ORDINANCE NO. 3602

AN ORDINANCE of the City Council of the City of Kent, Washington, repealing Section 5, entitled Standards for Stormwater Systems, of Ordinance No 3117, and adopting the Surface Water Design Manual dated February, 2002, to implement the policies codified in Chapters 7.05, 7.06 and 7.07 of the Kent City Code

WHEREAS, section five of the Kent Construction Standards entitled “Standards for Stormwater Systems,” originally adopted by Ordinance No 3117 on May 18, 1993, has not been updated or amended since the date of adoption, and

WHEREAS, the public health, safety, and welfare of the residents of the City of Kent require the proper design, construction, and maintenance of surface water and stormwater control systems, and

WHEREAS, during the preparation of the Surface Water Design Manual (“Manual”), staff met with the development community and a consulting firm and the manual was subject to the SEPA process, and

WHEREAS, the Manual presents the City’s strategy to reduce public hazards due to floods, erosion and landslides and enhance public health, safety, and welfare, better protects the City’s environmental resources, specifically our native salmon, improves regulatory review by introducing more certainty in the

Surface Water Design Manual
requirements, assists developers/engineers by providing more detailed information about how to analyze and design acceptable stormwater control systems; provides the City with the latest technology available for designing and constructing stormwater controls, and meets state and federal regulatory requirements for local municipalities under the Endangered Species Act and Clean Water Acts, and

WHEREAS, on May 6, 2002, the Public Works Committee recommended the Manual for adoption by the City Council, NOW THEREFORE,

THE CITY COUNCIL OF THE CITY OF KENT, WASHINGTON DOES HEREBY ORDAIN AS FOLLOWS

SECTION 1. Repeal Section 5 of the Kent Construction Standards, entitled “Standards for Stormwater Systems,” which was originally adopted by Ordinance No 3117, is hereby repealed in its entirety, PROVIDED, that all other sections of the Kent Construction Standards adopted by Ordinance No 3117 shall remain in effect unless previously or hereafter amended or repealed

SECTION 2. Adoption The Surface Water Design Manual, attached hereto as Exhibit A to this Ordinance, is hereby adopted

SECTION 3. Severability If any section, subsection, paragraph, sentence, clause, or phrase of this ordinance is declared unconstitutional or invalid for any reason, such decision shall not affect the validity of the remaining portions of this ordinance

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//

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2 Surface Water Design Manual
SECTION 4. **Effective Date**  This ordinance shall take effect and be in force thirty (30) days from and after its passage as provided by law.

JIM WHITE, MAYOR

ATTEST:

BRENDA JACOB, CITY CLERK
Mary Simmons, Acting

APPROVED AS TO FORM

ARTHUR "PAT" FITZPATRICK,
ACTING CITY ATTORNEY

PASSED 21 day of May, 2002

APPROVED 21 day of May, 2002

PUBLISHED 25 day of May, 2002

I hereby certify that this is a true copy of Ordinance No 3602

passed by the City Council of the City of Kent, Washington, and approved by the Mayor of the City of Kent as hereon indicated

(SEAL)
BRENDA JACOB, CITY CLERK
Mary Simmons, Acting

P:\Civil\Ordinance\Surface Water Design Manual.doc

Surface Water Design Manual
ACKNOWLEDGEMENTS

This Manual is based on the 1998 King County Surface Water Design Manual. Many individuals associated with King County were involved in preparation of that Manual. Acknowledgement of these individuals is included at the front of that Manual.

Individuals involved in preparation of the Kent Surface Water Design Manual are as follows:

**Mayor**
Jim White

**Kent City Council**
Tim Clark
Connie Epperly
Leona Orr*
Julie Peterson*
Bruce White
Judy Woods
Rico Yingling*
(* Public Works Committee Members)

**Chief Administrative Officer**
Mike Martin

**Public Works Director**
Don Wickstrom, P.E

**City Engineer**
Gary Gill, P.E

**Environmental Engineering Manager**
William Wolinski, P.E

**Project Manager**
Phil Noppe

**Consultants**
Ralph Nelson, P.E - ENTRANCO
Bruce Barker, P.E - MGS Engineering Consultants
Gary Minton, PhD, P.E - Resource Planning Consultants

**Technical Review**
Mike Mactutus, P.E
Dave Brock, P.E
Mel Daley, P.E - DMP, Inc
Dave Beckrath, POE Engineering
Dennis Alfredson, Schneider Homes
Tom Hemphill, ADS

**GIS Mapping**
Jim Cordova
Kurt Palowez

**Document Production**
Kenta Hadley
PREFACE
HOW TO USE
THIS DOCUMENT

CITY OF KENT
Surface Water Design Manual
(Chapter 5 – Kent Construction Standards)
PREFACE
HOW TO USE THIS DOCUMENT

This stormwater section is an addendum to the 1998 King County Surface Water Design Manual (KCSWDM) and applies to development proposals within the City of Kent. It includes all changes and deletions to the KCSWDM adopted by the City of Kent and is to be used for guidance in drainage review and design of stormwater facilities within the City.

Addendum Organization

The information presented in this addendum is organized as follows:

- **Preface—How to Use This Document.** This preface provides instructions for using the City of Kent’s addendum to the KCSWDM. It also defines terms in the King County manual that are used differently for the City of Kent, City departments that are equivalent to county departments referred to in the KCSWDM, and designations from the King County manual that do not apply to proposals in the City of Kent.

- **Chapter 1—Drainage Review Requirements:** A completely revised Chapter 1 has been provided in this addendum. It is to be used instead of Chapter 1 in the 1998 KCSWDM for all proposals in the City of Kent. This chapter sets forth the thresholds and requirements for drainage review, describes the three types of drainage review, and summarizes the eight Core and five Special Requirements.

- **Chapter 2—Drainage Plan Submittal:** A completely revised Chapter 2 has been provided in this addendum. It is to be used instead of Chapter 2 in the 1998 KCSWDM for all proposals in the City of Kent. This chapter describes the required format and components of submittals for the three types of drainage review.

- **Chapter 3—Hydrologic Analysis and Design:** The City of Kent has made no changes to Chapter 3 of the 1998 KCSWDM. The King County version of Chapter 3 applies for proposals in the City of Kent.

- **Chapter 4—Conveyance System Analysis and Design:** The City of Kent has made several minor changes to Chapter 4 of the 1998 KCSWDM. This addendum to Chapter 4 provides replacement text for the sections that are changed. Apart from these changes, the King County version of Chapter 4 applies for proposals in the City of Kent.

- **Chapter 5—Flow Control Design:** The City of Kent has made minor changes to Chapter 5 of the 1998 KCSWDM. This addendum to Chapter 5 provides replacement text for the section that is changed. Apart from these changes, the King County version of Chapter 5 applies to proposals in the City of Kent.

- **Chapter 6—Water Quality Design:** The City of Kent has made a few minor changes to Chapter 6 of the 1998 KCSWDM. This addendum to Chapter 6 provides replacement text for the.
section that is changed. Apart from this change, the King County version of Chapter 6 applies to proposals in the City of Kent.

- **Appendices** – Appendix A presents the City of Kent Maintenance Requirements for Privately Maintained Drainage Facilities (reprinted from Appendix D of the Kent Construction Standards), there is no Appendix B (King County includes Master Drainage Plan requirements here – does not apply in Kent). Appendices C and D are the Small Site Drainage Requirements and Erosion and Sediment Control Standards, respectively. These are included as separately bound documents included with the King County Manual.

- **References**: King County Reference Sections 1, 2, 3, 4b, 6A, and 7 do not apply to the City of Kent. The King County version of Reference sections 4A, 5, and 6B apply to proposals in the City of Kent. The City has modified and replaced several references within Section 8. This document includes the revised Sections 8-A through 8-J.

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### CITY EQUIVALENTS FOR COUNTY AGENCIES AND ORDINANCES

For proposals located within the City of Kent, all references in the KCSWDM to the following King County departments are to be replaced by reference to the Kent Public Works Department:

- DDES (Department of Development and Environmental Services)
- DNR (Department of Natural Resources)
- SWM (Surface Water Management)
- WLR (Water and Land Resources)

For proposals in the City of Kent, all references in the KCSWDM to the King County Sensitive Areas Ordinance (SAO) are to be replaced by reference to the Kent City Code, particularly Chapters 11, 14, and 15.

### COUNTY DESIGNATIONS THAT DO NOT APPLY IN THE CITY

The following designations are used in the 1998 KCSWDM but are not currently used in the City of Kent; any reference in the KCSWDM to the existence of areas with these designations or thresholds or requirements for such areas is to be disregarded for development applications within the City of Kent:

- Coal Mine Hazard Area
- Critical Drainage Area
- Rural Residential Development
- Shared Facility

### MANUAL UPDATES

With a publication of this complexity there may be errors that must be corrected and clarifications that are needed. There will also be new information and technological updates. The City of Kent Department of Public Works intends to publish corrections, updates and new technical information on our Departmental Home Page at [http://www.ci.kent.wa.us/PublicWorks/Stormwater](http://www.ci.kent.wa.us/PublicWorks/Stormwater). The web site will not be used to make revisions in key policy areas – such as the thresholds and minimum requirements in Chapter 1. We...
encourage you to visit this web site for periodically and incorporate updates and corrections into your copies of the manual. You can also visit this web site for updates and additional information about other Kent Public Works surface water activities.
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# CHAPTER 1

**DRAINAGE REVIEW AND REQUIREMENTS**

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CHAPTER 1
DRAINAGE REVIEW AND REQUIREMENTS

This chapter describes the drainage review procedures and types, the drainage requirements, and the adjustment procedures necessary to implement surface water runoff policies codified in Chapters 7.05, 7.06, and 7.07 of the Kent City Code. It also provides direction for implementing more detailed procedures and design criteria found in subsequent chapters of this manual.

Chapter Organization
The information presented in Chapter 1 is organized into four main sections as follows:
- Section 1.1, "Drainage Review"
- Section 1.2, "Core Requirements"
- Section 1.3, "Special Requirements"
- Section 1.4, "Adjustment Process"

Each section begins on an odd page so that tabs can be inserted by the user if desired for quicker reference.

Key Words and Phrases
Several key words and phrases have specific definitions as they are used in this manual, those of particular importance in determining drainage requirements are listed below. These and other terms are defined in the "Definitions" section in the back of the King County Manual. Many of these terms are also defined in Section 1.1 below and when first used in this chapter.

- Acceptable discharge point
- Closed depression
- Construct or modify
- Direct discharge
- Drainage area
- Equivalent area
- Existing site conditions
- Flow durations
- Flow path
- High-use site
- Hydraulically connected
- Natural discharge area
- New impervious surface
- Pollution-generating impervious surface
- Pollution-generating pervious surface
- Project site
- Redevelopment project
- Replaced impervious surface
- Single-family residential project
- Site (see also onsite and offsite)
- Surface flow
- Threshold discharge area

City of Kent Surface Water Design Manual
(Chapter 5 – Kent Construction Standards)
1.1 DRAINAGE REVIEW

Drainage review is the evaluation by the Public Works permit review staff of a proposed project’s compliance with the drainage requirements of this manual. During drainage review, Public Works permit review staff may also consider the proposed project’s compliance with other Kent requirements (which are not covered in this manual), such as those specified in the Kent Wetland Management Code, Kent Geologic Hazard Areas Code, and other environmental plans and policies. If required, drainage review becomes an integral part of the overall permit review process. This section describes when and what type of drainage review is required for a proposed project and how to determine the drainage requirements that apply.

Guide to Using Section 1.1

The following steps are recommended for efficient use of Section 1.1:

1. Determine whether your proposed project is subject to the requirements of this manual by seeing if it meets any of the thresholds for drainage review specified in Section 1.1. Making this determination requires an understanding of the key definitions listed below.

2. If drainage review is required per Section 1.1, use the flow chart in Figure 1.1.2 to determine what type of drainage review will be conducted by Public Works. The type of drainage review defines the scope of drainage requirements that will apply to your project as summarized in Table 1.1.2A.

3. Check the more detailed threshold information in Section 1.1.2 to verify that you have determined the correct type of drainage review.

4. After verifying drainage review type, use the information in Section 1.1.2 to determine the core requirements (found in Section 1.2) and the special requirements (found in Section 1.3) that must be evaluated for compliance by your project. To determine what actions are necessary to comply with each applicable core and special requirement, see the more detailed information on these requirements contained in Sections 1.2 and 1.3 of this chapter.

Note: For Steps 2 through 4, it is recommended that you arrange a preapplication meeting with Public Works permit review staff to confirm the type of drainage review and scope of drainage requirements that apply to your proposed project.

KEY DEFINITIONS

Proper application of the drainage review thresholds in this section requires an understanding of the key definitions listed below. Other definitions can be found in the “Definitions” section of the King County Manual.

Acceptable discharge point An enclosed drainage system (i.e., pipe system, culvert, or rightline) or open drainage feature (e.g., ditch, channel, swale, stream, river, pond, lake, or wetland) where concentrated runoff can be discharged without creating a significant adverse impact.

Base flood The flood having a one percent chance of being equaled or exceeded in any given year. Also referred to as the “100-year flood.” The base flood is determined for future flow conditions, except in
areas where the FEMA Flood Insurance Study includes detailed base flood calculations. In that case, the FEMA data shall apply.

**Construct or modify:** To install a new drainage pipe/ditch or make improvements to an existing drainage pipe/ditch (for purposes other than routine maintenance, repair, or emergency modifications, and excluding driveway culverts installed as part of single-family residential building permits) that either serves to concentrate previously unconcentrated surface and stormwater runoff or serves to increase, decrease, and/or redirect the conveyance of surface and stormwater runoff

**Contiguous Pollution-Generating Impervious Surface (CPGIS):** A discrete patch of PGIS that is all together as opposed to being separated in different locations on the project site. The intent is to identify those redevelopment projects that are replacing and/or adding enough impervious surface in one location to allow for opportune installation of a water quality treatment facility. The threshold of 5,000 square feet or more of contiguous PGIS shall be applied to by Threshold Discharge Area.

**Erodible or leachable materials, wastes, or chemicals:** Substances that, when exposed to rainfall, measurably alter the physical or chemical characteristics of the rainfall runoff (examples include erodible soil, uncovered process wastes, manure, fertilizers, oily substances, ashes, kiln dust, garbage dumpster leakage, etc.)

**Erosion hazard area:** Areas within the City of Kent underlain by soils which are subject to severe erosion when disturbed. Such soils include, but are not limited to those delineated in the Soil Survey, King County Area, Washington as having a moderate to severe, severe to very severe erosion hazard potential.

**Existing flooding:** Flooding over all lanes of the roadway or driveway has occurred in the past and can be verified by City records, City personnel, photographs, or other physical evidence.

**Existing site conditions:** Depend on what, if any, land conversion occurred on the site since December 1978, when Kent first required flow control for new development (Ordinance 2130). IF a drainage plan has been approved by the City since December 1978 for any land conversion activity which includes the addition of more than 5,000 square feet of new impervious surface, AND the plans indicate a stormwater management system was designed according to standards in place at the time, AND the same system shown on the approved plan was constructed and is still operating according to the design, THEN existing site conditions are those created by the site improvement. (In this case, including any drainage facilities constructed per the approved engineering plans.) It is the responsibility of the project proponent to submit such documentation to the Public Works Department. OTHERWISE, existing site conditions are those that were present on December 1978 as determined from aerial photographs, and if necessary, on knowledge of individuals familiar with the area. The intent is to mitigate unaddressed impacts created by site alterations or improvements, such as clearing, which have occurred since December 1978.

**Finished area:** Any enclosed area of a building that is designed to be served by the building's permanent heating or cooling system.

**Floodway:** The channel of the river or stream and those portions of the adjoining floodplains which are reasonably required to carry and discharge the base flood flow. The portions of the adjoining floodplains that are considered to be "reasonable required" are defined by the City flood hazard regulations as stated in Chapter 14 of the Kent City Code.

**Flow duration:** The aggregate time that peak flows are at or above a particular flow rate of interest (e.g., the amount of time over the last 40 years that peak flows were at or above the 2-year flow rate).

**Full build-out conditions:** The tributary area is developed to its full zoning potential except where there are existing streams, lakes, wetlands, closed depressions, geologic hazard areas, or open space tracts.

**Geologic Hazard Areas:** Include Seismic Hazard Areas, Erosion Hazard Areas, and Landslide Hazard Areas.
Habitable building: Any residential, commercial, or industrial building that is equipped with a permanent heating or cooling system and an electrical system.

High-use site: A commercial or industrial site that (1) has an expected average daily traffic (ADT) count equal to or greater than 100 vehicles per 1,000 square feet of gross building area, (2) is subject to petroleum storage or transfer in excess of 1,500 gallons per year, not including delivered heating oil, or (3) is subject to use, storage, or maintenance of a fleet of 25 or more diesel vehicles that are over 10 tons net weight (trucks, buses, trains, heavy equipment, etc). Also included is any road intersection with a measured ADT count of 25,000 vehicles or more on the main roadway and 15,000 vehicles or more on any intersecting roadway, excluding projects proposing primarily pedestrian or bicycle use improvements.

Impervious surface: A hard surface area which either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development, and/or a hard surface which causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development. Common impervious areas include, but are not limited to, roof tops, walkways, patios, driveways, parking lots, or storage areas, concrete or asphalt paving, gravel roads, packed earthen materials, and oiled macadam, or other surfaces which similarly impede the natural infiltration of surface and stormwater runoff. Open, uncovered flow control or water quality treatment facilities shall not be considered impervious surfaces (see also “new impervious surface”)

Landscape management plan: An approved plan for defining the layout and long-term maintenance of landscaping features to minimize the use of pesticides and fertilizers, and to reduce the discharge of suspended solids and other pollutants. Guidelines for preparing landscape management plans can be found in Reference Section 4-A. Submittal requirements are detailed in Section 2 3 1 4.

Landslide hazard area: The following shall be classified as landslide hazard areas:

1. Any existing active or dormant landslide
2. Areas delineated in the “Soil Survey, King County Area, Washington” as having a “severe” limitation for building site development. These soils consist of the following:
   - Alderwood gravelly sandy loam, 15 to 30 percent slopes (AgD)
   - Alderwood and Kitsap soils, very steep (AkF)
   - Beausite gravelly sandy loam, 15 to 30 percent slopes (BeD)
   - Beausite gravelly sandy loam, 40 to 75 percent slopes (BeF)
   - Everett gravelly sandy loam, 15 to 30 percent slopes (EvD)
   - Indianola loamy fine sand, 15 to 30 percent slopes (InD)
   - Kitsap silt loam, 8 to 15 percent slopes (KpC)
   - Kitsap silt loam, 15 to 30 percent slopes (KpD)
   - Ovall gravelly loam, 15 to 25 percent slopes (OvD)
   - Ovall gravelly loam, 40 to 75 percent slopes (OvF)
   - Ragnar fine sandy loam, 15 to 25 percent slopes (RaD)
   - Ragnar-Indianola association, moderately steep (RdE)
3. Areas designated as quaternary slumps, earth flows, mudflows, or landslides on maps published by the US Geological Survey, Washington Department of Natural Resources, or geologic consultant reports completed for the City of Kent
4. Areas with all three of the following characteristics:
   - slopes steeper than 15 percent,
   - slopes intersecting granular material over silts or clays, and
   - springs or ground water seepage or evidence of seasonal springs or ground water seepage
5. Slopes that are parallel or subparallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials.
6 Slopes subject to failure during seismic shaking
7 Areas potentially unstable as a result of rapid stream incision or stream bank erosion
8 Areas located in a canyon or on an active alluvial fan, presently or potentially subject to
   inundation by debris flows or catastrophic flooding
9 Any area with a slope of 40 percent or steeper and with a vertical relief of 10 or more feet. A
   slope is delineated by establishing its toe and top and measured by averaging the inclination over
   10 feet of vertical relief

**Landslide hazard drainage area.** Specially mapped areas where the City has determined that overland
flows from new projects will pose a significant threat to health and safety because of their close proximity
to landside hazard areas. Such areas are delineated on the Landslide Hazard / Landslide Hazard
Drainage Areas Map adopted with this manual (see map pocket inside cover)

**Natural discharge location:** The location where runoff leaves the project site under existing site conditions

**Natural onsite drainage feature** A natural swale, channel, stream, closed depression, wetland, or lake

**New impervious surface.** The addition of a hard or compacted surface such as roofs, pavement, gravel,
or dirt, or the addition of a more compacted surface such as the paving of pre-existing dirt or gravel

**NPDES:** National Pollutant Discharge Elimination System

**Organic content:** Measured on a dry weight basis using ASTM D2974

**Peak discharges:** Computed using KCRTS as detailed in Chapter 3

**Pollution-generating impervious surface (PGIS):** Those impervious surfaces considered to be a
significant source of pollutants in stormwater runoff. Such surfaces include those subject to vehicular use
or storage of erodible or leachable materials, wastes, or chemicals, and that receive direct rainfall or the
run-on or blow-in of rainfall. Metal roofs are also considered to be PGIS unless they are treated to prevent
leaching

**Pollution-generating pervious surface (PGPS):** Any non-impervious surface with vegetative ground
cover subject to use of pesticides and fertilizers. Such surfaces include, but are not limited to, the lawn
and landscaped areas of residential or commercial sites, golf courses, parks, and sports fields

**Project site:** That portion of a property or properties subject to proposed project improvements including
those required by this manual
Redevelopment project: A project that proposes to add, replace, and/or alter impervious surface (for purposes other than routine maintenance, resurfacing, regrading, or repair) on a site that is already substantially developed (i.e., has 35% or more of existing impervious surface coverage). The following examples illustrate the application of this definition.

**Example of an Existing Site Condition for a Redevelopment Project**

- **Existing Impervious Area (35%)**
- **Existing Pervious Area (65%)**
- **Parking**
- **Site Boundary**

**Example of a Proposed Redevelopment Project that Alters Existing Impervious Surface**

- **Impervious Area (35%)**
- **New Bldg**
- **Pervious Area (65%)**
- **Parking**
- **Site Boundary**

**Example of a Proposed Redevelopment Project that Adds to Existing Impervious Surface**

- **Pervious Area (15%)**
- **Impervious Area (85%)**
- **New Bldg**
- **Parking**
- **Site Boundary**

**Replaced impervious surface** Any existing impervious surface on the project site that is proposed to be removed down to bare soil or base course and replaced with pollution-generating impervious surface, excluding impervious surface removed for the sole purpose of installing utilities.

Roadway. The traveled portion of any public or private road or street.

Single-family residential project: A project that constructs or modifies a single-family dwelling unit and/or makes related onsite improvements, such as driveways, roads, outbuildings, play courts, etc., or a project that creates single-family residential lots such as a plat or short plat.

Site. The legal boundaries of the parcel or parcels of land for which an applicant has or should have applied for authority from Kent to carry out a development activity, including any drainage improvements required by this manual.

Subject to vehicular use. As used in the definition of pollution-generating surface, means a surface, whether paved or not, that is regularly used by motor vehicles. The following are considered regularly-used surfaces: roads, unvegetated road shoulders, bicycle lanes within the traveled lane of a roadway, driveways, parking lots, unfenced fire lanes, diesel equipment storage yards, and airport runways. The following are not considered regularly used surfaces: road shoulders primarily used for emergency parking, paved bicycle pathways, bicycle lanes adjacent to unpaved or paved road shoulders primarily used for emergency parking, fenced fire lanes, and infrequently used maintenance access roads.
Threshold discharge area: An onsite area draining to a single natural discharge location or multiple natural discharge locations that combine within one-quarter-mile downstream (as determined by the shortest flow path) The examples below illustrate this definition. The purpose of this definition is to clarify how the thresholds of this manual are applied to project sites with multiple discharge points.

Example of a Project Site with a Single Natural Discharge and a Single Threshold Discharge Area

Example of a Project Site with Multiple Natural Discharges and a Single Threshold Discharge Area

Example of a Project Site with Multiple Natural Discharges and Multiple Threshold Discharge Areas

1/4 Mile Downstream (shortest flow path)

Treatment train: A combination of two or more treatment Best Management Practices connected in series (i.e., the design water volume passes through each facility in turn)

Unsubmerged portion: Any portion outside the ordinary high water line of streams, lakes, and wetlands

Wetlands: All areas in the city of Kent that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, and similar areas. Wetlands do not include those artificial wetlands intentionally created from nonwetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities farm ponds, and landscape amenities. The burden of proving an area to be nonwetland rests with the applicant. Wetlands include artificial wetlands intentionally created from nonwetland areas for the purpose of mitigating conversion of wetlands. The City relies on the methodology contained in the Wetlands Delineation Manual, U.S. Army Corps of Engineers Technical Report Y-87-1 for identifying and delineating wetlands within the city. Wetland classes are based on the classification system described in the U.S. Fish and Wildlife Service's Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979) (See Kent City Code Chapter 11 05).

Wetland Buffer or wetland buffer zone: An area that surrounds and protects a wetland from adverse impacts to the functions and values of a wetland (See Kent City Code Chapter 11 05).
1.1.1 PROJECTS REQUIRING DRAINAGE REVIEW

Drainage review is required for any proposed project (except those proposing only routine maintenance, repair, or emergency modifications) that is subject to a Kent development proposal, permit, or approval listed below, AND that meets any one of the following conditions:

1. Adds 5,000 square feet or more of **new impervious surface**, OR
2. Proposes to **construct or modify** a drainage pipe/ditch that is 12 inches or more in size/depth, or receives surface and stormwater runoff from a drainage pipe/ditch that is 12 inches or more in size/depth, OR
3. Contains or is adjacent to a floodplain, stream, lake, wetland, closed depression, erosion hazard area, or landslide hazard area, OR
4. Is located within a Landslide Hazard Drainage Area and adds 2,000 square feet or more of new impervious surface, OR
5. Is a **redevelopment project** proposing $100,000 or more of improvements to an existing high-use site, OR
6. Is a **redevelopment project** proposing $500,000 or more of site improvements and creates 5,000 square feet or more of **contiguous pollution-generating impervious surface** through any combination of **new and/or replaced impervious surface**

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**Kent Permits and Approvals**

- Construction Permits
- Conditional Use Permits
- Grade and Fill Permits
- Flood Control Zone Permit
- Planned Unit Developments
- Rezones
- Shoreline Management Substantial Development Permits
- Short Subdivision Developments (Short Plat)
- Subdivision Developments (Plat)

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1. The threshold of 5,000 square feet or more of new impervious surface shall be applied by threshold discharge area and shall include all impervious surface that will ultimately result from the proposed project (e.g., impervious surface that will result from future homes within a plat or short plat).
2. Landslide Hazard Areas, Landslide Hazard Drainage Areas and Erosion Hazard Areas and Wetlands are defined in the section titled "Key Definitions" above. Maps have been included in the pocket of this manual showing locations of these areas.
3. This is the "project valuation" as declared on the Public Works and Construction Permit applications submitted to the City.
4. Contiguous pollution-generating impervious surface (PGIS) means a discrete patch of PGIS that is all together as opposed to being separated in different locations on the project site. The intent is to identify those redevelopment projects that are replacing and/or adding enough impervious surface in one location to allow for opportunite installation of a water quality treatment facility. The threshold of 5,000 square feet or more of contiguous PGIS shall be applied by threshold discharge area.
If drainage review is required for the proposed project, the type of drainage review must be determined based on project and site characteristics as described in Section 1.1.2. The type of drainage review defines the scope of drainage requirements that must be evaluated for project compliance with this manual.

1.1.2 DRAINAGE REVIEW TYPES AND REQUIREMENTS

For most projects adding 5,000 square feet or more of impervious surface, the full range of core and special requirements contained in Sections 1.2 and 1.3 must be evaluated for compliance through the drainage review process. However, for some types of projects the scope of requirements applied is narrowed to allow more efficient, customized review. Each of the following three drainage review types tailors the review process and application of drainage requirements to a project's size, location, type of development, and anticipated impacts to the local and regional surface water system:

- Small Site Drainage Review, Section 1.1.2.1
- Targeted Drainage Review, Section 1.1.2.2
- Full Drainage Review, Section 1.1.2.3

Each project requires only one of the above drainage review types, with the single exception that a project that qualifies for Small Site Drainage Review may also require Targeted Drainage Review. Figure 1.1.2 A can be used to determine the drainage review type that would be required. This may entail consulting the more detailed thresholds for each review type specified in the above-referenced sections.

Table 1.1.2 A can be used to quickly identify the requirements that are applied under each type of drainage review. The applicant must evaluate those requirements that are checked off for a particular drainage review type to determine what is necessary to meet compliance.
FIGURE 1.1.2.A FLOW CHART FOR DETERMINING TYPE OF DRAINAGE REVIEW REQUIRED

Is the project a single-family residential project (as defined in Section 1.1) that adds 2,000 to 10,000 sf of new impervious surface AND clears < 2 acres OR < 35% of the site, whichever is greater?  
Yes  

SMALL SITE DRAINAGE REVIEW  
Section 1.1.2.1  
Note: The project may also be subject to Targeted Drainage Review as determined below  

No  

Does the project add ≥ 2,000 sf of new impervious surface within a Landslide Hazard Drainage Area (LHDA) or ≥ 5,000 sf outside of a LHDA OR is it a redevelopment project costing ≥ $500,000 that creates ≥ 5,000 sf of contiguous PGIS from new and/or replaced impervious surface?  

Yes  

Does the project have the characteristics of one or more of the following categories (see the more detailed threshold language in Section 1.1.2.2)?  

1. Projects that contain or are adjacent to floodplains, streams, lakes, wetlands, closed depressions, landslide hazard areas or erosion hazard areas, OR projects within a Landslide Hazard Drainage Area  
2. Projects proposing to construct or modify a drainage pipe/ditch that is 12” or larger or receives runoff from a 12” or larger drainage pipe/ditch  
3. Redevelopment projects proposing ≥ $100,000 in improvements to an existing high-use site  

No  

Reassess whether drainage review is required per Section 1.1.2.1  

Yes  

TARGETED DRAINAGE REVIEW  
Section 1.1.2.2  

FULL DRAINAGE REVIEW  
Section 1.1.2.3
### TABLE 1.1.2.A REQUIREMENTS APPLIED UNDER EACH DRAINAGE REVIEW TYPE

<table>
<thead>
<tr>
<th>Section</th>
<th>Small Site Drainage Review</th>
<th>Targeted Drainage Review</th>
<th>Full Drainage Review</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SMALL SITE REQUIREMENTS</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>CORE REQUIREMENT #1</strong> Discharge at Natural Location</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>CORE REQUIREMENT #2</strong> Offsite Analysis</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>CORE REQUIREMENT #3</strong> Flow Control</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>CORE REQUIREMENT #4</strong> Conveyance System</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>CORE REQUIREMENT #5</strong> Erosion &amp; Sediment Control</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>CORE REQUIREMENT #6</strong> Maintenance &amp; Operations</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>CORE REQUIREMENT #7</strong> Financial Guarantees &amp; Liability</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>CORE REQUIREMENT #8</strong> Water Quality</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>SPECIAL REQUIREMENT #1</strong> Other Adopted Requirements</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>SPECIAL REQUIREMENT #2</strong> Developments within Floodplain/Floodway</td>
<td>✓</td>
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<tr>
<td><strong>SPECIAL REQUIREMENT #3</strong> Flood Protection Facilities</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td><strong>SPECIAL REQUIREMENT #4</strong> Source Control</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>SPECIAL REQUIREMENT #5</strong> Oil Control</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

1. Category 3 projects that install oil controls that construct or modify a 12-inch pipe/ditch are also Category 2 projects
2. May be applied by Public Works based on project or site-specific conditions
3. These requirements have exemptions or thresholds that may preclude or limit their application to a specific project

City of Kent Surface Water Design Manual
(Chapter 5 – Kent Construction Standards) 51-12 May, 2002
1.1.2.1 SMALL SITE DRAINAGE REVIEW

Small Site Drainage Review is a simplified alternative to Full Drainage Review for small residential projects adding less than 10,000 square feet of new impervious surface and restricting site clearing to less than 2 acres or less than 35% of the site, whichever is greater. The core and special requirements applied under Full Drainage Review are replaced with simplified small site requirements that can be applied by a non-engineer. These requirements include flow control, Best Management Practices (BMPs) such as setting aside open space to limit future site clearing, and using simple measures such as splash blocks and gravel trenches to disperse or infiltrate runoff from impervious areas. Also included are simple BMPs for erosion and sediment control (ESC). Formal water quality treatment is not necessary. This alternative to Full Drainage Review acknowledges that drainage impacts for many small development proposals can be effectively mitigated without construction of costly flow control and water quality facilities.

The Small Site Drainage Review process minimizes the time and effort required to design, submit, review, and approve drainage facilities for these proposals. In most cases, the requirements can be met with submittals prepared by contractors, architects, or homeowners without the involvement of a licensed civil engineer.

Threshold

Small Site Drainage Review is allowed for any project that is subject to drainage review as determined in Section 1 1 1 and that meets all of the following criteria:

- The project is a single-family residential project, AND
- The project adds 2,000 to 10,000 square feet of new impervious surface, AND
- The project clears less than 2 acres or less than 35% of the site, whichever is greater.

If the project is targeted for Small Site Drainage Review, it may also require Targeted Drainage Review if they meet any of the threshold criteria in Section 1 1 2 2.

Any potential small site proposal may elect to go through Full Drainage Review described in Section 1 1 2 3.

Scope of Requirements

If Small Site Drainage Review is allowed, THEN the applicant may apply the simplified small site submittal and drainage design requirements detailed in Small Site Drainage Requirements adopted as Appendix C to the King County Manual (detached) and available as a separate booklet from King County Department of Natural Resources or Department of Development and Environmental Services. These requirements include simplified BMPs for flow control and erosion and sediment control. Note: An open space tract or covenant may be required to preserve uncleared areas.

Exemption from Core and Special Requirements

The simplified drainage requirements applied under Small Site Drainage Review are considered sufficient to meet the overall intent of the core and special requirements in Sections 1 2 and 1 3, except under certain conditions when a proposed project has characteristics that trigger Targeted Drainage Review (see the threshold for Targeted Drainage Review in Section 1 1 2 2) and may require the involvement of a licensed civil engineer. Therefore, any proposed project that qualifies for Small Site Drainage Review as determined above and complies with the small site drainage requirements detailed in Appendix C is considered exempt.

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5 Single-family residential project is defined on page 5 1-4.

6 The threshold of 10,000 square feet of new impervious surface shall be applied by threshold discharge area and shall include all impervious surface that will ultimately result from the proposed project (e.g., impervious surface that will result from future homes within a plat or short plat).
SECTION 1.1 DRAINAGE REVIEW

from all core and special requirements in Sections 1.2 and 1.3 except those which would apply to the project if it is subject to Targeted Drainage Review as specified in Section 1.1.2.2

1.1.2.2 TARGETED DRAINAGE REVIEW

Targeted Drainage Review (TDR) is an abbreviated evaluation by Public Works of a proposed project's compliance with selected core and special requirements. Projects subject to this type of drainage review are typically small-site proposals or other small projects that have site-specific or project-specific drainage concerns that must be addressed by a licensed civil engineer or by Public Works. Under Targeted Drainage Review, engineering costs associated with drainage design and review are kept to a minimum because the review includes only those requirements that would apply to the particular project.

Threshold

Targeted Drainage Review is required for those projects subject to drainage review as determined in Section 1.1.1, AND that are not subject to Full Drainage Review as determined in Section 1.1.2.3, AND that have the characteristics of one or more of the following project categories:

- **TDR Project Category #1**: Projects that contain or are adjacent to a floodplain, stream, lake, wetland, closed depression, erosion hazard area or landslide hazard area, OR projects located within a Landslide Hazard Drainage Area.

- **TDR Project Category #2**: Projects that propose to *construct or modify* a drainage pipe/ditch that is 12 inches or more in size/depth or receives surface and stormwater runoff from a drainage pipe/ditch that is 12 inches or more in size/depth.

- **TDR Project Category #3**: Redevelopment projects that propose $100,000 or more of improvements to an existing high-use site.

Scope of Requirements

IF Targeted Drainage Review is required, THEN the applicant must demonstrate that the proposed project complies with the selected core and special requirements corresponding to the project category or categories that best match the proposed project. The project categories and applicable requirements for each are described below and summarized in Table 1.1.2.A.

Note: *If the proposed project has the characteristics of more than one project category, the requirements of each applicable category shall apply.*

Compliance with these requirements requires submittal of engineering plans and/or calculations stamped by a licensed civil engineer registered in the state of Washington, unless deemed unnecessary by Public Works. The engineer need only demonstrate compliance with those core and special requirements that have been predetermined to be applicable based on specific project characteristics as detailed below and summarized in Table 1.1.2.A. The procedures and requirements for submittal of engineering plans and calculations can be found in Section 2.3.

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7 *Construct and modify* is defined as to install a new drainage pipe/ditch or make improvements to an existing drainage pipe/ditch for purposes other than routine maintenance, repair, or emergency modifications, and excluding driveway culverts installed as part of single-family residential building permits that either serve to concentrate previously unconcentrated surface and stormwater runoff or serve to increase, decrease, and/or redirect the conveyance of surface and stormwater runoff.

8 A high-use site is defined as a commercial or industrial site that (1) has an expected average daily traffic (ADT) count equal to or greater than 100 vehicles per 1,000 square feet of gross building area, (2) is subject to petroleum storage or transfer in excess of 1,500 gallons per year, not including delivered heating oil, or (3) is subject to use, storage, or maintenance of a fleet of 25 or more diesel vehicles that are over 10 tons net weight (trucks, buses, trains, heavy equipment, etc.). Also included is any road intersection with a measured ADT count of 25,000 vehicles or more on the main roadway and 15,000 vehicles or more on any intersecting roadway, excluding projects proposing primarily pedestrian or bicycle use improvements.
In addition, Public Works may require the applicant to demonstrate compliance with any one or more of the seven core requirements in Section 1.2 based on project or site-specific conditions. For example, if a Category #1 TDR Project contains or is adjacent to a stream, lake, wetland, closed depression, or defined Hazard Area, Public Works may require compliance with “Core Requirement #1 Discharge at the Natural Location” (Section 1.2.1). This may in turn require compliance with “Core Requirement #2 Offsite Analysis” (Section 1.2.2) if a tightline is required by Core Requirement #1. If a tightline is found to be unfeasible, Public Works may instead require a flow control facility per “Core Requirement #3 Flow Control” (Section 1.2.3). If a tightline is feasible, “Core Requirement #4 Conveyance System” (Section 1.2.4) would be required to ensure proper size and design. Any required flow control facility or tightline system may also trigger compliance with “Core Requirement #6 Maintenance and Operations” (Section 1.2.6), “Core Requirement #7 Financial Guarantees and Liability” (Section 1.2.7), and possibly “Core Requirement #8 Water Quality” (Section 1.2.8) if runoff from pollution-generating impervious surfaces is collected.

The applicant may also have to address compliance with any applicable requirements in the Kent City Code for floodplains, streams, lakes, wetlands, closed depressions, or geologic hazard areas as determined by Public Works.

**TDR Project Category #1**

This category includes projects that are too small to trigger application of most core requirements, but may be subject to site-specific requirements pertaining to floodplains, streams, lakes, wetlands, closed depressions, Landslide Hazard Drainage Areas, Erosion Hazard Areas, or other area-specific drainage requirements adopted by the City. Such projects primarily include single-family residential projects in Small Site Drainage Review.

IF the proposed project meets the characteristics of TDR Project Category #1, THEN the applicant must demonstrate that the project complies with the following five requirements:

- Core Requirement #2 Offsite Analysis, Section 1.2.2
- Core Requirement #5 Erosion and Sediment Control, Section 1.2.5
- Special Requirement #1 Other Adopted Area-Specific Requirements, Section 1.3.1
- Special Requirement #2 Floodplain/Floodway Delineation, Section 1.3.2
- Special Requirement #3 Flood Protection Facilities, Section 1.3.3
- Special Requirement #4 Source Control, Section 1.3.4
SECTION 11 DRAINAGE REVIEW

TDR Project Category #2

This category is intended to apply selected core and special requirements to those projects that propose to construct or modify a drainage system of specified size, but are not adding sufficient impervious surface to trigger Full Drainage Review.

IF the proposed project meets the characteristics of TDR Project Category #2, THEN the applicant must demonstrate that the proposed project complies with the following requirements:

- Core Requirement #1 Discharge at the Natural Location, Section 121
- Core Requirement #2 Offsite Analysis, Section 122
- Core Requirement #4 Conveyance System, Section 124
- Core Requirement #5 Erosion and Sediment Control, Section 125
- Core Requirement #6 Maintenance and Operations, Section 126
- Core Requirement #7 Financial Guarantees and Liability, Section 127
- Special Requirement #4 Source Control, Section 134

TDR Project Category #3

This category is intended to improve water quality by applying water quality, source control, and oil control requirements to redevelopment projects located on the most intensively used sites developed prior to current water quality requirements. These are referred to as high-use sites and are defined below.

High-Use Site Definition: A high-use site is any one of the following:

- A commercial or industrial site with an expected average daily traffic (ADT) count equal to or greater than 100 vehicles per 1,000 square feet of gross building area, OR
- A commercial or industrial site subject to petroleum storage or transfer in excess of 1,500 gallons per year, not including delivered heating oil, OR
- A commercial or industrial site subject to use, storage, or maintenance of a fleet of 25 or more diesel vehicles that are over 10 tons net weight (e.g., trucks, buses, trains, heavy equipment, etc.), OR
- A road intersection with a measured ADT count of 25,000 vehicles or more on the main roadway and 15,000 vehicles or more on any intersecting roadway, excluding projects proposing primarily pedestrian or bicycle use improvements.

IF the proposed project meets the characteristics of TDR Project Category #3, THEN the applicant must demonstrate that the proposed project complies with the following requirements:

- Core Requirement #1 Discharge at Natural Location, Section 121
- Core Requirement #5 Erosion and Sediment Control, Section 125
- Core Requirement #6 Maintenance and Operations, Section 126
- Core Requirement #7 Financial Guarantees and Liability, Section 127
- Core Requirement #8 Water Quality, Section 128
- Special Requirement #4 Source Control, Section 134
- Special Requirement #5 Oil Control, Section 135
Note: In some cases, Public Works may determine that application of these requirements does not require submittal of engineering plans and calculations stamped by a licensed civil engineer. For example, if catch basin inserts are proposed to meet oil control requirements, engineered plans and calculations may not be necessary. A plot plan showing catch basin locations may suffice.

1.1.2.3 FULL DRAINAGE REVIEW

Full Drainage Review is the evaluation by Public Works permit review staff of a proposed project’s compliance with the full range of core and special requirements in this chapter. This review addresses the impacts associated with adding new impervious surface and changing land cover on typical sites.

Threshold

Full Drainage Review is required for any proposed new and redevelopment projects that are subject to drainage review as determined in Section 11 1, AND which meet one or more of the following criteria:

- Projects which add 5,000 square feet or more of new impervious surface but which do not qualify for Small Site Drainage Review as specified in Section 11 2 1 (p. 5 1-12), OR
- Projects located within a Landslide Hazard Drainage Area which add 2,000 square feet or more of new impervious surface but which do not qualify for Small Site Drainage Review per Section 1.1.2.1, OR
- Redevelopment projects proposing $500,000 or more of site improvements which create 5,000 square feet or more of contiguous pollution-generating impervious surface through any combination of new and/or replaced impervious surface.

Scope of Requirements

IF Full Drainage Review is required, THEN the applicant must demonstrate that the proposed project complies with the following requirements:

- All eight core requirements in Section 1 2
- All five special requirements in Section 1 3

Engineering plans and calculations stamped by a licensed civil engineer registered in the state of Washington must be submitted to demonstrate compliance with these requirements. The procedures and requirements for submittal of engineering plans and calculations can be found in Section 2 3.

1.1.3 DRAINAGE REVIEW REQUIRED BY OTHER AGENCIES

Drainage review for a proposed project’s impact on surface and stormwaters may be addressed by processes or requirements apart from Kent’s. Agencies such as those listed below may require some form of drainage review and impose drainage requirements that are separate from and in addition to Kent’s drainage requirements. The applicant is responsible for coordinating with these agencies and resolving any conflicts in drainage requirements.

9 Landslide Hazard Drainage Areas are delineated on a map adopted with this manual (see map pocket inside of back cover).

10 Pollution-generating impervious surface (PGIS) is partially defined on page 5 1-4 and fully defined on page 5 1-49. Contiguous pollution-generating impervious surface (PGIS) means a discrete patch of PGIS that is all together, as opposed to being separated in different locations on the project site. The intent is to identify those redevelopment projects that are replacing and/or adding enough impervious surface in one location to allow for opportunite installation of a water quality treatment facility.

11 Replaced impervious surface is defined on page 5 1-4.
### 1.1.4 DRAINAGE DESIGN BEYOND MINIMUM COMPLIANCE

This manual presents Kent’s minimum standards for engineering and design of drainage facilities. While the City believes these standards are appropriate for a wide range of development proposals, compliance solely with these requirements does not relieve the professional engineer submitting designs of his or her responsibility to ensure drainage facilities are engineered to provide adequate protection for natural resources and public and private property.

Compliance with the standards in this manual does not necessarily mitigate all probable and significant environmental impacts to aquatic biota. Fishery resources and other living components of aquatic systems are affected by a complex set of factors. While employing a specific flow control standard may prevent stream channel erosion or instability, other factors affecting fish and other biotic resources (such as increases in stream flow velocities) are not directly addressed by this manual. Likewise, some wetlands, including bogs, are adapted to a very constant hydrological regime. Even the most stringent flow control standard employed by this manual does not prevent increases in runoff volume that can adversely affect wetland plant communities by increasing the duration and magnitude of water level fluctuations. Thus, compliance with this manual should not be construed as mitigating all probable and significant stormwater impacts to aquatic biota in streams and wetlands, and additional mitigation may be required.

In addition, the requirements in this manual primarily target the types of impacts associated with the most typical land development projects occurring in the City. Applying these requirements to vastly different types of projects, such as rock quarries or dairy farms may result in poorer mitigation of impacts. Therefore, different mitigation may be required.
1.2 CORE REQUIREMENTS

This section details the following eight core requirements:

- Core Requirement #1 Discharge at the Natural Location, Section 1.2.1
- Core Requirement #2 Offsite Analysis, Section 1.2.2
- Core Requirement #3 Flow Control, Section 1.2.3
- Core Requirement #4 Conveyance System, Section 1.2.4
- Core Requirement #5 Erosion and Sediment Control, Section 1.2.5
- Core Requirement #6 Maintenance and Operations, Section 1.2.6
- Core Requirement #7 Financial Guarantees and Liability, Section 1.2.7
- Core Requirement #8 Water Quality, Section 1.2.8

1.2.1 CORE REQUIREMENT #1: DISCHARGE AT THE NATURAL LOCATION

All surface and stormwater runoff from a project must be discharged at the natural location so as not to be diverted onto or away from downstream properties. The manner in which runoff is discharged from the project site must not create a significant adverse impact to downhill properties or drainage systems (see "Discharge Requirements" below).

**Intent:** To prevent adverse impacts to downstream properties caused by diversion of flow from one flow path to another, and to discharge in a manner that does not significantly impact downhill properties or drainage systems. Diversions can cause greater impacts (due to greater runoff volumes) than would otherwise occur from new development discharging runoff at the natural location. Diversions can also impact properties that rely on runoff water to replenish wells and ornamental or fish ponds. Projects that do not discharge at the natural location will require an approved adjustment of this requirement (see Section 1.4).

**DISCHARGE REQUIREMENTS**

Proposed projects must comply with the following discharge requirements (1, 2, and 3) as applicable:

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

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

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

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12 Peak discharges for applying this requirement are determined using KCRTS as detailed in Chapter 3.
c) IF the 100-year peak discharge is greater than 0.5 cfs for either existing or developed conditions, or if a significant adverse impact to downhill properties or drainage systems is likely, THEN a conveyance system must be provided to convey the concentrated runoff across the downstream properties to an acceptable discharge point. Drainage easements for this conveyance system must be secured from downstream property owners and recorded prior to engineering plan approval.

2 IF a proposed project or any natural discharge area within a project is located within a Landslide Hazard Drainage Area and, in fact, ultimately drains over the erodible soils of a defined landslide hazard area with slopes steeper than 15%, THEN a tightline system must be provided through the landslide hazard area to an acceptable discharge point unless one of the following exceptions applies. The tightline system must comply with the design requirements in Core Requirement #4 and in Section 4.2.2 unless otherwise approved by Public Works. Drainage easements for this system must be secured from downstream property owners and recorded prior to engineering plan approval.

Exceptions: A tightline is not required for any natural discharge location where one of the following conditions can be met.

a) Less than 2,000 square feet of new impervious surface will be added within the natural discharge area, OR

b) Public Works determines that a tightline system is not physically feasible or will create a significant adverse impact based on a soils report by a geotechnical engineer.

3 For projects adjacent to or containing landslide hazard areas or erosion hazard areas, the applicant must demonstrate that onsite drainage facilities and/or flow control BMPs will not create a significant adverse impact to downhill properties or drainage systems.

1.2.2 CORE REQUIREMENT #2: OFFSITE ANALYSIS

Project proponents must submit an offsite analysis report that assesses potential offsite drainage impacts associated with development of the project site and that proposes appropriate mitigation measures for those impacts. The initial permit submittal shall include, at minimum, a Level 1 downstream analysis as described in Section 1.2.2.1 below.

Intent: To identify and evaluate offsite drainage problems that may be created or aggravated by the proposed project, and to determine appropriate measures for preventing aggravation of those problems in accordance with the requirements of this manual.

The primary component of an offsite analysis report is the downstream analysis. This examines the drainage system within one-quarter mile downstream of the project site or farther as described in Section 1.2.2.1 below. It is intended to identify existing or potential/predictable downstream problems so that appropriate mitigation, as specified in Section 1.2.2.2, can be provided to prevent aggravation of these problems. A secondary component of the offsite analysis report is an evaluation of the upstream drainage system to verify and document that impacts will not occur as a result of the proposed project. The evaluation must extend upstream to a point where any backwater effects created by the project cease.

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13 Acceptable discharge point means an enclosed drainage system (e.g., pipe system, culvert, or tightline) or open drainage feature (e.g., ditch, channel, swale, stream, river, pond, lake, or wetland) where concentrated runoff can be discharged without creating a significant adverse impact.
EXEMPTION FROM CORE REQUIREMENT #2

A proposed project is exempt from Core Requirement #2 if any one of the following is true:

1. Public Works determines there is sufficient information for them to conclude that the project will not have a significant adverse impact on the downstream and/or upstream drainage system, OR

2. The project adds less than 5,000 square feet of new impervious surface, AND does not construct or modify a drainage pipe/ditch that is 12 inches or more in size/depth or that receives runoff from a drainage pipe/ditch that is 12 inches or more in size/depth, AND does not contain or lie adjacent to an defined hazard area, OR

3. The project does not change the rate, volume, duration, or location of discharges to and from the project site (e.g., where existing impervious surface is replaced with other impervious surface having similar runoff-generating characteristics, or where pipe/ditch modifications do not change existing discharge characteristics)

1.2.2.1 DOWNSTREAM ANALYSIS

The downstream analysis must consider the existing conveyance system(s) for a minimum flow path distance downstream of one-quarter mile and beyond as needed to reach a point where the project site area constitutes less than 15% of the tributary area. This minimum distance may be increased as follows:

- **Task 2** of a Level 1 downstream analysis (described in detail in Section 2 3 1) is a review of all available information on the downstream area and is intended to identify existing drainage problems. In all cases, this information review shall extend one mile downstream of the project site. The existence of flooding, erosion, or nuisance problems may extend the one-quarter-mile minimum distance for other tasks to allow evaluation of impacts from the proposed development to the identified problems.

- If a project's impacts to flooding, erosion, or conveyance system overflow problems are mitigated by improvements to the downstream conveyance system, the downstream analysis will extend a minimum of one-quarter mile beyond the improvement. This is necessary because many such improvements result in a reduction of stormwater storage or an increase in peak flows from the problem site.

- At their discretion, Public Works may extend the downstream analysis beyond the minimum distance specified above on the reasonable expectation of impacts.

The **Level 1 downstream analysis** is a qualitative survey of each downstream system and is the first step in identifying flooding, erosion, or nuisance problems as defined below under “Downstream Problems Requiring Special Attention.” Each Level 1 analysis is composed of five tasks at a minimum:

- **Task 1** Define and map the study area
- **Task 2** Review all available information on the study area
- **Task 3** Field inspect the study area
- **Task 4** Describe the drainage system, and its existing and predicted problems
- **Task 5** Propose mitigation measures

Upon review of the Level 1 analysis, Public Works may require a Level 2 or 3 downstream analysis, depending on the presence of existing or predicted flooding, erosion, or nuisance problems identified in the Level 1 analysis.

**Levels 2 and 3 downstream analyses** quantify downstream problems by providing information on the severity and frequency of an existing problem or the likelihood of creating a new problem. A Level 2...
SECTION 12 CORE REQUIREMENTS

Analysis is a rough quantitative analysis (non-survey field data, uniform flow analysis). Level 3 is a more precise analysis (survey field data, backwater analysis) of significant problems. If conditions warrant, additional, more detailed analysis may be required beyond Level 3.

A detailed description of offsite analysis scope and submittal requirements is provided in Section 2.3.1.1. Hydrologic analysis methods and requirements for Levels 2 and 3 downstream analysis are contained in Chapter 3, hydraulic analysis methods are contained in Chapter 4.

DOWNSTREAM PROBLEMS REQUIRING SPECIAL ATTENTION

While the flow control standards in Core Requirement #3 serve to minimize the creation and aggravation of many types of downstream drainage problems, there are some types that are more sensitive to aggravation than others depending on the nature or severity of the problem and which flow control standard is being applied. In particular, there are three types of downstream problems where the City has determined that the nature and/or severity of the problem warrants additional attention through the downstream analysis and possibly additional mitigation to ensure no aggravation.

1. Conveyance system overflow problems
2. Severe erosion problems
3. Severe flooding problems

Conveyance system overflow problems may not cause extensive property or environmental damage. Chronic flooding or erosion problems can result from the overflow of a constructed conveyance system that is substandard or has become too small due to upstream development. Such problems warrant additional attention because of their chronic nature and because they result from the failure of a conveyance system to provide a minimum acceptable level of protection (see definition below). Severe flooding and erosion problems as defined below also warrant additional attention because they either pose a significant threat to health and safety or can cause significant damage to public or private property.

Conveyance System Overflow Problems (Type 1)

Conveyance system overflow problems in general are defined as any existing or predicted flooding or erosion which does not constitute a severe flooding or erosion problem as defined below. Conveyance system overflow problems are defined as any flooding or erosion that results from the overflow of a constructed conveyance system for runoff events less than or equal to a 25-year event. Examples include inundation of a shoulder or lane of a roadway, overflows collecting in yards or pastures, shallow flows across driveways, minor flooding of crawl spaces or unheated garages/outbuildings, and minor erosion.

If a conveyance system overflow problem is identified or predicted downstream, the need for additional mitigation must be evaluated as specified in Section 1.2.2.2 under “Problem-Specific Mitigation Requirements.” This may entail additional onsite flow control or other measures as needed to prevent creation or significant aggravation of the problem.

For any other problems (exclusive of severe erosion or flooding problems) which may be identified downstream, this manual does not require mitigation beyond the flow control standard applied in Core Requirement #3. This is because to prevent aggravation of such problems (e.g., those caused by the elevated water surfaces of ponds, lakes, wetlands, and closed depressions or those involving downstream erosion) can require two to three times as much onsite detention volume, which is considered unwarranted for addressing nuisance problems. However, if under some unusual circumstance, the aggravation of such a problem is determined by Public Works to be a significant adverse impact, additional mitigation may be required.

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Severe Erosion Problems (Type 2)

Severe erosion problems are defined as downstream channels, ravines, or slopes with evidence of or potential for erosion/incision sufficient to pose a sedimentation hazard to downstream conveyance systems or pose a landslide hazard by undercutting adjacent slopes. Severe erosion problems do not include roadway shoulder rilling or minor ditch erosion.

If a severe erosion problem is identified or predicted downstream, additional mitigation must be considered as specified in Section 1.2.2.2 under “Problem-Specific Mitigation Requirements.” This may entail additional onsite flow control or other measures as needed to prevent creation or aggravation of the problem.

Severe Flooding Problems (Type 3)

Severe flooding problems can be caused by conveyance system overflows or the elevated water surfaces of ponds, lakes, wetlands, or closed depressions. Severe flooding problems are defined as follows:

- Flooding of the finished area of a habitable building, or the electrical/heating system of a habitable building for runoff events less than or equal to a 100-year event. Examples include flooding of finished floors of homes and commercial or industrial buildings, or flooding of electrical/heating system components in the crawl space or garage of a home. Such problems are referred to in this manual as “severe building flooding problems.”

- Flooding over all lanes of a roadway or severely impacting a sole access driveway for runoff events less than or equal to the 100-year event. Such problems are referred to in this manual as “severe roadway flooding problems.”

If a severe flooding problem is identified or predicted downstream, the need for additional mitigation must be evaluated as specified in Section 1.2.2.2 under “Problem-Specific Mitigation Requirements.” This may entail consideration of additional onsite flow control or other measures as needed to prevent creation or significant aggravation of the problem.

1.2.2.2 IMPACT MITIGATION

A proposed project must not significantly aggravate existing downstream problems or create new problems as a result of developing the site. This manual does not require development proposals to fix or otherwise reduce the severity of existing downstream drainage problems, although doing so may be an acceptable mitigation.

PRINCIPLES OF IMPACT MITIGATION

Aggravation of an existing downstream problem means increasing the frequency of occurrence and/or severity of the problem. Increasing peak flows at the site of a problem caused by conveyance system overflows can increase the frequency of the problem's occurrence. Increasing durations of flows at or above the overflow return frequency can increase the severity of the problem by increasing the depth and duration of flooding. Controlling peaks and durations through onsite detention can prevent aggravation of such problems by releasing the increased volumes due to development only at return.

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14 Finished area, for the purposes of this definition, means any enclosed area of a building that is designed to be served by the building's permanent heating or cooling system.

15 Habitable building means any residential, commercial, or industrial building that is equipped with a permanent heating or cooling system and an electrical system.

16 Severely impacting means the flooding overlaps a culverted section of the driveway, posing a threat of washout or unsafe access conditions due to indiscernible driveway edges, or the flooding is deeper than 6 inches on the driveway, posing a severe impediment to emergency access.

17 Sole access driveway means there is no other unobstructed, flood-free route for emergency access to a habitable building.
frequencies below the conveyance overflow return frequency, with the net result of causing the conveyance system to flow full for a longer period of time.

When a problem is caused by high-water surface elevations of a volume-sensitive water body, such as a lake, wetland, or closed depression, aggravation means the same as for problems caused by conveyance overflows. Increasing the volume of flows to a volume-sensitive water body can increase the frequency of the problem's occurrence. Increasing the duration of flows for a range of return frequencies both above and below the problem return frequency can increase the severity of the problem, mitigating these impacts requires control of flow durations for a range of return frequencies both above and below the problem return frequency. The net effect of this duration control is to release the increased volumes due to development only at water surface elevations below that causing the problem, which in turn can cause an increase in these lower, but more frequently occurring, water surface elevations. This underscores an unavoidable impact of development upstream of volume-sensitive water bodies— the increased volumes generated by the development will cause some range of increase in water surface elevations, no matter what detention standard is applied.

Creating a new problem means increasing peak flows and/or volumes such that after development, the frequency of conveyance overflows or water surface elevations exceeds the thresholds for the various problem types discussed in Section 1 2 2 1. For example, application of the Level 1 flow control standard requires matching predeveloped and developed 2- and 10-year peak flows. The 100-year peak flow is only partially attenuated, and the flow increase may be enough to cause a "severe flooding" problem as described on page 23. The potential for causing a new problem is often identified during the Level 1 downstream analysis, where the observation of a reduction in downstream pipe sizes, for example, may be enough to predict creation of a new problem. A Level 2 or 3 analysis will typically be required to verify the capacity of the system and determine whether 100-year flows can be safely conveyed.

**SIGNIFICANCE OF IMPACTS TO EXISTING PROBLEMS**

Whether additional onsite mitigation or other measures are needed to address an existing downstream problem depends on the significance of the proposed project's predicted impact on that problem. For some identified problems, Public Works will make the determination as to whether the project's impact is significant enough to require additional mitigation. For the downstream problems defined in Section 1 2 2 1, this threshold of significant impact or aggravation is defined below.

*For conveyance system overflow problems,* the problem is considered significantly aggravated if there is any increase in the project's contributi on to the frequency of occurrence and/or severity of the problem for runoff events less than or equal to the 25-year event. *Note* Increases in the project's contribution to this type of problem are considered to be prevented if sufficient onsite flow control and/or offsite improvements are provided as specified in Table 1 2 3 A.

*For severe erosion problems,* the problem is considered significantly aggravated if there is any increase in the project's contributi on to the flow duration*18* of peak flows ranging from 50% of the 2-year peak flow up to the full 50-year peak flow at the eroded area. *Note* Increases in the project's contribution to this type of problem are considered to be prevented if Level 2 flow control or offsite improvements are provided as specified in Table 1 2 3 A.

*For severe building flooding problems,* the problem is considered significantly aggravated if there is any increase in the project's contributi on*19* to the frequency, depth, and/or duration of the problem for runoff events less than or equal to the 100-year event.

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*Flow duration* means the aggregate time that peak flows are at or above a particular flow rate of interest (e.g., the amount of time over the last 40 years that peak flows were at or above the 2-year flow rate).

*Increases in the project's contribution are considered to be prevented if sufficient onsite flow control and/or offsite improvements are provided as specified for "severe flooding problems" in Table 1 2 3 A (p. 5 1-27).*
For **severe roadway flooding problems**, the problem is considered significantly aggravated if any of the following thresholds are exceeded and there is any increase in the project’s contribution to the frequency, depth, and/or duration of the problem for runoff events less than or equal to the 100-year event.

- The *existing flooding* over all lanes of a roadway or overtopping the culverted section of a “sole access driveway” is predicted to increase in depth more than a quarter-inch or 10% (whichever is greater) for the 100-year runoff event.
- The “existing flooding” over all lanes of a roadway or “severely impacting a sole access driveway” is more than 6 inches deep or faster than 5 feet per second for runoff events less than or equal to the 100-year event.
- The “existing flooding” over all lanes of a **sole access roadway** is more than 3 inches deep or faster than 5 feet per second for runoff events less than or equal to the 100-year event, or is at any depth for runoff events less than or equal to the 10-year event.

### Problem-Specific Mitigation Requirements

1. IF a proposed project or threshold discharge area within a project drains to one or more of the three types of downstream drainage problems defined in Section 1.2.2.1 as identified through a downstream analysis, THEN the applicant must do one of the following:
   
a) Submit a Level 2 or Level 3 downstream analysis per Section 2.3.1 demonstrating that the proposed project will not create or significantly aggravate the identified downstream problem(s), OR
   
b) Show that the natural discharge area or threshold discharge area draining to the identified problem(s) qualifies for an exemption from Core Requirement #3 Flow Control, OR
   
c) Document that the area-specific flow control standard required in Core Requirement #3 is adequate to prevent creation or significant aggravation of the identified downstream problem(s) as indicated in Table 1.2.3.A with the phrase, “No additional flow control needed,” OR
   
d) Provide additional onsite flow control necessary to prevent creation or significant aggravation of the downstream problem(s) as specified in Table 1.2.3.A and further detailed in Section 3.3.5, OR
   
e) Provide offsite improvements necessary to prevent creation or significant aggravation of the identified downstream problem(s) as detailed in Chapter 3 unless identified as not necessary in Table 1.2.3.A, OR
   
f) Provide a combination of additional onsite flow control and offsite improvements sufficient to prevent creation or significant aggravation of the downstream problem(s) as demonstrated by a Level 2 or Level 3 downstream analysis.

2. IF it is identified that the manner of discharge from a proposed project may create a significant adverse impact as described in Core Requirement #1, THEN Public Works may require the applicant to implement additional measures or demonstrate the impact will not occur.

**Intent:** To ensure provisions are made (if necessary) to prevent creation or significant aggravation of the three types of downstream problems requiring special attention by this manual, and to ensure compliance with the discharge requirements of Core Requirement #1.

In addressing downstream problems per Problem-Specific Mitigation Requirement 1 above, the easiest of the provisions to implement will often be that of additional onsite flow control. This involves designing the required onsite flow control facility to meet an additional set of performance criteria targeted to

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20 *Existing flooding*, for the purposes of this definition, means flooding over all lanes of the roadway or driveway has occurred in the past and can be verified by City records, City personnel, photographs, or other physical evidence.

21 **Sole access roadway** means there is no other flood-free route for emergency access to one or more dwelling units.
prevent significant aggravation of specific downstream problems. To save time and analysis, a set of predetermined flow control performance criteria corresponding to each of the three types of downstream problems is provided in Table 1.2.3.A and described in more detail in Chapter 3.

Note that in some cases, the area-specific flow control standard applicable to the proposed project per Section 1.2.3.1 is already sufficient to prevent significant aggravation of many of the defined downstream problem types. Such situations are noted in Table 1.2.3.A as not needing additional onsite flow control or offsite improvements. For example, if the Level 3 flow control standard is required by Section 1.2.3.1, and a "conveyance system overflow problem" is identified through offsite analysis per Core Requirement #2, no additional onsite flow control is needed, and no offsite improvements are necessary.

1.2.3 CORE REQUIREMENT #3: FLOW CONTROL

All proposed projects, including redevelopment projects, must provide onsite flow control facilities to mitigate the impacts of increased stormwater and surface water runoff generated by the addition of new impervious surface and any related land cover conversion. These facilities shall, at a minimum, meet the performance criteria for one of the area-specific flow control standards described in Section 1.2.3.1 and be implemented according to the applicable flow control implementation requirements in Section 1.2.3.2.

**Intent:** To ensure the minimum level of control needed to protect downstream properties and resources from increases in peak, duration, and volume of runoff generated by new development. The level of control varies depending on location and downstream conditions identified under Core Requirement #2.
Guide to Applying Core Requirement #3

Core Requirement #3 requires that onsite detention and/or infiltration facilities be constructed to control runoff discharges from the project site. These facilities must meet a minimum flow control performance standard as set forth in Section 1231, 'Area-Specific Flow Control Standards', and may need to be even larger to ensure that downstream problems are not created or significantly aggravated as set forth in Section 1222, 'Problem-Specific Mitigation Requirements'. Table 123A provides a quick guide for selecting the flow control performance criteria necessary to meet both of these requirements.

Area-specific flow control standards target the level of flow control performance to the protection needs of specific regions or areas of the city. These areas are called flow control areas and are depicted on the Flow Control Applications Map adopted with this Manual (see map pocket inside cover of Manual). Each flow control area has a basic flow control standard that is specific to that area. The performance criteria of that basic standard may need to be increased to address a specific downstream drainage problem as explained in Step 4 below.

Flow control implementation requirements are the minimum requirements for analyzing and designing flow control facilities to achieve required performance and other protection goals.

For efficient application of Core Requirement #3, the following steps are recommended:

1. Determine the flow control standard that applies to the drainage basin where your project is located. Generally, the City of Kent has adopted the Level 2 flow control standard as the minimum standard to be applied citywide, but there are areas within the City with different requirements. They are shown on the Flow Control Applications Map included with this Manual and are described as follows:
   - Projects in the McSorley Creek Watershed shall apply Level 3 flow control.
   - Projects that provide for gravity stormwater discharges to the Green River shall follow the criteria specified by the Green River Management Agreement (see item 5 under the Exemptions from Core Requirement #3 section).
   - Projects that provide for stormwater discharges to the S 259th / 3rd Ave S Regional Detention Facility shall be required to provide ½ of the detention volume required by the Green River Management Agreement (see item 7 under the Exemptions from Core Requirement #3 section).
   - Projects in the Mill Creek Basin within the Kent Valley (generally below elevation 35' NGVD) and outside of the Green River Natural Resources Area Subbasin (see flow control applications map) shall apply Level 1 flow control with a 'pasture' assumption for predevelopment pervious areas.
   - Projects in areas where a Master Drainage Plan has been approved shall follow the provisions of the respective plan (this includes "Kentview" and "The Lakes" areas).

2. Check the list of exemptions following Table 123A to determine if and/or what portions of your project must provide flow control facilities per Core Requirement #3.

3. If flow control facilities are required, determine (for the flow control area identified above) the area-specific flow control standard that applies to your project by consulting the detailed threshold information in Section 1231. The applicable flow control standard will determine the minimum flow control performance required for your proposed project.

4. If downstream problems were identified through offsite analysis per Core Requirement #2 and are proposed to be addressed through onsite flow control, use Table 123A to determine if and what additional flow control performance is necessary to mitigate impacts (e.g., to prevent creation or aggravation of the identified problems).

5. The design of flow control facilities that are located on the Valley floor shall take into account the anticipated flood levels downstream of the facility. The project applicant shall demonstrate compliance with the minimum flow control requirements to Public Works where variable flooding occurs by analyzing the facility performance over the range of tailwater conditions anticipated, up to 100-year flood levels. See Section 1232 for requirements regarding projects in the Valley floor.

6. Use Section 1232 to determine the minimum requirements for implementing flow controls.
## TABLE 1.2.3.A
SUMMARY OF FLOW CONTROL PERFORMANCE CRITERIA ACCEPTABLE FOR IMPACT MITIGATION

### AREA-SPECIFIC STANDARD

<table>
<thead>
<tr>
<th>Downstream Problems Identified through Offsite Analysis per Core Requirement #2</th>
<th>Level 1 Flow Control</th>
<th>Level 2 Flow Control</th>
<th>Level 3 Flow Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>No problem identified</td>
<td>Match 2-year and 10-year peaks (Only applicable in the Kent Valley / Mill Creek Basin – see flow control applications map)</td>
<td>Match durations for 50% of 2-yr through 50-yr peaks</td>
<td>Match durations for 50% of 2-yr though 50-yr peaks AND match 100-year peaks</td>
</tr>
<tr>
<td>Type 1 Conveyance System Overflow Problem</td>
<td>Additional Flow Control Hold 25-yr peak to overflow $T_r$ peak$^{(2)}$</td>
<td>Additional Flow Control Hold 25-yr peak to overflow $T_r$ peak$^{(2)}$</td>
<td>No additional flow control or other mitigation is needed</td>
</tr>
<tr>
<td>Type 2 Severe Erosion Problem</td>
<td>Additional Flow Control Apply level 2 flow control$^{(6)(10)}$</td>
<td>No additional flow control is needed, but other mitigation may be required$^{(6)}$</td>
<td>No additional flow control is needed, but other mitigation may be required$^{(6)}$</td>
</tr>
<tr>
<td>Type 3 Severe Flooding Problem</td>
<td>Additional Flow Control Apply level 3 flow control $^{(6)(10)}$</td>
<td>Additional Flow Control Apply Level 3 flow control If flooding is from a closed depression, make design adjustments as needed to meet the special provision for closed depressions$^{(5)(6)}$</td>
<td>Additional Flow Control If flooding is from a closed depression, make design adjustments as needed to meet the special provision for closed depressions$^{(5)(6)}$</td>
</tr>
</tbody>
</table>

### Notes

1. More than one set of problem-specific performance criteria may apply if two or more downstream problems are identified through offsite analysis per Core Requirement #2. If this happens, the performance goals of each applicable problem-specific criterion must be met. This can require extensive, time-consuming analysis to implement multiple sets of outflow performance criteria if additional onsite flow control is the only viable option for mitigating impacts to these problems. In these cases, it may be easier and more prudent to implement the Level 3 flow control standard in place of the otherwise required area-specific standard. Use of the Level 3 flow control standard satisfies the specified performance criteria for all the area-specific and problem-specific requirements except if adjustments are required per the special provision for closed depressions described below in Note 5.

2. Overflow $T_r$ is the return period of conveyance system overflow. To determine $T_r$, requires a minimum level 2 downstream analysis as detailed in Section 2 3 1 1. To avoid this analysis, a $T_r$ of 2 years may be assumed.

3. Offsite improvements may be implemented in lieu of or in combination with additional flow control as allowed in Section 1 2 2 2 and detailed in Section 3 3 5.

4. A tightline system may be required regardless of the flow control standard being applied if needed to meet the discharge requirements of Core Requirement #1 or the outfall requirements of Core Requirement #4, or is deemed necessary by Public Works where the risk of severe damage is high.

5. Special Provision for Closed Depressions with a Severe Flooding Problem

   If the proposed project discharges by overland flow or conveyance system to a closed depression experiencing a severe flooding problem AND the amount of impervious surface area proposed by the project is greater than or equal to 10% of the 100-year water surface area of the closed depression, THEN use the point of compliance analysis technique described in Section 3 3 6 to verify that water surface levels are not increasing for the return frequencies at which flooding occurs, up to and including the 100-year frequency. If necessary, iteratively adjust onsite flow control performance to prevent increases. Note: The point of compliance analysis relies on certain field measurements taken directly at the closed depression (e.g., soils tests, topography, etc.) If permission to enter private property for such measurements is denied, Public Works may waive this provision and apply the Level 3 flow control standard with a mandatory 20% safety factor on the storage volume.
EXEMPTIONS FROM CORE REQUIREMENT #3

There are seven possible exemptions or departures from the requirement to provide a formal flow control facility per Core Requirement #3. The intent of these exemptions is to provide for situations where a facility may not be practical or needed, where other alternatives to a facility can be just as effective, other arrangements govern, or where it makes sense to provide incentives for retaining native vegetation or for maximizing use of existing developed areas.

1. Impervious Surface Exemption

A proposed project or any threshold discharge area within a project is exempt if less than 5,000 square feet of new impervious surface will be added and the project or threshold discharge area is not within a Landslide Hazard Drainage Area. If the project or threshold discharge area is located within a Landslide Hazard Drainage Area, this exemption only applies to new impervious surface less than 2,000 square feet.

2. Impervious Surface Exemption Using Flow Control BMPs

Any threshold discharge area within a proposed project is exempt if less than 10,000 square feet of new impervious surface will be added, and all of the following criteria are met:

a) The area cleared to accommodate the proposed project must be less than 35% or less than 2 acres of the threshold discharge area (whichever is greater), AND

b) If the project is a single-family residential project, flow control BMPs must be applied within the threshold discharge area as specified in Small Site Drainage Requirements (detached Appendix C of the King County Manual), AND

c) For projects other than single-family residential projects, the new impervious surface within the threshold discharge area must be comprised of either non-pollution-generating roofs that comply with the roof downspout controls in Section 5.1, OR roads, trails, or driveways that comply with the rural roadway dispersion requirements in Section 5.2.1, AND

d) The manner in which runoff is discharged from the project site must not create a significant adverse impact per Core Requirement #1.

3. Peak Flow Exemption Using Flow Control BMPs

Any threshold discharge area within a proposed project is exempt if the project improvements within the threshold discharge area generate less than a 0.1 cfs increase in the existing site conditions 100-year peak flow rate, and all of the following criteria are met:

a) If the project is a redevelopment project, flow control BMPs must be applied as specified in Section 5.2, and the project improvements must not significantly impact a "severe erosion problem" or "severe flooding problem" (see Section 1.2.2.1) and must not be located within a Landslide Hazard Drainage Area, AND

b) If the project is a single-family residential project, the runoff from impervious surfaces must be infiltrated or dispersed using flow control BMPs specified in Appendix C of the King County Manual, and any areas of native vegetation assumed not to be cleared for the purposes of computing the increase in 100-year peak flow must be preserved within a tract or by covenant as described in Appendix C of the King County Manual, AND

c) For projects other than redevelopment projects and single-family residential projects, the new impervious surface within the threshold discharge area must be comprised of either non-pollution-generating roofs that comply with the roof downspout controls in Section 5.1, OR roads, trails, or driveways that comply with the rural roadway dispersion requirements in Section 5.2.1, AND

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22 Landslide Hazard Drainage Areas are delineated on a map adopted with this manual (see map pocket inside cover).
SECTION 1.2 CORE REQUIREMENTS

trails, or driveways that comply with the rural roadway dispersion requirements in Section 5.2.1, AND

d) The manner in which runoff is discharged from the project site must not create a significant adverse impact per Core Requirement #1

4 Peak Flow Exemption for Urban Redevelopment Projects

Any natural discharge area of a redevelopment project located within the City is exempt if the project improvements within the natural discharge area generate less than a 0.1 cfs increase in the existing site conditions 100-year peak flow, AND all of the following criteria are met:

a) The application of this exemption to natural discharge areas within a proposed project must not result in more than a 0.4 cfs increase in the existing site conditions 100-year peak flow rate for any threshold discharge area of the project, AND

b) Flow control BMPs must be applied to the runoff from new impervious surfaces as specified in Section 5.2.1, AND

c) The project improvements within the natural discharge area must not significantly impact a "severe erosion problem" or "severe flooding problem" (see Section 1.2.2.1), AND

d) The manner in which runoff is discharged from the project site must not create a significant adverse impact per Core Requirement #1

5. Direct Discharge Exemption

In accordance with the provisions of the Green River Management Agreement, if the proposed development is located in an area that has a direct, gravity draining outlet to the Green River or is tributary to such a system (other than via the Black River Pumping Station) then stormwater runoff can be released unattended, provided all the following conditions are met:

1) Flood storage must be provided that is equivalent to the amount of rainfall falling on the entire site for a 100-year, 7-day design storm, corresponding to 9.8 to 10.0 inches depending on the site’s location as shown on the 100-year, 7-day Isopluvial Maps, AND

2) It must be demonstrated that the downstream conveyance system has the capacity to carry the resultant flows without overflowing, AND

3) Appropriate water quality treatment is provided as required.

Additional detention and release rate requirements may be required by the Washington State Department of Fish and Wildlife when a Hydraulic Project Approval (HPA) is required by the agency, or by the City to mitigate for conveyance problems downstream of the development. 

Release rates and/or detention requirements will be imposed by the City only when the Applicant's downstream system analysis indicates that the existing stormwater drainage system does not have the necessary capacity to carry the increased flows, AND appropriate off-site mitigation is not proposed by the developer.

The City of Kent does not recognize any other “major receiving waters” within the City that would be candidate for the Direct Discharge Exemption.

Standards are currently pending for the Washington Avenue Pump Station (refer to flow control map). Until standards are approved and adopted, the provisions of the Green River Management Agreement as described above shall apply.
6. Peak Flow Exemption for Horseshoe Acres and Union Pacific Pump Stations

Developments within the service areas draining to the Horseshoe Acres and Union Pacific Pump Stations along the Green River are not automatically required to provide on-site detention storage, but are required to provide on-site water quality treatment.

Release rates and/or detention requirements may be imposed by the City when the Applicant's downstream analysis indicates that the existing stormwater conveyance system from the development to the pump station does not have the necessary capacity to carry the increased flows, OR the pump station does not have the capacity to store and/or pump the additional runoff flows without local flooding.

Appropriate off-site mitigation measures to offset identified conveyance or pumping constraints may be proposed by the Applicant and accepted at the discretion of the Director of Public Works.

7. Area-specific Exemptions for Regional Facilities

Stormwater detention and treatment are not required for any development that discharges to the Valley Regional Detention/Enhanced Wetland Facility also known as the Green River Natural Resource Area (see the flow control applications map for the relevant subbasin boundary). The facility has been sized to provide detention and treatment for both existing and future developments.

Stormwater treatment and detention are required for any development that discharges to the 98th Avenue South Regional Treatment/Detention Pond because this system is designed to handle existing erosion problems and is not designed to provide adequate detention and treatment according to current standards for existing or future developments.

Stormwater detention and treatment are also required for any development that discharges to the Meridian Meadows (Springwood) Regional Detention Pond/Wetland Facility or the Upper or Lower Mill Creek Regional Detention Facilities. These facilities were not designed to provide regional detention or treatment according to current standards for existing or future developments.

Master Drainage Plans have been approved for Kentview and The Lakes development areas (shown on the Flow Control Applications Map). Drainage standards applied within these areas shall be in accordance with the provisions of the respective Master Drainage Plans.

Standards are pending for the S 259th/3rd Avenue Regional Detention Facility (refer to flow control map). Until standards are approved and adopted provisions of the Green River Management Agreement shall apply with the exception that only one-half of the Green River Management Agreement flood storage volume shall be required.

1.2.3.1 AREA-SPECIFIC FLOW CONTROL STANDARDS

Projects subject to Core Requirement #3 must, at a minimum, comply with one of the three area-specific flow control standards: Level 1, Level 2, or Level 3, whichever applies per the threshold information detailed in this section. These standards are described below.

LEVEL 1 FLOW CONTROL

Level 1 flow control is a peak-matching performance standard in the 1998 King County Surface Water Manual, primarily applied in areas where maintaining peak flows is sufficient to protect the natural and constructed conveyance systems that are not sensitive to development-induced increases in runoff volumes and flow durations.

The Level 1 Flow Control Standard is only applicable for the Kent Valley / Mill Creek Basin (see flow control applications map).
Performance Criteria

Level 1 Flow Control: Match the developed peak discharge rates to the *existing site conditions*\(^{23}\) peak discharge rates for 2- and 10-year return periods

Intent

The use of level 1 flow control for the Kent Valley / Mill Creek Basin is intended to protect flow-carrying capacity and limit increased erosion within the downstream conveyance system for runoff events less than or equal to the 10-year event. Matching the 2- and 10-year peak flows is intended to prevent increases in return-frequency peak flows less than or equal to the 10-year flow down to the 2-year flow. This level of control is also intended to prevent creation of new “conveyance system nuisance problems” as defined in Section 1 2 2. Volumes anticipated under the level 1 flow control standard assuming a “pasture” predevelopment condition are comparable to those previously required under the “Valley Criteria”.

Effectiveness in Addressing Downstream Problems

While the level 1 flow control standard provides reasonable protection from many development-induced conveyance problems, (up to the 10-year event), it does not prevent increases in runoff volumes or flow durations that tend to aggravate the three types of downstream problems described in Section 1 2 2.1 Consequently, if one or more of these problems are identified through offsite analysis per Core Requirement #2, additional onsite flow control and/or offsite improvements will likely be required (see “Problem-Specific Mitigation Requirements” in Section 1 2 2.2)

LEVEL 2 FLOW CONTROL

Level 2 flow control is a *duration-matching and peak-matching performance standard*, which is effective in preventing increases in existing erosion rates. The City has determined that a duration-matching standard is needed to prevent severe erosion and sedimentation damage caused by development-induced increases in flow durations. The Level 2 Flow Control also provides greater flood protection than the Level 1 and is a regionally accepted standard for fisheries resource protection

Performance Criteria

Level 2 Flow Control: Match developed discharge durations to predeveloped durations for the range of predeveloped discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow, assuming existing site conditions as the predeveloped condition. In addition, match the developed peak discharge rates to the *existing site conditions* peak discharge rates for 2- and 10-year return periods. (See previous section titled “Level 1 Flow Control” for a definition of “existing site conditions”)

Effectiveness in Addressing Downstream Problems

While the Level 2 flow control standard provides an excellent level of protection for preventing most development-induced problems, it does not necessarily prevent increases in 100-year peak flows that can aggravate “severe flooding problems” as defined in Core Requirement #2 (see Section 1 2 2.1), nor does it

\(^{23}\) *Existing site conditions* depend on what, if any, land conversion activity has occurred at the site since December 1978, when Kent first required flow control for new development (Ordinance 2130). If a drainage plan has been approved by the City since December 1978 (or since 1979 by the County) for any land conversion activity and the plans indicate a stormwater management system was designed according to standards in place at the time, and the same system shown on the approved plan was constructed and is still operating according to the design, then existing site conditions are those created by the site improvements (in this case, including any drainage facilities constructed per the approved engineering plans). The project proponent will be required to submit such documentation to the Public Works Department. Otherwise, existing site conditions are those that were present in December 1978 (or since 1979 by the County) as determined from aerial photographs and, if necessary, knowledge of individuals familiar with the area. The intent is to mitigate unaddressed impacts created by site alterations or improvements, such as clearing, which has occurred since December 1978.
necessarily prevent aggravation of all "severe erosion problems." Consequently, if one or more of these problems are identified through offsite analysis per Core Requirement #2, additional onsite flow control and/or offsite improvements will likely be required (see "Problem-Specific Mitigation Requirements," in Section 1.2.2.2)

**LEVEL 3 FLOW CONTROL**

Level 3 flow control is a duration-matching and peak-matching performance standard for up to the 100-year storm, which is effective in preventing significant increases in water surface levels of lakes, wetlands, and closed depressions. The standard is primarily applied in areas where the City has determined that a higher level of flow control is needed to prevent aggravation of existing documented flooding or erosion problems, the City has designated such areas as **Level 3 Flow Control Areas**. Level 3 flow control is required in the McSorley Creek Drainage Basin.

**Performance Criteria**

**Level 3 Flow Control:** Apply the Level 2 flow control standard AND match the developed 2-, 10- and 100-year peak discharge rate to the corresponding 2-, 10- and 100-year peak discharge rate for existing site conditions. (See previous section titled "Level 1 Flow Control" for a definition of "existing site conditions").

**Effectiveness in Addressing Downstream Problems**

If the Level 3 flow control standard is implemented onsite, no additional measures are required to prevent aggravation of the three types of downstream problems defined in Core Requirement #2. The one exception is when the wetland or lake is a closed depression with a "severe flooding problem," and the proposed project is adding impervious surface area amounting to more than 10% of the 100-year water surface area of the closed depression. In this case, additional onsite flow control or offsite improvements may be necessary as determined by a "point of compliance analysis" (see "Special Provision for Closed Depressions" in Table 1.2.3.4, and see Section 3.3.6, "Point of Compliance Analysis").

**1.2.3.2 FLOW CONTROL IMPLEMENTATION REQUIREMENTS**

**Onsite vs. Offsite Implementation**

All required flow control must be implemented onsite except where the below requirements can be met for direct discharge to a regional or shared facility constructed to provide flow control for the proposed project. Regional facilities are typically constructed as part of a basin plan. Shared facilities may be constructed under a City-developed shared facility drainage plan or under an agreement between two or more private developers. These requirements apply to proposed **new facilities**. The relationship between onsite and offsite implementation for *existing* regional facilities is described under "Exemptions from Core Requirement 3" (item 6, page 5.1-31).

1. The regional or shared facility must be of adequate size and design to meet the current flow control requirements for the proposed project's increased surface and stormwater runoff. *Note: the current flow control requirements are those specified by Core Requirement #3 of this manual unless superseded by other adopted area-specific flow control requirements per Special Requirement #1 (see Section 1.3.1)*

2. The regional or shared facility must be fully operational at the time the proposed project is constructed. In the case of a shared facility, the proposed project must comply with the terms and conditions of all contracts, agreements, and permits associated with the shared facility.

3. The conveyance system between the project site and the regional facility must be approved by Public Works and meet all the following criteria:
a) The conveyance system between the project site and the ordinary high water line of the regional facility shall be comprised of manmade conveyance elements (pipes, ditches, outfall protection, etc) and shall be within public right-of-way or a public or private drainage easement, AND

b) The conveyance system shall have **adequate capacity** per Core Requirement #4, Conveyance System, for the entire contributing drainage area, assuming **build-out conditions** to current zoning for the "equivalent area" portion (defined in Figure 1.2.3.A below) and existing conditions for the remaining area, AND

c) The conveyance system will be adequately stabilized to prevent erosion, assuming the same basin conditions as assumed in Criterion (b), AND

d) The conveyance system will not divert flows from or increase flows to an existing wetland or stream sufficient to cause a significant adverse impact

In the case of a shared facility, the criteria are the same, except the conveyance system need only have adequate capacity and erosion protection for buildout of the participating portion of the contributing drainage area. The participating portion includes those properties that have agreements for use of the shared facility.

**FIGURE 1.2.3.A EQUIVALENT AREA DEFINITION AND ILLUSTRATION**

**Equivalent area** The area tributary to a direct discharge conveyance system that is contained within an arc formed by the shortest, straight line distance from the conveyance system discharge point to the furthermost point of the proposed project.

**Methods of Analysis and Design**

Flow control facilities must be analyzed and designed using a continuous flow simulation method such as HSPF (Hydrologic Simulation Program–FORTRAN) or the simplified HSPF-based runoff files method. Specifications for use of the runoff files method and associated computer program, KCRTS, are found in Chapter 3. Detailed design specifications for flow control facilities are found in Chapter 5.

Flow control facilities to be constructed on the Valley floor (below elevation 35 feet) shall take into account the anticipated Valley floor flood levels in the facility design. The facility is to be designed assuming a freely draining outlet, but potential onsite flooding and facility performance should be evaluated considering tailwater conditions that can exist due to Valley floor flooding for up to the 100-
year flood. This evaluation shall be completed by routing the 100-year flood through the site storm drain/detention pond system considering high tailwater conditions (100-year flood). Potential onsite flooding needs to be identified and an overflow is to be provided that is capable of conveying the 100-year peak flood flow from the site in accordance with these conditions:

1. The overflow shall be directed to and released at the natural location without causing risk or damage to downstream properties, AND
2. No flooding of traffic lanes will occur, AND
3. No structural flooding will occur.

Developments sited on the Valley floor within the FEMA mapped floodplain will also be required to include compensatory flood storage volumes. This volume shall be calculated as 50% of the flood storage volume lost from the 100-year floodplain when comparing pre- and post-development conditions. Compensatory flood volumes can be added to the on-site flow control facility after the flow control volume has been determined. Storage volumes required for flow control will not be credited toward compensatory flood volumes (see Special Requirement #2, Section 1.3.2).

**Land Cover Assumptions**

Land cover assumptions for designing flow control facilities are detailed in Chapter 3. For residential development (plats, short plats, and large single-family projects), flow control facilities must be sized for the ultimate potential development of the site, this assumes that all forest and shrub cover (outside of proposed impervious surface areas) will be converted to grass unless protected by an open space tract or covenant.

Predeveloped pervious areas should be assumed to be forest or pasture, whichever was predominant in 1978. The grass assumption for pervious areas should only be made when the predeveloped land cover (current or 1978 as applicable) is greater than 4 dwelling units per gross acre.

**Roof Downspout Controls in Subdivisions**

All proposed single-family residential subdivision projects must, on a lot-specific basis, provide for or implement one of three types of roof downspout controls in the order of preference specified in Section 5.1. These include downspout infiltration, dispersion, or a perforated stub-out connection.

**Sizing Credits for Roof Downspout Controls**

When sizing flow control facilities serving single-family residential subdivisions, the following credits may be applied:

- Where roof runoff is infiltrated according to the requirements of Section 5.1.1, the roof area may be discounted from the net impervious area used for sizing flow control facilities.
- Where roof runoff is dispersed according to the requirements of Section 5.1.2 on lots 22,000 square feet or larger, and the vegetated flow path of the roof runoff is 50 feet or longer, the roof area may be modeled as grass surface rather than impervious surface when sizing flow control facilities.

*Note: These credits do not apply when determining eligibility for exemptions from Core Requirement #3.*

**Onsite Runoff Bypass**

Proposed project runoff may bypass proposed onsite flow control facilities provided that all of the following are true:

1. Runoff from both the bypass area and the flow control facility converges within a quarter-mile downstream of the project site discharge point, AND
SECTION 1.2 CORE REQUIREMENTS

2 The flow control facility is designed to compensate for the uncontrolled bypass area such that the net effect at the point of convergence downstream is the same with or without bypass, AND

3 The 100-year peak discharge from the bypass area will not exceed 0.4 cfs, AND

4 Runoff from the bypass area will not create a significant adverse impact to downstream drainage systems or properties, AND

5 Water quality requirements applicable to the bypass area are met

Offsite Bypass Requirement

IF the existing 100-year peak flow rate from any upstream offsite area is greater than 50% of the 100-year developed peak flow rate (undetained) for the project site, THEN the runoff from the offsite area must bypass onsite flow control facilities. The bypass of offsite runoff must be designed so as to achieve all of the following:

1 Any existing contribution of flows to an onsite wetland must be maintained, AND

2 Offsite flows that are naturally attenuated by the project site under predeveloped conditions must remain attenuated, either by natural means or by providing additional onsite detention so that peak flows do not increase, AND

3 Offsite flows that are dispersed or un-concentrated on the project site under predeveloped conditions must be discharged in a safe manner as described in Core Requirement #1 under “Discharge Requirements”

Manifold Detention Facilities

A manifold detention facility is a single detention facility designed to take the place of two or more otherwise required detention facilities. It combines the runoff from two or more onsite drainage areas having separate discharge points, and redistributes the runoff back to the natural discharge points following detention. Because manifold detention facilities divert flows from one discharge point to another and then back, they are not allowed except by an approved adjustment (see Section 1.4, “Adjustment Process”)

Use of Underground Detention Facilities

Open detention ponds are preferred over underground detention facilities (vaults or tanks) because open vegetated ponds provide additional stormwater treatment in addition to quantity controls. Storage vaults/tanks also require excessive maintenance costs compared to ponds and are therefore not acceptable for City-maintained retention/detention facilities.

Underground vaults or tanks shall not be permitted to meet detention requirements for 1) new developments on commercial or industrial parcels over 1-acre in size and 2) all residential developments. In addition, underground vaults or tanks shall not be permitted for redevelopments where there is an existing pond or where there is area available for an open pond, regardless of the size of the parcel area for the proposed redevelopment.

No credit will permitted toward required detention volumes for any element of the conveyance system.

Aquifer Recharge Areas

The City of Kent implements a wellhead protection program to protect and preserve regional groundwater resources. This program is critical to the City to ensure that the water supplies obtained from groundwater is maintained at the highest quantity and quality levels possible. Protection of quantity and quality of groundwater is also important to the City and regional interests due to the linkage between groundwater and surface water. Baseflow represents a high percentage of streamflow in the dry summer months in the Puget Sound Region.
To work towards protection of the groundwater resource, the City of Kent, Covington Water District, and Water District 111 have designated and mapped “Wellhead Protection Areas”. These areas are shown on the Soils/Wellhead Area Map included with this manual in the cover pocket. The City of Kent requires that any project located within Wellhead Protection Areas and subject to the requirements of this manual enhance or maintain groundwater recharge quantity and quality to the maximum extent possible. This shall predominantly be achieved through the construction of infiltration facilities as described in Chapter 5 – Flow Control Design.
1.2.4 CORE REQUIREMENT #4: CONVEYANCE SYSTEM

All engineered conveyance system elements for proposed projects must be analyzed, designed, and constructed to provide a minimum level of protection against overtopping, flooding, erosion, and structural failure as specified in the following groups of requirements:

- "Conveyance Requirements for New Systems," Section 1.2.4.1
- "Conveyance Requirements for Existing Systems," Section 1.2.4.2
- "Conveyance System Implementation Requirements," Section 1.2.4.3

**Intent:** To ensure proper design and construction of engineered conveyance system elements. Conveyance systems are natural and engineered drainage facilities that collect, contain, and provide for the flow of surface water and stormwater. This core requirement applies to the engineered elements of conveyance systems—primarily pipes, culverts, and ditches/channels.

### 1.2.4.1 CONVEYANCE REQUIREMENTS FOR NEW SYSTEMS

All new conveyance system elements, both onsite and offsite, shall be analyzed, designed, and constructed according to the following requirements. All analyses shall examine the full range of anticipated tailwater conditions.

**Pipe Systems**

1. New pipe systems shall be designed with sufficient capacity to convey and contain (at minimum) the 25-year peak flow, assuming developed conditions for onsite tributary areas and existing conditions for any offsite tributary areas.

2. Pipe system structures may overtop for runoff events that exceed the 25-year design capacity, provided the overflow from a 100-year runoff event does not create or aggravate a "severe flooding problem" or "severe erosion problem" as defined in Core Requirement #2, Section 1.2.2. Any overflow occurring onsite for runoff events up to and including the 100-year event must discharge at the natural location for the project site. In residential subdivisions, such overflow must be contained within an onsite drainage easement, tract, covenant, or public right-of-way.

3. The upstream end of a pipe system that receives runoff from an open drainage feature (pond, ditch, etc.) shall be analyzed and sized as a culvert as described below.

**Culverts**

1. New culverts shall be designed with sufficient capacity to meet the headwater requirements in Section 4.3.1 and convey (at minimum) the 25-year peak flow, assuming developed conditions for onsite tributary areas and existing conditions for any offsite tributary areas.

2. New culverts must also convey as much of the 100-year peak flow as is necessary to preclude creating or aggravating a "severe flooding problem" or "severe erosion problem" as defined in Core Requirement #2, Section 1.2.2. Any overflow occurring onsite for runoff events up to and including the 100-year event must discharge at the natural location for the project site. In residential subdivisions, such overflow must be contained within an onsite drainage easement, tract, covenant, or public right-of-way.

3. New culverts proposed in streams with salmonids shall be designed to provide for fish passage based on requirements published in the document "Fish Passage Design at Road Culverts — A design manual".

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24 New conveyance system elements are those that are proposed to be constructed where there are no existing constructed conveyance elements.
for fish passage at road crossings" by the Washington State Department of Fish and Wildlife Habitat and Lands Program - Environmental Engineering Division

Ditches/Channels

1 New ditches/channels shall be designed with sufficient capacity to convey and contain, at minimum, the 25-year peak flow, assuming developed conditions for onsite tributary areas and existing conditions for any offsite tributary areas

2 New ditches/channels must also convey as much of the 100-year peak flow as is necessary to preclude creating or aggravating a "severe flooding problem" or "severe erosion problem" as defined in Core Requirement 2, Section 1 2 2 Any overflow occurring onsite for runoff events up to and including the 100-year event must discharge at the natural location for the project site. In residential subdivisions, such overflow must be contained within an onsite drainage easement, tract, covenant, or public right-of-way

Tightline Systems Traversing Steep Slopes

New tightline conveyance systems traversing slopes that are steeper than 15% and/or located in designated Landslide Hazard Areas shall be designed with sufficient capacity to convey and contain (at minimum) the 100-year peak flow, assuming full build-out conditions for all tributary areas, both onsite and offsite. Tightline systems shall be designed as detailed in Section 4 2 2

Bridges

New bridges shall be designed to pass the 100-year peak flow with clearance as specified in Section 4 3 3

1.2.4.2 CONVEYANCE REQUIREMENTS FOR EXISTING SYSTEMS

The following conveyance requirements for existing systems are less rigorous than those for new systems to allow some salvaging of existing systems that are in useable condition. Existing systems may be utilized if they are capable of providing a minimum level of protection as-is or with minor modifications

Existing Onsite Conveyance Systems

No Change in Flow Characteristics: Existing onsite conveyance systems that will not experience a change in flow characteristics (e.g., peak flows or volume of flows) as a result of the proposed project need not be analyzed for conveyance capacity

Change in Flow Characteristics: Existing onsite conveyance systems that will experience a change in flow characteristics as a result of the proposed project must comply with the following conveyance requirements:

1 The existing system must be analyzed and shown to have sufficient capacity to convey and contain (at minimum) the 10-year peak flow assuming developed conditions for onsite tributary areas and existing conditions for any offsite tributary areas

2 The applicant must demonstrate that the 100-year peak flow to the existing system will not create or aggravate a "severe flooding problem" or "severe erosion problem" as defined in Core Requirement #2, Section 1 2 2

3 Minor modifications may be made to the conveyance system to achieve the required capacity stated above. Examples of minor modifications include raising a catch basin rim, replacing or relaying a

28 Full build-out conditions means the tributary area is developed to its full zoning potential except where there are existing environmentally sensitive areas, open space tracts, and/or native growth protection easements/covenants
section of pipe to match the capacity of other pipes in the system, improving a pipe inlet, or enlarging a short, constricted reach of ditch or channel.

4 Modifications to an existing conveyance system or element that act to attenuate peak flows due to the presence of upstream detention storage shall be made in a manner that does not significantly increase peak flows downstream. For example, if water is detained in a pond upstream of a restrictive road culvert, then installing an overflow system for the culvert should prevent overtopping of the road without significantly reducing existing detention storage.

**Existing Offsite Conveyance Systems**

1 Existing offsite conveyance systems need not be analyzed for conveyance capacity except as required by Core Requirement #2, or if offsite improvements or direct discharge are proposed per Core Requirement #3.

2 Improvements made to existing offsite conveyance systems to address the problem-specific mitigation requirements in Section 1 2 2 2 need only change existing conveyance capacity sufficiently to prevent aggravation of the drainage problem(s) being addressed.

### 1.2.4.3 CONVEYANCE SYSTEM IMPLEMENTATION REQUIREMENTS

**Methods of Analysis and Design**

Properly-sized conveyance elements provide sufficient hydraulic capacity to convey peak flows of the return frequencies indicated in Sections 1 2 4 1 and 1 2 4 2. Conveyance capacity shall be demonstrated using the methods of analysis detailed in Chapter 4. Design flows for sizing conveyance systems shall be determined using the appropriate runoff computation method specified in Section 3 2.

**Spill Control Provisions**

Projects proposing to construct or replace onsite conveyance system elements that receive runoff from non-roof-top pollution-generating impervious surface must provide a spill control device as detailed in Section 4 2 1 prior to discharge from the project site or into a natural onsite drainage feature. More specifically, this requirement applies whenever a proposed project does either of the following:

- Constructs a new onsite conveyance system that receives runoff from non-roof-top pollution-generating impervious surface, OR
- Removes and replaces an existing onsite conveyance system element that receives runoff from 5,000 square feet or more of non-roof-top pollution-generating impervious surface onsite.

The intent of this device is to temporarily detain oil or other floatable pollutants before they enter the downstream drainage system in the event of an accidental spill or illegal dumping. It may consist of a tee section in a manhole or catch basin, or another alternative as specified in Section 4 2 1. The spill control device should be installed upstream of any onsite water quality or flow control facility. If no facilities are present, then the spill control device must be installed upstream from the final discharge point to the downstream drainage system.

**Composition**

Where feasible, conveyance systems shall be constructed of vegetation-lined channels, as opposed to pipe systems. Vegetative channels shall generally be considered feasible if all of these conditions are present:

1. The channel gradient generally does not exceed five percent, AND

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26 *Natural onsite drainage feature* means a natural swale, channel, stream, closed depression, wetland, or lake.
2 No modifications to currently adopted standard roadway cross-sections in the *King County Road Standards* are necessitated by the channel, AND

3 The channel will be accessible for maintenance (see Section 1.2.6), AND

4 The channel will not be subject to erosion

**Exceptions:** The following are exceptions to the requirement for vegetative channels

- Conveyance systems proposed under roadways, driveways, or parking areas
- Conveyance systems proposed between houses in urban-zoned plats and short plats
- Conveyance systems conveying roof runoff only

**Outfalls**

An outfall is defined as a point where collected and concentrated surface and stormwater runoff is discharged from a pipe system or culvert

**Energy Dissipation:** At a minimum, rock erosion protection is required at outfalls from all drainage systems and elements except where Public Works determines that erosion protection is being provided by other means or is not needed. Details on outfall structures are included in Section 4.2.2

**New Point Discharges Over Steep Slopes / Landslide Hazard Areas:** Proposed outfalls that will 1) discharge runoff in a location where the natural (existing) discharge is unconcentrated over a slope steeper than 15%, and/or 2) discharge runoff through a designated landslide hazard area must meet the following criteria

1. **IF** the 100-year peak discharge is less than or equal to 0.2 cfs\(^2\) under existing conditions and will remain less than or equal to 0.2 cfs under developed conditions, THEN outfall runoff may be discharged onto a rock pad shaped in a manner so as to disperse flow. The outfall and rock pad must be located upstream from any Landslide Hazard Area buffer and no less than 50 feet from a defined Landslide or Erosion Hazard Area unless otherwise approved by Public Works based on an evaluation/report by a geotechnical engineer.

2. **IF** the 100-year peak discharge is greater than 0.2 cfs but less than or equal to 0.5 cfs under existing conditions and will remain less than or equal to 0.5 cfs under developed conditions, THEN runoff must be conveyed to a dispersal trench or other dispersal system. The dispersal trench or system must be located upstream from any landslide hazard area buffer and no less than 50 feet from a defined Landslide or Erosion Hazard Area unless otherwise approved by Public Works based on an evaluation/report by a geotechnical engineer.

3. **IF** the 100-year peak discharge is greater than 0.5 cfs for either existing or developed conditions, THEN a tightline conveyance system must be constructed to convey the runoff to the bottom of the slope unless other measures are approved by Public Works based on an evaluation/report by a geotechnical engineer. Tightline systems must be designed such that existing base flow conditions are not significantly changed and adequate energy dissipation is provided at the bottom of the slope.

**Outfalls to the Green River**

New stormwater outfalls or modifications to existing stormwater outfalls discharging to the Green River between River Mile 6 (South Boeing Access Road) and SR 18 are allowed only through the adjustment process. These outfalls must comply with requirements of the Green River Pump Operations Procedure Plan, which establishes storage volumes and release rate criteria for developments proposing to construct or modify outfalls. Copies of the plan are available from King County DNR.

\(^2\) Peak discharges shall be as computed using KCRTS as detailed in Chapter 3
**Interflow and Interception**

*Interflow* is near-surface groundwater that moves laterally through the soil horizon following the hydraulic gradient of underlying relatively impermeable soils. When interflow is expressed on the surface, it is termed a *spring or seepage*. Any significant springs or seepage areas that impact a roadway or structure proposed by the project must be intercepted and directed into a conveyance system. Where roadways may impede the passage of interflow to downstream wetlands or streams, provision for passage of unconcentrated flows must be made.

**Pump Systems**

Pump systems may be used to convey water from one location or elevation to another within the project site provided they meet the design criteria specified for such systems in Section 4.2.3 and will be privately owned and maintained.

Pump systems that discharge flows from the project site that would not have discharged by gravity flow under existing site conditions will require an approved adjustment to Core Requirement #1 (see Section 1.4, “Adjustment Process”). These pump systems will be considered only when they are the sole alternative to solving a flooding or erosion problem as defined in Section 1.2.2. Typical conditions of approval for these systems are available in Reference Section 8-1 under “Adjustment Application Form and Process Guidelines”.

**1.2.5 CORE REQUIREMENT #5: EROSION AND SEDIMENT CONTROL**

All proposed projects that will clear, grade, or otherwise disturb the site must provide erosion and sediment controls to prevent, to the maximum extent possible, the transport of sediment from the project site to downstream drainage facilities, water resources, and adjacent properties. To prevent sediment transport, *Erosion and Sediment Control (ESC)* measures are required and shall perform as described in Section 1.2.5.2. Both temporary and permanent erosion and sediment controls shall be implemented as described in Section 1.2.5.3.

**Intent:** To prevent the transport of sediment to streams, wetlands, lakes, drainage systems, and adjacent properties. Erosion on construction sites can result in excessive sediment transport to adjacent properties and to surface waters. Sediment transport can result in major adverse impacts, such as flooding due to obstructed drainageways, smothering of salmonid spawning beds, and creation of algal blooms in lakes.

**1.2.5.1 ESC MEASURES**

The following ESC measures shall be provided as specified below and as further detailed in the King County Erosion and Sediment Control (ESC) Standards, adopted as Appendix D (detached) of the King County Manual.

- **Clearing Limits:** Prior to any site clearing or grading, areas to remain undisturbed during project construction shall be delineated. At a minimum, clearing limit delineation flagging shall be provided at the edges of all stream, lake, or wetland buffers.

- **Cover Measures:** Temporary and permanent cover measures shall be provided when necessary to protect disturbed areas. Temporary cover shall be installed if an area is to remain unworked for more than seven days during the dry season (May 1 to September 30) or for more than two days during the wet season (October 1 to April 30), unless otherwise determined by the City. Any area to remain unworked for more than 30 days shall be seeded or sodded, unless the City determines that winter weather makes vegetation establishment unfeasible. During the wet season, slopes and stockpiles 3H:1V or steeper with more than 10 feet of vertical relief shall be covered if they are to remain...
unworked for more than 12 hours. The intent of these measures is to prevent erosion by having as much area as possible covered during any period of precipitation

- **Perimeter Protection**: When necessary, perimeter protection to filter sediment from sheet flow shall be provided downstream of all disturbed areas. Perimeter protection includes the use of vegetated strips, as well as more conventional constructed measures such as silt fences. Such protection shall be installed prior to upstream grading.

- **Traffic Area Stabilization**: Unsurfaced entrances, roads, and parking areas used by construction traffic shall be stabilized to minimize erosion and tracking of sediment offsite.

- **Sediment Retention**: Surface water collected from disturbed areas of the site shall be routed through a sediment pond or trap prior to release from the site. This does not apply to areas at the perimeter of the site small enough to be treated solely with perimeter protection. Sediment retention facilities shall be installed prior to grading any contributing area.

- **Surface Water Controls**: Surface water controls shall be installed to intercept all surface water from disturbed areas, convey it to a sediment pond or trap, and discharge it downstream of any disturbed areas. However, areas at the perimeter of the site small enough to be treated solely with perimeter protection do not require surface water controls. Significant sources of upstream surface water that drain onto disturbed areas shall be intercepted and conveyed to a stabilized discharge point downstream of the disturbed areas. Surface water controls shall be installed concurrently with or immediately following rough grading.

- **Dust Control**: Preventative measures to minimize wind transport of soil shall be implemented when a traffic hazard may be created or when sediment transported by wind is likely to be deposited in water resources.

### 1.2.5.2 ESC PERFORMANCE

The above ESC measures shall be applied and maintained so as to prevent, to the maximum extent possible, the transport of sediment from the project site or into onsite wetlands, streams, or lakes. This performance is intended to be achieved through proper selection, installation, and operation of the above ESC measures as detailed in the *ESC Standards* (detached Appendix D of the King County Manual) and approved by the City. However, the City may determine at any time during construction that such approved measures are not sufficient and additional action is required based on one of the following criteria.

1. **IF a sieve test of storm and surface water discharges indicates that sand-sized sediment (soil particles coarser than the #200 sieve, 0.075 mm) is leaving the project site or entering onsite wetlands, streams, or lakes, THEN corrective actions and/or additional measures beyond those specified in Section 1 2 5 1 shall be implemented as deemed necessary by the City. Note The City can require that the ESC supervisor have a #200 sieve on-site. Also, “leaving the project site” will be interpreted liberally. For example, if this criterion is applied to individual lots within a subdivision, it may, depending on the site, be appropriate to conduct the sieve test at the outlet of the drainage system rather than at the edge of the lot.**

2. **IF the City determines that the condition of the construction site poses a hazard to adjacent property or may adversely impact drainage facilities or water resources, THEN additional measures beyond those specified in Section 1 2 5 1 can be required by the City.**
1.2.5.3 IMPLEMENTATION REQUIREMENTS

ESC Plan

As specified in Chapter 2, all proposed projects must submit a plan for providing ESC measures. The ESC plan shall include a detailed construction sequence as proposed by the design engineer and shall identify required ESC measures. All ESC measures shall conform to the details and specifications in the ESC Standards unless an alternative is approved by Public Works (see “Alternative and Experimental Measures” in the ESC Standards, detached Appendix D). The ESC plan shall be accompanied by any calculations or information necessary to size ESC measures and demonstrate compliance with Core Requirement #5. The City may require large, complex projects to phase construction and to submit multiple ESC plans for the different stages of construction. Development of new ESC plans is not required for changes that are necessary during construction.

Wet Season Construction

During the wet season (October 1 to April 30), any site with exposed soils shall be subject to the “Wet Season Requirements” contained in the ESC Standards. In addition to the ESC cover measures, these provisions include covering any newly seeded areas with mulch and seeding as much disturbed area as possible during the first week of October to provide grass cover for the wet season.

Construction within Streams, Lakes, or Wetlands and Buffers

Any construction that will result in disturbed areas 1) on or within a stream or associated buffer, or 2) within a wetland or associated buffer, or 3) within 50 feet of a lake shall be subject to the “Sensitive Area Restrictions” contained in the ESC Standards. These provisions include phasing the project whenever possible so that construction in these areas is limited to the dry season.

Maintenance

All ESC measures shall be maintained and reviewed on a regular basis as prescribed in the ESC Standards. The applicant shall designate an ESC supervisor who shall be responsible for maintenance and review of ESC measures and for compliance with all permit conditions relating to ESC as described in the ESC Standards.

Final Stabilization

Prior to obtaining final construction approval, the site shall be stabilized, structural ESC measures (such as silt fences and sediment traps) shall be removed, and drainage facilities shall be cleaned as specified in the ESC Standards.

Flexible Compliance

Some projects may meet the intent of Core Requirement #5 while varying from specific ESC requirements contained here and in the ESC Standards. If a project is designed and constructed such that it meets the intent of this core requirement, the City may determine that strict adherence to a specific ESC requirement is unnecessary, an approved adjustment (see Section 1.4) is not required in these circumstances. Certain types of projects are particularly likely to warrant this greater level of flexibility, for instance, projects on relatively flat, well drained soils, projects that are constructed in closed depressions, or projects that only disturb a small percentage of a forested site may meet the intent of this requirement with very few ESC measures. More information on intent and general ESC principles is contained in the ESC Standards.

Roads and Utilities

Road and utility projects often pose difficult erosion control challenges because they frequently cross surface waters and are long and narrow with limited area available to treat and store sediment-laden water.
Because of these factors, road and utility projects are allowed greater flexibility in meeting the intent of Core Requirement #5 as described in the ESC Standards. Projects that pose a very low risk of erosion or sediment transport due to site conditions or project scope may also warrant greater flexibility.

Consideration of Other Required Permits

Consideration should be given to the requirements and conditions that may be applied by other agencies as part of other permits required for land-disturbing activities. In particular, the following permits may be required and should be considered when implementing ESC measures:

- A Class IV Special Forest Practices Permit is required by the Washington State Department of Natural Resources for projects that will clear more than two acres of forest or 5,000 board feet of timber. All such clearing is also subject to the State Environmental Policy Act (RCW 43.21C) and will require SEPA review.

- A NPDES General Permit for Construction (pursuant to the Washington State Department of Ecology's Baseline General Permit for Stormwater) is required for projects that will disturb more than five acres. The five-acre threshold applies even where the five acres are to be disturbed in phases, as long as the construction is "part of a larger common plan of development or sale."

1.2.6 CORE REQUIREMENT #6: MAINTENANCE AND OPERATIONS

Maintenance and operation of all drainage facilities is the responsibility of the applicant or property owner, except those facilities for which Kent is granted an easement, tract, or right-of-way and officially assumes maintenance and operation as described below.

Intent: To ensure that the maintenance responsibility for drainage facilities is clearly assigned and that these facilities will be properly maintained and operated in perpetuity.

Drainage Facilities to be Maintained by the City of Kent

Kent will assume maintenance and operation of 1) conveyance systems within improved public road rights-of-way and 2) flow control and water quality facilities if these systems/facilities are associated with a residential subdivision with five or more lots served by a public street, or a non-residential short plat or long plat subdivision (i.e., commercial, industrial, etc.). Kent will not assume maintenance and operation of 1) stormwater facilities associated with residential subdivisions with 9 or less lots served by a private street, or 2) stormwater facilities associated with commercial or industrial developments located on single parcels.

Kent will assume maintenance and operation of these facilities one year after final construction approval by Public Works and an inspection by the City to ensure the facilities have been properly maintained and are operating as designed.

Flow control and water quality facilities to be maintained and operated by Kent must be located in a tract or right-of-way dedicated to Kent. Access roads serving these facilities must also be located in the tract or right-of-way and must be connected to an improved public road right-of-way. When allowed (see section 1.2.3.2) they may be sited in private rights-of-way or roads if the easement includes provisions for facility access and maintenance.

Conveyance systems to be maintained and operated by Kent must be located in a drainage easement, tract, or right-of-way granted to Kent. Note: Kent does not normally assume maintenance responsibility for conveyance systems which are outside of improved public road right-of-way.

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28 Kent does not assume maintenance of lot drainage systems or drainage stub-outs serving single-family residential lot downspout, footing, or yard drains, nor does Kent assume maintenance of those water quality facilities installed and integrated into site landscaping.
Exceptions to the above will be made on a case-by-case basis as determined by the Director

**Drainage Facilities to be Maintained by Private Parties**

All privately maintained drainage facilities must be maintained as specified in Appendix A, “Maintenance Requirements for Privately Maintained Drainage Facilities,” and as further prescribed in Chapter 6 for water quality facilities. A copy of the *Operation and Maintenance Manual* submitted as part of the permit application (see Section 2 3 1) shall be retained on site and shall be transferred with the property to the new owner. A log of maintenance activity indicating when cleaning occurred and where waste was disposed of shall also be kept by the owner and be available for inspection by the City.

A “Declaration of Stormwater Facility Maintenance Covenant” must be completed for all private developments. This document is included with the manual as Reference 8-F. The timing of completion of this agreement varies depending on the type of development. For stormwater facilities serving more than one single family residential unit in a short plat serving less than four lots, the agreement shall be completed prior to plat recording. For all other developments or redevelopments (including commercial, industrial, multifamily development or redevelopment or single family residential building), the agreement shall be completed prior to engineering plan approval. The responsibilities detailed in the document may be assumed by a homeowners association or other legal organization as approved by the City of Kent.

Kent may inspect all privately maintained drainage facilities for compliance with these requirements. If property owner(s) fail to maintain their facilities to acceptable standards, the City may issue a written notice specifying the required actions. If these actions are not performed in a timely manner, the City may enter the property to perform the actions needed and bill the property owner(s) for the cost of the actions. In the event a hazard to public safety exists, written notice may not be required.

If the proposed project is a *residential subdivision development*, all privately maintained conveyance systems or other drainage facilities, which convey flows through private property, must be located in a **drainage easement dedicated to convey surface and stormwater**. Individual owners of the properties containing such easements must maintain the drainage facilities through their property. The legal instrument creating drainage easements on private property must contain language that requires a private property owner to obtain written approval from Kent prior to removing vegetation (except by routine mowing) from any drainage easement containing open, vegetated drainage facilities (such as swales, channels, ditches, ponds, etc.). A sample copy of the City of Kent’s Drainage Easement is included with the Manual as Reference 8-G.
1.2.7 CORE REQUIREMENT #7: FINANCIAL GUARANTEES AND LIABILITY

All drainage facilities constructed or modified for projects (except downspout infiltration and dispersion systems), and any work performed in the right-of-way, must comply with City of Kent’s financial guarantee requirements.

Intent: To ensure financial guarantees are posted to sufficiently cover the cost of correcting, if necessary, incomplete or substandard drainage facility construction work, and to warrant for one year the satisfactory performance and maintenance of those newly-constructed drainage facilities to be assumed by Kent for maintenance and operation. Core Requirement #7 is also intended to ensure that a liability policy is provided that protects the proponent and the City from any damages relating to the construction or maintenance of required drainage facilities by private parties.

Surface Water and Drainage Facilities Construction Bond

Prior to commencing construction, applicants that are required to construct drainage facilities pursuant to this manual and/or any other requirements of the Kent City Code must post a Surface Water and Drainage Facilities Construction Bond (see Reference 8-E). This guarantee must be an amount sufficient to cover the cost of project-related work performed on- or off-site. The exact amount of the bond shall be documented in the approved engineers estimate. Note Public Works may waive the requirement of this guarantee on projects proposing only minor modifications or improvements to the drainage system (e.g., catch basin inserts, spill control devices, pipe replacements, etc.) In addition, this guarantee may be combined with other required guarantees.

The bond shall be released in two stages as follows. Generally, 90% of the bond is released upon completion of the following:

1. Payment of all required fees
2. Construction of the drainage facilities
3. Receipt of final construction approval from Public Works
4. Provide the City with As-buils meeting the requirements of the City of Kent Construction Standards (including this manual)

The drainage facilities shall be maintained during a period of one year according to the City of Kent’s “Maintenance Requirements for Privately Maintained Drainage Facilities.” At the end of the year, the remaining 10% of the bond is released subject to the following requirements:

1. For plats, record the final plat
2. For tracts containing drainage facilities to be maintained by Kent and not located within the final plat, deed the tract to Kent and set property corners in conformance with state surveying standards
3. For easements containing drainage facilities to be maintained by Kent and not located within the final plat, provide easement documents and set temporary survey markers to delineate the easement location
4. Receive a final City inspection to ensure the drainage facilities have been properly maintained and are operating as designed
5. Correct any defects noted in the final inspection
6. Submit a letter to the City formally requesting a release of the bond

Following completion of these steps, the City will assume maintenance and operation of the drainage facilities.
1.2.8 CORE REQUIREMENT #8: WATER QUALITY

All proposed projects, including redevelopment projects, must provide water quality (WQ) facilities to treat the runoff from new and/or replaced pollution-generating impervious surfaces and pollution-generating pervious surfaces. These facilities shall be selected from one of the area-specific WQ menus described in Section 1.2.8.1 and implemented according to the applicable WQ implementation requirements in Section 1.2.8.2.

**Intent:** To require an efficient, cost-effective level of water quality treatment tailored to the sensitivities and resource protection needs of the downstream receiving water to which the project site drains, or, in the case of infiltration, protection of the receiving groundwater system.

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**Guide to Applying Core Requirement #8**

Core Requirement #8 requires that WQ treatment facilities be provided to remove pollutants from runoff discharging from the project site in accordance with either the Basic WQ Menu or the Resource Stream Protection menu found in Section 1.2.8.1.

The WQ menus are a group of facility options designed to provide levels of treatment targeted to resource protection needs.

WQ implementation requirements are the minimum requirements for analyzing and designing WQ facilities to achieve intended performance and other protection goals.

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**Other Important Information about Core Requirement #8**

Core Requirement #8 is the primary component of an overall water quality protection strategy required by this manual. Other requirements include the following:

- **Core Requirement #4 Conveyance System, Spill Control Provisions, Section 1.2.4**—This provision generally applies whenever a project constructs or replaces onsite conveyance system elements that receive runoff from pollution-generating impervious surfaces. The provision requires that runoff from such impervious surfaces be routed through a spill control device prior to discharge from the project site or into a natural onsite drainage feature.

- **Special Requirement #4 Source Control, Section 1.3.4**—This requirement applies water quality source controls from the King County Stormwater Pollution Control Manual to those projects proposing to develop or redevelop a commercial, industrial, or multifamily site.

- **Special Requirement #5 Oil Control, Section 1.3.5**—This requirement applies special oil controls to those projects proposing to develop or redevelop a high-use site.

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**State Standards**

The stormwater and surface water discharging from an individual property or project shall be of such quality as to meet Class “A” water quality standards of the State of Washington herein adopted as part of this manual by reference. No one shall introduce into the drainage waters any liquid or solid foreign substances of biodegradable or other nature that shall cause the water quality to degrade from applicable State Standards.
KEY DEFINITIONS

- **Pollution-generating impervious surface (PGIS) Definition:** Those impervious surfaces considered to be a significant source of pollutants in stormwater runoff. Such surfaces include those subject to vehicular use or storage of erodible or leachable materials, wastes, or chemicals and that receive direct rainfall or the run-on or blow-in of rainfall. Metal roofs are also considered to be PGIS unless they are treated to prevent leaching.

- **Pollution-generating pervious surface (PGPS) Definition:** Any non-impervious surface with vegetative ground cover subject to use of pesticides and fertilizers. Such surfaces include, but are not limited to, the lawn and landscaped areas of residential or commercial sites, golf courses, parks, and sports fields.

**EXEMPTIONS FROM CORE REQUIREMENT #8**

There are four possible exemptions from the requirement to provide a formal water quality facility per Core Requirement #8.

1. **Surface Area Exemption for New Development**

   A proposed project or any threshold discharge area within a project is exempt if it meets all of these criteria:

   a) Less than 5,000 square feet of new PGIS will be added, AND

   b) Less than 5,000 square feet of contiguous PGIS will be created through any combination of new and/or replaced impervious surface as part of a redevelopment project, AND

   c) Less than 1 acre of contiguous PGPS will be added and/or modified OR there is a formal agreement with the City to implement a landscape management plan for the PGPS areas on the site, AND

   d) The project does not propose greater than $100,000 in improvements to a high-use site.

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26 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, bicycle lanes within the traveled lane of a roadway, driveways, parking lots, unfenced fire lanes, diesel equipment storage yards, and airport runways. The following are not considered regularly used surfaces: road shoulders primarily used for emergency parking, paved bicycle pathways, bicycle lanes adjacent to unpaved or paved road shoulders primarily used for emergency parking, fenced fire lanes, and infrequently used maintenance access roads.

28 Erodible or leachable materials, wastes, or chemicals are those substances that, when exposed to rainfall, measurably alter the physical or chemical characteristics of the rainfall runoff (examples include erodible soil, uncovered process wastes, manure, fertilizers, oily substances, ashes, kiln dust, garbage dumpster leakage, etc.)

31 A covered parking area would be considered pollution-generating if runoff from uphill could regularly run through it, or if rainfall could regularly blow in and wet the pavement surface. The same parking area would not be included if it were enclosed by walls or if a low wall and berm prevented stormwater from being blown in or from running onto the covered area.

32 New PGIS means new impervious surface (as defined on page 5-16) that is pollution-generating.

33 Contiguous PGIS means a discrete patch of PGIS that is all together as opposed to being separated in different locations on the project site. As used in this and other exemptions, the intent is to apply Core Requirement #8 to those redevelopment projects that are replacing and/or adding enough impervious surface in one location to allow for opportunistic installation of a water quality facility.

34 Contiguous PGPS means a patch of PGPS that is all together as opposed to being separated in different locations on the project site.

35 Modified PGPS means any existing PGPS that is re-graded or re-contoured by the proposed project.

36 Landscape management plan means a King County approved plan for defining the layout and long-term maintenance of landscaping features to minimize the use of pesticides and fertilizers, and to reduce the discharge of suspended solids and other pollutants. Guidelines for preparing landscape management plans can be found in Reference Section 4-A. Submittal requirements are detailed in Section 2.3.1.4.
2. Cost Exemption for Redevelopment Projects
A redevelopment project or any threshold discharge area within a redevelopment project is exempt if it meets all of these criteria:

a) Less than $500,000 of total site improvements is proposed, AND
b) Less than 5,000 square feet of new PGIS will be added, AND
c) Less than 1 acre of contiguous PGPS will be added and/or modified, OR there is a formal agreement with the City to implement a landscape management plan for the PGPS areas, AND
d) The project does not propose greater than or equal to $100,000 in improvements to a high-use site.

3. Standard Infiltration Exemption
A proposed project or any drainage area within a project is exempt if the runoff from pollution-generating pervious and impervious surfaces is infiltrated in soils with a measured infiltration rate of less than or equal to 9 inches per hour.

4. Soil Treatment Exemption
A proposed project or any drainage area within a project is exempt if the runoff from pollution-generating impervious surfaces is infiltrated in soils that meet the “groundwater protection criteria” outlined below.

Groundwater Protection Criteria: The first 2 feet or more of the soil beneath an infiltration facility must meet one of the following specifications for general protection of groundwater:

a) The soil must have a cation exchange capacity greater than 5 and an organic content greater than 0.5%, OR
b) The soil must be composed of less than 25% gravel by weight with at least 75% of the soil passing the #4 sieve, and the portion passing the #4 sieve must meet one of the following gradations:
   - At least 50% must pass the #40 sieve and at least 2% must pass the #100 sieve, OR
   - At least 25% must pass the #40 sieve and at least 5% must pass the #200 sieve.

1.2.8.1 WATER QUALITY MENUS
Projects subject to Core Requirement #8 must provide a facility selected from either the Basic Water Quality menu or the Resource Stream Protection menu, whichever applies per the threshold information detailed in this section.

Redevelopment projects subject to Core Requirement #8 need only apply the Basic WQ menu. Note: A higher standard may be imposed by an adopted resource management plan through Special Requirement #1, Section 1.3.1, or the proposed project may apply a higher standard voluntarily.

Intent: The City of Kent contains numerous sensitive and significant water resources. The City has determined that the minimum level of treatment adequate to prevent further degradation of water quality, and to maintain the aquatic health of current fisheries, is that provided by the Resource Stream Protection menu. The Director has the option to require additional treatment, or treatment of existing impervious areas, when necessary to meet water quality standards and goals (see Reference 8-H).

37 Measured infiltration rate shall be as measured by the EPA method or the Double Ring Infiltrometer Method (ASTM D3385). For some soils, an infiltration rate of less than 9 inches per hour may be assumed based on a soil texture determination rather than a rate measurement. For more details, see the requirements in Section 5.4.1.
38 Cation exchange capacity shall be tested using EPA Laboratory Method 9381.
39 Organic content shall be measured on a dry weight basis using ASTM D2974.
SECTION 12 CORE REQUIREMENTS

- **BASIC WQ MENU**

  The Basic WQ menu is applied where a general, cost-effective level of treatment is adequate and where more intensive, targeted pollutant removal is not needed to protect receiving bodies. In the City of Kent, the only acceptable use of the Basic WQ menu is for redevelopment projects that are subject to Core Requirement #8

  **Treatment Goals and Options**

  The treatment goal for facility options in the Basic WQ menu is 80% removal of total suspended solids (TSS) for a typical rainfall year assuming typical pollutant concentrations in urban runoff. TSS is the general performance indicator for basic water quality protection because it is the most obvious pollutant of concern. The basic WQ menu includes facilities such as wetponds, combined detention/wetponds, biofiltration swales, filter strips and sand filters. See Chapter 6 for specific facility options and designs.

  **Intent**

  The Basic WQ menu is intended to be applied to both stormwater discharges that drain to surface waters and those that infiltrate into soils that do not provide adequate groundwater protection (see Exemptions 3 and 4 from Core Requirement #8)

- **SENSITIVE LAKE PROTECTION MENU**

  The City has determined that the Sensitive Lake Protection Menu does not adequately ensure removal of metals, and may not meet water quality goals and standards. Phosphorus is not a primary pollutant of concern in the City, lake watersheds are nearly built-out, so future development is not expected to change the trophic status or lead to declines in lake health due to excessive nutrient loadings.

- **RESOURCE STREAM PROTECTION MENU**

  The Resource Stream Protection menu is applied throughout Kent.

  **Treatment Goals and Options**

  The treatment goal for facility options in the Resource Stream Protection menu is 50% reduction of total zinc. Zinc is an indicator of a wider range of metals typically found in urban runoff that are potentially toxic to fish and other aquatic life. The Resource Stream Protection menu includes options for using a large sand filter or a combination of two facilities in series, one of which is either a sand filter or a leaf compost filter. See Chapter 6 for specific facility options and designs.

  **Intent**

  Facility options in the Resource Stream Protection menu are intended to remove more metals than expected from the Basic WQ menu. Lower metal concentrations reduce the risk to fish of exposure to both chronic and acutely toxic concentrations of metals such as copper and zinc.

1.2.8.2 WATER QUALITY IMPLEMENTATION REQUIREMENTS

**Methods of Analysis and Design**

Water quality treatment facilities shall be analyzed and designed as detailed in Chapter 6.

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40 For evaluation purposes, typical concentrations of TSS in Seattle area runoff are between 30 and 100 mg/L (Table 1, "Water Quality Thresholds Decision Paper," King County Surface Water Management Division, April 1994)
Siting of Treatment Facilities
Required treatment facilities shall be located to treat the runoff from all contiguous PGIS exceeding the threshold for application of Core Requirement #8 to redevelopment projects and all new PGIS on other projects, except as allowed below under “Treatment Trades” and “Untreated Discharges.” In addition, all runoff from 1 acre or more of new and/or modified contiguous PGIS must also be directed to a treatment facility.

Any other onsite or offsite runoff draining to a proposed treatment facility must be treated whether it is from a pollution-generating surface or not. This is because treatment effectiveness is determined in part by the total volume of runoff entering the facility.

Treatment of Pervious Surfaces
Pollution-generating pervious surfaces subject to Core Requirement #8 need only be treated using the Basic WQ menu. It is also possible for the facility requirement to be waived if there is a good faith agreement with Public Works to approve a landscape management plan that controls solids, pesticides, and fertilizers leaving the site.

Treatment Trades
Runoff from areas subject to water quality treatment requirements may be excused from the onsite treatment requirement if a pre-existing area of impervious surface of equivalent size and pollutant characteristics lying within the same watershed or stream reach tributary area is treated on the project site. Such substitution is subject to two restrictions:

1. The pre-existing impervious surface is not currently being treated, is not required to be treated by any phase of the proposed project, is not subject to NPDES or other permit requirements, and is not under a compliance order or other regulatory action, AND

2. The proposal is reviewed and approved by Public Works.

Untreated Discharges
If site topographic constraints are such that runoff from an area must be pumped to be treated by the water quality facility, then Public Works may allow the area runoff to be released untreated, provided that these conditions are met:

1. Treatment of the constrained area by filter strip, biofiltration, or a linear sand filter is not feasible, and a “treatment trade” as described above is not possible, AND

2. The untreated area is less than 5,000 square feet of new PGIS and is less than 5,000 square feet of contiguous PGIS being created through any combination of new and/or replaced impervious surface as part of a redevelopment project, AND

3. Any PGIS within the area to be released untreated shall be addressed with a landscape management plan unless otherwise exempt from Core Requirement #8.

Use of Experimental Water Quality Facilities
Treatment facilities other than those identified in Chapter 6 are allowed on an experimental basis if it can be demonstrated they are likely to meet the pollutant removal goal for the applicable receiving water. Use of such facilities requires an experimental design adjustment to be approved by Kent according to Section 1.4, “Adjustment Process.” When sufficient data on performance has been collected and if performance is acceptable, the new facility will be added to the appropriate water quality menu for common use.

Owner Responsibility for Water Quality
Regardless of the means by which a property owner chooses to meet the water quality requirements of this manual—whether a treatment facility, a train of facilities, a treatment trade, or an experimental treatment...
facility—it is ultimately the responsibility of the property owner to ensure that runoff from their site does not create water quality problems or degrade downstream beneficial uses. It is also ultimately the responsibility of the property owner to ensure that the discharge from their property is not in violation of State and Federal laws.
1.3 SPECIAL REQUIREMENTS

This section details the following five special drainage requirements which may apply to the proposed project depending on its location or site-specific characteristics:

- Special Requirement #1 Other Adopted Area-Specific Requirements, Section 1.3.1
- Special Requirement #2 Developments within Floodplain/Floodway, Section 1.3.2
- Special Requirement #3 Flood Protection Facilities, Section 1.3.3
- Special Requirement #4 Source Control, Section 1.3.4
- Special Requirement #5 Oil Control, Section 1.3.5

1.3.1 SPECIAL REQUIREMENT #1: OTHER ADOPTED AREA-SPECIFIC REQUIREMENTS

Other adopted area-specific regulations may be adopted and include additional requirements that have a more direct bearing on the drainage design of a proposed project. An example is a basin plan or lake management plan that is adopted by the City.

- Basin Plans (BPs) The City may adopt basin plans to provide for the comprehensive assessment of resources and to accommodate growth while controlling adverse impacts to the environment. A basin plan may recommend specific land uses, regional capital projects, and special drainage requirements for future development within the basin area it covers.

- Lake Management Plans (LMPs) The City may adopt lake management plans to provide for comprehensive assessment of resources and to accommodate growth while controlling adverse impacts from nutrient loading to selected lakes. A lake management plan may recommend nutrient control through special drainage and source control requirements for proposed projects within the area it covers.

<table>
<thead>
<tr>
<th>Threshold</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF a proposed project is in a basin plan or lake management plan</td>
<td>THEN the proposed project shall comply with the drainage requirements of the basin plan or management plan, respectively</td>
</tr>
</tbody>
</table>

Application of this Requirement

The drainage requirements of adopted area-specific regulations such as basin plans shall be applied in addition to the drainage requirements of this manual unless otherwise specified in the adopted regulation. Where conflicts occur between the two, the drainage requirements of the adopted area-specific regulation shall supersede those in this manual.

Examples of drainage requirements found in other adopted area-specific regulations include the following:

- More or less stringent flow control
- More extensive water quality controls
- Forest retention requirements
- Infiltration restrictions
- Groundwater recharge provisions
- Discharge to a constructed regional flow control or conveyance facility

### 1.3.2 SPECIAL REQUIREMENT #2: DEVELOPMENTS WITHIN FLOODPLAIN/FLOODWAY

Floodplains and floodways are subject to inundation during extreme events. The 100-year floodplains are delineated to minimize flooding impacts to new development and to prevent aggravation of existing flooding problems by new development. Regulations and restrictions concerning development within a 100-year floodplain are found in Chapter 14.09 of the Kent City Code.

The State Flood Control Program has designated the Green River Valley as a Flood Control Zone Number Two. Washington State law requires a flood control zone permit for all new development in or on the floodplain within the designated flood zone.

A condition of the issuance of an approved flood control zone permit is the requirement to flood proof, usually by land filling the proposed building site. The proposed finished floor elevations of all new buildings shall be located at least one foot above the existing 100-year floodplain elevation. The as-built elevations must be verified and an Elevation Certificate must be completed and returned to the City of Kent Public Works Department. The floodplain elevations adopted by the City of Kent are delineated on the Flood Insurance Rate Maps. Copies of these maps are available for review at the Public Works Department.

The following requirements relate to mapping of the floodplain/floodway and compensatory storage requirements:

<table>
<thead>
<tr>
<th>Threshold</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF a proposed project contains or is adjacent to a stream, lake, wetland, or closed depression, or if other Kent regulations require study of flood hazards</td>
<td>THEN the 100-year floodplain boundaries (and floodway, if available or if improvements are proposed within the 100-year floodplain) based on an approved flood hazard study (described below) shall be delineated on the site improvement plans and profiles, and on any final subdivision maps prepared for the proposed project.</td>
</tr>
<tr>
<td>IF a proposed project proposes to fill within a FEMA designated floodplain that is outside of the floodway (also known as the floodway fringe) AND if the proposed project is located in the Green River Valley</td>
<td>THEN the development must provide offsetting storage for 50% of the pre-development floodway fringe storage capacity that was provided on the property that is to be filled.</td>
</tr>
<tr>
<td>IF a proposed project proposes to fill within a FEMA designated floodplain that is outside of the floodway (also known as the floodway fringe) AND if the proposed project is located outside of the Green River Valley</td>
<td>THEN the development must provide offsetting storage for 100% of the pre-development floodway fringe storage capacity that was provided on the property that is to be filled.</td>
</tr>
</tbody>
</table>
1.3.3 SPECIAL REQUIREMENT #3: FLOOD PROTECTION FACILITIES

Developing sites protected by levees, revetments, or berms requires a high level of confidence in their structural integrity and performance. Proper analysis, design, and construction is necessary to protect against the potentially catastrophic consequences if such facilities should fail.

<table>
<thead>
<tr>
<th>Threshold</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF a proposed project either</td>
<td>THEN the flood protection facilities shall be analyzed and/or designed to conform with the Federal Emergency Management Administration (FEMA) regulations (44 CFR) and the State Flood Control Program</td>
</tr>
<tr>
<td>• contains or is adjacent to a stream that has an existing flood protection facility (such as a levee, revetment, or berm), OR</td>
<td></td>
</tr>
<tr>
<td>• proposes to construct a new or to modify an existing flood protection facility</td>
<td></td>
</tr>
</tbody>
</table>

Application of this Requirement

The applicant is required to demonstrate conformance with FEMA regulations using the methods specified in Section 4 4 2. In addition, certain easement requirements (outlined in Section 4 1) must be met to allow City access for maintenance of the facility.

1.3.4 SPECIAL REQUIREMENT #4: SOURCE CONTROLS

Water quality source controls prevent rainfall and runoff water from coming into contact with pollutants, thereby reducing the likelihood that pollutants will enter public waterways and violate water quality standards. King County prepared a Stormwater Pollution Control Manual for citizens, businesses, and industries to identify and implement source controls for activities that often pollute water bodies. Kent provides advice on source control implementation upon request. The City may, however, require mandatory source controls at any time through formal code enforcement if complaints or studies reveal water quality violations or problems.
SECTION 1.3 SPECIAL REQUIREMENTS

<table>
<thead>
<tr>
<th>Threshold</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF a proposed project is either</td>
<td>THEN the project must provide water quality source controls applicable to the proposed project in accordance with the King County Stormwater Pollution Control Manual</td>
</tr>
<tr>
<td>• a commercial, industrial, or multifamily site development, OR</td>
<td></td>
</tr>
<tr>
<td>• a redevelopment project proposing improvements to an existing commercial, industrial, multifamily site</td>
<td></td>
</tr>
</tbody>
</table>

Application of this Requirement

When applicable, structural source control measures, such as car wash pads or dumpster area roofing, shall be shown on the site improvement plans submitted for engineering review and approval. Other nonstructural source control measures, such as covering storage piles with plastic or isolating areas where pollutants are used or stored, are to be implemented after occupancy and need not be addressed during the plan review process. All commercial and industrial projects (irrespective of size) undergoing drainage review are required to implement applicable source controls.

1.3.5 SPECIAL REQUIREMENT #5: OIL CONTROL

Projects proposing to develop or redevelop a high-use site (defined below) must provide oil controls in addition to any other water quality controls required by this manual. Such sites typically generate high concentrations of oil due to high traffic turnover or the frequent transfer of oil.

A high-use site is any one of the following:

• A commercial or industrial site subject to an expected average daily traffic (ADT) count equal to or greater than 100 vehicles per 1,000 square feet of gross building area, OR
• A commercial or industrial site subject to petroleum storage and transfer in excess of 1,500 gallons per year, not including routinely delivered heating oil, OR
• A commercial or industrial site subject to use, storage, or maintenance of a fleet of 25 or more diesel vehicles that are over 10 tons gross weight (trucks, buses, trains, heavy equipment, etc), OR
• A road intersection with a measure ADT count of 25,000 vehicles or more on the main roadway and 15,000 vehicles or more on any intersection roadway, excluding project proposing primarily pedestrian or bicycle use improvements

The oil control requirement for high-use sites applies to all sites that generate high concentrations of oil, regardless of whether the project creates new impervious surface or makes site improvements to an existing high-use site. The traffic threshold identified focuses on vehicle turnover per square foot of building area (trip generation) rather than ADT alone. This is because oil leakage is greatest when engines are idling or cooling. In general, all-day parking areas are not intended to be captured by these thresholds except for diesel vehicles, which tend to leak oil more than non-diesel vehicles. The petroleum storage and transfer stipulation is intended to address regular transfer operations such as service stations, not occasional filling of heating oil tanks.

City of Kent Surface Water Design Manual
(Chapter 5 – Kent Construction Standards)
Threshold Requirement

If a proposed project either

- develops a site that will have high-use site characteristics (defined above), OR
- is a redevelopment project proposing $100,000 or more of improvements to an existing high-use site

THEN the project must treat runoff from the high-use portion of the site using oil control treatment options from the High-Use menu (described below and detailed in Chapter 6)

High-Use Menu

High-use oil control options are selected to capture and detain oil and associated pollutants. The goal of treatment is to have no visible sheen in runoff leaving the facility, or to have less than 10 mg/L total petroleum hydrocarbons (TPH), depending on the BMP. Oil control options include facilities that are small, handle only a limited site area, and require frequent maintenance, as well as facilities that treat larger areas and generally have less frequent maintenance needs. Facility choices include catch basin inserts, linear sand filters, and oil/water separators. See Chapter 6 for specific facility choices and design details.

Application of this Requirement

For high-use sites located within a larger commercial center, only the impervious surface associated with the high-use portion of the site is subject to treatment requirements. If common parking for multiple businesses is provided, treatment shall be applied to the number of parking stalls required for the high-use business only. However, if the treatment collection area also receives runoff from other areas, the treatment facility must be sized to treat all water passing through it.

High-use roadway intersections shall treat lanes where vehicles accumulate during the signal cycle, including left- and right-turn lanes and through lanes, from the beginning of the left-turn pocket (see Figure 1-3-5 A below). If no left-turn pocket exists, the treatable area shall begin at a distance equal to three car lengths from the stop line. If runoff from the intersection drains to more than two collection areas that do not combine within the intersection, treatment may be limited to any two of the collection areas.

Note: For oil control facilities to be located in public road right-of-way and maintained by Kent, only coalescing plate or baffle oil/water separators shall be used unless otherwise approved by an adjustment.

Methods of Analysis

The traffic threshold for the High-Use menu shall be estimated using information from *Trip Generation*, published by the Institute of Transportation Engineers, or from a traffic study prepared by a professional engineer or transportation specialist with experience in traffic estimation.
1.3.6 REDEVELOPMENT REQUIREMENTS

Stormwater management for redevelopment projects is addressed in many separate sections of this manual. In an effort to clarify the requirements for redevelopment, these sections have been compiled and are presented below.

Redevelopment projects are required to go through drainage review if they are subject to a Kent development proposal, permit, or approval (such as those listed on page 51-6) AND

- Propose $100,000 or more of improvements to an existing high-use site, OR
- Propose $500,000 or more of site improvements and create 5,000 square feet or more of contiguous pollution-generating impervious surface through any combination of new and/or replaced impervious surface.

Redevelopment Projects proposing $100,000 or more of improvements to an existing high-use site are subject to “Category 3” Targeted Drainage Review, and require the following:

- Core Requirement #1. Discharge at the Natural Location
- Core Requirement #5. Erosion and Sediment Control
- Core Requirement #6. Maintenance and Operations
- Core Requirement #7. Financial Guarantees and Liability
- Core Requirement #8. Water Quality
- Special Requirement #4. Source Control
SECTION 1.3 SPECIAL REQUIREMENTS

Special Requirement #5 Oil Control

In addition, a “Category 3” project that installs oil controls that construct or modify a 12-inch ditch are also a “Category 2” project that may also include the following:

- Special Requirement #1 other adopted requirements
- #3 flood protection facilities

Redevelopment Projects proposing $500,000 or more of site improvements and creating 5,000 square feet or more of contiguous pollution-generating impervious surface through any combination of new and/or replaced impervious surface are subject to full drainage review. The requirements for these projects are listed in Table 1 1 2 A and include flow control (Core Requirement #3) and Water Quality (Core Requirement #8).

1.3.6.1 FLOW CONTROL REQUIREMENTS

When analyzing a redevelopment project for flow control, flows must meet the area specific flow control standard by using KCRTS and comparing existing site conditions with proposed site conditions for the applicable frequency and/or duration criteria. Redevelopment projects may be granted an exemption from Core Requirement 3 - Flow Control under one scenario - the Peak Flow Exemption Using Flow Control BMPs, as follows:

IF the project improvements in the threshold discharge area generate less than a 0.1 cfs increase in the existing site conditions 100-year flow rate AND flow control BMPs are applied as specified in Section 5.2, AND the project improvements do not significantly impact a “severe erosion problem” or a “severe flooding problem”, AND the project is not located in a Landslide Hazard Drainage Area.

1.3.6.2 WATER QUALITY CONTROL REQUIREMENTS

Redevelopment projects may be granted an exemption from Core Requirement #8 - Water Quality Control under two scenarios:

1. Surface Area Exemption

IF a) less than 5,000 square feet of new PGIS will be added, AND b) less than 5,000 square feet of contiguous PGIS will be created through any combination of new and/or replaced impervious surface as part of the redevelopment project, AND c) less than 1 acre of PGPS will be added or modified, OR there is a formal agreement with the City of Kent to implement a landscape management plan for the PGPS areas, AND d) the project does not propose greater than $100,000 in improvements to a high use site.

2. Cost Exemption

IF a) less than $500,000 of total site improvements is proposed, AND b) less than 5,000 square feet of new PGIS will be added, AND c) less than 1 acre of contiguous PGPS will be added and/or modified, or there is a formal agreement with the City of Kent to implement a landscape management plan for the PGPS areas, AND d) the project does not propose greater than or equal to $100,000 in improvements to a high use site.

Redevelopment projects subject to Core Requirement #8 need only apply the Basic Water Quality Menu, regardless of the location of the development. Only one of the following facility options must be chosen to meet the requirement (see Section 6.1.1):

- Biofiltration Swale
SECTION 13 SPECIAL REQUIREMENTS

- Filter Strip
- Wetpond
- Wet vault
- Stormwater Wetland
- Combined Detention and Wetpond
- Sand Filter

In addition, these facilities need only be sized to treat the runoff from the new and/or replaced impervious surface that is subject to Core Requirement #8. Any other onsite or offsite runoff draining to a proposed treatment facility must be treated whether it is from a pollution-generating surface or not. This is because treatment effectiveness is determined in part by the total volume of runoff entering the facility.

Redevelopment Projects involving greater than or equal to $100,000 in improvements to a high use site are required to meet Special Requirement #5 - Oil Control. Runoff from the high-use portion of the site must be treated using oil control treatment options presented in Chapter 6.
1.4 ADJUSTMENT PROCESS

For proposed projects subject to drainage review by Public Works, this process is provided for the occasions when a project proponent desires to vary from one of the core or special requirements, or any other specific requirement or standard contained in this manual. Proposed adjustments should be approved prior to final permit approval, but they may be accepted up to the time Kent approves final construction or accepts drainage facilities for maintenance.

Types of Adjustments

To facilitate the adjustment process and timely review of adjustment proposals, the following types of adjustments are provided:

- **Standard Adjustments**: These are adjustments of the standards and requirements contained in the following chapters and sections of this manual:
  * Chapter 2, Drainage Plan Submittal
  * Chapter 4, Conveyance System Analysis and Design
  * Chapter 5, Flow Control Design
  * Appendix C of the King County Manual, Small Site Drainage Requirements (detached)
  * Appendix D of the King County Manual, Erosion and Sediment Control Standards (detached)

  Requests for standard adjustments will be accepted only for permits pending approval or approved permits that have not yet expired.

- **Complex Adjustments**: Complex adjustments typically require more in-depth review because they deal with more complicated requirements or requirements that affect basic City policies or other agencies. These adjustments deviate from the requirements contained in the following chapters and sections of this manual:
  * Chapter 1, Drainage Review and Requirements
  * Chapter 3, Hydrologic Analysis and Design
  * Chapter 6, Water Quality Design
  * Appendix D of the Kent Construction Standards, Maintenance Requirements for Privately Maintained Facilities

  Requests for complex adjustments will be accepted only for permits pending approval or approved permits that have not yet expired.

- **Preapplication Adjustments**: This type of adjustment may be requested when the applicant needs an adjustment decision to determine if a project is feasible or when the results are needed to determine if a project is viable before funding a full application. The approval of preapplication adjustments is tied by condition to the project proposal presented at a preapplication meeting with Public Works.

- **Experimental Design Adjustments**: This type of adjustment is used for proposing new designs or methods that are not covered in this manual, that are not uniquely site specific, and that do not have sufficient data to establish functional equivalence.

- **Blanket Adjustments**: This type of adjustment may be established by the City based on approval of any of the above-mentioned adjustments. Blanket adjustments are usually based on previously approved adjustments that can be applied routinely or globally to all projects where appropriate. Blanket adjustments are also used to effect minor changes or corrections to manual design requirements or to add new designs and methodologies to this manual.
1.4.1 ADJUSTMENT AUTHORITY

The Kent Public Works Department shall have full authority to approve or deny all types of adjustments for any proposed project subject to drainage review by Public Works.

1.4.2 CRITERIA FOR GRANTING ADJUSTMENTS

Adjustments to the requirements in this manual may be granted provided that granting the adjustment will achieve the following:

1. Produce a compensating or comparable result that is in the public interest, AND
2. Meet the objectives of safety, function, appearance, environmental protection, and maintainability based on sound engineering judgment.

Where it has been demonstrated that meeting the criteria for producing a compensating or comparable result will deny reasonable use of a property, the applicant shall produce the best practicable alternative as determined by the Director of Public Works. The director or his/her designee shall assess the case to affirm that denial of reasonable use would occur and to require the practicable alternative that best achieves the spirit and intent of the requirement. Public Works staff shall provide recommendations to the director on the best practicable alternative to be required.

Granting any adjustment that would be in conflict with the requirements of any other Kent department will require review and concurrence with that department.

Experimental Design Adjustments

Experimental design adjustments that request use of an experimental water quality facility or flow control facility will be approved by Public Works on a limited basis if, upon evaluation, Public Works agrees the following criteria are met:

1. The new design is likely to meet the identified target pollutant removal goal or flow control performance based on limited data and theoretical considerations, AND
2. Construction of the facility can, in practice, be successfully carried out, AND
3. Maintenance considerations are included in the design, and costs are not excessive or are borne and reliably performed by the applicant or property owner, AND
4. A share of the cost of monitoring to determine facility performance is contributed by the applicant or property owner.

Conditions for approval of these adjustments may include a requirement for setting aside an extra area and posting a financial guarantee for construction of a conventional facility should the experimental facility fail. Once satisfactory operation of the experimental facility is verified, the set aside area could be developed and the financial guarantee released.

1.4.3 ADJUSTMENT APPLICATION PROCESS

Standard and Complex Adjustments

The application process for standard and complex adjustments is as follows:

- Requests for standard and complex adjustments will be accepted only for permits pending approval or approved permits that have not yet expired.
SECTION 1.4 ADJUSTMENT PROCESS

- The completed adjustment request application forms must be submitted to Public Works along with sufficient engineering information (described in Chapter 2) to evaluate the request. The application shall note the specific requirement for which the adjustment is sought.

- If the adjustment request involves use of a previously unapproved construction material or construction practice, the applicant should submit documentation that includes, but is not limited to, a record of successful use by other agencies and/or evidence of meeting criteria for quality and performance, such as that for the American Association of State Highway and Transportation Officials (AASHTO) and the American Society of Testing and Materials (ASTM).

- A fee reduction may be requested if it is demonstrated that the adjustment request requires little or no engineering review.

Preapplication Adjustments

The application process is the same as for standard and complex adjustments except that requests will be accepted prior to permit application, but only if:

- The applicant provides justification at a preapplication meeting with Public Works that an adjustment decision is needed to determine the viability of the proposed project, AND

- Sufficient engineering information to evaluate the request is provided.

Experimental Design Adjustments

The application process is the same as for standard and complex adjustments except that requests will be accepted prior to permit application.

Blanket Adjustments

There is no application process for blanket adjustments because they are initiated and issued solely by the City.

1.4.4 ADJUSTMENT REVIEW PROCESS

The general steps of the review process for specific types of adjustments are presented as follows:

Standard and Complex Adjustments

- Public Works staff will review the adjustment request application forms and documentation for completeness and inform the applicant in writing as to whether additional information is required from the applicant to complete the review. The applicant will also be informed if Public Works determines that special technical support is required in cases where the adjustment involves a major policy issue or potentially impacts a Public Works drainage facility.

- The Public Works director or designee will review and either approve or deny the adjustment request following Public Work’s determination that all necessary information has been received from the applicant.

- Approvals of standard and complex adjustments will expire upon expiration of the permit to which they apply.

Preapplication Adjustments

The review process is the same as for standard and complex adjustments except that approvals will expire one year after the approval date, unless a complete permit application is submitted and accepted.
Experimental Design Adjustments

- Public Works staff will review the submitted material and inform the applicant as to whether additional information is required to complete the review. Public Works will also inform the applicant as to how much time is estimated to complete the review.
- The Public Works Director or designee will review and either approve or deny the adjustment request in writing.

Blanket Adjustments

Blanket adjustments will be established by Public Works based on

1. A previously approved standard, complex, preapplication, or experimental design adjustment and supporting documentation, AND

2. Information presenting the need for the blanket adjustment. Typically, blanket adjustments should apply globally to design or procedural requirements and be independent of site conditions.

1.4.5 APPEAL PROCEDURE

The applicant may appeal the denial or approval conditions of an adjustment request by submitting a formal letter to the Public Works Director within 15 working days of the decision. This letter must include justification for review of the decision, along with a copy of the adjustment request with the conditions (if applicable) and a listing of all previously submitted material. The Public Works Director shall respond to the applicant in writing within 15 working days; this decision shall be final. A per-hour review fee will be charged to the applicant for City review of an appeal.
CHAPTER 2
DRAINAGE PLAN SUBMITTAL

CITY OF KENT SURFACE WATER DESIGN MANUAL

Section 2.1 Plans for Permits and Drainage Review 5.2-3

Section 2.2 Plans Required with Initial Permit Submittal 5.2-5

Section 2.2.1 Subdivisions and Short Plats 5.2-5

Section 2.2.2 Commercial Site Development 5.2-7

Section 2.2.3 Single-Family Residential 5.2-7

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Section 2.3 Plans Required for Drainage Review 5.2-8

Section 2.3.1 Engineering Plan Specifications 5.2-8

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Section 2.4 Plans Required After Drainage Review 5.2-31

Section 2.4.1 Plan Changes After Permit Issuance 5.2-31

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Section 2.4.3 Final Plat, Short Plat, and Binding Site Plan Submittals 5.2-31
CHAPTER 2
DRAINAGE PLAN SUBMITTAL

This chapter details the drainage related submittal requirements for engineering design plans as part of a permit application to the Kent Public Works Department. The intent of these requirements is to present consistent formats for design plans and the technical support data required to develop the plans. These conventions are necessary to review engineering designs for compliance with Kent ordinances and regulations, and to ensure the intent of the plan is easily understood and implemented in the field. Properly drafted design plans and supporting information also facilitate the construction, operation, and maintenance of the proposed system long after its review and approval. When plans comply with the formats and specifications contained herein, they facilitate review and approval with a minimum of time-consuming corrections and resubmittals.

Note that this chapter primarily describes how to submit drainage plans for review—what must be submitted, in what formats, at what times, and to what offices. The basic drainage requirements that these plans must address are contained in Chapter 1, “Drainage Review and Requirements.” The specific design methods and criteria to be used are contained in Chapters 3, 4, 5, and 6.

Several key forms used in the plan review process are reproduced in Reference Section 8, “Plan Review Forms and Worksheets” accompanying Chapter 5 of the Kent Construction Standards.

Chapter Organization

The information presented in this chapter is organized into four main sections as follows:

- Section 2 1, “Plans for Permits and Drainage Review”
- Section 2 2, “Plans Required with Initial Permit Application”
- Section 2 3, “Plans Required for Drainage Review”
- Section 2 4, “Plans Required After Drainage Review”

These sections begin on odd pages so that tabs can be inserted by the user if desired for quicker reference.
2.1 PLANS FOR PERMITS AND DRAINAGE REVIEW

The Kent Public Works Department is responsible for the review of all engineering aspects of private development proposals. Drainage review is a primary concern of engineering design. This section provides an overview of the types of engineered drainage plans required for engineering review at various permit review stages. Detailed requirements are presented in Sections 2.2 and 2.3.

☑ PLANS REQUIRED FOR INITIAL PERMIT SUBMITTAL

Most projects require some degree of drainage plans or analysis to be submitted with the initial permit application (see Table 2.2.1A). At the City of Kent, subdivisions and short plats are reviewed in three stages: tentative, preliminary, and final. Subdivisions and short plats will require a “Tentative Plat/Short Plat Drainage Package” with the initial permit application. The package will provide general information on the proposal, including location of environmentally sensitive areas, road alignments and right-of-way, site topography, building locations, land use information, and lot dimensions. It will be used to determine the appropriate drainage conditions and requirements to be applied to the proposal during the drainage review process.

Single-family residential building permits require only a site plan with the initial permit application. Commercial permits require full engineering plans (see below). Other permits may have project-specific drainage requirements determined by the Kent Public Works Department.

☑ PLANS REQUIRED FOR DRAINAGE REVIEW

For drainage review purposes, engineering plans consist of the following:

1. Site improvement plans, which include all plans, profiles, details, notes, and specifications necessary to construct road, drainage, and off-street parking improvements (see Section 2.3.1.2).
2. A technical information report (TIR), which contains all the technical information and analysis necessary to develop the site improvement plan (see Section 2.3.1.0).
3. An erosion and sediment control (ESC) plan (see Section 2.3.1.3).

Note: A landscape management plan is also included if applicable (see Section 2.3.1.4).

Projects under Targeted Drainage Review usually require engineering plans, except that only certain sections of the technical information report are required to be completed, and the site improvement plan may have a limited scope depending upon the characteristics of the proposed project. The scope of these plans should be confirmed during the project preapplication meeting with the Kent Public Works Department. For other permits, such as single-family residential permits, the scope of the targeted engineering analysis is usually determined during Kent Public Works Department engineering review.

Projects without major drainage improvements may be approved to submit a modified site improvement plan. Major drainage improvements usually include water quality or flow control facilities, conveyance systems, bridges, and road right-of-way improvements. For projects requiring engineering plans for road construction, a modified site improvement plan is not allowed. See Section 2.3.1.2 for further information.

Plans Required for Small Site Drainage Review

Small site drainage plans are a simplified form of site improvement and ESC plans (without a TIR), which can be prepared by a non-engineer from a set of pre-engineered design details. Small site drainage plans are only allowed for projects in Small Site Drainage Review.

For single-family residential permits, the level and scope of drainage plan requirements are determined by the Kent Public Works Department during drainage review. Some projects qualifying for Small Site Drainage Review may also require Targeted Drainage Review.
### TABLE 2.2.1.A DRAINAGE PLAN SUBMITTALS

<table>
<thead>
<tr>
<th>Type of Permit or Project</th>
<th>Plans Required with Initial Land Use Permit Application</th>
<th>Type of Drainage Review(5)</th>
<th>Plans Required for Building Permit Drainage Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUBDIVISIONS AND SHORT PLATS*</td>
<td>Plat Map(1) Tentative Plat/Short Plat Drainage Package - Conceptual Drainage Plan - Level 1 Downstream Analysis - Survey/Topographic Information</td>
<td>Full or Targeted Drainage Review(2)</td>
<td>• Tentative Plat/Short Plat Drainage Package(1)  • Engineering Plans(3)</td>
</tr>
<tr>
<td>COMERCIAL</td>
<td>Engineering Plans(2),(3)</td>
<td>Full or Targeted Drainage Review</td>
<td>Engineering Plans(3)</td>
</tr>
<tr>
<td>SINGLE-FAMILY RESIDENTIAL BUILDING PERMITS</td>
<td>Conceptual Drainage Plan(1)</td>
<td>Small Site Drainage Review OR Small Site Drainage Review AND Targeted Drainage Review(2) OR Full or Targeted Drainage Review(2)</td>
<td>• Small Site Drainage Plans(4)  • Engineering Plans(3)</td>
</tr>
<tr>
<td>OTHER PROJECTS OR PERMITS</td>
<td>Project-specific (contact the Kent Public Works Department)</td>
<td>Full or Targeted Drainage Review(2)</td>
<td>Engineering Plans(3)</td>
</tr>
</tbody>
</table>

**Notes**

1. Submittal specifications for these plans are found in the application packages
2. Submittal specifications for Targeted Drainage Review are found in Section 2.3.2
3. Submittal specifications for engineering plans are detailed in Section 2.3.1
4. Specifications for submittal of small site drainage plans are found in Appendix C of the King County Manual, *Small Site Drainage Requirements* (detached)
5. Refer to Chapter 1, Table 1.1.2.A for definitions of the different drainage review types
   * Short plats meeting the thresholds defining small sites may go through the small site drainage review process.
2.2 PLANS REQUIRED WITH INITIAL PERMIT SUBMITTAL

This section describes the submittal requirements for initial permit applications at the City of Kent. The timing for submittal of engineering plans will vary depending on permit type. For subdivisions and short plats, this submittal usually follows the City's approval of the Tentative Plat/Short Plat Drainage Package. For commercial building permits, engineering plans must be submitted as part of the initial permit application. For other permit types, the drainage plan requirements are determined during the permit review process.

Note: If engineering plans are required to be submitted with the initial permit application, they must be accompanied by the appropriate supporting documents (e.g., required application forms, an environmental checklist, etc.). For more details, see Reference Section 8 accompanying Chapter 5 of the Kent Construction Standards.

Design Plan Certification

All tentative plat/short plat drainage packages and engineering plans must be stamped by a licensed civil engineer registered in the State of Washington. All land boundary surveys and legal descriptions used for preliminary and engineering plans must be stamped by a professional land surveyor registered in the State of Washington. Topographic survey data and mapping prepared specifically for a proposed project may be performed by the licensed civil engineer stamping the engineering plans as allowed by the Washington State Board of Registration for Professional Engineers and Land Surveyors.

2.2.1 SUBDIVISIONS AND SHORT PLATS

Applications for tentative subdivisions and short plats must include a tentative plat/short plat drainage package consisting of the following:

1. A Conceptual Drainage Plan prepared, stamped, and signed by a licensed civil engineer registered in the State of Washington. This plan must show the following:

   a) The level of detail of the plan should correspond to the complexity of the project. Plans submitted for review shall contain the following information at a minimum:

      i) A brief narrative describing existing and proposed site conditions, including inventoried or delineated wetlands, creeks, ponds, steep or unstable slopes, erosion hazard areas, and landslide hazard areas. Include a description of the existing use of the site and the proposed use of the site after development.

      ii) Two simple drainage plans are required for a Conceptual Drainage Plan: an existing condition drainage plan and post-development drainage plan.

      iii) Both drainage plans must be drawn to an engineering scale (e.g., 1" = 20', or 1" = 30', for example, not 1/8" = 1'), and must contain a north arrow. NOTE: North arrows shall either point to the top of the page or to the right side of the page only.

      iv) Include a vicinity map, which clearly shows the location of the development parcel with respect to public streets and other parcels and developments.

      v) Drainage plans will include property lines, including line lengths (bearings of property lines are preferred, but not required).

      vi) All public and private roads, driveway accesses, and road easements, with dimensions.
SECTION 2.3 PLANS REQUIRED FOR DRAINAGE REVIEW

g) All manmade or natural features (streams, creeks, drainage ditches, railroad tracks, hills, depressions, structures of all kinds, steep slopes, lakes, etc) and the existing direction of surface water flows shown by arrows pointing in the direction of flow.

h) Setback dimensions from all property lines and from sensitive areas such as wetlands, steep or unstable slopes, and Native Growth Protection Tracts.

i) Existing and proposed building and landscape locations.

j) Differentiate between developed portions of a parcel, and undeveloped/natural areas of a parcel, and areas set aside for future development.

k) Outside storage areas and types of surfaces for storage areas.

l) The post-development drainage plan shall include a proposed conveyance system layout, and the location of discharge points onto and off of the property, the total amount of impervious surface created (including rooftops), the approximate building and parking lot/storage yard footprints, and all proposed stormwater treatment, and proposed locations for stormwater management Best Management Practices (detention ponds, biofiltration swales, oil/water separators, etc).

m) A legal description for the property and the Assessor's Tax Lot Number for the property.

n) The name, address, and telephone number of the person preparing the Site Plan.

   a) A vicinity map that clearly shows the project location.

   b) The location and type of existing and proposed flow control facilities.

   c) The location and type of existing and proposed water quality facilities.

   d) The location and type of existing and proposed conveyance systems.

2 A Level 1 Downstream Analysis as required in Core Requirement #2 and outlined under “TIR Section 3, Offsite Analysis.” The Level 1 Downstream Analysis is required for all short plats except those meeting the exemptions outlined in Section 1.2.2 or qualifying for Small Site Drainage Review for the entire project. This offsite analysis shall be submitted to assess potential offsite drainage impacts associated with development of the project, and to help propose appropriate mitigation of those impacts. A higher level of offsite analysis may be requested by the Kent Public Works Department prior to preliminary approval, or as a condition of engineering plan submittal. The offsite analysis must be prepared, stamped, and signed by a licensed civil engineer registered in the State of Washington.

3 Survey/topographic information. The submitted site plan and conceptual drainage plan shall include:

   a) Field topographic base map to accompany application (aerial topography allowed with Kent Public Works Department permission).

   b) Name and address of surveyor and surveyor's seal and signature.

   c) Notation for field or aerial survey.

   d) Datum and benchmark/location and basis of elevation.

   e) Location of all streams, lakes, wetlands, closed depressions, or Hazard Areas (include any corresponding King County or Kent designation number, or identify as undesignated).
Contour intervals per the following chart

<table>
<thead>
<tr>
<th>Zoning Designation</th>
<th>Contour Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Densities of developed area of over 2 DU per acre</td>
<td>2 feet at less than 15% slope</td>
</tr>
<tr>
<td></td>
<td>5 feet at 15% slope or more</td>
</tr>
<tr>
<td>Densities of developed area of 2 DU or less per acre</td>
<td>5 feet</td>
</tr>
</tbody>
</table>

2.2.2 COMMERCIAL SITE DEVELOPMENT

Applications for commercial permits require that engineering plans be submitted as part of the initial permit application. Most commercial projects will go through Full Drainage Review and require complete engineering plans. Projects which may qualify for limited scope engineering design should request Targeted Drainage Review during the preapplication meeting with the Public Works Department.

2.2.3 SINGLE-FAMILY RESIDENTIAL

Applications for single-family residential permits require a non-engineered site plan to be submitted. Refer to the minimum requirements listed at the beginning of Section 2.2 (see detached Appendix C, Section C 5 3, note that erosion control, flow control not required).

2.2.4 OTHER PERMITS

Other permit applications will require project-specific information. Initial submittal requirements can be obtained by contacting the Kent Public Works Department.
2.3 PLANS REQUIRED FOR DRAINAGE REVIEW

This section presents the specifications and contents required of plans to facilitate drainage review. Most projects subject to Full Drainage Review will require engineering plans that include a technical information report (TIR), site improvement plans, and an erosion and sediment control (ESC) plan. In addition, a landscape management plan may also be required to comply with Core Requirement #8 (see Section 1.2.8). For more information on the types of projects subject to Full Drainage Review, see Section 1.1.2.3.

Small projects with specific drainage concerns that are subject to Targeted Drainage Review, also require engineering plans that include the same elements, except that the TIR may be of limited scope. The site improvement plans and ESC plans may also be of limited scope, but must meet all applicable specifications. For more information on the types of projects subject to Targeted Drainage Review, see Section 1.1.2.2.

Projects that qualify for Small Site Drainage Review may be required to submit small site drainage plans. These are simplified drainage and erosion control plans that can be prepared by a non-engineer from a set of pre-engineered design details, and do not require a TIR. The Small Site Drainage Requirements booklet available at the King County Department of Development and Environmental Services and appended to the King County Manual (detached Appendix C, Section C 5.3) contains the specifications for small site drainage plans and details on the Small Site Drainage Review process.

Note: Projects in Small Site Drainage Review may be required to submit engineering plans if they are also subject to Targeted Drainage Review as determined in Section 1.1.2.2 and Appendix C of the King County Manual. Also, short plats in Small Site Drainage Review will be required to submit engineering plans if roadway construction is a condition of preliminary approval.

Design Plan Certification

All tentative plat/short plat drainage packages and engineering plans must be stamped by a licensed civil engineer registered in the State of Washington.

All land boundary surveys and legal descriptions used for preliminary and engineering plans must be stamped by a professional land surveyor registered in the State of Washington. Topographic survey data and mapping prepared specifically for a proposed project may be performed by the licensed civil engineer stamping the engineering plans as allowed by the Washington State Board of Registration for Professional Engineers and Land Surveyors.

2.3.1 ENGINEERING PLAN SPECIFICATIONS

For drainage review purposes, engineering plans must consist of:

1. A technical information report (TIR) as detailed in Section 2.3.1.0, AND
2. Site improvement plans as detailed in Section 2.3.1.2, AND
3. An erosion and sediment control (ESC) plan as detailed in Section 2.3.1.3

Also, if applicable per Section 1.2.8, a landscape management plan, as detailed in Section 2.3.1.4, must be included.

Projects in Targeted Drainage Review require a limited scope TIR with site improvement plans and an ESC plan, as detailed in Section 2.3.2. The Kent Public Works Department may allow a modified site improvement plan for some projects in Targeted Drainage Review (see Section 2.3.2) or where major improvements (e.g., detention facilities, conveyance systems, bridges, road right-of-way improvements, etc.) are not proposed.
2.3.1.1 TECHNICAL INFORMATION REPORT (TIR)

The full TIR should be a comprehensive supplemental report containing all technical information and analysis necessary to develop the site improvement plan. This report should contain all calculations, conceptual design analysis, reports, and studies required and used to construct a complete site improvement plan based on sound engineering practices and careful geotechnical and hydrological design. The TIR must be stamped and dated by a licensed civil engineer registered in the State of Washington.

The TIR shall contain the following ten sections, preceded by a table of contents:

1. Project Overview
2. Conditions and Requirements Summary
3. Offsite Analysis
4. Flow Control and Water Quality Facility Analysis and Design
5. Conveyance System Analysis and Design
6. Special Reports and Studies
7. Other Permits
8. ESC Analysis and Design
9. Bond Quantities, Facility Summaries, and Declaration of Covenant

Every TIR must contain each of these sections, however, if a section does not apply, the applicant may simply mark “N/A” with a brief explanation. This standardized format allows a quicker, more efficient review of information required to supplement the site improvement plan.

The table of contents should include a list of the ten section headings and their respective page numbers, a list of tables with page numbers, and a list of numbered references, attachments, and appendices.

When the TIR package requires revisions, the revisions must be submitted in a complete TIR package.

**TIR SECTION 1
PROJECT OVERVIEW**

The project overview must provide a general description of the proposal, predeveloped and developed conditions of the site, site area and size of the improvements, and the disposition of stormwater runoff before and after development. The overview shall identify and discuss difficult site parameters, the natural drainage system, and drainage to and from adjacent property, including bypass flows.

The following figures are required:

**Figure 1. TIR Worksheet**

Include a copy of the TIR Worksheet (see Reference Section 8-A accompanying Chapter 5 of the Kent Construction Standards).

**Figure 2. Site Location**

Provide a map that shows the general location of the site. Identify all roads that border the site and all significant geographic features including all streams, lakes, wetlands, closed depressions, and Hazard Areas.
SECTION 2.3 PLANS REQUIRED FOR DRAINAGE REVIEW

Figure 3  Drainage Basins, Subbasins, and Site Characteristics

This figure shall display

1. Acreage of all subbasins
2. All site characteristics
3. Existing discharge points to and from the site
4. Routes of existing, construction, and future flows at all discharge points and downstream hydraulic structures
5. A minimum City of Kent Storm Sewer Facility Map, $1" = 300'$ as a base for the figure (available at the Kent Permit Center)
6. The length of travel (also cite) from the farthest upstream end of a proposed storm system in the development to any proposed flow control facility

Figure 4  Soils

Show the soils within the following areas

1. The project site
2. The area draining to the site
3. The drainage system downstream of the site for the distance of the downstream analysis (see Section 1.2.2)

Copies of King County Soil Survey maps may be used, however, if the maps do not accurately represent the soils for a proposed project (including offsite areas of concern), it is the design engineer's responsibility to ensure that the actual soil types are properly mapped. Soil classification symbols that conform to the SCS Soil Survey for King County shall be used, and the equivalent KCRTS soil type (till, outwash, or wetlands) shall be indicated (see Table 3.2.2.B)

All urban plats and short plats (creating lots less than 22,000 square feet) must evaluate onsite soils for suitability for roof downspout infiltration as detailed in Section 5.1.1. This soils report, as well as geotechnical investigations necessary for proposed infiltration facilities, should be referenced in the TIR Overview and submitted under Special Reports and Studies, TIR Section VI. A figure in the required geotechnical report that meets the above requirements may be referenced to satisfy 1, 2, and 3 above.

☐ TIR SECTION 2
CONDITIONS AND REQUIREMENTS SUMMARY

The intent of this section is to ensure all preliminary approval conditions and applicable requirements pertaining to site engineering issues have been addressed in the site improvement plan. All conditions and requirements for the proposed project should be included.

In addition to the core requirements of this manual, adopted basin plans and other plans as listed in Special Requirement #1 should be reviewed and applicable requirements noted. Sensitive area requirements, conditions of plat approval and conditions associated with development requirements (e.g., conditional use permits, rezones, variances and adjustments, SEPA mitigations, etc.) should also be included.

☐ TIR SECTION 3
OFFSITE ANALYSIS

All projects in engineering review shall complete, at a minimum, an Offsite Analysis, except for projects meeting the exemptions outlined in Section 1.2.2. The Offsite Analysis is usually completed as part of the

2 Any specific regulations related to floodplains, streams, lakes, wetlands, closed depressions, or geologic hazard areas.
initial permit application and review process, and is to be included in the TIR. Note: If offsite conditions have been altered since the initial submittal, a new offsite analysis may be required.

The primary component of the offsite analysis is the downstream analysis described in detail below. Upstream areas are included in this component to the extent they are expected to be affected by backwater effects from the proposed project. Other components of the offsite analysis could include, but are not limited to, evaluation of impacts to fish habitat, groundwater levels, groundwater quality, or other environmental features expected to be significantly affected by the proposed project due to its size or proximity to such features.

Levels of Analysis

The offsite analysis report requirements vary depending on the specific site and downstream conditions. Each project submittal shall include at least a Level 1 downstream analysis. Upon review of the Level 1 analysis, the Kent Public Works Department may require a Level 2 or Level 3 analysis. If conditions warrant, additional, more detailed analysis may be required. Note: Potential impacts upstream of the proposal shall also be evaluated.

Level 1 Analysis

The Level 1 analysis is a qualitative survey of each downstream system leaving a site. This analysis is required for all proposed projects and shall be submitted with the initial permit application. Depending on the findings of the Level 1 analysis, a Level 2 or 3 analysis may need to be completed or additional information may be required. If further analysis is required, the applicant may schedule a meeting with Kent Public Works Department staff.

Level 2 or 3 Analysis

If problems are identified in the Level 1 analysis, a Level 2 (rough quantitative) analysis or a Level 3 (more precise quantitative) analysis may be required to further evaluate proposed mitigation for the problem. Kent Public Works Department staff will determine whether a Level 2 or 3 analysis is required based on the evidence of existing or potential problems identified in the Level 1 analysis and on the proposed design of onsite drainage facilities. The Level 3 analysis is required when results need to be as accurate as possible, for example, if the site is flat, if the system is affected by downstream controls, if minor changes in the drainage system could flood roads or buildings, or if the proposed project will contribute more than 15 percent of the total peak flow to the drainage problem location. The Level 2 or 3 analysis may not be required if the Kent Public Works Department determines from the Level 1 analysis that adequate mitigation can be developed.

Additional Analysis

Additional, more detailed hydrologic analysis may be required if the Kent Public Works Department determines that the downstream analysis has not been sufficient to accurately determine the impacts of a proposed project on an existing or potential drainage problem. This more detailed analysis may include a point of compliance analysis as detailed in Section 3.3.6.

Scope of Analysis

Regardless of the level of downstream analysis required, the applicant shall define and map the study area (Task 1), review resources (Task 2), inspect the study area (Task 3), describe the drainage system and problems (Task 4), and propose mitigation measures (Task 5) as described below.

Task 1. Study Area Definition and Maps

For the purposes of Task 2 below, the study area shall extend downstream one mile (minimum flow path distance) from the proposed project discharge location and shall extend upstream as necessary to encompass the offsite drainage area tributary to the proposed project site. For the purposes of Tasks 3, 4, and 5, the study area shall extend downstream to a point on the drainage system where the proposed project site constitutes a minimum of 15 percent of the total tributary drainage area, but not...
less than one-quarter mile (minimum flow path distance). The study area shall also extend upstream of the project site a distance sufficient to preclude any back water effects from the proposed project.

The offsite analysis shall include (1) a site map showing property lines, and (2) the best available topographical map (e.g., at a minimum use the 1" = 300' City of Kent Storm Sewer Facility Maps available at the Kent Permit Center) with the study area boundaries, site boundaries, downstream flow path, and potential/existing problems (Task 4) shown. Other maps, diagrams, and photographs such as aerial photographs may be helpful in describing the study area.

**Task 2. Resource Review**

To assist the design engineer in preparing an offsite analysis, Kent has gathered information regarding existing and potential flooding and erosion problems. For all levels of analysis, all of the resources described below shall be reviewed for existing/potential problems in the study area (upstream and one mile downstream of the project site):

- Adopted basin plans (available at the Kent Public Works Department, King County Department of Development and Environmental Services, King County Department of Natural Resources and the library)
- Finalized drainage studies (available at the Kent Public Works Department)
- Basin Reconnaissance Summary Reports and 1"=400' scale problem summary maps (available at King County Department of Development and Environmental Services, King County Department of Natural Resources and the library)
- Floodplain/floodway (FEMA) maps (available at the Kent Public Works Department and the library)
- Other offsite analysis reports in the same subbasin, if available (check with the Kent Public Works Department records staff)
- Sensitive Areas Folio (available at King County Department of Development and Environmental Services—must be used to document the distance downstream from proposed project to nearest stream wetland or lake identified in the folio)
- U.S. Department of Agriculture, *King County Soils Survey* (available at King County Department of Development and Environmental Services and the library)
- Wetlands Inventory maps (City-wide map included with this manual, detailed maps available at the Kent Public Works Department)
- City of Kent Erosion Hazard Area Map and Landslide Hazard Area Maps (City-wide map included with this manual, detailed maps available at the Kent Public Works Department)

Potential/existing problems identified in the above documents shall be documented in the **Drainage System Table** (see Reference Section 8-B accompanying Chapter 5 of the Kent Construction Standards) and described in the text of the **Level 1 Downstream Analysis Report**. If a document is not available for the site, note in the report that the information was not available as of a particular date. If necessary, additional resources are available from Kent, King County, the Washington State Department of Fisheries and Wildlife (WDFW), the State Department of Ecology (Ecology), the United States Army Corps of Engineers (Corps), and the public works departments of other municipalities in the vicinity of the proposed project site.

**Task 3. Field Inspection**

The design engineer shall physically inspect the existing onsite and offsite drainage systems of the study area for each discharge location. Specifically, he/she shall investigate any evidence of the following existing or potential problems and drainage features:

**Level 1 Inspection:**

1. Investigate any problems reported or observed during the resource review.
SECTION 2.3 PLANS REQUIRED FOR DRAINAGE REVIEW

2 Locate all existing/potential constrictions or lack of capacity in the existing drainage system.
3 Identify all existing/potential flooding or nuisance problems as defined in Section 1.2.2.1.
4 Identify existing/potential overtopping, scouring, bank sloughing, or sedimentation.
5 Identify significant destruction of aquatic habitat or organisms (e.g., severe siltation, bank erosion, or incision in a stream).
6 Collect qualitative data on features such as land use, impervious surfaces, topography, and soil types.
7 Collect information on pipe sizes, channel characteristics, drainage structures, wetlands, streams, lakes, closed depressions, and Hazard Areas.
8 Verify tributary basins delineated in Task 1.
9 Contact neighboring property owners or residents in the area about past or existing drainage problems, and describe these in the report (optional).
10 Note the date and weather conditions at the time of the inspection.

Level 2 or 3 Inspection.

1 Perform a Level 1 inspection.
2 Document existing site conditions (approved drainage systems or pre-1978 aerial photographs) as defined in Core Requirement #3.
3 Collect quantitative field data. For Level 2, collect non-survey field data using hand tapes, hand reel, and rods, for Level 3, collect field survey profile and cross-section topographic data prepared by an experienced surveyor.

Task 4. Drainage System Description and Problem Descriptions

Each drainage system component and problem shall be addressed in the offsite analysis report in three places: on a map (Task 1), in the narrative (Task 4), and in the Offsite Analysis Drainage System Table (see Reference Section 8-B).

Drainage System Descriptions: The following information about drainage system components such as pipes, culverts, bridges, outfalls, ponds, tanks, and vaults shall be included in the report:

1 Location (corresponding map label and distance downstream/upstream from site discharge).
2 Physical description (type, size, length, slope, vegetation, and land cover).
3 Problems.
4 Field observations.

Problem Descriptions: All existing or potential problems (e.g., ponding water, high/low flows, siltation, erosion, etc.) identified in the resource review or field inspection shall be described in the offsite analysis. These descriptions will help in determining if such problems are one of three defined problem types that require special attention per Core Requirement #2 (see Section 1.2.2.1). Special attention may include more analysis, additional flow control, or other onsite or offsite mitigation measures as specified by the problem-specific mitigation requirements set forth in Section 1.2.2.2.

The following information shall be provided for each existing or potential problem:

1 Description of the problem (ponding water, high or low flows, siltation, erosion, slides, etc).
2 Magnitude of or damage caused by the problem (siltation of ponds, dried-up ornamental ponds, road inundation, flooded property, flooded building, flooded septic system, significant destruction of aquatic habitat or organisms).
SECTION 2-3 PLANS REQUIRED FOR DRAINAGE REVIEW

3 General frequency and duration of problem (dates and times the problem occurred, if available)

4 Return frequency of storm or flow (cfs) of the water when the problem occurs (optional for Level 1 and required for Levels 2 and 3) Note: A Level 2 or 3 analysis may be required to accurately identify the return frequency of a particular downstream problem, see Section 3-3.3

5 Water surface elevation when the problem occurs (e.g., elevation of building foundation, crest of roadway, elevation of septic dranfields, or wetland/stream high water mark)

6 Names and concerns of involved parties (optional for all levels of analysis)

7 Current mitigation of the problem

8 Possible cause of the problem

9 Whether the proposed project is likely to aggravate (increase the frequency or severity of) the existing problem or create a new one based on the above information. See Section 1-2-3 for more details on the effectiveness of flow control standards in addressing downstream problems.

Task 5. Mitigation of Existing or Potential Problems

For any existing or potential offsite drainage problem determined to be one of the three defined problem types in Section 1-2-2-1, the design engineer must demonstrate that the proposed project neither aggravates (if existing) nor creates the problem as specified in the problem-specific mitigation requirements set forth in Section 1-2-2-2. To meet these requirements, the proposed project may need to provide additional onsite flow control as specified in Table 1-2-3-A (see also Section 3-3.5), or other onsite or offsite mitigation measures as described in Section 3-3.5.

TIR SECTION 4
FLOW CONTROL AND WATER QUALITY FACILITY ANALYSIS AND DESIGN

Existing Site Hydrology (Part A)

This section of the TIR should include a discussion of assumptions and site parameters used in analyzing the existing site hydrology. The definition of "existing site conditions" presented in Section 1-1 shall be applied for this section.

The acreage, soil types, and land covers used to determine existing flow characteristics, along with basin maps, graphics, and exhibits for each subbasin affected by the development, should be included.

The following information must be provided on a topographical map:

1. delineation and acreage of areas contributing runoff to the site
2. flow control facility location
3. outfall location and description
4. overflow route

The scale of the map and the contour intervals must be sufficient to determine the basin and subbasin boundaries accurately. The direction of flow, the acreage of areas contributing drainage, and the limits of development should all be indicated on the map.

Each subbasin contained within or flowing through the site should be individually labeled and KCRTS parameters referenced to that subbasin.

All natural streams and drainage features, including wetlands and depressions, must be shown. Rivers, closed depressions, streams, lakes, and wetlands must have the 100-year floodplain (and floodway where applicable) delineated as required in Special Requirement #2 (see Section 1-3-2) and by applicable code.
environmental regulations

**Developed Site Hydrology (Part B)**

This section should provide narrative, mathematical, and graphical presentations of parameters selected and values used for the developed site conditions, including acreage, soil types, land covers, roadway layouts, and all constructed drainage facilities.

Developed subbasin areas and flows should be clearly depicted on a map and cross-referenced to computer printouts or calculation sheets. Relevant portions of the calculations should be highlighted and tabulated in a listing of all developed subbasin flows.

All maps, exhibits, graphics, and references used to determine developed site hydrology must be included, maintaining the same subbasin labeling as used for the existing site hydrology whenever possible. If the boundaries of the subbasin have been modified under the developed condition, the labeling should be modified accordingly (e.g., Subbasin “Am” is a modified version of existing Subbasin “A”).

**Performance Standards (Part C)**

The design engineer shall include brief discussions of the following:

- The area-specific flow control standard determined from the Flow Control Applications Map per Section 1 2 3 and any modifications to the standard to address onsite or offsite drainage conditions, and
- The applicable conveyance system capacity standards per Section 1 2 4

**Flow Control System (Part D)**

This section requires an illustrative sketch of the flow control facility and its appurtenances. This sketch must show basic measurements necessary to calculate the storage volumes available from zero to the maximum head, all orifice/restrictor sizes and head relationships, and control structure/restrictor orientation to the facility.

The applicant should include all computer printouts, calculations, equations, references, storage/volume tables, graphs, and any other aides necessary to clearly show results and methodology used to determine the storage facility volumes. KCRTS facility documentation files, “Compare Flow Durations” files, peaks files, return frequency or duration curves, etc., should be included to verify the facility meets the performance standards indicated in Part C.

**Water Quality System (Part E)**

This section provides an illustrative sketch of the proposed water quality facility (or facilities), source controls, oil controls, and appurtenances. This sketch (or sketches) should show overall measurements and dimensions, orientation on the site, location of inflow, bypass, and discharge systems, etc.

The applicant should include all computer printouts, calculations, equations, references, and graphs necessary to show the facility was designed and sized in accordance with the specifications and requirements in Chapter 6.

**TIR SECTION 5**
**CONVEYANCE SYSTEM ANALYSIS AND DESIGN**

This section should present a detailed analysis of any existing conveyance systems, and the analysis and design of the proposed stormwater collection and conveyance system for the development. This information should be presented in a clear, concise manner that can be easily followed, checked, and verified. All pipes, culverts, catch basins, channels, swales, and other stormwater conveyance appurtenances must be clearly labeled and correspond directly to the engineering plans.

The minimum information included shall be pipe flow tables, flow profile computation tables, nomographs, charts, graphs, detail drawings, and other tabular or graphic aides used to design and confirm...
SECTION 2.3 PLANS REQUIRED FOR DRAINAGE REVIEW

Performance of the conveyance system
Verification of capacity and performance must be provided for each element of the conveyance system. The analysis must show design velocities and flows for all drainage facilities within the development, as well as those offsite, which are affected by the development. If the final design results are on a computer printout, a separate summary tabulation of conveyance system performance should also be provided.

☐ TIR SECTION 6
SPECIAL REPORTS AND STUDIES

Some site characteristics, such as creeks, closed depressions, lakes, wetlands, or Hazard Areas, pose unique road and drainage design problems that are particularly sensitive to stormwater runoff. As a result, Kent may require the preparation of special reports and studies to address further the site characteristics, the potential for impacts associated with the development, and the measures that would be implemented to mitigate impacts. Special reports shall be prepared by people with expertise in the particular area of analysis. Topics of special reports may include any of the following:

- Geotechnical/soils
- Wetlands
- Floodplains
- Slope protection/stability
- Groundwater
- Fluvial geomorphology
- Erosion and deposition
- Anadromous fisheries impacts
- Structural design
- Geology/Geologic Hazard Areas
- Hydrology
- Water quality
- Structural fill

☐ TIR SECTION 7
OTHER PERMITS

Construction of road and drainage facilities may require additional permits from other agencies for some projects. These additional permits may contain more restrictive drainage plan requirements. This section of the TIR should provide the titles of any other permits, the agencies requiring the other permits, and the permit requirements that affect the drainage plan. Examples of other permits are listed in Section 11.3.

☐ TIR SECTION 8
ESC ANALYSIS AND DESIGN

This section must include all hydrologic and hydraulic information used to analyze and design the erosion and sediment control (ESC) facilities, including final site stabilization measures. The TIR shall explain how proposed ESC measures comply with the Erosion and Sediment Control Standards (Appendix D of the King County Manual) and show compliance with the implementation requirements of Core Requirement #5, Section 12.5.

The following information must be included:

1. Provide sufficient information to justify the overall ESC plan and the choice of individual erosion control measures. At a minimum, there shall be a discussion of each measure specified in...
Section 125 and its applicability to the proposed project

2 Include all hydrologic and hydraulic information used to analyze and size the ESC facilities shown in the engineering plans. Describe the methodology, and attach any graphics or sketches used to size the facilities.

3 Identify areas with a particularly high susceptibility to erosion because of slopes or soils. Discuss any special measures taken to protect these areas as well as any special measures proposed to protect water resources on or near the site.

4 Identify any ESC recommendations in any of the special reports prepared for the project. If these recommendations are not included in the ESC plan, provide justification.

5 If proposing exceptions or modifications to the standards detailed in the Erosion and Sediment Control Standards (Appendix D of the King County Manual), clearly present the rationale. If proposing techniques or products different from those detailed in the ESC Standards, provide supporting documentation so the City can determine if the proposed alternatives provide similar protection.

TIR SECTION 9
BOND QUANTITIES, FACILITY SUMMARIES, AND DECLARATION OF COVENANT

Bond Quantities Worksheet

Each plan submittal requires a construction quantity summary to establish appropriate bond amounts. Using the Bond Quantities Worksheet (Contact the City of Kent Public Works Department), the design engineer shall separate existing right-of-way and erosion control quantities from other onsite improvements. In addition, the engineer shall total the amounts based on the unit prices listed on the form.

Drainage facilities for single-family residential building permits, which are normally not bonded, shall be constructed and approved prior to granting the certificate of occupancy.

Flow Control and Water Quality Facility Summary Sheet and Sketch

Following approval of the plans, a Flow Control and Water Quality Facility Summary Sheet and Sketch (see Reference 8-C) shall be submitted along with an 8½" x 11" plan sketch for each facility proposed for construction. The plan shall show a north arrow, the tract, the facility access road, the extent of the facility, and the control structure location. The approximate street address shall be noted.

Declaration of Covenant
(Privately Maintained Flow Control and WQ Facilities Only)

A declaration of covenant (see Reference 8-F) must be signed and recorded with the City of Kent before any permit with privately maintained flow control or water quality facilities is approved.

TIR SECTION 10
OPERATIONS AND MAINTENANCE MANUAL

For each flow control and water quality facility that is to be privately maintained, and for those that have special nonstandard features, the design engineer shall prepare an operations and maintenance manual. The manual should be simply written and should contain a brief description of the facility, what it does, and how it works. In addition, the manual shall include a copy of the Stormwater Facility Maintenance Guide (see Appendix D of the Kent Construction Standards) and provide an outline of maintenance tasks and the recommended frequency each task should be performed. This is especially important for water quality facilities where proper maintenance is critical to facility performance. For this reason, most of the water facility designs in Chapter 6 include “maintenance considerations” important to the performance of each facility.
2.3.1.2 SITE IMPROVEMENT PLAN

Site improvement plans shall portray design concepts in a clear and concise manner. The plans must present all the information necessary for persons trained in engineering to review the plans, as well as those persons skilled in construction work to build the project according to the design engineer's intent. Supporting documentation for the site improvement plans must also be presented in an orderly and concise format that can be systematically reviewed and understood by others.

The vertical datum on which all engineering plans, plats, binding site plans, and short plats are to be based must be NGVD, USGS and USC and GS 1947 (adjusted to the 1929 datum), and the datum must be tied to at least one City of Kent Survey Control Network benchmark. The benchmark(s) shall be shown or referenced on the plans. Datum correlations can be found in Table 4.4.2 C of the King County Manual.

Horizontal control for all plats, binding site plans, and short plats shall reference the North American Datum of 1927 as the coordinate base and basis of bearings. All horizontal control for these projects must be referenced to a minimum of two City of Kent Survey Horizontal Control monuments. If two horizontal control monuments do not exist within one mile of the project, an assumed or alternate coordinate base and basis of bearings may be used. Horizontal control monument and benchmark information is available from the Kent Public Works Department.

The site improvement plans consist of all the plans, profiles, details, notes, and specifications necessary to construct road, drainage structure, and off-street parking improvements. Site improvement plans include the following:

- A base map (described in Table 2.3.1 A), and
- Site plan and profiles (see Section 2.3.1.1)

Note: Site improvement plans must also include grading plans if onsite grading extends beyond the roadway.

Modified Site Improvement Plan

The Kent Public Works Department may allow a modified site improvement plan for some projects in Targeted Drainage Review (see Section 2.3.2) or where major improvements (e.g., detention facilities, conveyance systems, bridges, road right-of-way improvements, etc.) are not proposed. The modified site improvement plan must:

1. Be drawn on a 11" x 17" or larger sheet,
2. Accurately locate structure(s) and access, showing observance of the setback requirements given in this manual, or other applicable documents, and
3. Provide enough information (datum, topography, details, notes, etc.) to address issues as determined by the Kent Public Works Department.

☐ GENERAL PLAN FORMAT

Site improvement plans should use APWA Standard Map Symbols as appropriate, and must include Standard Plan Notes (see Appendix A of the Kent Construction Standards). Each plan must follow the general format detailed below:

1. Plan sheets and profile sheets, or combined plan and profile sheets, specifications, and detail sheets as required shall be on 22 inch by 34 inch sheets. Right-of-way improvements must be on 22 inch by 34 inch. Original sheets shall be archive quality reproducibles, mylar or equal.
2. Drafting details shall generally conform to APWA Standard Map Symbols with lettering size (before reduction) no smaller than Leroy 80 (Leroy 100 is preferred). Existing features shall be shown with dashed lines or as half-toned (screened) to clearly distinguish existing features from proposed improvements.
3 Each submittal shall contain a project information/cover sheet with the following
   a) Title  Project name and Kent Public Works Department file number
   b) Table of contents (if more than three pages)
   c) Vicinity map
   d) Name and phone number of utility field contacts (e.g., water, sanitary sewer, gas, power, telephone, and TV) and the One-Call number (1-800-424-5555)
   e) Kent's preconstruction/inspection notification requirements
   f) Name and phone number of the erosion control supervisor
   g) Name and phone number of the surveyor
   h) Name and phone number of the owner/agent
   i) Name and phone number of the applicant
   j) Legal description
   k) Plan approval signature block for the Kent Public Works Department
   l) Name and phone number of the engineering firm preparing the plans (company logos acceptable)
   m) Fire Marshal's approval stamp (if required)
   n) Statement that mailbox locations have been designated or approved by the U.S. Postal Service (where required)
   o) List of conditions of preliminary approval on all site improvements

4 An overall site plan shall be included if more than three plan sheets are used. The overall plan shall be indexed to the detail plan sheets and include the following
   a) The complete property area development
   b) Right-of-way information
   c) Street names and road classification
   d) All project phasing and proposed division boundaries
   e) All natural and proposed drainage collection and conveyance systems with catch basin numbers shown

5 Each sheet of the plan set shall be stamped, signed, and dated by a licensed civil engineer registered in the State of Washington. At least one sheet showing all boundary survey information must be provided and stamped by a professional land surveyor licensed in the State of Washington.

6 Detail sheets shall provide sufficient information to construct complex elements of the plan. Details may be provided on plan and profile sheets if space allows.

7 A title block shall be provided on each plan sheet. At a minimum, the title block shall list the following
   a) Development title
   b) Name, address, and phone number of the firm or individual preparing the plan
   c) A revision block
   d) Page (of pages) numbering
   e) Sheet title (e.g., road and drainage, grading, erosion and sediment control)
8. The location and label for each section or other detail shall be provided

9. Buffers and setbacks required for wetlands, streams, lakes, and hazard areas shall be designated as required by Kent City Code

10. All match lines with matched sheet number shall be provided

11. All division or phase lines and the proposed limits of construction under the permit application shall be indicated

12. Reference all identified wetlands (sequentially if more than one)

13. The standard plan notes that apply to the project shall be provided on the plans (see Appendix A of the Kent Construction Standards)

14. Commercial building permit applications shall include the designated zoning for all properties adjacent to the development site(s)

□ BASE MAP

A site improvement plan base map provides a common base and reference in the development and design of any project. A base map helps ensure that the engineering plans, grading plans, and ESC plans are all developed from the same background information. This base map shall include the information listed in Table 2.3.1A
# TABLE 2.3.1.A BASE MAP REQUIREMENTS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground Surface Topography</td>
<td>Provide topography within the site and extending beyond the property lines Contour lines must be shown as described in “Plan View Site Plan and Roadway Elements” (see Section 2.3.1.2)</td>
</tr>
<tr>
<td>Surface Water Discharge</td>
<td>Provide ground surface elevations for a reasonable “fan” around points of discharge extending at least 50 feet downstream of all point discharge outlets</td>
</tr>
<tr>
<td>Hydrologic Features</td>
<td>Provide spot elevations in addition to contour lines to aid in delineating the boundaries and depth of all existing floodplains, wetlands, channels, swales, streams, storm drainage systems, roads (low spots), closed depressions, springs, seeps, swales, ditches, pipes, groundwater, and seasonal standing water</td>
</tr>
<tr>
<td>Other Natural Features</td>
<td>Show the location and relative sizes of other natural features such as rock outcroppings, existing vegetation, and trees 12 inches in diameter and greater that could be disturbed by the project improvements and construction activities (within tree canopy), noting species</td>
</tr>
<tr>
<td>Flows</td>
<td>Provide arrows that indicate the direction of surface flow on all public and private property and for all existing conveyance systems</td>
</tr>
<tr>
<td>Floodplains/Floodways</td>
<td>Show the floodplain/floodways as depicted on City of Kent maps or otherwise required by the City of Kent</td>
</tr>
</tbody>
</table>
| General Background Information | Show the location and limits of all existing  
  • Property boundaries  
  • Structures  
  • Easements (including dimensions)  
  • Total property (including dimensions)  
  • Roads and right-of-way  
  • Sanitary sewers and water utilities  
  • Common open space  
  • Public dedications  
  • Other manmade features affecting existing topography/proposed improvements |
| Development Limitations      | Delineate limitations to the development that may occur as identified on the TIR worksheet, Part 8 (see Reference 8-A)                                                                                             |
SITE PLAN AND PROFILES

The design engineer shall provide plans and profiles for all construction, including but not limited to the following information:

Plan View: Site Plan and Roadway Elements

1. Provide property lines, right-of-way lines, and widths for proposed roads and intersecting roads.
2. Provide all existing and proposed roadway features, such as centerlines, edges of pavement and shoulders, ditches, curbs, and sidewalks. In addition, show points of access to abutting properties and roadway continuations.
3. Show existing and proposed topography contours at 2-foot intervals (5-foot intervals for slopes greater than 15 percent, 10-foot intervals for slopes greater than 40 percent). Contours may be extrapolated from USGS mapping, aerial photographs, or other topography map resources. However, contours shall be field verified for roadway and stream centerlines, steep slopes, and conveyance systems. Contours shall extend 50 feet beyond property lines to resolve questions of setback, cut and fill slopes, drainage swales, ditches, and access or drainage to adjacent properties.
4. Show the location of all existing utilities and proposed utilities (except those designed by the utility and not currently available) to the extent that these will be affected by the proposed project. Clearly identify all existing utility poles.
5. Identify all roads and adjoining subdivisions.
6. Show right-of-way for all proposed roadways, using sufficient dimensioning to clearly show exact locations on all sections of existing and proposed dedicated public roadway.
7. Clearly differentiate areas of existing pavement and areas of new pavement.
8. For subdivision projects, use drawing scales of 1"=50'. For commercial, multi-family, or other projects, use scales of 1"=20'. Show details for clarification, including those for intersections and existing driveways, on a larger scale.
9. Identify all section, township and range information for the project area.

Plan View: Drainage Conveyance

1. Sequentially number all catch basins and curb inlets starting with the structure farthest downstream.
2. Represent existing storm drainage facilities in dashed lines and label with “Existing.”
3. Clearly label existing storm drainage facilities to be removed with “Existing to be removed.”
4. Show the length, diameter, and material for all pipes, culverts, and stub-outs. Include the slope if not provided on the profile view. Material may be noted in the plan notes.
5. Clearly label catch basins as to size and type (or indicate in the plan notes).
6. Clearly label downspout and footing drain stub-out locations for those lots intending to connect to the storm drainage flow control system. Locate all stub-outs to allow gravity flow from the lowest corner of the lot to the connecting catch basin.
7. Show datum, benchmark locations, and elevations on each plan sheet.
8. Clearly label all stub-out locations for any future pipe connections.
9. Clearly show on the plans all drainage easements, tracts, access easements, Native Growth Retention Areas, Sensitive Area Tracts, Sensitive Area Setback Areas, and building setback lines. Show dimensions, type of restriction, and use.
10. Using arrows, indicate drainage direction of hydraulic conveyance systems.
Plan View: Other

1. Show the location, identification, and dimensions of all buildings, property lines, streets, alleys, and easements
2. Verify the condition of all public right-of-way and the rights to use them as proposed
3. Show the locations of structures on abutting properties within 50 feet of the proposed project site
4. Show the location of all proposed drainage facility fencing, together with a typical section view of each fencing type
5. Provide section details of all retaining walls and rockeries, including sections through critical portions of the rockeries or retaining walls
6. Show all existing and proposed buildings with projections and overhangs
7. Show the location of all wells on site and within 100 feet of the site. Note wells to be abandoned
8. Show structural BMPs required by the King County Stormwater Pollution Control Manual and any subsequent revisions

Profiles: Roadway and Drainage

1. Provide existing centerline ground profile at 50-foot stations and at significant ground breaks and topographic features, with average accuracy to within 0.1 feet on unpaved surface and 0.02 feet on paved surface
2. For publicly maintained roadways, provide final road and storm drain profile with the same stationing as the horizontal plan, reading from left to right, to show stationing of points of curve, tangent, and intersection of vertical curves, with elevation of 0.01 feet. Include tie-in with intersecting pipe runs
3. On a grid of numbered lines, provide a continuous plot of vertical positioning against horizontal
4. Show finished road grade and vertical curve data (road data measured at centerline or edge of pavement). Include stopping sight distance
5. Show all roadway drainage, including drainage facilities, that are within the right-of-way or easement
6. On the profile, show slope, length, size, and type (in plan notes or on a detail sheet) for all pipes and detention tanks in public right-of-way
7. Indicate the inverts of all pipes and culverts and the elevations of catch basin grates or lids. It is also desirable, but not required, to show invert elevations and grate elevations on plan sheets
8. For pipes that are proposed to be within 20 feet of finished grade, indicate the minimum cover dimensions
9. Indicate roadway stationing and offset for all catch basins
10. Indicate vertical and horizontal scale
11. Clearly label all profiles with respective street names and plan sheet reference numbers, and indicate all profile sheet reference numbers on plan sheets, if drawn on separate sheets
12. Locate match points with existing pavements, and show elevations
13. Show all property boundaries
14. Label all match line locations
15. Provide profiles for all 12-inch and larger pipes and for channels (that are not roadside ditches)
16. Show the location of all existing and proposed (if available or critical for clearance) gas, water, and sanitary sewer crossings
17. Show energy dissipater locations
SECTION 2.3 PLANS REQUIRED FOR DRAINAGE REVIEW

18 Identify datum used and all benchmarks (may be shown on plan view instead). Datum and benchmarks must refer to established control when available.

19 Use a vertical scale of 1"=5'. As an exception, vertical scale shall be 1"=10' if the optional 1"=100' horizontal scale is used on projects with lots one acre or larger. Clarifying details, including those for intersections and existing driveways, should use a larger scale.

20 Split sheets, with the profile aligned underneath the plan view, are preferred but not required.

DETAILS

The design engineer shall provide details for all construction, including but not limited to the following.

Flow Control, Water Quality, and Infiltration Facility Details

1. Provide a scaled drawing of each detention pond or vault and water quality facility, including the tract boundaries.

2. Show predeveloped and finished grade contours at 2-foot intervals. Show and label maximum design water elevation.

3. Dimension all berm widths.

4. Show and label at least two cross sections through a pond or water quality facility. One cross section must include the restrictor.

5. Specify soils and compaction requirements for pond construction.

6. Show the location and detail of emergency overflows, spillways, and bypasses.

7. Specify rock protection/energy dissipation requirements and details.

8. Provide invert of all pipes, grates, inlets, tanks, and vaults, and spot elevations of the pond bottom.

9. Show the location of access roads to control manholes and pond/forebay bottoms.

10. Provide plan and section views of all energy dissipaters, including rock splash pads. Specify the size of rock and thickness.

11. Show bollard locations on plans. Typically, bollards are located at the entrance to drainage facility access roads.

12. On the pond or water quality facility detail, show the size, type (or in plan notes), slope, and length of all pipes.

13. Show to scale the section and plan view of restrictor and control structures. The plan view must show the location and orientation of all inlet pipes, outlet pipes, and flow restrictors.

14. Draw details at one of the following scales: 1"=1', 1"=2', 1"=4', 1"=5', 1"=10', or 1"=20'. Select a scale that clearly shows required information.

Structural Plan Details

Any submittal that proposes a structure (e.g., bridge crossing, reinforced concrete footings, walls, or vaults) shall include plan sheets that include complete working drawings showing dimensions, steel placement, and specifications for construction. Structures may require a design prepared and stamped by a professional structural engineer licensed in the State of Washington, and an application for a separate commercial building permit.
2.3.1.3 EROSION AND SEDIMENT CONTROL (ESC) PLAN

This section details the specifications and contents for ESC plans. Note that the ESC plan may be simplified by the use of the symbols and codes provided for each ESC measure in the *Erosion and Sediment Control Standards* (detached Appendix D of the King County Manual). In general, the ESC plan shall be submitted as a separate plan sheet(s). However, there may be some relatively simple projects where providing separate grading and ESC plans is unnecessary.

**General Specifications**

The site improvement plan shall be used as the base of the ESC plan. Certain detailed information that is not relevant (e.g., pipe/catch basin size, stub-out locations, etc.) may be omitted to make the ESC plan easier to read. At a minimum, the ESC plan shall include all of the information required for the base map (see Table 2 3 1 A), as well as existing and proposed roads, driveways, parking areas, buildings, drainage facilities, utility corridors not associated with roadways, all streams, lakes, wetlands, closed depressions, Hazard Areas and associated buffers, and proposed final topography. A smaller scale may be used to provide better comprehension and understanding.

The ESC plan shall generally be designed for proposed topography, not existing topography, since rough grading is usually the first step in site disturbance. The ESC plan shall address all phases of construction (e.g., clearing, grading, installation of utilities, surfacing, and final stabilization). If construction is being phased, separate ESC plans may need to be prepared to address the specific needs for each construction phase.

The ESC plan shall be consistent with the information provided in Section 8 of the TIR and shall show the following:

1. Identify areas with a high susceptibility to erosion
2. Provide all details necessary to clearly illustrate the intent of the ESC design
3. Include ESC measures for all on- and offsite utility construction included in the project
4. Specify the construction sequence. The construction sequence shall be specifically written for the proposed project. An example construction sequence is provided in Appendix D of the King County Manual.
5. Include *ESC Standard Plan Notes* (see Appendix A-9 of the Kent Construction Standards).

**Clearing Limits**

1. Delineate clearing limits
2. Provide details sufficient to install and maintain the clearing limits

**Cover Measures**

1. Specify the type and location of temporary cover measures to be used onsite
2. If more than one type of cover is to be used onsite, indicate the areas where the different measures will be used, including steep cut and fill slopes
3. If the type of cover measures to be used will vary depending on the time of year, soil type, gradient, or some other factor, specify the conditions that control the use of the different measures
4. Specify the nature and location of permanent cover measures. If a landscaping plan is prepared, this may not be necessary
5. Specify the approximate amount of cover measures necessary to cover all disturbed areas
6. If netting or blankets are specified, provide typical detail sufficient for installation and maintenance.
7 Specify the seed mixes, fertilizers, and soil amendments to be used, as well as the application rate for each item.

**Perimeter Protection**
1 Specify the location and type of perimeter protection to be used
2 Provide typical details sufficient to install and maintain the perimeter protection
3 If silt fence is to be used, specify the type of fabric to be used

**Traffic Area Stabilization**
1 Locate the construction entrance(s)
2 Provide typical details sufficient to install and maintain the construction entrance
3 Locate the construction roads and parking areas
4 Specify the measure(s) that will be used to create stabilized construction roads and parking areas
   Provide sufficient detail to install and maintain

**Sediment Retention**
1 Show the locations of all sediment ponds and traps
2 Dimension pond berm widths and all inside and outside pond slopes
3 Indicate the trap/pond storage required and the depth, length, and width dimensions
4 Provide typical section views through pond and outlet structures
5 Provide typical details of the control structure and dewatering mechanism
6 Detail stabilization techniques for outlet/inlet
7 Provide details sufficient to install cell dividers
8 Specify mulch or recommended cover of berms and slopes
9 Specify the 1-foot marker indicating when sediment removal is required
10 Indicate catch basins that are to be protected
11 Provide details of the catch basin protection sufficient to install and maintain

**Surface Water Control**
1 Locate all pipes, ditches, interceptor ditches, and swales that will be used to convey stormwater
2 Provide details sufficient to install and maintain all conveyances
3 Indicate locations of outlet protection, and provide detail of protections
4 Indicate locations and outlets of any possible dewatering systems
5 Indicate the location of any level spreaders, and provide details sufficient to install and maintain
6 Show all temporary pipe inverts
7 Provide location and specifications for the interception of runoff from disturbed areas and the conveyance of the runoff to a non-erosive discharge point
8 Provide location and details of rock check dams
9 Provide front and side sections of typical rock check dams

**Wet Season Requirements**
Provide a list of all applicable wet season requirements
SECTION 2.3 PLANS REQUIRED FOR DRAINAGE REVIEW

Sensitive Areas Restrictions
1. Specify the type, locations, and details of any measures necessary to comply with requirements to protect surface waters.
2. Specify the type, locations, and details of any measures necessary to comply with any additional protection required to protect Hazard Areas.

2.3.1.4 LANDSCAPE MANAGEMENT PLANS (IF APPLICABLE)

Approved landscape management plans are allowed to be used as an alternative to the requirement to formally treat (with a facility) the runoff from pollution-generating pervious surfaces subject to Core Requirement #8 (see Section 1.2.8). A landscape management plan is a Kent approved plan for defining the layout and long-term maintenance of landscaping features to minimize the use of pesticides and fertilizers, and reduce the discharge of suspended solids and other pollutants. General guidance for preparing landscape management plans is provided in Reference Section 4-A.

If a landscape management plan is proposed, it must be submitted with the engineering plans for the proposed project. The elements listed below are required for evaluation of landscape management plans:
1. Provide a site vicinity map with topography.
2. Provide a site plan with topography. Indicate areas with saturated soils or high water tables.
3. Provide a plant list (provide both common and scientific names) that includes the following information:
   a) Indicate any drought-tolerant plants, disease-resistant varieties, species for attracting beneficial insects (if any) and native plants.
   b) For shrubs and groundcovers, indicate the proposed spacing.
   c) For turf areas, indicate the grass mix or mixes planned. Indicate sun/shade tolerance, disease susceptibility, drought tolerance, and tolerance of wet soil conditions.
4. Provide a landscape plan. Indicate placement of landscape features, lawn areas, trees, and planting groups (forbs, herbs, groundcovers, etc.) on the site.
5. Include information on soil preparation and fertility requirements.
6. Provide information on the design of the irrigation method (installed sprinkler system, drip irrigation system, manual, etc.) on the site.
7. Provide a landscape maintenance plan, including the following:
   a) Physical care methods, such as thatch removal or aeration, and mowing height and frequency.
   b) Type of fertilizer (including N-P-K strength) and fertilization schedule or criteria.
   c) Type of chemicals to be used for common pests such as cranefly larvae, and the criteria or schedule for application.
   d) Any biocidal methods.
8. Provide information about the storage of pesticides or other chemicals, and disposal measures that will be used:
   a) If applicable, indicate how the chemicals will be stored on the site between applications to prevent contact with stormwater or spills into the storm drainage system.
   b) Indicate how excess quantities of fertilizers or chemicals will be handled for individual applications.
9. Provide an implementation plan (see Reference Section 4-A for guidance on preparing the implementation plan)

2.3.2 PROJECTS IN TARGETED DRAINAGE REVIEW

This section outlines the specifications and contents of limited scope engineering plans allowed for projects in Targeted Drainage Review. Table 2.3.2.A specifies the minimum required elements of the targeted technical information report based on the type of permit or project, and on the three categories of project characteristics subject to Targeted Drainage Review per Section 1 1 2 2
### TABLE 2.3.2.A MINIMUM ENGINEERING PLAN ELEMENTS\(^{(1)}\) FOR PROJECTS IN TARGETED DRAINAGE REVIEW

<table>
<thead>
<tr>
<th>Type of Permit or Project</th>
<th>Drainage Review Type</th>
<th>Project Category 1(^{(2)})</th>
<th>Project Category 2(^{(2)})</th>
<th>Project Category 3(^{(2)})</th>
</tr>
</thead>
<tbody>
<tr>
<td>SINGLE-FAMILY RESIDENTIAL BUILDING PERMITS (SFRs)</td>
<td>Targeted Drainage Review ONLY</td>
<td>Projects that contain or are adjacent to floodplains, streams, lakes, wetlands or closed depressions OR projects within a Landslide Hazard Area, Landslide Hazard Drainage Area or Erosion Hazard Area</td>
<td>Projects in Targeted Drainage Review that propose to construct or modify a 12&quot; or larger pipe/ditch, or receive runoff from a 12&quot; or larger pipe/ditch</td>
<td>Redevelopment projects (as defined in 11) in Targeted Drainage Review that propose $100,000 or more of improvements to an existing high-use site</td>
</tr>
</tbody>
</table>
| SHORT PLATS & OTHER PROJECTS OR PERMITS | Targeted Drainage Review COMBINED WITH Small Site Drainage Review | • TIR Sections 1, 2, and 6 (minimum)  
• Small Site ESC Plan\(^{(3)}\)  
• Site Improvement Plan\(^{(5)}\) | • TIR Sections 1, 2, 3, 5, 6, 7, and 8 (minimum)  
• Small Site ESC Plan\(^{(3)}\)  
• ESC Plan\(^{(4)}\) for conveyance work  
• Site Improvement Plan\(^{(5)}\) | N/A |
| OTHER PROJECTS OR PERMITS | Targeted Drainage Review ONLY | • TIR Sections 1, 2, 6, and 8 (minimum)  
• ESC Plan\(^{(4)}\) for any site disturbance work  
• Site Improvement Plan\(^{(5)}\) | • TIR Sections 1, 2, 3, 5, 6, 7, and 8 (minimum)  
• ESC Plan\(^{(4)}\) for any site disturbance work  
• Site Improvement Plan\(^{(5)}\) | • TIR Sections 1, 2, 4, 8, and 10 (minimum)  
• ESC Plan\(^{(4)}\) for any site disturbance work  
• Site Improvement Plan\(^{(5)}\) |

**Notes**

1. The above plan elements are considered the recommended minimum for most development cases in Targeted Drainage Review. The Kent Public Works Department may add to these elements if deemed necessary for proper drainage review. Predesign meetings with the Kent Public Works Department are recommended to identify all required elements.

2. For more detailed descriptions of project categories, see Section 1122. If the proposed project has the characteristics of more than one category, the plan elements under each applicable category shall apply.

3. Small site ESC plans are an element of the small site drainage plan as explained in the Small Site Drainage Requirements booklet (detached Appendix C).

4. ESC plans shall meet the applicable specifications detailed in Section 231 3.

5. Site improvement plans shall meet the applicable specifications detailed in Section 231 2. The Kent Public Works Department may allow modified site improvement plans as described in Section 231 2.
2.4 PLANS REQUIRED AFTER DRAINAGE REVIEW

This section includes the specifications and contents required of those plans submitted at the end of the permit review process or after a permit has been issued.

2.4.1 PLAN CHANGES AFTER PERMIT ISSUANCE

If changes or revisions to the originally approved engineering plans require additional review, the revised plans shall be submitted to the Kent Public Works Department for approval prior to construction. The plan change submittals shall contain all of the following:

1. The appropriate Plan Change Order form(s)
2. One copy of the revised TIR or addendum
3. Three sets of the engineering plans
4. Other information needed for review

2.4.2 FINAL CORRECTED PLAN SUBMITTAL

During the course of construction, changes to the approved engineering plans are often required to address unforeseen field conditions or design improvements. Once construction is completed, it is the applicant’s responsibility to submit to the Kent Public Works Department a final corrected plan (“as-builts”), which is an engineering drawing that accurately represents the project as constructed. These corrected drawings must be professionally drafted revisions applied to the original approved plan and must include all changes made during the course of construction, the ESC plan, however, should not be included. The final corrected plan must be stamped, signed, and dated by a licensed civil engineer registered in the State of Washington. Specific requirements for “as-built” submittals are described in Appendix E of the Kent Construction Standards.

Disposition of Approved Engineering Plans for Subdivisions

Upon engineering plan approval of any subdivision, the Kent Public Works Department will make a set of reproducible mylars (cost to be paid by the applicant) and return the original set to the applicant’s engineer. The Kent Public Works Department will retain this reproducible set, using it to make copies for public inspection, distribution, and base reference as required. At the time the development is accepted for maintenance by Kent, the Kent Public Works Department set of reproducibles shall be replaced by the corrected original set for permanent public records at the City of Kent.

2.4.3 FINAL PLAT, SHORT PLAT, AND BINDING SITE PLAN SUBMITTALS

Any subdivision to be finalized, thereby completing the subdivision process and legally forming new lots, requires a final submittal for approval and recording. Short plats also require a final submittal for approval and recording. Submittals shall be accompanied by appropriate fees as prescribed by ordinance. Final submittals will be allowed only after the approval of preliminary plans (for subdivisions only) and any required engineering plans, and after the construction of any required drainage facilities.

All final map sheets and pages shall be prepared by a professional land surveyor registered in the State of Washington and shall conform with all state and local statutes.

The final submittal for recording only applies to subdivisions (plats), and short plats. This plan is required by state and local statutes.
In addition to the requirements of the Kent Public Works Department, submittals for final recording of subdivisions, and short plats must include the following information:

1. Indicate dimensions of all easements, tracts, building setbacks, tops of slopes, wetland boundaries, and floodplains.

2. Include pertinent restrictions as they apply to easements, tracts, and building setback lines.

3. Include the dedication clause as provided in Reference Section 8-K accompanying Chapter 5 of the Kent Construction Standards.

4. State the maximum amount of added impervious surface and proposed clearing per lot as determined through engineering review. The maximum amount of impervious surface may be expressed in terms of percentage of lot coverage or square feet.

5. Specify roof downspout controls by lot based on the “Sizing Credits for Roof Downspout Controls” (see Section 1 2 3 2) as determined through engineering review and approval.

6. For a plat or short plat, record a note conditioning single-family residential permit approval on compliance with approved roof downspout controls (see notes in Section 5 1).
CHAPTER 3
HYDROLOGIC ANALYSIS AND DESIGN

KENT
WASHINGTON

CITY OF KENT
SURFACE WATER
DESIGN MANUAL
CHAPTER 3
HYDROLOGIC ANALYSIS AND DESIGN

The City of Kent has made no changes to Chapter 3 of the 1998 KCSWDM. Users should refer to the County document for guidance on hydrologic analysis and design.
CHAPTER 4
CONVEYANCE SYSTEM
ANALYSIS AND
DESIGN

CITY OF KENT
SURFACE WATER
DESIGN MANUAL
CHAPTER 4

CONVEYANCE SYSTEM ANALYSIS
AND DESIGN

The City of Kent has made several minor changes to Chapter 4 of the 1998 KCSWDM. Apart from these changes, the King County version of Chapter 4 applies to proposals in the City of Kent. The City’s changes to the County document are documented below:

1. Section 4.1 DESIGN CRITERIA, Easement and Setback Requirements (page 4-3 of the 1998 KCSWDM)—This section shall read as follows

   Permanent onsite Easements for access, maintenance, and construction are required for all public and private stormwater systems serving more than one property located outside of public right-of-way. When Easements are required, then legal descriptions for same shall be submitted with a professional land surveyors stamp thereon. Also at this time, a current title report covering the properties to be encumbered by the Easements shall accompany said description. Under no circumstances shall a Bill of Sale be placed on the City Council agenda for action until all Easements have been approved and recorded.

   When offsite Easements and/or onsite Easements for the extension of approved comprehensive stormwater plans are required, these shall be approved and recorded prior to holding any preconstruction meeting. Also the same conditions shall apply regarding legal descriptions and title reports.

   A. Easements

      The minimum easement widths are as follows:

      1. Storm drain pipelines (under 10 feet deep) – 15 feet wide
      2. Storm drain pipelines (10 -15 feet deep) – 20 feet wide. Note: large diameter or deeper sewers may require wider easements as determined necessary by the Director
      3. Access and/or maintenance roads are required to all retention/detention facilities, control manholes, and other drainage structures. The minimum roadway width shall be 12 feet. The road shall be paved with an all weather surface, and the pavement shall be designed to support a HS-20 loading maintenance vehicle.
      4. The Easements for detention facilities or other structures shall extend a minimum of 12 feet around the outside of the facility, and shall include access Easements as well.
B Right-of-way

Where possible, utility extensions shall be located within City Right-of-way. When possible storm drainage Retention/Detention facilities shall be located adjacent to City Right-of-way.

Work inside County and State Right-of-way requires use permits from the appropriate agencies. County and State Right-of-way Permits must be obtained by the developer/owner.

- Section 4.2.1.1 DESIGN CRITERIA, Acceptable Pipe Sizes (page 4-5 of the 1998 KCSWDM)—This section shall read, “The minimum diameter of storm drain approved for mainline conveyance systems, or for driveway culverts, shall be 12 inches. Minor laterals and connections to catch basins may be 8 inches in diameter if approved by the City. The minimum diameter acceptable for private systems shall be 8 inches excluding downspouts.”

- Section 4.2.1.1 DESIGN CRITERIA, Allowable Pipe Materials (page 4-5 of the 1998 KCSWDM)—This section shall read as follows:

The designer shall have the option of constructing storm sewers, drains, and culverts of the type of pipe listed below within the limits specified. It is not necessary that all pipe on the project be of the same type; however, all contiguous pipe shall be of the same type.

<table>
<thead>
<tr>
<th>Type of Pipe</th>
<th>Minimum Cover (ft) (from top of bell)</th>
<th>Public Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMP</td>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>PCP (Bell &amp; spigot Gasket joint)</td>
<td>2</td>
<td>Yes</td>
</tr>
<tr>
<td>RCP</td>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>HDPE</td>
<td>1.5</td>
<td>Private only</td>
</tr>
<tr>
<td>PVC SDR 35</td>
<td>3</td>
<td>Yes, except for culvert</td>
</tr>
<tr>
<td>PVC SDR 21</td>
<td>1.5</td>
<td>Yes, except for culvert</td>
</tr>
<tr>
<td>Ductile Iron</td>
<td>0.5</td>
<td>Yes</td>
</tr>
<tr>
<td>Ribbed PVC</td>
<td>2</td>
<td>Yes, except for culvert</td>
</tr>
</tbody>
</table>

NOTE These are minimum depths. Actual depths must meet design loading requirements. This includes maximum depths specified by the pipe manufacturer. Pipe cover in areas not subject to vehicular loads may be reduced to 1 inch minimum.

All materials used for construction of storm drainage systems and appurtenances shall be new and undamaged. All materials used shall be subject to inspection by the City prior to use. The contractor shall provide the City with shop drawings, manufacturer’s specifications, and certificates of materials as requested.

The materials referred to herein, shall conform to the applicable provisions of the Standard Specifications and the manufacturer’s recommended installation procedures.

1. Plain Concrete Storm Sewer Pipe (PCP)—All unreinforced concrete pipe shall be ASTM C1481 Class II or better with gasketed joints. The maximum diameter for unreinforced pipe shall be 12 inches.
2 Reinforced Concrete Pipe (RCP) – All reinforced concrete pipe shall be ASTM C76-85a Class IV or as specified

3 Corrugated Steel Pipe – All corrugated steel storm drain pipe shall be sixteen (16) gauge or thicker. Gaskets are required on all fittings and couplings. Couplings shall be Type F (See Standard State WSDOT Plan B-13b for coupler)

4 Protective Treatment – All steel pipe shall be coated with a protective asphalt treatment. The minimum acceptable protective treatment shall be APWA Treatment 1. Aluminum corrugated metal pipe may be substituted for Treatment 1 corrugated metal pipe. If smooth bore pipe is specified to improve hydraulic performance, the pipe shall be Treatment 5 for both annular and helical pipe. Aluminum pipe shall be painted with 2 coats of zinc chromate primer where it contacts concrete. Aluminum storm drain pipe may be used in place of corrugated steel pipe with equivalent structural strength.

5 Corrugation – All corrugated and steel storm drain pipe 15 inches in diameter and less shall have helical corrugations. Pipe larger than 15 inches in diameter can be either helical or annular.

6 Aluminum Pipe – Aluminum storm drain pipe may be used in place of corrugated steel pipe with equivalent structural strength.

7 PVC Pipe – PVC pipe conforming to ASTM 3034, SDR 35 and SDR 21 with rubber gasket joints may be used where adequate cover can be obtained. PVC pipe cannot be used for culvert pipes.

8 Ribbed PVC – PVC pipe conforming to ASTM F79H/UNI-B-9 with rubber gasket joints may be used where adequate cover can be obtained. Ribbed PVC pipe cannot be used for culvert pipes.

9 HDPE Pipe – HDPE pipe is approved only for private onsite drainage systems.

10 Ductile Iron Pipe – DI pipe shall be Class 50 in accordance with USA Standard A-21.1 (AWWA C-51). All joints shall be push-on mechanical or flanged.

- Section 4.2.1.1 DESIGN CRITERIA, Allowable Pipe Joints (page 4-6 of the 1998 KCSWDM) – Replace this section with the following:
  Rubber gaskets shall be used for all pipe joints except as described below. The rubber gaskets shall be factory manufactured for the particular type and brand of pipe used. Coupling bands and rubber gaskets are required for all steel or aluminum sewer pipe. Coupling bands for CMP shall be type “F” unless otherwise approved. The manufacturer recommendation shall be adhered to for HDPE pipe.

- Section 4.2.1.1 DESIGN CRITERIA, Pipe Alignment (page 4-7 of the 1998 KCSWDM) – Replace Requirement 1 with, “All storm drains smaller than 36 inches in diameter shall be designed with a straight alignment between manholes. The use of fabricated pipe bends for larger diameters requires approval by the City and shop manufactured fittings designed for the specific application.”

- Section 4.2.1.1 DESIGN CRITERIA, Structures (page 4-8 of the 1998 KCSWDM) – The following additional criteria shall apply to projects in the City of Kent:

  Storm Drainage Manholes:
  A Location – Storm drainage manholes or catch manholes for access are required at the following locations on the conveyance system:
  1 All changes in slope
  2 Changes in pipe diameter
3 Connections of storm pipes from manholes to the conveyance systems that are larger than 24 inches in diameter

The following exceptions may be connected to conveyance systems that are equal to a 48-inch-diameter pipe using an approved saddle branch

a Connections of storm pipes from catch manholes that are 24 inches and smaller in diameter

b Connections of storm pipes from catch basins that are 18 inches and smaller in diameter

4 Changes in alignment

5 Distances not greater than 400 feet on pipe runs

6 Dissimilar pipe materials

7 In a trunk line smaller than 12 inches, at every other catch basin but no greater than 400 feet

B Flow Channels – Where necessary to maintain the hydraulic grade line, channeled storm drain manholes shall be used. The manhole shall be fully channeled to the crown of the pipe to accomplish smooth flow and minimize turbulence at junctions. Catch or drop section manholes are permitted on the trunk system.

C Flow at Transition Manholes – To maintain the energy gradient and the velocity through grade changes and changes in diameter at manholes, the invert of the downstream pipe shall be lowered. A general method to achieve the required drop at manholes is to match crowns of the storm pipes. In cases where slopes are at a minimum, an alternate approach is to use the 0.8 rule. Where possible, a 0.1 foot drop in all manholes is desirable.

D Standard Manholes – The minimum diameter of manholes shall be 48 inches and shall be precast reinforced concrete structures. All manholes shall be equipped with safety steps. Larger diameter manholes are required for larger pipelines and special pipe configurations. The following table lists the minimum diameter of manholes for various runs of straight pipelines (See Standard Details 5-8(a), 5-8(b) and 5-9 in Appendix B of the Kent Construction Standards.)

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Manhole Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 inches – 21 inches</td>
<td>48 inches</td>
</tr>
<tr>
<td>24 inches – 36 inches</td>
<td>54 inches</td>
</tr>
<tr>
<td>36 inches – 42 inches</td>
<td>72 inches</td>
</tr>
<tr>
<td>42 inches – 60 inches</td>
<td>96 inches</td>
</tr>
</tbody>
</table>

Stormwater Inlets

Stormwater inlets, installed to intercept surface runoff, include catch basins, catch manholes, curb inlets, and headwall structures. Catch type inlets are required to trap or minimize silts, sediment, and debris from entering the main drainage systems. Curb type inlets without a drop section are permitted only where approved by the City.

A Catch Basin Locations for Street and Roadways – Catch basins or catch manholes shall be installed at these locations

1 At all street gutterline intersections in such a configuration as to minimize gutter flows through pedestrian crossings.
SECTION 4 CONVEYANCE SYSTEM ANALYSIS AND DESIGN

2 At locations along gutters so as to provide a maximum gutter flow of 200 feet for street grades up to 3%

3 Where Type II catch basms are used for access to the trunk storm sewer, the maximum spacing shall be 400 feet

4 At all low points of vertical curves and grade breaks

5 At the inlet of minor ditches to the drainage system

B The low point of vertical curves or roadway grades require catch basms with through curb inlet to minimize the potential for property damage. Cul-de-sacs located at the low end of roadway grades also require catch basms with through curb inlet. (See Standard Detail 5-2[a) and (b) in Appendix B of the Kent Construction Standards)

C In all cases, the location, size, and number of catch basms to be installed shall be sufficient to ensure that there is adequate capacity to efficiently collect the stormwater.

D Catch Basin Locations for Private Developments - Catch basms or catch manholes are required at these locations for private developments:

1 At the junction of private storm drainage systems with City drainage systems

2 At adequate locations throughout the development to provide efficient drainage of paved areas and to ensure that surface water runoff to adjacent City streets and private property is minimized

3 At locations as required to intercept natural drainage entering the site.

Castings

A Manhole frames and covers shall be cast gray iron or ductile iron. All manhole covers located outside the street shall have locking lids. (See Standard Details 4-5, 4-6[a] and 4-6[b] in Appendix B of the Kent Construction Standards)

B Public catch basin frame and grates shall be ductile iron and bolt down. (See Standard Details 5-1[a] and 5-1[b] in Appendix B of the Kent Construction Standards)

C Public catch basms used in areas not designed to receive surface drainage or where required by the Director shall have ductile iron bolt down frame with solid lid. (See Standard Detail 5-1[b] and 5-1[c] in Appendix B of the Kent Construction Standards)

D Public catch basms used in low point of vertical curves or roadway grades and at the low end of roadway grades in cul-de-sacs shall have through curb inlet frame and self-locking vaned grate. (See Standard Detail 5-1[d], 5-2[a] and 5-2[b] in Appendix B of the Kent Construction Standards)

E Public catch basms used in steep roadway grades of 6% and greater shall have ductile iron self-locking vaned grate with vaned grate frame. (See Standard Detail 5-1[d] and 5-1[e] in Appendix B of the Kent Construction Standards)

F Public catch basms used in rolled curb and gutter shall have rolled curb frame and grate. (See Standard Details 5-1[f] and 5-1[g] in Appendix B of the Kent Construction Standards)

G Block lettering is required on the top surfaces of storm drain castings, and shall read as follows:

"NO DUMPING! DRAINS TO STREAMS!"

Manhole and Catch Basin Adapters

A All aluminum surfaces in contact with the concrete or concrete pipe shall be painted with 2 coats of zinc chromate primer. The aluminum pipe to be painted shall be cleaned with solvent to remove contaminants. After cleaning, the pipe shall be painted with 2 coats of paint conforming to Federal Specification TT-P-645 (Primer, Paint, Zinc Chromate, Alkyd Vehicle)
B PVC pipe adapters shall be Kor-m-seal type flex joints or sand collars meeting ASTM D-303H-78 SDR35 specifications or other materials as approved by the Director to permit slight differential movement.

C Ribbed PVC adapters shall be Ribbed PVC sand collars meeting ASTM D-303H-78 SDR35 specifications. Where the pipe enters square to the manhole or catch basin, double gaskets may be used. The gaskets must fall within a 1-inch tolerance of the inside and outside face of the wall of the structure.

D All pipe materials other than the above shall be mudded directly into the manholes and catch basins using a smooth 45 degree bevel from the pipe to the structure. The allowable protrusion is 2 inches inside the structure unless otherwise approved by the Director.

Pipe Bedding

Pipe bedding for storm drain and culvert pipe shall be 5/8-inch minus crushed rock. (Pea gravel is not allowed.) A continuous and uniform bedding shall be provided in the trench for all buried pipe. Bedding material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe to 95% compaction ASTM D-1557, in accordance with the standard specifications and details and in conformance with the following gradation.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 Inch</td>
<td>100%</td>
</tr>
<tr>
<td>5/8 Inch</td>
<td>95 - 100%</td>
</tr>
<tr>
<td>1/4 Inch</td>
<td>45 - 65%</td>
</tr>
<tr>
<td>U.S. No. 40</td>
<td>6 - 18</td>
</tr>
<tr>
<td>U.S. No. 200</td>
<td>7.5 Max.</td>
</tr>
<tr>
<td>% Fracture</td>
<td>75 Min.</td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>40 Min.</td>
</tr>
</tbody>
</table>

L A wear 500 rev 35% Max, Degradation 25% min. Free from wood waste, bark, and other deleterious material.

Bedding shall be placed 6 inches under or around the pipe and 6 inches over the pipe where, in the opinion of the Director, existing material is found unsuitable. The pipe shall be protected from damage when compaction. At least 2 feet of cover is required over the pipe prior to using heavy compaction equipment.

Where determined necessary by the Director, ballast material shall be used below bedding to stabilize the trench. Ballast shall conform to the requirements of Foundation Material in Section 3 8 2 of the City of Kent Construction Standards.

Backfill

Pipe trench backfill shall be in accordance with Section 4 7 6 of the City of Kent Construction Standards unless otherwise approved by the Director.

Cleaning

All storm drain pipe including the downstream system shall be thoroughly cleaned to remove any solids or construction debris that may have entered the pipe system during construction.

The Contractor shall be responsible to ensure that materials flushed from the storm drain are trapped, removed, and do not enter the downstream drainage system.
Storm Drain Stenciling

The pavement adjacent to all new catch basins shall be stencil painted with a standard pollution prevention stencil such as the thermoplastic example below. The Contractor is responsible for purchase and installation of the stencils.

Reparis

All storm drain system installations shall be new and undamaged. Repairs by grouting or collars are not acceptable for new piping systems. The contractor shall bear all costs for correction of deficiencies.

Television Inspection

All new City storm drain extensions, 24 inches in diameter and smaller shall be TV camera inspected by the City of Kent Utility Department prior to acceptance. All construction must be completed and approved by the inspector prior to the TV inspection. The manholes and catch basins must be set to grade, channeled, and grade rings set in place prior to TV inspection. Castings and the top grade ring must be removed for paving and grouted in place after paving.

It is the responsibility of the contractor to string each storm main when required prior to the inspection. The string shall be a nylon cord of sufficient strength for the City equipment.

- **Section 4.2.1.1 DESIGN CRITERIA, Pipe Design Between Structures (page 4-9 of the 1998 KCSWDM)—Add the following to the list of requirements:**
  
  4 Storm sewers with design velocities greater than 10 fps shall be designed with energy dissipation structures as deemed necessary by the City. Pipes installed at slope greater than 20% require pipe anchors.

- **Section 4.2.1.1 DESIGN CRITERIA, Spill Control (page 4-10 of the 1998 KCSWDM)—Delete Item d “An active spill control plan.” This is not an acceptable option for spill control in the City of Kent.

- **Section 4.2.2.1 DESIGN CRITERIA, General (page 4-27 of the 1998 KCSWDM)—Add the following to the list of requirements:**

  5 Points of discharge from culverts and storm sewers into ditches and swales 15% or greater in grade shall require the design and installation of special energy dissipators.

- **Section 4.3.1.1 DESIGN CRITERIA, General (page 4-35 of the 1998 KCSWDM)—Add the following to the list of requirements**
3 The minimum diameter of culvert for roadside ditches or other installations shall be twelve (12) inches in diameter. Larger diameter culverts shall be installed where required by appropriate hydraulic analysis.

- Section 4.3.1.1 DESIGN CRITERIA, Headwater (page 4-35 of the 1998 KCSWDM)—Requirement 3 has been revised to read “The maximum headwater elevation at design flow shall be at least 12 inches below finished grade.”

- Section 4.3.1.1 DESIGN CRITERIA, Inlets and Outlets (page 4-36 of the 1998 KCSWDM)—Requirement 4 is revised to apply to all pipe larger than 12 inches. Requirement 5 shall apply to all new culverts unless deemed unnecessary by the City.

- Table 4.4.2 Datum Correlations to KCAS (page 4-75 of the 1998 KCSWDM)—The Kent datum is NGVD, USGS and USC and GS 1947 (adjusted to the 1929 datum).
CHAPTER 5
FLOW CONTROL DESIGN

CITY OF KENT
SURFACE WATER
DESIGN MANUAL
CHAPTER 5
FLOW CONTROL DESIGN

The City of Kent has made one minor change to Chapter 5 of the 1998 KCSWDM. Apart from this change, the King County version of Chapter 5 applies for proposals in the City of Kent. The City's change to the County document is as follows:

- **Section 5.3 DETENTION FACILITIES, Detention Ponds, Design Criteria, General (page 5-20 of the 1998 KCSWDM)**—The following items are added to this section:
  1. All retention/detention ponds shall have a minimum of one (1) foot freeboard above the maximum design water surface elevation.
  2. Outlets of all detention ponds shall be provided with suitable debris barriers designed to protect the outlet from blockage or plugging.
  3. The site and grading plans for open ponds shall clearly denote all elevations, dimensions, cross-sectional views (a minimum of one through each direction), soil preparation requirements, and other information necessary to construct the system as designed. The design plans shall also denote that the design engineer shall verify the pond volume and construction prior to landscaping.
  4. All ponds shall provide for the energy reduction of incoming flows.

- **Section 5.3 DETENTION FACILITIES, Detention Ponds, Design Criteria, Side Slopes (page 5-20 of the 1998 KCSWDM)**—This section is replaced with the following:
  1. Side slopes for earth-lined ponds shall not exceed three (3) feet horizontal to one (1) foot vertical unless specifically approved by the Director.
  2. Ponds constructed with rock walls or retaining walls shall be designed by a licensed structural or civil engineer registered in the State of Washington. Walls shall not exceed 6' in height.
  3. All ponds shall include at least two (2) sloped surfaces with one (1) accessible for maintenance equipment at a maximum 6:1 slope.

- **Section 5.3 DETENTION FACILITIES, Detention Ponds, Design Criteria, Embankments (page 5-20 of the 1998 KCSWDM)**—Requirements 1 and 2 have been revised according to the following, and item 7 has been added:
  1. Any embankment for a pond in excess of four (4) feet must be designed by a licensed civil engineer and approved by the City.
  2. The top width of the bench shall be fifteen (15) feet, unless otherwise approved.
7 A licensed civil engineer experienced in soil mechanics shall inspect and certify the construction of the berm

- **Section 5.3.1 DETENTION PONDS, Fencing (page 5-22 of the 1998 KCSWDM)**—Requirement 4 has been revised according to the following

  4 An access gate for access roads is required and shall be structurally and aesthetically acceptable for the use and location proposed. An acceptable alternative to control traffic shall be removable posts spaced at a maximum four (4) foot center in lieu of an access gate where fencing is not required, said posts shall be locked into position. Locks shall be keyed to City of Kent Specifications. (See Standard Detail 5-12(b) for access gates, 6-15(a), (b), (c), (d) and 6-16 for Bollards in Appendix “B”)

- **Section 5.3.1 DETENTION PONDS, Right-of-Way (page 5-23 of the 1998 KCSWDM)**—

  Requirements 2 has been revised according to the following, and item 3 has been added

  2 All storm water retention/detention systems and outlet control structures that service more than one legally defined property are required to be located within a recorded storm drainage easement. In some cases, the City may approve locating detention piping within the street right-of-way. If the detention facilities are not located adjacent to the roadway, a twelve (12) foot wide, all-weather surfaced access road shall be constructed to the facility. This access road shall be located within an easement and shall provide for unobstructed ingress and egress to the facility.

  3 A written restriction shall be added to the final plat drawing that “Prior approval must be obtained from the Department of Public Works before any structures fill or obstructions, including fences, are located within any drainage easement or delineated flood plain area.”

- **Section 5.3.2 DETENTION TANKS, Materials (page 5-33 of the 1998 KCSWDM)**—The following is added to this section

  Corrugated steel storage pipes shall be uniformly coated with APWA Treatment 1 asphalt or better. Corrugated aluminum or concrete pipe may be substituted without asphalt treatment. Aluminum shall be painted with two (2) coats of zinc chromate primer where it contacts concrete.

  The City of Kent Fire Department shall be consulted during design of any underground facilities to ensure that outrigger placement (pointload) requirements are met.

- **Section 5.3.3 DETENTION VAULTS, Structural Stability (page 5-37 of the 1998 KCSWDM)**—

  The following is added to this section

  The concrete structures shall be designed by a civil or structural engineer registered in the State of Washington, and be designed for at least HS-20 traffic loading conditions. Concrete vaults shall be designed in accordance with King County Surface Water Management Standard Details for detention vaults. A City building permit is required for vault structures.

  The City of Kent Fire Department shall be consulted during design of any underground facilities to ensure that outrigger placement (pointload) requirements are met.

- **Section 5.3.5 OTHER DETENTION OPTIONS, Use of Parking Lots for Additional Detention (page 5-51 of the 1998 KCSWDM)**—Replace this section with the following

  1 Maximum depth for surface storage in parking lots shall be as follows
a Commercial/multi-family parking and maneuvering areas – six (6) inches
b Industrial truck loading/maneuvering areas – eighteen (18) inches

2 Parking lots designed for detention shall not exceed slopes of 7% in areas of vehicular, parking or maneuvering

3 All parking lot ponds shall be designed and constructed in such a manner so as to provide 0.50 feet of free board between the maximum water surface elevation and adjacent driveways, landscaping or adjacent properties

4 The maximum water surface elevation of any parking lot pond shall be a minimum of six (6) inches below the finished floor elevation of adjacent buildings. All ponding systems shall be designed to go to overflow conveyance prior to flooding structures.

5 Where parking lot ponding is to be utilized, the site grading and paving plans shall clearly denote all critical elevations, ponding, dimensions and any other necessary information to construct the detention pond as designed. The design plan shall indicate that the respective details are critical for the storm drainage detention system operation and that the site grading must be verified.

- Section 5.3.5 OTHER DETENTION OPTIONS, Use of Roofs for Detention (page 5-51 of the 1998 KC SWDM)—Add the following items

6 The maximum allowable depth of any rooftop detention facility shall be three (3) inches

7 All rooftop detention facilities shall be provided with overflow scupper drums at the maximum water surface elevation

8 Rooftop detention rings shall be installed in accordance with the manufacturer’s specifications and shall be designed to restrict rooftop runoff rates not to exceed two (2) gallons per minute per 1000 sq feet of roof areas
CHAPTER 6
WATER QUALITY DESIGN

CITY OF KENT
SURFACE WATER DESIGN MANUAL
The City of Kent has made two changes to Chapter 6 of the 1998 KCSWDM. Apart from this change, the King County version of Chapter 6 applies for proposals in the City of Kent. The City’s change to the County document is as follows:

- **Section 6.1.3 RESOURCE STREAM PROTECTION MENU (page 6-10 of the 1998 KCSWDM)**—Add the following

  Experimental and proprietary BMPs may be allowed to provide pretreatment for filter BMPs or as the second WQ facility in the Two-Facility Treatment Option. Applications will be reviewed on a case-by-case basis. For an experimental or proprietary BMP to be approved, evidence must be provided that the BMP is capable of removing dissolved metals from stormwater, and the designer should show in the computations that the treatment train is capable of meeting the water quality standards for Class “A” waters. Because performance data is typically limited on these devices, if they are approved for an installation the City may require the implementation of a monitoring plan to assess the BMP performance.

- **Section 6.2 GENERAL REQUIREMENTS FOR WQ FACILITIES, SETBACKS, SLOPES, AND EMBANKMENTS, SIDE SLOPES, FENCING, AND EMBANKMENTS (page 6-20 of the 1998 KCSWDM)**—Add the following to the list of requirements: “Any above-ground stormwater facility will be screened from public right of way and adjacent property per the underlying zoning perimeter buffer requirements in the Kent City Code.”
# Maintenance Requirements for Privately Maintained Drainage Facilities

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# APPENDIX “D”

**MAINTENANCE REQUIREMENTS FOR PRIVATELY MAINTAINED DRAINAGE FACILITIES**

## NO. 1 - PONDS CONSTRUCTED WETLANDS

<table>
<thead>
<tr>
<th>Maintenance Components</th>
<th>Defect</th>
<th>Condition When Maintenance Is Needed</th>
<th>Maintenance Activity or Results After Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Trash &amp; Debris</td>
<td>Any trash and debris which exceeds 1 cubic foot per 1000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can) In general, there should be no visual evidence of dumping</td>
<td>Trash and debris cleared from site</td>
</tr>
<tr>
<td>Poisonous Vegetation</td>
<td></td>
<td>Any poisonous vegetation which may constitute a hazard to City personnel or the public. Examples of poisonous vegetation include tansy ragwort, poison oak, stinging nettles, devils club</td>
<td>No danger of poisonous vegetation where City personnel or the public might normally be exposed to the contaminants (Coordination with Seattle/King County Health Department)</td>
</tr>
<tr>
<td>Pollution</td>
<td></td>
<td>Oil, gasoline, or other contaminants in the area at levels that could 1) cause damage to plant, animal, or marine life, 2) constitute a fire hazard, or 3) be flushed downstream during rain storms</td>
<td>No contaminants present other than a surface film</td>
</tr>
<tr>
<td>Unmowed Grass/Ground Cover</td>
<td>It facility is located in private residential area, mowing is needed when grass exceeds 18 inches in height. In other areas, the general policy is to make the pond site match adjacent ground cover and terrain as long as there is no interference with the function of the facility</td>
<td>When mowing is needed, grass/ground cover should be mowed to 2 inches in height</td>
<td></td>
</tr>
<tr>
<td>Rodent Holes</td>
<td></td>
<td>Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes</td>
<td>Rodents destroyed and dam or berm repaired. (Coordination with Seattle/King County Health Department)</td>
</tr>
<tr>
<td>Insects</td>
<td></td>
<td>When insects such as wasps and hornets interfere with maintenance activities</td>
<td>Insects destroyed or removed from site</td>
</tr>
<tr>
<td>Tree Growth</td>
<td></td>
<td>Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring or equipment movements) If trees are not interfering with access, leave trees alone</td>
<td>Trees do not hinder maintenance activities. Selectively cultivate trees such as alders for firewood</td>
</tr>
</tbody>
</table>
## MAINTENANCE REQUIREMENTS FOR PRIVATELY MAINTAINED DRAINAGE FACILITIES

**NO. 1 - PONDS CONSTRUCTED WETLANDS CON'T**

<table>
<thead>
<tr>
<th>Maintenance Components</th>
<th>Defects</th>
<th>Condition When Maintenance Is Needed</th>
<th>Maintenance Activity or Results After Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side Slopes of Pond</td>
<td>Erosion</td>
<td>Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion</td>
<td>Slopes should be stabilized by using appropriate erosion control measure(s) e.g., rock reinforcement, planting of grass, compaction</td>
</tr>
<tr>
<td>Storage Area</td>
<td>Sediment</td>
<td>Accumulated sediment that exceeds 10% of the designed pond depth</td>
<td>Sediment cleaned out to designed pond elevation is reseeded if necessary to control erosion</td>
</tr>
<tr>
<td>Storage or treatment area</td>
<td>Bare area</td>
<td>Bare areas greater than one square foot are to be resodded or seeded using grass specifications in construction</td>
<td>Complete grass covered bottom to avoid erosion and to enhance pollutant removal</td>
</tr>
<tr>
<td></td>
<td>Vegetation gaps, or channelized flow</td>
<td>In constructed wetlands, significant open areas in the area of emergent vegetation</td>
<td>Replace with new stock</td>
</tr>
<tr>
<td>Pond Dikes</td>
<td>Settlements</td>
<td>Any part of dike which has settled 4 inches lower than the design elevation</td>
<td>Dike should be built back to the design elevation</td>
</tr>
<tr>
<td>Emergency Overflow/Spillway</td>
<td>Rock Missing</td>
<td>Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil</td>
<td>Replace rocks to design standards</td>
</tr>
<tr>
<td>Rock Filter</td>
<td>Plugging</td>
<td>When during storm, height of water on upstream face is 25% or more higher than the height of water on the downstream face</td>
<td>Replace rock media</td>
</tr>
</tbody>
</table>
# MAINTENANCE REQUIREMENTS FOR
PRIVATELY MAINTAINED DRAINAGE FACILITIES

## NO. 2 - INFILTRATION

<table>
<thead>
<tr>
<th>Maintenance Components</th>
<th>Defect</th>
<th>Condition When Maintenance Is Needed</th>
<th>Maintenance Activity or Results After Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Trash &amp; Debris</td>
<td>See &quot;Ponds&quot; Standard No 1</td>
<td>See &quot;Ponds&quot; Standard No 1</td>
</tr>
<tr>
<td></td>
<td>Poisonous Vegetation</td>
<td>See &quot;Ponds&quot; Standard No 1</td>
<td>See &quot;Ponds&quot; Standard No 1</td>
</tr>
<tr>
<td></td>
<td>Pollution</td>
<td>See &quot;Ponds&quot; Standard No 1</td>
<td>See &quot;Ponds&quot; Standard No 1</td>
</tr>
<tr>
<td></td>
<td>Unmowed Grass/Ground Cover</td>
<td>See &quot;Ponds&quot; Standard No 1</td>
<td>See &quot;Ponds&quot; Standard No 1</td>
</tr>
<tr>
<td></td>
<td>Rodent Holes</td>
<td>See &quot;Ponds&quot; Standard No 1</td>
<td>See &quot;Ponds&quot; Standard No 1</td>
</tr>
<tr>
<td></td>
<td>Insects</td>
<td>See &quot;Ponds&quot; Standard No 1</td>
<td>See &quot;Ponds&quot; Standard No 1</td>
</tr>
<tr>
<td>Storage Area</td>
<td>Sediment</td>
<td>A percolation test pit or test of facility indicates facility is only working at 90% its designed capabilities</td>
<td>Sediment is removed and/or facility is cleaned so that infiltration system works according to design</td>
</tr>
<tr>
<td></td>
<td>Sheet Cover (If Applicable)</td>
<td>Sheet cover is visible and has more than ¼ - inch hole in it</td>
<td>Sheet cover repaired or replaced</td>
</tr>
<tr>
<td></td>
<td>Sump filled with</td>
<td>Any sediment and debris filling vault to 10% of depth from sump bottom to bottom of outlet pipe or obstructing flow into connector pipe</td>
<td>Clean out sump to design depth</td>
</tr>
<tr>
<td></td>
<td>Sediment and Debris</td>
<td>(If Applicable)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Filter Bags</td>
<td>Filled with Sediment and Debris than ½ full</td>
<td>Replace filter bag or redesign system</td>
</tr>
<tr>
<td></td>
<td>Standing Water</td>
<td>When water is observed in the monitoring well more than 72 hours after a storm</td>
<td>Remove rock, and determine cause of slow infiltration rate remove and replace soil underneath the trench</td>
</tr>
</tbody>
</table>
# MAINTENANCE REQUIREMENTS FOR PRIVATELY MAINTAINED DRAINAGE FACILITIES

## NO. 3 – CLOSED DETENTION AND TREATMENT SYSTEMS (PIPES/TANKS)

<table>
<thead>
<tr>
<th>Maintenance Components</th>
<th>Defect</th>
<th>Condition When Maintenance Is Needed</th>
<th>Maintenance Activity or Results After Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Area</td>
<td>Plugged Air Vents</td>
<td>One-half of the cross section of a vent is blocked at any point with debris and sediment</td>
<td>Vents free of debris and sediment</td>
</tr>
<tr>
<td></td>
<td>Debris and Sediment</td>
<td>Accumulated sediment depth exceeds 10% of the diameter of the storage area for ½ length of storage vault or any point depth exceeds 15% of diameter. Example - 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than ½ length of tank.</td>
<td>All sediment and debris removed from storage area</td>
</tr>
<tr>
<td>Joints Between Tank/Pipe Section</td>
<td>Any crack allowing material to be transported into facility</td>
<td>Tank/pipe repaired or replaced to design</td>
<td></td>
</tr>
<tr>
<td>Manhole</td>
<td>Cover Not in Place</td>
<td>Cover is missing or only partially in place. Any open manhole requires maintenance.</td>
<td>Manhole is closed</td>
</tr>
<tr>
<td></td>
<td>Locking Mechanism Not Working</td>
<td>Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than ¼ inch of thread (may not apply to self-locking lids).</td>
<td>Mechanism opens with proper tools</td>
</tr>
<tr>
<td></td>
<td>Cover Difficult to Remove</td>
<td>One maintenance person cannot remove lid after applying 80 pounds of lift. Intent is to keep cover from sealing off access to maintenance.</td>
<td>Cover can be removed and reinstalled by one maintenance person</td>
</tr>
<tr>
<td></td>
<td>Ladder Rungs Unsafe</td>
<td>Ladder is unsafe due to missing rungs, misalignment, rust or cracks</td>
<td>Ladder meets design standards and allows maintenance persons safe access</td>
</tr>
<tr>
<td>Catch Basins</td>
<td></td>
<td>See “Catch Basins” Standard No 5</td>
<td>See “Catch Basins” Standard No 5</td>
</tr>
</tbody>
</table>
## MAINTENANCE REQUIREMENTS FOR
PRIVately MAINTAINED DRAINAGE FACILITIES

### NO. 4 – CONTROL STRUCTURE/FLOW RESTRICTOR

<table>
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<tr>
<th>Maintenance Components</th>
<th>Defect</th>
<th>Condition When Maintenance Is Needed</th>
<th>Maintenance Activity or Results After Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Trash and Debris (Includes Sediment)</td>
<td>Distance between debris build up and bottom of orifice plate is less than 1 1/2 feet</td>
<td>All trash and debris removed</td>
</tr>
<tr>
<td>Structural Damage</td>
<td>Structure is not securely attached to manhole wall, outlet pipe structure should support at least 1,000 pounds of up or down pressure</td>
<td>Structure is not securely attached to wall and outlet pipe</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Structure is not in upright position (allow up to 10% from plumb)</td>
<td>Structure in correct position</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connections to outlet pipe are not watertight and show signs of rust</td>
<td>Connections to outlet pipe are watertight, structure repaired or replaced and works as designed</td>
<td></td>
</tr>
<tr>
<td>Cleanout Gate</td>
<td>Damaged or Missing</td>
<td>Any holes – other than designed holes – in the structure</td>
<td>Structure has not holes other than designed holes</td>
</tr>
<tr>
<td></td>
<td>Cleanout gate is not watertight or is missing</td>
<td>Gate is watertight and works as designed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gate cannot be moved up and down by one maintenance person</td>
<td>Gate moves up and down easily and is watertight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chain leading to gate is missing or damaged</td>
<td>Chain is in place and works as designed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gate is rusted over 50% of its surface area</td>
<td>Gate is repaired or replaced to meet design standards</td>
<td></td>
</tr>
<tr>
<td>Orifice Plate</td>
<td>Damaged or Missing</td>
<td>Control device is not working properly due to missing, out of place, or bent orifice plate.</td>
<td>Plate is free of all obstructions and works as designed</td>
</tr>
<tr>
<td>Orifice Plate</td>
<td>Performance</td>
<td>When actual release rate at any one orifice is not within 75% to 125% of the design release rate</td>
<td>Correct problem with appropriate action such as replacement of the orifice plate</td>
</tr>
<tr>
<td>Overflow Pipe</td>
<td>Obstructions</td>
<td>Any trash or debris blocking (or having the potential of blocking) the overflow pipe</td>
<td>Pipe is free of all obstructions and works as designed</td>
</tr>
<tr>
<td>Manhole</td>
<td>See “Closed Detention Systems” Standard No 3</td>
<td>See “Closed Detention Systems” Standard No 3</td>
<td></td>
</tr>
<tr>
<td>Catch Basin</td>
<td>See “Catch Basins” Standard No 5</td>
<td>See “Catch Basins” Standard No 5</td>
<td></td>
</tr>
</tbody>
</table>
### MAINTENANCE REQUIREMENTS FOR PRIVATELY MAINTAINED DRAINAGE FACILITIES

**NO. 5 – CATCH BASINS**

<table>
<thead>
<tr>
<th>Maintenance Components</th>
<th>Defects:</th>
<th>Condition When Maintenance Is Needed</th>
<th>Maintenance Activity or Results After Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td>Trash &amp; Debris (Includes Sediment)</td>
<td>Trash or debris of more than 1/2 cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of basin by more than 10%</td>
<td>No trash or debris located immediately in front of catch basin opening</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trash or debris (in the basin) that exceeds 1/3 the depth from the bottom of basin to invert of the lowest pipe into or out of the basin</td>
<td>No trash or debris in the catch basin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height</td>
<td>Inlet and outlet pipes free of trash or debris</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dead animals or vegetation that could generate odors that would cause complaints or dangerous gases (e.g., methane)</td>
<td>No dead animals or vegetation present within the catch basin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Deposits of garbage exceeding 1 cubic foot in volume</td>
<td>No condition present which would attract or support the breeding of insects or rodents</td>
</tr>
<tr>
<td><strong>Structural Damage to Frame and/or Top Slab</strong></td>
<td>Corner of frame extends more than 3/4 inch past curb face into the street (if applicable)</td>
<td>Frame is even with curb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Top slab has holes larger than 2 square inches or cracks wider than ¼ inch (intent is to make sure all material is running into the basin)</td>
<td>Top slab is free of holes and cracks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frame not sitting flush on top slab, i.e., separation of more than ¼ inch of the frame from the top slab</td>
<td>Frame is sitting flush on top slab</td>
<td></td>
</tr>
<tr>
<td><strong>Cracks in Basin Walls/Bottom</strong></td>
<td>Cracks wider than ¼ inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks or maintenance person judges that structure is unsound</td>
<td>Basin replaced or repaired to design standards</td>
<td></td>
</tr>
</tbody>
</table>

D-6
# MAINTENANCE REQUIREMENTS FOR PRIVATELY MAINTAINED DRAINAGE FACILITIES

## NO. 5 – CATCH BASINS CON’T

<table>
<thead>
<tr>
<th>Maintenance Components</th>
<th>Defect</th>
<th>Condition When Maintenance is Needed</th>
<th>Maintenance Activity or Results After Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks</td>
<td>No cracks more than ¼ inch wide at the joint of inlet/outlet pipe</td>
</tr>
<tr>
<td>Settlement/ Misalignment</td>
<td></td>
<td>Basin has settled more than 1 inch or has rotated more than 2 inches out of alignment</td>
<td>Basin replaced or repaired to design standards</td>
</tr>
<tr>
<td>Fire Hazard</td>
<td></td>
<td>Presence of chemicals such as natural gas, oil and gasoline</td>
<td>No flammable chemicals present</td>
</tr>
<tr>
<td>Vegetation</td>
<td></td>
<td>Vegetation growing across and blocking more than 10% of the basin opening</td>
<td>No vegetation blocking opening to basin</td>
</tr>
<tr>
<td>Pollution</td>
<td></td>
<td>Nonflammable chemicals of more than ½ cubic foot per three feet of basin length</td>
<td>No pollution present other than surface film</td>
</tr>
<tr>
<td>Catch Basin Cover</td>
<td>Cover Not in Place</td>
<td>Cover is missing or only partially in place. Any open catch basin required maintenance</td>
<td>Catch basin cover is closed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mechanism cannot be opened by one maintenance person with proper tools and bolts into frame have less than ½ inch of thread</td>
<td>Mechanism opens with proper tools</td>
</tr>
<tr>
<td></td>
<td>Locking Mechanism Not Working</td>
<td>One maintenance person cannot remove lid after applying 80 lbs or lift, intent is to keep cover from sealing off access to maintenance</td>
<td>Cover can be removed by one maintenance person</td>
</tr>
<tr>
<td></td>
<td>Cover Difficult to Remove</td>
<td>Ladder is unsafe due to missing rungs, misalignment, rust, cracks, or sharp edges</td>
<td>Ladder meets design standards and allows maintenance person safe access</td>
</tr>
<tr>
<td></td>
<td>Ladder Rungs Unsafe</td>
<td>Grate with opening wider than 7/8 inch</td>
<td>Grate openings meet design standards</td>
</tr>
<tr>
<td></td>
<td>Metal Grates</td>
<td>Trash and debris that is blocking more than 20% of grate surface</td>
<td>Grate free of trash and debris</td>
</tr>
<tr>
<td></td>
<td>Trash and Debris</td>
<td>Grate missing or broken member(s) of the grate</td>
<td>Grate is in place and meets design standards</td>
</tr>
</tbody>
</table>
MAINTENANCE REQUIREMENTS FOR
PRIVATELY MAINTAINED DRAINAGE FACILITIES

NO. 6 – DEBRIS BARRIERS (e.g., Trash Racks)

<table>
<thead>
<tr>
<th>Maintenance Components</th>
<th>Defect</th>
<th>Condition When Maintenance Is Needed</th>
<th>Maintenance Activity or Results After Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Trash and Debris</td>
<td>Trash or debris that is plugging more than 20% of the openings in the barrier</td>
<td>Barrier clear to receive capacity flow</td>
</tr>
<tr>
<td>Metal</td>
<td>Damaged/Missing Bars</td>
<td>Bars are bent out of shape more than 3 inches or missing</td>
<td>Bars in place with no bends more than 3/4 inch or Bars in place according to design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bars are loose and rust is causing 50% deterioration to any part of barrier</td>
<td>Repair or replace barrier to design standards</td>
</tr>
</tbody>
</table>
# MAINTENANCE REQUIREMENTS FOR PRIVATELY MAINTAINED DRAINAGE FACILITIES

## NO. 7 – ENERGY DISSIPATORS

<table>
<thead>
<tr>
<th>Maintenance Components</th>
<th>Defect</th>
<th>Condition When Maintenance Is Needed</th>
<th>Maintenance Activity or Results After Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eternal Rock Pad</td>
<td>Missing or Moved Rock</td>
<td>Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil</td>
<td>Replace rocks to design standard</td>
</tr>
<tr>
<td>Dispersal Trench</td>
<td>Pipe Plugged with Sediment</td>
<td>Accumulated sediment that exceeds 20% of the design depth</td>
<td>Pipe cleaned/flushed so that it matches design</td>
</tr>
<tr>
<td></td>
<td>Not Discharging Water Properly</td>
<td>Visual evidence of water discharging at concentrated points along trench (normal condition is a “sheet flow” of water along trench) Intent is to prevent erosion damage</td>
<td>Trench must be redesigned or rebuilt to standards</td>
</tr>
<tr>
<td></td>
<td>Perforations Plugged</td>
<td>Over ½ of perforations in pipe are plugged with debris and sediment.</td>
<td>Clean or replace perforated pipe</td>
</tr>
<tr>
<td></td>
<td>Water Flows Out Top of Distributor Catch Basin</td>
<td>Maintenance person observes water flowing out during any storm less than the design storm or it is causing or appears likely to cause damage</td>
<td>Facility must be rebuilt or redesigned to standards</td>
</tr>
<tr>
<td></td>
<td>Receiving Area Over-Saturated</td>
<td>Water in receiving area is causing or has potential of causing landslide problems</td>
<td>No danger of landslides</td>
</tr>
<tr>
<td>Internal Manhole/Chamber</td>
<td>Worn or Damaged Posts, Baffles, Sides of Changer</td>
<td>Structure dissipating flow deteriorates to ½ of original size or any concentrated work spot exceeding one square foot which would make structure unsound</td>
<td>Replace structure to design standards</td>
</tr>
</tbody>
</table>
### MAINTENANCE REQUIREMENTS FOR PRIVATELY MAINTAINED DRAINAGE FACILITIES

**NO. 8 – FENCING**

<table>
<thead>
<tr>
<th>Maintenance Components</th>
<th>Defect</th>
<th>Condition When Maintenance Is Needed</th>
<th>Maintenance Activity or Results After Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Missing or Broken Parts</td>
<td>Any defect in the fence that permits easy entry to a facility</td>
<td>Parts in place to provide adequate security</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parts broken or missing</td>
<td>Broken or missing parts replaced</td>
</tr>
<tr>
<td></td>
<td>Erosion</td>
<td>Erosion more than 4 inches high and 12-18 inches wide permitting an opening under a fence</td>
<td>No opening under the fence that exceeds 4 inches in height</td>
</tr>
<tr>
<td>Wire Fences</td>
<td>Damaged Parts</td>
<td>Posts out of plumb more than 6 inches</td>
<td>Posts plumb to within 1 ½ inches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Top rails bent more than 6 inches</td>
<td>Top rail free of bends greater than 1 inch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Any part of fence (including posts, top rails, and fabric) more than 1 foot out of design alignment</td>
<td>Fence is aligned and meets design standards</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Missing or loose tension wire</td>
<td>Tension wire in place and holding wire</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Missing or loose barbed wire that is sagging more than 2 ½ inches between posts</td>
<td>Barbed wire in place with less than ¼ inch sag between posts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extension arm missing, broken, or bent out of shape more than 1 ½ inches</td>
<td>Extension arm in place with no bends larger than ¼ inch</td>
</tr>
<tr>
<td>Deteriorated Paint or Protective Coating</td>
<td></td>
<td>Part or parts that have a rusting or scaling condition that has affected structural adequacy</td>
<td>Structurally adequate posts or parts with a uniform protective coating</td>
</tr>
<tr>
<td>Opening in Fabric</td>
<td></td>
<td>Openings in fabric are such that an 8-inch diameter ball could fit through</td>
<td>No openings in fabric</td>
</tr>
</tbody>
</table>
### MAINTENANCE REQUIREMENTS FOR PRIVATELY MAINTAINED DRAINAGE FACILITIES

**NO. 9 – GATES**

<table>
<thead>
<tr>
<th>Maintenance Components</th>
<th>Defect</th>
<th>Condition When Maintenance Is Needed</th>
<th>Maintenance Activity or Results After Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td>Damaged or Missing Members</td>
<td>Missing gate or locking devices</td>
<td>Gates and locking devices in place</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Broken or missing hinges such that gate cannot be easily opened and closed by a maintenance person</td>
<td>Hinges intact and lubed Gate is working freely</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gate is out of plumb more than 6 inches and more than 1 foot out of design alignment</td>
<td>Gate is aligned and vertical</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Missing stretcher bar, stretcher band, and ties</td>
<td>Stretcher bar, bands, and ties in place</td>
</tr>
<tr>
<td><strong>Opening in Fabric</strong></td>
<td>See “Fencing” Standard No 8</td>
<td>See “Fencing” Standard No 8</td>
<td></td>
</tr>
</tbody>
</table>
## Maintenance Requirements for Privately Maintained Drainage Facilities

### No. 10 – Conveyance Systems (Pipes and Ditches)

<table>
<thead>
<tr>
<th>Maintenance Components</th>
<th>Defect</th>
<th>Condition When Maintenance Is Needed</th>
<th>Maintenance Activity or Results After Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipes</td>
<td>Sediment &amp; Debris</td>
<td>Accumulated sediment that exceeds 20% of the diameter of the pipe</td>
<td>Pipe cleaned of all sediment and debris</td>
</tr>
<tr>
<td></td>
<td>Vegetation</td>
<td>Vegetation that reduces free movement of water through pipes</td>
<td>All vegetation removed so water flows freely through pipes</td>
</tr>
<tr>
<td></td>
<td>Damaged</td>
<td>Protective coating is damaged, rust is causing more than 50% deterioration to any part of pipe</td>
<td>Pipe repaired or replaced</td>
</tr>
<tr>
<td>Open Ditches</td>
<td>Trash &amp; Debris</td>
<td>Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch and slopes</td>
<td>Trash and debris cleared from debris</td>
</tr>
<tr>
<td></td>
<td>Sediment</td>
<td>Accumulated sediment that exceeds 20% of the design depth</td>
<td>Ditch cleaned/flushed of all sediment and debris so that it matches design</td>
</tr>
<tr>
<td></td>
<td>Vegetation</td>
<td>Vegetation that reduces free movement of water through ditches</td>
<td>Water flows freely through ditches</td>
</tr>
<tr>
<td>Erosion Damage to Slopes</td>
<td>See “Ponds” Standard No 1</td>
<td></td>
<td>See “Ponds” Standard No 1</td>
</tr>
<tr>
<td>Rock Lining Out of Place or Missing</td>
<td>Maintenance person can see native soil beneath the rock lining</td>
<td>Replace rocks to design standard</td>
<td></td>
</tr>
<tr>
<td>Catch Basins</td>
<td>See “Catch Basins” Standard No 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debris Barriers</td>
<td>See “Debris Barriers” Standard No 6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# MAINTENANCE REQUIREMENTS FOR PRIVATELY MAINTAINED DRAINAGE FACILITIES

## NO. 11 – GROUNDS (Landscaping)

<table>
<thead>
<tr>
<th>Maintenance Components</th>
<th>Defect</th>
<th>Condition When Maintenance Is Needed</th>
<th>Maintenance Activity or Results After Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td>Weeds (non-poisonous)</td>
<td>Weeds growing in more than 20% of the landscaped area (trees and shrubs only)</td>
<td>Weeds present in less than 5% of the landscaped area</td>
</tr>
<tr>
<td></td>
<td>Safety Hazard</td>
<td>Any presence of poison ivy or other poisonous vegetation</td>
<td>No poisonous vegetation present in a landscaped area</td>
</tr>
<tr>
<td></td>
<td>Trash or Litter</td>
<td>Paper, cans, bottles, totaling more than 1 cubic foot within a landscaped area (trees and shrubs only) of 1,000 square feet</td>
<td>Area clear of litter</td>
</tr>
<tr>
<td><strong>Trees &amp; Shrubs Damage</strong></td>
<td>Trees or shrubs that have been blown down or knocked over</td>
<td>Trees and shrubs with less than 5% of the foliage with split or broken limbs.</td>
<td>Tree or shrub in place free of injury</td>
</tr>
<tr>
<td></td>
<td>Trees or shrubs which are not adequately supported or are leaning over, causing exposure of the roots</td>
<td>Tree or shrub in place and adequately supported, remove any dead or diseased trees</td>
<td></td>
</tr>
</tbody>
</table>
## MAINTENANCE REQUIREMENTS FOR PRIVATELY MAINTAINED DRAINAGE FACILITIES

### NO. 12 – ACCESS ROADS/EASEMENTS

<table>
<thead>
<tr>
<th>Maintenance Components</th>
<th>Defect</th>
<th>Condition When Maintenance Is Needed</th>
<th>Maintenance Activity or Results After Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Trash and Debris</td>
<td>Trash and debris exceeds 1 cubic foot per 1,000 square feet, i.e., trash and debris would fill up one standard size garbage can</td>
<td>Trash and debris cleared from site</td>
</tr>
<tr>
<td></td>
<td>Blocked Roadway</td>
<td>Debris which could damage vehicle tires (glass or metal)</td>
<td>Roadway free of debris which could damage tires</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Any obstructions restricting the access to a 10 to 12 foot width for a distance of more than 12 feet or any point restricting access to less than a 10 foot width</td>
<td>Obstruction removed to allow at least a 12 foot access</td>
</tr>
<tr>
<td>Road Surface</td>
<td>Settlement</td>
<td>When any surface defect exceeds 6 inches in depth and 6 square feet in area. In general, any surface defect which hinders or prevents maintenance access</td>
<td>Roads surface uniformly smooth with no evidence of settlement, potholes, much spots, or ruts</td>
</tr>
<tr>
<td></td>
<td>Potholes, Mush, Spots, Ruts</td>
<td>Weeds growing in the road surface that are more than 6 inches tall and less than 6 inches apart within a 400 square foot area</td>
<td>Road surface free of weeds taller than 2 inches</td>
</tr>
<tr>
<td></td>
<td>Vegetation in Road Surface</td>
<td>Erosion within 1 foot of the roadway more than 8 inches wide and 6 inches deep</td>
<td>Shoulder free of erosion and matching the surrounding road</td>
</tr>
<tr>
<td>Shoulders and Ditches</td>
<td>Erosion Damage</td>
<td>Weeds and brush exceed 18 inches in height or hinder maintenance access</td>
<td>Weeds and brush cut to 2 inches in height or cleared in such a way as to allow maintenance access</td>
</tr>
<tr>
<td></td>
<td>Weeds and Brush</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Maintenance Requirements for Privately Maintained Drainage Facilities

## No. 13 – Grass Biofilters and Filter Strips

<table>
<thead>
<tr>
<th>Maintenance Components</th>
<th>Defect</th>
<th>Condition When Maintenance Is Needed</th>
<th>Maintenance Activity or Results After Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Trash &amp; Debris</td>
<td>See “Ponds and Constructed Wetlands Standard No 1”</td>
<td>See “Ponds and Constructed Wetlands Standard No 1”</td>
</tr>
<tr>
<td></td>
<td>Poisonous Vegetation</td>
<td>See “Ponds and Constructed Wetlands Standard No 1”</td>
<td>See “Ponds and Constructed Wetlands Standard No 1”</td>
</tr>
<tr>
<td></td>
<td>Pollution</td>
<td>See “Ponds and Constructed Wetlands Standard No 1”</td>
<td>See “Ponds and Constructed Wetlands Standard No 1”</td>
</tr>
<tr>
<td>Curb Cuts</td>
<td></td>
<td>Flow entry points for filter strips are to be kept clear of debris</td>
<td>Debris blocks the entry of the stormwater.</td>
</tr>
<tr>
<td>Grass Heights</td>
<td></td>
<td>Mowing is needed if the grass exceeds eight inches, and is not to be cut to less than four inches</td>
<td>To maintain a thick growth of grass at the proper treatment height</td>
</tr>
<tr>
<td>Side Slopes</td>
<td>Erosion</td>
<td>Eroded damage over ½ inch deep where cause of damage is still present or where there is potential for continued damage</td>
<td>Level areas and resod or reseed using specifications in this manual</td>
</tr>
<tr>
<td></td>
<td>Bare Area</td>
<td>Any visibly bare area regardless of size is to be reseded, and resodded if greater than 1 square foot in area</td>
<td>Avoid erosion and reduction of treatment efficiency</td>
</tr>
<tr>
<td></td>
<td>Standing Water</td>
<td>Areas where water is found standing for a day or more. Cause must be determined and corrected</td>
<td>Standing water can kill the grass and possibly breed mosquitoes</td>
</tr>
<tr>
<td></td>
<td>Check Dams</td>
<td>Dislodged dam or portion of the dam, significant leakage of stormwater around, beneath or through a dam</td>
<td>Damaged check dams can result in damage to the treatment area</td>
</tr>
</tbody>
</table>
# MAINTENANCE REQUIREMENTS FOR PRIVATELY MAINTAINED DRAINAGE FACILITIES

## NO. 14 - OIL/WATER SEPARATORS

<table>
<thead>
<tr>
<th>Maintenance Components</th>
<th>Defect</th>
<th>Condition When Maintenance Is Needed</th>
<th>Maintenance Activity or Results After Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Area</td>
<td></td>
<td>See “Closed Detention Systems Standard No 3”</td>
<td>See “Closed Detention Systems Standard No 3”</td>
</tr>
<tr>
<td>Manhole</td>
<td></td>
<td>See “Closed Detention and Treatment Systems Standard No 3”</td>
<td>See “Closed Detention and Treatment Systems Standard No 3”</td>
</tr>
<tr>
<td>Catch Basins</td>
<td></td>
<td>See “Catch Basins Standard No 5”</td>
<td>See “Catch Basins Standard no 5”</td>
</tr>
<tr>
<td>Cleaning Frequency</td>
<td>Excessive Buildup of Petroleum and Floatables</td>
<td>No Specific Condition</td>
<td>Clean at least once every three months</td>
</tr>
<tr>
<td>Coalescing Plates</td>
<td>Plugging</td>
<td>When debris has plugged 10% or more of the vertical cross-section of the plates</td>
<td>Remove debris</td>
</tr>
</tbody>
</table>
REFERENCE

The City of Kent accepts References 4A, 5, and 6B as provided in the 1998 King County Surface Water Design Manual and they are included herein. References 8-A through 8-J are also provided herein. Some of the references in reference section 8 have been revised by the City. Other reference sections in the 1998 King County Manual (1, 2, 3, 4b, 6A, and 7) are not relevant to the City of Kent Surface Water Design Manual.

Six separate maps relevant to the Manual are included as hard copies and PDF files on disk (See Table of Contents for list).

REFERENCES

4A – Landscape Management Plan Guidelines
5 – Bibliography of Supporting Studies and Research
6B – Pond Geometry Equations
8-B – Offsite Analysis Drainage System Table
8-C – Flow Control and Water Quality Facility Summary Sheet and Sketch
8-D – Bond Quantities Worksheet – (contact the City of Kent Public Works Department)
8-E – Surface Water and Drainage Facilities Construction Bond
8-F – Declaration of Stormwater Facility Maintenance Covenant
8-G – Drainage Easements
8-H – Water Quality Memorandum
8-I – Adjustment Application Form and Process Guidelines
8-J – Plat Dedication Clause – Final Recording
REFERENCES

4A – LANDSCAPE MANAGEMENT PLAN GUIDELINES
REFERENCE 4-A

Guidelines for preparing a landscape management plan

Landscape management plans have the potential to significantly reduce the pollutant load washing off managed green spaces. For this reason, landscape management plans that incorporate key pollution prevention elements and which are consistently implemented can be used in lieu of water quality treatment facilities (see Section 128). Submittal requirements for obtaining an approved landscape management plan are given in Chapter 2.

GENERAL CONSIDERATIONS

Studies of pollutant transport have consistently shown that forested lands consistently produce lower pollutant loads—of solids, phosphorus and metals—than do lands used for residential, industrial or agricultural purposes. “Loading” refers to the total weight of a pollutant leaving a particular area or site. It is measured by determining both the concentration of a pollutant and the amount of flow leaving a site. Since the Puget Sound area was largely forested before settlement, lakes and streams in the area have developed biotic regimes in response to this low pollutant loading—clear, cool waters supporting salmon and other aquatic life. When the input of pollutants increases, lakes and streams often shift to a more biologically productive mode, often with a concomitant loss of clear water and a shift or even a decline in fish species.

When forests are converted to cities, this increase in pollutant load needs to be managed in order to maintain the beneficial uses of lakes and streams. One way to manage pollutants is to treat stormwater before it enters a water body. Biofiltration swales, wetpards and sand filters, as well as other facilities, can be used to provide this treatment. Another approach to manage pollutant loads is to prevent the pollutants from entering stormwater in the first place.

Our best models on how to keep nutrients and pollutants from entering storm water are from the original, unaltered landscape—the forests. Forests have a soft, absorptive duff layer, as well as dense vegetative cover, especially near the ground surface. Nutrients are provided in the form of slow-release organic materials, or leaves, needles and woody material. Rainfall runoff is greatly reduced from the levels seen in developed landscapes. These factors help to keep the total load of nutrients and sediments transported to receiving waters low.

ELEMENTS OF A SUCCESSFUL LANDSCAPE MANAGEMENT PLAN

Good planning, tailored to the specific conditions of the site, as well as good follow-through, are both essential in controlling the pollutants generated when forests are replaced with lawns, gardens or other landscape features. This section will focus on planning. Follow-through, or implementation, will be discussed in the next section.

I. PLAN CONTENTS

A landscape management plan for any particular site works best if developed with the specific site characteristics in mind. Soil type, slope, exposure, depth to groundwater as well as the particular suite of plants chosen for the site all should help direct the specific make-up of the plan. However, there are some basic principles that all sites should consider in order to be successful in controlling the export of soil or
organics, fertilizers and pesticides in stormwater runoff. Landscape management plans should address each of the general principles given in Table 1, tailoring them to fit the specific site situation.

Each of the five basic principles is expanded upon in the following sections. The recommendations discussed under each principle are intended as a framework for a variety of site situations, from individual homes to large parks and golf courses. Thus, not every landscape management plan may be able to apply each of the listed recommendations. In addition, landscapes are managed for different purposes, some more formal than others. It may be that some recommendations will not be appropriate for very formal sites and thus not adopted, in favor of other management practices that better fit the uses for which the site is intended. In the end, the extent to which a landscape management plan is successful depends on the ability of the practices chosen to retain soil, fertilizers and pesticides on the site and away from water resources throughout the entire year.

### Table 1: Basic principles to reduce pollutant transport from landscaped areas

<table>
<thead>
<tr>
<th>Principle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Minimize bare soil areas</td>
</tr>
<tr>
<td>2</td>
<td>Reduce water demand</td>
</tr>
<tr>
<td>3</td>
<td>Reduce extent of turf area—manage remaining turf for low-impact</td>
</tr>
<tr>
<td>4</td>
<td>Choose plants with sustainability in mind</td>
</tr>
<tr>
<td>5</td>
<td>Manage fertilizer and pesticide use wisely</td>
</tr>
</tbody>
</table>

### Principle 1: Minimize bare soil areas

Bare soil areas are one source of solids that can be mobilized and carried downstream by rainfall. Minimizing bare soil areas makes it less likely that solid particles will be dislodged by rainfall. Some pointers on how to manage landscapes to minimize bare soil are given below:

- **a)** Establish dense plantings of pest-resistant groundcover to shade out weeds. Some easy-care recommendations are rock rose (Cistus sp.), snowberry (Symphoricarpos alba), salal (Gaultheria shallon) and kinnickiminck (Arctostaphylos uva-ursi).

- **b)** If bare soil areas are required, as in plant beds or ball diamonds, surround the bare area with an area of grass or groundcover to filter out solids that may be picked up by stormwater runoff:
  - The denser the grass or groundcover, the better it works to capture solids in runoff.
  - Try to make the filtering area as level as possible. Avoid low spots, where runoff can concentrate and create channels.
  - In general, filter areas should be about one-fourth as long (along the flow path) as the area contributing low, assuming that slopes are gentle (less than about 10 percent). For flat, level areas without drips, this length can be reduced.

- **c)** Repair promptly bare patches in lawns or groundcovers that could contribute solids to stormwater runoff.

- **d)** Don't place bark or loose mulch on slopes where it can be carried to stormdrains.
**Principle 2  Reduce water demand**

Reducing the need for irrigation reduces the potential movement of pollutants, conserves water and saves money.

a) Use drought tolerant or native vegetation.
b) Install underground irrigation systems timed to water at night or drip irrigation systems.
c) Increase the organic content of soils to improve water-retention capability.
d) Allow for longer water retention by terracing sloped areas.

**Principle 3  Reduce turf area and manage remaining turf for low-impact**

Turf requires care to look good. In addition to mowing, turf areas typically require water, fertilizer and weed and disease control. However, some practices can reduce or minimize the amount of chemical controls needed.

a) Amend soil with organic matter to a depth of 8-12 inches before the lawn is established. Till the organic matter into the native soil.
b) Decide if all lawn area needs the same level of upkeep. Let some areas have a less formal look if possible, and reduce fertilizer and pesticide use in those areas.
c) Rely on irrigation and lawn aeration as the primary tools to maintain healthy turf.
d) Remove thatch each year to increase water penetration to grass roots and reduce runoff.
e) Plant groundcovers rather than grass in shady areas. Turf grasses usually need at least partial sun to remain vigorous.

**Principle 4  Choose plants with sustainability in mind**

Plants differ in their ability to cope with different soils, rainfall conditions, pest and diseases and microclimates. Choosing resilient plant species, plants with adaptations for particular environments or creating optimal microenvironments are all techniques that can be used to create landscapes that require less intervention. Less watering and less need for pesticide and fertilizer application means less potential for pollutants to leave the site.

a) Choose disease resistant plants.
b) Choose drought-resistant groundcovers, shrubs and trees in areas with poor soil or little shading.
c) Group plants in clusters with tree, shrub and groundcover layers to create a better micro-environment and to supply organic matter back to the soil.
d) Include plants in the landscape that are important for beneficial insects such as parasitic wasps. If beneficial insects have nothing to sustain them, they won’t stick around to control pests when you need them.
e) Use dense plantings or close spacing to shade out weeds rather than herbicides.
f) Use plants with fibrous roots on steeper slopes or erosion-prone areas. Some good choices include:
   - *New Zealand flax (Phormium penax)*
   - Ornamental grasses, lawn grasses
   - *Rock rose (Cistus sp)*
   - *Rosa rugosa*

---

1 Note that the County’s Sensitive Areas Code (21a) defines and protects steep slopes and landslide hazard areas from encroachment. Generally, clearing of vegetation is prohibited in areas with slopes of 40% or more.
• Salmonberry (*Rubus spectabilis*) -- native
• Snowberry (*Symphoricarpos alba*) -- native
* not hardy in all areas of the County

a) Use wetland plants in areas with seeps or a high water table
b) Attend to installation details. Write enforceable planting specifications that include details such as soil preparation, plant spacing, plant condition and size, planting depth, transplant handling and irrigation. Inspect the job during planting to prevent short cuts such as blowing the soil mixture around root balls rather than digging the roots into amended native soils

**Principle 5 Manage fertilizer and pesticide use wisely**

Many landscape plants and turf simply won’t do well without fertilization and some amount of pest management. It’s therefore important for landscape management plans to address when and how these actions will be taken

a) Keep plants healthy by building healthy soil using composted organic material. Healthy plants can better resist diseases and insect pests
b) Tailor fertilizer make-up to lawn needs. Adjust application rate and timing of fertilizer applications to avoid carry-off to storm runoff
c) Reduce the phosphorus (P) concentration in fertilizers when possible by using a low phosphorous formulation or formulations containing only nitrogen or potassium. Added phosphorus is often not needed for health foliage growth, only for encouraging profuse blooms
d) Use an integrated pest management approach to control pests. Keep current about non-chemical controls as a first-defense against pests
e) Encourage a diverse insect community in your landscape. Beneficial insects can help control pests, especially pests of trees and shrubs
f) Target pesticide application to the specific pest of concern. Avoid pesticide “mixes” targeting generic problems (such as weed and feed) unless you actually need each of the formulations for a current problem
g) Only apply pesticides during the life-stage when the pest is vulnerable
h) Use fungicides very sparingly—they disrupt the base of aquatic food webs. If you need to use fungicides, spray formulations with faster break-down times. Consult a golf course management text for information on the attributes of various fungicides (and other pesticides). Balough and Walker, 1992, *Golf course management and construction* by Lewis Publishers is one source of information
i) Tolerate some weeds.

**References**

“Weed management for lawns and gardens.” Washington Toxics Coalition Fact Sheet, 1989

“Least toxic lawn management.” The BioIntegral Resource Center (BIRC), P O Box 7414, Berkeley, CA 94707

Washington State Cooperative Extension publications on lawn care, Bulletin Office, Cooperative Extension, Cooper Publication Building, Washington State University, Pullman, WA 99164-5912

II PLAN IMPLEMENTATION

A landscape management plan, no matter how good, will not reduce pollutants in runoff if it is not implemented. And implementation often means that the plan needs to be modified over time since as plants grow and as the cycle of pests change, the original plan may not fit the site. The following must be addressed before a landscape management plan can be approved:

1. Identify who will be responsible for assuring the management plan is carried out.
2. Identify how the applicant will assure that grounds crews or homeowners have the training and/or resources required to implement the plan and keep up to date on advances in landscape care practices and products.
3. Agree to keep records of fertilizer and pesticide application, including rate of application, area treated and disposal or storage of residue.
4. Agree to certify each year that the landscape management plan for the project in question has been carried out, and that needed amendments or updates have been made.
5. Provide the plan to County maintenance or inspection personnel on request.
6. Agree to pay an annual fee (based on time expended) to allow the County to administer the certification process, including review of plans, tracking of information, periodic field inspections and sampling.
BIBLIOGRAPHY OF SUPPORTING STUDIES & RESEARCH

Several studies, issue papers and reports were prepared by King County Surface Water Management (SWM) Division staff and consultants in support of the 1996 revisions to this manual. This section presents a bibliography of these documents which are available from the SWM Division.

FLOW CONTROL ISSUE PAPERS

Director's Briefing - Summary of Key Issues to the King County Surface Water Design Manual Update  Rick Schaefer, R W Beck and Associates, Linda Holden, Jeff Stern, King County Surface Water Management  September, 1993  Briefing paper presenting an overview of proposed changes in flow control, water quality and the review process. Each section establishes the need for a change, evaluates options for implementing the change, recommends an option, and discusses effects of the recommendation.

Comparison of Current and Proposed Detention Standards  Linda Holden, Jeff Stern, King County Surface Water Management  September, 1993  Comparison of current and proposed peak and duration standards, in terms of peak flow increases, flooding frequency, and impacts to resources.

Detention Issue Paper  Malcolm Leytham, Northwest Hydraulic Consultants, Linda Holden, Kelly Whiting, King County Surface Water Management  April, 1994  Provides an overview of proposed detention-related changes, including:

- comparison of alternative design techniques - Discusses advantages and disadvantages of various hydrological models including the “Y&W” method, SCS/SBUH 24-hour event method, SCS 7-day event method, HSPF Version 10, and HSPF Runoff Files.

- components of design - Discusses use of various models for design of conveyance systems, R/D facilities and other miscellaneous hydraulic structures, with emphasis on applicability of KCRTS.

- impact analysis - Presents impacts on detention sizing for several development case studies, comparing SBUH 24-hour method and KCRTS for a variety of detention performance standards.

The “Runoff Files” Implementation of HSPF  Malcolm Leytham, Northwest Hydraulic Consultants, Linda Holden, Kelly Whiting, King County Surface Water Management  April, 1994  Provides details on the Runoff Files method, including principles and background, application of runoff files for facility design, and responses to some common questions and concerns.

Retention/Detention Standards Benefits and Limits in King County Basins  Rhett Jackson, Derek Booth, King County Surface Water Management  July, 1993  A discussion on the range of R/D standards available, the role of management objective and design methodology on their effectiveness, and fundamental limitations of onsite R/D on a basin-wide scale. Includes a comparison of KCRTS and SBUH standards and effectiveness.

Rationale For a “Threshold of Concern” in Stormwater Release Rates  Derek Booth, King County Surface Water Management  March, 1993  Discusses selection of “50% of the 2-year storm” as the lower threshold for duration control for stream protection detention standards.

A Comparison of 7-Day and 24-Hour Detention Pond Design Standards - The Consequences of Inadequate Detention  Rhett Jackson, King County Surface Water Management  August, 1992  A comparison of the effectiveness of 1990 Design Manual 24-hour SBUH ponds and SBUH 7-day ponds (“Barker method”) as specified in the East Lake Sammamish Basin Plan, including effects on stream channels, water quality, stream and wetland habitats, and proposed capital improvement projects.
WATER QUALITY ISSUE PAPERS

Incentives analysis of five case studies Gaynor Landscape Archtechs/Designers, Inc September, 1992 Five case studies exploring better ways to integrate stormwater facilities into sites—emphasis is on aesthetic enhancements

The selection and sizing of treatment BMPs in new developments to achieve water quality objectives. 1993 Prepared by Gary Minton, Resource Planning Associates with the assistance of Herrera Environmental Consultants and R W Beck A summary of the literature and some original analysis related to the size and performance of water quality facilities

Water quality thresholds decision paper Louise Kulzer, King County Surface Water Management, April 15, 1994 Explores the need to revise the 5,000 square pollution-generating impervious surface foot threshold used to trigger water quality facilities. Roof runoff quality explored Summarizes stormwater from a number of local studies in Table 1

High use/ Oil control decision paper Jennifer Gaus, King County Surface Water Management October, 1994 Examines the intensity of vehicle use and other “high use” land uses which would generate a concentration of oil in stormwater treatable via oil/water separators Based on assumptions of uniform oil loss per vehicle. Redevelopment water quality controls also discussed Identifies land use types affected and benefits of better oil control

Water quality credits decision paper Sheryl Corrigan, John Heal, Louise Kulzer King County Surface Water Management November, 1994 Identifies actions that reduce pollutant loading and presents example cases to show effect of source reduction versus stormwater treatment on annual phosphorus loading

WATER QUALITY BENCH TESTS & MODELING STUDIES

Oil leachate tests for various adsorbant filter media Randy Brake, King County Surface Water Management May 1994 Presents results of bench tests exploring the release of oil into water from six oil absorbant media once oil saturated Developed a standardized testing protocol

Infiltration and pollutant removal characteristics of a proposed sand filter configuration John Koon, King County Surface Water Management May 1994 DRAFT, revision write-up expected November 1995. Presents results of infiltration plugging potential and pollutant removal (TSS, turbidity & TP) from sand column tests using mortar sand Silty alluvial Duwamish valley sediments used to determine plugging potential

Sand Filter sizing and costing Linda Holden, King County Surface Water Management May, 1995 Extensive exploration of the effect of various sand filter design parameters and criteria on facility size using the KCRTS model Summary of options & recommendation, supported by spreadsheets detailing results of various options

Infiltration, hydraulic conductivity and pollutant removal characteristics of sand filter materials John Koon, King County Surface Water Management, March, 1995 Field Notes. Report expected November, 1995. Sand column tests expanded and modified to determine hydraulic conductivity in addition to infiltration rate Pollutant removal (TSS, turbidity, TP) of various fast and slow draining sands

Sand filter sand specifications John Koon, King County Surface Water Management June 16, 1995 Memo to Louise Kulzer Documents sand mixes examined and logic for the sand specification recommended, including vendor availability

OTHER ISSUE PAPERS AND STUDIES

King County Surface Water Design Manual Update - Cost Analysis Bruce Johnson, King County Surface Water Management December, 1995 Assessment of costs associated with proposed flow control and water quality changes

Infiltration Issue Paper Steve Foley, King County Surface Water Management April, 1994 Summarizes and discusses recent changes to portions of the manual dealing with infiltration, including revisions intended to increase the use of infiltration, provide increased water quality protection, and improve the functioning of infiltration facilities

Temporary Erosion and Sedimentation Control Decision Paper Thur Tyson, King County Surface Water Management November, 1993 Discussion and recommendations on recently implemented TESC issues, including maintenance standards,
Summary of Proposed Changes to the Variance Process  
Amy Carlson, Don Althauser, King County Surface Water Management  
February, 1994  
Discussion of changes proposed to the variance process with the goals of increasing flexibility and predictability and reducing review time and costs.

Shared Surface Water Facilities  
Matrix Management Group  
May, 1994  
Outlines a proposal to provide developers with the option of constructing shared surface water detention and treatment facilities as an alternative to currently required on-site facilities, including a discussion on financing options.

Application of Surface Water Control to Roadways  
Rick Schaefer, R W Beck and Associates  
December, 1992  
Identifies provisions of the current Design Manual that fail to address design challenges inherent in linear (roadway) projects, and recommends alternative methods of surface water quantity and quality control.
REFERENCES

6B – POND GEOMETRY EQUATIONS
Reference Section 6-B

_Pond Geometry Calculations_

<Known>
Volume (V)
Pond Depth (D)
Side Slope (Ss)
Length-to-Width Ratio (R)

<Find>
Bottom Area of Rectangular Pond

<Solution>
Y = depth of section measured from bottom, from zero to D
W₀ = width at pond bottom

The pond width (W) at any depth, Y

\[ W_Y = W_0 + 2S_s Y \quad \text{Eq 1} \]

The pond length (L) at any depth, Y

\[ L_Y = RW_0 + 2S_s Y \quad \text{Eq 2} \]

The pond area at any depth, Y

\[ A_Y = L_Y W_Y = (RW_0 + 2S_s Y)(W_0 + 2S_s Y) \quad \text{Eq 3} \]

or,

\[ A_Y = RW_0^2 + (R+1)2W_0S_s Y + 4S_s^2 Y^2 \quad \text{Eq 4} \]

The equation for the pond-full volume (V) is obtained by integrating between Y=0 and Y=D
\[ V = \int_0^D \left( (RW_0^2 + (R+1)2W_0S_sY + 4S_s^2Y^2) \right) dY \]  
Eq 5

or,

\[ V = \left[ RW_0^2Y + (R+1)W_0S_sY^2 + \frac{4}{3}S_s^2Y^3 \right]_0^D \]  
Eq 6

or,

\[ V = RDW_0^2 + S_sD^2(R+1)W_0 + \frac{4}{3}S_s^2D^3 - V \]  
Eq 7

Where

- \( V \) = Volume of rectangular pond
- \( R \) = Length-to-width ratio
- \( D \) = Depth
- \( S_s \) = Side Slope
- \( W_0 \) = Bottom width

Rearrange equation to solve for \( W_0 \) using quadratic equation, \( 0 = ax^2 + bx + c \)

\[ 0 = RDW_0^2 + S_sD^2(R+1)W_0 + \frac{4}{3}S_s^2D^3 - V \]  
Eq 8

Use Quadratic Equation to solve for positive solution of \( W_0 \), \[ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]

\[ W_0 = \frac{-S_sD^2(R+1) \pm \sqrt{[S_sD^2(R+1)]^2 - 4RD\left(\frac{4}{3}S_s^2D^3 - V\right)}}{2RD} \]  
Eq 9

Use Equation 2 for Length of pond at \( Y = 0 \),

\[ L_0 = RW_0 \]

Use Equation 3 for Area of pond at \( Y = 0 \),

\[ A_0 = L_0W_0 = RW_0^2 \]
8-A – TECHNICAL INFORMATION REPORT (TIR) WORKSHEET
### City of Kent Public Works Department
**Technical Information Report (TIR) Worksheet**

**PART 1** PROJECT OWNER AND PROJECT ENGINEER

<table>
<thead>
<tr>
<th>Field</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Owner</td>
<td></td>
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<tr>
<td>Address</td>
<td></td>
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<tr>
<td>Phone</td>
<td></td>
</tr>
<tr>
<td>Project Engineer</td>
<td></td>
</tr>
<tr>
<td>Company</td>
<td></td>
</tr>
<tr>
<td>Address/Phone</td>
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</table>

**PART 2** PROJECT LOCATION AND DESCRIPTION

<table>
<thead>
<tr>
<th>Field</th>
<th>Information</th>
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<tbody>
<tr>
<td>Project Name</td>
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<tr>
<td>Location</td>
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<tr>
<td>Township</td>
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<tr>
<td>Range</td>
<td></td>
</tr>
<tr>
<td>Section</td>
<td></td>
</tr>
</tbody>
</table>

**PART 3** TYPE OF PERMIT APPLICATION

- [ ] Subdivision
- [ ] Short Subdivision
- [ ] Grading
- [ ] Commercial
- [ ] Other

**PART 4** OTHER PERMITS

- [ ] DFW HPA
- [ ] COE 404
- [ ] DOE Dam Safety
- [ ] FEMA Floodplain
- [ ] COE Wetlands
- [ ] Shoreline Management
- [ ] Rockery
- [ ] Structural Vaults
- [ ] Other

**PART 5** SITE COMMUNITY AND DRAINAGE BASIN

<table>
<thead>
<tr>
<th>Field</th>
<th>Information</th>
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<tbody>
<tr>
<td>Community</td>
<td></td>
</tr>
<tr>
<td>Drainage Basin</td>
<td></td>
</tr>
</tbody>
</table>

**PART 6** SITE CHARACTERISTICS

- [ ] River
- [ ] Stream
- [ ] Critical Stream Reach
- [ ] Depressions/Swales
- [ ] Lake
- [ ] Steep Slopes
- [ ] Floodplain
- [ ] Wetlands
- [ ] Seeps/Springs
- [ ] High Groundwater Table
- [ ] Groundwater Recharge
- [ ] Other

**PART 7** SOILS

<table>
<thead>
<tr>
<th>Field</th>
<th>Information</th>
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<tbody>
<tr>
<td>Soil Type</td>
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<td>Slopes</td>
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</tr>
<tr>
<td>Erosion Potential</td>
<td></td>
</tr>
<tr>
<td>Erosive Velocities</td>
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</tbody>
</table>

- [ ] Additional Sheets Attached

---

*City of Kent Surface Water Design Manual*

May, 2002

5 R-6

Chapter 5 – Kent Construction Standards
PART 8 DEVELOPMENT LIMITATIONS

<table>
<thead>
<tr>
<th>REFERENCE</th>
<th>LIMITATION/SITE CONSTRAINT</th>
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<tr>
<td>□ Additional Sheets Attached</td>
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PART 9 ESC REQUIREMENTS

<table>
<thead>
<tr>
<th>MINIMUM ESC REQUIREMENTS DURING CONSTRUCTION</th>
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<tbody>
<tr>
<td>□ Sedimentation Facilities</td>
</tr>
<tr>
<td>□ Stabilized Construction Entrance</td>
</tr>
<tr>
<td>□ Perimeter Runoff Control</td>
</tr>
<tr>
<td>□ Clearing and Grading Restrictions</td>
</tr>
<tr>
<td>□ Cover Practices</td>
</tr>
<tr>
<td>□ Construction Sequence</td>
</tr>
<tr>
<td>□ Other</td>
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</table>

<table>
<thead>
<tr>
<th>MINIMUM ESC REQUIREMENTS FOLLOWING CONSTRUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Stabilize Exposed Surface</td>
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<tr>
<td>□ Remove and Restore Temporary ESC Facilities</td>
</tr>
<tr>
<td>□ Clean and Remove All Silt and Debris</td>
</tr>
<tr>
<td>□ Ensure Operation of Permanent Facilities</td>
</tr>
<tr>
<td>□ Flag Limits of SAO and Open Space Preservation Areas</td>
</tr>
<tr>
<td>□ Other</td>
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PART 10 SURFACE WATER SYSTEM

<table>
<thead>
<tr>
<th>GRASS LIKED CHANNEL</th>
<th>TANK</th>
<th>INFILTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Grass Lined Channel</td>
<td>□ Tank</td>
<td>□ Infiltration</td>
</tr>
<tr>
<td>□ Pipe System</td>
<td>□ Vault</td>
<td>□ Depression</td>
</tr>
<tr>
<td>□ Open Channel</td>
<td>□ Energy Dissipater</td>
<td>Method of Analysis</td>
</tr>
<tr>
<td>□ Dry Pond</td>
<td>□ Wetland</td>
<td>□ Flow Dispersal</td>
</tr>
<tr>
<td>□ Wet Pond</td>
<td>□ Stream</td>
<td>□ Waiver</td>
</tr>
</tbody>
</table>

Brief Description of System Operation

Facility Related Site Limitations

<table>
<thead>
<tr>
<th>Reference</th>
<th>Facility</th>
<th>Limitation</th>
</tr>
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<tbody>
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</table>

PART 11 STRUCTURAL ANALYSIS

<table>
<thead>
<tr>
<th>CAST IN PLACE VAULT</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Cast in Place Vault</td>
<td>□ Other</td>
</tr>
<tr>
<td>□ Retaining Wall</td>
<td></td>
</tr>
<tr>
<td>□ Rockery &gt; 4' High</td>
<td></td>
</tr>
<tr>
<td>□ Structural on Steep Slope</td>
<td></td>
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</tbody>
</table>

PART 12 EASEMENTS/TRACTS

<table>
<thead>
<tr>
<th>DRAINAGE EASEMENT</th>
<th>ACCESS EASEMENT</th>
<th>NATIVE GROWTH PROTECTION EASEMENT</th>
<th>TRACT</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Drainage Easement</td>
<td>□ Access Easement</td>
<td>□ Native Growth Protection Easement</td>
<td>□ Tract</td>
<td>□ Other</td>
</tr>
</tbody>
</table>

PART 13 SIGNATURE OF PROFESSIONAL ENGINEER

I, or a civil engineer under my supervision, have visited the site. Actual site conditions as observed were incorporated into this worksheet and the attachments. To the best of my knowledge the information provided here is accurate.

Signed/Date

City of Kent Public Works Department
TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Figure 1, page 2 of 2

City of Kent Surface Water Design Manual
Chapter 5 – Kent Construction Standards

May, 2002
8-B – OFFSITE ANALYSIS DRAINAGE SYSTEM TABLE

<table>
<thead>
<tr>
<th>City of Kent Surface Water Design Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 5 – Kent Construction Standards</td>
</tr>
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</table>

May, 2002

5 R-8
### OFF-SITE ANALYSIS DRAINAGE SYSTEM TABLE

**Surface Water Design Manual, Core Requirement #2**

<table>
<thead>
<tr>
<th>Subbasin Name:</th>
<th>Subbasin Number:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Drainage Component Type, Name, and Size</th>
<th>Drainage Component Description</th>
<th>Slope</th>
<th>Distance from site discharge</th>
<th>Existing Problems</th>
<th>Potential Problems</th>
<th>Observations of field inspector resource reviewer, or resident</th>
</tr>
</thead>
<tbody>
<tr>
<td>see map</td>
<td>Type: sheet flow, swale, stream, channel, pipe, pond, Size: diameter, surface area</td>
<td>drainage basin, vegetation, cover, depth, type of sensitive area, volume</td>
<td>%</td>
<td>1/4 ml = 1,320 ft</td>
<td>constrictions, under capacity, ponding, overtopping, flooding, habitat or organism destruction, scouring, bank sloughing, sedimentation, incision, other erosion</td>
<td>tributary area, likelihood of problem, overflow pathways, potential impacts</td>
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</tbody>
</table>
## OFF-SITE ANALYSIS DRAINAGE SYSTEM TABLE

**Surface Water Design Manual, Core Requirement #2**

### Basin: Crystal Drainage Basin

#### Subbasin Name: Clear Creek

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Drainage Component Type, Name, and Size</th>
<th>Drainage Component Description</th>
<th>Slope</th>
<th>Distance from site discharge</th>
<th>Existing Problems</th>
<th>Potential Problems</th>
<th>Observations of field inspector resource reviewer, or resident</th>
</tr>
</thead>
<tbody>
<tr>
<td>see map</td>
<td>Type: sheet flow, swale, stream, channel, pipe, pond; Size; diameter; surface area</td>
<td>drainage basin, vegetation, cover, depth, type of sensitive area, volume</td>
<td>%</td>
<td>1/4 mi = 1,320 ft</td>
<td>constrictions, under capacity, ponding, overtopping, flooding, habitat or organism destruction, scouring, bank sloughing, sedimentation, incision, other erosion</td>
<td>tributary area, likelihood of problem, overflow pathways, potential impacts</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Site Discharge Location</td>
<td>Crystal Drainage Basin</td>
<td>0'</td>
<td></td>
<td></td>
<td></td>
<td>Swale has capacity, no erosion exists</td>
</tr>
<tr>
<td>A - B</td>
<td>Natural Swale</td>
<td>Natural, dense vegetation</td>
<td>2%</td>
<td>0 - 240'</td>
<td>None</td>
<td>None</td>
<td>No erosion exists</td>
</tr>
<tr>
<td>B - C</td>
<td>12&quot; CMP</td>
<td>Under private drive</td>
<td>3%</td>
<td>240' - 260'</td>
<td>None</td>
<td>Under capacity</td>
<td>No erosion exists</td>
</tr>
<tr>
<td>C - D</td>
<td>Draw</td>
<td>Natural, dense vegetation</td>
<td>8%</td>
<td>260' - 500'</td>
<td>Erosion</td>
<td>Further erosion</td>
<td>Tributary area about 650 - 1900 acres</td>
</tr>
<tr>
<td>D - E</td>
<td>18&quot; CMP</td>
<td>Under 57th Street</td>
<td>6%</td>
<td>500' - 660'</td>
<td>None</td>
<td>Under capacity</td>
<td>Overtopping is unlikely. If culvert were plugged, drainage would flow toward roadside ditch.</td>
</tr>
<tr>
<td>E - F</td>
<td>Seasonal stream</td>
<td>Natural, dense vegetation</td>
<td>5%</td>
<td>660' - 860'</td>
<td>None</td>
<td>None</td>
<td>No erosion exists</td>
</tr>
<tr>
<td>G - H</td>
<td>36&quot; RCP</td>
<td>Under 15th Street</td>
<td>5%</td>
<td>860' - 1010'</td>
<td>None</td>
<td>Under capacity</td>
<td>No erosion exists</td>
</tr>
<tr>
<td>H - I</td>
<td>36&quot; RCP</td>
<td>Under I-22</td>
<td>3%</td>
<td>1010' - 1160'</td>
<td>None</td>
<td>Under capacity</td>
<td>No erosion exists</td>
</tr>
<tr>
<td>I - J</td>
<td>36&quot; RCP</td>
<td>Adjacent to Smith Street</td>
<td>5%</td>
<td>1160' - 1310'</td>
<td>Flooding and Sedimentation</td>
<td>Under capacity</td>
<td>No erosion exists</td>
</tr>
<tr>
<td>J - K</td>
<td>Clear Creek</td>
<td>Type 2 Stream</td>
<td>5%</td>
<td>1310' - 1610'</td>
<td>Erosion</td>
<td>Further erosion</td>
<td>No erosion exists</td>
</tr>
<tr>
<td>K - L</td>
<td>Wetland CL21</td>
<td>Type 2 Wetland</td>
<td>1610' - 1660'</td>
<td>Tributary area 15 sq mi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L - M</td>
<td>Crystal Lake</td>
<td></td>
<td>1660'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Site discharge location for Crystal Drainage Basin
- Subbasin number: AA
- Observations of field inspector, resource reviewer, or resident
- Tributary area, likelihood of problem, overflow pathways, potential impacts
- Swale has capacity, no erosion exists
- No erosion exists
- Tributary area about 650 - 1900 acres
- Overtopping is unlikely. If culvert were plugged, drainage would flow toward roadside ditch.
## STORMWATER FACILITY SUMMARY SHEET

Development __________________________ Date __________________

Location ______________________________

<table>
<thead>
<tr>
<th>ENGINEER</th>
<th>DEVELOPER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Name</td>
</tr>
<tr>
<td>Firm</td>
<td>Firm</td>
</tr>
<tr>
<td>Address</td>
<td>Address</td>
</tr>
<tr>
<td>Phone</td>
<td>Phone</td>
</tr>
</tbody>
</table>

Developed Site: Acres __________ Number of lots __________

Number of detention facilities on site

- _____ ponds
- _____ vaults
- _____ tanks

Number of infiltration facilities on site

- _____ ponds
- _____ vaults
- _____ tanks

Flow control provided in regional facility (give location) ______________________________________

No flow control required ______ Exemption number __________________

### Downstream Drainage Basins

<table>
<thead>
<tr>
<th></th>
<th>Immediate</th>
<th>Major Basin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basin A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basin B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basin C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basin D</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Number & type of water quality facilities on site

- _____ biofiltration swale (regular/wet/ or continuous inflow?)
- _____ combined detention/WQ pond
  (WQ portion basic or large?)
- _____ combined detention/wetvault
- _____ compost filter
- _____ filter strip
- _____ flow dispersion
- _____ farm management plan
- _____ landscape management plan
- _____ oil/water separator (baffle or coalescing plate?)
- _____ catch basin inserts Manufacturer_____________________
- _____ pre-settling pond
- _____ pre-settling structure Manufacturer_________________
- _____ flow-splitter catchbasin

### DESIGN INFORMATION

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Quality design flow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Quality treated volume or wetpond Vr</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>DESIGN INFORMATION, cont'd</td>
<td>TOTAL</td>
<td>INDIVIDUAL BASIN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------</td>
<td>------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drainage basin(s) Onsite area</td>
<td></td>
<td></td>
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<tr>
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<tr>
<td>Offsite area</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Type of Storage Facility</td>
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</tr>
<tr>
<td>Live Storage Volume</td>
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<tr>
<td>Predeveloped Runoff Rate</td>
<td>2-year</td>
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<td>10-year</td>
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<tr>
<td></td>
<td>100-year</td>
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<td>Developed runoff rate</td>
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<td>100-year</td>
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<tr>
<td>Type of restrictor</td>
<td></td>
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<td>Size of office/restiction</td>
<td>No 1</td>
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<td></td>
<td>No 4</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

FLOW CONTROL & WATER QUALITY FACILITY SUMMARY SHEET SKETCH

All detention, infiltration and water quality facilities must include a sketch per the following criteria

1. Heading for the drawings should be located at the top of the sketch (top right-hand corner)
   The heading should contain
   • North arrow (point up or to left)
   • Plat name or short plat number
   • Date drawn (or updated)
   • D9# (nearest)
   • Thomas Brothers page, grid number

2. Label CBs and MHs with the plan and profile designation. Label the control structure in writing or abbreviate with C.S. Indicate which structures provide spill control.

3. Pipes-- indicate
   • Pipe size
   • Pipe length
   • Flow direction
   Use a single heavyweight line.

4. Tanks-- use a double, heavyweight line and indicate size (diameter).

5. Access roads
   • Outline the limits of the road
   • Fill the outline with dots if the road is gravel. Label in writing if another surface.

6. Other Standard Symbols
   • Bollards • • • • • • • • • •
   • Rip rap 000000 000000
   • Ditches -->D-->D-->D-->D

7. Label trash racks in writing.

8. Label all streets with the actual street sign designation. If you don't know the actual street name, consult the plat map.

9. Include easements and lot lines or tract limits when possible.

10. Arrange all the labeling or writing to read from left to right or from bottom to top with reference to a properly oriented heading.

11. Indicate driveways or features that may impact access, maintenance or replacement.

9/1/98

1998 Surface Water Design Manual
REFERENCES

8-D – BOND QUANTITIES WORKSHEET
(CONTACT KENT PUBLIC WORKS)
REFERENCES

8-E – SURFACE WATER AND DRAINAGE FACILITIES CONSTRUCTION BOND
MAIL TO
PROPERTY MANAGEMENT
City of Kent
220 4TH Avenue South
Kent, Washington 98032
Attn ______________________

SURFACE WATER AND DRAINAGE
FACILITIES CONSTRUCTION BOND

STATE OF WASHINGTON ) PROJECT NAME _________________________
 )SS PROJECT NUMBER _________________________
COUNTY OF KING ) KIVA # ____________________________

KNOW ALL MEN BY THESE PRESENTS, that we ________________________, as Principal,
and the _______________________________, a Corporation organized and
existing under and by virtue of the laws of the State of ________________________ and authorized
to transact the business of surety in the State of Washington, as surety, are held and firmly bound
unto the City of Kent, in the penal sum of _________________________ for
payment of which, well and truly to be made, we bind ourselves and each of our heirs, executors,
administrators and assigns, jointly and severally, firmly by these presents

The condition of the foregoing obligation is such that the above described principal is about
to construct ________________________, hereinafter referred to as “Improvements,” that
may cause damage and disruption to certain lands and/or public rights-of-way within the City
limits of Kent and in the County of King in accordance with approved plans on file with the City
of Kent Engineering Department

The principals of this bond agree to the following terms and conditions
1 Said Improvements and their appurtenances thereto shall be constructed in accordance
with the approved plans,
2 Construction shall be completed within ____ days after construction begins unless the
City Engineer, for good cause shown, has granted an extension of time,
3 All construction and restoration shall be in accordance with the City of Kent Standards,
APWA Standards and Surface Water and Drainage Ordinance as set forth by City of Kent
Ordinance Nos 1142, 1672, and 3208 and as may hereafter be amended

4 Traffic control shall be implemented in accordance with the US Department of
Transportation Manual on Uniform Traffic Control Devices as may hereafter be amended as set
forth in Part VI within said manual

The Construction Inspector of the City of Kent shall be given twenty-four (24) hours notice
prior to the commencement of any work
The condition of this obligation is such that if the principal shall construct said improvements in accordance with the terms and conditions set forth herein this obligation shall terminate. Otherwise, it shall remain in full force and effect. This obligation shall be released after final acceptance of the improvements by the City and upon receipt by the City of the required maintenance bond for the one-year maintenance period, otherwise to remain in full force and effect.

Signed, sealed and dated this ______ day of ______________________, 20______.

APPROVED AS TO FORM:

ROGER A. LUBOVICH, CITY ATTORNEY
CITY OF KENT

______________________________
PRINCIPAL

______________________________
ADDRESS

______________________________
PHONE

______________________________
PRESIDENT

______________________________
SECRETARY

______________________________
BONDING COMPANY

*By _______________________

*AUTHORIZATION FOR ATTORNEY-IN-FACT ATTACHED HERETO
AFTER RECORDING MAIL TO:

Property Management
City of Kent
220 4th Avenue South
Kent, WA 98032
Attn:___________

Reference Number of Related Document
Grantor(s):
Grantee(s): City of Kent
Abbreviated Legal Description
Additional Legal Description is on Page(s) ___ of Document
Assessor's Tax Parcel No
Project:

DECLARATION OF STORMWATER FACILITY
MAINTENANCE COVENANT
(INDIVIDUAL)

IN CONSIDERATION OF THE City of Kent ("City") approval for __________________________relating to real property legally described as follows.

the undersigned Grantor(s) declares that the above-described property is subject to a privately maintained stormwater drainage, detention, and/or stormwater treatment system (the, "Stormwater Facilities"), and also covenants and agrees as follows

DUTIES OF GRANTOR(S):

Stormwater covenant
1 Grantor(s) shall regularly inspect and maintain/repair the private Stormwater Facilities on the said-described property in accordance with the standards specified in the City's Construction Standards, specifically including Appendix D ("Maintenance Requirements for Privately Maintained Drainage Facilities"), as now collectively enacted or hereafter amended, which are incorporated by this reference as if fully set forth herein (the "City Construction Standards").

2 Grantor(s) shall inspect the Stormwater Facilities as often as conditions require, but in any event at least once each year. Grantor(s) shall, within four weeks after each inspection, maintain/repair the Stormwater Facilities as required by the City Construction Standards.

3 Grantor(s) shall inspect each element of the Stormwater Facilities whenever the City's Public Works Director ("Director"), in his/her sole discretion, determines that unacceptable conditions exist within or adjoining to the Stormwater Facilities. Similarly, the Director, in his/her sole discretion, may require the Grantor(s) to complete the maintenance/repair of the Stormwater Facilities within a shorter time period than allowed in Section 2, above.

4 Grantor(s), in effecting this maintenance/repair, shall restore the Stormwater Facilities to like new condition, or if that is not practical, to an acceptable condition to the extent listed and/or described in the City Construction Standards.

5 Grantor(s) is hereby required to obtain written approval from the Director prior to grading, filling, piping, cutting or removing vegetation (except for routine and minor landscape maintenance) in open vegetated drainage facilities (such as biofiltration swales, channels, ditches, ponds, etc.) or performing any alterations or modifications to the Stormwater Facilities. Grantor(s) shall obtain all necessary permits and provide all required land surveys as required by the City Construction Standards.

6 Grantor(s) shall assume all responsibility for the implementation and cost of any maintenance and/or repairs to the Stormwater Facilities.

RIGHTS OF THE CITY
1 The City shall have ingress and egress rights to the said-described property for inspection and monitoring of the Stormwater Facilities in order to determine performance, operational flows or defects in the Stormwater Facilities, all in accord with the City Construction Standards.

2 If the City determines that, pursuant to the City Construction Standards, the Stormwater Facilities require maintenance and/or repair work, the Director shall deliver written notice to the Grantor specifically describing the required maintenance and/or repair. The notice shall also set a reasonable time in which Grantor must complete the described work. The notice shall also state that the City or its authorized agent may perform the authorized maintenance and/or repair if the Grantor(s) fails to complete the maintenance and/or repair within the time allowed.

3 If the Grantor(s) does not complete the required maintenance and/or repair within the time allowed as set forth in the Director’s notice, the City of its authorized agent will not commence the maintenance and/or repair work described in the Director’s notice until at least seven (7) calendar days after the expiration of the time allotted to Grantor to make the maintenance and/or repair. However, if the Director determines, at his or her sole discretion, that an imminent danger exists, the City’s obligation to provide written notice shall be deemed waived, and the City or its authorized agent may immediately begin the required maintenance and/or repair work.

4 If the City or its authorized agent performs the required maintenance and/or repairs to the Stormwater Facilities, Grantor(s) shall reimburse the City all its costs incurred in completing the maintenance and/or repairs within thirty (30) calendar days of Grantor’s receipt of the City’s invoice for that work. Overdue payments shall accrue interest at the rate of twelve percent (12%) per annum.

5 If the Director determines, in his/her sole discretion, that the Stormwater Facilities, if originally constructed in accordance with the City’s approve design, need further modifications, Grantor(s) authorizes the City to enter the Stormwater Facilities property in order to make these modifications.
Any notice or consent required to be given or otherwise provided for by the provisions of this agreement shall be effective either upon personal delivery or three (3) calendar days after mailing by Certified Mail, return receipt requested.

This Covenant is intended to protect the value and desirability of the property described above, including the larger parcel(s), if any, benefited by the Stormwater Facilities. Further, this Covenant shall inure to the benefit of all the citizens of the City and shall bind Grantor(s), and its heirs, successors and assigns.

GRANTOR
(Address): ____________________________

(Phone): _____________________________

GRANTOR

STATE OF WASHINGTON

COUNTY OF KING

I, the undersigned, a Notary Public in and for the State of Washington, hereby certify that on this ______ day of ________________________, 20__, personally appeared before me __________________________ and __________________________ to me known to be the individual(s) described in and who executed the foregoing instrument and acknowledged that they signed and sealed the same as their free and voluntary act and deed for the uses and purposes therein mentioned.

Print Name __________________________
Notary Public in and for the State Washington, residing at ____________

My Commission Expires ____________
AFTER RECORDING MAIL TO

Property Management
City of Kent
220 4th Avenue South
Kent, WA 98032
Attention

Reference Number of Related Document
Grantor(s)
Grantee(s) City of Kent
Abbreviated Legal Description
Additional legal Description is on Page(s) ___ of Document
Assessor's Tax Parcel No

Project Name

Easement
Individual

THIS INSTRUMENT made this ___ day of ______ 20___ by and between ___________________________ hereinafter called "Grantor" and CITY OF KENT, a municipal corporation of King County, State of Washington, hereinafter called "Grantee"

WITNESSETH That said Grantor for and in consideration of ___________________________ and/or other valuable consideration receipt of which is hereby acknowledged by said Grantor, do by these presents grant, bargain, sell, convey, and confirm forever unto the said Grantee, its successors and/or assigns, an easement for __________________ with necessary appurtenances, including use of incidental areas immediately adjacent for the installation, operation, maintenance, extending, constructing, altering, reconstructing and repair over, through, across under and upon the following described property situated in King County, Washington, more particularly described as follows

The said Grantee shall have the right without prior institution of suit or proceeding at law, at times as may be necessary, to enter upon said property and immediate adjacent areas with the necessary equipment for the purposes of altering, installation, operation, maintenance, extending, constructing, repair and reconstructing of said __________________ or making any connections therewith without incurring any legal obligation or liability therefore, providing that said altering, installation, operation, maintenance, extending, constructing, repair and reconstructing of said __________________ shall be accomplished in such a manner that the private improvements existing within this easement area including said incidental areas shall not be disturbed or destroyed, or in the event they are disturbed or destroyed, they will be replaced in as good a condition as they
were immediately before the property was entered upon by the Grantee.

The Grantor shall retain the right to use the surface of this easement including said incidental areas so long as said use does not interfere with the uses heretofore defined. Under no circumstances shall any cement concrete or any structures be placed or erected on this easement. This easement shall be a covenant running with the land forever and shall be binding on the Grantor's successors, heirs, and assigns.

Dated this ___ day of ___________ 20__

______________________________
Print Name
Notary Public in and for the State of Washington, residing at ____________________
My Commission Expires ________________
8-H – WATER QUALITY MEMORANDUM
DESIGNATION OF WATER BODIES
IN THE CITY OF KENT WITH
RESPECT TO STORMWATER
TREATMENT

Prepared for Entranco Engineers
Under contract with the City of Kent
to update the City’s Stormwater Manual

Prepared by
Gary R. Minton, PhD, PE
Resource Planning Associates
Seattle, Washington

September 28, 2000
The City of Kent intends to adopt the King County surface water design manual. With respect to stormwater treatment, the County manual identifies four levels of treatment: "basic," "biologically significant (sensitive) streams," "sensitive lakes," and "sphagnum bogs." For each treatment level, there is a menu of treatment options. "Basic" is the lowest treatment level, roughly corresponding to the treatment efficiency achieved by the BMPs identified in the Department of Ecology's 1992 stormwater manual. "Basic" is applied to any water body unless it has been specifically designated into one of the other three groupings. The County's current designation is presented in a fold-out plate contained within its manual.

The question for the City of Kent is how shall it designate its surface water bodies, which in turn determines the treatment level. Which lakes, if any, should be classified as "sensitive"? Which streams, if any, should be classified as "biological significant"? The City has no sphagnum bogs and therefore that grouping is not considered here.

Designation of particular receiving waters for higher levels of treatment should be based on the consideration of several factors. Amongst these are:

- How King County designated its water bodies
- City ordinances, policies and broad community objectives with respect to water quality and aquatic health
- Existing management plans for specific water bodies
- Water quality data
- 303d listing of the Department of Ecology
- Ecology's updated manual, Final Draft
- Fisheries and aquatic habitat data
- The effectiveness of "basic" treatment systems to protect the City's creeks and lakes

**KING COUNTY DESIGNATION PROCESS**

**Streams:** The County developed a procedure to identify regionally and locally significant resource areas. Three criteria were used for regionally significant streams:

1. "Watershed functions are not appreciably altered from predevelopment conditions",
2. The diversity and abundance of aquatic and associated terrestrial habitats are of consistently high quality and are dispersed throughout the system, and,
3. Freshwater life, particularly salmonids, approach or exceed the abundance and diversity of equivalent undisturbed systems and make a significant contribution to the regional fishery resource of Puget Sound"

Three criteria were used for locally significant streams:

1. "Watershed functions have been altered (but conditions) are adequate for spawning and rearing of salmonids, and these functions include migration corridors connected to regional significant streams",
2. The diversity and abundance of aquatic and associated riparian habitats are good but not exceptional, and,
3. Freshwater life, particularly salmonids, are supported at one more species and life stages at population levels that are low but sustainable"
Concerning creeks within watersheds relevant to the City, the County designated Covington and Jenkens Creeks as regionally significant. It did not identify any streams as locally significant suggesting that the criteria of Booth et al. was not used at least for this category. The above criteria are considered later in this memorandum when reviewing the available data on fish habitat in the City. It is of interest to note that existing water quality did not factor into the County's designations.

**Lakes:** The procedure followed by King County for the designation of lakes has three criteria:

1. Trophic Status Index (TSI),
2. Resource value, which relates to public access and wetland resource information;
3. Land use, expressed as percent of the watershed that is forested now and in the future.

The evaluation paper considered 40 lakes, including Lake Meridian but not Lake Fenwick. The 40 lakes were scored 3, 2, 1, and 0, representing the highest score with respect to potential sensitivity. In its manual King County identifies three "sensitive" lakes - Cottage, Beaver, and Desire. These designations apparently did not flow from the procedures paper. Although Beaver and Desire received scores of 3, Cottage received a score of only 2 yet was designated "sensitive." Further, several other lakes with scores of 3 were not designated "sensitive." Lake Meridian was given a score of 2.

**CITY ORDINANCES, POLICIES**

City Ordinance 7 05 140 requires that storm water containing pollutants discharges have a permit. The ordinance states that determination of whether pollutants will be present in the stormwater is to be determined by the public works director using a variety of sources of information including the water quality standards for the State (Chapter 173-201 WAC). However, the ordinance does not specify whether the pollutants are to be decreased, or controlled or mitigated in any manner.

The City's comprehensive plan (1995) notes that in 1985 the City in conjunction with the establishment of the stormwater utility adopted the following water quality goal: "Reduce the environmentally detrimental effects of present and future runoff in order to maintain or improve stream habitat wetlands, particularly water quality, and protected water-related uses."

The comprehensive plan (1995) established Goal LU-23, entitled "Protect and enhance water resources for multiple benefits, including recreation, fish and wildlife resources and habitat, flood protection, water supply, and open space." Sub-policies LU-23.1 and LU-23.2 speak to protecting wetlands. Sub-policy LU-23.4 states that the City shall "Maintain rivers and major and minor streams in their natural state." To implement this sub-policy requires that stormwater discharges be treated to a high level.

**EXISTING WATERSHED OR BASIN PLANS**

There are two significant lakes in the City. Fenwick and Meridian. Lake Fenwick has a lake management plan. The plan does not call for inordinately high (more than "basic") levels of treatment in new developments. Further, the watershed is essentially developed. Hence, requiring higher levels of treatment for any new developments would not be of any use. In light of the management program underway for Lake Fenwick, it should not receive special designation at this time. It is possible in the future that the City might conclude that the management plan needs to be revisited. If that occurs, special designation could be considered at that time. There is no management plan for Lake Meridian because water quality has not been a problem.
WATER QUALITY DATA

Lakes: Given the above conclusion concerning Lake Fenwick, only Lake Meridian is left for consideration. Like Lake Fenwick, the watershed of Lake Meridian is essentially developed. Only about 15% of the watershed is available for development. Recent data indicate that the trophic state of Lake Meridian continues to be in the oligotrophic-mesotrophic stage. In recent years water quality has improved. Average summer total phosphorus concentrations have decreased from about 18 ug/L in 1994 to about 9 ug/L in 1998. The dominant alga has been the blue-green Anabaena. Nonetheless, it is unlikely that development of the remaining 15% of the watershed will have a noticeable impact on the water quality of the lake. Hence, Lake Meridian should not be designated "sensitive."

Streams: The relevant data are of samples taken from creeks during storms. The City recently sampled two storms at 15 stations. While there are many pollutants in stormwater that are potentially toxic, the constituents of particular concern to fish are the metals. Stations where the metals standards were exceeded in either storm are summarized below.

Storm 1. Chronic standard for copper exceeded in upper Meridian Valley Creek.
Chronic standard for mercury exceeded in one of three stations in Big Soos Creek, two of three stations in McSorley Creek, and at the mouths of Mullen Slough and Mill Creek-Auburn.
Acute and chronic criteria for zinc exceeded one of three stations in McSorley Creek.

Storm 2. Neither zinc or copper standards exceeded at any station. Mercury was not analyzed.

Metals standards depend on water hardness. The higher the hardness, the higher the numeric standard. The City’s data indicate that the hardness is highly variable, ranging from 19 to 94 between the stations over the two storms. An examination of the data for dissolved zinc indicate a weak inverse relationship to hardness. That is, the higher the hardness the lower the concentration of dissolved zinc. This likely reflects the differences in the proportions of stormwater and base stream flow at each station during each storm. The hardness of stormwater tends to be significantly lower than base stream flows. Hence, the greater the storm, the lower the hardness in the stream during the storm because the majority of the flow in the stream is of storm runoff. This analysis suggests that during large storms, particularly during the early period of each storm when concentrations tend to be highest, that the metals standards are most likely to be exceeded.

It is also important to note that the City’s data are event mean concentrations (EMC), composites of several individual samples taken over several hours. However, the acute standard is the average concentration during any one hour period. Consequently, it is possible that the acute standard was exceeded at other stations than those listed above. Taking this into consideration, assume that peak metals concentrations were double the observed EMC. If this were the case, the following exceedances for copper and zinc may have occurred.

Storm 1: Acute standard for copper exceeded in upper Meridian Valley Creek.
Acute standard for zinc exceeded at one of three stations in Meridian Valley Creek.

Storm 2: Neither zinc or copper standards exceeded at any station.
The above analysis indicates that doubling the observed concentrations has a minor effect. Stated differently, with the exceptions noted the EMCs were considerably below the standard. The chronic standard is not considered as it is the average concentration over a four day period.

It is of interest to note that the concentrations in Springbrook Creek, below its confluence with Mill Creek, were not notably high relative to the standards. Mill Creek is on the Department of Ecology 303d (see below) list for metals. Samples were not taken in Mill Creek.

The above analysis leads to the conclusion that there is too little data to base a decision on designation. It is important to understand that with regard to metals standards, an exceedance is allowed only once over a three year period. Approximately 150 storm runoff events occur over a three year period. Failing to meet the standard of only one metal during only one of 150 events constitutes a violation.

303D LISTING OF THE DEPARTMENT OF ECOLOGY

A water body lake that receives 303d designation means that water quality standards are not being met for the particular water quality parameters listed for the particular water body. Creeks within the City that have received this designation are segments of Soos Creek and its tributaries, and Mill Creek. Parameters specified for the specified segments of the Soos Creek system include dissolved oxygen, fecal coliform, and temperature. Meridian Valley Creek, a tributary of the Soos, is not a designated segment. The parameters specified for Mill Creek are dissolved oxygen, fecal coliform, temperature, dissolved chromium, dissolved copper, total mercury, and dissolved zinc.

Stormwater treatment systems are generally ineffective in reliably reducing fecal coliform in stormwater and have little relevance to temperature. They do remove organic matter which affects dissolved oxygen in streams, and metals. However, temperature and dissolved oxygen problems in Mill and Soos Creek likely occur during dry-weather and in the summer months, and have no relationship to storm events.

Based on its 303d listing Mill Creek should be designated “sensitive” with particular attention to the control of dissolved metals. Irrespective of the City’s designation for Mill Creek, only treatment technologies capable of removing dissolved metals should be allowed. For example, a wet vault should not be acceptable method of treatment. As metals are not specified for Soos Creek, its tributaries within the City (Soosette Creek and Big Soos) should not be designated “sensitive” based on the 303d list.

Despite the fact that the water quality of Lake Meridian appears to be acceptable (identified as oligotrophic-mesotrophic), the lake is designated on Ecology’s 303d list. It is listed for fecal coliform and total phosphorus. However, as previously noted little of the watershed remains undeveloped. Hence, requiring higher levels of phosphorus removal by new developments will be of little benefit. If it is the view of the City that listing by the Department of Ecology is valid then the City should proceed to develop a management plan. If however the City believes the listing is not valid, it is recommended that the City seek de-listing.

DEPARTMENT OF ECOLOGY’S NEW STORMWATER MANUAL

Ecology just recently published the Final Draft of its new manual[12]. The final manual is to be adopted by the end of the year. Ecology has defined two levels of treatment: basic and enhanced. Basic treatment represents AKART and includes those treatment systems and sizes described in
Ecology’s 1992 manual\(^2\) With respect to enhanced treatment, Ecology has generally followed the concept originally developed by King County. However, Ecology has included two unique concepts with respect to streams. First, Ecology identifies enhanced treatment as the removal of dissolved metals (King County focuses on total metals, represented by zinc). Secondly, Ecology has specified that enhanced treatment shall be used for all discharges that enter “fish bearing streams” or “streams that flow to fish bearing streams.” Whether this concept will remain in the final manual is not known. However, to follow Ecology’s lead would mean that enhanced treatment would be required of all discharges entering all of the City’s streams.

**FISHERIES AND AQUATIC HABITAT DATA**

Data are synthesized from several sources. The City’s creeks have recently been scored\(^4\) with respect to two habitat indices: the B-IBI, index of biological integrity, and the RBI, rapid bioassessment of habitat. The former is based on invertebrates, the latter is based on several habitat metrics. Rating ranges for each creek are summarized in Table 1. For the B-IBI, above 40 is considered “excellent,” 30 to 40 is considered “good,” 20 to 30 is considered “fair,” and less than 20 is considered “poor.”

Following the criteria used by King County, the data in Table 1 suggest Big Soos could be classified as “locally significant.”

**TABLE 1 HABITAT DATA SUMMARY**

<table>
<thead>
<tr>
<th>CREEK</th>
<th>B-IBI</th>
<th>RBI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mill</td>
<td>14 - 20</td>
<td>58 to 139</td>
</tr>
<tr>
<td>Springbrook</td>
<td>18</td>
<td>116</td>
</tr>
<tr>
<td>Garrison</td>
<td>14 - 20</td>
<td>120 to 150</td>
</tr>
<tr>
<td>Soosette</td>
<td>16 to 22</td>
<td>59 to 132</td>
</tr>
<tr>
<td>Meridian Valley</td>
<td>18 to 22</td>
<td>97 to 131</td>
</tr>
<tr>
<td>Big Soos</td>
<td>26 to 32</td>
<td>148 to 170</td>
</tr>
<tr>
<td>McSorley</td>
<td>20 to 22</td>
<td>114 to 151</td>
</tr>
</tbody>
</table>

Three studies have examined fish habitat conditions\(^9\)\(^,\)\(^10\)\(^,\)\(^11\). Harza (1999) rated various stream segments and identified potential limiting factors. The ratings are summarized in Table 2.

**TABLE 2 SUMMARY OF CREEK RATING CONCLUSIONS**

<table>
<thead>
<tr>
<th>CREEK</th>
<th>RATING</th>
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<tbody>
<tr>
<td>Big Soos</td>
<td>Good</td>
</tr>
<tr>
<td>Midway</td>
<td>Poor to good depending on reach</td>
</tr>
<tr>
<td>Mill mouth-Auburn</td>
<td>Good</td>
</tr>
<tr>
<td>Mullen Slough</td>
<td>Good</td>
</tr>
<tr>
<td>Soosette</td>
<td>Poor to excellent depending on reach</td>
</tr>
<tr>
<td>Meridian Valley</td>
<td>Poor to excellent depending on reach</td>
</tr>
<tr>
<td>Clark lake outlet</td>
<td>Poor</td>
</tr>
</tbody>
</table>
The 1999 study did not include the Springbrook-Mill-Garrison system as it had been examined in the 1996 study. However, the 1996 study did not include ratings. The 1996 study did observe that coho were found most frequently in the upper reaches and not on the valley floor.

The above information appears to be too limited to draw firm conclusions concerning designation. Since portions of the Soosette and Meridian Valley Creeks are rated “excellent,” perhaps special protection should be applied to the entirety of each creek. It makes little sense to apply the designation to only a portion of each creek.

THE EFFECTIVENESS OF “BASIC” TREATMENT SYSTEMS

Since King County initially identified its menus of advanced treatment for streams and lakes (about 1995) there have been additional data generated on the performance of certain treatment systems. It is reasonable to ask whether in fact some if not all of the “basic” treatment systems provide adequate protection even for streams like Mill Creek.

The question is whether “basic” treatment is insufficient to protect streams in those watersheds within City where all land within each watershed will be essentially 100% developed. In this case, the assumption is that if the effluent from a “basic” treatment system does not meet receiving water standards, that there likely will be receiving water violations. This is because almost all of the stream flow during a storm in heavily developed watersheds will be runoff from the developed lands.

To address this question, performance data were compiled of individual treatment systems that have been studied in the Pacific Northwest. PNW data are available from only eight facilities: three grass swales, two wet ponds, and three sand filters. However, the sizes of the two ponds do not fit either current King County or Ecology criteria. One pond is very small and one is very large, about 7% and 150% of the King County “basic” facility, respectively. The large pond is in essence an “enlarged” pond according to King County criteria. There are no PNW data for constructed wetlands. Wet vaults are not considered as they do not remove dissolved metals and therefore should not be allowed as stand-alone treatment systems.

Copper and zinc are used to assess the effectiveness of “basic” treatment systems with respect to streams. Receiving water standards are based on the dissolved fraction. Unfortunately, for the eight research facilities identified above, influent and effluent samples were evaluated for dissolved metals for only the swales and one of the sand filters.

Presented in Figure 1 is a plot of the zinc data for individual storms for the three swales and two of the three sand filters. Data are not included for one of the filters (the Lakemont filter) because the report does not present data for individual storms. For the three swales, Figure 1 presents data for dissolved zinc. However, only total zinc is available for the two remaining sand filters (only the Lakemont study analyzed dissolved). Therefore, these data were multiplied by 0.5, assuming that 50% of the total zinc was in the dissolved form. This is a reasonable assumption on average the dissolved fraction is about 50% of the total although it can range from 20% to 80% for individual storms. Sand filters are able to remove dissolved zinc.

The standard for dissolved metals depends upon the hardness rising with increasing hardness. However, only Koon measured hardness. It was found to vary from 18 to 50 with an average of about 25. The acute standard for zinc at a hardness of 25 is 0.032 mg/L. Within the hardness range of 15 to 50, the acute standard for zinc ranges from 0.021 to 0.058 mg/L (the chronic standard is about 90% of the acute).
A similar graph was prepared for copper. Figure 2. The acute standard for copper at a hardness of 25 is 0.0038 mg/L. Within the hardness range of 15 to 50, the acute standard ranges from 0.0032 to 0.008 mg/L (the chronic standard is about 70% of the acute).

A comparison of the standards for each metal to the performances represented in Figures 1 and 2 leads to the following observations:

1. For most of the storms sampled in the swale studies, the influent concentrations of zinc and copper were less than their respective standards. It is possible that this is also the case for the sand filters if it were assumed that the dissolved/total ratio was about 0.25 rather than 0.50. But the low ratio is unlikely. But it does suggest that metals concentrations from residential properties may be generally less than the standard. All three swales were located in residential developments.

2. Where the influent concentrations of zinc or copper exceeded their respective standards, grass swales are not able to meet either standard. Of 20 storms sampled, the removal efficiency was zero or negative in eight events for both metals. Sand filters appear to be more effective and reliable than swales. However, even sand filters may not be able to reduce zinc below the standard when the hardness is less than about 20 and the influent concentration is above about 0.2 mg/L. Swales probably cannot reduce the copper concentration to below the standard irrespective of the hardness or influent concentration.

3. King County has identified a performance goal of removing 50% by “enhanced” treatment systems. Grass swales are not able to meet the 50% performance goal for either copper or zinc. However, the “basic” sand filter appears able to remove 50%, meaning a sand filter provides “enhanced” treatment.

The findings of the study of the Lakemont sand filter are consistent with the above observations. A range of concentrations was given in the report of the filter which serves a residential area. Influent values for dissolved zinc ranged from 0.0016 to 0.016 mg/L, effluent concentrations ranged from 0.0006 to 0.0014 mg/L. However, it appears likely that the influent concentration never rose above the standard. Dissolved copper was also reduced; influent values ranged from 0.0013 to 0.0068 mg/L, effluent concentrations ranged from 0.0008 to 0.0013 mg/L. It is likely that the influent concentration for dissolved copper did at times exceed the standard.

SUMMARY

The following streams could be considered for special designation:

- Mill Creek: justification, placement on the 303d list
- Soosette Creek: justification, value of current fishery
- Meridian Valley Creek: justification, value of current fishery
- Big Soos: value of habitat (B-IBI and RBP)

It is possible that upper Garrison Creek should be designated “sensitive” based on the RBP score.

Alternatively, it could be decided that “enhanced” treatment will be used throughout the City. The logic of this decision is that “basic” treatment is likely insufficient to meet water quality standards in those watersheds that are currently or in the future will be heavily developed. Also, the City is attempting to maintain the current relatively healthy fishery, e.g., Soosette Creek. Requiring enhanced treatment throughout the City is consistent with the new manual of the Department of Ecology that calls for such treatment for all “fish-bearing streams.”
Irrespective of the designation, only systems capable of reliably removing dissolved metals should be allowed. This precludes the following stand-alone systems listed in the King County manual: biofiltration swales, filter strips, and wet vaults. The restriction also prevents the use of several proprietary, prefabricated devices as stand-alone systems: Stormceptor, Vortechs, V2B1, Downstream Defender, CDS, and BaySaver. These systems can be used as pretreatment units.

The City should consider the inclusion of two proprietary, prefabricated devices: StormFilter and StormTreat. Both are capable of removing dissolved metals. However, performance data are very limited on both systems. Neither have sufficient data to meet the Puget Sound protocol. Therefore, their inclusion could be considered provisional until the protocol is met. Or they need not be included in the manual, but allowed in a few sites on the condition that data are collected.

REFERENCES

1. King County, 1998, Surface Water Design Manual
2. Ecology (Department of), 1992, Stormwater Manual for the Puget Sound Watershed
3. Booth, D et al, undated, Regionally and Locally Significant Resource Areas, King County, provided by Louise Kulzer of King County
4. Walton, S and T Bennett, December 1994, Development of a Lake Protection Standard Listing (Draft), King County, provided by Louise Kulzer of King County
5. Richard Chase, personal communication
6. King County, 1999, Lake Monitoring Report
7. Data provided by Richard Chase
10. Harza Engineers, 1996, Meridian Annex Area, Fish Habitat and Fish Population Survey, prepared for the City of Kent
11. Harza Engineers, 1995, Final Report, Comprehensive Fisheries Assessment of the Mill Creek, Garrison Creek, and Springbrook Creek System, prepared for the City of Kent
12. Ecology (Department of), August, 2000, Stormwater Management in Washington State (Final Draft)
Figure 1 Zinc Removal
PNW data - 3 swales, 2 sand filters

Figure 2 Copper Removal
PNW data - 3 swales 2 filters
8-I – ADJUSTMENT APPLICATION FORM AND PROCESS GUIDELINES
SURFACE WATER DESIGN MANUAL
REQUIREMENTS / STANDARDS
ADJUSTMENT REQUEST

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<th>Engineer/Planner Name</th>
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INSTRUCTIONS TO APPLICANT/DESIGN ENGINEER:
Please be sure to include all plans, sketches, photos, and maps which may assist in complete review and consideration of this adjustment request. Failure to provide all pertinent information may result in delayed processing or denial of your request. Please submit this request and all applicable fee.

REFER TO SECTION 1.4 IN CHAPTER 1 OF THE SURFACE WATER DESIGN MANUAL FOR ADJUSTMENTS

DESCRIPTION OF ADJUSTMENT REQUEST
- Standard
- Complex
- Experimental
- Blanket
- Pre-application

APPLICABLE SECTION(S) OF STANDARDS

JUSTIFICATION (see attachments, pages ____ to ____)

AUTHORIZATION SIGNATURES

Director/Designee Determination:
- Approval
- Conditional Approval (see below)
- Denial

Approval Signed __________________________ Date __________ (Experimental & Blanket adjustments only)

CONDITIONS OF APPROVAL
- See attached memo dated __________________________

Engineering Review Supervisor

Signed | Date
---|---
| |
REFERENCE 8-J

ADJUSTMENT PROCESS GUIDELINES

1.0 PREAPPLICATION ADJUSTMENT PROCESS

This process is used when the applicant needs an adjustment decision to determine if a project is feasible or the results are needed to determine if a project is viable before funding a full application. Preapplication adjustment requests will be accepted when 1) an issue is raised or a potential constraint is identified at a preapplication conference with DDES, and 2) sufficient engineering information to evaluate the request is provided. A higher preapplication adjustment fee will apply to these requests, and any unused adjustment fee will be credited towards the permit application fee.

Steps in the processing of a preapplication adjustment shall include:

- A DDES preapplication conference is scheduled at which the applicant provides justification that a decision on the adjustment will effect viability of the project. An example could include a need to divert flows due to a downstream problem.

- King County may request additional information and site visits due to the limited data and lack of prior project review.

- A preapplication deposit is required and fee for review will be an hourly rate billing applied against the deposit. Any unused fees could be returned to the applicant. Any fees in excess of the deposit must be paid prior to the issuance of a decision.

- For approved preapplication adjustment, the applicant can apply that approval to the applied for permit proposal provided conditions of the approval are met, the proposal has not substantially changed and the applicable regulations have not changed. This will be determined by DDES.

The criteria for granting a preapplication adjustment are the same as for a Standard or Complex adjustment. However, preapplication adjustments will be tied by condition to the project proposal resented at the preapplication meeting. The appeal process is also the same as for a Standard adjustment or a Complex adjustment. This approval will expire 1 year after the approval date, unless a complete permit application is submitted and accepted.
3.0 FEE REDUCTION

This process is used for adjustments that are determined to meet either of the conditions A or B identified below. The DDES Director or designee shall be responsible for making the determination for a fee reduction.

A  Minor adjustment requests that are defined as issues requiring no engineering review to determine appropriateness. These include:

- New or revised standard specifications for engineering and construction which are cited in the Manual (e.g., APWA standard specifications for public works construction, WSDOT standard specifications),
- Minor design alternatives that meet the stated intent in the Manual,
- Identified errors in the Manual.

B  Blanket Adjustments (See Reference Section 10-A Blanket Adjustments, for approved Blanket Adjustments).
DEDICATION

Know all people by these presents that we, the undersigned owners of interest in the land hereby subdivided, hereby declare this plat to be the graphic representation of the subdivision made hereby, and do hereby dedicate to the use of the public forever all streets and avenues not shown as private hereon and dedicate the use thereof for all public purposes not inconsistent with the use thereof for public highway purposes. Also the right to make all necessary slopes for cuts and fills upon the lots shown thereon in the original reasonable grading of said streets and avenues, and further, the undersigned owners of the land hereby subdivided, waive for themselves, their heirs and assigns and any person or entity deriving title from the undersigned, any and all claims for damages against the City of Kent, its successors and assigns which may be occasioned by the establishment, construction, or maintenance of roads and/or drainage systems within this subdivision. Also tract(s) " (and) " is hereby dedicated to the use of the public forever for any and all public purposes. This subdivision, dedication, waiver of claims and agreement to hold harmless is made with the free consent and in accordance with the desires of the said owners. Also the specific conditions and/or agreements that are conditions of this plat are made a part hereto and the owners and their assigns do hereby agree to and/or comply with all these conditions.

IN WITNESS WHEREOF we set our hands and seals.