, and details of behind curb/gutter/sidewalk perforated drains*
 - c) *Profile of gutter flowline on curb/gutter curve return*
 - d) *Appropriate construction centerline*
 - e) *Stationing and centerline offset* of facilities and structures
 - f) *Design profile of storm sewer pipeline* with stationing the same as shown on the horizontal plan, reading from left to right, to include equations at intersecting pipe runs
 - g) *Location and size of energy dissipaters*
 - h) *All roadway drainage elements* that are within the rights-of-way or easement
 - i) *Slope, length, size, class and type for all pipes*
 - j) *Inverts of all pipes/culverts and the elevations of catch basin grates or lids.* If the plan and profile elements are on separate sheets, then the elevations of catch basin grates or manhole lids and pipe inverts shall appear on both the plan view and profile view
 - k) *For pipes that are proposed to be within 2 feet or less of finished grade,* dimension the minimum cover requirements and show structural bridging design
 - l) *Roadway stationing and offset for all catch basins,* if pipeline is roadway related
 - m) Whenever feasible, *show profile aligned underneath the plan view*
 - n) *Vertical and horizontal scale*
 - o) *Label all match line locations*
 - p) *Location of all available existing and proposed gas, electrical, water and sanitary sewer or other utility crossings*

- q) *Note indicating crossings of any utilities wherein depth of cover is unknown*
 - r) *Energy dissipater locations*
 - s) *Identify horizontal and vertical datum used. Show benchmarks and Datum*
12. **Detention/Retention Details:** (at a minimum, show and clearly label)
- a) *Pre-development and finished grade contours at two-foot intervals*
 - b) *Maximum water surface elevations for design storm event under consideration*
 - c) *At least two cross sections through pond, one cross section must include the restrictor. Calculate and show pond design capacity.*
 - d) *Location and detail of emergency overflows and spillways*
 - e) *Location of access road to control manhole and ponds*
 - f) *Invert elevations of pipe, inlets, tanks, vaults and spot elevations of pond bottoms*
 - g) *Plan and section view of all energy dissipaters, including rock splash pads, specify size of rock*
 - h) *Plan and section view of restrictor/control structure with orientation of all inlet pipes, outlet pipes and T-section; include invert elevations*
 - i) *Specify soils and compaction requirements for pond construction*
 - j) *The size, type (or in plan notes), invert elevation, slope and length of all pipes*
 - k) *Dimension all berm widths*
 - l) *Show on plan/profile **OR** transmit to the Technical Administrator a report which details variances, if any, of the following hydraulic or hydrologic data materially at variance with the values contained in the Design Report:*
 - i. *Pipe and Channel Conveyance Systems, locations, velocities, quantities or size. Variations in size or type of flow restrictions*
 - ii. *Pre- and post-development hydrographs and level pool routing for each design storm under consideration*
13. **Infiltration System Details:** The type of structures, material specification, accessibility for maintenance, safety measures, easement requirements, and hydraulic/structural design methods to be used for infiltration systems are the same as required for detention/retention basins. At a minimum, show and clearly label the following:
- a) *Pre-development and finished grade contours at two-foot intervals for infiltration basins*
 - b) *At least two cross sections through pond or trench*
 - c) *Location and detail of emergency overflows and spillways*
 - d) *Location of access road to pond. Inverts of pipe, inlets, and spot elevations of pond bottoms*
 - e) *Plan and section view of all energy dissipaters, including rock splash pads; specify size of rock*
 - f) *Soil log locations, a minimum of one soils log required for each 5,000 square feet of infiltration basin area and in no case less than three soil logs per basin. Soil logs shall extend five feet below infiltration system base*

- g) *The size, type, invert elevations, slope and length of all pipes*
 - h) *Inverts and top elevations of inlets, and spot elevations of pond bottoms*
 - i) *Depth from bottom of facility to seasonal high ground water level.*
14. **Water Quality Facility Details:** (at a minimum, show and clearly label the following)
- a) *The location, elevations and dimensions of biofiltration swales and vegetative filter strips*
 - b) *The location and elevations of the "on-line" and "off-line" system*
 - c) *The permanent presettling basin location, elevations and dimensions*
 - d) *The location and elevation of log or rock check dams*
 - e) *Maintenance access easements*
 - f) *Cross-section dimension and slope of biofiltration swale or trench*
 - g) *Longitudinal slope of bio-filtration facilities*
 - h) *Type, location and density of all vegetation to be installed*
 - i) *Hydraulic and biologic characteristics of system, design flow quantities, velocities and bio-contact time shall be shown on plans or submitted to the technical administrator by separate report.*
15. **Maintenance and Easement Agreements:** The Stormwater Management Plans and Specifications shall be accompanied by an executed set of documents including all required on-site and off-site drainage easement agreements and provisions for maintaining facilities such as detention/retention ponds (see Section 220 for details.)
16. **Plans Certification:** All Design Plan Sheets shall bear the seal and signature of the Engineer of Record in the following form:

ENGINEER'S DECLARATION

"I, _____, a Professional Engineer registered in the State of Washington as a Civil Engineer, do hereby declare that this plan was prepared by, or under my personal supervision, that this plan was prepared in accordance with generally accepted engineering practices and that the proposed facilities shown hereon are consistent with the design recommendations contained in the design report, prepared by _____ dated _____. I hereby affirm that, to the best of my knowledge, information and belief, this plan was prepared in full compliance with the Whatcom County Stormwater Ordinance, Whatcom County #94-022, and in compliance with the Whatcom County Development Standards and all Technical Standards adopted thereunder; EXCEPT as specifically set forth under "Exceptions to Whatcom County Standards," shown hereon."

**ENGINEER'S
SEAL**

Engineer's Name and
Registration Number

Registration
Expiration

Date _____, 19 __

Section 217 - CONSTRUCTION ENGINEERING

All temporary erosion and sediment control and storm water management facilities shall be installed and constructed in accordance with the approved plans, specifications and approved change orders.

All construction shall be monitored, inspected, and tested by the construction engineer.

A. Construction Engineer: The construction engineer shall be a registered professional Civil Engineer in the State of Washington.

1. The construction engineer shall act as the owner's agent during the course of construction for all engineering matters related to construction.
2. The construction engineer shall conduct and arrange for all inspections and testing of constructed facilities which are required by these standards.
3. The construction engineer shall require all other testing, inspection and construction surveillance, which in the engineer's opinion is necessary to assure that the stormwater facility has been constructed in accordance with the approved plans, specifications and change orders.
4. Construction shall be monitored, inspected, tested and approved by the construction engineer.

B. Preconstruction Conference: Following the approval of plans and prior to commencement of construction, the owner, contractor, construction engineer, and the Technical Administrator will meet at a mutually agreed upon time and place. The purpose of the meeting will be to:

1. Establish the individuals who will act as the Technical Administrator's representative, the owner's construction engineer, the construction surveyor, and the contractor's representative during the construction of the project.
2. Review and clarify any contractor questions and concerns.
3. Define all contractor required permits and bonding requirements, and provide necessary application forms to contractor.
4. Review contractor's work sequence and schedule.
5. Discuss traffic control measures to be implemented by contractor.
6. Discuss temporary erosion control and water quality control measures to be

implemented by the contractor.

7. Review all required testing to be performed in connection with the construction.
8. Review all required inspection to be performed by the construction engineer, and by the Technical Administrator.
9. Review change order procedures and approval process.
10. Review construction survey requirements.

The Technical Administrator will prepare and distribute minutes for those in attendance.

C. Change Orders: Changes to the approved Plans and Specifications shall require an approved Change Order. Change Orders shall be authorized by the owner, and approved by the Construction Engineer and the Technical Administrator, and shall:

1. Be prepared by the construction engineer in written form.
2. Contain a complete description of the nature of and reason for the proposed change.
3. Include appropriate drawings, details, and engineering analysis supporting the proposed change.
4. Be copied and transmitted to the contractor, owner, construction engineer and the Technical Administrator.

D. Inspection: The construction engineer shall provide inspection to ensure that construction activities are in accordance with the approved plans and specifications, and shall conduct a minimum of two general inspections each week during the construction period, and shall conduct specific inspections:

1. Upon completion of temporary erosion and sediment control facility.
2. Upon completion of clearing activity.
3. Upon completion of construction surveys, and prior to installation of all structures, pipelines and conveyance systems.
4. Upon completion of all earth excavation activity.
5. Upon completion of all structures and pipelines.
6. Upon installation of permanent erosion control vegetation.
7. Final inspection.

E. Testing: The Engineer shall perform those tests determined to be appropriate to

ensure that the facility will perform in accordance with the design criteria and approved plans and specifications.

- F. Construction Surveys:** All structures, pipelines, ponds and conveyance systems shall be constructed to line and grade from survey control stakes and monuments established by a Professional Land Surveyor registered in the State of Washington. Construction survey tolerance and allowable misalignment shall not exceed 50% of the amounts of construction tolerances set forth in WSDOT/APWA specifications.
- G. Construction Compliance Assurance:** Following the final inspection and completion of all construction, the construction engineer shall prepare and submit to the Technical Administrator correspondence stating the date of completion of construction, together with the following As-Built statement:

"I hereby affirm that the improvements shown on page ____ through page ____ of plans prepared by _____, dated _____, 19__ have been inspected and tested by the undersigned, and that the improvements are complete and have been constructed in conformance with the plans and specifications and change orders approved by the Technical Administrator."

**ENGINEER'S
SEAL**

*Engineer's Name and
Registration Number*

Registration
Expiration

Date _____, 19 __

- H. Construction Cost Estimate Certification:** Prior to the authorization of performance or maintenance bonds, the construction engineer shall submit a construction cost certification to the Technical Administrator with the following statement:

"I hereby affirm that this construction cost estimate was prepared under my direction, and represents the cost of construction to complete the items shown thereon, all in conformance with the approved plans and specifications prepared by _____, and dated _____."

**ENGINEER'S
SEAL**

*Engineer's Name and
Registration Number*

Registration
Expiration

Date _____, 19 __

- I. As-Built Surveys:** Upon completion of the improvements shown in the approved plans, a set of certified As-Built plans shall be prepared and submitted to the County for review and permanent record. As-Built plans shall be prepared and certified to by a Professional Land Surveyor, registered in the State of Washington.

The As-Built plans shall reference all improvements to the established project horizontal and vertical datum, and shall show:

1. Project boundary bearings, dimensions and area
2. Bar scale and north arrow
3. All rights-of-way and easement dimensions within project
4. Horizontal location, invert elevation and top elevation of all drainage structures
5. Location, slope, size and type of all pipelines, ditches and water conveyance elements, including bearings and distances between structures
6. Location, elevations, slopes and dimensions of all biofiltration swales
7. Location, elevations and dimensions of all detention and all retention facilities:
 - a) Show a one foot contour interval of all ponds, including interior and exterior surfaces
 - b) Location, type, invert, and top elevations of control structures
 - c) Location, dimensions and elevations of emergency spillways
 - d) Location and invert elevation of all inflow and outflow pipelines

J. As-Built Survey Statement:

"I hereby affirm that this plan accurately depicts the locations and elevations of constructed drainage improvements which are shown hereon as of this date."

**LAND SURVEYOR'S
SEAL**

*Land Surveyor's Name and
Registration Number*

Registration
Expiration

Date _____, 19 __

Section 218 - BONDING AND SECURITIES

A. Performance Securities: In lieu of completing required drainage improvements prior to plat recording or development approval, the owner may post a financial security device, with approval from the Technical Administrator's office, to guarantee completion of said improvements and the financial assurance process shall comply with the following conditions:

1. The security shall be equal to 125% of the engineer's certified construction cost estimate or 150% of the construction cost estimate (up to \$10,000 project cost) if not certified.

2. The security shall be of a form approved by the Prosecuting Attorney's Office. Types of securities include, but are not limited to, cash deposits, assigned savings accounts, deed of trust on real property and surety bonds.
3. The security shall be for one (1) year at which time it may be extended at the option of the Technical Administrator. A new security amount will be calculated at a time of any extension.
4. The financial security device shall specify what improvements are covered and shall establish a date for completion of the improvements.
5. The security may be used by the Technical Administrator to make the required improvements if the improvements are not installed in accordance with the time specified in the financial security device.
6. On new drainage facilities, ninety (90) percent of the security may be released upon completion and approval of the work by the Technical Administrator. The remaining ten (10) percent or \$5,000 (whichever is greater) shall be held until the facilities are provisionally accepted and a maintenance security has been received.
7. On existing established County drainage facilities, ninety (90) percent of the security may be released upon completion of the work and approval by the Technical Administrator. The remaining ten (10) percent or \$5,000 (whichever is greater) may be released upon receipt of the maintenance security.
8. The County may require financial assurance for the proper performance and repair of temporary erosion and sediment control facilities when it determines that there is a likelihood that sensitive downstream areas will be significantly impacted as a result of the project.

B. Maintenance Bonding Securities: The owner shall post a maintenance security with the Technical Administrator's office for drainage facilities which conforms to the following:

1. The security shall be in effect for two years from the date of provisional acceptance of new drainage facilities.
2. The maintenance security shall be for an amount of ten percent (10%) of the engineer's construction cost estimate or \$5,000 (whichever is greater).
3. The security shall cover the cost of repair of specific defects in the constructed facilities identified by the Technical Administrator during the guarantee period.
4. The release of the security on the effective date shall be for the amount of the security, minus the cost of repairs necessary to assure county final acceptance of an operating system consistent with the approved plans and specifications.

C. Encroachment Bond Permits: A surety commensurate with the extent of work to be

done on the drainage facilities, may be required and shall be posted with the Technical Administrator's Office prior to the issuance of a permit to work within County road rights-of-way.

Section 219 - TECHNICAL REQUIREMENTS

- A. General:** In some cases, proposed stormwater management techniques are simple enough so that general minimum standard requirements may replace specific engineering analysis and unique design solutions. The following Stormwater Management practices represent the mandatory minimum requirements that Whatcom County will accept without additional, design specific, engineering analysis. These requirements are intended to be conservative; however, because of the many variables involved, Whatcom County does not assure the adequacy of these minimums. The County reserves the right to require a full engineering analysis of any proposed stormwater practice or design before approval.

Whatcom County encourages engineering analysis on all proposed projects. In many cases, such an engineering analysis will demonstrate a more innovative, appropriate and economic size or type of stormwater facility.

- B. Stormwater Best Management Practices (BMPs):** It is an established common law within the State of Washington that a property owner who elects to develop lands has a legal duty to the owners of the lands lying adjacent to the proposed development site. Generally, the rules hold that a property owner who elects to develop lands has a duty to the owners of lands lying above and upstream of the site to receive and convey all ground and surface water flows when said upstream lands have established pre-development surface and ground water flows over said development site. The rules further hold that a property owner who elects to develop lands has a duty to the owners of lands lying below and downstream of the proposed development site to deliver ground and surface water flows at the pre-development peak flow rates to the pre-development locations and at the same water quality conditions which existed prior to the development.

The law presumes that land development will occur and that the developing land owner will employ reasonable and realistic BMPs to approximate the pre-development ground and surface water conditions as the test of compliance with the legal duties to the upstream and downstream property owners.

Stormwater BMPs are required as part of all development activity. BMPs which are specified in the *Washington State Department of Ecology Technical Manual*, and those set forth in this section have been pre-approved for use by the Design Engineer. The County reserves the right to require an engineering analysis of any proposed practice or design before approval. The Design Engineer may specify other BMPs which are supported by detailed engineering analysis. The use of BMPs not specifically pre-approved are subject to the review and approval of the Technical Administrator. Pre-approved BMPs are set forth as follows:

1. **Source Control of Pollution BMPs:** Source control BMPs are designed to prevent pollutants from entering stormwater by eliminating the source of pollution or preventing contact of pollutants with rainfall and runoff.

Source control BMPs may be selected, designed, and maintained according to the latest edition of the *Stormwater Management Manual for the Puget Sound Basin* Washington State Department of Ecology.

2. **Runoff Treatment BMPs:** Runoff treatment BMPs are designed to remove pollutants that are contained in runoff. Treatment BMPs utilize a variety of mechanisms to remove pollutants from stormwater including sediment, filtration, plant uptake, ion exchange, absorption, and bacterial decomposition.

Runoff treatment BMPs shall be sized to capture and treat the water quality design storm, defined as the six-month, 24 hour return storm event. A high priority for treatment shall be to infiltrate as much as practicable of the design storm runoff. Ground water recharge is only recommended when site conditions are appropriate and ground water quality will not be impaired. Direct discharge of polluted, untreated stormwater to ground water is prohibited.

Runoff treatment BMPs shall be selected, designed, and maintained according to the latest edition of the *Stormwater Management Manual for the Puget Sound Basin* Washington State Department of Ecology.

3. **Streambank Erosion Control BMPs** Streambank erosion control BMPs are designed to prevent or control the excessive erosion that typically occurs in streams located in developing watersheds. The goal of streambank erosion control BMPs is to replicate, to the extent practicable, the historical dominant discharge of the stream or channel. Excessive erosion results from increased work being done upon the stream/channel banks, which increased work is occasioned by, and primarily due to, storm events with a return frequency of one year or less.

- a. *Stormwater discharges* to streams shall control stream bank erosion by limiting the peak rate of runoff from individual development sites to the existing condition one year, 24-hour design storm event. This requirement applies only to situations where stormwater runoff is discharged directly into a stream or onto lands located within the stream drainage basin within 1000 feet of the stream. In such situations, this requirement must be met in addition to meeting the requirements of Section 219.C.1.a. (below).

- b. As the first priority, *stream bank erosion control BMPs* shall utilize infiltration to the fullest extent practicable, only if site conditions are appropriate and ground water quality is protected.

- c. *Peak runoff control BMPs* may be selected, designed, and maintained according to the latest edition of the *Stormwater Management Manual for the Puget Sound Basin* Washington State Department of Ecology.

4. Wetland Quality Control BMPs

- a. Pursuant to 9.8.10 of the Critical Areas Ordinance, wetlands shall not be used for the treatment of stormwater except when the stormwater facility meets all of the following criteria:
 - i. The use of upland sites is determined by the County to be unfeasible. Criteria for such a determination are included in the Whatcom County Development Standards chapter that addresses Environment.
 - ii. The functions and values of the existing wetland are enhanced by the creation of a constructed wetland and not materially degraded by its use in stormwater management.
- b. Upon meeting the above criteria, constructed wetlands may be located in a Category III Wetland when the existing condition of the wetland is degraded (See definition and CAO for details).
- c. Wetland quality control BMPs are designed to prevent or control the degradation of water quality entering regulated wetland eco-systems. The requirements of this section apply only to situations where stormwater discharges through a conveyance system into a wetland. In such situations, the requirements of this section must be met in addition to meeting the requirements of 16.16.600, of the Whatcom Code.
 - i. Discharges to wetlands shall approximate the hydro-period and flows of existing site conditions to the extent necessary to protect the important characteristic uses of the wetland.
 - ii. Prior to discharging to a wetland, alternative discharge locations shall be evaluated. Natural water storage and infiltration opportunities outside the wetland shall be optimized, to the extent practical.

C. Minimum Requirements

1. **Storm Runoff - Design Flows for Runoff Management:** Stormwater runoff shall be controlled to be consistent with the following:
 - a) *Post-Development Stormwater Control:* Post development runoff shall be limited to the peak rate of runoff for the existing site condition as follows:
 - i. 1 year, 24-hour, duration design storm event when applicable to Section 219.B.3.a
 - ii. 2 year, 24-hour, duration design storm event
 - iii. 10 year, 24-hour, duration design storm event
 - iv. 25 year, 24-hour, duration design storm event
 - v. 100 year, 24-hour, duration design storm event

This requirement may be modified if the subject property lies within a drainage basin covered by a County approved Drainage Basin Plan and post-development peak runoff conforms with the requirements of the plan.
 - b) *Water Quality Design Storm and Treatment Facilities:* Stormwater

treatment facilities shall be sized to treat the post development peak rate water quality design storm, defined as the six month, 24-hour return period storm.

- c) *Existing Drainage to be Maintained:* Off-site surface water drainage entering the site shall enter and leave the site at, or as near as practical to, their existing locations. Energy dissipaters shall be provided, as necessary, to minimize downstream stormwater damage. There shall be no significant diversions at the inlet or outlet locations, unless previously authorized by an approved Basin Plan or approved by affected property owners.

D. Stormwater Conveyance Requirements: Stormwater conveyance systems shall be required to convey the peak design storm flow. New conveyance systems may be constructed of either vegetation-lined open channels or closed pipeline systems. These systems will be installed in accordance with the following:

1. **Biofiltration:** Conveyance design may incorporate grass swales and other means of biofiltration for surface water. Where existing open ditch drainage provides biofiltration, the drainage should not be enclosed unless alternative, additional stormwater treatment has been provided which would replace the lost biofiltration function.
2. **Fish Passage:** Streams or channels which are populated with fish shall not be altered in such a manner that the alteration obstructs or impairs the passage of fish.
3. **Design Parameters:** Stormwater conveyance systems shall be designed as follows:
 - a) *Existing Open Ditches:* Existing ditches shall remain open where acceptable. Open channel systems shall be considered acceptable if:
 - i. the channel gradient generally does not exceed five percent;
 - ii. no modification to currently adopted standard roadway cross-sections in these Standards are necessitated by the channel; and
 - iii. the channel will be accessible for maintenance.
 - b) *Rip-rap or closed systems* or other approved channel stabilization methods are required if:
 - i. the channel gradient generally exceeds five percent or erosion potential is high;
 - ii. the closed system does not require currently adopted standard roadway cross-sections in these Standards to be changed; or
 - iii. the channel is inaccessible for maintenance.
 - c) *Design Storm Events:* To minimize property damage due to flooding, all pipe, ditch and channel conveyance systems shall be designed to convey the post development 25 year storm event. To minimize the threat to loss of life due to flooding, all

developments shall demonstrate that a floodway system exists that meets the following criteria:

- i. The floodway system is capable of conveying the flows from a post development 100 year flood event to the detention facility; and
- ii. the location and nature of the floodway will not endanger human life.

4. **Methods of Hydraulic Analysis:** Two methods of hydraulic analysis using Manning's equation may be used for the analysis of pipe systems. The first method is the Uniform Flow Analysis Method and is used for the preliminary design of new pipe systems. The second method is the Backwater Analysis Method and is used to analyze the capacity of both proposed, and existing, pipe systems (See DOE Manual for details).
5. **Methods of Hydrologic Analysis:** The determination of pre- and post-development runoff may be computed using the following established methods:
 - a) *The Modified Rational Method* may be used only with the following limitations:
 - i. For use in predicting a conservative peak flow rate to be used in determining the required capacity for conveyance elements.
 - ii. Drainage sub-basin area cannot exceed 10 acres for a single calculation.
 - iii. The time of concentration cannot exceed 60 minutes.
 - b) *The Modified Rational Method* shall be employed to determine peak flows for purposes of sizing of conveyance systems from basins where area is less than 40 acres.
 - c) *The SCS Unit Hydrography method* or other approved computer models using recorded or synthetic data shall be used for computing runoff for design of detention, retention and water quality assurance systems, and may be used to compute peak runoff flows for design of conveyance systems 40 acres or greater.
6. **Location of Underground Drain Lines:** Closed (underground) drain lines shall not be located with their centerline closer than ten feet to any building footing and five feet to any property line separating adjacent lots or tracts.
7. **Open Channel Stormwater Systems:** Open channel conveyance systems shall be designed and installed in compliance with the following:
 - a) *System Sizing:* Open channel drainage, including culverts, shall be sized for the design storm in accordance with Section 219.C.3.c and by determining the maximum allowable headwater or flow elevation to which water may rise without damage to private property or the public road or over-topping existing stormwater facilities.
 - b) *Freeboard:* One foot minimum freeboard shall be provided between the design flow elevation and the top of banks.
 - c) *Side Slopes:* Channel and ditch side slopes, as shown in the stormwater plans, shall be stable. Minimum side slopes shall be 2:1.
 - d) *Maximum Channel Velocity:* Maximum channel velocities shall be consistent with channel stability. The maximum allowed velocity shall be

- eight feet per second (fps). Bank stabilization is required when the design flow velocities of constructed channels exceeds five feet per second (fps).
- e) *Minimum Velocity*: Minimum allowed design velocity shall be 0.5 fps unless functioning for biofiltration purposes.
 - f) *Channel Improvements - Erosion Areas*: Where erosion is a potential problem due to stormwater discharge from a culvert, a rock lining or other energy dissipater shall be provided.
 - g) *Erosion Control*: Means of preventing erosion along new channels, ditches, and at pipe outfalls, is required and shall be shown on the Stormwater Management Plans and Specifications as follows:
 - i. The channels at points of discharge from culverts and storm sewers shall be rock-lined with rip-rap.
 - ii. The rock lining shall extend for a minimum distance of eight feet from the point of culvert or stormwater discharge and shall have a width of three feet in excess of the diameter of the culvert or storm sewer.
 - iii. In addition, special outlet structures serving as energy dissipaters may be required depending on the erosion potential of existing soils.
 - h) *Design of Cross Sections*: Preferred conveyance ditch cross sections are shown in standard plans, details, and notes (Appendix II).
 - i) *Rock Channel Liners*: Rock lining shall meet the following requirements:
 - i. Rock gradient shall be as follows, at a minimum:
 - Passing 8-inch square sieve 100%
 - Passing 6-inch square sieve 40%
 - Passing 2-inch square sieve 0-10%
 - ii. Rock shall be placed so as to form a firm, dense protective mat that conforms to the design surface of the ditch. Individual rocks shall not protrude more than three inches from that surface. Actual ditch dimensions shall be based on calculated stormwater flows.
 - j) *Open Channel Easements*: If maintenance is required, channels crossing private property shall have a minimum easement width of the channel cross section plus 15 feet on one side.
 - k) *Cross Culvert Sizing*: Cross culverts shall be sized for the design storm in accordance with Section 219.C.2.c. Where open channels intersect public roads, the minimum diameter cross culvert shall be 18 inches, unless otherwise approved.
 - l) *Design velocities* shall be shown in the computations for all stormwater culverts.
 - m) *Culverts crossing driveways* within the rights-of-way shall be a minimum of 12-inches.
8. **Closed Conveyance Systems**: Closed or piped conveyance systems shall be designed and installed in conformance with the following:
- a) *The centerline of drain line* shall not be located closer than:
 - i. Ten (10) feet from building footing
 - ii. Five (5) feet from property line

- b) *Pipe Sizing:* Piped or closed stormwater systems shall be sized to convey the design storm events set forth in Section 219.C.2.c. An hydraulic analysis of the proposed pipeline system shall be performed to ensure that the conveyance system capacity is not exceeded.
 - c) *Maximum Spacing of Structures:* Maximum spacing between inlets or catch basins shall be 150 feet on grades less than 1% and 200 feet on grades from 1% to 3%. Otherwise, maximum spacing shall be 300 feet on grades over 3%. Maximum spacing of inlets or catch basin structures may be determined by an engineering analysis of gutter flow and inlet capacity.
 - d) *Energy Loss Allowance:* Allowance for energy loss due to turns, structures, pipe size change, etc. shall be included in the design of the stormwater facilities.
 - e) *Minimum Pipe Sizes:*
 - i. Storm drain pipe other than pipe connecting street inlets to main storm drains shall be a minimum of ten inches in diameter in accordance with WSDOT/APWA Standard Specifications.
 - ii. Storm drain pipe connecting street inlets to main storm drains by structure, i.e., catch basin or manhole, shall be a minimum of eight inches in diameter with a maximum length of 50 feet.
 - f) *Gradients:* Storm drain gradients shall be designed to assure a minimum scouring velocity of three feet per second at the peak design flow of a ten year event.
 - g) *Pipe Anchors:* All pipelines shall be analyzed for structural stability if the pipe gradient exceeds 15%. Gravity anchors shall be installed at suitable locations to insure pipe stability.
 - h) *Bedding and Backfill:* Pipe bedding and trench backfill requirements shall be as shown in Appendix II, and as specified in the State Standard Specifications.
 - i) *Pipe Cover:* Storm drain pipe under public roads shall have a minimum of two (2) feet of cover. Culverts under driveways shall have a minimum of one (1) foot of cover.
 - j) *Debris Barrier:* Trash racks (and rug-rat barriers), will be installed on all pipes 10 inches or larger entering a closed pipe system and all outlet pipes 15 inches or larger.
9. **Stormwater Easements:** Storm sewers crossing private property shall have a minimum 15-foot wide easement. Wider easements may be required by the County for deep storm sewers, large pipe, unstable soil situations, or other special circumstances. Drainage stormwater easements shall be located within a single lot or tract, except where the drain line may involve additional properties or unless otherwise approved by the County.

10. **Pipe Material Requirements:**

a) *Maximum pipes sizes shall be as follows:*

Catch Basin Type ⁽¹⁾	Maximum Pipe Diameter	
	⁽²⁾ CMP, Spiral Rib CPEP, HDPP, PVC	Concrete and Ductile Iron
Inlet ⁽⁴⁾	12"	12"
Type 1 ⁽³⁾	18"	12"
Type 1 L ⁽³⁾	24"	18"
Type 2-48-inch dia.	30"	24"
Type 2-54-inch dia.	36"	30"
Type 2-72-inch dia.	54"	48"
Type 2-96-inch dia.	72"	72"

- (1) *Catch basins, including manhole steps, ladder, and handholds shall conform to Whatcom County Standards (see Appendix II).*
- (2) *Generally these pipe materials will be one size larger than concrete due to smaller wall thickness. However, for angled connections or those with several pipes on the same plane, this will not apply.*
- (3) *Maximum 5 vertical feet allowed between grate and invert elevation.*
- (4) *Inlets without drop sections may be used provided they are connected to a mainline catch basin.*

- i. Catch basin (or manhole) diameter shall be determined by pipe orientation at the junction structure. A plan view of the junction structure, drawn to scale, will be required when more than four pipes enter the structure on the same plane, or if angles of approach and clearance between pipes are of concern. The plan view (and sections if necessary) must ensure a minimum distance (of solid concrete wall) between pipe openings of 8 inches for 48-inch and 54-inch catch basins and 12 inches for 72-inch and 96-inch catch basins.
- ii. Evaluation of the structural integrity for H-20 loading may be required for multiple junction catch basins and other structures.
- iii. Catch basins shall be provided within 50 feet of the entrance to a pipe system to provide for silt and debris removal.

b) *Pipe material, joints and protective treatment shall be in accordance with APWA Standard Specifications Section 9.05 and modified as noted below:*

- i. Material allowed in public rights-of-way
 - Plain concrete (PC) - 12-in. min. diameter, and only as driveway culvert
 - Ductile iron (DI) - Class 50 or 52
 - Reinforced concrete pipe (RCP)
 - Corrugated high density polyethylene pipe (CPEP)

- [smooth interior]
- Polyvinyl chloride (PVC) sewer pipe (SDR 35 or thicker, and meet requirements of ASTM D3034)
- High density polyethylene pipe (HDPP)
- ii. Subject to approval by the Technical Administrator, other pipe materials and methods, such as cast-in-place concrete pipe, may be used provided that conditions make it feasible, recognized specifications are available to control quality, and acceptable user experience with the product can be shown.
- c) *Material allowed on private property* (in addition to material allowed in public rights-of-way).
 - i. Galvanized corrugated steel pipe (CMP)
 - ii. Galvanized steel spiral rib pipe (CMP)
 - iii. Corrugated aluminum pipe (CMP)
 - iv. Corrugated high density polyethylene pipe (CPEP) (single wall)

11. Drainage Structure Requirements

- a) *Drainage access structures* are required at:
 - i. All changes in horizontal or vertical alignment. Minor horizontal curvature in pipe less than 15 degrees may be allowed without access structures, depending on pipe size, street alignment, and degree of curvature. Maximum joint deflection shall be in accordance with the manufacturer's recommendations.
 - ii. All connections where the diameter of the lateral pipe is greater than one-half of the main line pipe.
 - iii. All changes in pipe size and pipe material type.
 - iv. At a spacing no greater than 600 feet.
- b) *On storm drains with depths less than five feet to flow line*, catch basins may be one of the following:
 - i. Catch Basin Type 1
 - ii. Catch Basin Type 1L.
 - iii. Catch Basin Type II - 48 inches
- c) *On storm drains with depths five feet and over to flow line*, joining or inletting structures shall be selected from the following:
 - i. Catch Basin Type II - 48 inches
 - ii. Catch Basin Type II - 54
 - iii. Catch Basin Type II - 72
 - iv. Catch Basin Type II - 96
- d) *Where structure is needed for access or for juncture of storm drains*, but not for catchment of silt, the structure shall be one of the following types of manhole:
 - i. Manhole Type I - 48 inches
 - ii. Manhole Type II - 54
 - iii. Manhole Type II - 72
 - iv. Manhole Type II - 96
 - v. Manhole Type III - 48 or 54
 - vi. Manhole Type III - 72
 - vii. Manhole Type III - 96
- e) *Provisions contained in the APWA Standard Specifications* shall apply, unless otherwise specified, to catch basins and curb inlets as well as

- manholes.
- f) *Subject to approval by the Technical Administrator*, drainage structure materials other than reinforced concrete may be used provided that required specifications are available to control quality and acceptable user experience with the product can be shown.
 - g) *When drainage structures do not serve as inlet*, a solid cover, or equal, shall be used.
 - h) *Vaned grates* shall be used on all structures located on or immediately downstream from gutterline grades which exceed 6%.
 - i) *On drainage structures under vertical curb and gutter*, a through-curb inlet frame shall be used where conditions limit the effectiveness of a flat surface inlet. Examples of such conditions are road grades exceeding 10% and likelihood of clogging from leaf fall or other debris, especially in sag vertical curves.
 - i. When used with this through-curb inlet frame, the standard grate shall, in all cases, be ductile iron.
 - ii. Installation of the through-curb inlet shall be as shown in standards plans and notes (See Appendix II).
 - j) *Locking bolts* shall be provided on frames and grates or covers when:
 - i. Location is off the traveled portion of roadway or otherwise limits public surveillance.
 - ii. Structure is flow restrictor/oil pollution (FROP) control device.
 - k) *Unless otherwise specified, cast iron products* shall conform to ASTM Designation A 48 Class 30 and ductile iron to ASTM Designation A 536 Grade 80-55-06.

12. Stormwater Discharge Control Requirements

- a) *Facilities Required*
 - i. Stormwater discharges from the project must be treated and controlled by a suitable combination of BMPs.
 - ii. Stormwater detention systems shall be designed in accordance with Best Management Practices. Volumes II, III, and IV, as amended, of the DOE Technical Manual may be used as reference in the design and construction of stormwater facilities.
 - iii. The following technical requirements apply to the construction of all stormwater facilities.
 - Stormwater detention/retention facilities: Stormwater detention/retention facilities shall be sized according to computational requirements specified in Section 219.C.1.a.
 - Emergency Overflow: All stormwater storage facilities shall make provisions for emergency overflow. The impacts of a facility failure shall be analyzed to determine on-site and off-site effects.
 - Design of emergency overflow spillways require the analysis of a broad-crested trapezoidal weir, able to safely pass the 100-year, 24- hour post development design storm. The emergency overflow spillway shall be armored and located to direct overflows safely toward the downstream conveyance system.

- All detention/retention or infiltration ponds shall have a minimum of one foot (12") of freeboard above the maximum design water elevation of the 100-year post development runoff rate.
 - Installation Prior to Paving and Building Construction: All required detention/retention facilities must be constructed and in operation prior to paving and building construction.
 - Access Roads: Minimum access easement width shall be 20 feet. Minimum access roadway width shall be 10 feet, surfaced with at least six inches of gravel, grades shall not exceed 30% without County Engineer's approval. All surfaces on grades over 15% shall be treated with a 2-1/2 inch thick asphaltic treated base (ATB).
 - Facilities Not Permitted in Road Rights-Of-Ways: Open detention/retention ponds and infiltration facilities shall not be located in dedicated public road rights-of-way areas without the consent of the County Engineer.
 - Flood Protection for Public Safety: The design of detention/retention facilities shall incorporate adequate measures to protect the public from the inherent hazards of such facilities including health risks associated with a failure of the system. All detention/retention ponds shall be designed and constructed to attenuate the 100-year post development flood event, and to release the 100-year event at the pre-development 100-year peak flow rates. All facilities shall be designed in such a manner that system failure will not cause flooding that threatens the safety of the public. Special protective measures may be required by the Technical Administrator to safeguard public health and safety.
- b) *Design Criteria:* Detention and retention facilities shall be designed in conformance with the following:
- i. Detention/Retention facilities may include open basins, wet ponds, constructed wetlands, roof-top storage, parking lot ponding, underground storage, gravel filled trench storage, infiltration trenches, or combinations of any of the above, or other facilities as approved by the technical administrator.
 - ii. Bottom Gradient: Constructed and graded detention ponds shall be sloped no less than 0.005 ft/ft. (.5%) toward the outlet for drainage.
 - iii. Side Slopes: Side slopes for earth-lined detention/retention ponds should be no steeper than three horizontal to one vertical, unless access control is provided. Flatter slopes are encouraged. Slopes in excess of 3:1 shall be fenced. All pond slopes shall be stabilized to prevent slope failure.
 - iv. Design Methods: Acceptable computational methods for sizing a peak rate control facility shall be based upon design flow requirements specified in Section 219.C.1.a.
 - v. Hydrologic Analysis, Antecedent Condition: The infiltration rate of soil is highly dependent on the initial level of soil moisture,

commonly referred to as the antecedent moisture condition. Catchments with low initial soil moisture are not conducive to high runoff response. Conversely, catchment basins with high initial moisture are likely to produce large quantities of runoff. Most basin analyses are conducted using an average soil moisture level, known as Antecedent Moisture Condition II (average). However, using Antecedent Moisture Condition III (wet) gives a more accurate portrayal of adverse soil conditions and provides more accurate estimates of basin runoff for the Whatcom County area. The winter weather pattern of western Whatcom County usually consists of several storm systems immediately following one another. During this period, the level of soil moisture is probably not within the average range. The 1, 2, 10, 25, and 100-year recurrence storm events will most likely occur when the watershed is practically saturated from antecedent rainfalls. The designer shall use Antecedent Moisture Condition III when employing the Unit Hydrologic Method.

c) *Design for Maintenance*

- i. General: Detention/Retention facilities shall be designed and constructed to minimize the frequency and difficulty of future maintenance. The designer shall evaluate the range of potential problems that might occur with the system and determine the corrective action needed. The County will require that a Maintenance and Operations Manual be prepared by the design engineer if the system is particularly complex or will have unusual maintenance needs.
- ii. Accessibility of Facilities: All detention/retention facilities shall be accessible for maintenance and operation. Required access roads shall be provided in access easements and shall accommodate heavy equipment loading. Minimum access easement width shall be 20 feet. Minimum access roadway width shall be 10 feet, surfaced with at least six inches of gravel or equal, with grades no steeper than 30%. For grades in excess of 20%, the gravel surface shall be overlaid with 2-1/2 asphalt treated base (ATB).
- iii. Stormwater Infiltration: Infiltration is the highest priority for both runoff treatment and streambank erosion control, provided proper conditions exist for its use. Infiltration as a means of disposing of stormwater runoff shall conform to the best management practices.
- iv. Oil Pollution Control: Whenever contamination of runoff by oil, grease, or other pollutants is anticipated, an oil/water separation device, or other water quality assurance system, shall be installed. They shall be located at a point where they can be maintained, and where they will intercept floating contaminants from roadways and other sources of pollution.
- v. Maintenance Responsibility: It shall be the obligation and responsibility of the persons required to provide such temporary erosion-sediment control facilities to maintain them in a satisfactory condition and remove them when no longer needed.

Section 220 - MAINTENANCE OF STORMWATER FACILITIES

Proper Maintenance of Public and Private Stormwater Facilities is necessary to insure they serve their intended function. Without adequate maintenance, sediment and other debris can quickly clog facilities, making them useless. Rehabilitation of such facilities is expensive, and in the case of infiltration systems may be impractical. Polluted water and sediments removed during the cleaning operation must be disposed of properly.

A. General Provisions:

1. **Minimum Standards**, the following are the minimum standards for the maintenance of stormwater facilities:
 - a) *Facilities shall be inspected* according to a schedule described in the Maintenance Plan submitted with each application.
 - b) *Grassy swales and other bio-filters shall be inspected* according to a schedule described in the approved Maintenance Plan.
 - c) *Where lack of maintenance* is causing or contributing to a water quality problem, immediate action shall be taken to correct the problem.
 - d) *Disposal of waste* from maintenance activities shall be done in accordance with a process described in the approved Maintenance Plan.

2. **Maintenance Plan Minimum Requirements and Frequency of Inspection**, the following items shall be included as a minimum in the Maintenance Plan:
 - a) *Facilities shall be inspected annually* (preferably early fall), shall be cleared of debris, sediment and vegetation when they threaten to affect the functioning and/or design capacity of the facility.
 - b) *Grassy swales and other bio-filters are to be inspected annually* and mowed or replanted as necessary.
 - c) *Facilities shall be inspected annually* for evidence of rodent holes or water passing through rodent holes and provisions shall be made for their repair.
 - d) *Inspection of flow control facilities to be performed annually* and during major storms.
 - e) *Inspection every two years for accumulated sediment* that exceeds 10% of the designed pond depth.
 - f) *Annual inspection for any deterioration* threatening the structural integrity of the facility.
 - g) *Inspection and cleaning annually or after major storm events* of catch basins and manholes for sediment accumulation if the depth of deposits are equal to or greater than one-third the depth from the basin to the invert of the lowest pipe into or out of the basin.
 - h) *Other information as required by the Technical Administrator* on a site specific basis.

3. **Financial Responsibility**: Property owners are financially responsible for the inspection, maintenance, operation, or repair of stormwater systems not specifically accepted by the County through the development process. Property

owners shall maintain, operate, and repair these facilities in compliance with the requirements of the Maintenance Plan and these standards. Financial responsibility includes reimbursing the County for its costs to perform routine inspections to verify compliance, as described in the Maintenance Plan.

B. Inspection/Compliance Program:

1. **Inspection:** The County is authorized to inspect during regular working hours and at other reasonable times all stormwater systems to determine compliance with the provisions of the Maintenance Plan. The person or persons designated in the Maintenance Plan as having inspection responsibility shall maintain appropriate records of all inspection activities and of all maintenance activities. These records shall be made available to the County on request for review for compliance.
2. **Compliance:** If the County, upon inspection of the stormwater system, finds deficiencies, the County will first make a reasonable effort to locate the owner or other person(s) having charge or control of the property or portions of the property and request correction of the situation.

If, after reasonable effort, the deficiencies are not corrected and there is reason to believe the condition of the stormwater system creates an imminent hazard to persons or property, the County may execute corrective measures. Following completion of all corrective measures, the County will submit an itemized billing for all costs to the responsible party for reimbursement.

C. County Maintained Facilities: If the County determines that it is in its best interest to assume maintenance responsibility for a stormwater system, the County shall assume maintenance after the expiration of a two-year maintenance period, during which time the owner will maintain these facilities, The County shall assume maintenance only after the following have been met:

1. **The bonding requirements of these standards** have been fulfilled.
2. **The facilities have been inspected and approved** by the County at the time of acceptance.
3. **All necessary easements entitling the County** to properly maintain the facility have been conveyed to the County and recorded with the County Auditor.
4. **The method of financing and payment** for all maintenance efforts is accepted and approved by the County.

- D. Privately Maintained Facilities:** If the above conditions are not met, or if for other reasons, the County does not assume maintenance responsibility for the stormwater facility, it shall be the responsibility of the owner to make arrangements with the occupants or owners of the subject property, for assumption of maintenance consistent with the Maintenance Plan. Such arrangements shall be completed and approved prior to the end of the two year period of the developer's responsibility or in the case of plats, prior to the time of recording.
- E. Detention/Retention:** Constructed wet ponds must be managed for stormwater treatment. If these systems are not managed and maintained in accordance with these standards for a period exceeding three years, these systems may no longer be considered constructed wetlands.

Section 221 – STORMWATER SPECIAL DISTRICT

These standards apply to single family residences and duplexes on lots less than five acres (nominal) in size and that do not have common detention and water quality facilities meeting the standards of the 1996 Whatcom County Development Standards or the 1992 Department of Ecology Stormwater Management Manual for the Puget Sound Basin (or more current versions) as part of an approved comprehensive stormwater management plan for that subdivision, short subdivision, binding site plan or major development approval.

Whatcom County has established the following geographical areas as Stormwater Special Districts per WCC 20.80.634

- (a) Drayton Harbor watershed
- (b) Lake Whatcom watershed
- (c) Lake Samish watershed

The Stormwater Special District Standards can be found under separate cover titled "Stormwater Special District Standards for Single Family Residences and Duplexes on Existing Lots".

APPENDIX I. GENERAL FORMATTING

General formatting, copying, and submittal process shall include:

- A. Plan sheets and profile sheets or combined plan and profile sheets, specifications and detail sheets as required, shall be on sheet sizes 24-inch by 36-inch. Original sheets shall be good quality reproducibles, mylar or equal.
- B. Drafting details and symbols shall conform to generally accepted civil engineering drafting standards.
- C. When the plan view extends over more than one sheet, then the first sheet shall show a vicinity map, an overall development layout, with the relationship of roads, utilities, drainage, lots, and other features clearly indicated, and shall show standard notes. When more than five sheets are used, the first sheet shall show a table of contents and an index sheet.
- D. Each plan sheet shall have as a minimum the following information:
 1. Name of proposed project and owner's name.
 2. Title block showing engineers name, address, and phone number.
 3. North arrow indicator (north at top or left side of sheet).
 4. Bar Scale indicated; generally 1 inch = 50 feet with a larger scale for clarification of details.
 5. 1/4 Section, Township and Range. (First Sheet)
 6.
 - a) Vertical and horizontal scales, basis of bearing and position, benchmark location and elevation.
 - b) Standard vertical scale shall be 1 inch = 5 feet unless otherwise approved.
 - c) Clarifying details, should be done to a larger scale.
 7. Engineer's signature, seal and certification.

"I, _____, a Professional Engineer registered in the State of Washington as a Civil Engineer, do hereby declare that this plan was prepared by, or under my personal supervision, that this plan was prepared in accordance with generally accepted engineering practices and that the proposed facilities shown hereon are consistent with the design recommendations contained in the design report, prepared by _____ dated _____. I hereby affirm that, to the best of my knowledge, information and belief, this plan was prepared in full compliance with the Whatcom County Stormwater Ordinance, Whatcom County #94-022, and in compliance with the Whatcom County Development Standards and all Technical

Standards adopted thereunder; EXCEPT as specifically set forth under "Exceptions to Whatcom County Standards," shown hereon."

**ENGINEER'S
SEAL**

*Engineer's Name and
Registration Number*

Registration
Expiration

Date _____, 19 __

8. Legend, showing all symbols and line types used on the plans.
- E. First submittal will include one complete set of prints for review. Upon approval by the Technical Administrator, the original set of plans will be signed and returned to the designing engineer. Two complete sets of prints will be returned to Technical Administrator.
- F. **As-Built Submittal.** Prior to final acceptance of any drainage facility, a complete set of good quality reproducible copies of the corrected plans (mylar or equal) shall be submitted to the Technical Administrator by the designing engineer. Such drawings shall describe any and all revisions or additions to the approved plans. On each page of the as-built drawings, the construction engineer certification as shown on page 34, Section 217.G, together with the following land surveyors certification shall be shown. The land surveyor shall make the following statement:

"I hereby affirm that this plan accurately depicts the locations and elevations of the constructed improvements which are shown hereon as of this date."

**LAND SURVEYOR'S
SEAL**

*Land Surveyor's Name and
Registration Number*

Registration
Expiration

Date _____, 19 __

APPENDIX II. STANDARD PLANS, DETAILS AND NOTES

Standard Plans and Details shown in the following manuals are approved by the County. As appropriate the design engineer can submit other plans and details for approval.

1. *WSDOT/APWA Standard Plans*
2. *DOE Stormwater Management Manual (The Technical Manual)*

APPENDIX III. DEFINITIONS

Agriculture or Agricultural Activity: A condition or activity which occurs on a farm or agricultural land in connection with the commercial production of **farm products** and includes, but is not limited to marketed produce on roadside stands or farm markets; noise, odors; dust; fumes; operation of machinery and irrigation pumps; movement including, but not limited to, use of current county road ditches, streams, rivers, canals, and drains, and use of water for agricultural activities; ground and aerial application of seed, fertilizers, conditioners, and plant protection products; employment and use of labor; roadway movement of equipment and livestock, protection of damage by wildlife; prevention of trespass; construction and maintenance of buildings, fences, roads, bridges, ponds, drains, waterways, and similar feature and maintenance of streambanks and watercourses; and conversion from one agricultural activity to another.

Annual Flood: The highest peak discharge on average which can be expected in any given year.

Antecedent Moisture Conditions: The degree of wetness of a watershed or within the soil at the beginning of a storm.

As-built Drawings: Engineering plans which have been revised to reflect all changes to the approved plans which occurred during construction.

Backwater: Water upstream from an obstruction which is deeper than it would normally be without the obstruction.

Backwater Analysis: An analysis to compute a simple backwater profile (hydraulic grade line) through a proposed, or existing conveyance system for the purposes of verifying adequate capacity.

Base Flood: 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.

Base Flood Elevation: The water surface elevation of the base flood. It shall be referenced to the National Geodetic Vertical Datum of 1929 (NGVD).

Berm: A constructed barrier of compacted earth, rock or gravel.

Best Management Practice (BMP): Physical, structural, and/or managerial practices that, when used singly or in combination, prevent or reduce pollution of water. Those generally accepted engineering principals and practices which when implemented and operated according to design achieves water quality, conveyance, and discharge control.

Bio-contact Time: The amount of time (hydraulic residence time) that stormwater runoff is in contact with vegetation.

Biodegradable: Capable of being readily broken down by biological means, especially by bacterial action. Degradation can be rapid or may take many years depending upon such factors as available oxygen and moisture.

Biofilter: A designed, vegetated treatment facility where the more or less simultaneous processes of filtration, infiltration, adsorption and biological uptake of pollutants in stormwater takes place 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.

Biofiltration: The process of reducing pollutant concentrations in water by filtering the polluted water through biological materials.

Bond: A surety bond, cash deposit or escrow account, assignment of savings, irrevocable letter of credit or other acceptable means to guarantee; completion of a project's improvements, workmanship and/or maintenance.

Catchbasin: A chamber or well, usually built at the curb line of a street, for the admission of surface water to a sewer or subdrain, having at its base a sediment sump designed to retain grit and detritus below the point of overflow.

Catchline: A line where a severe slope plane intercepts a different, more gentle slope plane.

Catchment: Surface drainage area.

Channel: A feature that conveys surface water and is open to the air.

Channel Stabilization: Erosion prevention and stabilization of velocity distribution in a channel using vegetation, jetties, drops, revetments, and/or other measures.

Channelization: Alteration of a stream channel by widening, deepening, straightening, cleaning, or paving certain areas to change flow characteristics.

Check Dam: Small dam constructed in a gully or other small watercourse to decrease the streamflow velocity, minimize channel scour, and promote deposition of sediment.

Clearing: The destruction and/or removal of vegetation by manual, mechanical, or chemical methods.

Compaction: Densification of a fill or disturbed ground by mechanical means.

Constructed Wetland: Those wetlands intentionally created on sites that are not wetlands for the primary purpose of wastewater or stormwater treatment and managed as such. Constructed wetlands are normally considered as part of the stormwater collection and treatment system.

Contour: An imaginary line on the surface of the earth connecting points of the same elevation.

Contour Interval: The vertical spacing between contour lines.

Conveyance: A mechanism for transporting water from one point to another, including pipes, ditches, and channels.

Conveyance System: 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 detention/retention facilities.

Created Wetland: Those wetlands intentionally created from non-wetland sites to produce or replace natural wetland habitat (e.g., compensatory mitigation projects).

Culvert: Pipe or concrete box structure which drains open channels, swales or ditches under a roadway or embankment. Typically with no catchbasins or manholes along its length.

Dead Storage: 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.

Degradation (Water): The lowering of the water quality of a watercourse by an increase in the pollutant loading.

Degraded Wetland: A wetland that has over 80% of non-native vegetation species; including, but not limited to, reed canary grass and common grasses, hardtack, soft rusk and alder less than 25 years of age.

Depression Storage: The amount of precipitation that is trapped in depressions on the surface of the ground.

Design Engineer: 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.

Design Storm: A prescribed hydrograph 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.)

Detention: The process whereby increased surface water runoff resulting from development is temporarily stored and subsequently released at frequencies which approximate the naturally occurring runoff rates.

Detention Facility: A type of storage facility designed to temporarily impound stormwater runoff. Infiltration may or may not occur in a detention facility.

Detention/Retention Facility (D/R): To hold surface and stormwater runoff for a short period of time and then release it to the surface and stormwater management system; or 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. May also refer to a type of storage facility designed to incorporate the characteristics of both a detention and

a retention facility.

Development: Any activity that requires Federal, State, or local approval for the use or modification of land or its resource. These activities include; but are not limited to, subdivision and short subdivisions; binding site plans; planned unit developments; variances; shoreline substantial development; clearing activity; fill and grade work; activity conditionally allowed; building or construction; revocable encroachment permits, and; septic approval.

Discharge Outflow: The flow of a stream, canal, or aquifer. One may also speak of the discharge of a canal or stream into a lake, river, or ocean. (Hydraulics) 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.

Dispersed Discharge: Release of surface and stormwater runoff from a drainage facility system 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.

Dominant Discharge: Flow which is most effective in performing work on the channel, in terms of its magnitude, frequency of occurrence and duration. The frequency of occurrence is generally accepted as the 2-year storm event.

Drainage: The collection, conveyance, containment, and/or discharge of surface and storm water 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 Ditch: An artificially created watercourse constructed to drain surface or groundwater.

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 Facility: The system of collecting, conveying, and storing stormwater runoff. Drainage facilities include but not limited to all surface and stormwater runoff conveyance and containment facilities including streams, pipelines, channels, ditches, swamps, lakes, wetlands, closed depressions, infiltration facilities, detention/retention facilities, erosion/sediment control facilities and other drainage structures and appurtenances, both natural and man-made.

Drainage Structure: A catchbasin or manhole in reference to a storm drainage system.

ESCP: Erosion and Sediment Control Plan.

Emergency Overflow: Armored spillway designed to safely pass discharges in excess of the capacity of the designed principal outlet system.

Energy Dissipator: 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.

Erodible Granular Soils: Soil materials that are easily eroded and transported by running water, typically fine or medium grained sand with minor gravel, silt, or clay content. 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.

Erosion: 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:

1. **Accelerated Erosion:** Erosion much more rapid than normal or geologic erosion, primarily as a result of the influence of the activities of man or, in some cases, of the animals or natural catastrophes that expose bare surfaces (e.g., fires).
2. **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.
3. **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.
4. **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.
5. **Normal Erosion:** The gradual erosion of land used by man which does not greatly exceed natural erosion. See **Natural Erosion**.
6. **Rill Erosion:** An erosion process in which numerous small channels only several inches deep are formed; occurs mainly on recently disturbed and exposed soils.
7. **Sheet Erosion:** The removal of a fairly uniform layer of soil from the land surface by runoff.
8. **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/Sediment Control: Any temporary or permanent measures taken to reduce erosion; control siltation and sediment; 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.

Existing Site Conditions: a) For developed sites that have not had stormwater facilities previously reviewed by the county and all undeveloped sites, existing site conditions mean, the natural pre-development condition for purposes of calculating runoff characteristics. b) For developed sites that have had previous stormwater review, the existing site conditions are those that occur with the existing drainage facilities constructed per approved permits and engineering plans when required.

Filter Fabric Fence: A temporary sediment barrier consisting of an entrenched filter fabric stretched across and attached to supporting posts. The fence is used in stormwater erosion and sediment control applications to trap sediment. The filter fence is constructed of stakes and synthetic woven or non-woven, water-permeable fabric with a rigid wire fence backing where necessary for support.

Filter Strip: A strip of vegetation used to retard or collect sediment for the protection of diversions, drainage basins, or other structures. Often used in conjunction with a level spreader to keep flow from becoming channelized in the filter strip.

Fish Habitat: See **Regulatory** definition.

Flood: 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.

Flood Stage: The stage at which overflow of the natural banks of a stream begins.

Floodway: The channel of a river or other watercourse or land area that must be reserved in order to discharge the base flood.

Freeboard: The vertical distance between the design water surface elevation and the elevation of the barrier which contains the water.

Frequency of Storm (Design Storm Frequency): 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 which occur under such storm conditions would be expected to be surcharged by any storms of greater amount or intensity.

Geologist: 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.

Grade: 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.

Gradient: The inclined surface of any part of the Earth's surface, delineated by establishing its toe and top and measured by averaging the inclination over at least ten feet of vertical relief.

Grading: Any act which changes the elevation of the ground surface.

Grassed Waterway: 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.

Ground Water: Water in a saturated zone or stratum beneath the land surface or a surface water body.

Ground Water Table: 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.

Head (Hydraulics): The height of water above any plain 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.

Hydraulic Gradient: Slope of the potential head relative to a fixed datum.

Hydrograph: A graph of runoff rate, inflow rate or discharge rate, past a specific point over time.

Hydroperiod: A seasonal occurrence of flooding and/or soil saturation; it encompasses depth, frequency, duration, and seasonal pattern of inundation.

Hyetograph: A graph of percentages of total precipitation for a series of time steps representing the total time in which precipitation occurs.

Illicit Discharge: 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.

Impervious: A surface which cannot be easily penetrated. For instance, rain does not readily penetrate paved surfaces.

Impervious Surface: A hard surface area which either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development, and/or a hard 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, and oiled, macadam or other surfaces which similarly impede the natural infiltration of stormwater. Open, uncovered detention/retention facilities shall not be considered as impervious surfaces.

Infiltration: The downward movement of water from the surface to the subsoil.

Infiltration Facility (or System): A drainage facility designed to use the hydrologic process of surface and stormwater runoff soaking into the ground, commonly referred to as percolation, to dispose of surface and stormwater runoff.

Infiltration Rate: A form of measurement, usually expressed in./hr., of the movement of water through soil. Rate is dependent on soil type, ground cover conditions, and rainfall intensity.

Inlet: A form of connection between surface of the ground and a drain or sewer for the admission of surface and stormwater runoff.

Interflow: 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 wetland, spring or seep.

Intermittent Stream: 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.

Invert: The lowest point on the inside of a pipe or other conduit.

Invert Elevation: The vertical elevation of a pipe or orifice in a pond which defines the water level.

Isopluvial Map: A map with lines representing constant depth of total precipitation for a given return frequency.

Lake: A naturally or artificially created body of deep (generally greater than 6.6 feet) open water, 20 acres or greater, that persists throughout the year.

Land Disturbing Activity: Any activity that results in a change in the existing soil cover and/or the existing soil topography. Land disturbing activities include, but are not limited to clearing, grading, filling and excavation.

Large Development: Larger developments that meet or exceed the Review Thresholds under Section 207 and must comply with the minimum requirements of Section 211.

Level Spreader: A 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 are to prevent concentrated, erosive flows from occurring, and to enhance infiltration.

Manning's Equation (Hydraulics): 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.

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.

Mulching: The act of spreading organic material (hay, straw, wood fiber cellulose, etc.) to protect disturb soil.

NGVD: National Geodetic Vertical Datum 1929.

Natural Location: 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.

NRCS: Natural Resources Conservation Service (formerly SCS).

Off-site: 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.

Off-system Storage: 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.

One year, 24-hour Design Storm: Estimated to be 0.82 times the two year 24-hour storm value.

On-site: The entire property that includes the proposed development.

Orifice: 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.

Outlet: Point of water disposal from a stream, river, lake, tidewater, or artificial drain.

Overtopping: To flow over the limits of a containment or conveyance element.

Owner: The person(s) that have the legal title and/or control of the property under review or their authorized representative.

Peak Discharge: The maximum instantaneous rate of flow during a storm, usually in reference to a specific design storm event.

Percolation Rate: The rate, usually expressed as a velocity, at which water moves through saturated granular material.

Permeability Rate: The rate at which water will move through a saturated soil. Permeability rates are classified as follows:

Very slow	Less than 0.06 inches per hour
Slow	0.06 to 0.20 inches per hour
Moderately slow	0.20 to 0.63 inches per hour
Moderate	0.63 to 2.0 inches per hour
Moderately rapid	2.0 to 6.3 inches per hour
Rapid	6.3 to 20.0 inches per hour
Very rapid	More than 20.0 inches per hour

Permeable Soils: 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.

Perviousness: Related to the size and continuity of void spaces in soils; related to a soil's infiltration rate.

Post-development: Those conditions after the completion of the project under review.

Pre-development: Those conditions prior to the proposed project, existing site conditions, generally means natural site conditions.

Professional Civil Engineer: A person registered with the State of Washington as a professional Engineer in Civil Engineering.

Professional Land Surveyor: A person registered with the State of Washington to practice the profession of land surveying under the provisions of chapter 18.43 RCW.

Project: The proposed action of a permit application or an approval which requires county review.

Rational Method: 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.

Reach: A length of channel with uniform characteristics.

Receiving Waters: Bodies of water or surface water systems receiving water from upstream manmade (or natural) streams.

Recharge: The flow to ground water from the infiltration of surface and stormwater runoff.

Redevelopment: On an already developed site, the creation or addition of impervious surfaces, structural development including construction, installation or expansion of a building or other structure, and/or replacement of impervious surface that is not part of a routine maintenance activity; and land disturbing activities associated with structural or impervious redevelopment.

Regional Detention Facility: A stormwater quantity control structure designed to correct existing excess 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.

Release Rate: The computed peak rate of surface and stormwater runoff for a particular design storm event and drainage area conditions.

Retention: The process of collecting and holding surface and stormwater runoff with no surface outflow.

Retention Facility: A type of storage facility designed to impound stormwater runoff for an indefinite period of time. The water impounded in a retention facility is eventually released via evapo-transpiration and/or infiltration processes.

Riprap: A facing layer or protective mound of stones placed to prevent erosion or sloughing of a structure or embankment due to flow of surface and stormwater runoff.

Riser: 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.

Runoff: 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.

Rural Zoning Districts: Zoning districts that allow rural, agricultural, recreation and forestry activities and do not require sewer and/or water prior to development. These zoning districts include; R2A, R5A, R10A, ROS, Agriculture, and Forestry.

SCS Method: A hydrologic analysis based on the Curve Number Method (*National Engineering Handbook*, Section 4: Hydrology, August 1972).

Sediment: Fragmented material that originates from weathering and erosion of rocks or unconsolidated deposits, and is transported by, suspended in, or deposited by water.

Sedimentation: The depositing or formation of sediment.

Short Circuiting: The passage of runoff through a BMP in less than the design treatment time.

Siltation: The process by which a river, lake, or other water body becomes clogged with sediment. Silt can clog gravel beds and prevent successful salmon spawning.

Six month, 24-hour Design Storm: Estimated to be 0.64 times the two year 24-hour storm value.

Slope: 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.

Slope Failure: Gradual or rapid downslope movement of soil or rock under gravitational stress.

Small Development: Development of smaller sites that do not meet the Review Thresholds under Section 207 but must comply with Small Development Minimum Requirements #1-#4, under Section 210.

Soil Group, Hydrologic: 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.

Soil Stabilization: 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.

Source Control BMP: A BMP that is intended to prevent pollutants from entering stormwater. A few examples of source control BMPs are erosion control practices, maintenance of stormwater facilities, constructing roofs over storage and working areas, and directing wash water and similar discharges to the sanitary sewer or a dead end sump.

Spillway: 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.

Storm Drains: The enclosed conduits that transport surface and stormwater runoff toward points of discharge.

Storm Frequency: 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 1-year, 10-year, 25-year, or 100-year storm.

Stormwater: That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, channels or pipes into a defined surface water channel, or a constructed infiltration facility.

Stormwater Drainage System: Constructed and natural features which function together as a system to collect, convey, channel, hold, inhibit, retain, detain, infiltrate, divert, treat or filter stormwater.

Stormwater Facility: 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 basins, retention basins, constructed wetlands, infiltration devices, catchbasins, oil/water separators, sediment basins and modular pavement.

Stormwater Site Plan: A plan which includes an Erosion and Sediment Control (ESCP) Plan

and/or a Permanent Stormwater Quality Control Plan (PSQC). For small sites, this plan is the equivalent of a Small Development Erosion and Sediment Control Plan.

Streambanks: The usual boundaries, not the flood boundaries, of a stream channel. Right and left banks are named facing downstream.

Streams: Those areas where surface waters produce a defined channel or bed and the mean annual flow is under 20 cubic feet per second. A defined channel or bed is an area which demonstrates clear evidence of the passage of water and includes, but is not limited to bedrock channels, gravel beds, sand and silt beds and defined-channel swales. The channel or bed need not contain water year-round. This definition includes drainage ditches, canals, or other artificial water courses which were natural streams prior to human alteration or replaced natural streams with the construction of the artificial watercourse.

Stub-out: A short length of pipe provided for future connection to a storm drainage system.

Subbasin: A drainage area which drains to a water course or waterbody named and noted on common maps and which is contained within a basin.

Surface and Stormwater Management System: Drainage facilities and any other natural features which collect, store, control, treat and/or convey surface and stormwater.

Swale: A shallow drainage conveyance with relatively gentle side slopes, generally with flow depths less than one foot.

TESC: Temporary erosion sediment control.

Time of Concentration: 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.

Travel Time: The estimated time for surface water to flow between two points of interest.

Treatment BMP: A BMP that is intended to remove or reduce pollutants from stormwater. A few examples of treatment BMPs are detention ponds, oil/water separators, biofiltration swales and constructed wetlands.

Unstable Slopes: 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.

Urban and Suburban Zoning Districts: Zoning districts that allow industrial, commercial activities and high and medium density residential densities. These zoning districts include; UR, URM, RR, RR-1, NC, GC, TC, RC, GI, LII, GM, HII, and AO.

Vegetation: All organic plant life growing on the surface of the earth.

Water Quality: A term used to describe the chemical, physical, and biological characteristics off water, usually in respect to its suitability for a particular purpose.

Water Quality BMP: A BMP specifically designed for pollutant removal.

Water Quality Design Storm: The 6-month 24-hour design storm.

Water Quality Swale: An open vegetated drainage channel intended to optimize water quality treatment of surface and stormwater runoff by following the specific design criteria described in the manual.

Watershed: A geographic region within which water drains into a particular river, stream, or body of water.

Water Table: The upper surface or top of the saturated portion of the soil or bedrock layer, indicates the uppermost extent of ground water.

Weir: A device for measuring or regulating the flow of water.

Weir Notch: A shaped notch through which water flows are measured. Common shapes are rectangular, trapezoidal, and triangular.

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.

Wetponds and Wetvaults: 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.

WSDOT/APWA: Washington State Department of Transportation and American Public Works Association.