EXHIBIT A
STORMWATER CODE SUPPLEMENT TO EDMONDS COMMUNITY DEVELOPMENT CODE CHAPTER 18.30

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1.0 Introduction

This Stormwater Code Supplement (Supplement) provides direction for implementing the City of Edmonds Community Development Code (ECDC) Chapter 18.30, Stormwater Management. Review ECDC Chapter 18.30.030 to determine if the City's Stormwater Management code and this Supplement apply to your project.

The contents of this Supplement come from several primary sources, including:

- Stormwater Management Manual for Western Washington (Ecology 2005) (Stormwater Manual) and manuals deemed equivalent to it by the Washington State Department of Ecology (***Ecology***).
- Western Washington Phase II Municipal Stormwater Permit (Ecology 2009) (Phase II Permit). See Appendix A for more information.
- Low Impact Development, Technical Guidance Manual for Puget Sound (Puget Sound Action Team and WSU Pierce County Extension 2005) (LID Manual).
- Basis for Updated Stormwater Management Standards for New Development and Redevelopment Projects in Edmonds (Herrera Environmental Consultants 2009*)*.

Where this Supplement conflicts with the Stormwater Manual, this Supplement shall apply. Where provisions of this Supplement conflict with other City of Edmonds Code requirements or state and federal requirements, the document with the more stringent provisions will apply.

The rest of this Supplement is organized as follows:

- Chapter 2 - Project Classifications: How to determine the stormwater requirements that apply to your site.
- Chapter 3 – Low Impact Development (LID): Introduction to LID stormwater management practices and where they are found in this Supplement
- Chapter 4 – Large Site Requirements: Direction on the applicable minimum requirements and ***best management practice*** (BMP) selection and design criteria for Large Site Projects, including low impact development (LID) techniques and specific runoff treatment and flow control measures.
- Chapter 5 – Small Site Requirements: Direction on the applicable minimum requirements, and BMP selection/design criteria for Category 1 and Category 2 Small Site Projects, including the use of LID techniques and specific runoff treatment and flow control measures.
- Chapter 6 – Minor Site Requirements: Direction on the applicable minimum requirements and BMP selection/design criteria for Minor Site Projects
- Chapter 7 – Operations and Maintenance: Operations and maintenance (O&M) direction for the BMPs referenced in this Supplement.

- Chapter 8 – Terminology: Definitions of key terms used in this Supplement.
- Chapter 9 – References.

The Appendices provide additional background information on stormwater management in the City.

- Appendix A summarizes provisions of the Western Washington Phase II Municipal Stormwater Permit (Phase II Permit) that affect City stormwater management requirements.
- Appendix B provides a map of Edmonds' watersheds, areas with steep slopes, and soils information.
- Appendix C describes the two approved methods for obtaining design infiltration rates.

Throughout the remainder of this document, words in the definitions section of ECDC Chapter 18.30 and in Chapter 8 of this Supplement are in ***bold italics*** when first used.

2.0 Classifying Projects

This chapter helps you classify a project per ECDC Chapter 18.30.050. It also helps you classify ***impervious surfaces*** as existing, new, or replaced, which is necessary for determining which minimum requirements apply to a project.

*Terms in **bold italics** are defined in the Terminology section of this document or in ECDC Chapter 18.30.*

2.1 Project Classifications

New development, redevelopment, and construction projects are classified as ***Large Site Projects*** (see Chapter 4), ***Small Site Projects*** (see Chapter 5), or ***Minor Site Projects*** (see Chapter 6). Small Site Projects are further divided into Category 1 and Category 2. See Figure 2-1 (located at the end of this chapter) and the text below to determine the classification (and the category, if a Small Site Project) of your project. The classification is largely based on the extent to which a project has the following:

- ***Land-disturbing activity*** (including clearing, grading, and excavating)
- ***New impervious surface*** and ***replaced impervious surface*** area – Figure 2-2 and Section 2.2 provide direction on determining whether any or all of the ***impervious surface*** area on a site is considered new impervious area. Section 2.3 provides direction on determining the extent of replaced impervious surface area (if any).
- Conversion of ***native vegetation*** to lawn or landscaped area.

2.2 Determining New Impervious Surface Area

Determining a project's classification and applicable minimum requirements is based in part on the area of ***new impervious surface*** generated. "New impervious surfaces" are those impervious surfaces (currently pervious) that are proposed for the project, but also include existing impervious surface on the site if the following condition applies: the existing impervious surface was created after July 6, 1977 (the effective date of the City's first drainage control ordinance) without stormwater controls (with noted exceptions).

Figure 2-2 presents a process for determining what portions of a ***project site*** are considered to be ***new impervious surface*** for the purposes of stormwater management.

2.3 Determining Replaced Impervious Surface Area

Determining a project's classification and applicable minimum requirements is based in part on the area of ***replaced impervious surface***. "Replaced impervious surfaces" are exterior impervious surfaces proposed for the project where existing surfaces are also impervious. More specifically, "replaced impervious surface" means:

> "For structures, the removal and replacement of any exterior impervious surfaces or foundation. For other impervious surfaces, the removal down to bare soil or base course and replacement. For sites with existing single family dwelling units, (as defined in Chapter 21.90.080 ECDC) a project that solely replaces impervious surfaces in-kind (footprint and imperviousness of material does not change, but not a structural foundation), **shall not** be considered replaced impervious surface for the purposes of this chapter, unless the project site has 1 acre or greater of land-disturbing activities."

Therefore, in-kind replacement of exterior impervious surfaces alone for Small Site Projects and Minor Site Projects (that are not part of a larger scale site redevelopment) are not considered to be replaced impervious surfaces. In these cases, the impervious surfaces are classified as *existing* impervious surfaces. These existing surfaces, however, may meet the definition of "new impervious surface" if they were constructed after July 6, 1977, as described in Section 2.2.

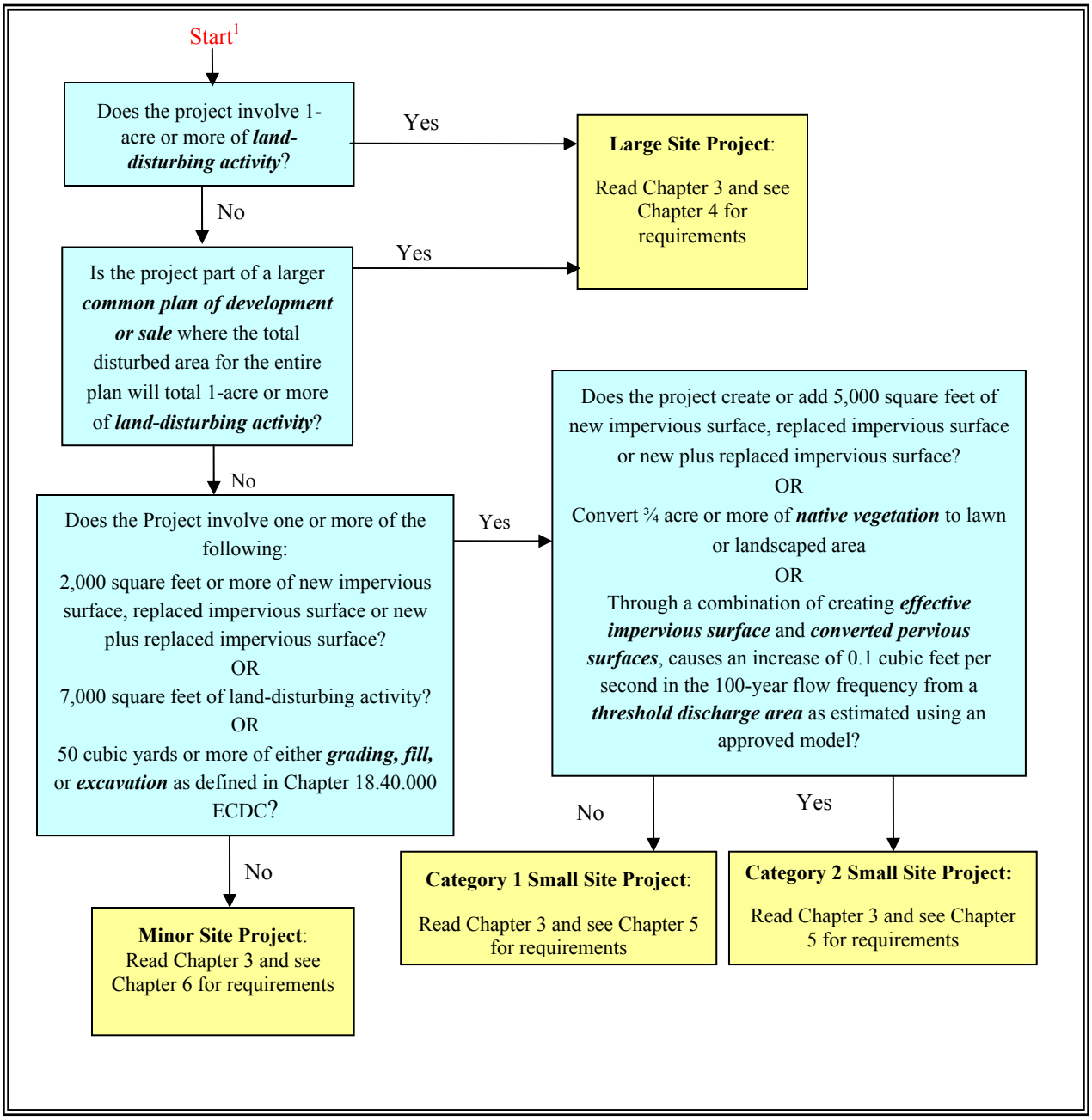
2.3 Determining Project Basin Type

Projects are also classified by the drainage basin type: "***Creek or Lake Basin***" or "***Direct Discharge Basin***" sites. These categories are defined below.

1. **Creek or Lake Basin sites**: Those that eventually discharge into a surface ***water body*** such as a creek, wetland or pond, prior to discharging into Puget Sound; or that discharge into a storm drain or surface water body such as a creek prior to discharging into Lake Ballinger.
2. **Direct Discharge Basin sites**: Those that discharge runoff directly to Puget Sound via a pipe system, ditch, or other direct means without first entering a creek or other ***water body***. Sites located in Direct Discharge Basins may have a different standard for flow control or may be exempt from flow control (See Sections 4.7 and 5.7).

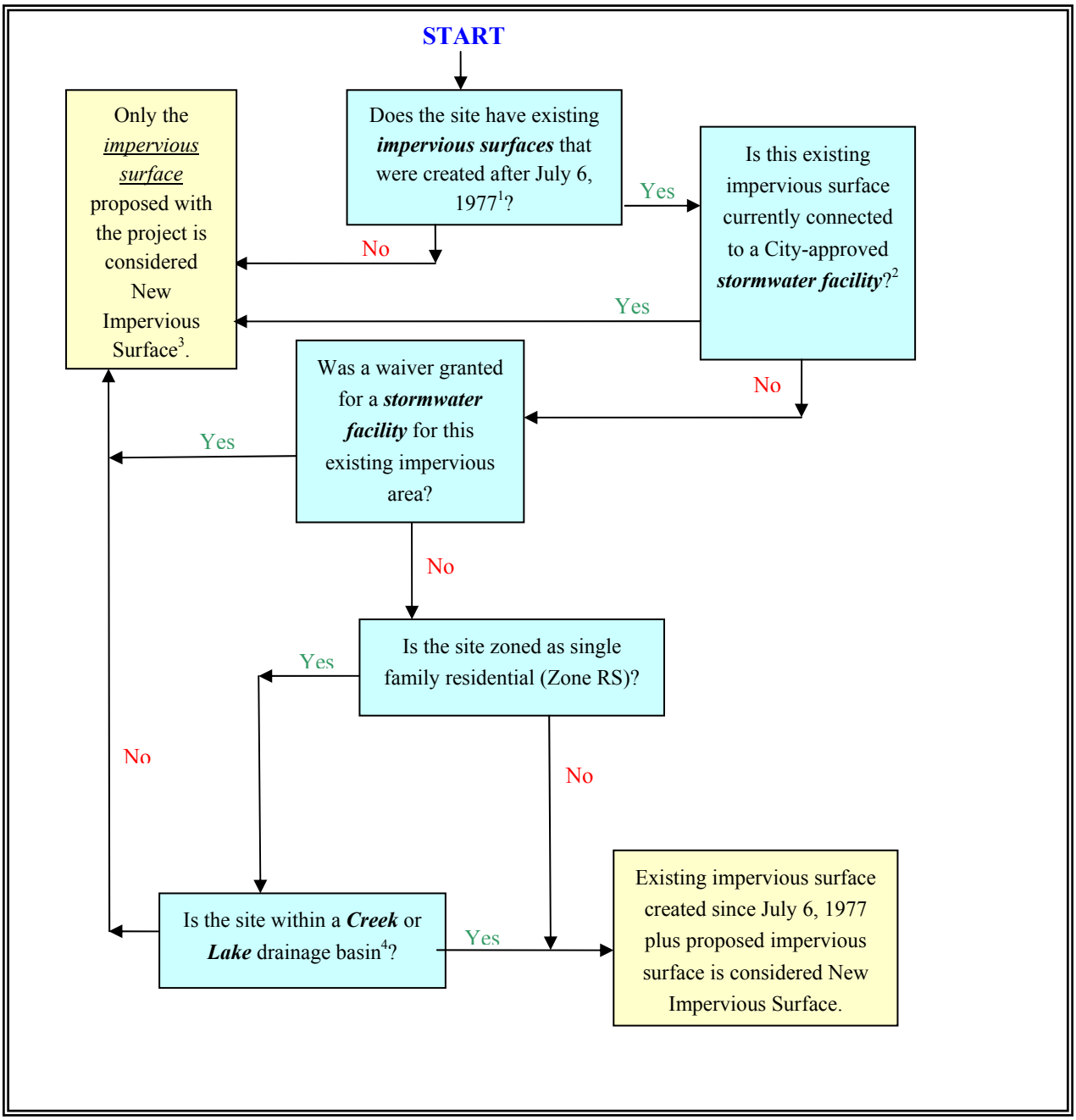
A map of watersheds in Edmonds is presented as Figure B-1 in Appendix B to this Supplement. Direct Discharge Basins are those labeled "Puget Sound," Puget Sound Piped," and "Edmonds Way." All other basins are considered as Creek or Lake Basins. Approximately 83 percent of the land area of the City is within a Creek or Lake Basin. An applicant with site-specific information that is contrary to the basin designations shown in Figure B-1 can present this information to the Public Works Director or designee for a possible change in basin designation. The Public Works Director or designee will make a determination on any requests for a site-specific change in basin designation.

Figure 2-1: Project Classification



[1] Assumes the project in question meets applicability requirements of ECDC18.30.030.

Figure 2-2: Determining What Qualifies as "New Impervious Surface" for a Project



[1] This is the effective date of the City's first drainage control ordinance. The intent of this cumulative impacts ***mitigation*** requirement is to adequately mitigate for impervious surfaces on project sites that are submitted under separate permits. The separate submittals could have project areas that do not meet thresholds, but would meet thresholds if the projects are combined as one project.

For parcels that were annexed to the City after this date, the date of annexation shall substitute for the effective date of the City's first drainage control ordinance. For annexed parcels, a functioning Snohomish County-approved stormwater management facility can substitute for a City-approved facility.

[2] For the purpose of this flowchart, it is assumed that all existing impervious surface will remain after the proposed project is complete. If any existing impervious surface will be demolished for this project, the project may contain a combination of new and replaced impervious surface. Consult the City's Engineering Division for direction.

[3] If there is an existing stormwater management system on site, contact the City's Engineering Division to discuss whether the existing system has the capacity for the new impervious surface area.

[4] See Figure B-1 and Section 2.3.

3.0 Low Impact Development

Low impact development (LID) is a relatively new approach to stormwater management. Formulation of LID principles began in Prince George's County, Maryland in the late-1980s to address the growing economic and environmental limitations of conventional stormwater management practices. For the purposes of this document, LID is defined as:

> "Stormwater management and land development strategies applied at the parcel and subdivision scale that emphasizes the conservation and use of onsite natural features integrated with engineered, small scale hydrologic controls to more closely mimic the predevelopment hydrologic functions" (PSAT and WSU, 2005).

The goal of LID is to mimic a site's predevelopment hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to its source in small, decentralized facilities. Instead of managing and treating stormwater in large, costly, end-of-pipe facilities at the bottom of drainage areas, LID seeks to manage stormwater using small, cost-effective landscape features at the lot level. Well-designed and appropriately sited LID measures can also improve the habitat and aesthetics of a developed site.

3.1 LID and this Stormwater Supplement

This Supplement allows the use of LID techniques or BMPs on ***Large Site Projects***, when feasible and as required by the Phase II Permit. The Permit requires that the City identify and summarize barriers to the use of LID techniques. To accomplish this, the Supplement requires that ***Large Site Projects*** consider the use of LID techniques and document the decision-making processes used to select their application. More information on this requirement can be found in Sections 4.5 and 4.7. While small sites are not required to consider or use LID techniques, the use of LID is allowed by the City, where feasible.

LID BMPs are found throughout this Supplement. These BMPs emphasize minimizing the volume and rate of stormwater runoff from a site both during and after construction. *Use caution when using some LID BMPs: site conditions, such as the presence of "hardpan" or till soils, steep slopes, and proximity of adjacent proprieties may preclude the use of LID BMPs due the possibility of causing flooding or erosion impacts to nearby properties.*

Minimizing the stormwater runoff that leaves the site during the construction phase of a project is discussed in Minimum Requirement #2 (Construction Stormwater Pollution Prevention Plan) for Large, Small, and ***Minor Site Projects*** (Sections 4.2, 5.2, or 6.1). Minimizing stormwater runoff that leaves a site after construction with a permanent stormwater control plan is accomplished in two main ways, in the following order:

1. **Minimize the amount of rainwater that becomes stormwater runoff** through site design practices that use LID planning methods, including those that minimize

impervious surface area using Minimum Requirement #1, Stormwater Site Plan (Sections 4.1 or 5.1).

2. **Minimize or eliminate runoff going off site** with LID techniques, *if site conditions allow* by implenting Minimum Requirement #5, Onsite Stormwater Management (Sections 4.5 or 5.5).

LID methods that are allowed and encouraged in Edmonds include:

- Retaining or restoring native forest cover, other trees, and site vegetation to capture, infiltrate, and evaporate all or part of the precipitation falling on the site.
- Developing a site with the smallest impervious footprint possible and minimize land-disturbing activities such as clearing and grading.
- Preserving or restoring the health and water-holding capacity of the soils by compost-amending.

Other LID methods that are allowed but that should only be implemented if site conditions allow are:

- Designing with runoff reduction methods such as vegetated roofs, rainwater harvesting and permeable pavement.
- Managing stormwater runoff using infiltration, bioretention, and dispersion to the extent practicable.

Once these LID practices have been explored for applicability, stormwater runoff that cannot be managed onsite and flows offsite must meet applicable flow control and water quality requirements: Minimum Requirement #6, Runoff treatment and Minimum Requirement #7, Flow Control (Sections 4.6 and 4.7 or 5.6 and 5.7).

4.0 Large Site Requirements

This chapter explains how to comply with the ***Large Site Project*** minimum requirements (ECDC Chapter 18.30.060A-D1). For all large sites, the Thresholds, Definitions, Minimum Requirements and Exceptions, Adjustment and Variance Criteria found in Appendix I of the NPDES Phase II Municipal Stormwater Permit are applicable per Chapter 18.30 ECDC, as well as the mandatory incorporated provisions of the Stormwater Manual.

Figures 4-1 and 4-2 (located at the end of this chapter) will help you determine whether a ***Large Site Project*** is considered ***new development*** or ***redevelopment***, which minimum requirements apply, and to which site surfaces (new impervious, replaced impervious, land disturbed, and/or ***converted pervious***) the requirements apply. The minimum requirements for Large Site Projects are described below. Appendix B contains supplemental technical information on watershed boundaries and the location of steep slopes and soil types to assist with a stormwater site plan.

4.1. Minimum Requirement #1 – Preparation of Stormwater Site Plan

Stormwater Site Plans shall be prepared for all Large Site Projects in accordance with Volume 1, Chapter 3 of the Stormwater Manual. The Stormwater Site Plan will document compliance with all applicable minimum requirements and the design of all ***best management practices*** (BMPs). For all Large Site Projects that involve 5,000 square feet or more of new or replaced impervious surface, stormwater best management practices must be designed by a ***civil engineer***. See handouts prepared by the City's Engineering Division for specific submittal requirements.

The Stormwater Site Plan shall include the submittal requirements in the handout, reflect consideration of site planning and design measures intended to reduce project impact on stormwater quality and quantity, and must consider the use of LID approaches.

The use of LID should also include approaches that minimize the ***effective impervious surface*** area (area directly connected to the City's drainage system or surface waters) therefore reducing the amount of impervious surface area that requires mitigation using stormwater management BMPs. By reducing the amount of stormwater runoff generated, LID site planning and design techniques can also be used to satisfy the flow control requirements of Minimum Requirement #7. See Section 4.7.2 for criteria. Simplified design tools are available to encourage the use of LID and allow easy evaluation of LID flow control benefits (see Section 4.7.3.2).

Table 4-1 summarizes some potential LID site planning measures.

Large Site Minimum Requirement #5 (Section 4.5) discusses LID techniques for managing stormwater runoff on site to reduce or eliminate the amount of runoff that flows offsite to ***receiving waters.***

Table 4-1: Site Planning and Design Techniques to Reduce the Amount of Stormwater Runoff Generated

BMP #	Stormwater Management Technique	Reference(s)/Design Guidance
T5.21	Better Site Design (e.g., ,Reduce Effective Impervious Areas Associated with Roads, Shared Accesses, Alleys, Sidewalks, Driveways, and Parking Areas)	Volume V Stormwater Manual; Chapter 3 LID Manual
T5.20	Native Vegetation Protection, Reforestation, and Maintenance	Volume V Stormwater Manual; Chapter 4 LID Manual
--	Minimize disturbance area	Volume V Stormwater Manual; Section 5 LID Manual
--	Vegetated Roofs	City Building Division
--	Rainwater Harvesting	LID Manual/City Building Divison
--	Permeable Pavement (asphalt, concrete, paving blocks, "grass-crete")	Section 6.3 LID Manual or Volume 3 Seattle Manual 2009 (base course requirements)

Stormwater Manual = Stormwater Management Manual for Western Washington (Ecology 2005)
LID Manual = Low Impact Development: Technical Guidance Manual for Puget Sound.
Volume 3 Seattle Manual = Stormwater Flow Control & Water Quality Treatment Technical Requirements Manual.

4.2 Minimum Requirement #2 – Construction Stormwater Pollution Prevention Plan

All new development and redevelopment projects are responsible for preventing ***erosion*** and discharge of sediment and other pollutants into receiving waters during construction. See Section 4.2, Appendix 1 of the Phase II Permit and Volume II of the Stormwater Manual for a complete description of minimum requirement and direction on BMP selection and design. Compliance with this minimum requirement may be achieved for an individual site if the site is covered under Ecology's *General NPDES Permit for Stormwater Discharges Associated with Construction Activities,* if the provisions of such permit are fully implemented, and such a permit is approved by the Public Works Director or designee. The City does not approve erosivity waivers, as described in Section 4.2, Appendix 1 of the Phase II Permit.

4.3 Minimum Requirement #3 – Source Control of Pollution

All known, available, and reasonable ***source control*** BMPs shall be applied to control pollution. Source control BMPs shall be selected, designed, and maintained according to the Stormwater Manual. See Volume IV of the Stormwater Manual for guidance on the applicable source control BMP selection and implementation.

Specific source controls are not required for single family residential sites. General requirements for these sites include preventing the discharge of pollutants to the City's storm drainage system per Edmonds City Code Chapter 7.200 (Illicit Discharges). This includes common household items such as pesticides, herbicides, fertilizers, detergents and fluids from vehicle maintenance.

4.4 Minimum Requirement #4 – Preservation of Natural Drainage Systems and Outfalls

Natural drainage patterns shall be maintained. Run-on (from a potential upstream site) and runoff discharges from the project site shall occur at the location of the ***natural drainage system and outfall***, to the maximum extent practicable. In most cases, the "natural location" is the existing discharge location on the site. For some redevelopment projects, the natural location for runoff discharge may have been previously altered. Contact City Engineering staff with questions about the natural discharge location.

The manner by which runoff is discharged from the project site must not cause an adverse impact to downstream receiving waters and downgradient properties. All outfalls to creeks, ditches, or other open channels require energy dissipation to prevent erosion. Minimum Requirement #10 describes offsite analysis that is required to identify potential downstream concerns so that adverse impacts are avoided through appropriate onsite design.

See Section 2.5.4 of Volume I of the Stormwater Manual for guidance on complying with this minimum requirement. The supplemental requirement in 2.5.4 of Volume I of the Stormwater Manual apply to Large Site Projects.

4.5 Minimum Requirement #5 – Onsite Stormwater Management

Onsite stormwater management BMPs described in this section are considered LID techniques. These LID BMPs must be used to infiltrate, disperse, and retain stormwater runoff on site to the ***maximum extent feasible*** without causing flooding or erosion impacts, in accordance with Section 4.5, Appendix 1 of the Phase II Permit. These onsite/LID BMPs can be used for flow control and/or runoff treatment to reduce the size of, or eliminate the need for, additional facilities designed for Minimum Requirements #6 and #7, if applicable. *All Large Site Projects are required to consider the use of LID practices and document the decision–making processes used to select or screen out their application.*

As described in Minimum Requirement #1, the use of LID should begin in the site planning stage to minimize the amount of stormwater released from the site. Once site planning and design is complete and the generation of offsite runoff is minimized, stormwater runoff from the planned ***impervious surface*** and ***converted pervious surface*** areas must be mitigated.

All sites are required to implement:

- Roof downspout control BMPs, (either infiltration or dispersion) functionally equivalent to those described in Chapter 3 of Volume III of the Stormwater Manual to reduce the hydrologic disruption of the developed site to the ***maximum extent feasible*** without causing flooding or erosion impacts**.**
- The soil quality and depth BMP T5.13 for compost-amending, in Chapter 5 of Volume V of the Stormwater Manual for all ***disturbed pervious surface areas***.

For some Large Site Projects, reducing the amount of stormwater runoff generated using LID planning techniques (Section 4.1) and using LID BMPs can satisfy the flow control requirements of Minimum Requirement #7 as well as Minimum Requirement #5. See Section 4.7.2 for criteria. Simplified design tools are available to encourage the use of LID and allow easy evaluation of LID flow control benefits (see Section 4.7.3.2).

4.5.1 BMP Selection

Common onsite/LID practices include but are not limited to:

- Bioretention cells (also known as rain gardens).
- Small-scale "traditional" infiltration facilities (such as dry wells, gravelless chambers, and trenches).
- Permeable pavement (asphalt, concrete, paving blocks, "grass-crete").
- Dispersion BMPs such as wheel strip driveways or other pavement sloped to drain to onsite vegetation adequate for dispersion, or downspout or sheet flow dispersion.

Onsite/LID BMP design requirements shall be those in the LID Manual or the Washington State Department of Transportation's Highway Runoff Manual (HRM). BMP design requirements presented in other stormwater management manuals or standard documents approved by Ecology such as the City of Seattle and King County stormwater manuals are also acceptable when modified for local conditions such as precipitation and soil conditions. Table 4-2 presents a summary of onsite/LID measures that could be used to manage stormwater on site, along with references for design guidance information. Additional LID BMPs can be proposed as long as they are found in an Ecology-approved stormwater manual, are appropriate for site conditions, and do not cause on- or offsite flooding or erosion impacts.

LID techniques that rely on infiltration should be designed with caution, due to the prevalence of till or "hardpan" soil and steep slopes in Edmonds. Section 4.5.2 discusses this matter further.

See Section 5.5.3 for a discussion of installing rain gardens on single-family residential sites without the services of a geotechnical professional to assess soil infiltration rates.

4.5.2 Onsite/LID Techniques and Infiltration

Onsite/LID features that rely on infiltration (such as bioretention) are not appropriate for every site. Limitations and considerations include:

- Infiltration is prohibited in the Earth Subsidence and Landslide Hazard Area (ESLHA) (ECDC Chapter 19.10), upgradient of the ESLHA, and other areas with geological instability (landslide hazard areas). See Figure B-3 in Appendix B.
- Infiltration is prohibited in "steep slope areas" with average ground surface slopes equal to or greater than 15 percent. See Figure B-3 in Appendix B.

- Infiltration is prohibited within setbacks from the top of a designated landslide hazard or steep slope areas.
- Infiltration should be applied in areas that have higher infiltration rates (especially in areas with soils classified as Everett gravelly sandy loam).

When not restricted as noted above, infiltration should be used as much as possible in the ***Greater Lake Ballinger Watershed*** and in all other ***creek*** basins.

Table 4-2: Commonly Used Onsite/LID Stormwater Management Techniques

BMP #	Onsite Stormwater Management Technique	Reference(s)/Design Guidance
Infiltration BMPs		
--	Bioretention Facilities (Rain gardens)	Section 6.1 LID Manual and City Pre-Sizing Tables
--	Infiltration Trench (downspout or other)	City Pre-Sizing Tables
--	Drywell	City Pre-Sizing Tables
--	Gravelless Chamber	City Pre-Sizing Tables
T5.13	Preserve and Restore Soil Quality and Depth	Volume V Stormwater Manual; "Soils for Salmon" website, Section 6.1 LID Manual
Dispersion BMPs		
C.2.9.3	Wheel Strip Driveway	King County Manual. Appendix C.
T5.10, T5.11 & T5.12	Downspout or Sheet Flow Dispersion Systems	Volume V Stormwater Manual, City Pre-Sizing Tables
T5.30	Full Dispersion	Volume V Stormwater Manual

LID Manual = Low Impact Development: Technical Guidance Manual for Puget Sound.
City Pre-Sizing Tables are available from the City's Engineering Division
Stormwater Manual = Stormwater Management Manual for Western Washington.
King County Manual = 2009 King County Surface Water Design Manual.

Soils reports are required where infiltration is proposed; soil reports for individual lots must include at least two soil logs for each proposed infiltration location. Each log shall correspond to soil conditions extending a minimum of 4 feet depth below ground surface (6 feet for drywells). The report shall describe the Soil Conservation Service (SCS, now called the Natural Resource Conservation Service or NRCS) series of the soil and the textural class of each horizon through the depth of the log, and shall note any evidence of a high ***groundwater*** table, such as mottling. Reports solely using the Unified Soil Classification System (USCS) will not be accepted. Soils reports must be prepared by or under the direction of a licensed onsite sewage system designer, ***civil engineer***, engineering geologist, or geotechnical engineer.

A soils report produced for siting and design of an onsite sewage system may also be used to satisfy this soils report requirement, provided that (a) the depth of the soil log(s) is at least 4 feet, (b) the depth to seasonal high water table is determined, and (c) the location of the soil logs is adequate to determine the feasibility of the infiltration system.

Field infiltration rates can be evaluated using one of two approved methods: USDA Textural Classification, or the Modified Pilot Infiltration Testing (PIT) Method. These methods are described in Appendix C to this Supplement.

A correction factor shall be applied to the measured infiltration rate to convert to the design infiltration rate. This correction factor shall be different based on the time of year of the test. If the test is conducted from May 1 through October 31, the correction factor shall be two times the correction factor listed in Table C-1 (USDA method) or Table C-2 (modified PIT method) in Appendix C of this Supplement. For infiltration rates tested from November 1 – April 30, the correction factor shall be equal to the correction factor listed in Table C-1 (USDA method) or Table C-2 (modified PIT method) in Appendix C of this Supplement.

In certain situations, BMPs that rely on infiltration are classified as Underground Injection Controls (UICs) and may be regulated by Ecology under the UIC Program (Washington Administrative Code [WAC] 173 218). For more information on Underground Injection Control (UIC) see the 2006 Ecology document titled Guidance for UIC Wells that Manage Stormwater. This document is available online at <http://www.ecy.wa.gov/biblio/0510067.html>.

4.6 Minimum Requirement #6 – Runoff Treatment

Runoff treatment BMPs must handle the water quality ***design storm*** volume or flow rate using the appropriate treatment type (basic, enhanced, oil control, or phosphorus treatment) for all new and replaced project pollution-generating surfaces. BMPs to meet this minimum requirement must be designed by a ***civil engineer***.

4.6.1 Project Thresholds

Stormwater treatment facilities are required for the following:

- Projects in which the total of new and replaced effective, ***pollution-generating impervious surface*** (PGIS) is 5,000 square feet or more in a ***threshold discharge area*** of the project.
- Projects in which the total of ***pollution-generating pervious surfaces*** (PGPS) is three-quarters (3/4) of an acre or more in a threshold discharge area, and from which there is a surface discharge from the site into a natural or man-made conveyance system.

That portion of any development project in which the PGIS or PGPS thresholds listed above is not exceeded in a threshold discharge area shall apply onsite stormwater management BMPs in accordance with Minimum Requirement #5 to the maximum extent practicable.

4.6.2 Runoff Treatment Standards

Runoff treatment standards shall be implemented per Section 4.6, Appendix 1 of the Phase II Permit. In addition, the following Edmonds-specific requirements apply.

4.6.2.1 Oil Control

All projects in areas not zoned as single family residential that collect runoff from 5 or more parking spaces shall install oil containment catch basins if another approved oil control system is not employed. The outlet pipe of these catch basins shall have a downturned 90 degree elbow to restrict the outflow of oil and other floatables. There should be at least 9 inches of clearance between the elbow and the inside wall of the catch basin to facilitate removal of floatables. A maintenance schedule for the removal of oil and other floatables from these catch basins must be submitted with all plans for review.

4.6.2.2 Phosphorus Treatment

Per Section 4.6.2, Appendix 1 of the Phase II Permit, phosphorus treatment is required for projects that discharge to a ***nutrient-critical receiving water***. Currently this requirement applies to projects in the ***Greater Lake Ballinger Watershed*** (see Appendix B) that has a ***Total Maximum Daily Load*** (TMDL) for phosphorus. Bioretention systems with overflows (i.e., systems not providing 100 percent infiltration) should not be used in this basin due to potential phosphorus export in the treated runoff discharged ultimately to the lake.

4.6.3 Runoff Treatment BMP Selection

A sampling of runoff treatment BMPs is summarized in Table 4-3, with the treatment levels and design criteria references. Additional BMPs may be approved by the City's Engineering Division on a case-by-case basis. BMPs shall be selected from the list according to the treatment type required, and according to the following general prioritization guidelines:

- Bioretention systems should be implemented where feasible in creek basins. If infiltration of runoff is not feasible at the site, consider use of bioretention systems with underdrains.
- Onsite Stormwater Management Measures (see Section 4.5 above) are preferred, if feasible, over larger runoff treatment facilities. Be sure that these onsite techniques are being applied to the maximum extent practicable before selecting runoff treatment BMPs.

Table 4-3: Runoff Treatment Best Management Practices

BMP #	Runoff Treatment BMP	Treatment Type				Reference(s)/Design Guidance
		Basic Treatment	Enhanced Treatment	Phosphorus Treatment	Oil Control	
--	Bioretention Facilities (Rain Gardens)	X	X			Section 3.1 LID Manual
T7.10	Infiltration Basins	*	*	*		Volume III Stormwater Manual
T7.20	Infiltration Trenches	*	*	*		Volume III Stormwater Manual
T7.30	Bioinfiltration swale	*	*	*		Volume V Stormwater Manual
T9.10	Basic Biofiltration Swale	X				Volume V Stormwater Manual
T9.20	Wet Biofiltration Swale	X				Volume V Stormwater Manual
T9.30	Continuous Inflow Biofiltration Swale	X				Volume V Stormwater Manual
T9.40	Basic Filter Strip	X				Volume V Stormwater Manual
T9.50	Narrow area filter strip	X				Volume V Stormwater Manual
RT.02	Compost-Amended Vegetated Filter Strip	X	X		X	HRM
T10.10	Wetponds (basic)	X				Volume V Stormwater Manual
T10.10	Wetponds (large)	X		X		Volume V Stormwater Manual
T10.20	Wet vaults	X			*	Volume V Stormwater Manual
T10.30	Stormwater treatment wetland	X	X			Volume V Stormwater Manual
T10.40	Combined detention/wetpool facilities	X	*	*		Volume V Stormwater Manual
--	Sand Filter Basin	X	*	*		Volume V Stormwater Manual
T8.10	Sand Filter Vault	X	*	*		Volume V Stormwater Manual
T8.20	Linear Sand Filter	X	*	*	X	Volume V Stormwater Manual
RT.07	Media Filter Drain	X	X	X		HRM
T11.10	API (Baffle type) Separator Bay				X	Volume V Stormwater Manual
T11.11	Coalescing Plate (CP) Separator Bay				X	Volume V Stormwater Manual
RT.22	Oil Control Booms				X	HRM

X = BMP meets this treatment type
* = BMP can be designed to meet this treatment type
LID Manual = Low Impact Development: Technical Guidance Manual for Puget Sound
Stormwater Manual = Stormwater Management Manual for Western Washington
HRM = WSDOT Highway Runoff Manual

4.7 Minimum Requirement #7 – Flow Control

Flow control BMPs shall be implemented for all ***effective impervious surface area*** that *is* ***new and replaced*** and ***converted pervious surfaces*** per Section 4.7, Appendix 1 of the Phase II Permit to reduce the impacts of stormwater runoff from impervious surfaces and land cover conversions. BMPs to meet this minimum requirement must be designed by a ***civil engineer***. Large Site Projects that fall below the Phase II Permit thresholds for flow control but have 2,000 square feet or more effective impervious surface must comply with the Edmonds-specific flow controls standard described in Section 4.7.2.

The use of LID techniques under Minimum Requirements #1 and #5 can satisfy this minimum requirement for some Large Site projects. Simplified design tools are available to encourage the use of LID and allow easy evaluation of LID flow control benefits (see Section 4.7.3.2).

4.7.1 Project Thresholds and Applicability

The applicability of this minimum requirement is dependent upon the drainage basin of the project site. See Chapter 2 for drainage basin classifications. If flow control is not required, onsite stormwater management techniques must still be applied to the maximum extent practicable (see Section 4.5).

Creek or Lake Basin Projects

Large Site Projects in Creek or Lake Basins must meet Phase II Permit flow control standards if any of the following Phase II permit thresholds are met or exceeded:

- Projects in which the total new and replaced ***effective impervious surface*** in a ***threshold discharge area*** is greater than 10,000 square feet.
- The native vegetation area converted to lawn or landscaping is 3/4 acres or more, or the native vegetation area converted to pasture is 2.5 acres or more in a threshold discharge area and from which there is surface discharge in natural or man-made conveyance systems from the site.
- Where through a combination of ***effective impervious surface*** and ***converted pervious surfaces*** the project causes a 0.1 cubic feet per second or greater increase in the 100-year recurrence peak flow from a threshold discharge area as estimated by an Ecology-approved continuous simulation model.

Direct Discharge Basin Projects

Large Site Projects in ***Direct Discharge Basins*** can be exempt from Small Site Minimum Requirement #7 under one of the following circumstances:

- A quantitative Offsite Analysis as described in Large Site Minimum Requirement #10 is performed by the applicant and no unacceptable downstream issues (such as a capacity or erosion issue), are found.

- A quantitative Offsite Analysis as described in Large Site Minimum Requirement #10 is performed by the applicant, and one or more unacceptable downstream issues are discovered. A plan is proposed by the applicant to mitigate for the unacceptable downstream issue and the mitigation plan is approved by the Public Works Director or designee.

Any Large Site Project in a Direct Discharge Basin can be exempt from Large Site Minimum Requirement # 10 by meeting the applicable flow controls standard for sites in Creek or Lake Basins (see Section 4.7.2).

4.7.2 Flow Control Standards

Flow control standards for Large Site Projects vary by basin type and the amount of effective impervious surface. These standards for projects that must meet Phase II permit requirements are summarized in Table 4-4, and for all other projects in Table 4-5 (Lake or Creek Basin) or Table 4-6 (Direct Discharge Basin).

Table 4-4: City of Edmonds flow control requirements for Large Site Projects Triggering Phase II Permit Requirements

	≥ 10,000 sf Effective Impervious Area [a]
Numerical Standard:	Match 1/2 the 2-year to 50-year flow durations to predeveloped forest condition
Applies to:	New and replaced impervious surface and disturbed pervious areas
Computational Methods:	Continuous hydrologic modeling with MGS precipitation data [b, c]
Options to Meet Numerical Standard	
LID Credit Option (If feasible):	Credit given for meeting the flow control standard using LID techniques described in the Stormwater Manual
Traditional Option:	If it is not feasible to achieve the standard using LID only, larger-scale infiltration or detention may be used as described in the Stormwater Manual

sf: square feet

LID: low impact development

[a] Or at least 3/4 acres conversion to lawn/landscape, at least 2.5 acres conversion to pasture, or a greater than 0.1 cubic feet per second increase in the 100-year flood frequency.

[b] MGS precipitation is the Puget East 36 precipitation time series developed for the Washington State Department of Transportation by MGS Engineering Consultants, Inc. and available in WWHM and MGS Flood hydrologic modeling software.

[c] For infiltration facilities, flood frequency calculations (i.e., determination of recurrence interval peak flows) must be performed using an approach capable of properly evaluating zero flow years as explained in Section 4.7.3.1 below.

Phase II Permit Flow Control Standard

Large Site Projects in Creek or Lake Basins that meet one or more of the Phase II permit thresholds listed above must meet the following flow control standard for all new and replaced impervious surface and converted pervious surface: match 1/2 the 2-year to 50-year recurrence flow durations to the ***predeveloped condition*** as determined using a continuous hydrologic model.

Edmonds-Specific Flow Control Standards

Large Site Projects in Creek or Lake Basins or in Direct Discharge Basins that do not meet one or more of the Phase II permit thresholds must meet the City-specific flow control standards. Large Site Projects in Direct Discharge Basins can be exempt from these flow control standards if a quantitative off-site analysis indicates that the uncontrolled flows from the site will not cause a flooding, erosion, or other problem downstream (see Section 4.10).

Recurrence interval flows for the developed condition shall be determined using a continuous hydrologic model. For sites with 2,000 square feet or greater (and less than or equal to 5,000 square feet) of new plus replaced impervious surface area the post-development 10-year recurrence interval flow shall not exceed 0.25 cubic feet per second (cfs) per acre of impervious surface area for all flow control BMPs.

For sites with greater than 5,000 square feet of new plus replaced impervious surface area, limits for the post-development peak flows depend upon the BMP type selected:

- For detention BMPs:
  - Creek or Lake Basins: the post-development 2-, 10-, and 100-year recurrence interval peak flows shall not exceed 0.07, 0.14, and 0.33 cfs per acre of impervious surface area, respectively.
  - Direct Discharge Basins: the post-development 10-, and 100-year recurrence interval peak flows shall not exceed, 0.25 and 0.45 cfs per acre of impervious surface area, respectively.
- For infiltration BMPs:
  - Creek or Lake Basins: the post-development 2-, 10-, and 100-year recurrence interval peak overflows shall not exceed 0.07, 0.25, and 0.45 cfs per acre impervious surface area, respectively.
  - Direct Discharge Basins: the post-development 10-, and 100-year recurrence interval peak overflows shall not exceed 0.25, and 0.45 cfs per acre impervious surface area, respectively.

There are two methods to satisfy Minimum Requirement #7 for sites subject to the City-specific Standard: the "LID Credit Option" and the "Traditional Option". Large Site Projects shall use the LID Credit Option to implement flow control, if feasible. The LID Credit Option allows an applicant to mitigate only a portion of the new and replaced impervious surface area if only LID site planning techniques and LID BMPs are used. The requirements for the LID Credit Option are presented below.

- For projects that generate greater than 2,000 square feet (but less than or equal to 5,000 square feet) of new plus replaced effective impervious surface area, the greater of 1) 2,000 square feet or 2) 85 percent of new plus replaced impervious surface area is mitigated to meet the flow control standard using LID measures.
- For projects that generate greater than 5,000 square feet of new plus replaced effective impervious surface area, the greater of 1) 5,000 square feet or 2) 90 percent of new plus

replaced impervious surface area is mitigated to meet the flow control standard using LID measures.

If it is not feasible to use the LID Credit Option to meet Minimum Requirement #7, the project shall meet the flow control standard for all new and replaced impervious surface and converted pervious surface. In this case, the "Traditional Option", larger-scale infiltration BMPs or detention BMPs may be used to provide flow control for the areas not mitigated using LID measures.

Table 4-5: City of Edmonds Flow Control Requirements for Large Site Projects Creek or Lake Basins[a]

	≥2,000 sf Effective Impervious Area [b]	≥5,000 sf Effective Impervious Area
Numerical Standard		
Maximum Recurrence Interval Flow from Developed Site:	10-year = 0.25 cfs/acre impervious	For detention BMPs: 2-year = 0.07 cfs/acre impervious, 10-year = 0.14 cfs/acre impervious, and 100-year = 0.33 cfs/acre impervious. For infiltration BMPs: 2-year = 0.07 cfs/acre impervious, 10-year = 0.25 cfs/acre impervious, and 100-year= 0.45 cfs/acre impervious.
Applies to:	New and replaced effective impervious surface	New and replaced effective impervious surface
Computational Methods	Simplified Sizing Approach or continuous hydrologic modeling with MGS precipitation data [c,d]	Simplified Sizing Approach or continuous hydrologic modeling with MGS precipitation data [c,d]
Options to Meet Numerical Standard		
LID Credit Option (If Feasible)	If 2,000 sf or 85% of new plus replaced impervious surface area (whichever is greater) is mitigated to the numerical standard using Onsite/LID techniques (Minimum Requirement #5), the requirement is met.	If 5,000 sf or 90% of new plus replaced impervious surface area (whichever is greater) is mitigated to the numerical standard using Onsite/LID techniques (Minimum Requirement #5), the requirement is met.
Traditional Option	If not feasible to achieve standard with Onsite/LID option, numerical standard must be achieved for the entire site. Larger-scale infiltration or detention may be used – see Section 4.7.4.	If not feasible to achieve standard with Onsite/LID option, numerical standard must be achieved for the entire site. Larger-scale infiltration or detention may be used – see Section 4.7.4.

cfs: cubic feet per second

sf: square feet

LID: low impact development

[a] Sites with less than 1-acre of land-disturbing activities

[b] But less than 5,000 sf of new plus replaced impervious area

[c] MGS precipitation is the Puget East 36 precipitation time series developed for the Washington State Department of Transportation by MGS Engineering Consultants, Inc. and available in WWHM and MGS Flood hydrologic modeling software.

[d] For infiltration facilities, flood frequency calculations (i.e., determination of recurrence interval peak flows) must be performed using an approach capable of properly evaluating zero flow years as explained in Section 4.7.3.1 below

Table 4-6: City of Edmonds Flow Control Requirements for All Other Large Site Projects Direct Discharge Basins

	≥ 2,000 sf Effective Impervious Surface [a]
Numerical Standard:	For detention and infiltration BMPs: 10-year = 0.25 cfs/acre impervious, and 100-year= 0.45 cfs/acre impervious An exemption from these flow control standards may be allowed by the Public Works Director or designee if a quantitative offsite analysis per Large Site Minimum Requirement # 10 (see Section 4.10) indicates no unacceptable downstream issue (such as a capacity or erosion issue). If an unacceptable downstream issue is found, the applicant can either propose mitigation of the issue to the Public Works Director or designee (whom will consider the proposal but not necessarily approve it) or design and implement flow control measures to the Lake or Creek Basin Standard (see Section 4.7.1).
Applies to:	New and replaced effective impervious surface
Computational Methods	Simplified Sizing Approach or continuous hydrologic modeling with MGS precipitation data [b, c]
Options to Meet Numerical Standard	
LID Credit Option (If feasible)	For sites with 2,000 sf or more (but less than 5,000 sf) of effective impervious surface: If 2,000 sf or 85% of new plus replaced impervious surface area (whichever is greater) is mitigated to the numerical standard using Onsite/LID techniques (Minimum Requirement #5), the requirement is met. For sites with 5,000 sf or more of effective impervious surface: If 5,000 sf or 90% of new plus replaced impervious surface area (whichever is greater) is mitigated to the numerical standard using Onsite/LID techniques (Minimum Requirement #5), the requirement is met.
Traditional Option	If Onsite/LID techniques are not feasible, larger-scale infiltration or detention may be used to mitigate capacity impact to the extent necessary - See Section 4.7.4.

sf: square feet

[a] But less than 10,000 square feet of effective impervious area.

[b] MGS precipitation is the Puget East 36 precipitation time series developed for the Washington State Department of Transportation by MGS Engineering Consultants, Inc. and available in WWHM and MGS Flood hydrologic modeling software.

[c] For infiltration facilities, flood frequency calculations (i.e., determination of recurrence interval peak flows) must be performed using an approach capable of properly evaluating zero flow years as explained in Section 4.7.3.1 below.

4.7.3 Flow Control Facility Sizing

All flow control facilities for Large Site Projects must be designed by a ***civil engineer***.

4.7.3.1 Modeling Requirements

Flow control facilities must be sized to meet the standards described above using an approved continuous runoff simulation model. Guidance on application of continuous runoff models for flow control BMP sizing is provided in Volume III of the Stormwater Manual. Supplemental guidance is provided in this section.

Approved continuous runoff models include Western Washington Hydrologic Model (WWHM) and MGS-Flood. Flow control sizing must be conducted using the "Puget East 36" precipitation time series developed by MGS Engineering Consultants (MGS 2002). This time series is available in WWHM (labeled "DOT data"), and is one of the default precipitation time series in MGS-Flood.

In addition, for infiltration facilities, flow frequency calculations (i.e., determination of recurrence interval peak flows) must be performed using an approach capable of properly evaluating zero flow years. This is important because infiltration facilities sized to meet the recommended flow control standards will infiltrate approximately 98 percent of the runoff volume, resulting in an annual peak flow time series that contains several zero or very low peak flow values. Currently the MGS-Flood model properly calculates flood frequency for these scenarios, while WWHM does not. Until WWHM integrates a more flexible flow frequency routine, it is recommended that annual peak flow datasets with multiple low or zero annual peak flow values be exported from WWHM and analyzed using a spreadsheet method to determine flow frequency (i.e., 2-, 10-, and 100-year recurrence interval flows). The Gringorten plotting position formula (Maidment 1993), which is non-parametric (i.e., does not depend on the mean, standard deviation, or skew of the data), works well for these applications.

4.7.3.2 Simplified Sizing Approach

A pre-sized approach for sizing flow control BMPs has been developed for Large Site Projects in Edmonds with between 2,000 and 10,000 square feet of new and replaced impervious surface area. This approach allows the designer to size selected BMPs to meet the numerical flow control standards without the use of a continuous hydrologic model. Guidance for using the simplified sizing approach for flow control BMPs is provided in City of Edmonds Handouts available from the Engineering Division.

4.7.4 Flow Control BMP Selection

This section discusses infiltration and flow control BMPs. If onsite/LID is not used, flow control can be achieved using larger-scale infiltration or detention.

4.7.4.1 Larger-Scale Infiltration

If LID is not feasible, larger-scale, centralized infiltration facilities may be used (as opposed to the small and distributed infiltration facilities associated with LID). Infiltration is the preferred method of stormwater flow control relative to detention, but only in certain areas of Edmonds where infiltration of large amounts of runoff in a concentrated area will not contribute to flooding or offsite slope stability problems. The feasibility of infiltration as a means to meet stormwater flow control and treatment requirements will depend upon specific project site locations due to the variations in soil and topography across the City. See Chapter 4.5.2 for guidelines pertaining to the applicability and testing required for implementing infiltration for flow control.

Examples of infiltration BMPs for flow control are summarized in Table 4-7.

4.7.4.2 Detention

If infiltration BMPs are not feasible to meet flow control requirements for a site, detention BMPs can be used. The minimum orifice size for detention facility outlet control structures is one-half inch (1/2 inch).

Table 4-9 summarizes some available BMPs for flow control, including several detention options. The City's Building Division should be contacted prior to designing roof detention systems.

Table 4-7: Flow Control Best Management Practices

BMP #	Flow Control BMP	Reference(s)/Design Guidance
Larger- Scale Infiltration BMPs		
T7.10	Infiltration Basins	Volume III Stormwater Manual
T7.20	Infiltration Trenches	Volume III Stormwater Manual
T7.30	Infiltration Vaults	Volume III Stormwater Manual
--	Gravelless Chambers	Kitsap County Stormwater Management Design Manual (Kitsap County 1997)
Detention BMPs		
--	Detention Ponds	Volume III Stormwater Manual
--	Detention Tanks	Volume III Stormwater Manual
--	Detention Vaults	Volume III Stormwater Manual
--	Use of Parking Lots for Detention	Volume III Stormwater Manual
--	Use of Roofs for Detention	Volume III Stormwater Manual

Stormwater Manual = Stormwater Management Manual for Western Washington.

4.8 Minimum Requirement #8 – Wetland Protection

Volume I, Section 2.5.8 of the Stormwater Manual has guidance on meeting Minimum Requirement #8. Refer also to ECDC Chapter 23.40.

4.9 Minimum Requirement #9 – Operation and Maintenance

BMPs shall be maintained in accordance with the provisions in Chapter 7 of this Supplement.

4.10 Minimum Requirement #10 – Offsite Analysis and Mitigation

Large Site Projects that discharge stormwater off site shall submit as part of their ***Stormwater Site Plan*** an offsite analysis that assesses the potential offsite impacts of stormwater discharge. Offsite analyses assess upstream and downstream conditions, including the conveyance capacity and erosion potential in the downstream system. If a problem is found, mitigation is required to prevent worsening of that problem.

The existing or potential impacts to be evaluated and mitigated as part of any off- site/downstream analysis shall include:

- Conveyance system capacity problems.
- Localized flooding.
- Wetlands impacts such as siltation or other damage.
- Upland erosion impacts, including landslide hazards.

- Stream channel erosion in the channel or at the outfall location.
- Locations where surface water enters and exits the site.

All projects shall perform a *qualitative* analysis downstream from the site. A *quantitative* analysis may also be required by the Director or his/her designee when there is a potential for downstream flooding or erosion. Each of these types of analysis is described further below.

4.10.1 Qualitative Analysis

Project applicants shall submit a qualitative analysis of each upstream drainage system entering a site (run-on) and each downstream drainage system leaving a site (runoff). The upstream analysis shall identify and describe points where water enters the site and the tributary area. The qualitative analysis shall extend downstream for the entire flow path, from the project site to the receiving water, or up to one-quarter mile, whichever is less. A map defining the onsite and offsite areas that contribute stormwater runoff to the site shall be provided by the applicant. The map shall be prepared with a defined scale.

Upon review of this analysis, the Public Works Director or Designee may require a qualitative analysis extending further downstream, mitigation measures deemed adequate to address the problems, or a quantitative analysis, depending upon the presence of existing or predicted flooding, erosion, or water quality problems, and on the proposed design of the onsite drainage facilities.

4.10.2 Quantitative Analysis

If required, a ***civil engineer*** or professional land surveyor must field survey all existing storm drainage systems downstream of the project site for a minimum distance of 1/4-mile from the point of connection to the existing public drainage system. If the ultimate discharge point is to Puget Sound via a culvert owned by BNSF Railway, the analysis must be followed through the drainage system all the way to Puget Sound. The goal of the inspection and analysis is to evaluate whether the capacity of the drainage system(s) is adequate to handle the existing flows, flows generated by the project, flooding problems, erosion damage or potential, amount of freeboard in channels and pipes, and storage potential within the system.

All existing and proposed offsite surface water conveyance systems shall be sized to convey flows without surcharging the City's storm system or the BNSF culvert under the railroad tracks (if applicable) during the 50-year recurrence event. If the project is in the North Edmonds Earth Subsidence and Landslide Hazard Area (ESLHA, see Appendix B), contact the City Engineering Division for requirements.

If a capacity problem, streambank erosion problem, or other problem with the downstream system is encountered in the analysis, the runoff flow from the project site will be restricted per Minimum

Requirement #7 – Flow Control or other mitigation may be proposed by the applicant subject to review by the Public Works Director or Designee.

4.11 Minimum Requirement #11 – Financial Liability

A performance bond shall be posted as a financial guarantee for required stormwater systems and BMPs related to Construction Stormwater Pollution Prevention Plans for the following Large Site Projects:

- Single family residential projects located within ***Critical Areas***, Critical Area buffers including the ESLHA.
- Multi-family residential and commercial projects
- Subdivisions involving 7,000 square feet or more of ***land disturbing activity***.

Figure 4-1: Flow Chart for Determining Minimum Requirements for New Development on Large Site Projects

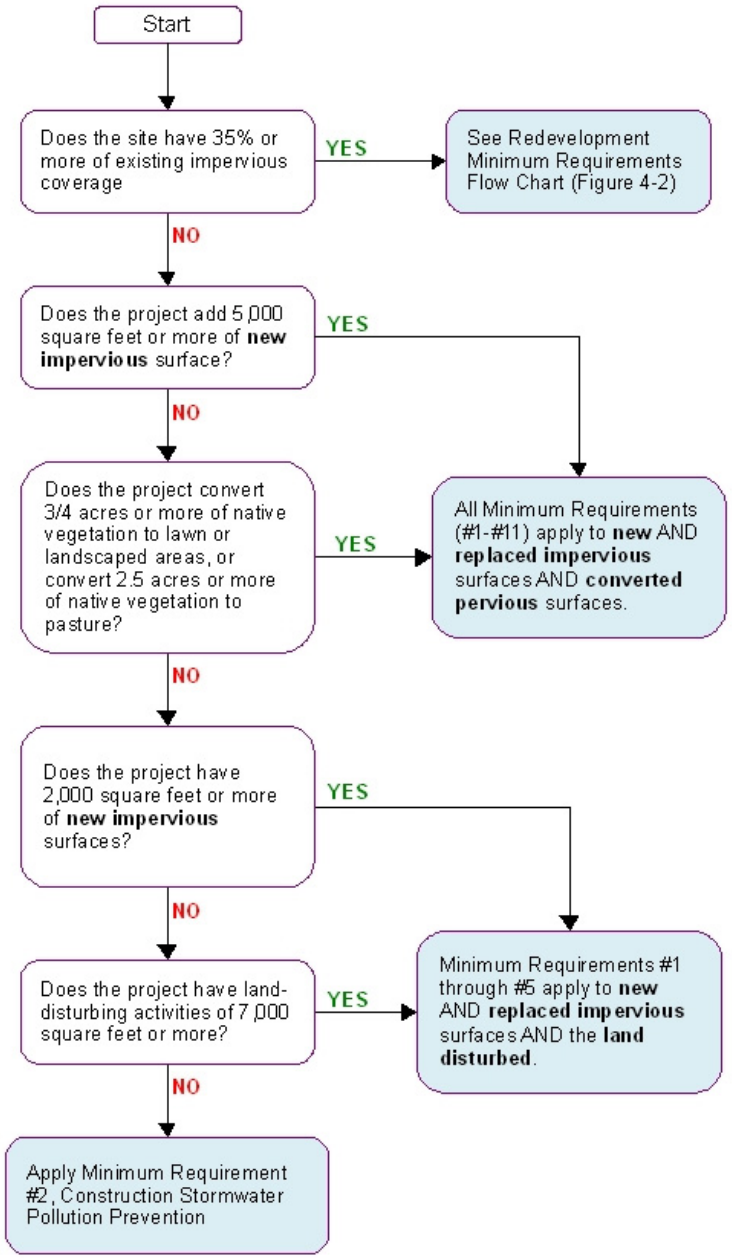
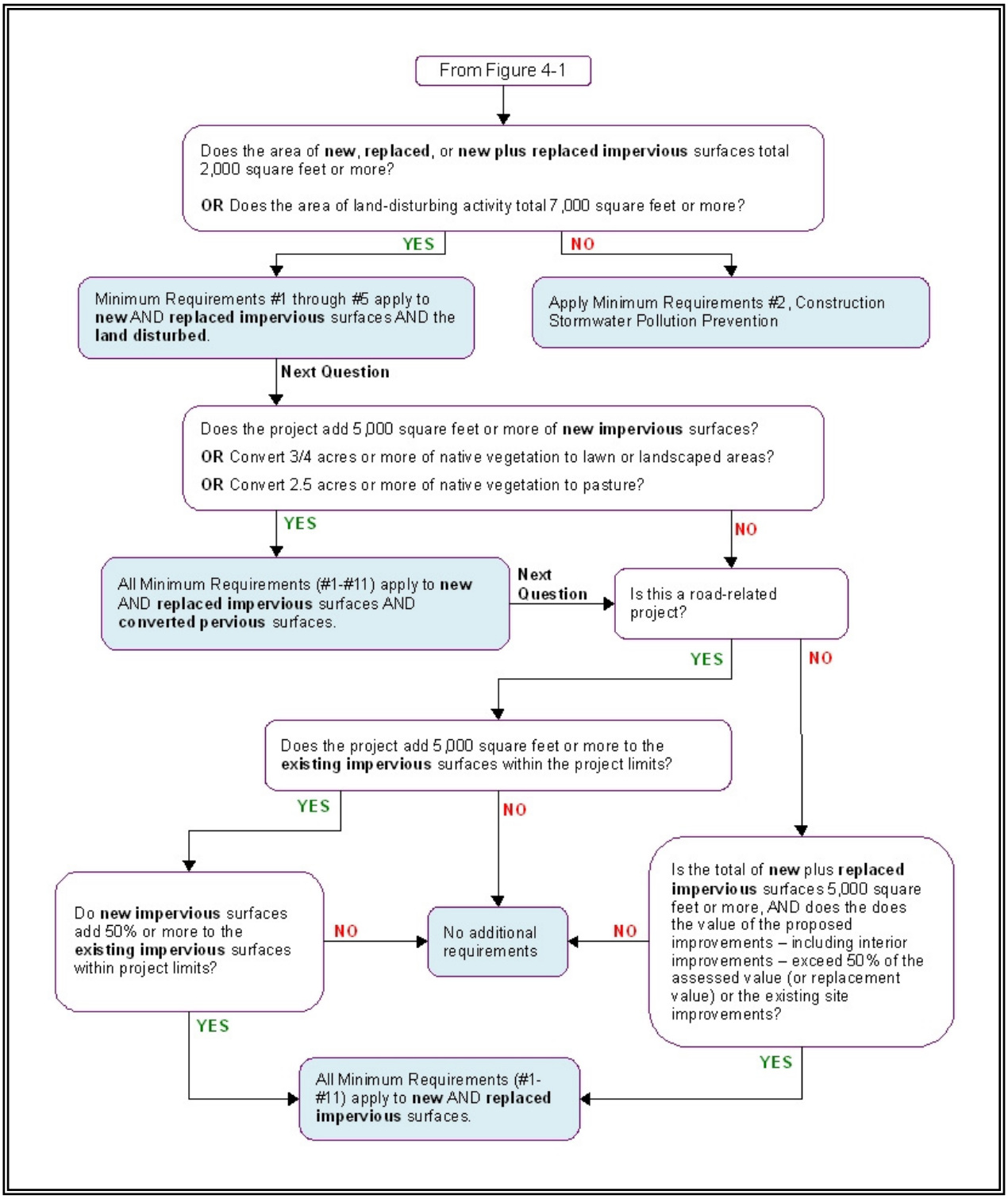


Figure 4-2: Flow Chart for Determining Minimum Requirements for Redevelopment on Large Site Projects



5.0 Small Site Requirements

This section provides specific guidance on how to comply with the minimum requirements for ***Small Site Projects***. Appendix B contains supplemental technical information on watershed boundaries and the location of steep slopes and soil types.

The requirements applicable to Small Site Projects differ for **Category 1** and **Category 2** project types. For an explanation of how to classify a Small Site project, see Chapter 2.

Category 1 Small Site Projects are subject to the following Minimum Requirements for all ***new and replaced impervious surfaces***, ***converted pervious surfaces***, and ***disturbed pervious surface*** areas:

- **Small Site Minimum Requirement #1** – Preparation of Stormwater Site Plan (Section 5.1)
- **Small Site Minimum Requirement #2** – Construction Stormwater Pollution Prevention Plan (Section 5.2)
- **Small Site Minimum Requirement #3** – Source Control of Pollutants (Section 5.3, not required for single family residential sites)
- **Small Site Minimum Requirement #4** – Preservation of Natural Drainage Systems and Outfalls (Section 5.4)
- **Small Site Minimum Requirement #5** – Onsite Stormwater Management (Section 5.5)
- **Small Site Minimum Requirement #7** – Flow Control (Section 5.7, may be waived under certain circumstances)
- **Small Site Minimum Requirement #8 –** Wetland Protection (Section 5.8, if wetlands are on the site or the site drains to certain wetlands)
- **Small Site Minimum Requirement #9** – Operation and Maintenance (Section 5.9 if a structural BMP is installed)
- **Small Site Minimum Requirement #11** – Financial Liability (Section 5.11) for single family residential sites, applies only to stormwater systems constructed in or adjacent to Critical Areas or Critical Area buffers).

All nine of these Minimum Requirements may a not be applicable to any particular project. In most cases, Category 1 single family residential projects are subject to Minimum Requirements #1, #2 , #4 , #9 (possibly), and either Minimum Requirement #5 or #7 or a combination of both #5 and #7.

Category 2 Small Site Projects are subject to the Small Site Minimum Requirements listed for Category 1 Small Site Projects, as well as evaluating the applicability of the following for all ***new and replaced impervious surfaces***, ***converted pervious surfaces***, and ***disturbed pervious surface*** areas:

- **Small Site Minimum Requirement #6** – Runoff Treatment (Section 5.6)

- **Small Site Minimum Requirement #8** – Wetland Protection (Section 5.8)
- **Small Site Minimum Requirement #10** – Offsite Analysis and Mitigation (Section 5.10).

All 11 of these Minimum Requirements may a not be applicable to any particular project. In most cases, Category 2 single family residential projects are subject to Minimum Requirements #1, #2, #4, #9 and either Minimum Requirement #5 or #7 or a combination of both #5 and #7

5.1 Small Site Minimum Requirement #1 – Preparation of Stormwater Site Plan

Stormwater Site Plans shall be prepared for all Small Site Projects. The Stormwater Site Plan shall document compliance with all applicable minimum requirements and the design of all BMPs. For all Category 2 Small Site Projects that involve 5,000 square feet or more of ***new or replaced impervious surface*** (Category 2), stormwater BMPs must be designed by a ***civil engineer***.

This Stormwater Site Plan shall include the following:

- A complete dimension site plan, drawn to scale, showing area of proposed construction, modifications or repair, topographical information and a tally of the new and replaced impervious surface.
- Construction plan, details, and specifications when applicable of all stormwater control features.

Additional information may be required depending on the site conditions and proposed development. See handouts prepared by the City's Engineering Division for guidance and details on the submittal requirements.

The Stormwater Site Plan shall include the submittal requirements in the handout and reflect consideration of site planning and design measures intended to reduce the impact of the project on stormwater quality and quantity and should strongly consider the use of LID approaches as outlined in Section 3.0.

Table 5-1 summarizes some LID site planning measures that can be implemented, with references to guidance documents for further information.

Small Site Minimum Requirement #5 (Section 5.5) discusses LID techniques for managing stormwater runoff on site to reduce or eliminate the amount that flows offsite to ***receiving waters***.

Table 5-1: Site Planning and Design Techniques to Reduce the Amount of Stormwater Runoff Generated

BMP #	Stormwater Management Technique	Reference(s)/Design Guidance
T5-21	Better Site Design (e.g., ,Reduce Effective Impervious Areas Associated with Roads, Shared Accesses, Alleys, Sidewalks, Driveways, and Parking Areas)	Volume V Stormwater Manual; Chapter 3 LID Manual
T5.20	Native Vegetation Protection, Reforestation, and Maintenance	Volume V Stormwater Manual; Chapter 4 LID Manual
--	Minimize disturbance area	Volume V Stormwater Manual; Section 5 LID Manual
--	Vegetated Roofs	City Building Division
--	Rainwater Harvesting	LID Manual
--	Permeable Pavement (asphalt, concrete, paving blocks, "grass-crete")	Section 6.3 LID Manual or Volume 3 Seattle Manual (base course requirements)

LID Manual = Low Impact Development: Technical Guidance Manual for Puget Sound.
Volume 3 Seattle Manual = Stormwater Flow Control & Water Quality Treatment Technical Requirements Manual.
Stormwater Manual = Stormwater Management Manual for Western Washington.

5.2 Small Site Minimum Requirement #2 – Construction Stormwater Pollution Prevention Plan

A Construction Stormwater Pollution Prevention Plan contains two parts: an Erosion and Sediment Control Plan and a Stormwater Spill Prevention Plan. Most Small Site Projects are only required to have an Erosion and Sediment Control Plan. Additional pollution prevention measures may be required based on site specific conditions or construction methods proposed.

All new development and redevelopment projects are responsible for preventing erosion and discharge of sediment and other pollutants into receiving waters during construction. See handouts prepared by the City's Engineering Division for guidance on preparing a stormwater pollution prevention plan for small sites. See Volume II of the Stormwater Manual for direction on BMP selection and design. The City of Edmonds does not approve erosivity waivers, as described in Section 4.2, Appendix 1 of the Phase II Permit.

5.3 Small Site Minimum Requirement #3 – Source Control of Pollution

All known, available, and reasonable ***source control*** BMPs shall be applied to control pollution. Source control BMPs shall be selected, designed, and maintained in according to the Stormwater Manual. See Volume IV of the Stormwater Manual for guidance on the applicable source control BMP selection and implementation.

Specific source controls are not required for single family residential sites. General requirements for these sites include preventing the discharge of pollutants to the City's storm drainage system per Edmonds City

Code Chapter 7.200 (Illicit Discharges). These pollutants include common household items such as pesticides, herbicides, fertilizers, detergents, and fluids from vehicle maintenance.

5.4 Small Site Minimum Requirement #4 – Preservation of Natural Drainage Systems and Outfalls

Natural drainage patterns shall be maintained, with run-on (from a potential upstream site) and runoff from effective impervious surface on the project site discharging via the location of the ***natural drainage system and outfall***, to the maximum extent practicable. In most cases, the "natural location" is the existing discharge location at the site. For some redevelopment projects, the natural location for runoff discharge may have been previously altered. If there is a question as to the natural discharge location, contact City Engineering Division staff.

The manner in which runoff is discharged from the project site must not cause an adverse impact to downstream receiving waters and down-gradient properties. All outfalls require energy dissipation to prevent erosion. Minimum Requirement #10 describes offsite analysis that is required for certain Category 2 Small Site Projects to identify potential downstream concerns so that adverse impacts are avoided through appropriate design.

5.5 Small Site Minimum Requirement #5 – Onsite Stormwater Management

Onsite stormwater management BMPs described in this section are considered LID techniques. These onsite/LID techniques should be considered at all small sites to infiltrate, disperse, and retain stormwater runoff on site *without causing flooding or erosion impacts*. If properly designed in the right soil conditions, these onsite/LID BMPs can be used for flow control and/or runoff treatment to reduce the size of, or eliminate the need for, additional facilities designed to comply with Minimum Requirements #6 (Runoff treatment) and #7 (Flow Control), if applicable.

As stated in Small Site Minimum Requirement # 1, the use of LID approaches should begin at the site planning stage to minimize the amount of stormwater runoff that is released from a site. Once site planning and design are complete and the generation of offsite stormwater runoff is minimized, the stormwater runoff from the planned impervious surface and converted pervious surface areas may be mitigated.

The soil quality and depth BMP T5.13 for compost-amending, in Chapter 5 of Volume V of the Stormwater Manual is required for all ***disturbed pervious surface areas*** to restore the water holding capacity of these areas.

5.5.1 Onsite/LID BMP Selection

Common LID practices include but are not limited to:

- Bioretention cells (also known as rain gardens).
- Small-scale "traditional" infiltration techniques (such as trenches, dry wells, and gravelless chambers).
- Permeable pavement (asphalt, concrete, paving blocks, "grass-crete").
- Dispersion BMPs such as wheel strip driveways or other pavement sloped to drain to drain to onsite vegetation adequate for dispersion, or downspout or sheet flow dispersion.

Onsite/LID BMP design requirements shall be those in the LID Manual or the Washington State Department of Transportation's Highway Runoff Manual. BMP design requirements presented in other stormwater management manuals or standard documents approved by Ecology such as the City of Seattle and King County stormwater manuals are also acceptable when modified for local conditions such as precipitation and soil conditions. Table 5-2 presents a summary of Onsite/LID measures that could be used to manage stormwater onsite, along with references for design guidance information. Additional LID BMPs can be proposed as long as they are found in an Ecology-approved stormwater manual, appropriate for site conditions, and do not cause flooding or erosion impacts onsite or offsite.

LID techniques that rely on infiltration should be designed with caution, due to the prevalence of till or "hardpan" soil and steep slopes in Edmonds. Section 5.5.2 discusses this matter further.

Table 5-2: Commonly Used Onsite/LID Stormwater Management Techniques

BMP #	Onsite Stormwater Management Technique	Reference(s)/Design Guidance
Infiltration BMPs		
	Bioretention Facilities (Rain gardens)	Section 6.1 LID Manual and City Pre-Sizing Tables
-	Infiltration Trench (downspout or other)	City Pre-Sizing Tables
-	Drywell	City Pre-Sizing Tables
	Gravelless Chamber	City Pre-Sizing Tables
T5.13	Post-Construction Soil Quality and Depth (compost-amended)	Volume V Stormwater Manual; Section 6.1 LID Manual
Dispersion BMPs		
C.2.9.3	Wheel Strip Driveway	King County Manual. Appendix C.
	Downspout or Sheet Flow Dispersion Systems	City Pre-Sizing Tables

LID Manual = Low Impact Development: Technical Guidance Manual for Puget Sound.
City Pre-Sizing Tables are available from the City's Engineering Division
Stormwater Manual = Stormwater Management Manual for Western Washington.
King County Manual = 2009 Surface Water Design Manual.

5.5.2 Onsite/LID Techniques and Infiltration

Onsite/LID features that rely on infiltration are not appropriate for every site. Limitations and considerations include:

- Infiltration is prohibited in the North Edmonds Earth Subsidence and Landslide Hazard Area (ESLHA, see Appendix B) (ECDC Chapter 19.10), upgradient of the ESLHA, and other areas with geological instability (landslide hazard areas).
- Infiltration is prohibited in "steep slope areas" with average ground surface slopes equal to or greater than 15 percent (see Appendix B).
- Infiltration is prohibited within setbacks from the top of a designated landslide hazard or steep slope areas.
- Infiltration should be applied in areas that have higher infiltration rates (including Everett gravelly sandy loam soils).

When not restricted as noted above, infiltration should be used as much as possible in the ***Greater Lake Ballinger Watershed*** and in all other ***creek*** basins.

Soils reports are required where infiltration is proposed, and for individual lots they must include at least two soils logs for each proposed infiltration location. Each log shall correspond to soil conditions extending a minimum of 4 feet depth below ground surface (6 feet for drywells). The report shall describe the Soil Conservation Service (SCS, now called the Natural Resource Conservation Service or NRCS) series of the soil and the textural class of each horizon through the depth of the log, and it shall include notes of any evidence of a high ***groundwater*** table, such as mottling. Reports solely using the Unified Soil Classification System (USCS) will not be accepted. Soils reports must be prepared by or under the direction of a licensed onsite sewage system designer, ***civil engineer***, engineering geologist, or geotechnical engineer.

A soils report produced for siting and design of an onsite sewage system may also be used to satisfy this soils report requirement, provided that (a) the depth of the soil log(s) is at least 4 feet, (b) the depth to seasonal high water table is determined, and (c) the location of the soil logs is adequate to determine the feasibility of the infiltration system.

Field infiltration rates can be evaluated using one of two approved methods: the USDA Textural Classification, or the Modified Pilot Infiltration Testing (PIT) Method.

A correction factor shall be applied to the measured infiltration rate to convert to the design infiltration rate. This correction factor shall be different based on the time of year of the test. If the test is conducted from May 1 through October 31, the correction factor shall be two times the correction factor listed in Table C-1 (USDA method) or Table C-2 (modified PIT method) in Appendix C of this Supplement. For infiltration rates tested from November 1 – April 30, the correction factor shall be equal to the correction factor listed in Table C-1 (USDA method) or Table C-2 (modified PIT method) in Appendix C of this Supplement.

In certain situations, BMPs that rely on infiltration are classified as Underground Injection Controls (UICs) and may be regulated by Ecology under the UIC Program (Washington Administrative Code [WAC] 173 218). For more information on Underground Injection Control (UIC) see the 2006 Ecology document titled Guidance for UIC Wells that Manage Stormwater. This document is available online at <http://www.ecy.wa.gov/biblio/0510067.html>.

5.5.3 Bioretention Cells or Rain Gardens for Single Family Residential Sites

Rain gardens may be designed using the Rain Garden Handbook for Western Washington Homeowners (WSU Extension 2009) (without the services of certified geotechnical professional) under the following circumstances:

- The area of ***land-disturbing activity*** on the site is below the regulatory threshold (1 acre of land-disturbing activity).
- The site is zoned as single-family residential.
- The rain garden(s) will receive runoff from less than 2,000 square feet of impervious surface.

If the amount of new, replaced, or new plus replaced impervious surface area (regulated impervious area) is 2,000 square feet or greater, the applicant may subtract the amount of regulated impervious surface area that will be served by the rain garden(s) from the total regulated impervious surface area. The balance of the regulated impervious surface area will still be subject to all applicable minimum requirements (even if this balance is less than 2,000 square feet). For example, suppose a Category 1 single-family residential Small Site Project has 3,700 square feet of regulated impervious surface area. An owner plans to use two rain gardens designed per the Rain Garden Handbook for Western Washington Homeowners, each handling 950 square feet of regulated impervious surface area. The owner must apply other BMPs to the remaining 1,800 square feet of regulated impervious surface area to meet this minimum requirement.

If a rain garden is removed from service at any time, the impervious surface draining to it becomes new impervious surface subject to applicable stormwater requirements.

5.6 Small Site Minimum Requirement #6 – Runoff Treatment

Runoff treatment BMPs, if applicable, must handle the water quality ***design storm*** volume or peak flow rate using the appropriate treatment type (basic, enhanced, oil control, and/or phosphorus treatment) for all new and replaced project pollution generating surfaces. BMPs to meet this minimum requirement must be designed by a ***civil engineer***.

5.6.1 Project Thresholds

Stormwater treatment facilities are required for the following Category 2 Small Site Projects:

- Projects in which the total of new and replaced effective, ***pollution-generating impervious surface*** (PGIS) is 5,000 square feet or more in a ***threshold discharge area*** of the project.
- Projects in which the total of ***pollution-generating pervious surfaces*** (PGPS) is three-quarters (3/4) of an acre or more in a threshold discharge area, and from which there is a surface discharge from the site into a natural or man-made conveyance system from the site.

That portion of any development project in which the PGIS or PGPS thresholds listed above are not exceeded in a threshold discharge area should consider the use onsite stormwater management BMPs in accordance with Small Site Minimum Requirement #5 to the maximum extent practicable.

5.6.2 Runoff Treatment Standards

Runoff treatment standards shall be implemented per Section 4.6, Appendix 1 of the Phase II Permit. In addition, the following Edmonds-specific requirements apply.

5.6.2.1 Oil Control

All projects in areas *not* zoned as single family residential that collect runoff from 5 or more parking spaces shall install oil containment catch basins, if other approved oil control systems are not employed. The outlet pipe of these catch basins shall have a downturned 90 degree elbow to restrict the outflow of oil and other floatables. There should be at least 9 inches of clearance between the elbow and the inside wall of the catch basin to facilitate removal of floatables. A maintenance schedule for the removal of oil and other floatables from these catch basins must be submitted with all plans for review.

5.6.2.2 Phosphorus Treatment

Per Section 4.6.2, Appendix 1 of the Phase II Permit, phosphorus treatment is required for projects that discharge to a ***nutrient-critical receiving water***. Currently, this applies to projects in the ***Greater Lake Ballinger Watershed*** that have a ***total maximum daily load*** (TMDL) for phosphorus. Bioretention systems with overflows (i.e., systems not providing 100 percent infiltration) should not be used in this basin due to potential phosphorus export.

5.6.3 Runoff Treatment BMP Selection

A sampling of runoff treatment BMPs is summarized in Table 4-3, Section 4.6, with the treatment levels and design criteria references. BMPs shall be selected from the list according to the treatment type required, and according to the following general prioritization guidelines:

- Bioretention systems should be implemented where feasible in creek basins. If infiltration of runoff is not feasible at the site, consider use of bioretention systems with underdrains.

- Onsite stormwater management measures (see Section 5.5 above) are preferred, if feasible, over larger runoff treatment facilities. Be sure that these onsite techniques are being applied to the maximum extent practicable before selecting runoff treatment BMPs.

5.7 Small Site Minimum Requirement #7 – Flow Control

To reduce the impacts of stormwater runoff from impervious surfaces and land cover conversions, flow control BMPs shall be implemented for all ***effective impervious surface*** that *is* ***new and replaced*** and ***converted pervious surfaces***. To meet this minimum requirement, flow control BMPs for Category 2 Small Site Projects must be designed by a ***civil engineer***. As discussed in Section 5.5.1, the use of LID techniques under Small Site Minimum Requirements #1 and #5 can reduce or eliminate the need for compliance with this minimum requirement.

5.7.1 Project Thresholds and Applicability

The applicability of this minimum requirement is dependent upon the drainage basin of the project site. See Chapter 2 for drainage basin classifications.

Creek or Lake Basin Projects

For Small Site Projects in Creek or Lake Basins, Edmonds-specific flow control standards must be met if the total new and replaced impervious surface area exceeds 2,000 square feet.

Direct Discharge Basin Projects

For Small Site Projects in ***Direct Discharge Basins*** Edmonds-specific flow control standards must be met if the total new and replaced impervious surface area exceeds 2,000 square feet. Small Site Projects in ***Direct Discharge Basins*** can be exempt from Small Site Minimum Requirement #7 under any one of the following circumstances:

- A quantitative offsite analysis as described in Small Site Minimum Requirement #10 is performed by the applicant and no unacceptable downstream issues are found.
- A quantitative offsite analysis as described in Small Site Minimum Requirement #10 is performed by the applicant and one or more unacceptable downstream issue is discovered. A plan is proposed by the applicant to mitigate for the unacceptable downstream issue and the mitigation plan is approved by the Public Works Director or designee.

Any Small Site Project in a Direct Discharge Basin can be exempt from Small Site Minimum Requirement # 10 by meeting the applicable flow control standards for sites in Creek or Lake Basins (see Section 5.7.2).

5.7.2 Flow Control Standards

Flow control standards for Small Site Projects vary by basin type and the amount of new and replaced effective impervious surface area and whether the project is in a Creek or Lake Basin or a Direct Discharge Basin. These standards are summarized in Table 5-3 and 5-4 below.

Small Site Projects in Creek or Lake Basins must meet the Edmonds-specific flow control standards. Recurrence interval flows for the developed condition shall be determined using a continuous hydrologic model. For sites with 2,000 square feet or greater (and less than or equal to 5,000 square feet) of new plus replaced effective impervious surface area the post-development 10-year recurrence interval flow shall not exceed 0.25 cubic feet per second (cfs) per acre of impervious surface area.

For sites with greater than 5,000 square feet of new plus replaced impervious surface area, limits for the post-development peak flows depend upon the BMP type selected:

- For detention BMPs:
  - Creek or Lake Basins: the post-development 2-, 10-, and 100-year recurrence interval peak flows shall not exceed 0.07, 0.14, and 0.33 cfs per acre of impervious surface area, respectively.
  - Direct Discharge Basins: the post-development 10-, and 100-year recurrence interval peak flows shall not exceed, 0.25 and 0.45 cfs per acre of impervious surface area, respectively.
- For infiltration BMPs:
  - Creek or Lake Basins: the post-development 2-, 10-, and 100-year recurrence interval peak overflows shall not exceed 0.07, 0.25, and 0.45 cfs per acre impervious surface area, respectively.
  - Direct Discharge Basins: the post-development 10-, and 100-year recurrence interval peak overflows shall not exceed 0.25, and 0.45 cfs per acre impervious surface area, respectively.

There are two methods to satisfy Minimum Requirement #7 for sites subject to the Edmonds-specific standard: the "LID Credit Option" and the "Traditional Option". Small Site Projects should strongly consider the LID Credit Option to implement flow control, if feasible. The LID Credit Option allows an applicant to mitigate only a portion of the new and replaced impervious surface area if only LID site planning techniques and LID BMPs are used. The requirements for the LID Credit Option are presented below:

- For projects that generate greater than 2,000 square feet (but less than or equal to 5,000 square feet) of new plus replaced effective impervious surface area, the greater of 1) 2,000 square feet or 2) 85 percent of new plus replaced impervious surface area is mitigated to meet the flow control standard using LID measures.
- For projects that generate greater than 5,000 square feet of new plus replaced effective impervious surface area, the greater of 1) 5,000 square feet or 2) 90 percent of new plus

replaced impervious surface area is mitigated to meet the flow control standard using LID measures.

If the LID Credit Option is not used to meet Minimum Requirement #7, the project shall meet the flow control standard for all new and replaced impervious surface and converted pervious surface. In this case, the "Traditional Option", larger-scale infiltration BMPs or detention BMPs may be used to provide flow control for the areas not mitigated using LID techniques.

Table 5-3: City of Edmonds Flow Control Requirements for Small Site Projects – Creek or Lake Basins [a]

	≥2,000 sf Effective Impervious Area [b]	≥5,000 sf Effective Impervious Area
Numerical Standard		
Maximum Recurrence Interval Flow from Developed Site:	10-year = 0.25 cfs/acre impervious	For detention BMPs: 2-year = 0.07 cfs/acre impervious, 10-year = 0.14 cfs/acre impervious, and 100-year = 0.33 cfs/acre impervious. For infiltration BMPs: 2-year = 0.07 cfs/acre impervious, 10-year = 0.25 cfs/acre impervious, and 100-year= 0.45 cfs/acre impervious.
Applies to:	New and replaced impervious surface	New and replaced impervious surface
Computational Methods	Simplified Sizing Approach or continuous hydrologic modeling with MGS precipitation data [c,d]	Simplified Sizing Approach or continuous hydrologic modeling with MGS precipitation data [c,d]
Options to Meet Numerical Standard		
LID Credit Option (If feasible)	If 2,000 sf or 85% of new plus replaced impervious surface area (whichever is greater) is mitigated to the numerical standard using Onsite/LID techniques (Minimum Requirement #5), the requirement is met.	If 5,000 sf or 90% of new plus replaced impervious surface area (whichever is greater) is mitigated to the numerical standard using Onsite/LID techniques (Minimum Requirement #5), the requirement is met.
Traditional Option	If not feasible to achieve standard with Onsite/LID option, numerical standard must be achieved for the entire site. Larger-scale infiltration or detention may be used – see Section 5.7.4.	If not feasible to achieve standard with Onsite/LID option, numerical standard must be achieved for the entire site. Larger-scale infiltration or detention may be used – see Section 5.7.4.

cfs: cubic feet per second

sf: square feet

LID: low impact development

[a] Sites with less than 1-acre of land-disturbing activities

[b] But less than 5,000 sf of new plus replaced effective impervious surface

[c] MGS precipitation is the Puget East 36 precipitation time series developed for the Washington State Department of Transportation by MGS Engineering Consultants, Inc. and available in WWHM and MGS Flood hydrologic modeling software.

[d] For infiltration facilities, flood frequency calculations (i.e., determination of recurrence interval peak flows) must be performed using an approach capable of properly evaluating zero flow years as explained in Section 5.7.3.1 below.

Table 5-4: City of Edmonds Flow Control Requirements for Small Site Projects – Direct Discharge Basins [a]

	≥ 2,000 sf Effective Impervious Area
Numerical Standard:	For detention and infiltration BMPs: 10-year = 0.25 cfs/acre impervious, and 100-year= 0.45 cfs/acre impervious An exemption from these flow control standards may be allowed by the Public Works Director or designee if a quantitative offsite analysis per Large Site Minimum Requirement # 10 (see Section 4.10) indicates no unacceptable downstream issue (such as a capacity or erosion issue). If an unacceptable downstream issue is found, the applicant can either propose mitigation of the issue to the Public Works Director or designee (whom will consider the proposal but not necessarily approve it) or design and implement flow control measures to the Lake or Creek Basin Standard (see Section 5.7.1)..
Applies to:	New and replaced impervious surface and disturbed pervious areas
Computational Methods	Simplified Sizing Approach or continuous hydrologic modeling with MGS precipitation data [a, b]
Options to Meet Numerical Standard	
LID Credit Option (If feasible)	For sites with 2,000 sf or more (but less than 5,000 sf) of effective impervious surface: If 2,000 sf or 85% of new plus replaced impervious surface area (whichever is greater) is mitigated to the numerical standard using Onsite/LID techniques (Minimum Requirement #5), the requirement is met. For sites with 5,000 sf or more of effective impervious surface: If 5,000 sf or 90% of new plus replaced impervious surface area (whichever is greater) is mitigated to the numerical standard using Onsite/LID techniques (Minimum Requirement #5), the requirement is met.
Traditional Option	If Onsite/LID techniques are not feasible, larger-scale infiltration or detention may be used to mitigate capacity impact to the extent necessary - See Section 5.7.4.

sf square feet

[a] MGS precipitation is the Puget East 36 precipitation time series developed for the Washington State Department of Transportation by MGS Engineering Consultants, Inc. and available in WWHM and MGS Flood hydrologic modeling software.

[b] For infiltration facilities, flood frequency calculations (i.e., determination of recurrence interval peak flows) must be performed using an approach capable of properly evaluating zero flow years as explained in Section 5.7.3.1 below

5.7.3 Flow Control Facility Sizing

5.7.3.1 Modeling Requirements

Flow control facilities must be sized to meet the standards described above using an approved continuous simulation runoff model. Guidance on application of continuous runoff models for flow control BMP sizing is provided in Volume III of the Stormwater Manual. Supplemental guidance is provided in this section.

Approved continuous runoff models include the Western Washington Hydrologic Model (WWHM) and MGS-Flood. Flow control sizing must be conducted using the "Puget East 36" precipitation time series developed by MGS Engineering Consultants (MGS 2002). This time series is available in WWHM (labeled "DOT data"), and is one of the default precipitation time series in MGS-Flood.

Flood frequency calculations (i.e., determination of recurrence interval peak flows) must also be performed for infiltration facilities, using an approach capable of properly evaluating zero flow years.

This is important, because infiltration facilities sized to meet the recommended flow control standards will infiltrate approximately 98 percent of the runoff volume, resulting in an annual peak flow time series that contains several zero or very low peak flow values.

Currently, the MGS-Flood model properly calculates flood frequency for these scenarios, but WWHM does not. Until WWHM integrates a more flexible flood frequency routine, it is recommended that annual peak flow datasets with multiple low or zero annual peak flow values be exported from WWHM and analyzed using a spreadsheet method to determine flood frequency (i.e., 2-, 10-, and 100-year recurrence interval flows). The Gringorten plotting position formula (Maidment 1993), which is non-parametric (i.e., does not depend on the mean, standard deviation, or skew of the data), works well for these applications.

5.7.3.2 Simplified Sizing Approach

A pre-sized approach for sizing flow control BMPs has been developed for Small Site Projects in Edmonds with between 2,000 and 10,000 square feet of new and replaced impervious surface area. This approach allows the designer to size selected BMPs to meet the numerical flow control standards without the use of a continuous hydrologic model. Guidance for using the simplified sizing approach for flow control BMPs is provided in handouts available from the City Engineering Division.

5.7.4 Flow Control BMP Selection

This section discusses infiltration and flow control BMPs. If onsite/LID techniques are not used, flow control can be achieved using larger-scale infiltration or detention facilities.

5.7.4.1 Larger Scale Infiltration

If LID techniques are not feasible to meet this minimum requirement, larger-scale, centralized infiltration facilities may be used (as opposed to the small and distributed infiltration facilities associated with LID). Infiltration is a preferred method of stormwater flow control relative to detention, but only in certain areas of Edmonds where infiltration of large amounts of runoff in a concentrated area will not contribute to flooding or offsite slope stability problems. The feasibility of infiltration as a means to meet stormwater flow control and treatment requirements will depend upon specific project site locations due to the variations in soil and topography across the City. See Chapter 5.5.2 for guidelines pertaining to the applicability and testing required for implementing infiltration for flow control.

A sampling of infiltration BMPs for flow control is summarized in Table 5-5.

5.7.4.2 Detention

If infiltration BMPs are not feasible to meet flow control requirements for a site, detention BMPs can be used. The minimum orifice size for a detention control structure is one-half inch (1/2 inch). Table 5-4 summarizes some available detention BMPs for flow control.

5.8 Small Site Minimum Requirement #8 – Wetland Protection

Section 2.5.8 of Volume I of the Stormwater Manual has guidance on meeting Small Site Minimum Requirement #8. Refer also to ECDC Chapter 23.40.

5.9 Small Site Minimum Requirement #9 – Operation and Maintenance

BMPs shall be maintained in accordance with the provisions in Chapter 7 of this Supplement.

Table 5-5: Flow Control Best Management Practices

BMP #	Flow Control BMP	Reference(s)/Design Guidance
Larger-Scale Infiltration BMPs		
T7.10	Infiltration Basins	Volume III Stormwater Manual
T7.20	Infiltration Trenches	Volume III Stormwater Manual
T7.30	Infiltration Vaults	Volume III Stormwater Manual
--	Gravelless Chambers	Kitsap County Stormwater Management Design Manual (Kitsap County 1997)
Detention BMPs		
--	Detention Ponds	Volume III Stormwater Manual
--	Detention Tanks	Volume III Stormwater Manual
--	Detention Vaults	Volume III Stormwater Manual
--	Use of Parking Lots for Detention	Volume III Stormwater Manual
--	Use of Roofs for Detention	Volume III Stormwater Manual and City Building Division

Stormwater Manual = Stormwater Management Manual for Western Washington.

5.10 Small Site Minimum Requirement #10 – Offsite Analysis and Mitigation

Offsite analyses assess upstream and downstream conditions, including conveyance capacity limitations or erosion potential in the downstream system. A *qualitative* or *quantitative* analysis may be required by the Public Works Director or a designee when there is a potential for downstream flooding or erosion. If a problem is found, mitigation is required to prevent worsening the problem.

The existing or potential impacts to be evaluated and mitigated as part of any offsite/downstream analysis shall include:

- Conveyance system capacity problems.
- Localized flooding.
- Wetlands impacts such as siltation or other damage.
- Upland erosion impacts, including landslide hazards.
- Stream channel erosion in the channel or at the outfall location.

- Locations where surface water enters and exits the site.

5.10.1 Qualitative Analysis

If required, project applicants shall submit a *qualitative* analysis of each upstream drainage system entering a site (run-on) and each downstream drainage system leaving a site (runoff). The upstream analysis shall identify and describe points where water enters the site and the tributary area. The qualitative analysis shall extend downstream for the entire flow path, from the project site to the receiving water, or up to one-quarter mile, whichever is less. A map defining the onsite and offsite areas that contribute stormwater runoff to the site shall be provided by the applicant. The map shall be prepared with a defined scale.

Upon review of this analysis, the Public Works Director or Designee may require a qualitative analysis extending further downstream, mitigation measures deemed adequate to address the problems, or a quantitative analysis, depending upon the presence of existing or predicted flooding, erosion, or water quality problems, and on the proposed design of the onsite drainage facilities.

5.10.2 Quantitative Analysis

If required, a ***civil engineer*** or professional land surveyor must field survey all existing storm drainage systems downstream of the project site for a minimum distance of 1/4-mile from the point of connection to the existing public drainage system. If the ultimate discharge point is to Puget Sound via a culvert owned by BNSF Railway, the analysis must be followed through the drainage system all the way to Puget Sound.

The goal of the inspection and analysis is to evaluate whether the capacity of the drainage system(s) is adequate to handle the existing flows, flows generated by the project, flooding problems, erosion damage or potential, amount of freeboard in channels and pipes, and storage potential within the system. All existing and proposed offsite surface water conveyance systems shall be sized to convey flows without surcharging the City's storm system or the BNSF culvert under the railroad tracks (if applicable) during the 50-year recurrence event. If the project is in the ESLHA (see Appendix B), contact the City Engineering Division for requirements.

If a capacity problem, streambank erosion problem, or other problem with the downstream system is encountered in the analysis, the flow from the project shall be restricted per Minimum Requirement #7 – Flow Control or other mitigation may be proposed by the applicant subject to review by the Public Works Director or designee..

5.11 Small Site Minimum Requirement #11 – Financial Liability

A performance bond shall be posted as a financial guarantee for required stormwater systems and BMPs related to Construction Stormwater Pollution Prevention Plans for the following Small Site Projects:

- Single family residential projects located within ***Critical Areas*** (including the ESLHA) and critical area buffers.
- Multi-family residential and commercial projects
- Subdivisions involving 7,000 square feet or more of ***land disturbing activity***.

6.0 Minor Site Requirements

Minor Site Projects must comply with Minor Site Construction Stormwater Pollution Prevention Practices.

6.1 Minor Site Minimum Requirement – Construction Stormwater Pollution Prevention Plan

All new development, redevelopment, and construction projects are responsible for preventing erosion and discharge of sediment and other pollutants into the City's municipal storm drainage system and receiving waters. For Minor Site Projects, a shorter Minor Site Construction Stormwater Pollution Prevention Plan can be prepared.

The following BMPs must be applied:

For Sites with Clearing and Grading:

- Plan and implement proper clearing and grading of the site. It is most important to clear only the areas needed, preserve vegetation, protect soils, and keep exposed areas to a minimum.
- Re-vegetate, cover with straw, or otherwise stabilize all exposed soil as soon as possible.
- Locate any soil piles away from drainage systems. Temporary stabilization or covering of soil piles must occur at the end of each work day or other best management practices must be implemented to prevent discharges of soil or sediment to the City's storm drainage system or surface waters or adjacent properties.
- Provide storm drain inlet protection within the project area and downstream as required to prevent sediment and pollutants from entering the City's storm drainage system. Inlet protection must be maintained throughout the life of the project and not cause any discharge of sediment or localized flooding issues. All inlet protection must be removed and properly disposed of immediately after project completion.

Additional Requirements for Underground Utility Projects

- Areas within the paved City right-of-way that have soil or sediment deposited during construction must be swept or otherwise removed and properly managed at the end of each work day, unless other arrangements have been made with the City's Engineering Division.
- Water-tight trucks must be used to transport any saturated soils from the site.
- All contractors must a have a spill containment and clean up kit onsite at all times that is compatible with the applicable pollutants
- All utility workers must exercise proper pollution prevention techniques during all construction activities including the proper storage of any hazardous materials.

De-watering shall be controlled per Element #10, Section 3.2.3, Volume II, of the Stormwater Manual. All discharges into the City-owned storm system or water of the state shall be in compliance with ECC 7.200, Illicit Discharges. Sanitary sewer discharges must have the approval from the Edmonds Treatment Plant and Engineering Division.

See Volume II of the Stormwater Manual for additional guidance on the selection and design of construction-phase best management practices designed to prevent erosion and sedimentation.

7.0 Operation and Maintenance Requirements

See the LID Manual and Volume III and Volume V of the Stormwater Manual for guidance on operation and maintenance measures for BMPs.

8.0 Terminology

This section explains terms used in this Supplement. Additional definitions for stormwater requirements are found in ECDC 18.30.010 and the Stormwater Manual.

Basin plan: A plan or study to manage the quality and/or quantity of stormwater or water bodies within a watershed that has been formally adopted by the City of Edmonds.

Civil engineer: A professional engineer licensed in the state of Washington in civil engineering.

Direct discharge basin: A drainage basin that discharges runoff directly to Puget Sound via a pipe system, ditch, or other direct means without first entering a creek or other water body.

Disturbed pervious surface: Any part of a pervious area that is disturbed during a development or redevelopment project, but remains pervious after the project is completed.

Effective impervious surface: Those impervious surfaces that are connected via sheet flow or discrete conveyance to the City's municipal separate storm sewer system.

Grade: The slope of a surface such as a road, channel, or natural ground.

Grading: Any one or a combination of the following: excavating, filling, or disturbance of that portion of the soil profile that contains decaying organic matter.

Greater Lake Ballinger Watershed: That portion of the City of Edmonds that discharges stormwater runoff directly or indirectly into Chase Lake, Hall Creek, or Lake Ballinger.

Mitigation: Implement best management practices to reduce or eliminate the impacts of development on the City's stormwater system and receiving waters.

Nutrient-critical receiving water: Any surface water or water segment listed as Category 5 (impaired) under Section 303(d) of the Clean Water Act for total phosphorus through the State of Washington's Water Quality Assessment program and approved by EPA. Lake Ballinger is considered a nutrient-critical receiving water.

Pollution-generating impervious surfaces (PGIS): Those impervious surfaces considered to be a significant source of pollutants in stormwater runoff. Such surfaces include those which are subject to:

- Vehicular use
- Industrial activities as defined in the Stormwater Manual (Volume I, Glossary- p. 26)
- Storage of erodible or leachable materials, wastes, or chemicals
- Receiving direct rainfall or the run-on or blow-in of rainfall.

Erodible or leachable materials, wastes, or chemicals are those substances which, when exposed to rainfall, measurably alter the physical or chemical characteristics of the rainfall runoff. Examples include erodible soils that are stockpiled, uncovered process wastes, manure, fertilizers, oily substances, ashes, kiln dust, and garbage dumpster leakage.

Metal roofs are also considered PGIS unless they are coated with an inert, non-leachable material (e.g., baked-on enamel coating). A surface, whether paved or not, shall be considered subject to vehicular use if it is regularly used by motor vehicles. The following are considered regularly-used surfaces:

- Roads
- Unvegetated road shoulders
- Bike lanes within the traveled lane of a ***roadway***
- Driveways
- Parking lots
- Unfenced fire lanes
- Vehicular equipment storage yards
- Airport runways.

The following are not considered regularly used surfaces:

- Paved bicycle pathways separated from and not subject to drainage from roads for motor vehicles
- Fenced fire lanes
- Infrequently used maintenance access roads
- Sidewalks separated from and not subject to drainage from roads for motor vehicles.

Pollution-generating pervious surfaces (PGPS): Any non-impervious surface subject to application of pesticides or fertilizers, or loss of soil. Typical PGPS include lawns, landscaped areas, golf courses, parks, cemeteries, and sports fields.

Predevelopment condition: For sites that meet or exceed the regulatory threshold, and exceed the thresholds that require flow control in Table 4.2, Section 4.7 of the Phase II Permit, shall use the appropriate predevelopment condition described in said section of the Phase II Permit.

Regulatory Threshold: When referring to site size, those that have one acre or more of land-disturbing activity, including projects less than one acre of land-disturbing activity that are part of a larger ***common plan of the development or sale***.

Total Maximum Daily Load (TMDL): A TMDL is a calculation of the maximum amount of a pollutant that a ***water body*** can receive and still meet water quality standards, and an allocation of that amount to

the pollutant's sources. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation must include a margin of safety to ensure that the water body can be used for the purposes the state has designated. The calculation must also account for seasonable variation in water quality. Water quality standards are set by states, territories, and tribes. They identify the uses for each water body, for example, drinking water supply, contact recreation (swimming), and aquatic life support (fishing), and the scientific criteria to support that use. The Clean Water Act, section 303, establishes the water quality standards and TMDL programs. In Washington State, the Department of Ecology establishes water cleanup plans to guide TMDL implementation.

9.0 References

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Appendix A – Synopsis of the Western Washington Phase II Municipal Stormwater Permit

The City of Edmonds has a population of approximately 41,000 and owns and operates a municipal stormwater system that is separate from the sanitary sewer system. As such, the City is regulated by the Washington Department of Ecology (Ecology) to comply with the provisions of the Western Washington Phase II Municipal Stormwater Permit (Phase II Permit*)* for stormwater entering into and discharging from this municipal stormwater system.

The complete text of the NPDES Phase II Permit is available on Ecology's website [1]. This section provides a summary of permit provisions that relate to the City's management of stormwater.

Section S5.C.4 of the Phase II Permit prescribes how the City should regulate runoff from new development, redevelopment, and construction sites. For projects that involve 1 acre or more of land-disturbing activity [2] ("***regulatory threshold***"), the Phase II Permit requires compliance with certain minimum technical requirements. The City has adopted these minimum technical requirements from Appendix 1 of the Phase II Permit for sites that meet or exceed the regulatory threshold (Large Site Projects). Appendix 1 of the Phase II Permit also modifies or changes portions of the Stormwater Manual related to certain minimum requirements and exceptions/***variances***. These changes/additions have been incorporated into ECDC Chapter 18.30 and this Supplement and will be noted as such.

The Phase II Permit requires the City of Edmonds stormwater regulations to have a site planning process and BMP selection and design criteria that, when used to implement the Permit's minimum requirements (Appendix 1), will protect water quality, reduce the discharge of pollutants to the maximum extent practicable and satisfy the State requirement under Chapter 90.48 RCW to apply all known, available and reasonable methods of prevention, control and treatment (AKART) prior to discharge. The Phase II Permit also states that Permittees who choose to use the site planning process and BMP selection and design criteria in the Stormwater Manual, or an equivalent manual approved by Ecology under the Phase I Permit, may cite this choice as their sole documentation to meet this requirement. For Large Site Projects, the City of Edmonds has chosen to use the site planning process and BMP selection and design criteria in the Stormwater Manual, as modified by other equivalent manuals approved by the Department under the Phase I Permit. This Supplement provides details on implementing those requirements in Edmonds on sites of all sizes.

[1] <http://www.ecy.wa.gov/programs/wq/stormwater/municipal/phaseIIww/wwphiipermit.html>
[2] Including projects less than 1 acre of land-disturbing activity that are part of a larger common plan of the development or sale.

For sites that fall below regulatory threshold, the Phase II Permit gives regulated jurisdictions a choice: 1) either continue to apply the local stormwater requirements in effect at the time of permit issuance (February 2007) or 2) apply the same minimum requirements as for the Large Site Projects. The City of Edmonds has chosen to continue using the current stormwater requirements for projects that fall below the regulatory threshold but to clarify the requirements and provide more choices (Best Management Practices or BMPs) for achieving these requirements including the use of Low Impact Development (LID) techniques. The most recent stormwater requirements for City of Edmonds were adopted in March 1995. The field of stormwater management has advanced substantially in the almost 15 years since adopting these requirements. This Supplement incorporates advancements that aim to strike a balance between encouraging desirable development and providing environmental protection.

Most development projects in Edmonds will only be subject to the Small Site Project or Minor Site Project requirements since very few parcels in the City are 1 acre or greater. The Small Site Project requirements are tailored to primarily address stormwater management issues related to development and redevelopment of single family residential projects in the urban environment of Edmonds. These projects make up the majority of the development activity in the City. These requirements apply to non-single-family residential projects as long as these sites meet the definition of a Small Site Project.

Appendix B – Supplemental Technical Information

Edmonds Watersheds

Broadly speaking, the stormwater runoff in Edmonds either travels west to Puget Sound (either via a creek or directly piped) or to the east to Lake Ballinger or Hall Creek, which discharges to Lake Ballinger (Figure B-1).

Lake Ballinger has a Department of Ecology-mandated limit on the amount of phosphorus (a chemical element) that can enter the lake. Excess phosphorus from stormwater runoff is the primary driver for unwanted algae blooms in the lake. Due to this limit (or TMDL-total maximum daily load) for total phosphorus imposed by Ecology, special water quality treatment requirements are included under Minimum Requirement # 6 or Small Site Minimum Requirement #6. Private properties on the lake experience periodic flooding during large storm events. The City of Edmonds in conjunction with its watershed partners (Cities of Lynnwood, Mountlake Terrace, Shoreline and Lake Forest Park and Snohomish County) have developed a Strategic Action Plan for the greater Lake Ballinger/McAleer Creek Watershed to begin to address flooding a water quality issues in the basin.

Edmonds Soils and Slopes

Edmonds is fortunate to be located adjacent to Puget Sound and possess topography that facilitates desirable views. The underlying soils and relatively steep slopes, however, complicate the application stormwater management techniques.

Prior to logging and subsequent development of the Edmonds area, trees and the forest duff layer above the soil surface (consisting or primarily or needles, leaves, branches, bark, and stems, in various stages of decomposition) covered the City. The tree canopy stored a large amount of the rainfall and the duff layer acted as a giant sponge storing and soaking up rainfall. Virtually all of this rainfall was stored in the tree canopy and the duff layer, absorbed by the roots of trees or other vegetation, or slowly moved through the soil on top of less permeable layers, forming the headwaters of Edmonds creeks. There was little or no "runoff" from these forests.

With logging came the elimination of the majority of the tree canopy and the duff layer and the elimination of the associated water-holding capacity. The soils that remain, in the vast majority of the City, once the forest is removed, is till or hard pan that does not store or absorb the rainwater. Rain water, instead, primarily becomes runoff that flows off the impermeable soils and the hardscape or impermeable surfaces built during development (roofs, parking lots, roads, sidewalks, etc.). This runoff is collected in ditches or pipes and these concentrated flows are discharged to creeks, Lake Ballinger, or Puget Sound

(without treatment). By planting trees and using compost-amended soils the water-holding capacity of a developed site can improve, to a limited extent.

The U.S. Department of Agriculture, Natural Resource Conservation Service or USDA-NRCS (formerly the Soil Conservation Service) has mapped soil types in Edmonds (Figure B-2). Based on the most recent data from 1983, approximately 82 percent of the land area in Edmonds is underlain by Alderwood series soils (till or hardpan). Approximately 12 percent of Edmonds has Type A or permeable soils. Given this soil regime, infiltration, and low impact development techniques that primarily rely on infiltration, are challenging to implement in the majority of Edmonds.

Approximately 25 percent of the land area of Edmonds has a slope of 15 percent or greater or is in an Earth Subsidence and Landslide Hazard Area (the Meadowdale area in the northernmost portion of the City) (Figure B-3). Geologic hazards in these areas can be increased when stormwater runoff from impervious surfaces percolates into the soil.

Planners and designers should use the information on Figures B-2 and B-3 as guidelines since soil and slope conditions on an individual parcel may vary from the information presented. Nevertheless, careful consideration should be applied when infiltration or LID techniques relying on infiltration are considered in areas of till soils or steep slopes.

There are areas in the City where infiltration and low impact development techniques that rely on infiltration are feasible based on favorable soil type and relatively flat slopes; Southwest Edmonds, for example. In these areas infiltration and LID techniques are encouraged over more conventional stormwater management techniques.

FIGURE B-1
CITY OF EDMONDS WATERSHEDS

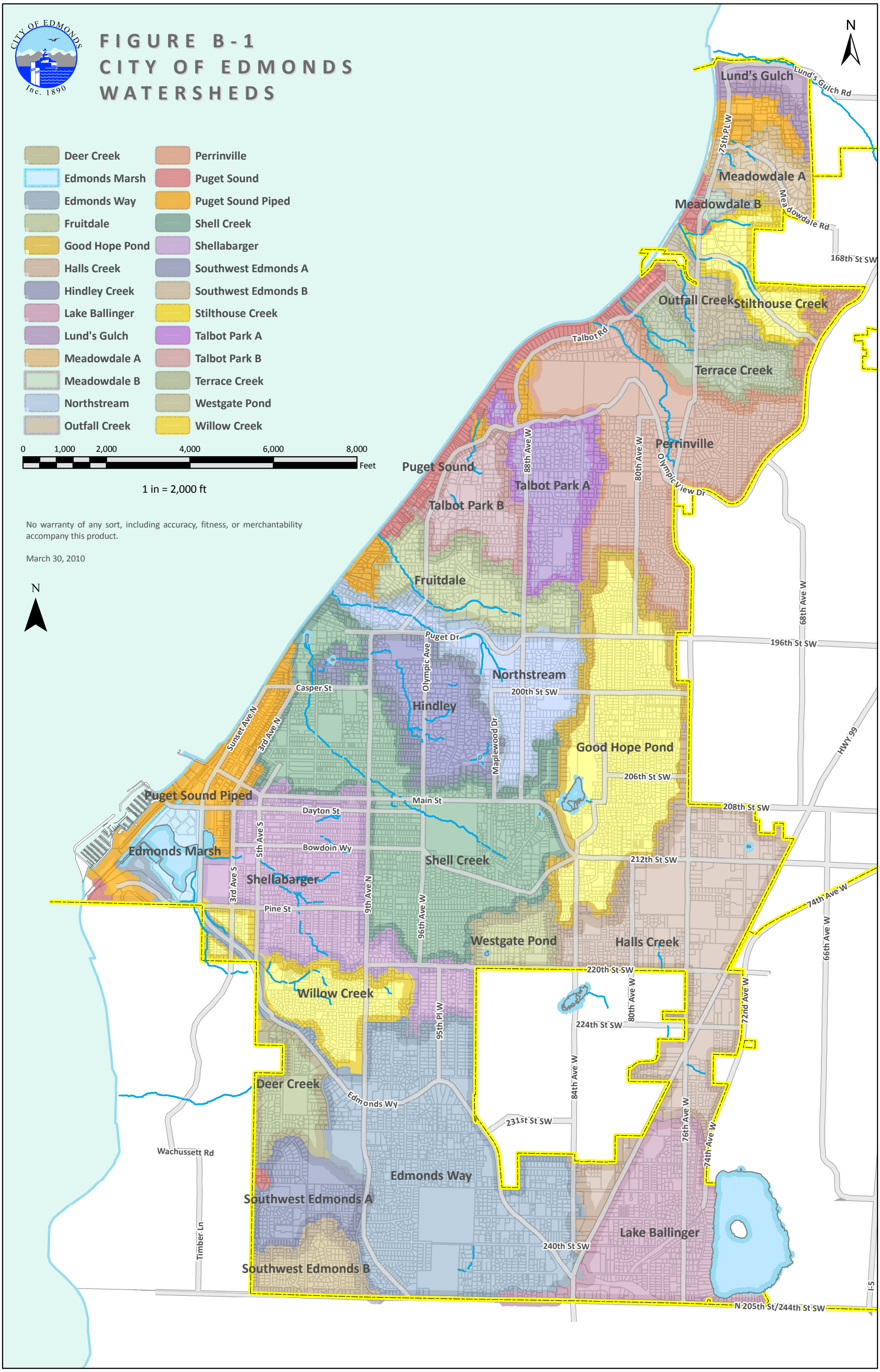


Figure B-2
City of Edmonds
Soil Map Units (SCS 1983)

LEGEND

City of Edmonds Boundary

Soil Map Units

SOIL_NAME

- Alderwood Gravelly sandy loam, 2-8 % slopes
- Alderwood Gravelly sandy loam, 8-15 % slopes
- Alderwood Gravelly sandy loam, 15-25 % slopes
- Alderwood Urban land complex, 2-8 % slopes
- Alderwood Urban land complex, 8-15 % slopes
- Alderwood-Everett Gravelly sandy loams, 25-70
- Custer fine sandy loam
- Everett gravelly sand loam, 0-8 % slopes
- Everett gravelly sand loam, 8-15 % slopes
- Everett gravelly sand loam, 15-25 % slopes
- Fluvaquents, tidal
- Kitsap silt loam, 0-8 % slopes
- Kitsap silt loam, 8-25 % slopes
- McKenna gravelly silt loam, 0-8 % slopes
- Mukilteo muck
- Pits
- Urban land

0 1,000 2,000 4,000 6,000 8,000 Feet

1 in = 2,000 ft

No warranty of any sort, including accuracy, fitness, or merchant ability accompany this product.

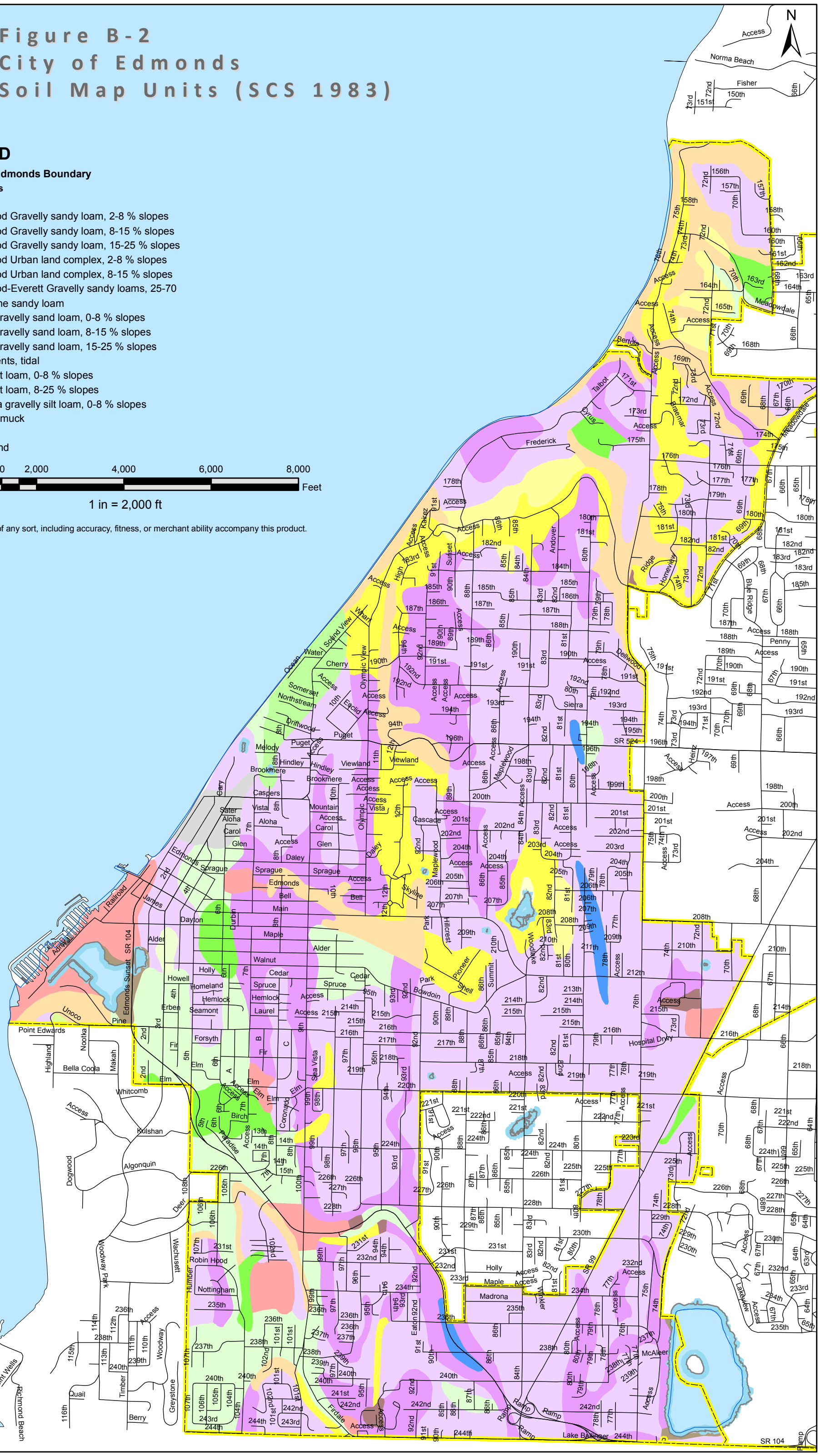


Figure B-3
City of Edmonds
Slopes Greater than 15 percent and North Edmonds Earth Subsidence & Landslide Hazard Area (ESLHA)

LEGEND

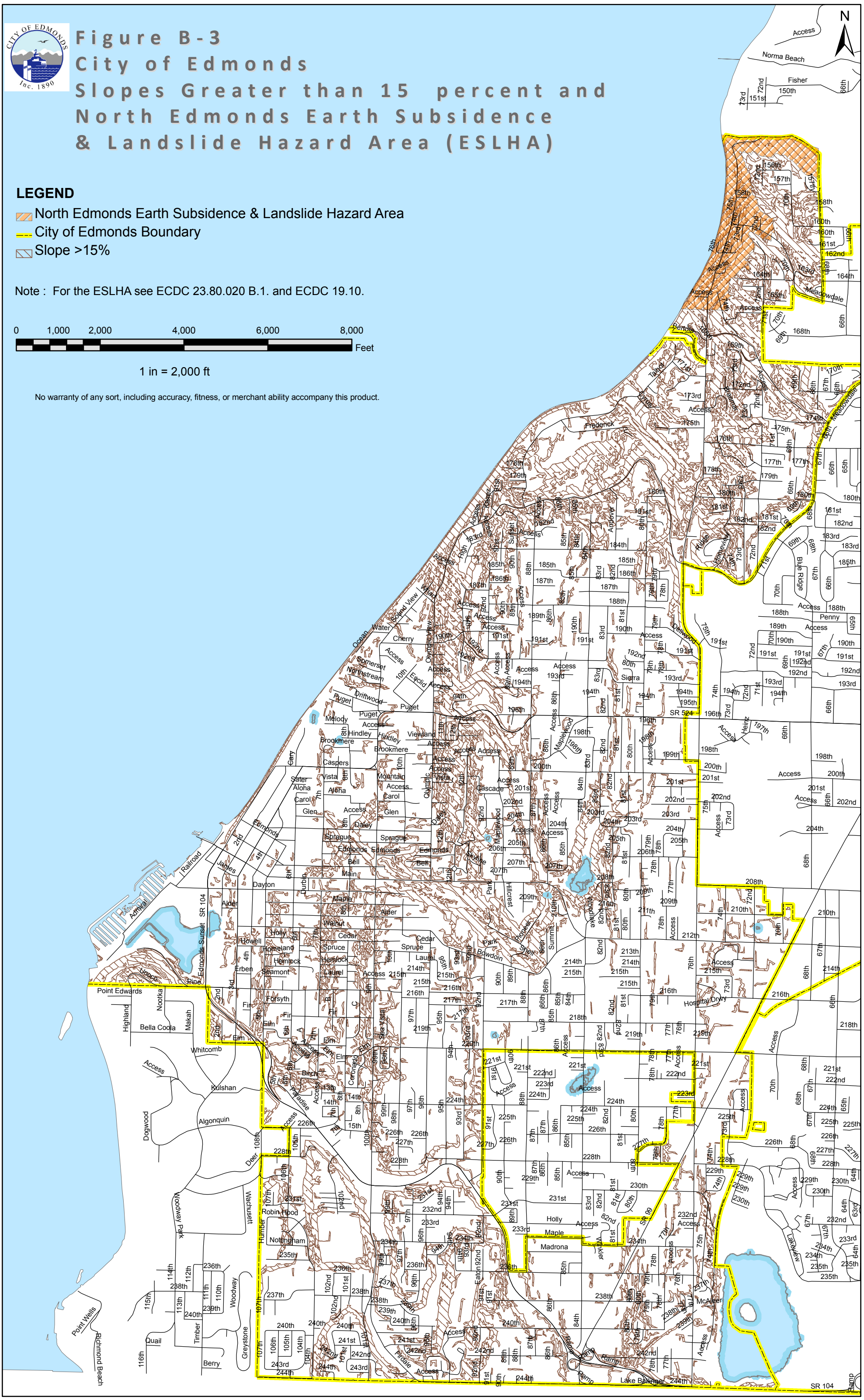
- North Edmonds Earth Subsidence & Landslide Hazard Area
- City of Edmonds Boundary
- Slope >15%

Note : For the ESLHA see ECDC 23.80.020 B.1. and ECDC 19.10.

0 1,000 2,000 4,000 6,000 8,000 Feet

1 in = 2,000 ft

No warranty of any sort, including accuracy, fitness, or merchant ability accompany this product.



Appendix C – Approved Methods for Obtaining Design Infiltration Rates

This appendix supplements the infiltration requirements found in Sections 4.5.2 and 5.5.2 of this document. The Unites States Department of Agriculture (USDA) textural classification or the modified pilot infiltration test (PIT) may be used to obtain a site design infiltration rate. The City may require the modified PIT procedure on large sites and/or on sites that demonstrate considerable variability between samples using the USDA textural classification.

USDA Textural Classification

Short-term infiltration rates may be estimated from soil grain size distribution (gradation) data using the USDA textural analysis approach. This estimated short-term infiltration rate can then be converted to a design infiltration rate using information in the Stormwater Manual.

The soil particle size distribution and soil texture analysis to obtain a short-term infiltration rate should be implemented in accordance with the USDA (Soil Survey Manual, USDA, October 1993, Chapter 3 pages 60-65).

This manual only considers soil passing the #10 sieve (2 mm) (U.S. Standard) to determine percentages of sand, silt, and clay for use in Figure C-1. These short-term (field) infiltration rates should be used with the required correction factors in the Stormwater Manual to obtain the design (long-term) infiltration rates (Table C-1 below from the Volume 3 of the Stormwater Manual). With prior approval by the City of Edmonds Engineering Division, the correction factors may be reduced (to a minimum of 2.0) if there is little soil variability and there will be a high degree of long-term facility maintenance and adequate pretreatment to reduce total suspended solids in influent stormwater.

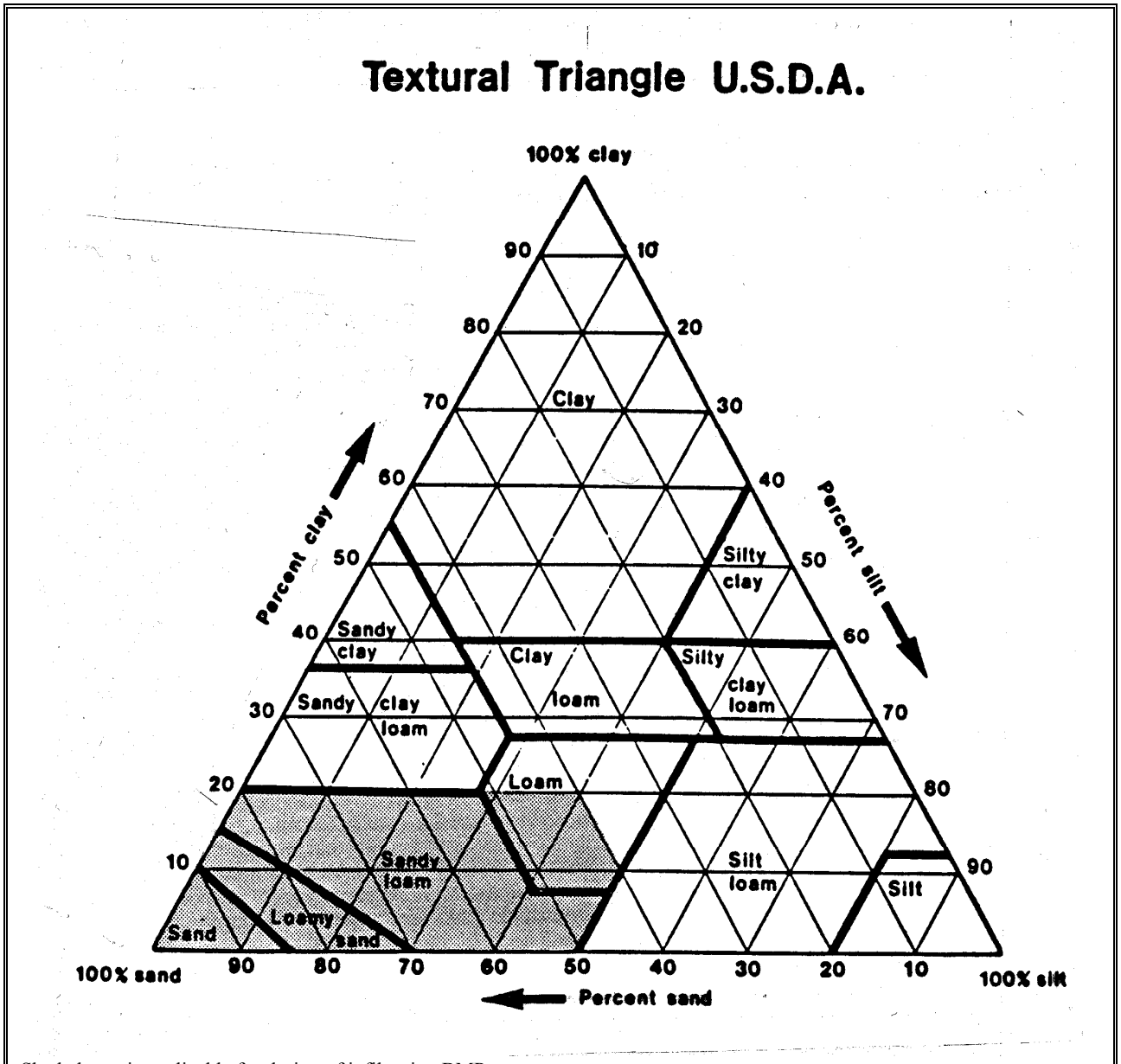
Table C-1: Recommended Infiltration Rates Based on USDA Soil Textural Classification

	*Short-Term Infiltration Rate (in./hr)	Correction Factor CF	Estimated Design (Long-term) Infiltration Rate (in./hr)
Clean sandy gravels and gravelly sands (i.e., 90% of the total soil sample is retained in the #10 sieve)	20	2	10
Sand	8	4	2
Loamy Sand	2	4	0.5
Sandy Loam	1	4	0.25
Loam	0.5	4	0.13

Source: Stormwater Management Manual for Western Washington (Ecology 2005).

* From WEF/ASCE (1998).

Figure C-1: Soil Classification Based on the Textural Triangle



Shaded area is applicable for design of infiltration BMPs

Modified Pilot Infiltration Testing (PIT) Method

The Pilot Infiltration Test (PIT) consists of a relatively large-scale infiltration test to better measure infiltration rates for design of stormwater infiltration facilities. The PIT reduces some of the scale errors associated with relatively small-scale double ring infiltrometer or "stove-pipe" infiltration tests. It is not a standard test but rather a practical field procedure based on the methods recommended by Ecology's Technical Advisory Committee. Correction factors must be applied to the infiltration rate measured using PIT to establish a design infiltration rate for BMP sizing.

For infiltration basins, there shall be one test pit per 5,000 square feet of basin infiltrating surface with a minimum of two per basin, regardless of basin size. For bioretention facilities and permeable pavement facilities, there shall be one test pit per 5,000 square feet of contributing area. For infiltration trenches, there shall be one test pit per 50 feet of trench length. For drywells, there shall be at least one test pit per well.

Prepare detailed logs for each test pit and a map showing the location of the test pits. Logs must include the depth, depth to water, evidence of seasonal high groundwater elevation, existing ground surface elevation, proposed facility bottom elevation, and presence of stratification that may impact the infiltration design.

PIT reports shall be stamped by a Professional Engineer or prepared by an onsite wastewater treatment designer licensed with the State of Washington.

Infiltration Test

- Excavate the test pit to the depth of the bottom of the proposed infiltration facility. Lay back or otherwise stabilize the slopes sufficiently to avoid caving and erosion during the test. A pre-formed, bottomless box made of plywood can be useful for limiting the size of the excavation.
- The size of the bottom of the test pit should be as close to the size of the planned infiltration facility as possible, but not less than 2 feet by 2 feet. Where water availability is a problem, smaller areas may be considered as determined by the site professional.
- Accurately document the size and geometry of the test pit.
- Install a device capable of measuring the water level in the pit during the test. This may be a pressure transducer (automatic measurements) or a vertical measuring rod (minimum 5 feet long) marked in half-inch increments in the center of the pit bottom (manual measurements).
- Use a rigid 6-inch-diameter pipe with a splash plate or some other device on the bottom of the pit to reduce side-wall erosion and excessive disturbance of the pit bottom. Excessive erosion and disturbance may result in clogging and yield lower than actual infiltration rates.
- Add water to the pit at a rate that will maintain a water level between 3 and 4 feet above the bottom of the pit.

Note: A water level of 3 to 4 feet provides for easier measurement and flow stabilization control. However, the depth should not exceed the proposed maximum depth of water expected in the completed facility.

Every 15 to 30 minutes, record the cumulative volume and instantaneous flow rate in gallons per minute necessary to maintain the water level at the same point (between 3 and 4 feet) on the measuring rod. This

can best be accomplished with an in-flow meter. It can also be accomplished by timing how long it takes to fill a known volume such as a 5-gallon bucket.

Add water to the pit until 1 hour after the flow rate into the pit has stabilized (constant flow rate) while maintaining the same pond water level (usually 17 hours).

After the flow rate has stabilized, turn off the water and record the rate of infiltration in inches per hour using the pressure transducer or measuring rod, until the pit is empty.

Data Analysis

Calculate and record the infiltration rate in inches per hour until 1 hour after the flow has stabilized.

Note: Use statistical/trend analysis to obtain the hourly flow rate when the flow stabilizes. This would be the lowest hourly flow rate.

Apply Correction Factor

The infiltration rate obtained from the PIT shall be considered to be a short-term rate. This "short-term" rate must be reduced through correction factors to account for site variability and number of tests conducted, degree of long-term maintenance and influent pretreatment/control, and potential for long-term clogging due to siltation and bio-buildup. The corrected infiltration rate is considered the "long-term" or "design" infiltration rate and is used for all BMP sizing calculations.

One exception to the requirement for a correction factor applies to bioretention facilities. Specifically, when imported bioretention soil is used, no correction factor is required for the infiltration rate of the underlying native soil.

A minimum infiltration rate correction factor of 2.0 is required for all facilities designed using the PIT method. Correction factors greater than 2.0 should be considered for situations where long-term maintenance will be difficult to implement, where little or no pretreatment is anticipated, or where site conditions are highly variable or uncertain. These situations require the use of best professional judgment by the site engineer and the approval by the City of Edmonds. The typical range of correction factors to account for these issues, based on Ecology's guidance, is summarized in Table C-2. **In no case shall the design infiltration rate exceed 10 inches per hour.**

Table C-2: Correction Factors to be Used With In-Situ Infiltration Measurements to Estimate Long-Term Design Infiltration Rates

Issue	Partial Correction Factor
Site variability and number of locations tested	CFv = 1.5 to 6
Degree of long-term maintenance to prevent siltation and bio-buildup	CFm = 2 to 6
Degree of influent control to prevent siltation and bio-buildup	CFi = 2 to 6

Total Correction Factor (CF) = $CF_v + CF_m + CF_i$

The following discussions are to provide assistance in determining the partial correction factors that may apply.

Site variability and number of locations tested – The number of locations tested must be capable of producing a picture of the subsurface conditions that fully represents the conditions throughout the facility site. The partial correction factor used for this issue depends on the level of uncertainty that adverse subsurface conditions may occur. If the range of uncertainty is low—for example, conditions are known to be uniform through previous exploration and site geological factors—one pilot infiltration test may be adequate to justify a partial correction factor at the low end of the range. If the level of uncertainty is high, a partial correction factor near the high end of the range may be appropriate. This might be the case where the site conditions are highly variable due to a deposit of ancient landslide debris, or buried stream channels. In these cases, even with many explorations and several pilot infiltration tests, the level of uncertainty may still be high. A partial correction factor near the high end of the range could be assigned where conditions have a more typical variability, but few explorations and only one pilot infiltration test is conducted. That is, the number of explorations and tests conducted do not match the degree of site variability anticipated.

Degree of long-term maintenance to prevent siltation and bio-buildup – a partial correction factor at the low end of the range may be used if there is certainty that maintenance requirements will be carried out consistently. If there is a high degree of uncertainty that long-term maintenance will be carried out consistently, or if the maintenance plan is poorly defined, a partial correction factor near the high end of the range may be justified.

Degree of influent control to prevent siltation and bio-buildup – A partial correction factor near the high end of the range may be justified under the following circumstances:

- If the infiltration facility is located in a shady area where moss buildup or litter fall buildup from the surrounding vegetation is likely and cannot be easily controlled through long-term maintenance
- If there is minimal pre-treatment, and the influent is likely to contain moderately high TSS levels.

If influent into the facility can be well controlled such that the planned long-term maintenance can easily control siltation and biomass buildup, then a partial correction factor near the low end of the range may be justified.

The determination of long-term design infiltration rates from in-situ infiltration test data involves a considerable amount of engineering judgment. Therefore, when reviewing or determining the final long-term design infiltration rate, the local jurisdictional authority should consider the results of both textural analyses and in-situ infiltration tests results when available.

Example:

The area of the bottom of the test pit is 8.5 feet by 11.5 feet.

Water flow rate was measured and recorded at intervals ranging from 15 to 30 minutes throughout the test. Between 400 minutes and 1,000 minutes, the flow rate stabilized between 10 and 12.5 gallons per minute or 600 to 750 gallons per hour, or an average of (9.8 + 12.3) / 2 = 11.1 inches per hour.

Applying at least the minimum correction factor of 2.0 (example only) the design long-term infiltration rate becomes 5.6 inches per hour, anticipating adequate maintenance and pre-treatment.