PACIFIC COUNTY, WASHINGTON
FLOOD CONTROL ZONE DISTRICT NO. 1

LAND ALTERATION STANDARDS

PACIFIC COUNTY
DEPARTMENT OF PUBLIC WORKS

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SECTION 1 INTRODUCTION

1.1 PURPOSE , POLICIES AND GOALS

1.1.1 Purpose

The Pacific County Flood Control Zone District No. 1 (hereinafter referred to as the "District") Land Alteration Standards (hereinafter referred to as the "Standards") establish policies, minimum requirements, minimum design standards, and procedures for the analysis, design, construction of land alteration activities shall be in accordance with these Standards, including any amendments thereto. It is the express purpose of these Standards that land alteration be conducted in a manner which provides for and promotes the health, safety, and welfare of the general public.

1.1.2 Policies and Goals

The policies and goals directing land development related to land alteration and drainage are contained in District Ordinance No. 1. The provisions of these Standards are intended to carry out those policies.

The policies include:

1. Potential dangers or public costs associated with inappropriate land development and improper control of surface water runoff from such development shall be minimized by reasonable regulation of said land development. Reasonable regulation shall be achieved by balancing of individual and collective interests.

2. Land alteration and development activities shall make provision for surface water and erosion control.

3. Drainage features should be maintained and enhanced to protect water quality, reduce public costs, and prevent environmental degradation. Public improvements and private development should not alter drainage systems without acceptable mitigating measures which eliminate risk of flooding or negative impacts to water quality.

4. The natural flood storage function of floodplains shall be preserved. Natural flood water storage sites that help regulate stream flows and/or recharge groundwater should be preserved and their water quality protected. Floodplains shall be protected by locating roads and structures above the 100-year flood elevation. Existing flood storage lost to land alteration and development shall be replaced using acceptable mitigating measures.

5. Land alteration and development should not increase peak surface water runoff. In frequently flooded areas, land alteration and development should not increase total runoff quantity.

6. Water quality, natural drainage, and shellfish, fish and wildlife habitat of rivers, streams, channels, lakes, and Willapa Bay shall be protected.

The goals are:

1. To protect human life, health and property;

2. To encourage growth and development patterns compatible with natural and constructed drainage features;

3. To minimize water pollution, flooding, and habitat damage resulting from increases in surface water runoff and soil erosion;

4. To minimize expenditure of public money on flood control improvements and operation and maintenance of flood control facilities of the District;

5. To minimize prolonged business interruptions due to flooding;

6. To minimize damage to public facilities and utilities due to flooding; and

7. To provide for the sound use, development, and protection of areas of special flood hazard.

1.2 INTENT OF THESE STANDARDS

These Standards are intended to represent the minimum design standards for land alteration. Special conditions and/or environmental constraints may require more stringent design than would normally be required under these Standards. Compliance with these standards does not relieve the proponent of the responsibility to apply sound professional judgment to protect the health, safety, and welfare of the general public.

It is not the intent of the District to limit unreasonably any innovative or creative effort which could result in a superior result based upon the performance criteria of safety, economical maintenance, and pleasant appearance. Proposed departures from the Standards shall be reviewed in a formal variance process as defined in District Land Alteration and Drainage Ordinance No. 1.

1.3 DESIGN STANDARDS

The following design standards are referenced within this Standard. The referenced sections of said standards shall have full force and effect as if set forth fully herein. In the case of conflict with this Standard, the more stringent or restrictive requirement shall apply.

Surface Water Design Manual, King County Department of Public Works - Division of Surface Water Management, January 1990, Revised November 1994.

Stormwater Management Manual for the Puget Sound Basin, Washington State Department of Ecology, current edition.

1.4 STANDARD PLANS AND STANDARD SPECIFICATIONS

Except where these Standards provide otherwise, design detail, workmanship and materials shall be in accordance with:

Current edition of the "Standard Specifications for Road, Bridge, and Municipal Construction" prepared by the Washington State Chapter of the American Public Works Association (APWA) and the Washington State Department of Transportation (WSDOT), hereinafter referred to as the "Standard Specifications"; and

Current edition of the "Standard Plans for Road and Bridge Construction" prepared by the Washington State Chapter of the American Public Works Association (APWA) and the Washington State Department of Transportation (WSDOT), hereinafter referred to as the "Standard Plans".

1.5 DEFINITIONS

Unless the context specifically indicates otherwise, the meaning of terms used in these Standards shall be as defined in the District Land Alteration and Drainage Ordinance No. 1. For convenience, these definitions are included in the glossary of these Standards. Where conflicts occur between the definitions presented in the glossary and those presented in Ordinance No. 1, those of Ordinance No. 1 shall apply.

1.6 OTHER APPLICABLE LAWS

Development activities covered under this Ordinance may also be subject to other regulations, permit authority review, and approvals. Requirements of this Ordinance or any permit granted pursuant to this Ordinance shall not remove a person's obligation with respect to the applicable provisions or any other Federal, State, or local law or regulation, including, but not limited to, the acquisition of any other required permit or approval.

In the event that federal, state, or other applicable laws impose a standard or regulation that is in conflict with any provision of this Ordinance or any standard or regulation that the District may adopt pursuant to this Ordinance, the most restrictive standard shall prevail.

Other agencies such as those listed in Table 1 may require review for a project's impact. Such other agency requirements are separate from, and in addition to, the District's requirements. The proponent shall coordinate joint agency review, including resolution of any conflicting requirements between agencies.

TABLE 1
OTHER PERMITS AND APPROVALS

Agency	Permit/Approval
Department of Ecology	Short Term Water Quality Modification Approval
Department of Fisheries & Wildlife	Hydraulic Project Approval
Department of Ecology	Dam Safety Permit
Department of Ecology	NPDES Permit
Army Corps of Engineers	Section 10 Permit
Army Corps of Engineers	Section 404 Permit

1.7 PACIFIC COUNTY ORDINANCES, PLANS, AND POLICIES

This Ordinance and any administrative policies or standards developed to effectuate this Ordinance, are intended to be consistent with the most currently adopted provisions of:

1. District Ordinances, and more specifically the following:

Ordinance No. 2	Civil Infractions
Ordinance No. 3	Procedures for Processing Land Alteration and Drainage Permit Applications

2. Pacific County Ordinances, and more specifically the following:

Ordinance No. 2	Highway, Right of Way Use (Road Standards)
Ordinance No. 31	Subdivisions
Ordinance No. 34	Buildings
Ordinance No. 48	Short Subdivisions
Ordinance No. 95	Zoning
Ordinance No. 116A	Flood Damage Prevention
Ordinance No. 119	Mobile Home
Ordinance No. 121	Environmental Policy
Ordinance No. 147	Critical Areas and Resource Lands

3. Comprehensive Flood Hazard Management Plans of the District

4. Pacific County Shoreline Master Program

SECTION 2 SUMMARY OF REQUIREMENTS

2.1 PERMIT REQUIRED

A Land Alteration Permit is required prior to initiating any activity not exempted by Section 3.2 of District Land Alteration and Drainage Ordinance No. 1. No land alteration as defined by this Ordinance shall occur in the absence of express approval by the Administrator. Any land alteration shall occur only through the issuance of a development permit. The proponent shall submit a Land Alteration Permit Application on forms provided by the Department of Community Development. Other permits, approvals, or agreements may also be required by the District or other jurisdictions.

2.2 NATURAL DRAINAGE FEATURES

Natural drainage features including, but not limited to, wetlands, lakes, swamps, creeks, swales, gullies, and canyons shall be left in the natural state and shall not be filled or altered in any way.

2.3 FREQUENTLY FLOODED AREAS AND CRITICAL AREAS

Land alteration within Frequently Flooded Areas and which: (1) eliminates existing flood storage; or (2) increases peak surface water runoff; or (3) increases total runoff quantity, shall be prohibited unless certification by a Qualified Professional is provided demonstrating to the satisfaction of the Administrator that proposed land alteration or encroachment, including any proposed mitigation, will not result in any increase in flood levels during the occurrence of the 100-year flood discharge. Land alteration in or adjacent to other critical areas shall be as required by the Pacific County Critical Areas and Resource Lands Ordinance.

2.4 SEASONAL/WEATHER LIMITS

Land alteration activities may be suspended by the Administrator due to actual or anticipated adverse weather conditions which may exacerbate impacts of the alteration. When so suspended, operations shall not be resumed until the Administrator determines that temporary erosion/sedimentation control facilities are operating satisfactorily.

2.5 PRESERVATION OF EXISTING VEGETATION

Existing vegetation shall be preserved during land alteration to the greatest extent practicable in order to control erosion and to preserve an area's character and quality of the environment.

Site design shall maximize the preservation of:

1. Healthy trees which can remain healthy in the (proposed) surrounding environment;

2. The overstory (vegetation over ten feet in height), particularly where it forms a continuous canopy;

3. All vegetation, particularly the brush (vegetation from one to four feet in height), understory (vegetation four feet to ten feet in height), and overstory, within any erosion prone area;

4. Vegetation on the site perimeter which may serve as a screen to or from adjoining property or roadways;

5. Vegetation in required buffer zones for streams, wetlands and floodplains or other protected areas as defined in the Pacific County Critical Areas and Resource Lands Ordinance No. 147;

6. Vegetation which functions as a medium for filtration of sheet flow runoff or has other water quality control functions; and

7. No disturbance, fill or excavation shall be allowed within ten trunk diameters of the trunk of any tree to be preserved or retained. Trunk diameter shall be measured at four feet above existing grade.

2.6 TEMPORARY EROSION/SEDIMENTATION CONTROL

Temporary erosion/sedimentation control shall be provided for all land alteration in accordance with the District Surface Water Control Standards. Off-site water quality standards shall be maintained at all times during land alteration activities.

2.7 DRAINAGE REVIEW AND SURFACE WATER CONTROL

Drainage review may be required for certain land alteration activities as defined in Section 7.3 of the Land Alteration and Drainage Ordinance No. 1. Surface water control shall be in accordance with the District Surface Water and Erosion Control Standards.

2.8 EARTH FILLS

2.8.1 Preparation

Vegetation, non-complying fill, and other unsuitable materials encountered in the permitted area of work as determined by the Qualified Geotechnical Professional shall be removed. Except for fill operations occurring on peat or other soil types where the Qualified Geotechnical Professional recommends non-disturbance, the surface shall be plowed or scarified to a depth of at least six inches and until the surface is free from ruts and hummocks.

2.8.2 Types of Fill

Fill shall conform to the requirements listed below for structural fill and common fill.

2.8.2.1 Structural Fill

Structural fill is fill material placed with care and skill with the intent to support structures without settlement or failures. Structural fill shall consist of material selected by the proponent's Qualified Geotechnical Professional. The material shall be free from organic matter and other deleterious substances. It shall not contain rocks or similar irreducible material having a dimension of more than four inches, unless otherwise allowed by the proponent's Qualified Geotechnical Professional.

Fill material shall be spread in uniform layers normally up to six inches compacted depth, unless a lesser or greater depth is specified by the proponent's Qualified Geotechnical Professional. Content of water in the fill shall be at that level recommended by the proponent's geotechnical engineer.

Fill shall be compacted to a minimum of 90% maximum dry density, per ASTM D-1557. Fill intended to support habitable structures, parking lots, roadways, or berms used to retain water shall be compacted to a minimum of 95% maximum dry density, unless otherwise specified by the proponent's Qualified Geotechnical Professional.

2.8.2.2 Common Fill

Common (non-structural) fill is general material that is outside the limits of support for structures; includes landscape areas, open space, recreational areas.

Common fill shall be a porous free-draining material with a minimum in-place percolation rate of 10 minutes per inch to encourage internal drainage and absorption of surface water. In areas where surface water is diverted away, common fill can be of a general soil type. Where settlement is allowable, organic materials can be included. Common fill containing more than two percent organic material shall be so designated unless it occurs within the top three feet of the fill and is used for landscaping purposes.

Fill shall only be compacted to the extent necessary to prevent undue settlement and to provide slope stability. Care shall be exercised to prevent compaction which would restrict internal water flow.

2.9 SLOPES

2.9.1 General

The following standards shall apply to the design of artificially created slopes. Slope requirements shall also adhere to the requirements of the Pacific County Building Code.

2.9.2 Slope Control

The slope of cut surfaces shall be no steeper than is safe for the intended use. The maximum (steepest) slope shall be two horizontal feet to one vertical foot (2H:1V), and shall not exceed the natural angle of repose of the exposed material, as determined by a Qualified Geotechnical Professional. A steeper slope may be allowed by the Administrator provided a geotechnical report as specified in Section 3.7 substantiates the design. The minimum factor of safety under all loading conditions shall be 1.5 as determined by a Qualified Geotechnical Professional. The steeper slope shall not result in increased erosion beyond that of a 2H:1V slope with mature vegetation in the same soil type and must be structurally stable.

2.9.3 Setback Requirement

The tops of cut and toes of fill slopes shall be set back from property boundaries as far as necessary for safety of the adjacent properties and to prevent damage resulting from water runoff or erosion of the slopes, as determined by the proponent's Qualified Geotechnical Professional.

2.9.4 Lot Line Location

At the time of subdivision, lot lines shall be located at the top of banks or along slope benches, instead of at intermediate locations. Otherwise the exterior property line must fall a minimum distance of 10 feet horizontally beyond the top or toe of a natural slope.

2.9.5 Geologic Hazards

Land alteration on parcels containing geologic hazards, such as erosion and landslide hazard areas, seismic hazard areas, and mine hazard areas, shall be in accordance with Pacific County Critical Areas and Resource Lands Ordinance No. 147.

Special site investigations to determine stability shall be conducted by the proponent for any slope determined by the Administrator to be a potentially unstable slope. Such investigations shall be conducted by a Qualified Geotechnical Professional. The investigation and subsequent report shall evaluate the risk of land alteration and subsequent development of the parcel. The report shall be submitted to the Administrator for review. The adequacy of any investigation shall be determined solely by the Administrator.

Denial of a Land Alteration Permit is possible if land alteration techniques are not likely to allow for development of the parcel at an acceptable level of risk to public safety, natural systems, or public or private property, as determined by the Administrator and consistent with Pacific County and District ordinances, standards, and policies. The Administrator may request additional information or clarification of the study before making a final determination.

2.10 ROAD MAINTENANCE

The proponent shall schedule and control his work so as to comply with applicable provisions of the Pacific County Right-of-Way permit requirements, Roads and Bridges Ordinance, and Road Haul Permit Ordinance to prevent any hazards to public safety, health, and welfare.

Specific requirements include the following:

1. On existing streets, two way traffic shall be maintained at all times unless traffic control plans have been approved in advance by the County.

2. Roads shall be kept free of dirt and debris on a continuous basis.

3. Pedestrian facilities shall be kept free of obstructions and continuity of pedestrian access maintained at all times.

4. Pedestrian and vehicular access to occupied buildings shall be maintained at all times except where approval from the building owner has been obtained.

2.11 VARIANCE PROCESS

2.11.1 Process

A process is provided for variance from one or more of the Base or Special Requirements, or one of the design requirements, contained in these Standards. All variances shall be reviewed by the County Engineer as described in Ordinance No. 1.

Requests for a variance will be accepted only for permits pending approval or approved permits which have not yet expired. A variance request must be submitted to the Administrator along with sufficient information necessary to evaluate the request. Proposed variances should be approved prior to final permit approval.

All variance requests shall be accompanied by a Variance Request Application form and the variance fee. The burden of proof shall be on the proponent to bring forth evidence in support of the application and to provide sufficient information on which any decision has to be made on the application. In granting any variance, the Administrator shall prescribe such conditions and safeguards as are necessary to secure adequate protection of the altered land and adjacent properties from adverse impacts.

2.11.2 Criteria for Granting Variance

The County Engineer will grant a variance if the proponent demonstrates that the requested variance conforms to all of the criteria set forth below:

1. That special conditions and circumstances exist which are peculiar to the land, such as size, shape, topography, or location; and

2. That literal interpretation of the provisions of Ordinance No. 1 would deprive the proponent of rights commonly enjoyed by other properties conforming to the terms of Ordinance No. 1; and

3. That the special conditions and circumstances do not result from the actions of the proponent; and

4. That the granting of the variance requested will not confer on the proponent any special privilege that is denied by Ordinance No. 1 to other lands, structures, or buildings under similar circumstances; and

5. That the variance requested is the minimum necessary to afford relief; and

6. That to afford relief the requested variance will not create significant impacts to critical areas and resource lands, downstream or adjacent properties, flood control or surface water control facilities, and will not be materially detrimental to the public welfare, injurious to the property in the vicinity and zone in which subject property is situated, or contrary to the public interest.

2.12 APPEAL PROCEDURE

A final decision regarding an application or a variance may be appealed to the Board of Supervisors of the District if (1) a written appeal is filed with the Board of Supervisors within fourteen (14) calendar days of the date of the decision and (2) the appeal fee is paid. The Board of Supervisors will hear appeals District Ordinance No. 2.

SECTION 3 SUBMITTAL REQUIREMENTS

3.1 INTRODUCTION

This section details the required procedures for the submittal of plans required by these Standards. The intent of these procedures is to present consistent formats to facilitate review for compliance with District ordinances and regulations.

3.2 PHASED PROJECT SUBMITTAL

A plan showing the overall project, clearly delineating phase boundaries, and estimating dates of construction, shall be part of any permit application. Phased projects shall be completed in accordance with approved plans and in accordance with any phased development requirements of the District or Pacific County.

3.3 PROFESSIONAL QUALIFICATIONS

Grading and Filling Plans required by these Standards shall be prepared, sealed, and signed by a Qualified Professional. Geotechnical engineering reports required by these Standards shall be prepared, sealed, and signed by a Qualified Geotechnical Professional. Abbreviated Grading and Filling Plans for development of a single-family residence parcel need not be prepared by a Qualified Professional.

3.4 LAND ALTERATION PERMIT APPLICATION

A Land Alteration Permit is required prior to initiating any land alteration activity not exempted by Section 3.2 of District Land Alteration and Drainage Ordinance No. 1. The proponent shall submit a Land Alteration Permit Application on forms provided by the Department of Community Development. Land alteration permit applications, except for activities related to a single-family residence, shall include a Grading and Filling Plan as specified in Section 3.5. Land alteration permit applications related to a single family residence shall include an Abbreviated Grading and Filling Plan as specified in Section 3.6.

Depending on the proposed activities, a Land Alteration Permit may also require that a Drainage Permit Application be submitted in accordance with Section 4.5 of District Land Alteration and Drainage Ordinance No. 1. Additional plans and submittals, including a Surface Water Control Plan and a Temporary Erosion/Sedimentation Control Plan, may be required as specified in the District Surface Water Control Standards.

3.5 GRADING AND FILLING PLANS

The Grading and Filling Plan shall show existing conditions and the proposed project, including but not limited to:

1. Property boundaries; existing and proposed easements; lot dimensions; and areas;

2. Existing and proposed topography contours shall be shown at 2-foot intervals (5-foot intervals for slopes greater than 15%, 10-foot intervals for slopes greater than 40%), clearly marked with elevation. Topography shall be provided both on the subject property and all adjacent properties

sufficient to determine all potential topographic impacts of the construction. At a minimum, existing topography shall extend 50 feet beyond property boundaries;

3. Existing utility locations including type, material, depth, dimensional locations;

4. Natural or manmade drainage courses or pipes to the extent necessary to determine all hydraulic or hydrologic impacts of the proposed projects;

5. Locations of all existing and proposed structures or pavement within 100 feet of the project boundaries; areas of existing and proposed structures, pavements, and other impervious surfaces shall be shown;

6. Drainage features, including but not limited to, gullies, ravines, swales, wetlands, steep slopes, estuaries, springs, wetlands, creeks and lakes, showing the direction of natural drainage flow;

7. Existing and proposed wells on-site and on adjacent properties, whether "of record" or not; existing and proposed fuel tanks; and existing and proposed on-site sanitary systems; and

8. Existing and proposed roadway features, including centerline, edge of pavement and shoulder, ditchlines, curbs and sidewalks.

For subdivision projects, drawing scale shall be 1"=50'. For commercial, industrial, multi-family, redevelopment and public facility projects, scale shall be 1"=20', unless a smaller scale is allowed by the Administrator. Contours may be extrapolated from USGS mapping, aerial photos, or other topographic mapping resources. However, field verification of contours may be required by the Administrator for conveyance systems, roadways, easements, and surface water control facilities.

Plans shall be sufficiently clear so as to enable construction of the project in proper sequence, using specified methods and materials, with sufficient dimensions to fulfill the intent of all Pacific County ordinances and these Standards.

Plans shall be 24 inches by 36 inches or 22 inches by 34 inches, and shall include north arrow, scale, and at least two bench mark references and at least two coordinates referenced to a coordinate system acceptable to the Administrator. Drawings shall include a legend explaining the map symbols used.

3.6 ABBREVIATED GRADING AND FILLING PLANS

The Abbreviated Grading and Filling Plan shall show existing conditions and the proposed project, including but not limited to:

1. Property boundaries; existing and proposed easements; lot dimensions; and areas;

2. Areal extent of clearing, excavation, grading, surfacing, and paving;

3. Areal extent and depth of filling;

4. Existing utility locations including type, material, depth, dimensional locations;

5. Approximate location of natural or manmade drainage features, including but not limited to, gullies, ravines, swales, wetlands, steep slopes, estuaries, springs, wetlands, creeks and lakes, showing the direction of natural drainage flow;

6. Locations of all existing and proposed structures or pavement within the project boundaries; areas of existing and proposed structures, pavements, and other impervious surfaces shall be shown; and

7. Existing and proposed wells on-site; existing and proposed fuel tanks; existing and proposed on-site sanitary systems, and other existing and proposed utilities.

Minimum drawing scale shall be 1"=50'. Field verification of data may be required by the Administrator. Plans shall be a minimum of 8½ inches by 11 inches and shall include north arrow and scale. Drawings shall include a legend explaining the map symbols used.

3.7 GEOTECHNICAL REPORT

Geotechnical reports, when required by these Standards, shall be prepared by a Qualified Geotechnical Professional. The report shall, at a minimum, characterize and classify the underlying soils based on the SCS classification system and soil texture method, identify any impacted areas containing groundwater interflow, and describe any special characteristics of the underlying soils that should be addressed by the proposed project. Such characteristics shall include: load bearing capacity; suitability for use as common fill and structural fill; erodibility during construction; and the ability to support vegetation. The report may also need to evaluate slope stability, including an evaluation of the probability and consequences of slope failure.

3.8 STANDARD NOTES

The standard notes listed in Appendix A shall be affixed to all plans submitted under these Standards. Additional notes as needed to ensure that contractors have clear and complete instructions to construct the project shall also be affixed to all plans.

3.9 AUTHORIZATION TO INSPECT PROJECT SITE PRIOR TO ISSUANCE OF PERMIT

Submission of a permit application shall constitute authorization for the Administrator or his/her designee to inspect the project site prior to issuance of any permit. The Administrator or his/her designee shall be authorized to enter upon premises to review said premises, ascertain, or make necessary tests as required to review the proposed land development under Ordinance No. 1 and these Standards.

3.10 PLAN CHANGES AND REVISIONS AFTER PERMIT ISSUANCE

Notice of changes or revisions to the originally approved drainage plans shall be provided to the Administrator prior to proceeding with changed work. If changes or revisions to the originally approved drainage plans require additional review, the revised plans shall be submitted to the Pacific County Department of Community Development for approval prior to construction. Plan changes and revisions shall be prepared, reviewed, and processed as described herein.

SECTION 4 CONSTRUCTION REQUIREMENTS

4.1 AUTHORITY TO CONSTRUCT

Until the Administrator approves a Grading and Filling Plan or Abbreviated Grading and Filling Plan, the District shall not:

1. Issue a Land Alteration Permit; and

2. Allow land alteration, demolition, site work, or construction to commence;

No person shall initiate land alteration activities without said permit. Issuance of a permit will constitute authority to construct the proposed project, incorporating all provisions of the approved plans and reports and these Standards.

Work performed within the public right-of-way, or as described in these Standards, whether by or for a private developer, by County forces, or by a County contractor, shall be done to the satisfaction of the District and in accordance with the Standard Specifications, any approved plans, and these Standards. Unless otherwise approved, any revision to construction plans must be approved by the District before being implemented. The District shall have authority to enforce the Standards as well as other referenced or pertinent specifications.

The proponent shall notify the Pacific County Department of Public Works in advance of the commencement of any authorized work. A pre-construction conference and/or field review may be required before the commencement of any work on significant projects, as determined by the Administrator.

Failure to comply with the provisions of these Standards may result in stop work orders, removal of work accomplished, or other penalties as established by ordinance.

4.2 INSPECTION

Approved Grading and Filling Plans and Abbreviated Grading and Filling Plans shall be kept on the project site during construction and made available to the Administrator upon request.

The Administrator or his/her designee may inspect the work authorized by the permit. The Administrator or his/her designee shall be authorized to enter upon premises to review construction authorized by a permit for compliance with said permit, District Ordinance No. 1 and these Standards. The proponent's contractor shall provide access to the construction for inspection of the work by the Administrator or his assistants at all times. In the event that entry is refused, necessary steps shall be taken to make application for a search warrant to accomplish the inspection.

4.3 STOP WORK ORDER

If a person fails to comply with the terms of a permit issued under Ordinance No. 1, or engages in activities regulated under Ordinance No. 1 without the appropriate permit(s), the Administrator may issue a written order to immediately stop all work except that which is necessary to bring the project into compliance with Ordinance No. 1.

4.4 CORRECTIONS OF DEFICIENCIES IN WORK

At the discretion of the Administrator, significant errors or omissions in the approved plans or information used as a basis for such approvals may constitute grounds for withdrawal of any approvals and/or stoppage of any or all of the permitted work. It shall be the responsibility of the proponent to show cause why such work should continue, and make such changes in plans that may be required by the Administrator before the plans are re-approved or permits reissued.

Materials, work, or workmanship which, in the opinion of the Administrator, do not conform to the approved plans or are in any way unsatisfactory or unsuited to the purpose for which they are intended may be determined to be deficient by the Administrator.

The Administrator may order the removal, correction or replacement of any deficiency. All costs associated with said removal, correction or replacement shall be the sole responsibility of the property owner, the property owner's association, or the project proponent. The District assumes no liability for performing any action authorized under this Section.

4.5 ACCEPTANCE OF CONSTRUCTION

The Administrator shall not approve plats, grant certificates of occupancy, release financial securities, or otherwise accept construction as complete until:

1. All work is completed to the satisfaction of the Administrator; and

2. The site has been permanently stabilized and restored, and temporary erosion control measures have been removed.

APPENDIX A STANDARD NOTES

The following notes shall be affixed to all Grading and Filling Plans.

1. The temporary sedimentation and erosion control facilities shown on the approved plans shall be constructed and implemented prior to any grading or land clearing in accordance with the approved plans. These facilities shall be satisfactorily maintained until the construction and permanent restoration is completed and the potential for on-site erosion has passed.

2. No final cut or fill slope shall exceed two (2) horizontal to one (1) vertical without stabilization.

3. Upon the issuance of a Stop Work Order, the Proponent shall suspend all work referenced by said order. The Proponent shall correct all deficiencies noted in said Order prior to continuing other work. All necessary corrections shall be the sole responsibility of the Proponent.

PACIFIC COUNTY, WASHINGTON
FLOOD CONTROL ZONE DISTRICT NO. 1

SURFACE WATER CONTROL STANDARDS

PACIFIC COUNTY
DEPARTMENT OF PUBLIC WORKS

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1.1.1 Purpose

The Pacific County Flood Control Zone District No. 1 (hereinafter referred to as the "District") Surface Water Control Standards (hereinafter referred to as the "Standards") establish policies, minimum requirements, minimum design standards, and procedures for the analysis, design, construction and maintenance of surface water control facilities, and for the control of erosion and sedimentation on construction sites shall be in accordance with these Standards, including any amendments thereto. It is the express purpose of these Standards that surface water and erosion control be conducted in a manner which provides for and promotes the health, safety, and welfare of the general public.

1.1.2 Policies and Goals

The policies and goals directing land development related to land alteration and drainage are contained in District Ordinance No. 1 (see Appendix L). The provisions of these Standards are intended to carry out those policies.

The policies include:

1. Potential dangers or public costs associated with inappropriate land development and improper control of surface water runoff from such development shall be minimized by reasonable regulation of said land development. Reasonable regulation shall be achieved by balancing of individual and collective interests.

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The goals are:

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3. To minimize water pollution, flooding, and habitat damage resulting from increases in surface water runoff and soil erosion;

4. To minimize expenditure of public money on flood control improvements and operation and maintenance of flood control facilities of the District;

5. To minimize prolonged business interruptions due to flooding;

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7. To provide for the sound use, development, and protection of areas of special flood hazard.

1.2 INTENT OF THESE STANDARDS

These Standards are intended to represent the minimum design standards for the construction of surface water and erosion control facilities. Special conditions and/or environmental constraints may require more stringent design than would normally be required under these Standards. Compliance with these standards does not relieve the Proponent of the responsibility to apply sound professional judgment to protect the health, safety, and welfare of the general public.

It is not the intent of the District to limit unreasonably any innovative or creative effort which could result in a superior result based upon the performance criteria of safety, economical maintenance, and pleasant appearance. Proposed departures from the Standards shall be reviewed in a formal variance process as defined in District Land Alteration and Drainage Ordinance No. 1.

1.3 APPROACH

1.3.1 Surface Water Control System Design

A multitude of approaches are available for the design of surface water control systems to mitigate impacts of development. System design shall consider the hydrology, hydraulics, and environmental constraints of both on- and off-site drainage systems. The Qualified Professional shall consider both the details of the development design as well as the comprehensive goals and policies of Pacific County.

Protection of existing natural drainage features is required by the District Land Alteration and Drainage Ordinance No. 1 and the Pacific County Critical Areas and Resource Lands Ordinance. Generally, systems incorporating water quality protection and low-maintenance system components with gravity control are required. Multi-use facilities, such as a passive recreation area located within a detention system, may be allowed, depending upon maintenance and liability considerations.

In general, the District requires the use of on-site surface water controls and storage facilities which are intended to reduce the impacts of increased runoff quantity at the source by replicating existing pre-

development runoff rates. In general, land alteration and development which does not increase runoff quantity above a specified threshold is exempt from runoff control requirements. Through on-going basin planning, the District will investigate integrating on-site controls with larger, basin-specific controls.

Other alternatives to on-site runoff quantity control may be effective in meeting the District's goals of preserving and protecting natural drainage systems. It may be more efficient hydraulically to discharge stormwater without detention if the site is located adjacent to a water receiving body or a regional facility designed to receive runoff from the site, provided the conveyance system is adequate and water quality protection measures are constructed.

1.3.2 Surface Water Quantity Control

The primary means to minimize impacts of development on natural and constructed drainage systems is to require on-site detention facilities to limit the peak rate of discharge from multiple design storm events to levels existing in the predeveloped condition. Discharge shall be controlled from multiple design storm events: both from the less frequent, but higher magnitude, event; and the more prevalent, lesser magnitude, but equally destructive event.

In most cases, this approach will be adequate to control runoff impacts without limiting the total increased volume of runoff which results from most development. However, for certain sites (such as where the site discharges to a closed depression or where there is severe erosion potential), total increased flow may also be limited.

The hydrograph method shall be utilized to estimate pre-development and post-development runoff characteristics in the District. These hydrographs shall be used to analyze and design facilities, both existing and new. The Santa Barbara Urban Hydrograph (SBUH) method using Soil Conservation Service curve numbers shall be used in all analyses. For drainage basins greater than 25 acres, the SCS TR-20 Hydrograph Method may be used.

1.3.3 Surface Water Quality Control

Measures intended to preserve existing water quality and reduce potential pollution have been incorporated into many requirements of these Standards. Measures include criteria and requirements to control discharges which might cause erosion, to control sedimentation, and other controls.

Retention and detention facilities provide flow control by detaining and attenuating flows. These attributes also provide pollution control by detaining flow to allow for pollutant removal by physical and biochemical processes. The most important parameter in minimizing impacts to off-site water quality is to promote siltation by providing adequate detention time for runoff.

Control of the 6-month, 24-hour design storm event has been demonstrated to provide protection from cumulative impacts that result in erosion. These frequent storm events have been shown to be dominant in producing erosion in channels.

Special water quality controls provided for in these Standards include wet ponds and vaults, and biofiltration systems, including channels and filter strips. These special controls are primarily required to treat runoff from developed areas prior to discharge to sensitive natural drainage features, such as wetlands, lakes and streams when not treated by retention or detention and prior to infiltration. Both of

these controls use sedimentation, biofiltration, and biologic activity as mechanisms for removal of pollutants, and have been demonstrated to provide substantial water quality improvements.

Preservation of native growth is also effective in preserving water quality by filtering pollutants and providing protection of wildlife habitat. Natural vegetative buffers along streams and around wetlands provide biofiltration to incoming pollutants in runoff and preserve the aquatic and wildlife habitat along the water's edge.

1.3.4 Temporary Erosion/Sedimentation Control

Measures intended to control discharges which might cause erosion and/or sedimentation have been incorporated into many requirements of these Standards. Measures include criteria and requirements to, and other controls. These measures are intended prevent sediment from crossing a project's boundaries or entering receiving waters. There is no practical limit to the number, variations, and types of erosion control devices. Nothing in these Standards is intended to limit the approaches to erosion control provided the Proponent demonstrates to the satisfaction of the Administrator that they will meet the intention of these Standards.

1.4 COMPREHENSIVE FLOOD HAZARD MANAGEMENT PLANS

If a proposed Project is located in a basin or sub-basin for which the District has an adopted Comprehensive Flood Hazard Management Plan, stormwater requirements specifically identified in said Plan shall take precedence over those provided in these Standards. However, all other elements detailed in these Standards shall continue to apply to such projects.

1.5 DESIGN STANDARDS

The following design standards are referenced within this Standard. The referenced sections of said standards shall have full force and effect as if set forth fully herein. In the case of conflict with this Standard, the more stringent or restrictive requirement shall apply.

Surface Water Design Manual, King County Department of Public Works - Division of Surface Water Management, January 1990, Revised November 1994.

Stormwater Management Manual for the Puget Sound Basin, Washington State Department of Ecology, current edition.

Open Channel Hydraulics, V.T. Chow.

Hydraulics Manual, Washington State Department of Transportation, current edition.

1.6 STANDARD PLANS AND STANDARD SPECIFICATIONS

Except where these Standards provide otherwise, design detail, workmanship and materials shall be in accordance with:

Current edition of the "Standard Specifications for Road, Bridge, and Municipal Construction" prepared by the Washington State Chapter of the American Public Works Association (APWA) and the Washington

State Department of Transportation (WSDOT), hereinafter referred to as the "Standard Specifications"; and

Current edition of the "Standard Plans for Road and Bridge Construction" prepared by the Washington State Chapter of the American Public Works Association (APWA) and the Washington State Department of Transportation (WSDOT), hereinafter referred to as the "Standard Plans".

1.7 DEFINITIONS

Unless the context specifically indicates otherwise, the meaning of terms used in these Standards shall be as defined in the District Land Alteration and Drainage Ordinance No. 1. For convenience, these definitions are included in the glossary of these Standards. Where conflicts occur between the definitions presented in the glossary and those presented in Ordinance No. 1, those of Ordinance No. 1 shall apply.

1.8 OTHER APPLICABLE LAWS

Development activities covered under this Ordinance may also be subject to other regulations, permit authority review, and approvals. Requirements of this Ordinance or any permit granted pursuant to this Ordinance shall not remove a person's obligation with respect to the applicable provisions or any other Federal, State, or local law or regulation, including, but not limited to, the acquisition of any other required permit or approval.

In the event that federal, state, or other applicable laws impose a standard or regulation that is in conflict with any provision of this Ordinance or any standard or regulation that the District may adopt pursuant to this Ordinance, the most restrictive standard shall prevail.

Other agencies such as those listed in Table 1 may require review for a project's impact. Such other agency requirements are separate from, and in addition to, the District's requirements. The proponent shall coordinate joint agency review, including resolution of any conflicting requirements between agencies.

TABLE 1-1
OTHER PERMITS AND APPROVALS

Agency	Permit/Approval
Department of Ecology	Short Term Water Quality Modification Approval
Department of Fisheries & Wildlife	Hydraulic Project Approval
Department of Ecology	Dam Safety Permit
Department of Ecology	NPDES Permit
Army Corps of Engineers	Section 10 Permit
Army Corps of Engineers	Section 404 Permit

1.9 PACIFIC COUNTY ORDINANCES, PLANS, AND POLICIES

This Ordinance and any administrative policies or standards developed to effectuate this Ordinance, are intended to be consistent with the most currently adopted provisions of:

1. District Ordinances, and more specifically the following:

Ordinance No. 2	Civil Infractions
Ordinance No. 3	Procedures for Processing Land Alteration and Drainage Permit Applications

2. Pacific County Ordinances, and more specifically the following:

Ordinance No. 2	Highway, Right of Way Use (Road Standards)
Ordinance No. 31	Subdivisions
Ordinance No. 34	Buildings
Ordinance No. 48	Short Subdivisions
Ordinance No. 95	Zoning
Ordinance No. 116A	Flood Damage Prevention
Ordinance No. 119	Mobile Home
Ordinance No. 121	Environmental Policy
Ordinance No. 147	Critical Areas and Resource Lands

3. Comprehensive Flood Hazard Management Plans of the District

4. Pacific County Shoreline Master Program

SECTION 2 SUMMARY OF REQUIREMENTS

2.1 GENERAL

2.1.1 Introduction

These Standards contain the requirements and standards for designing surface and storm water management systems and controlling erosion. Certain of these requirements shall apply to every proposed project which requires review for conformance with these Standards, and shall be considered "Base Requirements". Other "Special Requirements" may apply to a proposed project depending on the nature of the project, its location, and other variables. Many of the Special Requirements are required only if a proposed project exceeds a "threshold" of one or more parameters.

2.1.2 Base Requirements

The Base Requirements are:

1. **Discharge at the Natural Location.** The discharge from a project site shall occur at the natural location. See Section 2.2.

2. **Off-Site Analysis.** Project submittals shall identify the upstream tributary drainage area and perform a downstream analysis. Qualitative analysis is always required; quantitative analysis may be required by the Administrator based on the impacts identified. See Section 2.3.

3. **Runoff Control.** The peak rate of runoff from projects under post-development conditions shall be limited to pre-development peak rates for specific design storm events. See Section 2.4 and Section 5.

4. **Conveyance System.** Conveyance systems shall be analyzed, designed and constructed for existing tributary off-site runoff and developed on-site runoff from the project. See Section 2.5 and Section 6.

5. **Temporary Erosion and Sedimentation Control.** Temporary erosion and sedimentation measures shall be provided for all projects to minimize the transport of sediment to drainage facilities, water resources, and adjacent properties. See Section 2.6 and Section 10.

6. **Runoff Treatment.** Runoff from proposed projects shall be treated prior to discharge from the site to either surface or ground waters. The level of treatment depends upon the project type, size, location and discharge. See Section 2.7 and Section 9.

7. **Maintenance and Operation.** Maintenance and operation of drainage facilities constructed under these Standards is the responsibility of the Proponent, property owner, and/or property owner's association. Maintenance and operation shall be in compliance with District maintenance standards (see Maintenance Requirements for Privately Maintained Drainage Facilities, Appendix J). See Section 2.8.

8. **Bonds.** Construction and maintenance of drainage facilities, except for those constructed for single-family residences, shall be secured by bond. See Section 2.9.

Each of the Base Requirements are defined in detail in the following subsections.

2.1.3 Special Requirements

In addition to the Base Requirements, the following special requirements may apply to a proposed project.

1. **Adopted Comprehensive Flood Hazard Management Plan.** The District Board of Supervisors adopts Comprehensive Flood Hazard Management Plans for the comprehensive management of drainage and flooding problems within a specific drainage basin. An adopted Comprehensive Flood Hazard Management Plan may recommend capital improvements, non-structural improvements, and special drainage requirements for proposed projects within the drainage basin. See Section 2.10.

2. **Oil/Water Separation.** If a proposed project meets certain threshold criteria for petroleum storage, vehicular use, or heavy equipment use, storage, or maintenance, then oil/water separation to treat the project's discharge shall be incorporated into the project's surface water control system. See Section 2.11 and Section 9.9.

3. **Use of Lakes, Wetlands, or Closed Depressions for Peak Rate Runoff Control.** If a proposed project will use a lake, wetland, or closed depression for peak rate runoff control, will discharge directly to a lake, wetland, or closed depression, or otherwise increases the volume of runoff to an off-site closed depression, then the project shall incorporate special water quality controls and observe limits on increases to the water level to said lake, wetland, or closed depression. See Section 2.12.

4. **Delineation of 100-Year Floodplain.** If a proposed project contains or abuts a stream, lake, wetland, or closed depression, or if other Pacific County ordinances require study of flood hazards, then the Proponent shall delineate the 100-year floodplain on the Drainage Plans. See Section 2.13.

Each of the Special Requirements are defined in detail in the following subsections.

2.2 DISCHARGE AT THE NATURAL LOCATION (BASE REQUIREMENT #1)

Runoff from a proposed project shall be discharged at the natural, pre-development location so as not to divert onto, or away from, the adjacent downstream property. This requirement may be waived by the Administrator subject to the variance procedures defined in the District Land Alteration and Drainage Ordinance No. 1, provided that discharge at other than the natural location produces no significant impact to the drainage system of the downstream property or to upstream properties due to backwater.

Where no conveyance system exists at the adjacent downstream property line and the discharge was previously unconcentrated flow, any concentrated flow shall be:

1. Conveyed across the downstream properties to a discharge point acceptable to the Administrator, with drainage easements secured from affected property owner(s) and recorded with the Pacific County Auditor prior to approval of the underlying permit requiring drainage review; or

2. Distributed along the property line in the same manner as under pre-development conditions using rock pads or a dispersal trench, with drainage easements secured from affected property owner(s)

and recorded with the Pacific County Auditor prior to approval of the underlying permit requiring drainage review.

2.3 OFF-SITE ANALYSIS (BASE REQUIREMENT #2)

All proposed projects subject to these Standards shall prepare a qualitative off-site analysis. The qualitative analysis shall :

1. Provide a detailed qualitative analysis of the flow path from the project site (including those with retention facilities) to receiving water. If the flow path crosses private property before reaching receiving waters, include property owner names and/or parcel numbers;

2. Describe flow routing and provide existing pipe and channel sizes and estimated capacities;

3. Discuss any known or reasonably anticipated downstream erosion, flooding or water quality problems, including those that may be caused by interflow from any proposed retention facility; and

4. Describe emergency services located along the flow path such as fire, police and hospital services.

Based upon findings of the qualitative analysis, the Administrator may require that a quantitative analysis of the conveyance system be performed both upstream and downstream of the project site. The Administrator shall specify the distance and level of detail to be provided by the Proponent. In making this determination, the Administrator shall consider the possibility of flooding of downstream properties resulting from storm events up to 100 year recurrence frequency.

The quantitative downstream analysis shall include modeling the hydraulics of the proposed project and all other sources of runoff tributary to the receiving water body for the 24-hour, 100-year event (in addition to "Design Event" analysis) for each component of the system including pond spillway. The Qualified Professional's quantitative analysis shall determine water surface levels with and without the project for the 100-year, 24-hour storm event using backwater analysis if necessary. A map showing inundated areas for the 100-year, 24-hour event shall be submitted.

As a result of quantitative analysis and other sources of information, the Administrator may impose stricter discharge and/or detention standards if the discharge from the Project is reasonably expected to result in one or more of the following:

1. Damage due to flooding;

2. Loss of aquatic habitat due either to high or low flows;

3. Property damage;

4. Water quality problems;

5. Erosion;

6. Unacceptable interruption of essential public facilities; or

7. Groundwater or shallow aquifer impacts.

If the Administrator determines based on quantitative analysis that greater treatment, infiltration and/or storage volumes, lower release rates, or downstream improvements are needed, project design criteria or other means may be specified by the Administrator to relieve the downstream problems. Other means might include increases in downstream flow capacity and/or off-site detention and infiltration facilities.

2.4 RUNOFF CONTROL (BASE REQUIREMENT #3)

2.4.1 Peak Rate Runoff Control

Proposed projects shall provide peak rate runoff control to limit the developed conditions peak rates of runoff from specific design storm events not to exceed the peak rates for the "Pre-developed" or "existing site conditions". Methods of analysis of peak rate runoff control are provided in Section 5 and the design standards referenced in Section 1.5.

Proposed project peak rate runoff control shall be provided on-site. Use of off-site storage for peak rate runoff control may be allowed by the Administrator, as provided under subsection 2.12 Use of Lakes, Wetlands, and Closed Depressions for Runoff Control.

2.4.2 Exemptions from Runoff Control

Peak rate runoff control will not be required for a proposed project meeting one or more of the following requirements:

1. Negligible Peak Runoff Rate Increase:

   The post-development peak runoff rate for the 100-year, 24-hour design storm event is calculated for each discharge location to be less than 0.5 cfs more than the peak runoff rate for the pre-development site conditions. Proposed projects located within an area delineated as a Frequently Flooded Area shall not qualify for this exemption.

2. Direct Discharge:

   The proposed project will discharge surfacewater directly to:

   a. One of the following receiving water bodies:

      1) Willapa Bay;
      2) Columbia River; or
      3) Pacific Ocean.

   b. A regional surface water control facility or a public storm water system which discharges to a regional surface water control facility, provided that:

      1) No flooding of public systems shall occur as a result of the design event under post-development conditions for the area tributary to the public system; and

2) All other users of the public system may enjoy the same exemption from storage requirements without flooding; and

3) No structural damage will occur to the outfall during the 100-year, 24-hour design event.

3. The discharge is from a single-family residence, provided that:

   a. No flooding of public systems will occur as a result of the design event under post-development conditions for the area tributary to the public system; and

   b. No structural damage will occur to the outfall during the 100-year, 24-hour design event; and

   c. Runoff from structure roofs and foundation drains is infiltrated where infiltration is determined to be feasible in accordance with Section 8 of these Standards; or runoff from structure roofs and foundation drains is dispersed where infiltration is determined to be not feasible.

2.4.3 Methods of Runoff Control

Three basic methods for peak rate runoff control: detention, retention, and infiltration. Detention is the temporary storage of surface water with the outflow rate restricted. Retention is the storage of surface water with effectively no surface outflow; outflow occurs by evapotranspiration. Infiltration is the soaking of surface water into the ground.

Detention, retention and infiltration facilities each shall be sized to meet the required allowable peak rate runoff rates for the range of design storm events specified in Section 5.5. Each method is discussed in greater detail in subsequent sections and the design standards referenced in Section 1.5.

2.4.4 Discharge of Run-on

Run-on (surface water entering onto the project site from upstream of the project site) shall be routed in the same manner as existed in the pre-development condition. In other words, after development, run-on flows shall be infiltrated within or passed-through the project site in the same proportion as occurred prior to development. The development's peak rate runoff control systems shall be sized to accommodate the correct proportion of run-on flows.

Run-on pass-through flows shall be routed across the project site separate from site runoff. They shall not be routed through the project's peak rate runoff control systems. No storage or treatment of run-on pass-through flow is required.

However, if the Administrator determines that separate handling of run-on flow is impracticable, then such run-on may be routed through the project's peak rate runoff control systems. Those systems shall be sized to treat and detain said run-on flow as if generated on-site.

2.5 CONVEYANCE SYSTEM (BASE REQUIREMENT #4)

2.5.1 General

Conveyance systems shall be analyzed, designed and constructed for existing tributary off-site runoff and developed on-site runoff from the project. The Proponent shall demonstrate that conveyances, either existing or proposed, are sized to convey the peak rate runoff specified in these Standards.

2.5.2 Sizing

Conveyance system adequacy shall be demonstrated using the methodology specified in Section 6.2. The runoff originating from the project site plus any upstream run-on to the site that will be conveyed through the project conveyances shall be included in the analysis. Design storm events shall be as specified in Section 6.2.3. Downstream conveyances shall be analyzed using the same methodology as required by the Off-Site Analysis specified in Section 2.3.

2.5.3 Conveyance Preference

Grass-lined or otherwise vegetated open-channel surface drainage shall be required for the conveyance of stormwater, subject to the exceptions listed below. The Qualified Professional shall justify the use of any conveyance practice other than flow through vegetated channels. The following hierarchy lists conveyance practices in their order of preference:

1. Flow overland or through vegetated swales.
2. Flow through armored channels.
3. Flow through storm drains or culverts.

A variance from this requirement may be requested in accordance with the District Land Alteration and Drainage Ordinance No. 1. Factors that the Administrator may consider when reviewing said variance request shall include, but not be limited to:

1. Road widening takes up all available land for open channels;
2. Terrain requires deep cuts (swale/pipe combinations may be feasible in such cases, however);
3. Traverse of an unstable or steep slope;
4. Excessive flow velocities and/or depths;
5. Other factors that render open conveyance impracticable from an engineering standpoint;
6. Pacific County Road Standards prohibit preferred conveyance; and
7. Lack of adequate space due to existing development coverage.

If, in the Administrator's opinion, there is no practical alternative to the use of storm drains or culverts to convey runoff, then the Qualified Professional shall, wherever possible, place catch basins within grass

islands (see Figure A2) in off-street parking situations to provide biofiltration before runoff enters the pipe system.

2.5.4 Pumping Prohibited

Pump systems are prohibited in surface water control systems in the District. A variance from this requirement may be requested in accordance with the District Land Alteration and Drainage Ordinance No. 1. The Administrator will only consider granting said variance request when a pump system is the only alternative to solve a flooding problem impacting existing residential or commercial structures, and when said pump system is not used to circumvent any other District drainage requirement.

Any pump system allowed shall be required to meet the following minimum requirements:

1. The pump system has a storage facility, sized to hold 25 percent of the total volume of runoff for the developed tributary drainage area for the 2-year, 24-hour design storm event. This storage requirement is in addition to any peak rate runoff control requirement;

2. The pump system has dual, redundant pumps (alternating), each capable of discharging the design flow, and provided with an external (audible and visual) alarm system; and

3. The pump system shall be owned, operated, and maintained by the property owner(s) or homeowner's association.

2.5.5 Outfalls

Outfalls shall dissipate energy of the runoff prior to discharge into an erodable receiving drainage feature. Acceptable methods of energy dissipation are defined in Section 6. Outfalls to tidal basins shall account for appropriate tailwater elevation. Outfalls on or above steep slopes shall be a tightline conveyance to the bottom of the slope with adequate energy dissipation at the bottom, and shall be anchored.

2.5.6 Interception of Interflow

Any significant interflow (area of spring or seepage) that impact a roadway or structure adjacent to the project site shall be intercepted and directed into the conveyance system.

2.6 TEMPORARY EROSION AND SEDIMENTATION CONTROL (BASE REQUIREMENT #5

Temporary erosion and sedimentation measures shall be provided for all projects to minimize the transport of sediment to drainage facilities, water resources, and adjacent properties. To accomplish this requirement, temporary erosion/sedimentation control measures shall be designed, installed, and maintained in accordance with the requirements of Section 10 of these Standards.

2.7 RUNOFF TREATMENT (BASE REQUIREMENT #6)

2.7.1 Runoff Treatment Requirement

Runoff from proposed projects shall be treated prior to discharge from the site to either surface or ground waters. The purpose of runoff treatment is to reduce pollutant loadings and concentrations in storm water runoff using physical, biological, and chemical removal mechanisms.

Treatment systems shall be designed and sized to capture and treat the water quality design storm event, which is defined as the 6-month, 24-hour design storm event. The level of treatment depends upon the project type, size, location and discharge.

2.7.2 Exemption of Roof Runoff from Treatment

Runoff treatment shall not be required for runoff from roofs, provided that

1. the roof runoff does not flow through any required water quality facility; and

2. the Administrator determines that the untreated discharge will not produce significant adverse impacts to downstream water quality.

This exemption does not relieve Proponent from complying with the requirements for peak rate runoff control specified in subsection 2.4.

2.7.3 Method of Treatment

Methods of treatment include water quality swales, constructed wetlands, wet ponds and vaults, biofiltration facilities, and filtration facilities. The treatment process shall be selected, designed, and maintained as specified in Section 9.

If a proposed project meets certain threshold criteria, then oil/water separation may be required as specified in Special Requirement No. 2. An adopted Comprehensive Flood Hazard Management Plan may further impose surface water treatment requirements as specified in Special Requirement No. 1.

2.8 MAINTENANCE AND OPERATION (BASE REQUIREMENT #7)

2.8.1 Maintenance Required

Maintenance and operation of drainage facilities, including conveyances, constructed under these Standards is the responsibility of the Proponent and property owner. However, maintenance and operation of drainage facilities constructed for Preliminary Plats, Subdivisions, and Short Subdivisions, may be assumed by a property owner's association after one year following acceptance of construction by the Administrator.

At the sole option of the District, maintenance and operation of drainage facilities may be assumed by the District for Preliminary Plats and Subdivisions, and for Short Subdivisions where drainage facilities serve more than one residential lot. The District will only assume maintenance two years year following acceptance of construction by the Administrator, and following inspection by the District to assure the facilities have been properly maintained and are operating as designed.

Maintenance and operation shall be in compliance with District maintenance standards (see Maintenance Requirements for Privately Maintained Drainage Facilities, Appendix J). Privately-maintained facilities may be inspected at any time by representatives of the District for compliance with the maintenance requirements of these Standards. If the Proponent, property owner, or property owners' association fails to maintain their facilities to the standards defined herein, the District may issue a written notice specifying the required actions to remedy any deficiencies. If these actions are not performed within the time period specified in the written notice, the District may enter the property along the easement to perform the actions

needed. All costs of such maintenance shall be assessed and billed to the property owner or property owners' association. In the event a hazard to public safety exists, written notice may not be required.

In no event will the District assume maintenance of lot drainage systems serving single-family residences.

2.8.2 Property Owners' Associations

If the Proponent of any subdivision requiring surface water control facilities in accordance with this Standard forms a property owners' association, the document creating the property owners' association shall make provision for the following:

1. Members of the property owners' association shall be responsible for maintenance of storm drainage facilities outside the public road right-of-way;

2. Inclusion by reference of Surface Water Control, Maintenance, and/or Erosion Control Plans prepared by the Proponent in accordance with these Standards; and

3. Authority to assess fees to maintain surface water control and permanent erosion control facilities.

2.8.3 Maintenance Covenants

2.8.3.1 Plat Covenants

A declaration of covenant shall be filed on the plat and recorded against each lot within the subdivision, and shall include the language included in Appendix D.

2.8.3.2 Property Owners' Association Covenants

A covenant stating the property owners' or property owners' association's specific maintenance responsibilities shall be included on the face of the plat and recorded against each lot in the subdivision. The covenant shall include the language included in Appendix E.

2.8.4 Easements Required

All man-made surface water control facilities and conveyances and all natural channels (including swales, stream channels, lake shores, wetlands, potholes, estuaries, gullies, ravines, etc.) shall be located within easements deeded to the public. All surface water control facilities in plats or subdivisions, including Short Subdivisions, shall be located in separate tracts or drainage easements deeded to the District for purposes of reasonable inspection, maintenance, monitoring, and other activities permitted by law.

The legal instrument creating drainage easements on private property shall include the language included in Appendix K. All parties of interest to the property upon which the access road and facility are to be located shall execute said easement.

No structure, including but not limited to, bridges, culverts, control structures, and well points shall be placed in, over, or adjacent to a drainageway for which the public has a drainage easement without the written permission of the District. All requirements of the District Land Alteration and Drainage Ordinance No. 1 and these Standards shall be met prior to receiving said permission.
Easement width for conveyance systems shall be as stipulated in Table 2-1.

TABLE 2-1
MINIMUM EASEMENT WIDTHS FOR CONVEYANCE SYSTEMS

Conveyance Width	Easement Width
Channels < 30' wide	Channel width at top + 15', one side
Channels > 30' wide	Channel width at top + 15', both sides
Pipes < or = 60"	20' centered on pipe
Pipes > 60"	Pipe width + 30', centered on pipe

Greater widths may be required based on pipe size, depth of burial, or other parameters as determined by the Administrator. It is preferable that such easements be located within a single lot or tract, except where linear extent of the conveyance may involve additional properties.

2.8.5 Access to Constructed Facilities Required

A minimum 15-foot wide access easement shall be provided from a public street or right-of-way to and around surface water control facilities, including ponds, tanks, vaults, and control structures. Access roads shall be a minimum 12-foot width of lattice block pavement, crushed rock, or other approved surfacing material constructed in a manner to provide year-round equipment access of maintenance vehicles to the facility. Access roads shall be constructed in accordance with the Pacific County Road Standards.

A gate for access roads shall be required and shall be of design acceptable to the Administrator for the use and location proposed or an alternative acceptable to the Administrator to control traffic shall be provided. Gates shall be installed prior to recording of the plat.

2.8.6 Road Maintenance Required

The Proponent shall schedule and control his work so as to comply with applicable provisions of the Pacific County Right of Way permit requirements, Pacific County Road Standards, and Road Haul Permit Ordinance.

Specific requirements include the following:

1. Two way traffic shall be maintained at all times unless traffic control plans have been approved in advance by the Department of Public Works.

2. Roads shall be kept free of dirt and debris.

3. Pedestrian facilities shall be kept free of obstructions. Continuity of pedestrian access shall be maintained at all times.

4. Pedestrian and vehicular access to occupied buildings shall be maintained at all times except where written approval from the building owner has been obtained.

2.9 BONDS AND LIABILITY (BASE REQUIREMENT #8)

Construction and maintenance of drainage facilities, except for those constructed for single-family residences and duplexes on a single tax parcel, shall be secured. There are two security requirements for drainage facilities: construction performance security and maintenance security.

2.9.1 Construction Performance Security

Under certain circumstances or as required by District Ordinance, securities may be required by the Administrator to guarantee the performance of permitted work. The security shall be in the form of cash deposit or surety bond, and shall be in an amount equal to one hundred (100) percent of the estimate of cost of the permitted work, as determined by the Administrator. If the security is a surety bond, it shall:

1. Be of a form acceptable to the Administrator;
2. Be signed by the Contractor and the surety;
3. Be approved by the Administrator;
4. Be registered with the Washington State Insurance Commissioner;
5. Appear on the current Authorized Insurance List in the State of Washington as published by the Office of the Insurance Commissioner;
6. Be conditioned upon the faithful performance of the construction by the Proponent; and
7. Guarantee that the surety shall indemnify, defend, and protect the District and Pacific County, including its officers, agents, and employees, against any claim of direct or indirect loss resulting from the failure:
    a. of the Contractor to faithfully perform the contract; of
    b. of the Contractor to pay all laborers, mechanics, subcontractors, materialpersons, or any other person who provides supplies for carrying out the work.

Ninety (90) percent of the security may be released by the Administrator to the Proponent upon substantial completion of the permitted work, as determined by the Administrator. The remainder of the security shall be retained for not more than thirty (30) days following acceptance of construction by the Administrator as specified in Section 4.6, or until all required fees are paid, whichever occurs last.

2.9.2 Maintenance Security

After acceptance of construction by the Administrator, the Proponent shall operate and maintain the facility for a one year warranty period. To insure satisfactory facilities maintenance, operation and implementation of the property owners' association covenants regarding maintenance of facilities, the Proponent shall provide a maintenance security. The security shall be in the form of cash deposit or surety bond. If the security is a surety bond, it shall meet the requirements specified above for construction performance security.

The Administrator shall specify a bond amount sufficient to perform major repairs to the drainage and erosion control facilities but not less than 25% nor more than 100% of the total construction cost. At the end of the one year warranty period, the Administrator may use any portion of the security to correct design or construction deficiencies, restore facilities that have been damaged during the warranty period, or perform maintenance necessary to the operation of facilities. Upon completion of such corrective work, the Administrator shall release the balance of said security to the Proponent.

The Administrator may approve combining this security with other securities associated with the project into a single security; provided that at no time shall the amount of the security be less than the amount which would have been required by separate securities; and provided that such a security on its face shall identify those separate securities that it is intended to replace; and provided that the portion of the security for storm drainage and erosion control facilities may be released at a different time than the portions securing other facilities.

2.10 COMPREHENSIVE FLOOD HAZARD MANAGEMENT PLANS (SPECIAL REQUIREMENT #1)

The District Board of Supervisors adopts Comprehensive Flood Hazard Management Plans for the management of drainage and flooding problems within a specific drainage basin. An adopted Comprehensive Flood Hazard Management Plan may recommend capital improvements, non-structural improvements, and special drainage requirements for proposed projects within the drainage basin.

If a proposed project lies within an area with an adopted Comprehensive Flood Hazard Management Plan, then the drainage plans for the proposed project shall be prepared in conformance with any special requirements of the adopted Comprehensive Flood Hazard Management Plan.

Copies of adopted Comprehensive Flood Hazard Management Plans are available for reference at the Department of Community Development and the Department of Public Works. Examples of special drainage requirements which may be imposed by specific Comprehensive Flood Hazard Management Plans may include, but are not limited to, the following:

1. more stringent runoff control requirements, such as different design storm events;
2. more extensive water quality controls;
3. groundwater recharge requirements;
4. discharge to a constructed regional surface water control facility; and
5. specific 100-year flood elevations.

If the adopted Comprehensive Flood Hazard Management Plan does not specify any special requirements for drainage control, the requirements of these Standards shall apply.

2.11 OIL/WATER SEPARATION (SPECIAL REQUIREMENT #2)

If a proposed project will construct more than two (2) acres of impervious surface that will be subject to petroleum storage or transfer; to vehicular use in excess of 2,500 vehicle trips per day; or to heavy equipment use, storage, or maintenance, then oil/water separation shall be incorporated to treat the project's discharge prior to further treatment as required by Section 9 of these Standards.

Design requirements and standards for oil/water separation shall be as specified in Section 9.9.

2.12 USE OF LAKES, WETLANDS, OR CLOSED DEPRESSIONS FOR RUNOFF CONTROL (SPECIAL REQUIREMENT #3)

If a proposed project will use a lake, wetland, or closed depression for peak rate runoff control, will discharge directly to a lake, wetland, or closed depression, or otherwise increases the volume of runoff to an off-site closed depression, a Closed Depression Analysis shall be performed as specified in Section 5.6. Limits on increases to the water level to said lake, wetland, or closed depression shall be as defined in Section 5.6.

Stormwater discharges to wetlands shall not impair the wetland's natural hydroperiod or flows needed to preserve its existing functions and values. Prior to proposing discharge of higher volumes of stormwater to a wetland, alternative discharge, detention, and infiltration practices located in areas outside the wetland shall be used where feasible.

2.13 DELINEATION OF 100-YEAR FLOODPLAIN (SPECIAL REQUIREMENT #4)

If a proposed project contains or abuts a stream, lake, wetland, or closed depression, or if other Pacific County ordinances require study of flood hazards, then the Proponent shall delineate the 100-year floodplain as part of the Drainage Plan prepared for the proposed project.

If a flood hazard study exists and has been approved by the Administrator, then it may be used as a basis for delineating the floodplain boundaries. If a flood hazard study does not exist, then one shall be prepared by a Qualified Professional. The method of analysis shall be as specified in Section 4.3.8 of the King County, Washington Surface Water Design Manual.

2.14 VARIANCE PROCESS

2.14.1 Process

A process is provided for variance from one or more of the Base or Special Requirements, or one of the design requirements, contained in these Standards. All variances shall be reviewed by the County Engineer as described in Ordinance No. 1.

Requests for a variance will be accepted only for permits pending approval or approved permits which have not yet expired. A variance request must be submitted to the Administrator along with sufficient information necessary to evaluate the request. Proposed variances should be approved prior to final permit approval.

All variance requests shall be accompanied by a Variance Request Application form and the variance fee. The burden of proof shall be on the proponent to bring forth evidence in support of the application and to provide sufficient information on which any decision has to be made on the application. In granting any variance, the Administrator shall prescribe such conditions and safeguards as are necessary to secure adequate protection of the altered land and adjacent properties from adverse impacts.

2.11.2 Criteria for Granting Variance

The County Engineer will grant a variance if the proponent demonstrates that the requested variance conforms to all of the criteria set forth below:

1. That special conditions and circumstances exist which are peculiar to the land, such as size, shape, topography, or location; and

2. That literal interpretation of the provisions of Ordinance No. 1 would deprive the proponent of rights commonly enjoyed by other properties conforming to the terms of Ordinance No. 1; and

3. That the special conditions and circumstances do not result from the actions of the proponent; and

4. That the granting of the variance requested will not confer on the proponent any special privilege that is denied by Ordinance No. 1 to other lands, structures, or buildings under similar circumstances; and

5. That the variance requested is the minimum necessary to afford relief; and

6. That to afford relief the requested variance will not create significant impacts to critical areas and resource lands, downstream or adjacent properties, flood control or surface water control facilities, and will not be materially detrimental to the public welfare, injurious to the property in the vicinity and zone in which subject property is situated, or contrary to the public interest.

2.15 APPEAL PROCEDURE

A final decision regarding an application or a variance may be appealed to the Board of Supervisors of the District if (1) a written appeal is filed with the Board of Supervisors within fourteen (14) calendar days of the date of the decision and (2) the appeal fee is paid. The Board of Supervisors will hear appeals District Ordinance No. 2.

SECTION 3 SUBMITTAL REQUIREMENTS

3.1 INTRODUCTION

This section details the required procedures for the submittal of plans required by these Standards. The intent of these procedures is to present consistent formats to facilitate review for compliance with District ordinances and regulations.

3.2 PROCEDURES FOR PROCESSING LAND ALTERATION AND DRAINAGE PERMIT APPLICATIONS

The Pacific County Department of Community Development is responsible for accepting and processing applications for both land alteration and drainage permits. Procedures for processing applications will be in accordance with District Ordinance No. 2.

The Water and Waste Services Section of the Pacific County Department of Public Works is responsible for the review of all land alteration and drainage aspects of development proposals.

3.3 PROFESSIONAL QUALIFICATIONS

Drainage Plans shall be prepared and signed by a Qualified Professional. Geotechnical engineering reports shall be prepared and signed by a Qualified Geotechnical Professional. Soils reports shall be prepared and signed by a Qualified Soils Professional.

3.4 DRAINAGE PLANS

3.4.1 General Requirements

Submittals required by these Standards shall document how the Base and Special Requirements apply to a proposed project. In addition to application forms, various engineering plans, reports, and drawings may also be required to be submitted, depending on the type of project or activity proposed. Not all submittals are required for every type of project or activity; specific submittal requirements are shown in Table 3-1. The format and content of the submittals shall be as described in the following subsections.

Submittals shall include:

1. Surface Water Control Plan

2. Temporary Erosion/Sedimentation Control (TE/SC) Plan

3.4.2 Abbreviated Drainage Plan

Certain types of projects or development activities identified in Table 3-1, such as single-family residential construction, may require only an abbreviated surface water control plan. However, a full Surface Water Control Plan and/or Temporary Erosion/Sedimentation Control Plan may be required based on potential downstream impacts of the proposed project, as determined by the Administrator.

The Administrator's determination will be based on, but not limited by, the following criteria:

1. extent of potential impacts to downstream property from runoff from the project site;

2. potential to increase water surface levels in a closed depression, if subject property, alone or in conjunction with other properties in the basin, discharge to said closed depression; and

3. quality, accuracy, and content of the Abbreviated Drainage Plan.

Evaluation of potential impacts will be based on engineering reports, aerial photographs, topographic mapping interpreted from said photographs, previous actions of agencies, maintenance reports, and, if necessary, on knowledge of individuals familiar with the area. Impacts evaluated may include, but not be limited to, the following:

1. surface water quality;
2. erosion;
3. sediment deposition;
4. flooding;
5. habitat destruction;
6. groundwater quality; and
7. public health, safety and welfare.

Requirements of an Abbreviated Drainage Plan are stipulated in Section 3.7.

TABLE 3-1
SUBMITTAL REQUIREMENTS

Project or Activity Type	Surface Water Control Plan	TE/SC Plan	Abbreviated Drainage Plan
Preliminary/Final Subdivision	Yes	Yes	No
Short Subdivision	Yes	Yes	No
Building Permit-Single Family, Duplex	No	No	Yes
Building Permit-Multi-Family	Yes	Yes	No
Building Permit-Commercial, Industrial	Yes	Yes	No
Mobile Home/RV Parks	Yes	Yes	No
Shoreline Substantial Development Permit[1,2]	Yes	Yes	No
Conditional Use Permit[1]	Yes	Yes	No
Land Use Variance Request[1]	Yes	Yes	No
Land Alteration Permit[2,3]	Yes	Yes	No
Zoning Reclassification (Rezone)[1]	Yes	Yes	No
Right of Way Permit	Yes	Yes	No
Public Facility Construction	Yes	Yes	No

1 If the proposed project or activity will require subsequent permits or approvals which require review for conformance with these Standards, then submission of the required plans may be deferred by the Administrator until application for subsequent permits.

2 If permit is for single family residential construction or land use, an Abbreviated Drainage Plan shall be prepared.

3 If proposed land alteration consists solely of clearing, and said clearing does not exceed 20 acres, only an Abbreviated Drainage Plan is required.

3.5 SURFACE WATER CONTROL PLAN

3.5.1 General

A Surface Water Control Plan shall consist of the following:

1. Drainage Report;
2. Engineering Plans & Specifications; and
3. Maintenance Plan.

3.5.2 Drainage Report

The report shall be prepared on 8½ x 11-inch size stock and shall be bound or stapled. The drainage report shall include all of the following elements and chapter headings:

Cover Sheet
Qualified Professional's Certification
Table of Contents
Section 1.0 - Project Overview
Section 2.0 - Existing Conditions Summary
Section 3.0 - Design Narrative
Section 4.0 - Offsite Analysis
Section 5.0 - Runoff Analysis
Section 6.0 - Conveyance System Analysis and Design
Section 7.0 - Flood Analysis
Section 8.0 - Special Reports and Studies
Appendices

Descriptions and requirements for each of the elements follow. If some required chapter headings do not apply, the words "not applicable" shall be placed underneath the chapter heading.

Cover Sheet. The drainage report shall have a cover sheet which identifies the name of the project; the Proponent's name, address, and telephone number; the name of the Qualified Professional responsible for the preparation of the report; the project location, including legal description, section, township and range; the date of submittal; and the name, address, and telephone number of the project's contact person.

Qualified Professional's Certification. The drainage report shall include the following certificate:

> *I hereby certify that this Surface Water Control Plan for _____(name of project) has been prepared by me or under my supervision and meets minimum standards of the Pacific County Flood Control Zone District No. 1 and normal standards of engineering practice. I understand that the District does not and will not assume liability for the sufficiency, suitability or performance of drainage facilities designed by me.*

Said certificate shall be signed by the Qualified Professional, and his/her seal shall be affixed thereto.

Table of Contents. The drainage report shall include a table of contents with page numbers referenced.

Section 1.0 - Project Overview. This section of the drainage report shall:

1. Describe the project, including a general description of what is being proposed to be constructed on the site, the pre-developed and post-developed conditions of the site, the area of the site, the size of the improvements, and the disposition of the surface water runoff before and after development.

2. Describe any off-site areas tributary to the project.

Section 2.0 - Existing Conditions Summary. This section of the drainage report shall describe the site's existing conditions, including:

1. Topography; a Topographic Site Map as described in subsection 3.5.3.3 shall be included.

2. Soils; a summary of the site soils types within the project site and its upstream tributary area shall be included. The SCS Soil Survey of Pacific County shall be used; however, if the maps do not accurately represent the project site soils, the Qualified Professional shall ensure that the actual soil types are properly mapped. If a geotechnical report is required, a figure in the report that identifies site soil types may be referenced.

3. Critical areas as defined by the Pacific County Critical Areas and Resource Lands Ordinance;

4. Natural drainage features, including drainage basins and sub-basins. The following items shall be discussed: (1) acreage of all basins and existing discharge points to and from the site; (2) the upstream tributary area including adjacent ground cover, soil type, and mode that surface water currently enters the project site; (3) any existing or potential problems that may occur due to development of the site; and (4) possible impacts of groundwater seepage or interflow on the project.

5. Existing and abandoned wells; existing and abandoned underground tanks; and existing and abandoned on-site sanitary sewer systems;

6. All other existing site conditions relating to drainage and water quality.

Section 3.0 - Design Narrative. This section of the drainage report shall provide a narrative which describes the design of the surface water control systems and presents design criteria. At a minimum this section shall:

1. Describe how site surface water is discharged to off-site drainage conveyances.

2. Describe all control facilities including detention/retention facilities, treatment facilities, conveyance systems, and outfalls.

3. Provide a narrative to coordinate the site plan, work maps, calculations and model results, nomographs and design guides used in the design.

4. Summarize the analysis for sizing conveyance systems, treatment facilities, detention/retention facilities, and outfalls.

5. Proposed utilities, buildings, parking areas, sewer systems, and similar site infrastructure.

Section 4.0 - Offsite Analysis. This section of the drainage report shall provide an analysis of both upstream tributary areas and downstream discharge areas in accordance with the requirements of Section 2.3. At a minimum, a qualitative analysis shall be provided. Depending upon the findings of this analysis, the Administrator may require that this section contain a quantitative off-site analysis.

Section 5.0 - Runoff Analysis. This section of the drainage report shall include an analysis of site hydrology for both pre-development and post-development conditions, and shall describe any proposed retention/detention facilities required to meet the requirements of Section 2.4 and Section 5. At a minimum, this section shall include:

1. A discussion of existing site hydrology, including:

   a. assumptions and site parameters used in analyzing the existing site hydrology;

   b. narrative, mathematical and graphical presentation of parameters selected and values used for the developed site conditions, including the acreage, runoff coefficients or curve numbers, times of concentration, and travel times used to determine existing flow characteristics, along with maps and exhibits for each sub-basin affected by the proposed project; and

   c. delineation and acreage of areas contributing runoff to the site, retention/detention facility location, and outfall and overflow route; each sub-basin should be individually labeled; hydrograph/flow calculations for a given sub-basin should be labeled identically to that sub-basin.

2. A discussion of developed site hydrology, including:

   a. narrative, mathematical and graphical presentation of parameters selected and values used for the developed site conditions, including the acreage, runoff coefficients or curve numbers, times of concentration, travel times, roadway layouts, and constructed drainage facilities used to determine existing flow characteristics, along with maps and exhibits for each sub-basin affected by the proposed project;

   b. delineation of developed sub-basin areas and flows, referenced to hydraulic modeling reports or calculation sheets with relevant areas highlighted and tabulated in a listing of all developed sub-basin flows; and

   c. delineation and acreage of areas contributing runoff to the site, retention/detention facility location, outfall, and overflow route; each sub-basin should be individually labeled; hydrograph/flow calculations for a given sub-basin should be labeled identically to that sub-basin.

3. A discussion of runoff control systems, including:

   a. the performance required to calculate the size of conveyance systems;

   b. a conceptual drawing of the facilities and appurtenances showing basic measurements necessary to calculate the storage volumes available from zero to the maximum head,

orifice/restrictor sizes and head relationships, and control structure/restrictor orientation to the detention facility; and

c. calculations, equations, references, storage/volume tables, graphs, and other aides necessary to clearly show results and methodology used.

4. A discussion of runoff treatment systems, including:

a. the selection of treatment method;

b. a determination of need for oil/water separation;

c. an evaluation of feasibility of infiltration;

d. a conceptual drawing of the facilities and appurtenances showing basic measurements; and

e. calculations, equations, references, graphs, and other aides necessary to clearly show results and methodology used.

Section 6.0 - Conveyance System Analysis and Design. This section of the drainage report shall present a detailed analysis of any existing conveyance systems and any proposed collection and conveyance systems (See Section 6). Pipes, culverts, catch basins, channels, swales, and other stormwater conveyances and appurtenances shall be clearly labeled and identified.

Information shall be referenced to the Surface Water Control System Plans required by Section 3.5.3.5. Information shall include pipe flow tables, flow profile computation tables, nomographs, charts, graphs, or other tabular or graphic aides used to design and confirm performance of the conveyance system.

Verification of capacity and performance shall be provided for each element of the conveyance system. Design velocities and flows shall be shown for both on-site and off-site drainage facilities affected by the proposed project.

Section 7.0 - Flood Analysis. If there is a natural water body such as a stream or lake on or adjacent to the project, this section of the drainage report shall show existing 100-year flood limits. If none exist, the Administrator may require the Qualified Professional to prepare a backwater analysis to determine flooding limits for the 100-year flood. The method of analysis shall be as specified in the King County Surface Water Design Manual (See Section 1.5).

Section 8.0 - Special Reports and Studies. This section of the drainage report shall identify special studies which may be required by the Administrator. Such studies may include, but are not limited to, relevant basin plans, groundwater studies, flooding studies, geotechnical studies, and other studies which further address site characteristics, the potential for impacts associated with the development, and the measures which would be implemented to mitigate impacts. Such special reports shall be prepared by a Qualified Professionals with expertise in the applicable area of analysis.

Appendices. Appendices shall include the following:

Appendix A - Site and Facility Summary Form.
Appendix B - Calculations.

Appendix C - Bond Quantities and Calculation of Bond Amount.
Appendix D - Geotechnical Report.
Appendix E - Property Owners' Association Articles.
Appendix F - Inspection Schedule

3.5.3 Engineering Plans & Specifications

3.5.3.1 General Requirements

Plans shall be sufficiently clear so as to enable construction of the project in proper sequence, using specified methods and materials, with sufficient dimensions to fulfill the intent of all District ordinances and these Standards.

Plans shall be 24 inches by 36 inches and shall include north arrow, scale, and at least two bench mark references and at least two coordinates referenced to a coordinate system acceptable to the Administrator. Drawings shall include a legend explaining the map symbols used. Drawings shall bear the stamp and signature of the Qualified Professional responsible for their preparation.

3.5.3.2 Vicinity and Location Map

Using the most recent topographical information available, the base map shall show the project's boundaries, sub-basin boundaries, off site areas tributary to the project, contours, major drainage features, such as channels, detention facilities and floodways, and flow path to receiving waters. If flow path crosses private property, property boundaries and current owner names shall be included. A minimum USGS 1:2,400 topographic map shall be used as a base for the map.

3.5.3.3 Topographic Site Map

The Topographic Site Map shall show existing conditions and the proposed project, including but not limited to:

1. Property boundaries; existing and proposed easements; lot dimensions; and areas;

2. Existing and proposed topography contours shall be shown at 2-foot intervals (5-foot intervals for slopes greater than 15%, 10-foot intervals for slopes greater than 40%) with contour intervals clearly indicated. Topography shall be provided both on the subject property and all adjacent properties sufficient to determine all potential topographic impacts of the construction. At a minimum, topography shall extend 50 feet beyond property boundaries;

3. Existing utility locations including type, material, depth, dimensional locations;

4. Natural or manmade drainage courses or pipes to the extent necessary to determine all hydraulic or hydrologic impacts of the proposed projects;

5. Locations of all existing and proposed structures or pavement within 100 feet of the project boundaries; areas of existing and proposed structures, pavements, and other impervious surfaces shall be shown;

6. Critical areas and resource lands, as defined in Pacific County Critical Areas and Resource Lands Ordinance No. 147.

7. Existing and proposed wells on-site and on adjacent properties, whether "of record" or not; existing and proposed fuel tanks; and existing and proposed on-site sanitary systems; and

8. Existing and proposed roadway features, including centerline, edge of pavement and shoulder, ditchlines, curbs and sidewalks.

For subdivision projects, drawing scale shall be 1"=50'. For all other projects, scale shall be 1"=20', unless a smaller scale is allowed by the Administrator. Contours may be extrapolated from USGS mapping, aerial photos, or other topographic mapping resources. However, field verification of contours may be required by the Administrator for conveyance systems, roadways, easements, and surface water control facilities

3.5.3.4 Topographic Work Map

A topographic work map shall show surface water control system and reference it to computer model input or calculations. Conveyance links and contributing areas shall be named or numbered consistent with computer input. Using the same scale as the topographic site map, the contour topographical work map shall:

1. Show unit areas used in calculations contributing to a reach or to a catch basin, including off-site area;

2. Identify areas contributing to retention/detention facilities;

3. Indicate total area, percent of total area which is impervious, average slope, and estimated ultimate infiltration rate for unit areas;

4. Indicate conveyance data, including symbol which is referenced to computer hydrologic model output), length, slope, inverts up and down;

5. Show overland flow paths and distances;

6. Identify soil types;

7. Indicate locations of soil pits and infiltration tests;

8. Show water surface elevation for the design storm, invert elevations at breaks in the grade, design discharge, and design velocity for open channel systems; and

9. Show spot water surface elevation discharges and velocities for the design event.

3.5.3.5 Surface Water Control System Plans

Plans shall include plan and profile drawings of the proposed drainage system showing all hydraulic and physical data, including but not limited to:

1. Existing and proposed topography;

2. Invert elevations at all inlets, structures, outfalls, and other points of interest;

3. Bottom elevations of all ditches, channels, ponds, swales, and streams;

4. Pipe sizes or channel cross sections;

5. Pipe length and material;

6. Grades on all pipes or channel bottoms;

7. Design water surface elevations and flow rates for all conveyance pipes or channels;

8. Design volume, contours of the finished surface, inlet locations, outlet details including inverts or grate elevations, and secondary overflow paths for above ground ponds;

9. Top or grate elevations of all structures, inlets, catch basins, or manholes;

10. Detention pipe or vault details including dimensions, elevations of inverts, and maximum water surface elevations;

11. Details of all structures not shown in the Standard Drawings, including underground detention vaults, if used;

12. Phasing limits for phased construction projects and any interim drainage control measures required due to the phasing; and

13. Datum, benchmark locations, and elevations used for vertical control.

3.5.4 Maintenance Plan

A maintenance plan shall be prepared for each surface water control facility. The plan shall be bound separately from other plans required by these Standards and shall:

1. Describe the required type, size, location and design features of all control facilities;

2. Provide an outline of maintenance tasks and recommended frequency at which each task should be performed for all facilities, incorporating at least the minimum standards for inspection and maintenance then available from the Administrator;

3. Include an estimate of the average annual cost of maintenance;

4. Describe hazardous materials handling protocols developed specifically for the type of development or business designed to prevent the release of pollution from the site. The relevant procedures found in Volume IV of the Stormwater Management Manual for the Puget Sound Basin (Washington State Department of Ecology) shall be followed. Copies of the relevant procedures shall be attached as necessary;

5. A declaration of covenant as required by Section 2.8.3; and

6. A maintenance bond as required by Section 2.9.2.

3.6 TEMPORARY EROSION/SEDIMENTATION CONTROL PLAN

The report shall be prepared on 8½ x 11-inch size stock and shall be bound or stapled. The plan shall have the same general format and requirements described in Section 3.5.2, and shall contain the following elements.

3.6.1 Construction Sequence and Procedure

The plan shall state which construction elements are contingent upon completion of erosion/sedimentation control facilities. Sequence of construction shall be described in specifications or shown on plans.

3.6.2 Temporary Erosion/Sedimentation Control Features

The plan shall describe: (1) methods and procedures for trapping sediment before it reaches the storm drainage detention system, adjoining property, or natural channels; (2) how loss of soil due to vehicles tracking it away from the site will be prevented; (3) clean-up methods both on and off site; and (4) procedures for stabilizing exposed soil in or near environmentally sensitive areas.

At a minimum, the following shall be shown:

1. Construction entrance detail;

2. Silt fences and traps;

3. Mulching and vegetation plans;

4. Clearing and grubbing limits;

5. Existing and finished grade; and

6. Construction phases.

3.6.3 Permanent Erosion Control and Site Restoration

The plan shall describe retaining walls, revetments, energy dissipaters, geotextiles, paving or bank reinforcement, landscaping, and other permanent site restoration features.

3.6.4 Emergency Management Plan

An emergency management plan shall also be submitted. The report shall be prepared on 8½ x 11-inch size stock and shall be bound or stapled. At a minimum, the plan shall contain the following information:

1. Name, address, and 24-hour telephone number(s) for the person(s) responsible for regular observation and repair or replacement of all erosion and sedimentation control measures;

2. Schedule for regular inspection, maintenance, and replacements of erosion and sedimentation control measures;

3. Location and inventory of materials required to be stockpiled on the site for emergency repair, of the approved erosion and sedimentation control system; and

4. Contingency plans for use in case of failure of erosion and sedimentation control/systems to meet permit requirements.

3.6.5 Restoration Plan

For projects that expose more than 20,000 square feet of earth, or contain or adjoin drainage features, frequently flooded areas, or environmentally sensitive areas, or occur on slopes over fifteen (15) percent, the Administrator will require a restoration plan that shall consider vegetation types, mulching/armoring, and/or maintenance to affect the following:

1. Erosion and sediment control;

2. Soil and slope stability; and

3. Protection of drainage features and environmentally sensitive areas.

3.7 ABBREVIATED DRAINAGE PLAN

An Abbreviated Drainage Plan shall generally describe how drainage and erosion and sedimentation will be controlled. An Abbreviated Drainage Plan shall show all existing and proposed site improvements, with all structures accurately located and access clearly delineated. Any required drainage features, including driveway culverts, roof drain/foundation drain infiltration trench systems, detention facilities (if required), connections to drainage facilities, temporary erosion/sedimentation control measures, and easements shall be shown. All drainage features on or within 50 feet of the site shall be shown. The direction and location of surface water runoff shall be shown. Surface water run-on from all adjacent properties shall be indicated. Plans shall be drawn on 8½" x 11" or larger sheet, and shall have a north arrow. Drawing shall indicate plat and lot number(s), address, and street name(s). Preparation of the plan by a Qualified Professional is not required unless specifically required by the Administrator.

The general requirements for temporary erosion and sediment control specified in Section 10.2 shall be followed. The requirements of the Small Parcel Erosion Control Plan shown in Figure B17 shall be attached by the Administrator as a required condition to all permits issued in response to Abbreviated Drainage Plans.

3.8 GEOTECHNICAL AND SOILS REPORTS

Geotechnical and soils reports, when required by these Standards, shall be prepared by a Qualified Geotechnical Professional or Qualified Soils Professional, as appropriate and as specified in these Standards. The report shall, at a minimum, characterize and classify the underlying soils based on the SCS classification system and soil texture method, identify any impacted areas containing groundwater interflow, and describe any special characteristics of the underlying soils that should be addressed by the proposed project. Such characteristics shall include: load bearing capacity; suitability for use as common fill and structural fill; erodibility during construction; and the ability to support vegetation.

The standard notes listed in Appendix C shall be affixed to all plans submitted under these Standards. Additional notes as needed to ensure that contractors have clear and complete instructions on installing and maintaining temporary erosion/sedimentation control practices shall also be affixed to all plans.

3.10 AUTHORIZATION TO INSPECT PROJECT SITE PRIOR TO ISSUANCE OF PERMIT

Submission of a permit application shall constitute authorization for the Administrator or his/her designee to inspect the project site prior to issuance of any permit. The Administrator or his/her designee shall be authorized to enter upon premises to review said premises, ascertain, or make necessary tests as required to review the proposed land development under Ordinance No. 1 and these Standards.

3.11 EXPIRATION

Drainage Plans, including Surface Water Control Plans, Temporary Erosion/Sedimentation Plans, and Abbreviated Drainage Plans shall expire within one (1) year of issuance date of a Drainage Permit, unless an underlying local permit (Building Permit, Shoreline Substantial Development Permit, Short Plat Approval, etc.) carries a longer expiration period, in which case the expiration period of the underlying period shall prevail. If an underlying permit carries no expiration period, the expiration period shall be one (1) year.

If construction of the permitted activity is not completed by the expiration date, the proponent shall submit a written request for an extension of the permit period. The written request shall clearly specify the reasons for extension. The Administrator may grant an extension of the permit for up to one (1) additional year and the permitted activities may be subject to additional conditions and requirements, which are in effect at the time an extension of permit is granted.

3.12 PLAN CHANGES AND REVISIONS AFTER PERMIT ISSUANCE

Notice of changes or revisions to the originally approved drainage plans shall be provided to the Administrator prior to proceeding with changed work. If changes or revisions to the originally approved drainage plans require additional review, the revised plans shall be submitted to the Pacific County Department of Community Development for approval prior to construction. Plan changes and revisions shall be prepared, reviewed, and processed as described herein.

SECTION 4 CONSTRUCTION PROCESS

4.1 AUTHORITY TO CONSTRUCT

Until the Administrator approves a Surface Water Control Plan, Temporary Erosion/Sedimentation Control Plan, and/or Abbreviated Drainage Plan, the District shall not:

1. Grant a drainage permit or land alteration permit; and

2. Allow land alteration, demolition, site work, or construction to commence, except as needed to install erosion and sediment control facilities.

The District shall not approve construction of footings for structures, unless erosion control devices are in place and functional.

Issuance of a permit shall constitute authority to construct the proposed project, incorporating all provisions of the approved plans and reports and these Standards.

Work performed within the public right-of-way, or as described in these Standards, whether by or for a private developer, by County forces, or by a County contractor, shall be done to the satisfaction of the County and in accordance with the Standard Specification, any approved plans and these Standards. Unless otherwise approved, any revision to construction plans shall be approved by the District before being implemented. The District shall have authority to enforce the Standards as well as other referenced or pertinent specifications.

The Proponent shall notify the District in advance of the commencement of any authorized work. A pre-construction conference and/or field review may be required before the commencement of any work, as determined by the Administrator.

Failure to comply with the provisions of these standards may result in stop work orders, removal of work accomplished, or other penalties as established by ordinance.

4.2 INSPECTION

Approved plans, including Abbreviated Drainage Plans, shall be kept on the project site during construction and made available to the Administrator upon request.

The Administrator or his/her designee may inspect the work authorized by the permit. The Administrator or his/her designee shall be authorized to enter upon premises to review construction authorized by a permit for compliance with said permit, District Ordinance No. 1 and these Standards. The proponent's contractor shall provide access to the construction for inspection of the work by the Administrator or his assistants at all times. In the event that entry is refused, necessary steps shall be taken to make application for a search warrant to accomplish the inspection.

In addition to inspection performed by the Administrator, the Proponent shall provide inspection of all construction covered by a drainage permit, except for a drainage permit granted in response to an Abbreviated Drainage Plan. Construction performed under a permit granted in response to an Abbreviated Drainage Plan need not be inspected.

Inspection shall be performed by a qualified individual who shall keep detailed records of the construction as required to prepare a construction report as defined in Section 4.3. The Proponent's contractor shall provide access to the construction for inspection of the work by the Administrator or his or her designee at all times.

4.3 CONSTRUCTION REPORT

The Proponent shall prepare a construction report. The report shall describe all factors related to the construction, including but not limited to:

1. A description of the construction techniques observed.

2. Compaction test results and analyses of materials used.

3. Photographs and descriptive narrative of subject taken during construction documenting the construction and compliance with the approved plans.

4. A description of any conditions found in the field which are at variance from conditions as described in previous geotechnical reports.

5. Construction record documents as specified in Section 4.5.

Construction reports need not be prepared for construction performed under a permit granted in response to an Abbreviated Drainage Plan.

Construction reports shall be submitted to the Administrator and approved prior to the issuance of any Certificate of Occupancy, or issuance of any subsequent permits.

4.4 STOP WORK ORDER

If a person fails to comply with the terms of a permit issued under Ordinance No. 1, or engages in activities regulated under Ordinance No. 1 without the appropriate permit(s), the Administrator may issue a written order to immediately stop all work except that which is necessary to bring the project into compliance with Ordinance No. 1.

4.5 CORRECTIONS OF DEFICIENCIES IN WORK

At the discretion of the Administrator, significant errors or omissions in the approved plans or information used as a basis for such approvals may constitute grounds for withdrawal of any approvals and/or stoppage of any or all of the permitted work. It shall be the responsibility of the Proponent to show cause why such work should continue, and make such changes in plans that may be required by the Administrator before the plans are re-approved or permits reissued.

Materials, work, or workmanship which, in the opinion of the Administrator, do not conform to the approved plans or are in any way unsatisfactory or unsuited to the purpose for which they are intended may be determined to be deficient by the Administrator.

The Administrator may order the removal, correction or replacement of any deficiency. All costs associated with said removal, correction or replacement shall be the sole responsibility of the property owner or the Proponent.

If the Administrator determines that immediate action is required to remedy a deficiency at a project site or facility for which the District has an easement, the District may perform the necessary construction or remedial work and bill the property owner, the property owner's association, or the Proponent for all costs associated with said work.

The property owner, the property owners' association, and Proponent are jointly and severally liable for all costs, including a reasonable attorney's fee, incurred in any remedial action performed by the District under this Section. The District may record a lien on the property owned by such jointly and severally liable entities for payment of costs plus reasonable attorney's fees. Interest shall accrue on costs and fees at the same rate as for real estate tax delinquencies and shall commence on the date of completion of remedial action.

The District assumes no liability for performing any action authorized under this Section.

4.6 CONSTRUCTION RECORD DOCUMENTS

Construction record documents shall, at a minimum, show:

1. Location and type of all catch basins, manholes, or other structures;
2. Location, lengths and type of pipe installed in the system;
3. Elevation at top, inverts, and bottoms of all structures;
4. Locations and volumes of all above ground ponding/detention areas;
5. All connections to drainage systems;
6. All outfalls to streams or other bodies of water; and
7. Signature and stamp of the Qualified Professional preparing the documents.

The as-built information above shall be shown in the form of revisions to the approved plans and shall be submitted in a reproducible form and/or in digital, electronic format.

4.7 ACCEPTANCE OF CONSTRUCTION

The Administrator shall not release financial securities related to surface water and erosion control or accept final construction until:

1. Work is completed to the satisfaction of the Administrator;
2. Construction Report is approved by the Administrator;
3. Any provisions of these Standards have been placed on the cover sheet of a plat;

4. An easement for access by the District to inspect and maintain all drainage facilities is provided;

5. Maintenance covenants are approved by the Administrator;

6. Covenants on lots, property owners' association articles, maintenance easements, agreements with adjacent property owners, conservation easements, and similar documents as required in the Surface Water Control Plan have been recorded with Pacific County Auditor; and

7. The site has been permanently stabilized and restored, and temporary erosion control measures have been removed.

SECTION 5 RUNOFF CONTROL STANDARDS

5.1 INTRODUCTION

This section addresses surface water runoff: the short-term movement of water over land resulting directly from precipitation. This section presents the acceptable methods for estimating the quantity and characteristics of surface water runoff, as well as the assumptions and data required as input to the methods. These methods are used by Qualified Professionals to analyze and design existing and proposed surface water control systems and facilities.

Several comprehensive manuals have been prepared by other jurisdictions and agencies detailing the analysis methodology for runoff control. Therefore, much of the methodology will not be included herein. The purpose of this section is to define the minimum computational standards required and to outline how these may be applied; the design standards listed in Section 1.5 shall be used as references to conduct analysis and design.

A complete, basic understanding of the hydrologic, geologic, and environmental processes integral to surface water systems is essential for the proper and accurate application of the methods contained in this section and the design standards referenced in Section 1.5.

5.2 DESIGN STORM

5.2.1 General

Design storms shall be based on total rainfall volume (depth in inches) and rainfall distribution.

5.2.2 Design Storm Volume

The design storm event is specified by return frequency and duration. The design storm volume is delineated in Table 5-1.

5.2.3 Rainfall Distribution

All storm event hydrograph methods require the input of a rainfall distribution or design storm hyetograph, which is a plot of rainfall depth versus time for a given design storm frequency and duration. The design hyetograph shall be the standard SCS Type 1A rainfall distribution.

5.3 COMPUTATION METHOD

All surface water control and conveyance systems, existing and proposed, shall be analyzed and designed using the Santa Barbara Urban Hydrograph (SBUH) Method. For drainage basins greater than 25 acres, the SCS TR-20 Hydrograph Method may be used. Other acceptable methods may be used if approved by the Administrator.

TABLE 5-1
TOTAL RAINFALL VOLUMES

Design Storm[1]	Volume (Inches)
6-Month, 24-Hour	2.24
2-Year, 24-Hour	3.2
5-Year, 24-Hour	4.0
10-Year, 24-Hour	4.5
25-Year, 24-Hour	5.0
50-Year, 24-Hour	5.5
100-Year, 24-Hour	6.1
100-Year, 7-Day	11.3

[1] Source: NOAA, Atlas 2, Volume IX.

5.4 HYDROGRAPH METHOD

The hydrograph method shall be as described in the Ecology Stormwater Management Manual or other of the design standards referenced herein. The "level pool routing" or similar hydrograph routing method shall be used for routing a hydrograph through an existing retention/detention facility or closed depression, and for sizing a new retention/detention facility using hydrograph analysis.

Soils classifications or hydrologic soil groups may be determined from the SCS Soil Survey of Pacific County or from site investigations conducted by a Qualified Soils Professional. SCS curve numbers for western Washington are provided in Appendix I.

Numerous PC-based computer applications have been developed to perform hydrologic analysis and to generate, add and route hydrographs. Although these analyses may be performed manually, the District encourages use of commercially-available software, such as WaterWorks by Engenious Systems, Inc., Seattle, Washington, (206) 628-0167.

5.5 PEAK RATE RUNOFF CONTROL

5.5.1 Control Requirement

In order to minimize downstream erosion and flooding impacts, discharge of surface water from a site or control facility shall be limited. Stormwater detention facilities shall be provided in order to store all surface water runoff in excess of the allowable peak discharge specified in subsection 5.5.2. Discharge may be further limited by other criteria in these Standards, or if the proposed project will endanger downstream property.

5.5.2 Allowable Peak Discharge Rate

The post-development peak discharge rate shall not exceed:

1. Fifty (50%) percent of the pre-development peak runoff for the 2-year, 24-hour design storm; and

2. One hundred (100%) percent of the pre-development peak runoff for the 25-year, 24-hour design storm.

3. One hundred (100%) percent of the pre-development peak runoff for the 100-year, 24-hour design storm.

The allowable peak discharge rate shall be used with the Hydrograph Method to calculate storage volume requirements, conveyance systems, infiltration systems, and water treatment facilities in accordance with these Standards.

5.5.3 Pre-Development Analysis

Pre-development analysis shall be based on the existing condition of project site prior to any development or construction. In determining the Curve Number for the pre-development analysis, the Qualified Professional shall use a Land Use Description of "Wood or Forest" and a Condition of "Undisturbed" (see Appendix I) unless other appropriate Curve Numbers are justifiable by a Qualified Professional based on the available data.

5.5.4 Post-Development Analysis

Post-development analysis shall be based on the proposed development. For the purpose of calculating impervious cover in a subdivision where the amount of impervious cover on one or more lots is indeterminate at the time of drainage review, the Qualified Professional shall determine storage requirements as if all lots were developed.

5.6 CLOSED DEPRESSION ANALYSIS

5.6.1 General

Closed depressions are low-lying areas which have no, or such limited, surface outlet that in most storm events the area acts as a retention basin, holding water for infiltration into the ground or evaporation into the air. By their nature, many closed depressions may contain wetlands which shall require conformance with requirements of Pacific County's Critical Areas and Resource Lands Ordinance No. 147 as well as other regulations.

The analysis of closed depressions requires special assessment of the existing hydrologic performance in order to evaluate the impacts of a proposed project.

5.6.2 Discharge Requirements

Runoff may be discharged to a closed depression provided that:

1. no significant public health, safety, welfare, or property damage issues are or will be created, as determined by the Administrator;

2. the Proponent has a legal right to discharge to the closed depression; and

3. the following requirements are met:

   a. For a closed depression contained entirely on the project property, the peak water elevation for the 100-year 7-day design storm event is retained in dead storage on-site (does not create overflow condition); and

b. For a closed depression contained partially on the project property or entirely off-site, the peak water elevation for the 100-year 7-day design storm event for the tributary area under post-development conditions does not exceed 0.1-foot above the pre-development peak water elevation.

5.6.3 Management Alternatives

On-site infiltration and retention are two potential mechanisms that may assist in satisfying the above requirements. These requirements may be met by excavating additional storage volume in the closed depression, subject to all applicable laws and regulations. If infiltration alone cannot satisfy the requirements, the closed depression shall incorporate all features of a retention facility as described in Section 7 of these Standards. Overflow routes shall be analyzed to address potential adverse impacts in accordance with these Standards.

5.6.4 Allowable Exceedance of Discharge Requirements

The discharge requirements of Section 5.6.2 may be exceeded provided that:

1. Quantitative off-site analysis is performed; and

2. Owner(s) of the property impacted by overflow discharge or increased water elevation provide written documentation that they will accept higher flows. Documentation shall consist of covenants, a conservation easement, dedication to the public, or other means acceptable to the Administrator.

SECTION 6 CONVEYANCE SYSTEM STANDARDS

6.1 OVERVIEW

A conveyance system includes all portions of the surface water control system, either natural or man-made, that transport storm and surface water runoff. The conveyance system drains surface water from properties. A properly designed conveyance uses proper materials, shape, slope and size to maximize hydraulic efficiency. An ideal conveyance is sized to provide adequate capacity for design flow while minimizing erosion and allowing for habitat preservation.

A man-made conveyance system should emulate the natural conveyance system of the site to the greatest extent practicable. Inflow and discharge should occur at the natural drainage point(s) as determined by topography and existing drainage patterns.

Conveyance systems include:

- open channels;
- culverts;
- storm sewers; and
- outfalls.

See Section 2.5.3 for hierarchy of preferred conveyance methods and other requirements.

6.2 ANALYSIS AND DESIGN REQUIREMENTS

6.2.1 Methodology

Existing and proposed conveyance systems shall be analyzed and designed using the peak flows from hydrographs developed using the procedures described in Section 5 and the design standards referenced in Section 1.5 of these Standards. Methodology for estimating stream flow for sizing of bridges and culverts shall be proposed by a Qualified Professional and approved by the Administrator.

6.2.2 Easements

All publicly and privately maintained conveyance systems (except roof downspout drains, yard drains, and footing drains) shall be located in drainage easements or covenants granted to the District. Minimum easement widths shall be as specified in Section 2.8.4. No portion of the drainage easement shall be located within an adjacent property or right-of-way.

6.2.3 Design Storm

6.2.3.1 Conveyance Systems

Minimum capacity for conveyance systems shall be equal to or greater than the peak discharge runoff rate from the 25-year, 24-hour design storm event, providing that a minimum of 0.5-foot of freeboard is maintained between the hydraulic grade line and the top of structures.

Surcharged conditions for pipe systems and "bank-full" conditions for open ditches and channels may be acceptable to the Administrator, provided that:

1. There shall be no damage to structures nor inundation of buildings or building sites from the peak discharge from the 100-year, 24-hour design storm event;

2. Public roads and streets shall not have water over more than 50 percent of the outside driving lane for the 25-year, 24-hour design storm event;

3. Not more than six inches of standing water over major or minor collector roads and streets or critical access points (as determined by the Administrator) will result from peak discharge from the 100-year, 24-hour design storm event; and

4. If overland sheet flow occurs, it will flow through a drainage easement, covenant, or right-of-way.

6.2.3.2 Culverts and Bridges

Culverts for and bridges over natural channels shall convey the 100-Year, 7-Day peak flood with zero backwater rise. Bridges shall provide a minimum clearance of two (2) feet between the design water surface and the bottom of any part of the bridge.

6.2.3.3 Outfalls

Outfalls shall be designed to convey the design storm event specified for other conveyances and to suffer no structural damage or undercutting during the 100-year, 24-hour storm event. The Qualified Professional shall present calculations showing the velocity, discharge, and flow path of the 100-year, 24-hour event.

6.3 OPEN CHANNELS

6.3.1 General

Open channels can be classified either as natural or constructed. Natural channels are generally referred to as streams, creeks, or swales, while constructed channels are called ditches or channels. Constructed channels shall be either vegetation-lined or rock-lined.

6.3.2 Design Criteria

Channels shall be V-shaped, trapezoidal (flat bottom), or swale (segmental or parabolic) in geometry. Side slopes shall not be steeper than three horizontal to one vertical (3H:1V) for vegetation-lined channels and 2H:1V for rock-lined channels.

Maximum velocity shall be 5 feet per second (fps) for vegetation-lined channels and 12 fps for rock-lined channels. Channels with design flow velocities which exceed 5 fps shall be rock-lined or otherwise stabilized so as to prevent erosion. Rock-lined channels shall include sand and gravel filter or filter fabric. Vegetation-lined channels shall be stabilized against erosion in compliance with minimum standards for erosion control set forth in Section 10 of these Standards.

6.3.3 Methods of Analysis and Design

Methods of analysis and design shall be in accordance with the design standards referenced in Section 1.5.

6.3.4 Details

Check structures for purposes of velocity control in ditches may be of rock construction as shown in Figure B15.

6.4 CULVERTS

6.4.1 General

Culverts are relatively short segments of pipe of circular, elliptical, rectangular, or arch cross section. They are usually placed under road embankments to convey surface water flow safely under the embankment. They may be used to convey flow from constructed or natural channels.

6.4.2 Design Criteria

Maximum design water surface elevation for the conveyance system design storm event in the backwater behind culverts in constructed channels shall be below top of channel. Maximum design water surface for culverts that convey streams shall be below the culvert crown.

Minimum diameter culvert under public roads and streets and private drives shall be 12 inches. Culvert size shall be determined from engineering calculations.

Culverts required to provide passage or migration of fish shall conform to Washington Department of Fisheries and Wildlife regulations.

6.4.3 Trash Racks

Where open channels or ponds discharge into culverts, trash racks are required on all inlet pipes 18-inches and larger. Trash racks shall be removable with ordinary hand tools.

6.4.4 Methods of Analysis and Design

Methods of analysis and design shall be in accordance with the design standards referenced in Section 1.5.

6.5 STORM SEWERS

6.5.1 General

Storm sewers are networks of storm drain pipes, catch basins, manholes, inlets, and outfalls designed and constructed to convey surface water.

6.5.2 Design Criteria

6.5.2.1 Pipe Size, Slope and Velocity

Table 6-1 presents minimum pipe sizes for various applications as well as minimum velocities. Maximum slopes and velocities shall be as shown in Table 6-2. Anchor spacing shall be as shown in Table 6-3.

TABLE 6-1
MINIMUM PIPE DIAMETER AND VELOCITY FOR STORM DRAINS

Application	Minimum Pipe Diameter (Inches)		Minimum Velocity (fps)
	Privately Maintained	District Maintained	
Inlet to CB or MH	8	12	2
CB to CB or MH to MH	8	12	2
Other	6[1]	12	2

[1] Administrator may allow 4-inch diameter pipe when located entirely on private property, serves no more than one single family residence, and is privately maintained.

TABLE 6-2
MAXIMUM PIPE SLOPES AND VELOCITIES

Pipe Material	Pipe Slope Above Which Pipe Anchors[2] Required (%)	Maximum Allowable Slope (%)	Max. Velocity at Pipe Full[1] (fps)
PVC	20	30	30
CMP	20	30	30
Concrete / Ductile Iron	20	20	30
HDPE	20	None	None

[1] If pipe full velocities exceed 15 feet per second, provide anchors at bends and junctions.

[2] See Figure A16 for anchor details.

TABLE 6-3
MINIMUM PIPE ANCHOR SPACING

Slope (%)		Anchor Spacing (feet)
Greater Than	Less Than or Equal To	
20	35	36
36	50	24
50	100	16
100	NA	Design[1]

[1] For pipe slope greater than 100%, anchors and spacing shall be determined by design by Qualified Professional.

6.5.2.2 Pipe Alignment, Connections and Trench Design

Alignment. Provide 6-inches minimum vertical and 3-feet minimum horizontal clearance between storm sewer pipes and other utility pipes and conduits. Clearances within Pacific County right-of-way shall be in accordance with the Pacific County Road Standards. For crossings of sanitary sewer or water lines, criteria established by the Washington State Department of Ecology shall apply. For crossings of swale or channel easements, 12-inches minimum of vertical backfill between required pipe cover and base of swale shall be required.

Connections. Change in pipe size or direction shall be allowed only at structures. On private property, for four-inch and six-inch diameter pipe, clean-outs at junctions are permissible. Connections to a pipe system shall only be made at structures. When connecting pipes at structures, match crowns or inverts. Curvilinear pipe may be installed in strict accordance with manufacturers instructions which shall be submitted with Surface Water Control Plan and shall be available on the job site.

Trench Design. Trench excavation, backfill and compaction shall be as specified in the Standard Specifications. Minimum pipe cover shall be two (2) feet. Additional cover shall be provided as required to maintain structural integrity of pipe. Additional cover amount shall be determined by engineering analysis or from pipe cover specifications contained in the referenced standards. Where cover requirements is determined by engineering analysis, design calculations shall be submitted with Surface Water Control Plan for review by the Administrator.

6.5.3 Structures

Inlets, Catch Basins and Manholes. Inlets, catch basins and manholes shall be as specified in the Standard Specifications. Catch basin and manhole diameter shall be determined based on pipe orientation at the structure, number of pipes penetrating the structure, the recommendations of the structure manufacturer, and as described in the Standard Specifications. When structure is located within County road right-of-way, the structure shall be evaluated for HS-20 loading.

Catch basins shall be provided within 50 feet of the entrance to a storm sewer system to provide for silt and debris removal. Maximum spacing of inlets or catch basins shall be 150 feet on grades less than 1%; 200 feet on grades from 1% to 3%; and 300 feet on grades greater than 3%.

When design flow will be above 10 cubic feet per second (cfs), catch basin and manhole inlet capacities shall be analyzed by a Qualified Professional. The analysis shall be included in the Surface Water Control Plan for review by the Administrator. Inlet capacity limitations may be used to divide flow between channels or gutters and storm sewers. Inlet capacity of grates shall be determined in accordance with Chapter 5 of the Washington State Department of Transportation Hydraulics Manual, current edition.

Anti-Dumping Message. Each catch basin or grated manhole shall have a message cast into the catch basin cover. The message shall read as follows:

DUMP NO WASTE
DRAINS TO (STREAM) (GROUNDWATER)

In addition to casting the message into the catch basin cover or manhole grate, it shall be depicted by one of the following means:

1. Painted with pavement striping paint on pavement or curb. See Figure A15 for stencil print;
2. Cast or embossed in the curb or pavement and painted with pavement striping paint; or
3. Cast in structure lid.

Trash Racks. Trash racks are required on inlet pipes 18-inches and larger entering a storm sewer system. Trash racks shall be removable with ordinary hand tools.

6.5.4 Methods of Analysis and Design

Methods of analysis and design shall be in accordance with the design standards referenced in Section 1.5. The hydraulic analysis of flow in storm drains typically is limited to gravity flow; however, in analyzing existing systems it may be necessary to address pressurized conditions.

If the Administrator believes that, as a result of the Project, runoff for any event through the 100-year, 24-hour event would cause property damage or interrupt vital services, he/she may require a computer backwater (pressure sewer) analysis.

6.5.5 Details

See Standard Plans B-1 through B-12 for detailed diagrams.

6.6 OUTFALLS

6.6.1 General

An outfall is a point where collected and concentrated surface and storm water runoff is discharged from the project site or into an open drainage feature, including ditches, channels, swales, streams, rivers, ponds, lakes, or other receiving water bodies. Outfalls to waters of the United States or natural water bodies are subject to hydraulic project requirements of the Washington Department of Fisheries and Wildlife which shall take precedence if the requirements are more restrictive than those stated herein.

6.6.2 Design Criteria

6.6.2.1 General

The standard for outfall design is as shown in Figure A5. This design is limited to slopes of 33% or flatter where native vegetation is well established or where slope armoring is engineered to the Administrator's satisfaction. For sites where the Administrator agrees that the standard is impractical because of lack of space, danger of erosion, etc., alternate outfall designs shown in Figures A6 and A7 may be allowed.

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

6.6.2.2 Energy Dissipation

Mechanisms which reduce velocity prior to discharge from an outfall are encouraged. At a minimum, energy dissipater shall be a splash pad as shown in Figure A6. Minimum splash pad requirements are provided in Table 6-5.

Engineered energy dissipaters, such as gabion splash blocks, stilling basins, drop pools, baffled aprons, etc., shall be required for outfalls with flow velocity greater than 12 feet per second (fps) or discharge greater than two (2) cubic feet per second (cfs) for the Design Storm Event. A sample gabion mattress energy dissipater for this purpose has been provided as Figure A7. This mechanism may not be adequate to address flows of very high energy; therefore, a detailed engineering analysis shall be prepared by the Qualified Professional and submitted with the Surface Water Control Plan for review by the Administrator. The Qualified Professional shall also refer to Section III-2.3.5 of the Stormwater Management Manual for the Puget Sound Basin for additional specific design information.

TABLE 6-5
MINIMUM SPLASH PAD REQUIREMENTS[1]

Maximum Velocity at Pipe Full (fps)	Type	Thickness (ft)	Width (ft)	Length (ft)	Height (ft)
5	8" Rock	1	Pipe Diameter + 6	8	Crown + 1
12	Rip Rap	2	Pipe Diameter + 6	12	Crown + 1

[1] Source: King County Drainage Manual

6.6.2.3 Outfalls on Steep Slopes

Outfall pipes on steep slopes shall be anchored as specified in Table 6-4, and shall be fused or butt-welded or mechanically restrained. They may not be gasketed, slip fit, or banded. HDPE pipe has proven effective for use in steep slope applications. HDPE pipe may be laid on the surface or in a shallow trench, anchored, protected against sluicing, and hand compacted.

HDPE pipe shall be designed to address the material limitations, especially thermal expansion and contraction, as specified by the manufacturer. Sliding connections to address thermal expansion and contraction shall be located as close to the discharge end of the outfall system as is practical.

HDPE pipe longer than 100 feet shall be secured by placing the upstream and downstream ends placed in a four-foot long section of the next larger pipe size. This sliding sleeve connection allows for high thermal expansion/contraction.

Due to HDPE pipe's ability to transmit flow of very high energy, engineered energy dissipation systems as defined above shall be provided.

6.6.3 Methods of Analysis and Design

Methods of analysis and design shall be in accordance with the design standards referenced in Section 1.5.

6.6.4 Details

See Figures A6 and A7.

6.7 MATERIALS

All components of conveyance facilities including drains, manholes, catch basins, and outfalls, shall be as specified in the Standard Specifications. Any pipe material specified in Section 9-05 of the Standard Specification may be used for storm sewer systems, with the following exceptions and requirements:

1. Plain concrete pipe shall not be used.

2. Corrugated polyethylene (CPE) pipe shall be double-walled, smooth interior pipe meeting the requirements of AASHTO M294S. Single wall CPE may be used only for temporary storm sewer systems and for residential roof drain, foundation drain, and yard drain collectors located on private property. CPE pipe shall be joined by split corrugated couplings with gaskets and which are at least four corrugations wide.

3. CPE pipe installed in County road right-of-way may be required to be perforated for use as subgrade drains to collect interflow in accordance with Pacific County Road Standards or as required by the Administrator.

4. PVC pipe shall be SDR 35 or thicker and shall only be used for privately maintained systems. Joints shall conform to ASTM D 3212; gaskets shall conform to ASTM F 477.

5. Reinforced concrete pipe shall be rubber gasketed.

6. Corrugated metal pipe (CMP) shall be aluminum or aluminized steel, and shall be rubber gasketed and securely banded. Galvanized or zinc-coated pipe shall not be used.

7. HDPE shall comply with the requirements of Type III C5P34 as tabulated in ASTM D1248 and have the PPI recommended designation of PE3408 and have an ASTM D3350 cell classification of 345434C or 345534C. The pipe shall have a manufacturer's recommended hydrostatic design stress rating of 800 psi based on a material with a 1,600 psi design basis determined in accordance with ASTM D2837-69. The pipe shall have a suggested design working pressure of 50 psi at 73.4 degrees F and SDR of 32.5. HDPE pipe shall be jointed using butt fusion methods.

6.8 CONSTRUCTION

Construction of storm drains shall be in accordance with the Standard Specifications.

SECTION 7 DETENTION FACILITY STANDARDS

7.1 OVERVIEW

Detention facilities provide temporary storage for increased surface water runoff resulting from development. When properly designed, such facilities release surface water at or below the naturally occurring runoff rate by temporarily storing the runoff for specific design storm events.

In addition to runoff control, detention facilities can also provide water quality enhancement to surface water runoff. Detention of small storms is particularly effective for the removal of pollutants through gravity sedimentation and biochemical mechanisms.

There are two primary types of detention facilities: (1) ponds, and (2) tanks and vaults.

7.2 METHODS OF ANALYSIS AND DESIGN

Detention facilities shall be analyzed using the hydrograph method and routing procedures discussed in Section 5 of these Standards and the design standards referenced in Section 1.5. Detention facilities shall account for overflow which bypass flows around or over the flow restrictor system.

7.3 SITE SELECTION

Site selection for detention systems should consider both the natural topography of the area, property boundaries, and other site constraints. Detention ponds shall not be located in dedicated public road rights-of-way unless approved by the Administrator and the jurisdiction managing the right-of-way. Detention ponds not located in dedicated public road rights-of-way shall be located in a tract dedicated to the District.

7.4 FACTOR OF SAFETY

The design volume of detention facilities used to meet the peak rate runoff control requirements of Section 5.5 for the 2- and 25-year, 24-hour duration design storm events shall be increased by a 30 percent factor of safety. This requirements shall be met by increasing proportionally by 30 percent the design detention volume between each one (1) foot of storage depth without increasing the total depth of storage or altering the control structure orifice/weir sizing.

7.5 PONDS

7.5.1 General

Open ponds for detention facilities are the most desirable method of controlling runoff from developed properties. In addition to detention ponds, the following criteria may be used for infiltration ponds, constructed wetlands and wet ponds as defined in Sections 8 and 9. All detention ponds shall be designed to drain dry within a 48-hour period after the beginning of the Design Storm Event.

7.5.2 Design Criteria

7.5.2.1 Capacity/Discharge

Volume and restrictor analysis shall be in accordance with the requirements of Section 5 of these Standards and the design standards referenced in Section 1.5. Flow restrictor design shall be in accordance with Section 7.8 of these Standards. Factor of safety shall be as specified in Section 7.4.

Ponds shall be located at an elevation above the 100-year flood elevation of the nearest natural watercourse.

7.5.2.2 Geometrics

Ponds shall be designed to the following requirements:

1. Minimum length to width ratio of the pond design water surface shall be 2:1. Pond inlet and outlet shall be located as far apart as possible in the pond to maximize water quality benefits.

2. Interior side slopes shall be no steeper than 3H:1V.

3. Exterior side slopes shall not be steeper than 2H:1V unless analyzed for stability by a Qualified Geotechnical Professional.

4. Pond bottom shall be level and 0.5-foot below the inlet and outlet piping inverts.

A variance to the requirement for interior side slope may be requested in accordance with the procedures specified in the District Land Alteration and Drainage Ordinance No. 1. In review of said variance request, the Administrator may consider pond location, security, and safety.

Facilities with side slopes steeper than three horizontal to one vertical shall be provided with a barrier to entry of humans and wildlife who may be incapable of climbing out of the facility. The barrier shall be at least a 10-foot-wide strip of thorny or otherwise impenetrable vegetation for the portion of the facility that has slopes in excess of 3H:1V. Vegetation type shall be approved by the Administrator and shall be in place within one growing season of pond excavation.

At the Administrator's discretion, fencing may be required to supplement impenetrable vegetation. Fencing shall be chain link as specified in the Standard Specifications. Other materials may be accepted if they can be demonstrated to the satisfaction of the Administrator to have a longevity equal to steel fencing. Fencing shall be at least 42 inches high and shall adequately restrict entry of humans and wildlife which may be incapable of climbing out of the facility.

Ponds designed for the storage of 10 acre-feet or more of water shall require review and approval by the Department of Ecology in accordance with the requirements of RCW 90.03.350.

7.5.2.3 Outlets

Pond outlets shall provide controlled discharge of the 100-year, 24-hour design storm event for postdeveloped site conditions without overtopping any part of the pond embankment or exceeding the

capacity of the emergency overflow spillway. Discharge shall be directly into the downstream conveyance system.

Outlets for wet ponds shall have a device for trapping floatable contaminants (e.g., an inverted elbow). Flow control outlets for detention ponds may be slotted weir, orifice plates, sutro weirs, notch weirs or other as approved by the Administrator. Pond outlets for ponds with both live and dead storage may be sidewall underdrain systems as shown in Figures A8, A9 and A10.

7.5.2.4 Emergency Overflow Spillway

In addition to outlets, a safe spillway shall be provided which will pass the 100-year, 24-hour design storm event without damage to the facility. The spillway shall be designed assuming pond full at the beginning of the event. The spillway may be of any type (e.g., morning glory, broad crested weir, v-notch weir). The spillway shall be located at the elevation reached by runoff from the design storm event. If armoring of the spillway over the crest of the berm is necessary, grass/pavers may be used. If rock or gabions are used, the armoring shall be covered with a minimum four-inch layer of topsoil and plant with suitable vegetation.

7.5.2.5 Slope Stabilization

Pond berm embankments higher than 6-feet shall require design by a Qualified Geotechnical Professional or Qualified Professional. Berms shall have a minimum 12-foot top width for maintenance access.

All ponds shall be planted. A landscaping plan shall be submitted describing suitable covering for the conditions expected. For wet ponds and constructed wetlands, vegetation shall be suitable for varying depths, frequency, and duration of inundation found in various sectors of the pond.

Ponds shall be planted as soon as practical after excavation and shall have well-established vegetation cover after one growing season. The Administrator may approve a postponement of the planting for ponds that are to function initially as temporary sediment ponds. Proponent shall provide in the maintenance plan for the project a program of vegetation maintenance to ensure survival of plantings.

The Proponent shall monitor performance of the vegetation for a minimum of two years. After two years:

1. All plants lost shall be replaced by like species unless directed otherwise by the Administrator.

2. Vegetated cover of bottom area, excluding exotic and invasive species shall be at least 50 percent. If constructed wetland cover is less than 50 percent, removal of exotic/invasive species and additional plantings shall be required.

7.5.3 Materials

7.5.3.1 Underdrain Pipe

Underdrain pipe, other than AASHTO Designation M36 Type III Class IV, shall be perforated. Pipe may be concrete, polyvinyl chloride (PVC), corrugated polyethylene (PE), or aluminum CMP.

Polyvinyl chloride pipe shall conform to the requirements of ASTM D 3034 SDR 35 or ASTM F 789. Fittings for PVC pipe shall be injection molded tees or factory solvent cemented saddle tees. Normally, all

fittings shall be the same material as the pipe being connected except that fittings using other materials or constructed with more than one material may be used subject to the approval of the Administrator. Fittings shall have sufficient strength to withstand handling and load stresses normally encountered.

7.5.3.2 Outlet Butterfly Valves

All solid thermoplastic butterfly valves shall be of the lined body design and seal bubble tight with only the liner and disc as wetted parts. Butterfly valves shall be suitable for direct burial. The size of the butterfly valves shall be the same as that of the line on which they are located.

7.5.4 Special Requirements for Detention Ponds For Single Family Residences

In cases where the Administrator determines that detention is required for single family residences, facility design shall be guided by this section. Methods of analysis and design shall be as specified above. Roof runoff shall be conveyed by pipe to the pond. Driveway runoff shall also be routed to the pond where feasible.

General pond design shall:

1. Locate pond adjacent to right-of-way or in such a manner as to facilitate homeowner maintenance and avoid impacts on adjoining property;

2. Integrate ponds into lawn areas, with gentle side slopes, shallow depths, and wetness-tolerant grass throughout;

3. Provide ponds with a flat bottom and a small area depressed on one side to allow overflow; do not direct overflow across sidewalks; and

4. Show ponds on building applications so that property owners are made aware of the necessity to maintain ponds as designed.

Where roof runoff is to be routed to a retention/detention facility, conveyance shall be such that runoff does not damage adjoining properties and is not directed across a sidewalk.

7.6 TANKS

7.6.1 General

Detention tanks are underground facilities for the storage of surface water. Tanks are typically constructed from corrugated pipe. Tanks provide less water quality benefit than ponds; therefore, biofiltration prior to discharge to a tank is required.

7.6.2 Design Criteria

7.6.2.1 Capacity/Discharge

Volume and restrictor analysis shall be in accordance with the requirements of Section 5 of these Standards and the design standards referenced in Section 1.5. Flow restrictor design shall be in accordance with

Section 7.8 of these Standards. Factor of safety shall be as specified in Section 7.4. Minimum diameter shall be 36-inches.

7.6.2.2 Structural Stability

Tanks shall meet structural requirements for overburden soils, hydrostatic and traffic loading, as applicable. Tanks lying within road right-of-way shall be designed for HS-20 loading. Metal tank end plates shall be designed for structural stability at maximum hydrostatic loading conditions.

Tanks shall be placed on stable, compacted native material or suitable bedding. Tanks shall not be allowed in fill slopes unless analyzed by a Qualified Geotechnical Professional for stability.

7.6.2.3 Buoyancy

Where seasonal groundwater may induce flotation, tanks shall be ballasted with concrete backfill and/or tie down anchors. Buoyancy resistance system shall be designed by a Qualified Professional. Calculation shall be submitted with Surface Water Control Plan for review by the Administrator.

7.6.2.4 Inlet Sump

Inflow shall enter the tank through a catch basin connected to the detention tank using no more than 2-feet of 36-inch minimum diameter pipe. The tank bottom shall be located 0.5-foot below the inlet and outlet to provide dead storage.

7.6.2.5 Access

The maximum depth to a tank invert shall be 20 feet. Spacing between tank access points shall not exceed 100 feet. A 36-inch minimum diameter CMP riser-type manhole of the same gauge as the vault material may be used for access along the length of the vault provided that access points shall support expected wheel loads. Openings shall have round, solid, locking lids. Tank access openings shall be readily accessible by maintenance vehicles.

7.6.3 Materials

Pipe material and joints shall be in accordance with the requirements of Section 6.7 of these Standards, except that materials shall be limited to:

1. Aluminum spiral rib pipe;
2. Corrugated aluminum pipe and pipe arch;
3. Reinforced concrete pipe; or
4. Corrugated polyethylene pipe (CPE) - Smooth interior

No corrugated iron or steel pipe (galvanized or aluminized) shall be allowed.

7.7 VAULTS

7.7.1 General

Detention vaults are underground facilities for the storage of surface water. Vaults are typically constructed from reinforced concrete. Vaults provide less water quality benefit than ponds; therefore, biofiltration prior to discharge to a tank is typically required.

7.7.2 Design Criteria

7.7.2.1 Capacity/Discharge

Volume and restrictor analysis shall be in accordance with the requirements of Section 5 of these Standards and the design standards referenced in Section 1.5. Flow restrictor design shall be in accordance with Section 7.8 of these Standards. Factor of safety shall be as specified in Section 7.4.

7.7.2.2 Structural Stability

Vaults shall meet structural requirements for overburden soils, hydrostatic and traffic loading, if appropriate. Vaults lying within road right-of-way shall be designed for HS-20 loading. Cast-in-place wall sections shall be designed as retaining walls. Structural designs shall be prepared and stamped by a structural engineer licensed to practice in the State of Washington.

Vaults shall be placed on stable, compacted native material or suitable bedding. Vaults shall not be allowed in fill slopes unless certified as stable by a Qualified Geotechnical Professional.

7.7.2.3 Buoyancy

Where seasonal groundwater may induce flotation, vaults shall be analyzed for uplift and bounce. Buoyancy resistance system shall be designed by a Qualified Professional. Calculations shall be submitted with Surface Water Control Plan for review by the Administrator.

7.7.2.3 Inlet Sump

Vault design shall be "flow-through". The vault bottom shall be located 0.5-foot below the inlet and outlet to provide dead storage. Vaults shall be designed to provide approximately half the volume between two cells divided by a baffle wall. The top of the baffle wall shall be 1-foot below the design water surface elevation and have a minimum 6-inch wide slot or pipe orifice cast into the wall that shall be capable of passing the post-development flow for the 2-year, 24-hour design storm event with the invert of the slot or orifice set 6-inches above the bottom of the vault.

7.7.2.4 Access

The maximum depth to a vault invert shall be 20 feet. Spacing between vault access points shall not exceed 50 feet, with at least one access with ladder to the bottom of the vault per cell. The minimum internal height shall be seven (7) feet and the minimum width shall be four (4) feet. Openings shall have round, solid, locking lids. Vault access openings shall be readily accessible by maintenance vehicles.

7.7.3 Materials

Concrete shall be 4,000 psi minimum compressive strength as specified in Section 6-02 of the Standard Specifications.

7.7.4 Details

See Figure A11.

7.8 CONTROL STRUCTURES

7.8.1 General

Control structures are catch basins with a restrictor device for controlling outflow from a facility to meet the desired performance. They also function as an oil-water separator. The restrictor device is typically a multiple orifice device with a weir section sized and located to meet performance requirements.

7.8.2 Design Criteria

Catch basins used to house flow restrictor devices shall be a minimum of 54-inch diameter. Assemblies shall be equipped with a chain-operated lift gate that can be opened in emergency situations. Catch basin lids shall be locking, and rim elevation shall match finish grade.

A maximum of five (5) orifices may be used to meet the peak rate runoff control requirements. In most cases, only two (2) orifices are necessary to meet the 2-, 25-, and 100-year, 24-hour design storm events: one at the bottom and one near the top of the riser. However, additional orifices may best utilize detention storage volume. Several orifices may be located at the same elevation if necessary to meet discharge requirements. Minimum orifice diameter shall be 0.5 inch.

Properly designed weirs may be used as flow restrictors.

7.8.3 Methods of Analysis

Orifice and weir analysis shall be as specified in the design standards referenced in Section 1.5.

7.8.4 Details

See Figures A3 and A4.

7.9 USE OF DETENTION FACILITIES FOR OPEN SPACE/RECREATION

Surface water control facilities may be used for recreation or open space if allowed by law and if the Administrator determines that stormwater management is not impaired.

SECTION 8 INFILTRATION SYSTEM STANDARDS

8.1 OVERVIEW

Infiltration and filtration are two surface water management techniques. Infiltration systems percolate runoff into the soil where it can remove pollutants and recharge groundwater and thereby eliminates impacts associated with downstream runoff. Filtration systems use treatment media, such as sand, to remove pollutants. Unlike infiltration systems, filtration systems have a discharge which must be detained to avoid off-site impacts.

Infiltration is preferred to filtration due to its ability to both effectively treat runoff and control off-site impacts from runoff. Infiltration not only reduces or eliminates surface runoff, but also helps maintain the hydrologic balance of the surface and ground water systems. Infiltration can limit erosion and recharge groundwaters that supply water to wetlands, streams, and wells. Preserving infiltration following development is the most effective mechanism in preventing adverse impacts to the surface water system. Therefore, the District encourages the use of infiltration systems for runoff control where soils conditions are conducive.

However, both techniques can be successfully used if adherence to proper design, construction, and maintenance standards is followed. The standards in this section are intended to prevent common problems associated with infiltration and filtration systems.

Infiltration systems are not practical in all cases. The feasibility depends not only on the nature of the soils but also on the need to protect ground water quality. The location and depth to impermeable layers and the water table can preclude the use of infiltration. In addition, the proximity of infiltration systems to water wells, foundations, on-site sewage disposal systems, unstable slopes, and other features can restrict their use.

Infiltration systems include both open pond type and trench type systems. Special infiltration systems, such as roof drain infiltration systems, small infiltration basins, and lattice block paving, are also discussed in this section.

8.2 METHODS OF ANALYSIS AND DESIGN

As for detention facilities, infiltration systems shall be analyzed using the hydrograph method and routing procedures discussed in Section 5 of these Standards and the design standards referenced in Section 1.5.

8.3 DETERMINATION OF SOILS AND INFILTRATION CHARACTERISTICS

8.3.1 General

The Proponent shall demonstrate through soils and infiltration testing that sufficient permeable soil exists on a project site to allow a properly functioning infiltration system to be constructed. Demonstration shall include the written opinion of a Qualified Soils Professional. Said demonstration shall be submitted as part of the Soils Report required under Section 3.8.

The Administrator may partially or wholly waive the requirement for soils and infiltration testing based on at least one of the following conditions:

1. Testing would not significantly improve the estimate of soil characteristics and/or infiltration rates available for the project site or similar nearby sites.

2. No infiltration test procedure has demonstrated validity on the type of soil present on the site.

3. Soils characteristics and infiltration rates are provided to the Administrator as a result of soils investigations conducted in support of on-site wastewater disposal system design and/or permit application.

8.3.2 Determination of Soil Characteristics

Site soil characteristics shall be determined by a Qualified Soils Professional using normal laboratory and field procedures such as particle size analysis and percolation tests. The results of soils evaluation shall be recorded on the forms provided in Appendix H.

Infiltration rate shall be determined as specified in Section 8.3.4 for all infiltration systems, except for roof drain infiltration systems. Sizing of roof drain infiltration systems shall be determined based on general soil classification as specified in Section 8.4.

8.3.3 Soils Descriptions

Soils descriptions shall be in accordance with the United States Department of Agriculture, Soil Conservation Service soil classification system, as shown in Table 8-1.

TABLE 8-1
SOIL TEXTURAL CLASSIFICATION

Soil Type	Soil Classification
1	Coarse sand and coarser material
2	Medium sand
3	Fine sand, loamy sand
4	Sandy loam, loam
5	Porous, well-developed structure in silt and silt loam
6	Other silt loams, silty clay loam, clay loam

8.3.4 Determination of Infiltration Rate

8.3.4.1 Methodology

For trench type infiltration facilities, infiltration rate shall be determined in accordance with the procedure for falling head percolation tests described in EPA, 1980 (See Appendix F). For other infiltration facilities, the infiltration rate shall be determined using concentric ring infiltrometers as described in ASTM 3385 "Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometers" if the test is applicable for the soil type. Infiltration rate shall be calculated as the field-saturated percolation rate in inches per hour.

8.3.4.2 Test Pits or Borings

Test pits or borings shall be excavated at the location of the proposed infiltration facility. Test pits or borings shall be sufficient in number to accurately characterize the soils through soils textural analysis and to estimate the infiltration rate through infiltration testing.

At least three (3) tests shall be performed for each proposed infiltration facility. At a minimum, tests shall be performed for every 10,000 square feet with a minimum of four (4) tests performed for each closed depression.

Infiltration tests for the facility shall be performed at the design infiltration surface. At a minimum, test pits or borings shall be 5-feet below the bottom of the infiltration facility, but no deeper than the water table.

If till is encountered, excavation shall continue through the till layer but not deeper than 20 feet from original ground surface. If the till layer is less than twenty feet deep, soils classification and infiltration testing shall be evaluated below the till layer. Infiltration rates for each test pit shall be averaged and an average rate reported in inches per hour.

Soils logs shall be prepared for each test pit or boring describing the soil series, the textural class of the soil horizon through the depth of the log, and note any evidence of high ground water level, such as mottling.

8.3.4.3 Determination of Design Infiltration Rate

The design infiltration rate shall be determined by a Qualified Soils Professional using infiltration rate testing, soils logs, and other testing and analysis that the Qualified Soils Professional deems necessary. The design infiltration rate shall not be higher than the measured rate with the following safety factors applied: 2.0 for the falling head percolation (EPA) test; 1.75 for the concentric ring infiltrometer test (ASTM 3385).

In no case shall the design infiltration rate be higher than the maximum infiltration rates for various soil types as shown in Table 8-2.

TABLE 8-2
MAXIMUM INFILTRATION RATES FOR SOIL TYPES

Soil Type	Maximum Infiltration Rate (Inches per hour)
1	20
2	8.0
3	2.4
4	1.0
5	0.0
6	0.0

8.4 GENERAL REQUIREMENTS FOR INFILTRATION

8.4.1 General

The following general requirements and criteria apply to the design, construction, operation, and maintenance of all infiltration systems, including ponds, trenches, tanks, and roof drain control systems.

8.4.2 Determination of Feasibility of Infiltration

In order for infiltration to be feasible, a minimum of three (3) feet of permeable soil shall exist below the bottom of an infiltration facility and the maximum wet season water table. Soils shall be considered permeable if they meet the requirements of Types 1, 2, 3, or 4 as defined in Table 8-1.

Measurements to demonstrate compliance with this requirements shall be made during the period when the water level is expected to be at a maximum, as determined by the Administrator. A permit application for a project which includes infiltration as a surface water control measure and located in an area suspected of having a high wet season water table may not be accepted as complete unless compliance with this water table level demonstration is provided.

8.4.3 Design Criteria

A. Where multiple trenches are used, trenches shall be a minimum of 6-feet on center.

B. All facilities shall be designed to drain dry within a 48-hour period after the beginning of the Design Storm Event.

C. Trench type infiltration facilities are required where an impervious layer (hardpan) underlies the upper soil layer and shallow groundwater is the target for infiltration.

D. In the absence of more stringent regulations, infiltration facilities shall be prohibited from slopes exceeding 40 percent; and, facilities may not be placed on slopes exceeding 15 percent or within 50 feet of top of slope, except where determined to be acceptable by a Qualified Geotechnical Professional and approved by the Administrator.

E. An overflow route shall be identified in the event the tank, trench, or pond infiltration capacity is exceeded or the facility becomes plugged or fails. Ponds shall have an emergency overflow spillway as specified in Section 7.5.2.4. Overflow systems shall be designed to convey the 100-year, 24-hour design storm event to the natural surface outlet.

F. Inflow to infiltration ponds, tanks and trenches (except roof downspout infiltration trenches) shall be treated for sediment removal prior to discharge to the infiltration facility.

G. Infiltration facilities (except for roof downspout infiltration trench systems) shall not be allowed under streets or roads, public or private. Infiltration facilities may be placed under pavement in off-street parking lots. Observation wells shall be placed no further than 100 feet apart.

H. Roof downspout infiltration trench systems may be located under pavement provided that an inlet with grated cover is placed at the end of the trench pipe such that if the trench infiltration capacity is

exceeded, the overflow would occur out of the inlet at an elevation at least one (1) foot below that of any overlying pavement, and in a location which can accommodate the overflow.

8.4.4 Construction

A. Construction shall be as specified in the Standard Specifications.

B. Infiltration areas shall be clearly marked before site work begins to avoid disturbance of the soil during construction. No vehicle traffic shall be allowed within 10 feet of infiltration trench areas.

C. Infiltration facilities shall be constructed after site work, roads, utilities, permanent erosion control measures, and landscaping are in place in the tributary area served by the facility.

8.4.5 Inspection

A. A Qualified Soils Professional shall inspect infiltration facilities before, during, and after construction as necessary to ensure facilities are built to design specifications, that proper procedures are employed in construction, that the infiltration surface is not compacted, and that protection from sedimentation is in place. The Qualified Soils Professional shall perform a sufficient number of infiltration tests and/or soil logs after construction to determine that the facility will operate as designed. Construction reports summarizing the inspections shall be provided to the Administrator as specified in Section 4 of these Standards.

B. For Roof Downspout Infiltration Systems, the Administrator shall make an inspection of the soil after the system is excavated and before the trench is filled with rock to confirm that suitable soils are present. At the option of the Proponent, a Qualified Soils Professional may be retained at the sole expense of the Proponent to perform the inspection. The Qualified Soils Professional shall submit signed certification that exposed soils provide the design infiltration rate for the system.

C. After the facility is constructed, the inlet into the system shall remain plugged until the Administrator has verified that the tributary area has been stabilized and construction reports have been reviewed and approved.

8.4.6 Operation and Maintenance

Infiltration facilities shall be operated and maintained in accordance with good engineering practice.

8.4.7 Setbacks

Setbacks for infiltration facilities from other site features are given in Table 8-3. Other laws, regulations, or ordinances may provide setbacks. When this standard is in conflict with any other standard, the most stringent shall apply.

TABLE 8-3
SETBACKS FROM INFILTRATION FACILITIES

Site Feature	Setback (Feet)			
	Infiltration Pond, Trench or Tank		Roof Downspout Infiltration System	
	Up-gradient	Down-gradient	Up-gradient	Down-gradient
Onsite Septic System	100	30	30	10
Water Supply Well	100	100	30	10
Building Foundation	100	20	50	10
Slopes Over 15%	50	NA	25	NA

8.5 ROOF DRAIN CONTROL SYSTEMS

8.5.1 General

Roof drain control systems are intended only for use in infiltrating and/or dispersing runoff from roof downspout drains. They are not designed to directly infiltrate any surface water that could transport sediment or pollutants such as from paved areas. Two types of infiltration systems may be used to infiltrate roof downspout runoff from single-family residences and duplexes: dispersion systems (splash blocks) and infiltration trench systems.

8.5.2 Requirement

8.5.2.1 Runoff Control Requirement

All roof runoff from single family residential, duplex, subdivision, and short subdivision lots shall be either infiltrated, unless project is exempt from runoff control as specified in Section 2.4.2, provided that infiltration is feasible as defined in Section 8.4.2. If infiltration is not feasible, dispersion of roof runoff may be allowed provided that dispersion criteria are met as specified below. If dispersion criteria are not met or dispersion is otherwise not allowed, on-site detention is required to meet the runoff control requirements specified in Section 2.4.2. If a plat or public drainage system is available, stub-outs shall be provided to connect roof drains to the drainage system.

Where roof drain infiltration systems are used, the roof area which is infiltrated need not be included in the impervious area used to determine detention facility size, as specified in Section 5. Where splash blocks are used for dispersion, no reduction in impervious area shall be allowed.

8.5.2.2 Dispersion

Dispersion shall be required where infiltration is determined to be not feasible as defined in Section 8.4.2. Dispersion may be used alone without infiltration trench systems provided that:

1. the project site soils are classified as Type 1, as defined in Table 8-1, and the lot size is a minimum of 9,800 square feet;

2. the project site soils are classified as Type 1 or 2, as defined in Table 8-1, and the lot size is a minimum of 20,000 square feet;

3. the discharge points are each a minimum of 50 feet from roadways or surface water control facilities, or at least 25 feet of vegetated area is provided before the discharge leaves the site; and

4. no significant erosion or flooding problems are created, as determined by the Administrator.

Dispersion shall be accomplished with splash blocks or other suitable method approved by the Administrator. Splash blocks shall also be used in conjunction with infiltration trench systems as shown in Figure A14.

8.5.3 Splash Blocks

Splash blocks shall be located at each downspout and direct runoff away from structures onto a flat portion of the lot. Runoff shall, to the greatest extent practicable, be routed away from property lines such that infiltration is maintained on-site.

Splash blocks shall be standard, pre-manufactured plastic or concrete splash blocks. Splash blocks shall be located as shown in Figure A14.

8.5.4 Infiltration Trench Systems

8.5.4.1 System Types and Use

The infiltration trench design shown in Figure A14 shall be used only in soil types 1, 2, or 3. For soil type 4, roof drains shall be hard piped to the drywell trench, and a 6-inch diameter perforated, corrugated polyethylene pipe shall be placed along the entire length of the trench. Backfill requirements for both drywell types shall be as shown in Figure A14.

For lots in Subdivisions or Short Subdivisions, roof drain infiltration systems need not be provided for every lot, provided that roof runoff from each lot is conveyed to an infiltration or detention system within the Subdivision or Short Subdivision.

8.5.4.2 Limitations

The following limitations shall apply to infiltration trench systems:

1. A single system shall not serve more than 5,000 square feet of roof area;

2. Systems shall not be used on slopes greater than 25%;

3. Systems shall not be used in fill materials except for engineered sand and gravel fill, provided that the engineered fill has a measured infiltration rate of not less than 3 inches per hour;

4. Systems shall be setback from other site features as specified in Section 8.4;

5. Systems shall only be used in the SCS soil types 1, 2, 3, and 4 as listed in Table 8-1; and

6. Minimum lot size requirements shall be as shown in Table 8-4.

TABLE 8-4
MINIMUM LOT SIZES FOR INFILTRATION TRENCH SYSTEMS

Soil Type[1]	Minimum Lot Size (Sq. Ft.)[2]
1	None
2	None
3	7,200[3]
4	15,000
5	Not Allowed
6	Not Allowed

[1] See Table 8-2 for description of soils.

[2] Minimum lots sizes are for lots with public sewer system. Greater minimum sizes may be required under Pacific County Ordinance No. 117 for lots with on-site sewage disposal.

[3] 9,800 for a two-family dwelling (duplex) on a single lot.

8.5.4.3 Design Criteria

Designs shall be in compliance with the setback requirements shown in Table 8-3 and applicable Uniform Building Code specifications. Infiltration trench system design shall be based upon soils and infiltration testing as specified in Section 8.3 of these Standards. The Qualified Soils Professional shall recommend the completion (bottom) depth of the infiltration trench system based upon soil texture and topographic factors. The controlling soil texture shall be used to determine the required infiltration trench systems length.

Minimum infiltration trench system sizes shall be based on soil types according to Table 8-5. Where individual lot infiltration trench systems are to be installed in a Subdivision or Short Subdivision, the Qualified Professional shall determine the required size using Table 8-5 for each lot or group of lots with similar soils. The Qualified Professional shall then record these sizes as necessary to ensure that they become restrictions for future building applications (e.g., record written conditions for lots and/or dictate infiltration trench systems size on the face of the final plat mylar).

TABLE 8-5
MINIMUM INFILTRATION TRENCH SYSTEMS SIZE BY SOIL CLASSIFICATION

Soil Type[1]	Minimum Length of Trench[2] (Feet)
1	25
2	35
3	100
4	200

[1] See Table 8-2 for description of soils.

[2] Per 1,000 square feet of horizontal projection of roof area. Minimum length of infiltration trench based on 2' x 2' trench as shown in Figure A14.

8.5.4.4 Details

See Figure A14.

8.6 INFILTRATION TANKS

8.6.1 General

Infiltration tanks consist of underground pipe that has been perforated to allow detained surface water to be infiltrated.

8.6.2 Design Criteria

Infiltration surface elevation (bottom of trench) shall be in native soil excavated at least one foot in depth.

The spacing and construction of structures, materials allowed, accessibility for maintenance, easements, and hydraulic design methods shall be the same as those specified for detention tanks in Section 7.6, except for those features required to allow infiltration.

Minimum spacing between parallel tanks shall be equal to twice the distance from the bottom of the lowest tank to the ground surface.

Tanks shall be bedded and backfilled with washed drain rock which extends at least one (1) foot below the bottom of the tank, at least two (2) feet beyond the sides, and extends to the top of the tank.

Filter fabric shall be placed over the top of the drain rock prior to backfilling.

8.6.3 Methods of Analysis and Design

The size of the tank shall be determined by using the hydrograph methods described in Section 5 of these Standards and in accordance with the design standards referenced in Section 1.5.

8.7 INFILTRATION PONDS

8.7.1 General

Infiltration ponds may be constructed using excavation and berm construction.

8.7.2 Design Criteria

Infiltration surface elevation (bottom of trench) shall be in native soil excavated at least one (1) foot in depth.

The spacing and construction of structures, materials allowed, accessibility for maintenance, easements, and hydraulic design methods shall be the same as those specified for detention ponds in Section 7.5, except for those features required to allow infiltration.

Infiltration pond bottoms shall be laced with trenches to improve the contact of stormwater with underlying soils except where soils are Type 1 as defined in Table 8-1 and lack significant stratification or any other features that may eventually impede drainage. Trenches shall be excavated a minimum of three feet below the grade of the pond bottom, or into a well-drained soil horizon that can be exposed with standard excavation equipment. Trenches shall cover a minimum of 10 percent of the bottom beginning two (2) feet up the side slope.

Pond bottoms shall have zero slope to achieve even ponding over the infiltration surface.

8.8 INFILTRATION TRENCHES

8.8.1 General

8.8.2 Design Criteria

The entire bottom area of trenches and 25 percent of the sidewall area may be counted in sizing the area required for infiltration providing the target for infiltration is not shallow groundwater over hardpan.

The media of the trench shall be wrapped with filter fabric to prevent the sediment from reaching the infiltration face. Clean, washed stone aggregate or other approved media shall be used. All or part of the media may be replaced by perforated pipe or other means or materials to increase the effective storage volume.

Trenches shall be covered the same day they are opened.

Trenches shall be no wider than can be excavated by a backhoe straddling the trench.

Parallel trenches shall be spaced no closer than ten (10) feet except for trenches whose target for discharge is the interflow zone. If hardpan is less than six (6) feet below finished grade, or the trench is excavated to closer than three feet of hardpan (whatever the depth), then the target for infiltration is the interflow zone and:

1. Trenches, as nearly as practical, shall follow a contour line;
2. The facility shall be designed to infiltrate only through the downslope sidewall;
3. Parallel trenches shall be spaced no closer than 25 feet apart; and
4. Trench type infiltration facilities bottom slopes shall be less than five (5) percent.

8.8.3 Methods of Analysis and Design

Methods of analysis and design shall be in accordance with the design standards referenced in Section 1.5.

8.8.4 Details

See Figure A13.

8.9 MATERIALS

8.9.1 General

Pipe shall be perforated corrugated polyethylene pipe. Rock backfill shall be gravel backfill for drains. All materials shall be as specified in the Standard Specifications.

8.9.2 Filter Fabric

Selection of filter fabric shall be based on soil conditions which effect Equivalent Opening Size (EOS) fabric specifications. Filter fabric shall prevent soil from silting up filter media, yet shall have openings large enough to permit drainage. The design standards referenced in Section 1.5 and manufacturer's literature shall be used to properly select filter fabric. When joints are necessary, filter cloth shall be lapped a minimum six inches.

8.10 ALTERNATIVE SYSTEMS

8.10.1 General

This section presents alternative types of infiltration facilities to further the District goal of encouraging the use of infiltration wherever feasible.

8.10.2 Small Infiltration Basins

Small infiltration basins consist of bottomless, pre-cast concrete catch basins or equivalent structure placed in an excavation filled with washed drain rock. Surface water infiltrates through the drain rock into the surrounding soil. This type of facility is intended for use with contributing surface areas of less than 5,000 square feet.

The design criteria for small infiltration basins shall be as specified for infiltration tanks. Access into the basin shall be provided for inspection and maintenance.

8.10.3 Lattice Block Paving

Lattice block paving provides localized infiltration. It is designed for low traffic driveways, overflow parking areas, maintenance access roads, and similar areas. The use of lattice block paving can decrease the size of detention facilities, because the area covered by the lattice block may be considered to be a grassed pervious surface rather than an impervious surface when conducting hydraulic modeling.

Lattice block paving consists of a lattice of concrete, plastic, or other load bearing material, over a permeable base course such as gravel or sand, as shown in Figure A17. Such paving may be used off road right-of-way in low-traffic or infrequently used areas. The finish grade of the soil surface within the pavers should be 3/4-inch below the top of the pavers.

SECTION 9 SURFACE WATER TREATMENT STANDARDS

9.1 INTRODUCTION

Discharge of stormwater runoff into surface water bodies can result in water quality degradation of the natural surface water system. Pollutants in runoff are commonly attached to sediments. In addition, sediments clog spawning gravels and reduce the capacity of conveyance systems. Control of sediment during all phases of development is therefore critical to reducing the discharge of pollutants to surface waters of the District. Consequently, these Standards require control of erosion and sedimentation both during and after construction (See Base Requirement No. 5 and Section 10).

Measures intended to preserve existing water quality or reduce potential pollutant loadings have been incorporated into these Standards. These measures include design criteria and requirements intended to control erosive discharges, promote controlled sedimentation, and special water quality controls. Studies demonstrate that substantial removal of pollutants in stormwater can be achieved by gravity sedimentation if turbulent mixing can be avoided and the detention time is long.

Therefore, the runoff control requirement (see Base Requirement No. 3), although designed to control downstream erosion and flooding, also promotes detention and sedimentation, thereby resulting in enhanced water quality control.

In addition, proposed projects which exceed certain threshold criteria specified in Section 2.11 Oil/Water Separation (Special Requirement No. 2) shall incorporate special water quality controls.

9.2 GENERAL REQUIREMENTS

9.2.1 Runoff Treatment Requirement

Runoff from proposed projects shall be treated prior to discharge from the site to either surface or ground waters. The purpose of runoff treatment is to reduce pollutant loadings and concentrations in storm water runoff using physical, biological, and chemical removal mechanisms. The level of treatment depends upon the project type, size, location, and discharge.

9.2.2 Method of Treatment

Methods of treatment include infiltration ponds and trenches, constructed wetlands, wet ponds and vaults, biofiltration facilities, and filtration facilities. The treatment process shall be selected, designed, and maintained as specified in this section.

If a proposed project meets certain threshold criteria, then oil/water separation may be required as specified by Special Requirement No. 2. An adopted Comprehensive Flood Hazard Management Plan may further impose surface water treatment requirements as specified in Special Requirement No. 1.

Guidance for screening, evaluating, and selecting the method of treatment is provided in Section 9.3 of these Standards.

9.2.3 Exemptions from Treatment

Runoff from roofs need not receive water quality treatment. This exemption does not exempt proposed projects from complying with the requirements for runoff control specified in Base Requirement No. 3.

9.2.4 Sequence of Runoff Treatment and Control

Multiple scenarios exist for sequencing of runoff treatment and control measures. Treatment may either precede or follow runoff control measures. The effectiveness of both treatment and control can be affected by their sequence. The sequence of treatment, control and discharge shall be clearly shown in the Drainage Plan.

Oil/water separation, if required by Special Requirement No. 2, shall be provided upstream of treatment and control systems.

9.2.5 Prevention of Groundwater Contamination

Significant concern exists regarding the potential contamination of ground water resources from inadequately treated surface water runoff that may be readily infiltrated at surface water treatment facilities serving impervious areas of intensive use, such as major arterial roadways, commercial, manufacturing, and industrial sites.

In order to address this concern, surface water treatment facilities shall be lined if they:

1. are proposed to be located in soils having a maximum infiltration rate greater than 9 inches per hour; and

2. serve tributary areas containing impervious areas subject to risk of hazardous material spill.

Areas considered to be subject to risk of spill include, but are not limited to:

1. intersections of arterial roadways, state highways, and railways;

2. commercial, manufacturing, or industrial facility at which hazardous material is handled and for which no other government agency requires spill prevention control and countermeasures.

Liner shall be a commercial heavy (minimum 30 mil) plastic (PVC, HDPE, or polyethylene) material suitable for exposure to petroleum products, designed for the purpose intended, and installed per manufacturer's instructions. Alternative liners may be accepted subject to the approval of the Administrator provided that they satisfy the function of preventing discharge to groundwater over an acceptable design life.

Infiltration facilities designed and provided for peak rate runoff control shall be located downstream of lined surface water treatment facilities.

All wet ponds placed in soils with a maximum infiltration rate greater than 2.0 inches per hour shall be lined with four inches of silt loam, sandy clay loam, or organic muck or other suitable material approved by the Administrator.

9.2.6 Source Controls

Source controls are defined as methods designed and implemented to prevent storm water from coming into contact with potential pollutants. Source controls are either specific to the type of land use or development being proposed, or are intended to control a specific type of pollution problem within a drainage basin, such as nutrients that may contribute to eutrophication. They are often a cost-effective means of reducing pollutants in stormwater.

Examples of source controls include reducing or eliminating use of a pesticide, covering areas used to store chemicals, and street sweeping during dry weather conditions.

The Administrator may require implementation of source controls if:

1. Data is available or presented indicating water quality problems for a receiving water, such as violations of state water quality standards or non-attainment of designated uses;

2. Action by the Washington State Department of Ecology that requires reduced source loadings of pollutants to a receiving water; or

3. Actions specified in an adopted Comprehensive Flood Hazard Management Plan.

9.2.7 Water Quality Design Storm Event

Treatment systems shall be designed and sized to capture and treat the water quality design storm event, which is defined as the 6-month, 24-hour design storm event. The volume of the 6-month, 24-hour design storm event shall be as specified in Table 5-1.

9.3 SELECTION OF TREATMENT METHOD

9.3.1 General

Selection of a treatment method shall be based on the type and quantity of pollutants anticipated to be treated and the relative effectiveness of the method to remove pollutants. Effectiveness of removing pollutants is dependent upon several parameters. Potential treatment methods shall be evaluated, compared, and screened in order to select the most effective method.

The two most important parameters are soil type and area of the tributary drainage area served by the treatment facility. Many treatment methods are only effective over a narrow range of drainage area and soil type. Some methods may not be feasible in certain situations; selection shall consider site conditions.

9.3.2 Selection Criteria

Drainage area, soil type, and other factors, including site slope, depth to water table, and depth to bedrock, shall be evaluated to select the preferred treatment method. The Stormwater Management Manual for the Puget Sound Basin (Washington State Department of Ecology) shall be utilized as guidance for screening, evaluating, and selecting treatment methods.

9.3.3 Order of Preference

Table 9-1 shall be used to determine the order of preference for runoff treatment methods. Infiltration is the preferred practice for treatment, provided that suitable soils conditions exist (see Section 8.4.2) and that groundwater is adequately protected (see Section 9.2.5).

TABLE 9-1
TREATMENT METHOD ORDER OF PREFERENCE

Rank	Treatment Method[1]
1	Infiltration
2	Constructed Wetland, Wet Pond, Biofiltration, or Filtration
3	Wet Vault

[1] Treatment methods with the same rank have an equal level of preference.

The highest ranked treatment method shown in Table 9-1 shall be used unless the Administrator approves a lower-ranked method based on site-specific limitations which make the preferred method impracticable. For example, a site with excessively well-drained soils and limited drainage area, or with steep terrain, is not well suited for use of a Constructed Wetland.

9.4 INFILTRATION

Infiltration is the preferred runoff treatment method. Benefits include preservation of baseflow in streams, ground water recharge, reduction of peak runoff flow, and elimination of conveyance systems.

Standards for the design, construction, and maintenance of infiltration ponds, trenches, and tanks are presented in Section 8 of these Standards.

9.5 FILTRATION

9.5.1 General

Filtration systems use treatment or filter media such as sand to trap pollutants. Filtration systems typically use underdrain systems that convey treated runoff to a runoff control facility or to the point of discharge. Filtration systems are generally not as effective as infiltration systems. However, experimental systems using compost and peat may be promising in enhancing the effectiveness of filtration.

9.5.2 Design Criteria

Sand filtration facilities shall be designed according to the guidelines in Chapter III-3.7.2 and III-3.7.3 of the Stormwater Management Manual for the Puget Sound Basin (Washington State Department of Ecology).

9.5.3 Details

A typical sand filtration concept is shown in Figure A12.

9.6 BIOFILTRATION

9.6.1 General

Biofiltration systems include biofiltration swales and vegetative filter strips. Both shall have a thick grass surface over which runoff shall flow at uniform depth less than or equal to design depth for the design storm event.

9.6.2 Design Criteria

Vegetation required, accessibility for maintenance, hydraulic design methods, and design criteria shall be as specified in Chapter III-6 of the Stormwater Management Manual for the Puget Sound Basin (Washington State Department of Ecology). A summary of design criteria is provided in Table 9-2.

9.6.3 Subgrade Preparation and Planting

The subgrade of biofiltration swales and vegetative filter strips shall be graded to the required slope and cross-section. A minimum of 6-inches of topsoil shall be placed on the subgrade and rolled level.

Between April 1 and September 30 biofilters shall laid with sod or be planted with a combination drought and wetness-tolerant vegetation seed mix approved by the jurisdiction (refer to Table III-6.1 in the Stormwater Management Manual for the Puget Sound Basin (Washington State Department of Ecology)). Between October 1 and March 30 sod tolerant of seasonal saturation and drought conditions shall be placed.

For seeded biofilters, sufficient armoring shall be placed to ensure that the seed bed will withstand the erosion control design event without undue damage. (For example, stake down jute mat or straw mat according to manufacturer's recommendations; use filter fences, hay bale check dams, etc., to reduce velocities.)

Irrigation and other maintenance as necessary shall be provided to ensure that the vegetation remains viable and that a hardy root structure forms in the first year.

9.6.4 Biofiltration Swales

When concentrated flow is directed to a biofiltration swale, it acts as a conveyance as well as treatment facility. If the biofiltration swale carries all storm flows, the swale shall be able to carry the conveyance Design Storm Event specified in Section 6.2.3.

Biofiltration swales located between road edge and lot line as in a residential subdivision shall have a maximum side slope toward the lot line of 20%. Maximum side slope toward the road is 33%. The purpose of these criteria is as a disincentive for property owners to fill the biofilter and for ease of mowing.

9.6.5 Vegetative Filter Strips

Vegetative filter strips receive runoff as sheetflow at depths less than or equal to design depth for biofilters for the treatment facility design event. Strips shall have runoff distributed evenly across the threshold as a road or parking lot edge with no curb.

9.6.6 Details

See Figures A1 and A2.

TABLE 9-2
BIOFILTRATION FACILITY DESIGN CRITERIA

Design Criteria	Biofiltration Swale	Vegetative Filter Strip
Minimum Bottom[1] Surface Area Per Impervious Tributary Acre (Sq. Ft.)	2,000	2,000
Minimum Length (Ft.)	50	10
Minimum Width (Ft.)	2	2
Maximum Width Without Level Spreaders (Ft.)	8	NA
Maximum Depth (In.)	2	2
Friction Factor (Manning "n")	0.15	0.15
Maximum Velocity (fps)	1.5	1.5
Flow Line Slope (Ft. per Ft.)	0.01 min.; 0.04 max.	0.01 min.; 0.04 max.

[1] Bottom area includes portion of side slopes wetted by treatment design depth.

9.7 WET PONDS AND WET VAULTS

9.7.1 General

Wet ponds and wet vaults contain a permanent pool of water. The pond or vault fills with the initial onset of frequent storms such that the major portion of the volume of runoff is treated. The principal mechanism of treatment is settlement due to sedimentation. In wet ponds, this treatment is enhanced by biofiltration and biologic mechanisms.

9.7.2 General Design Criteria

Wet ponds and vaults shall be designed as specified for detention ponds and vaults in Section 7. Construction, materials allowed, accessibility for maintenance, easements, and hydraulic design methods shall be the same as those specified in Section 7 for detention ponds and vaults. Additional design criteria are specified in Section III-4 of the Stormwater Management Manual for the Puget Sound Basin (Washington State Department of Ecology).

9.7.3 Wet Ponds

A wet pond shall be designed using the following criteria:

1. The permanent pool area of the pond shall equal four (4) percent of the impervious surface draining to the pond.

2. Permanent pool depth shall be a minimum of three (3) feet plus one (1) foot of dead storage for sediment.

3. To protect groundwater, all wet ponds placed in soils with a maximum infiltration rate greater than 2.0 inches per hour shall be lined with four inches of silt loam, sandy clay loam, or organic muck or other suitable material approved by the Administrator.

4. No planting of areas below permanent pool storage water level shall be required. All pond slopes above the permanent pool storage water level shall be hydroseeded with appropriate wetness-tolerant seed and planted with screening vegetation (shrubbery). Shrubs shall be spaced in such a manner that within one year of planting adjacent plants will have grown together to form a screen.

5. Ponds which will serve both as treatment and detention may have dead and live storage in the same facility. Ponds which are designed to infiltrate all or a portion of runoff may not have dead storage.

6. Ponds shall be at least five times longer than they are wide with outlet and inlet at opposite ends of the facility, unless provided with means to prevent short-circuiting, such as berms (dividing the pond into cells), groins, baffles, or islands..

7. A single pond may be replaced by a series of ponds provided that either all ponds are controlled by the same release structure or that pond routing is performed and calculations provided showing that volumes in all ponds acting in concert provide the necessary storage for design storm events.

9.7.4 Wet Vaults

Wet vaults shall be designed using the following criteria:

1. Impervious surface draining to a wet vault shall not exceed two (2) acres.

2. Bottom area shall equal 2.5 percent of the impervious surface draining to the vault. Bottom area shall be calculated where water depth equals three (3) feet when the permanent pool area is full.

3. Length to width ratio shall be as described for ponds in Section 7.5.2.2.

9.7.5 Details

See Figure A8 and Figure A11.

9.8 CONSTRUCTED WETLANDS

9.8.1 General

A constructed wetland is an artificial wetland intentionally constructed for the purpose of managing storm water runoff. The primary function of a constructed wetland is to provide runoff treatment of both conventional pollutants and nutrients using a permanent pool of water which has extensive marsh areas. A

constructed wetland can also provide recreational opportunities, wildlife habitat, and be an aesthetic amenity.

Constructed wetlands are essentially a wet pond; the difference is in the emphasis placed on vegetation and depth and area concerns. The two most important factors when designing a constructed wetland are hydrologic factors and selection of vegetation.

9.8.2 Design Criteria

Constructed wetlands shall be designed to satisfy the requirements of Chapter III-4.4.3 of the Stormwater Management Manual for the Puget Sound Basin (Washington State Department of Ecology). In addition, the following criteria shall be followed:

1. Dead storage volume shall equal or exceed the volume of an equivalent wet pond (i.e., three feet deep multiplied by tributary impervious surface area multiplied by 0.025). Permanent pool surface area shall be allocated according to the following areal distribution:

   a. 60 percent at less than one foot deep;

   b. 20 percent at one to three feet deep; and

   c. 20 percent at greater than three feet deep (forebay area) unless otherwise approved by the Administrator.

2. The constructed wetland bottom and wetted side slopes shall be planted with mature plants and shrubs.

3. The constructed wetland bottom shall have suitable soil type:

   a. loam;

   b. silt loam;

   c. silty clay loam; or

   d. muck

   If the native soil is unsuitable, the constructed wetland shall be over-excavated by four (4) inches and refilled with one of the listed suitable soil types.

4. Planting surface shall be tilled for planting and root establishment. All planting shall occur between the months of October and April unless otherwise approved by the Administrator.

5. For each 1,500 square feet of constructed wetland bottom, plant at least 100 open-water or emergent plants in homogeneous groups of 10 or more, on two-foot centers. In addition, plant at least 30 shrubs on five-foot centers, midway between the low and high-water level. Shrubs may be from cuttings or stakes if appropriate to the type of plant. Plantings used shall be from the recommended list in Appendix G unless otherwise approved by the Administrator.

9.9 OIL/WATER SEPARATORS

9.9.1 General

If a proposed project will construct more than five (5) acres of impervious surface that will be subject to oil, petroleum, or similar hydrocarbon product storage or transfer; high vehicular use (more than 2,500 annual average vehicle trips per day); or heavy equipment use, storage, or maintenance, then oil/water separation shall be incorporated to treat the project's discharge prior to further treatment.

There are two basic types of oil/water separators: gravity or spill-control type and coalescing plate type. Because oil/water separators are usually manufactured units rather than constructed units, appropriate manufacturers or suppliers should be consulted to obtain guidance for use.

9.9.2 Design Criteria

Design criteria and maintenance for gravity oil/water separators is available through the Washington Department of Ecology, document WDOE 82-1. Oil/water separators shall be designed to satisfy the requirements of Chapter III-7 of the Stormwater Management Manual for the Puget Sound Basin (Washington State Department of Ecology). In addition, the following criteria shall be followed:

1. Selection and sizing of oil/water separators shall be subject to approval of the Administrator, and shall include the maximum use of vegetative or other natural filtration means possible.

2. Oil separators discharging to a storm water system or directly to a waterway require approval from the Department of Ecology..

3. All stormwater shall enter the separator through inlet pipe.

4. The amount of area contributing runoff to the oil/water separator shall be limited to that area which may potentially introduce oil and grease into the runoff.

5. Peak runoff flows above that for the water quality design storm event shall bypass the facility in a separate conveyance to the point of discharge. A mechanism shall be provided at the bypass point to allow the facility to be manually taken "off-line" for maintenance and repair.

6. Separator shall be covered with removable sections.

7. Access for inspection shall be provided at all times.

8. Oil accumulation in the oil separation compartment shall not exceed three (3) inches at any time.

9. A gravity drain with shut-off valve shall be provided above the bottom of the oil/water separator and sized to allow the device to be completely drained in one (1) hour. The valve shall be closed during oil removal, grit removal and water re-filling operations.

10. Waste oil accumulations removed from the separator shall be disposed of other than to the ground surface, storm drains, or streams.

11. The effluent discharged from any oil removal treatment facility to the storm sewer shall contain no visible oil and less than ten parts per million total oil.

12. The spacing and construction of structures, materials allowed, accessibility for maintenance, easements, and hydraulic design methods shall be the same as those specified for detention vaults in Section 7.7.

SECTION 10 TEMPORARY EROSION/SEDIMENTATION CONTROL

10.1 INTRODUCTION

Discharge of stormwater runoff into surface water bodies can result in water quality degradation of the natural surface water system. Pollutants in runoff are commonly attached to sediments. In addition, sediments clog spawning gravels and reduce the capacity of conveyance systems. Control of sediment during all phases of development is therefore critical to reducing the discharge of pollutants to surface waters of the District. Consequently, these Standards require all development to prepare a plan for the control of erosion and sedimentation both during and after construction (See Base Requirement No. 5).

The requirements of the Small Parcel Erosion Control Plan shown in Figure B17 shall be attached by the Administrator as a required condition to all permits issued in response to Abbreviated Drainage Plans.

10.2 GENERAL REQUIREMENTS

10.2.1 Protection for Storm Sewer Inlets

Storm sewer inlets receiving runoff from the project site during construction shall be protected so that sediment-laden water will be filtered before entering the conveyance system. See Figure B8.

10.2.2 Dust Control

Dry soil shall be sprayed with water or approved dust palliative as required to control dust.

10.2.3 Sedimentation Control

Prior to initiating any land alteration activity, devices for interception of all runoff from the area to be altered shall be installed. Said interception shall cause all silt-laden runoff to be conveyed by open swale or other means to temporary facilities necessary or required to remove silt from runoff prior to discharge to downstream properties.

10.2.4 Stockpile Management

Soil stockpiles shall be set back at least 50 feet from down gradient drainage features (e.g., channels, catch basins, detention ponds, pavement, stream banks, environmentally sensitive areas). If there is no practical alternative, the Administrator may allow a stockpile within the 50-foot setback with the condition that it shall be stabilized daily.

Stockpiles shall be completely covered with plastic. Install filter fabric fence around toe of stockpile.

No material shall be stockpiled on pavement without authorization from the Administrator. Such authorization will be conditioned on implementation of a procedure to prevent sediment transport.

10.2.5 Construction Entrances

Construction site entrances are egress points for vehicles onto paved roadways. All projects which will have vehicular traffic shall have a means to prevent vehicles from tracking soil from the site. Stabilized

construction entrance rock pad (refer to Standard Drawing B16) shall be provided at every egress point. The Proponent shall maintain the entrance(s) as necessary to ensure proper functioning of pad.

If sediment is tracked off-site, sediment shall, on a daily basis, be swept or shoveled from the paved surface before washing.

Runoff from construction entrances shall be directed to sediment ponds or traps where these have been otherwise provided on development sites.

10.2.6 Construction Road Stabilization

Construction Road Stabilization shall be used wherever rock-based roads or parking areas are constructed, whether permanent or temporary, for use by construction traffic. This practice provides erosion protection to subdivision roads, parking areas, and other on-site vehicle transportation routes immediately after grading.

A six-inch depth of two-inch to four-inch crushed rock, gravel base, or crushed surfacing base course shall be applied immediately after grading or the completion of utility installation within the right-of-way. A four-inch course of asphalt treated base (ATB) may be used in lieu of crushed rock.

Temporary roads shall follow the contour of the natural terrain to the extent possible. Slope shall not exceed 15 percent. Roadways shall be carefully graded to drain transversely. Drainage swales shall be provided on each side of the roadway in the case of a crowded section, or on one side in the case of a super elevated section.

10.2.7 Maintenance

Temporary erosion/sedimentation control facilities shall be maintained at all times. Control facilities shall be periodically inspected and maintenance performed in order to ensure their proper functioning. In addition to regular inspection and maintenance, the Proponent shall inspect facilities during and after rainfall events to ensure that they continue to function effectively. Repairs shall be made as soon as possible during rainfall events. Control facilities shall be replaced as necessary to maintain their design effectiveness.

10.2.8 Trench Construction

The construction of trenches shall be subject to the following criteria:

1. No more than 500 feet of trench shall be opened at one time.

2. Excavated material shall be placed on the uphill side of trenches.

3. Trench dewatering devices shall be discharged in a manner that will not adversely affect flowing streams, drainage systems or off-site property. Sediment-laden water discharged from trench dewatering pumps shall be routed through a sediment pond or trap.

10.2.9 Site Conditions During Construction

Site conditions may change rapidly during construction due to construction activity, weather, and other factors. Based on observed performance of the erosion/sedimentation control system, the Administrator shall have the authority to require that the Proponent install additional erosion/sedimentation control measures where those specified in the Temporary Erosion/Sedimentation Control Plan are not fully effective.

10.2.10 Removal of Temporary Erosion/Sedimentation Control Measures

Temporary erosion control measures may not be removed until the site is permanently restored to the satisfaction of the Administrator. All temporary erosion control measures shall be removed within 30 days after final site stabilization has been achieved or after the measures are no longer needed. Sediment collected in traps, ponds, or silt fence shall be removed and properly disposed of or stabilized on site. Disturbed soil areas resulting from sediment removal shall be permanently stabilized within seven (7) days.

10.2.11 Miscellaneous

The following construction practices shall be implemented during land alteration operations:

1. Construction field offices, storage yards, and shop yards should be located where erosion and sediment hazards are slight. Where this is not possible, the necessary erosion control practices shall be applied.

2. Fording of streams with machinery is not an acceptable construction practice. Temporary bridges or culverts shall be used where stream crossings are unavoidable.

3. Utilization of borrow areas where pollution from the borrow operation is inevitable shall be avoided.

4. All elements of the drainage system, including storm drains, streams, and wetlands, shall be protected from chemicals, fuel, lubricants, sewage, or other pollutants during land alteration operations.

5. Use of the drainage system for disposal of any waste products, pollutants, or contaminants whatsoever is strictly prohibited.

6. Care shall be taken so as to deposit no material from sites of land alteration activity onto public rights-of-way and/or adjoining properties. If such depositions occur, it shall be the responsibility of the Proponent to immediately remove such material from public rights-of-way and adjoining properties, and restore to the original conditions.

10.3 DESIGN STORM

Temporary erosion/sedimentation control facilities such as ponds, filters, traps, revetments, slope armoring, and other related facilities shall be designed for the 2-year, 24-hour storm event unless otherwise specified herein.

10.4 GENERAL METHODS

10.4.1 General

The Proponent shall incorporate temporary erosion/sedimentation control systems using practices that are appropriate to the site. Table 10-1 lists several common types of temporary erosion/sedimentation controls and provides guidance and limitations on their usage. Such controls shall be utilized in such combination as is necessary to achieve the level of control required by these Standards and to meet water quality objectives. Techniques and/or devices other than those listed in Table 10-1 may be allowed with permission of the Administrator if deemed suitable for the situation.

This subsection provides design guidance for several of the most common sediment and erosion control practices. More detailed information is provided in Volume II of the Stormwater Management Manual of the Puget Sound Basin, February 1992, prepared by the Washington State Department of Ecology. Refer to Chapter II-5, "Standards and Specifications for Best Management Practices for Erosion and Sediment Control".

10.4.2 Inlet Sediment Protection (Standard Drawings B8, B9)

Standard inlet protection techniques are intended for filtration of small amounts of sediment. Such techniques shall only be used when flooding due to water backup resulting from said technique is acceptable. The placement of a length of filter fabric cloth under a catch basin grate will not be allowed.

Drop-in catch basin filters may be used in place of other standard inlet protection practices. In contrast to standard practices, this inlet protection technology can be used in situations where right-of-way flooding would be problematic. To maintain function, filters shall be removed and cleaned or replaced after each storm event.

10.4.3 Pipe Slope Drains (Standard Drawing B10)

The entrance shall consist of a standard flared end section for culverts with a minimum six-inch metal toe plate to prevent runoff from undercutting the pipe inlet. The slope of the entrance shall be at least three percent.

10.4.4 Stair Stepping Cut Slopes And Grooving Slopes (Standard Drawing B11)

Graded areas with slopes greater than 3H:1V but less than 2H:1V shall be roughened before seeding to trap seeds and encourage plants to become established. This can be accomplished in a variety of ways, including "trackwalking," or driving a crawler tractor up and down the slope, which leaves a pattern of cleat imprints parallel to slope contours.

Graded areas steeper than 2H:1V shall be stair-stepped with benches as shown in Figure B11. The stair-stepping will help vegetation become established and also trap soil eroded from the slopes above.

10.4.5 Erosion Control Blankets (Standard Drawing B12)

Erosion control blankets (nets and mats) may be used on level areas, on slopes up to 2H:1V, and in waterways. Where soil is highly erodible, erosion control blankets shall only be used in conjunction with an organic mulch such as straw and wood fiber. Jute net shall be heavy, uniform cloth woven of single jute

yarn, which shall weigh an average of 1.2 lbs/linear yard for net of 36 to 48 inches in width. It shall be so applied that it is in complete contact with the soil. Netting shall be securely anchored to the soil with No. 11 gauge wire staples at least six inches long.

Before installing erosion control blankets, all required runoff control measures shall be in place.

TABLE 10-1
TEMPORARY EROSION/SEDIMENTATION CONTROL METHODS

Method	Standard Drawing	Maximum Drainage Area (Acres)	Maximum Discharge (cfs/sq.ft.)	Maximum Slope (H:V)	Notes
Sedimentation Pond or Trap		Note 1	NA	NA	2
Filter Fabric Fence	B2	1	0.1	1:1	3
Straw/Hay Bale Barrier	B3,B4	0.25	0.01	1:1	4
Brush Barrier	B5	0.25	0.1	NA	6
Sandbag Berm	B6	5	NA	NA	
Gravel Berm	B5	5	Note 8	Note 5	
Triangular Sediment Filter Dike	B7	1	0.05	NA	7
Gravel Outlet Structure	B14	5	NA	NA	
Check Dam	B15	10	NA	NA	
Perimeter Dike	B13	5	NA	Note 5	

Notes:

1. Maximum drainage area dependent upon load capacity of pond or trap.
2. Maximum velocity dependent upon settling velocity of particles. See Stormwater Management Manual for the Puget Sound Basin (Washington State Department of Ecology).
3. Selection of fence fabric dependent upon soil conditions. Sheet or overland flow path length to the fence shall not exceed 100 feet. Concentrated flows greater than 0.5 cfs shall not be discharged to a fence.
4. Not suitable for high sediment producing areas. May be used in conjunction with filter fabric fence. The length of the slope behind the barrier should be no greater than 100 feet; or 50 feet if the slope has a gradient greater than 10 percent.
5. Slope dependent upon spacing of berms or dikes.
6. Minimum height shall be three feet. Minimum width shall be five feet at base. Administrator may require a filter fence anchored over the brush berm to enhance the filtration ability of the barrier.
7. May be used where there is no concentration of water in a channel or other drainageway above the barrier. If a concentrated flow does occur after installation, dikes shall be replaced with gravel berms.
8. Maximum discharge is limited to 1 cfs per 8 linear feet of gravel berm, or 0.1 cfs/sq. ft. of drainage area, whichever is less.

10.4.6 Temporary Interceptor Dikes and Swales (Standard Drawing B13)

10.4.6.1 Design Criteria

Interceptor dikes shall have a minimum top width of two (2) feet and a minimum height of 18 inches as measured from upslope toe following compaction. Dikes shall be compacted to 95 percent of the maximum dry density in accordance with the Standard Specifications. Side slopes shall be 3H:1V or flatter. Grade of dikes shall be limited to 1 percent or flatter.

Interceptor swales shall have a minimum bottom width of two (2) feet; the bottom width shall be level. Minimum depth shall be 1-foot. Side slopes shall be 3H:1V or flatter. Grade of swales shall be between one (1) and three (3) percent with a positive drainage to a suitable outlet (such as a sedimentation pond).

Dikes and swales shall be stabilized by seeding, fertilizing and mulching within five days of construction.

10.4.6.2 Spacing

Horizontal Spacing of Interceptor Dikes and Swales shall be as follows or as otherwise justified by hydraulic analysis:

Slope	Spacing (feet)
< 5 %	300
5-10 %	200
10-40 %	100

10.4.6.3 Outlet

The upslope side of the dike shall provide positive drainage to the dike outlet. No erosion shall occur at the outlet. Energy dissipation measures shall be provided as necessary. Sediment-laden runoff shall be released through a sediment trapping facility.

10.4.7 Temporary Gravel Outlet Structure (Standard Drawing B14)

A temporary gravel outlet is an auxiliary structure installed in conjunction with and as part of an interceptor dike or other structure designed to temporarily pond sediment-laden surface runoff. This provides a means of draining the storm runoff which is collected behind a structure while retaining the sediment.

Gravel shall be 5/8-inch minus washed rock. A layer of filter fabric shall be embedded in the gravel. Minimum length in feet of the gravel outlet structure shall be equal to six times the number of acres of contributing drainage area. Water shall be discharged from the gravel outlet onto an already stabilized area or into a stable watercourse.

The Proponent shall inspect gravel outlet structure after each runoff-producing rain. Gravel shall be replaced when the structure ceases to function as intended due to sediment accumulation among the gravel.

10.4.8 Check Dams (Standard Drawing B15)

Check dams can be constructed of either rock or logs. The maximum spacing between the dams shall be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam.

Rock check dams shall be constructed of two- to four-inch diameter rock. The rock shall be placed by hand or mechanical placement (no dumping of rock to form dam) to achieve complete coverage of the ditch or swale and to ensure that the center of the dam is lower than the edges.

Log check dams shall be constructed of four- to six-inch diameter logs. The logs shall be embedded into the soil at least 18 inches.

When installed in grass-lined ditches and swales, check dams shall be removed when the grass has matured sufficiently to protect the ditch or swale. The area beneath the check dams shall be seeded immediately after dam removal.

Check dams shall be checked for sediment accumulation after each rainfall event. Sediment shall be removed no later than when it reaches one half of the original dam height.

10.4.9 Plastic Covering

Plastic covering may be used on bare slopes which require immediate protection from erosion. Clear plastic may be used in areas which have been seeded during the period from November 1 to March 31.

10.4.10 Seeding, Fertilizing and Mulching

Exposed soils, including stockpiles, that will not be brought to final grade or will not receive permanent cover treatment or vegetation within 15 days of exposure shall be seeded, fertilized and mulched. Seed mixture, fertilizer type, mulch and application rates shall be as recommended by local suppliers, agricultural extension agents, manufacturers, or the Stormwater Management Manual for the Puget Sound Basin (Washington State Department of Ecology), and as approved by the Administrator. Minimum seeding application rate shall be 120 pounds per acre. Mulches shall be used on areas with slopes greater than 2H:1V.

Seeding, fertilizing and mulching shall be constructed in accordance with the Standard Specifications.

10.4.11 Topsoiling

Topsoil shall be applied to areas with highly dense or impermeable soils, where mulch and fertilizer alone would not provide a suitable growth medium and where slopes do not exceed 3H:1V. Topsoil shall meet the requirements of the Standard Specifications, and may be imported or obtained from the project site. Borrow areas for topsoil shall incorporate temporary erosion/sedimentation control measures of these Standards.

10.5 NPDES REQUIREMENTS

As part of the implementation of the National Pollutant Discharge Elimination System (NPDES), projects that will disturb more than five (5) acres of total area must apply for coverage under the Washington State Department of Ecology's Baseline General Permit for Stormwater. The five acre threshold applies even if 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". In general, the temporary erosion/sedimentation control plan required by these Standards is equivalent to that required by the state through the Stormwater Management Manual for the Puget Sound Basin (DOE, 1982). The DOE stormwater permit application requires the filing of a Notice of Intent (NOI) at least 30 days prior to the start of construction. Contact the Department of Ecology at (360) 407-7156 for complete information on permit thresholds, applications, and requirements.

GLOSSARY

Adjacent — Within a radius of 300 feet from the exterior boundaries of a designated Frequently Flooded Area or other critical area or resource lands.

Administrator — The County Engineer of the Pacific County Department of Public Works, or his/her designee.

Agricultural Activities-Existing and Ongoing — Those activities routinely conducted on lands defined in RCW 84.34.020(2), and those activities involved in the production of crops and/or raising or keeping livestock. Agricultural activities include associated activities, including the operation and maintenance of farm and stock ponds, drainage ditches, irrigation systems including irrigation laterals, canals, or irrigation drainage ditches, and normal operation, maintenance, and repair of existing serviceable agricultural structures, facilities or improved areas, and the practice of aquaculture. Forest practices regulated under Chapter 76.09 RCW and Title 222 WAC as amended are not included in this definition.

Allowable Discharge (Q) — The rate at which runoff may be released from a project.

Alteration — A human induced action which materially affects the physical condition of land or improvements including, but not limited to, those activities which are commonly referred to as clearing, grubbing, excavation, filling, grading, surfacing, paving, compaction, stockpiling, and stabilizing.

Applicant — The individual or corporation preparing and submitting an application on behalf of a Proponent or owner.

Assessed Value — The value of the existing improvements, excluding land, as listed in the current records of the Pacific County Assessor.

Basin or **Drainage Basin** — The land area that contributes surface runoff to any point of interest, such as the mouth of a stream.

Basin Plan — A comprehensive flood hazard management plan adopted by the Board of Supervisors of Flood Control Zone District No. 1 which identifies flood history and frequency patterns, and specifies capital improvements, regulations and policies for managing drainage in a basin.

Best Management Practice (BMP)

Conservation practices and/or systems of practices and management measures that: (1) control soil loss and water quality degradation; and (2) minimize adverse impacts to surface water and ground water flow, circulation patterns, and to the chemical, physical, and biological characteristics of receiving water bodies.

Biofilter

A plane, vegetated surface over which runoff traverses at a uniform depth and velocity.

Biofiltration

The process by which pollutant concentrations in runoff are reduced by filtration through vegetation.

Board of Supervisors

The governing body of the Flood Control Zone District No. 1 of Pacific County. The Board of County Commissioners are ex officio, by virtue of their office, members of the Board of Supervisors.

Bond

A surety bond, cash deposit or escrow account, assignment of savings, irrevocable letter of credit or other means acceptable to the Administrator to guarantee that work is completed in compliance with the project permits, approvals and plans and in compliance with all District requirements. Surety bond shall be furnished by a corporate surety company authorized to conduct business in Washington State and which is acceptable to the Administrator. Surety bond shall be of a form acceptable to the Administrator.

Check Structure or **Check Dam**

A rock, earthen or log dam used in channels to reduce water velocities, promote sediment deposition, and/or enhance infiltration.

Clean Impervious Surface

An impervious surface on which the frequency or probability of contamination from motor vehicles or from the routine handling of hazardous materials is minimal. Such surfaces may include, but are not limited to, rooftops, sidewalks, dedicated play areas and emergency fire lanes.

Clearing

The act of vegetation removal from the land surface by mechanical or chemical means, and is often referred to as land clearing

Closed Depression

A basin for which there is no surface water outlet.

Compaction

The mechanical stabilization or densification of earth material.

Construction Cost — The estimated cost, including sales tax, of the redevelopment calculated using current Uniform Building Code methods, bid estimates, or best available information.

Conveyance — A mechanism or device for transporting water including, but not limited to, pipes, natural and/or man made channels, culverts, gutters and manholes.

Critical Areas — All wetlands, frequently flooded areas, aquifer recharge areas, fish and wildlife habitat conservation areas, geologically hazardous areas, shellfish, kelp, eelgrass, herring, and smelt spawning areas, as those terms are used and defined in the Pacific County Critical Areas and Resource Lands Ordinance No. 147, or any amendments thereto.

Critical Facilities — Critical facilities include: schools; hospitals; police, fire, and emergency response installations; sewage and water treatment facilities; electrical substations and other essential utility infrastructure; and installations which produce, use, or store hazardous waste.

Dangerous Wastes — Those wastes designated in WAC 173-303-070 through 173-303-120 as dangerous or extremely hazardous or mixed waste. As used in Chapter 173-303 WAC, the words "dangerous waste" refer to the full universe of wastes regulated by that chapter.

Dead Storage — The volume of storage in a stormwater facility below an outlet which does not drain freely after a storm event.

Delineation — A formal demarcation of the boundary of a frequently flooded area by the Department of Public Works or a Qualified Professional.

Department of Community Development — The Department of Pacific County which, among other things, is responsible for the administration of land development standards within Pacific County.

Department of Public Works — The Department of Pacific County which has been established, pursuant to Pacific County Resolution dated September 2, 1969, as a completely independent department within the government of Pacific County. The Department's County Engineer is responsible for the administration of the affairs and activities of the District in accordance with RCW 86.15.060.

Design Event

An amount of rainfall in a specified period of time and occurring in specified volume increments over time which is used in the design of facilities.

Detention Facility

A storage facility such as a pond, vault, or pipe in which surface water runoff is temporarily stored and released to a natural channel or storm drain.

Detention Pond

A detention facility which is an open pond.

Determination

An action or decision by the Administrator.

Development

Any land altering activity that requires a permit or approval, including but not limited to, a building permit, land alteration permit, shoreline substantial development permit, conditional use permit, zoning variance or reclassification, subdivision, short subdivision, or Right of Way permit.

Discharge (Q)

Runoff, excluding off-site flows, leaving the proposed development through overland flow, built conveyance system, or infiltration facilities.

Disturbed Area

An area inside project boundaries which is altered from its natural state by human activity or natural action, such as landslide or erosion.

Drainage

The collection, conveyance, containment, and/or discharge of surface and storm water runoff.

Drainage Easement

The land reserved or dedicated for the installation, operation, and maintenance of stormwater facilities, or required along a stream or watercourse for preserving the channel and providing for the flow of water to safeguard the public against flood damage, sedimentation, and erosion.

Drainage Review

An evaluation by the Department of Public Works staff of a proposed project's compliance with the drainage requirements in the District Surface Water Control Standards.

Easement

A legal right of use of a property of another for a particular purpose.

Ecology Technical Manual

The most recent edition of the State of Washington, Department of Ecology's "Stormwater Management Manual for the Puget Sound Basin".

Effective Impervious Surface	Impervious surface which is not directed to an infiltration facility capable of infiltrating the design event and which causes runoff.
Emergency Action	An action that is taken to address an unanticipated and imminent threat to public health, safety, or the environment which requires immediate action within a time period too short to allow full compliance with this Ordinance.
Erosion	Detachment of soil or rock fragments by water, ice, wind, gravity, or other elements.
Erosion Control	On-site and off-site control measures that are used to control conveyance and/or deposition of earth or sediment which associated with development.
Excavation	The mechanical removal of earth material.
Fill/Filling	Deposition of earth material (any rock, natural soil and/or combinations thereof) placed by artificial means.
Flood/Flooding	A partial or complete inundation of water over land not usually covered by water, or water which inundates an area of the surface of the earth where it ordinarily would not be expected to be.
100-Year Flood	The flood having a one (1) percent chance of being equaled or exceeded in any given year.
Flood Control Zone District No. 1 (District)	The quasi-municipal corporate body created by the Pacific County Board of Commissioners under the provisions of Chapter 86.15 RCW and delineated geographically according to subsection 1.2 of District Ordinance No. 1.
Forest Land	Any land designated as forest land of long-term significance or as transitional forest land under the Pacific County Critical Areas and Resource Lands Ordinance No. 147, or any amendments thereto.
Forest Practice	Any activity regulated by WAC 222-12 through 222-50, except for Class IV General forest practices that are conversions from timber land to other uses.
Frequently Flooded Areas	Frequently flooded areas shall be those floodways and associated floodplains: (1)designated by the Federal Emergency Management Act (FEMA) flood hazard

classifications as delineated on the area flood hazard maps for Pacific County dated September 27, 1985, or as subsequently revised by FEMA, as being within the 100-year floodplain, or (2) those floodways and associated floodplains delineated by a comprehensive flood hazard management plan adopted by the Board of Supervisors of the District, as being within the 100-year floodplain, or (3) those areas delineated by the Administrator as having experienced historic flooding as documented by aerial photography, personal testimony from Qualified Professionals, or personal testimony from individuals otherwise deemed qualified by the Administrator as being experienced in such delineation.

Grading — Excavation or filling or combination thereof.

Grubbing — The act of root vegetation removal from beneath the surface of the earth, usually in association with clearing.

Hazardous Substances — See Dangerous Waste.

Impervious Surface — A surface which prevents or retards the transmission of water into the soil mantle as under natural conditions prior to development, and/or a hard surface area which causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development. Common impervious surfaces include, but are not limited to, asphalt and portland cement paving, paving blocks, compacted soils for parking areas, rooftops, walkways, patios, driveways, parking lots or storage areas, gravel roads, packed earthen material, and oiled, macadam, or other surfaces which similarly impede the natural infiltration of surface and storm water runoff. Lattice work paving systems which have a portion of their area open to the subgrade shall be not be considered impervious as to the portion which is open. Open, uncovered retention/detention facilities shall not be considered as impervious surfaces.

Interflow — Subsurface flow moving laterally in the unsaturated zone following the hydraulic gradient of soil layers with lower vertical hydraulic conductivity. At the surface, interflow is referred to as a "spring" or a "seep".

Land Alteration — A human induced action which materially affects the physical condition of land or improvements including, but not limited to, those activities which are commonly

referred to as clearing, grubbing, excavation, filling, grading, surfacing, paving, compaction, stockpiling, and stabilizing.

Maintenance

Those usual acts to prevent a decline, lapse, or cessation from a lawfully established condition or to restore a development to a state comparable to its original conditions within a reasonable period after decay or partial destruction expect where repair involves total replacement which is not common practice or causes substantial adverse effects to the environment.

Marine Bluff Hazard Zone

The area seaward of a plane surface extending landward at a 50% slope from the toe of a marine bluff.

Mitigation

The use of any or all of the following actions that are listed in descending order of preference:

1. Avoiding the impact altogether by not taking a certain action or parts of an action; or
2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps to avoid or reduce impacts; or
3. Rectifying the impact by repairing, rehabilitating, or restoring the affected area; or
4. Reducing or eliminating the impact over time by preservation or maintenance operations during the life of the development proposal; or
5. Compensating for the impact by replacing, enhancing, or providing substitute areas; or
6. Monitoring the impact and taking appropriate corrective measures.

Monitor

To measure something systematically and repeatedly in order to document conditions over time.

Native Vegetation

Plant species which are indigenous to the subject site.

Natural Channel

A stream, creek, river, lake, wetland, estuary, gully, swale, ravine or any open channel in which water concentrates and flows intermittently or continuously.

Natural Discharge Location	The location of the drainage pathway at the proposed project boundary at the time of analysis.
New Impervious Surface	Any impervious surface proposed by a project that will increase the runoff curve number of that surface for existing site conditions (e.g. gravel to asphalt).
Off-site	Any land area lying upstream of the site that drains onto the site and any land area lying downstream of the site to which the site drains.
On-site	The entire property that includes the proposed development.
Outfall (Point of Discharge)	A point where collected and concentrated surface and storm water runoff is discharged from the project site or into an open drainage feature, including receiving water bodies.
Owner	The lawful and legal owner of a lot or parcel of land.
Permeability or **Coefficient of Permeability**	The soil property which describes how water flows through soils, as determined by field and/or laboratory work conducted by a Qualified Soils Professional.
Permit	Written authorization from the Administrator granting the permission to make the land alteration(s) requested in the application for same.
Permittee	A person granted a permit under this Ordinance.
Person	An individual, a partnership (including partners and managers), a corporation (including board members, officers, and managers), or any other entity of any kind. "Person" also includes an applicant, a re-applicant, a permit holder, an authorized agent of any entity, or any third party acting on behalf of any entity.
Plat	A map or representation of a subdivision showing the division of a tract or parcel of land into lots, blocks, streets, or other divisions and dedications.
Post-development Conditions	The condition of a site following project completion.
Pre-development Conditions	The existing condition of a site prior to any development or construction in relation to a proposed project.

Project — The proposed action of a permit application or an approval which leads to addition or reconstruction of impervious surface, addition of value to a property, or disturbance of the ground surface.

Project Site — The parcel or parcels on which the permitted activity occurs including adjacent parcels with existing development which the Administrator determines is part of the project.

Proponent — The owner and/or his agents, contractors, or other entity representing the Owner who proposes a development activity.

Qualified Professional — Any individual registered as a professional engineer in the State of Washington in accordance with Chapter 18.43 RCW, and having experience, education, professional degree(s), and/or training pertaining to hydrology, surface water management, drainage, and/or flooding.

Qualified Geotechnical Professional — Any individual registered as a professional engineer in the State of Washington in accordance with Chapter 18.43 RCW, and who has at least four years of professional employment and experience as a geotechnical engineer.

Qualified Soils Professional — A registered sanitarian, registered soil scientist, a certified on-site septic system designer, a Qualified Professional, or a Qualified Geotechnical Professional having knowledge and experience in the areas of soil classification and infiltration testing, ad determined by the Administrator.

Receiving Waters — A natural water feature including but not limited to wetlands, lakes, marine water bodies, intermittent streams, natural swales and gullies, and all waters of the United States.

Retention/Detention Facility — Either a facility with an outlet to surface water intended to discharge partially to groundwater and partially to surface water, or a retention facility or a detention facility or combination thereof.

Retention Facility — A facility, such as a pond, vault, or pipe, having no outlet to surface water and which is intended to discharge to groundwater or through evaporation.

Retention Pond — A retention facility that is an open pond.

Runoff — Surface water which is discharged from a project site.

Run-on — Surface water which enters or runs onto a project site.

Sediment — Soil transported from its site of origin by water, ice, wind, gravity, or other natural means as a product of erosion.

SEPA — The State Environmental Policy Act, Chapter 43.21C RCW, as amended.

Single-family Residence — A detached dwelling designed for and occupied by one family including those structures and developments within a contiguous ownership which are a normal appurtenance. An "appurtenance" is necessarily connected to the use and enjoyment of a single-family residence and is located upland of a frequently flooded area. Normal appurtenances include a garage; deck; driveway; septic system; utilities; and fences. For the purpose of this Ordinance, a single-family residence shall include a duplex located on a single tax parcel.

Site — One or more parcels on which the project is proposed to be located, including those parcels on which existing development is located.

Slope — An inclined ground surface, the inclination of which is expressed as a ratio of horizontal distance to vertical distance.

Stabilizing — Counteracting the actions of water, ice, gravity, wind, water, or other natural processes.

Stockpiling — The temporary deposition of earth material placed by artificial means.

Storm drain or **Storm drain system** — A network of open ditches or channels or enclosed conduits that transport surface and stormwater runoff toward points of discharge.

Stormwater — Water originating from rainfall and other precipitation, such as snow, sleet, or hail, that is found in drainage facilities, rivers, streams, springs, seeps, ponds, lakes, and wetlands as well as other shallow groundwater, washdown water, irrigation wastewater, and other wastewater that enters the drainage system.

Surface water

Any body of water, whether fresh or marine, which either flows or is contained in natural or artificial depressions for continuous periods of thirty (30) days or more. Such bodies include, but are not limited to, natural and artificial lakes, ponds, rivers, streams, swamps, marshes, and tidal waters.

Surface Water Control Facilities

Any structure, facility, or system intended to control and/or treat surface water including, but not limited to, conveyance, treatment, detention/retention, and infiltration systems; channel, ditch, stream, and lake protection and rehabilitation; and other surface water control facilities. For the purpose of establishment of connection fees, surface water control facilities shall also include comprehensive planning; public education and outreach programs; and other activities associated with construction of surface water control facilities or the avoidance of such construction

Stream

Those areas where naturally occurring surface waters flow sufficiently to produce a defined channel or bed which demonstrates clear evidence of the passage of water, including, but not limited to, bedrock channels, gravel beds, sand and silt beds, and defined-channel swales. The channel or bed need not contain water during the entire year. This definition does not include water courses which were created entirely by artificial means, such as irrigation ditches, canals, roadside ditches, or storm or surface water run-off features, unless the artificially created water course contains salmonids or conveys a stream that was naturally occurring prior to the construction of the artificially created water course.

Temporary Erosion/Sedimentation Control Plan (TE/SC Plan)

The plan and specifications for construction of temporary erosion/sedimentation control facilities for the project.

Wetland or Wetlands

Areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were

unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from non-wetland areas created to mitigate conversion of wetlands.

Wet Pond

A stormwater detention pond used for treatment of surface water runoff and designed to maintain a continuous or seasonal static water level below the pond outlet elevation.

APPENDIX A STANDARD DRAINAGE DRAWINGS

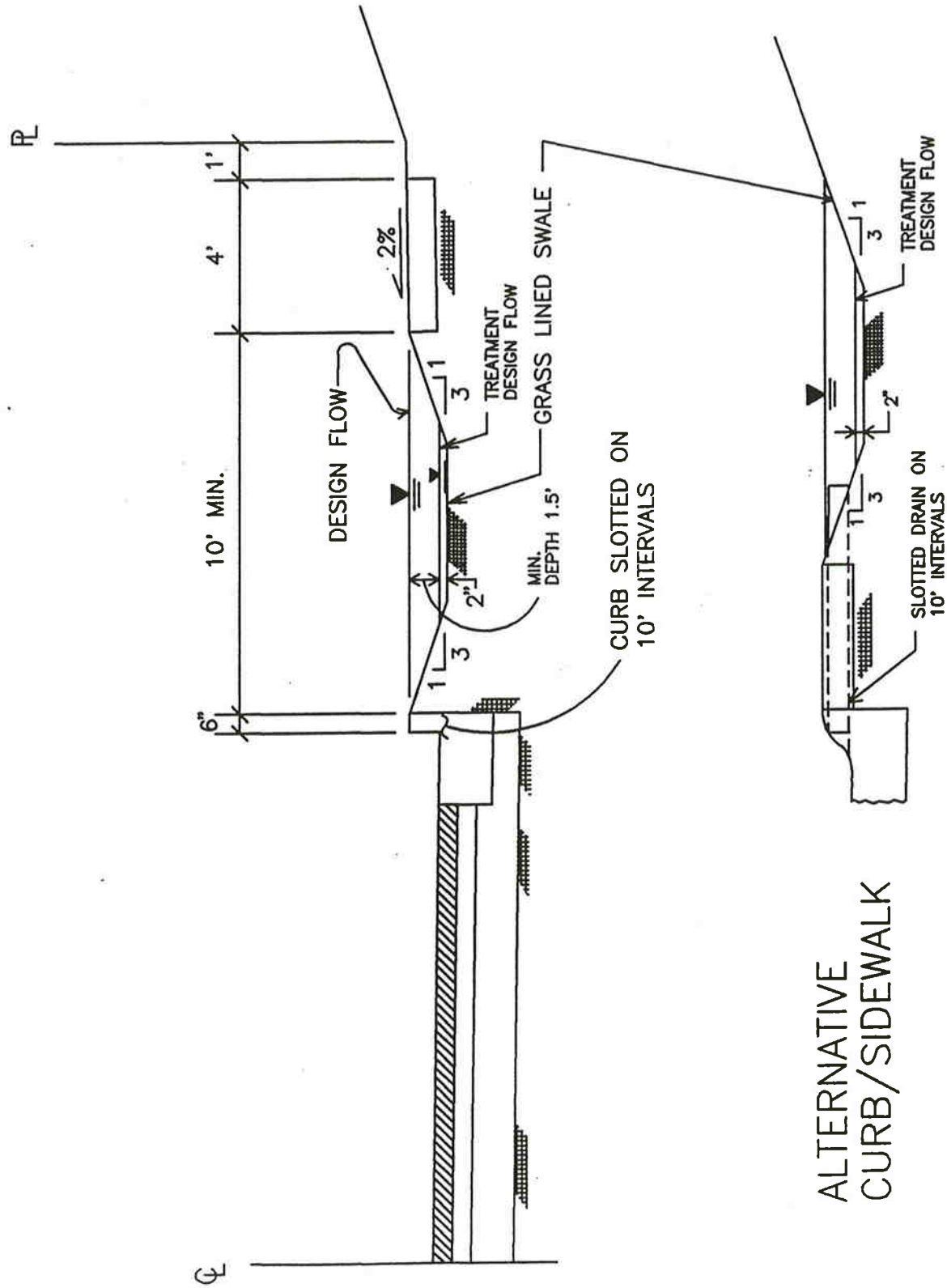
STANDARD DRAINAGE DRAWINGS

The following drawings are adopted by the District as standards for surface water control:

Figure A1	Biofiltration Swale
Figure A2	Parking Lot Conveyance Channel
Figure A3	Flow Control Manhole
Figure A4	Flow Restrictor
Figure A5	Standard Outfall
Figure A6	Outfall Detail
Figure A7	Alternate Gabion Outfall
Figure A8	Detention System Schematic - Plan View
Figure A9	Section A-A Detention System
Figure A10	Detention System
Figure A11	Typical Detention Tank
Figure A12	Sand Filter
Figure A13	Infiltration System
Figure A14	Roof Drain Drywell Example
Figure A15	Catch Basin Anti-Dumping Message
Figure A16	Pipe Anchor Detail
Figure A17	Lattice Block Pavement Example
Figure A18	Roadside Conveyance/Infiltration

STORM DRAINAGE DESIGN MANUAL

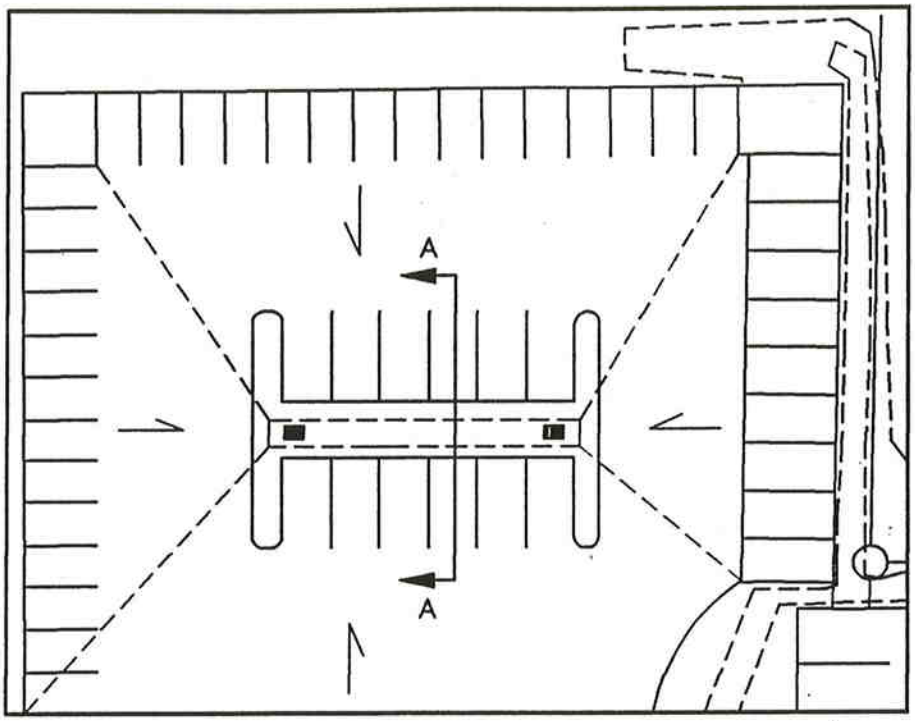
FIG A1



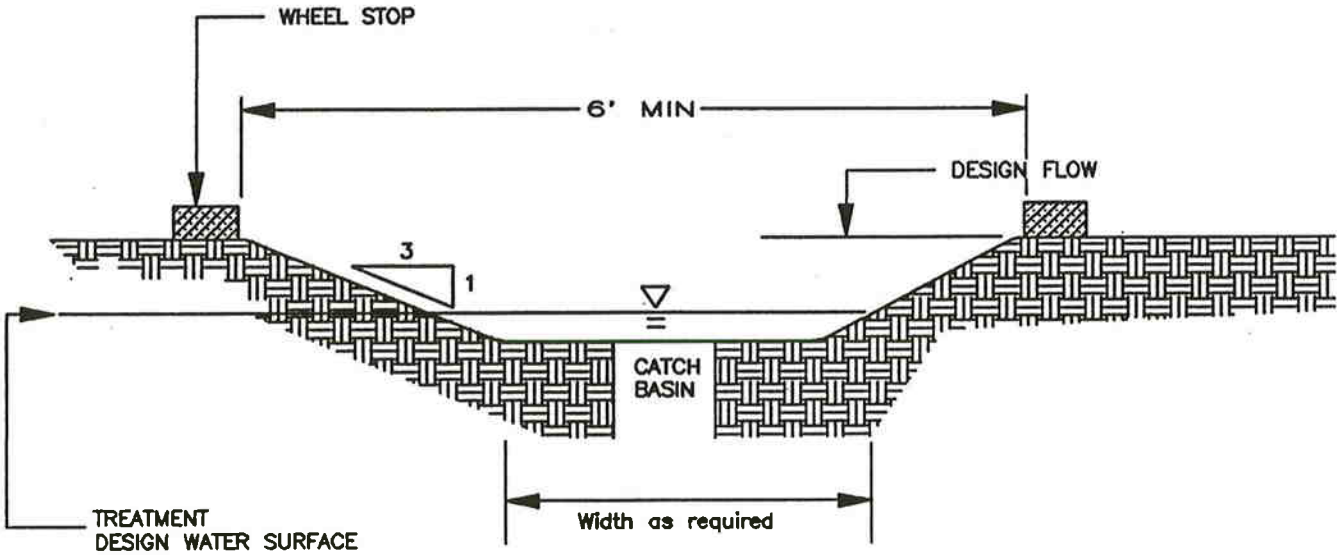
DATE:
JUNE 1995

BIOFILTRATION SWALE

STORM DRAINAGE DESIGN MANUAL | FIG A2



PLAN

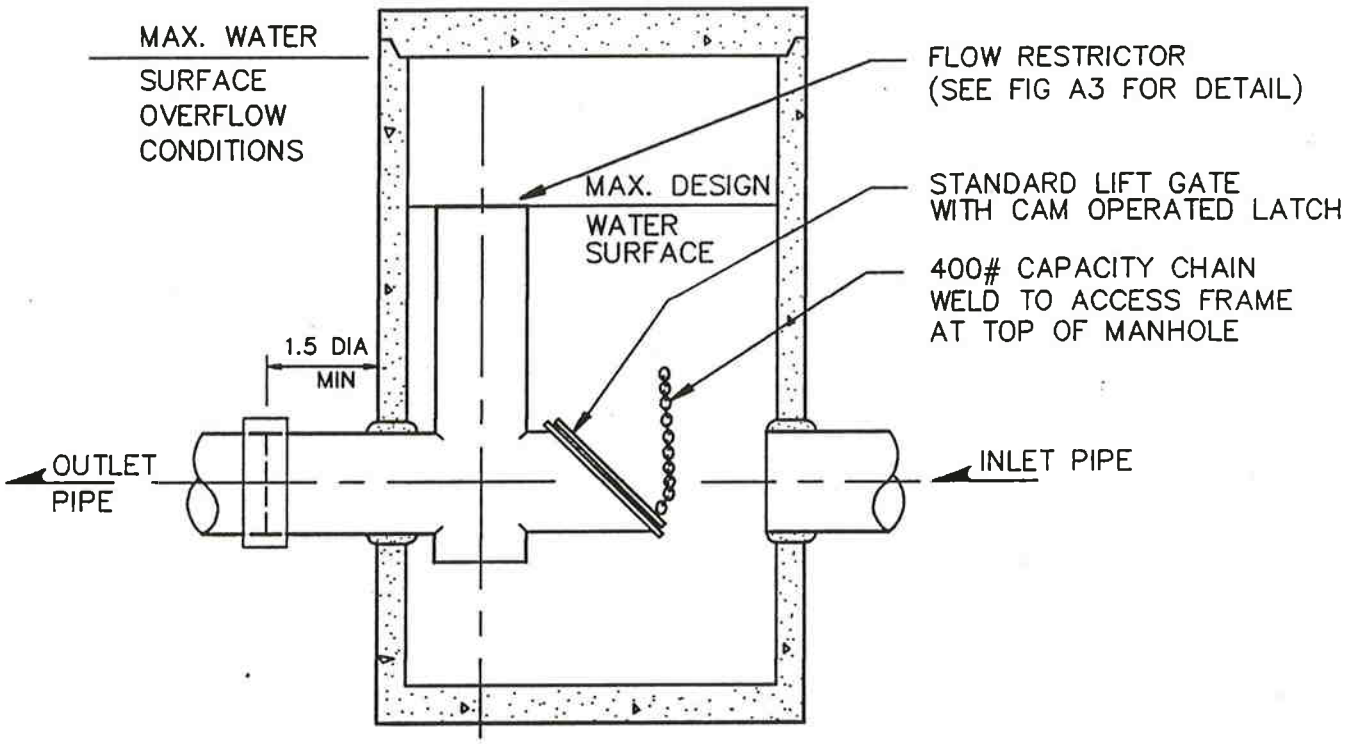


SECTION A – A

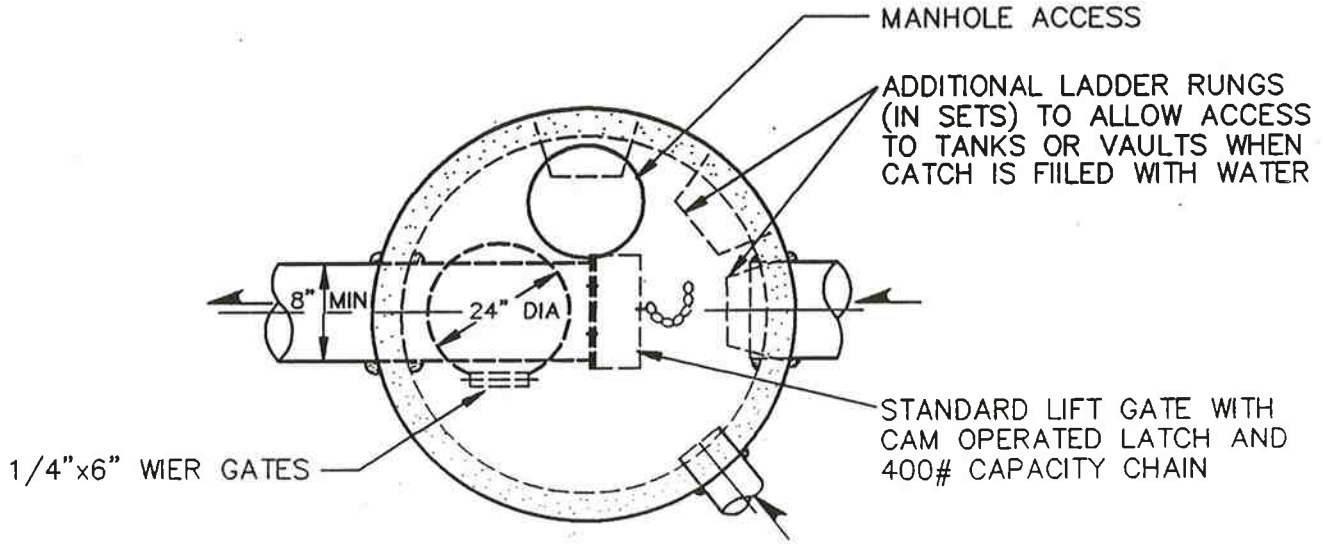
DATE: JULY 1988

PARKING LOT CONVEYANCE CHANNEL

STORM DRAINAGE DESIGN MANUAL | FIG A3



SECTION VIEW

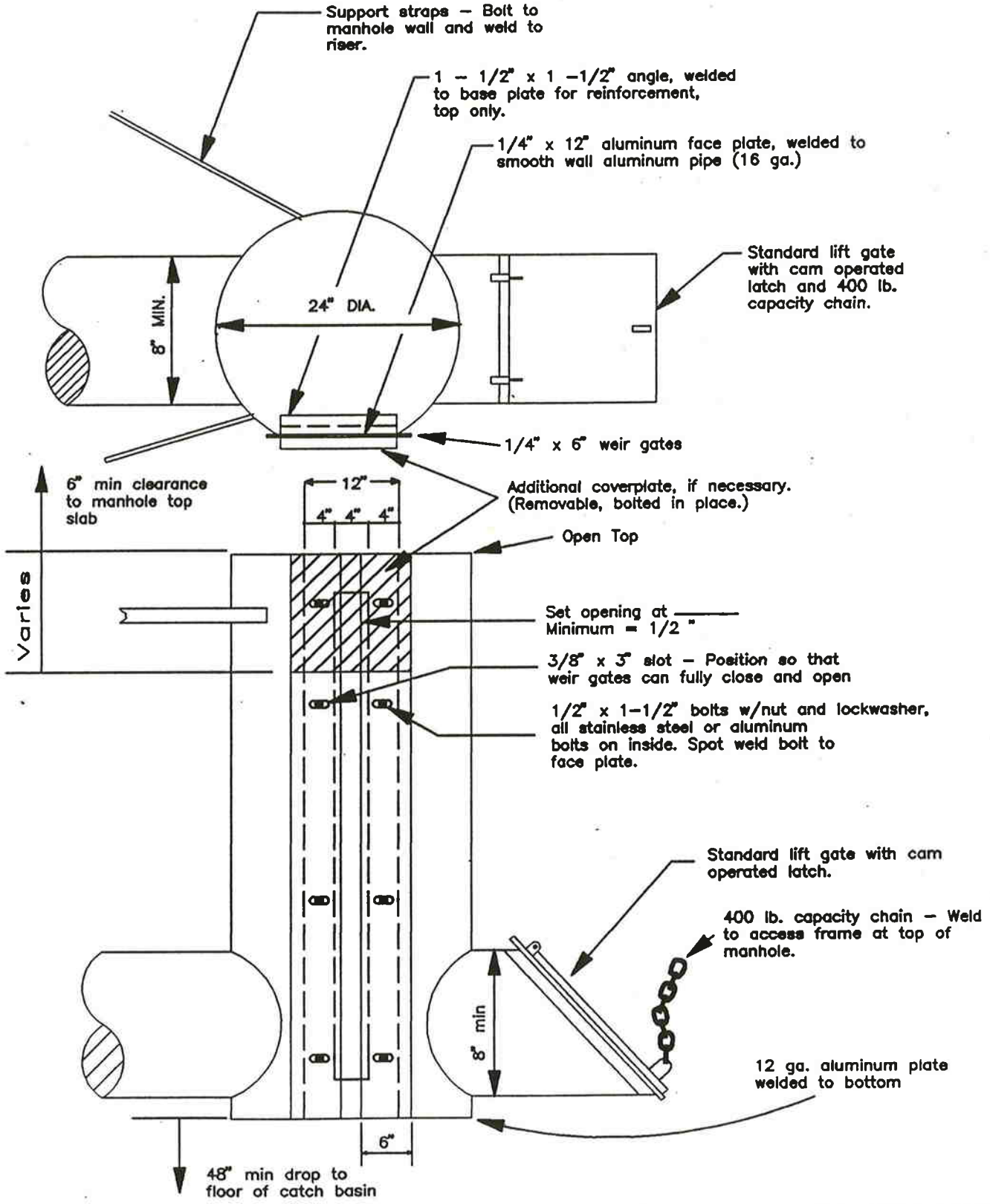


PLAN VIEW

DATE: JUNE 1995

FLOW CONTROL MANHOLE

STORM DRAINAGE DESIGN MANUAL | FIG A4



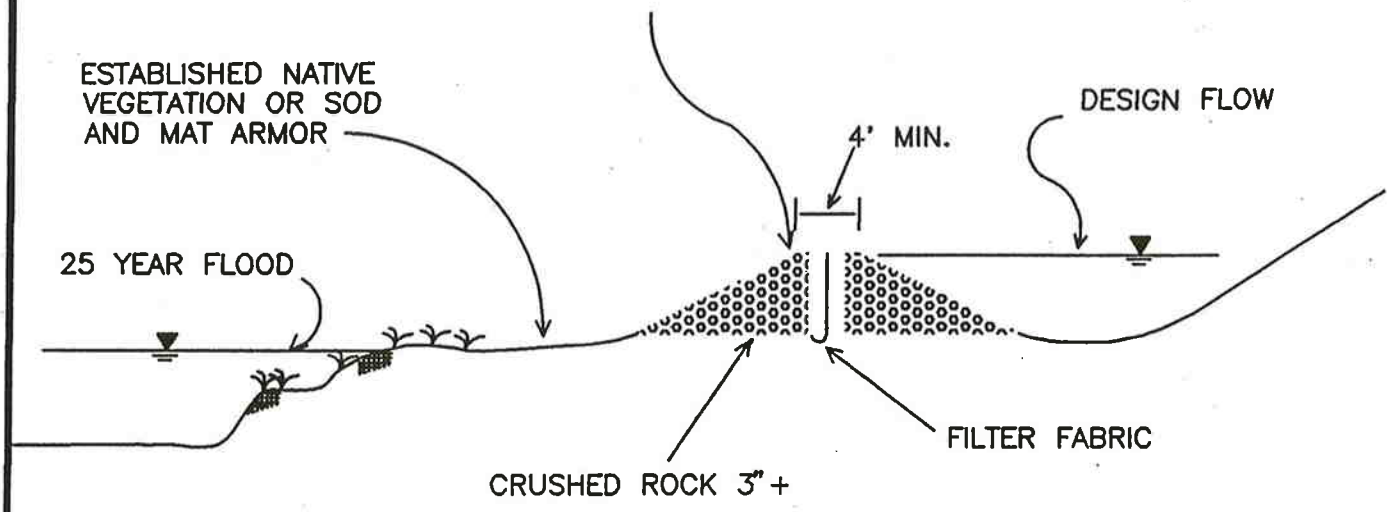
REFERENCE:
MOUNTLAKE TERRACE, WASHINGTON, ENGINEERING STANDARDS HANDBOOK

DATE:
JUNE 1995

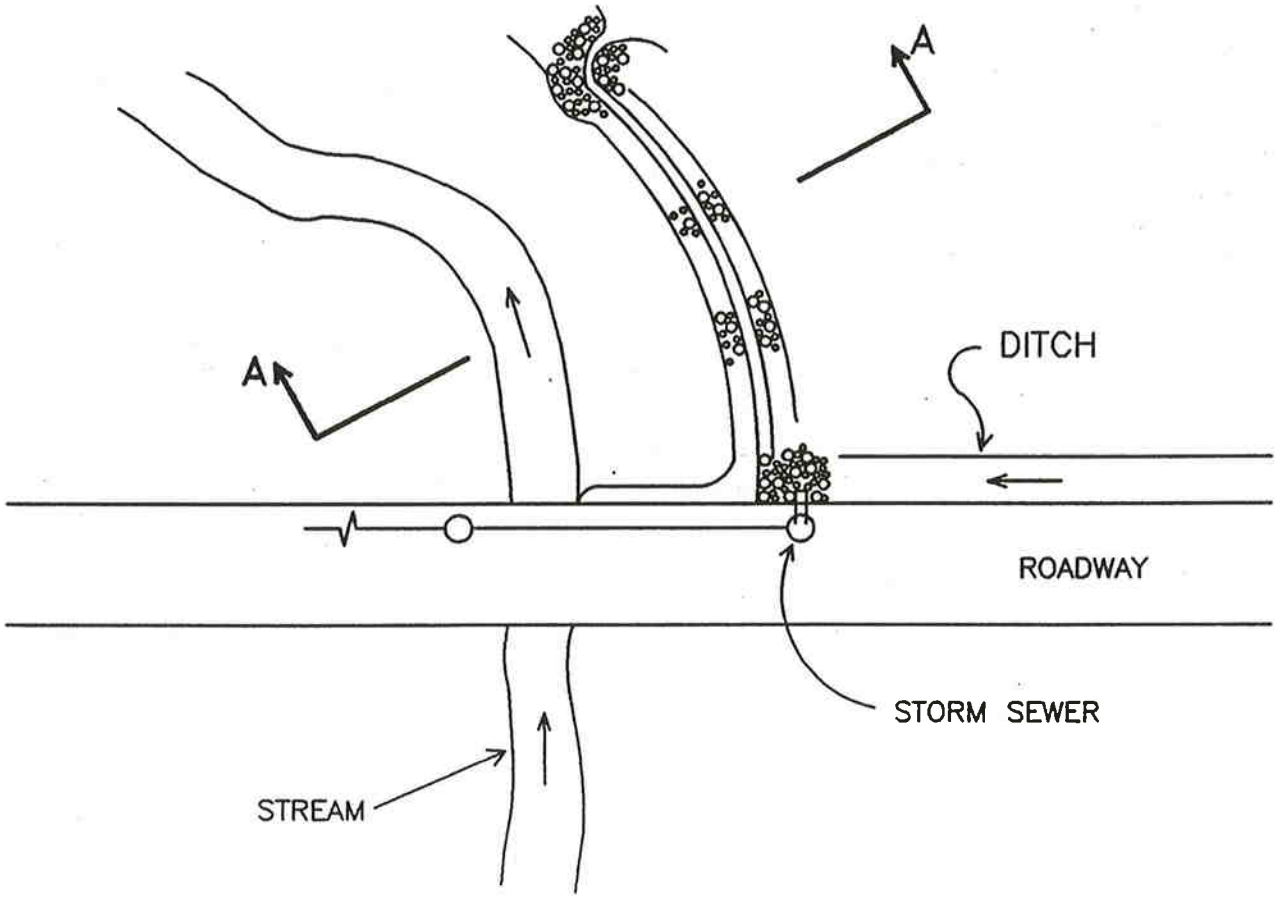
FLOW RESTRICTOR

STORM DRAINAGE DESIGN MANUAL | FIG A5

NOTE: SHEET FLOW OVER WEIR
FOR DESIGN EVENT <1" DEEP.



SECTION AA

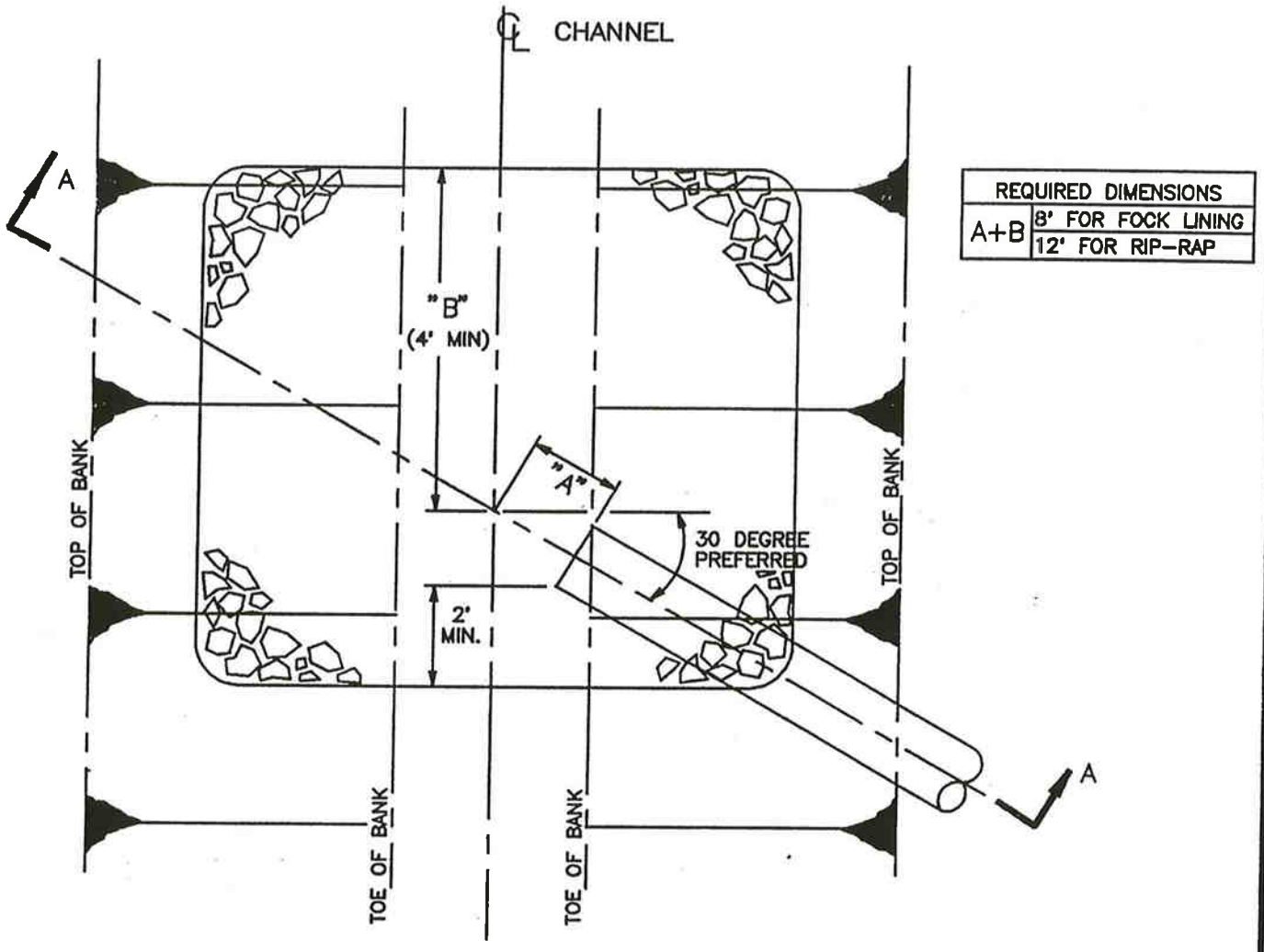


DATE:
JULY 1988

STANDARD OUTFALL

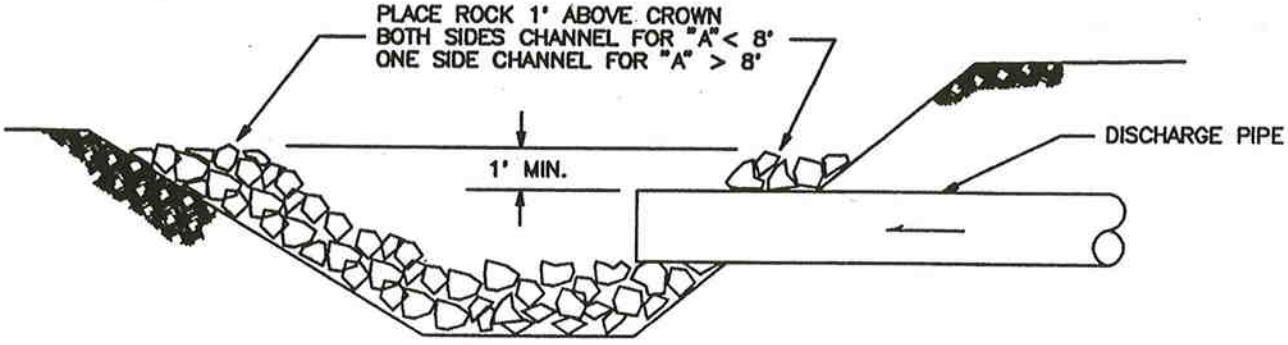
STORM DRAINAGE DESIGN MANUAL

FIG A6



REQUIRED DIMENSIONS	
A+B	8' FOR FOCK LINING
	12' FOR RIP-RAP

PLAN
SCALE: NTS



1' OR 2' ROCK THICKNESS
SEE TABLE A.2

SECTION A-A

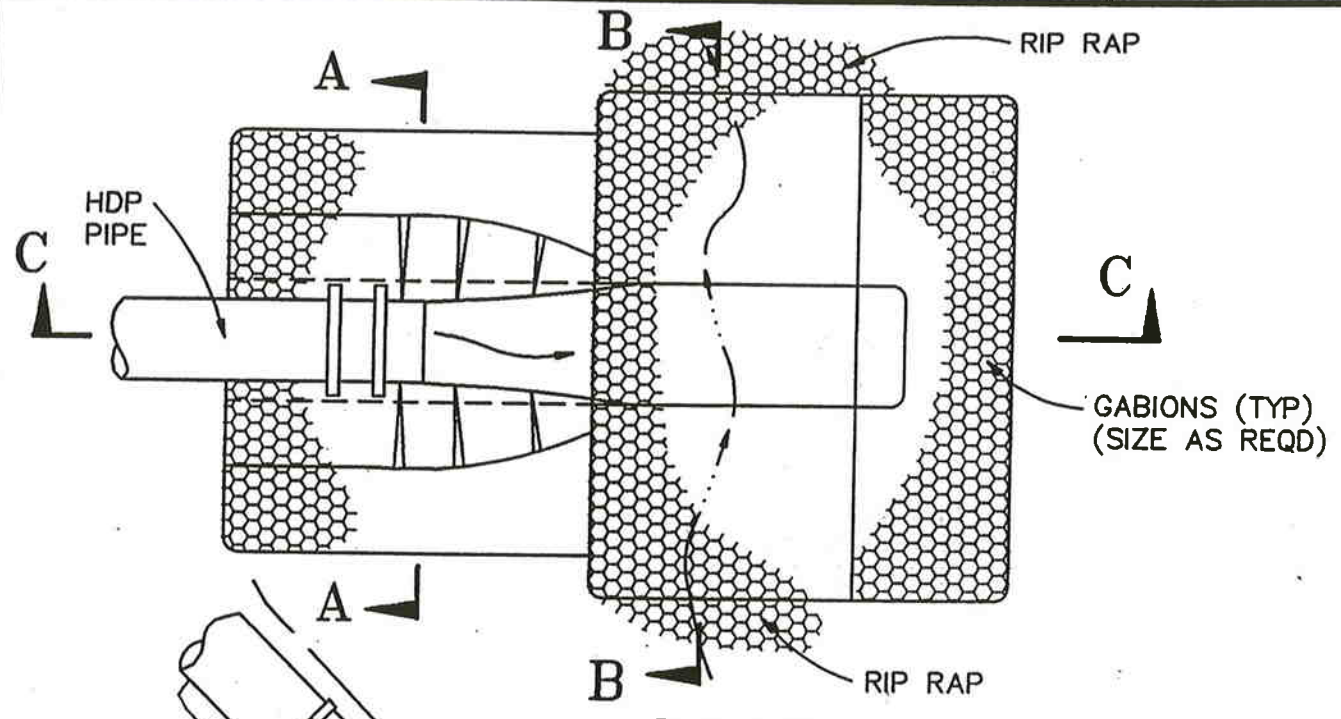
REFERENCE:
KING COUNTY, WASHINGTON, SURFACE WATER DESIGN MANUAL

DATE:
JULY 1988

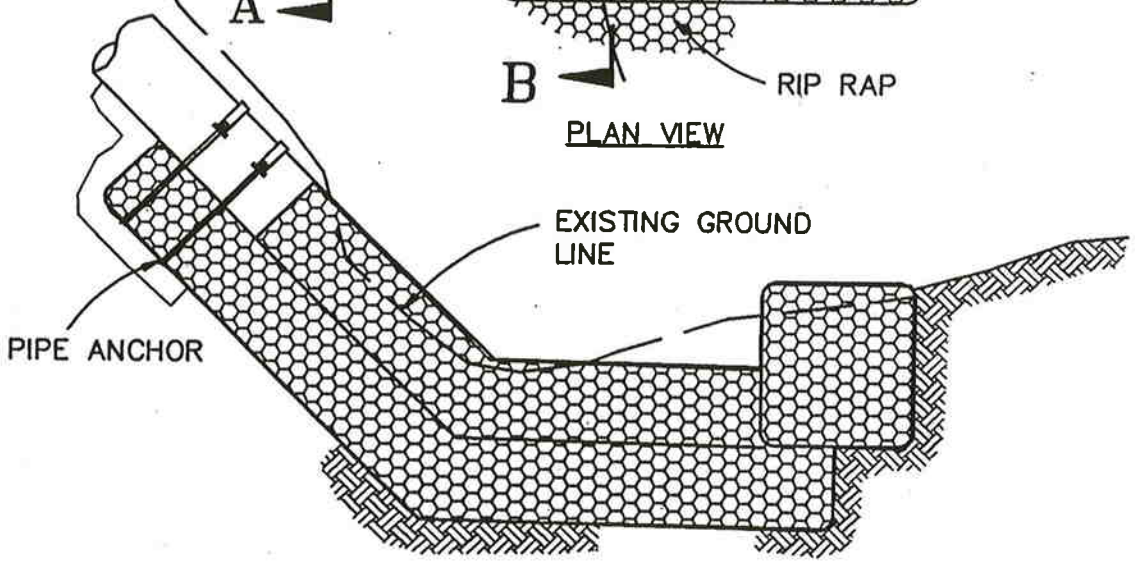
OUTFALL DETAIL

STORM DRAINAGE DESIGN MANUAL

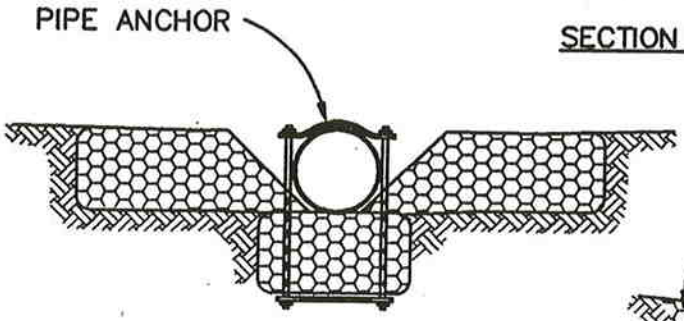
FIG A7



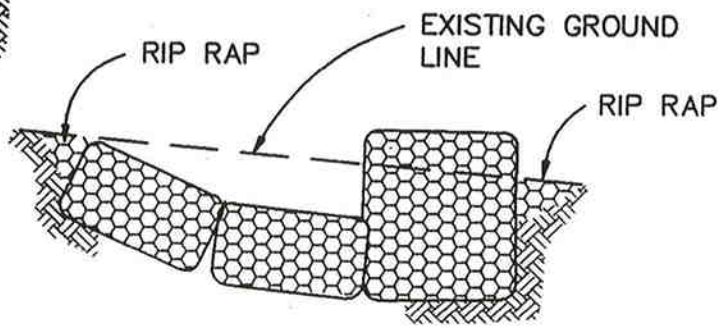
PLAN VIEW



SECTION C–C



SECTION AA

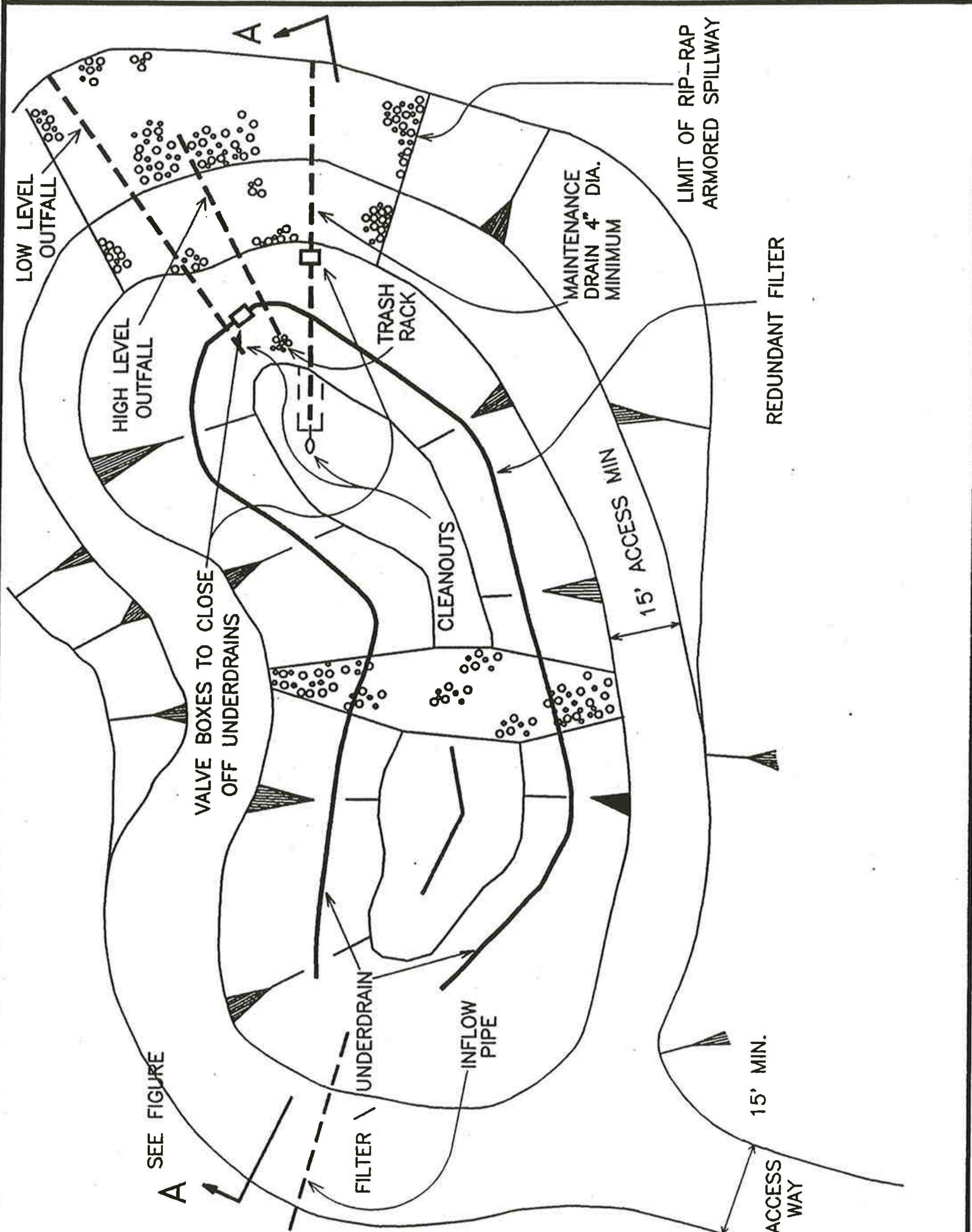


SECTION B–B

DATE:
JULY 1988

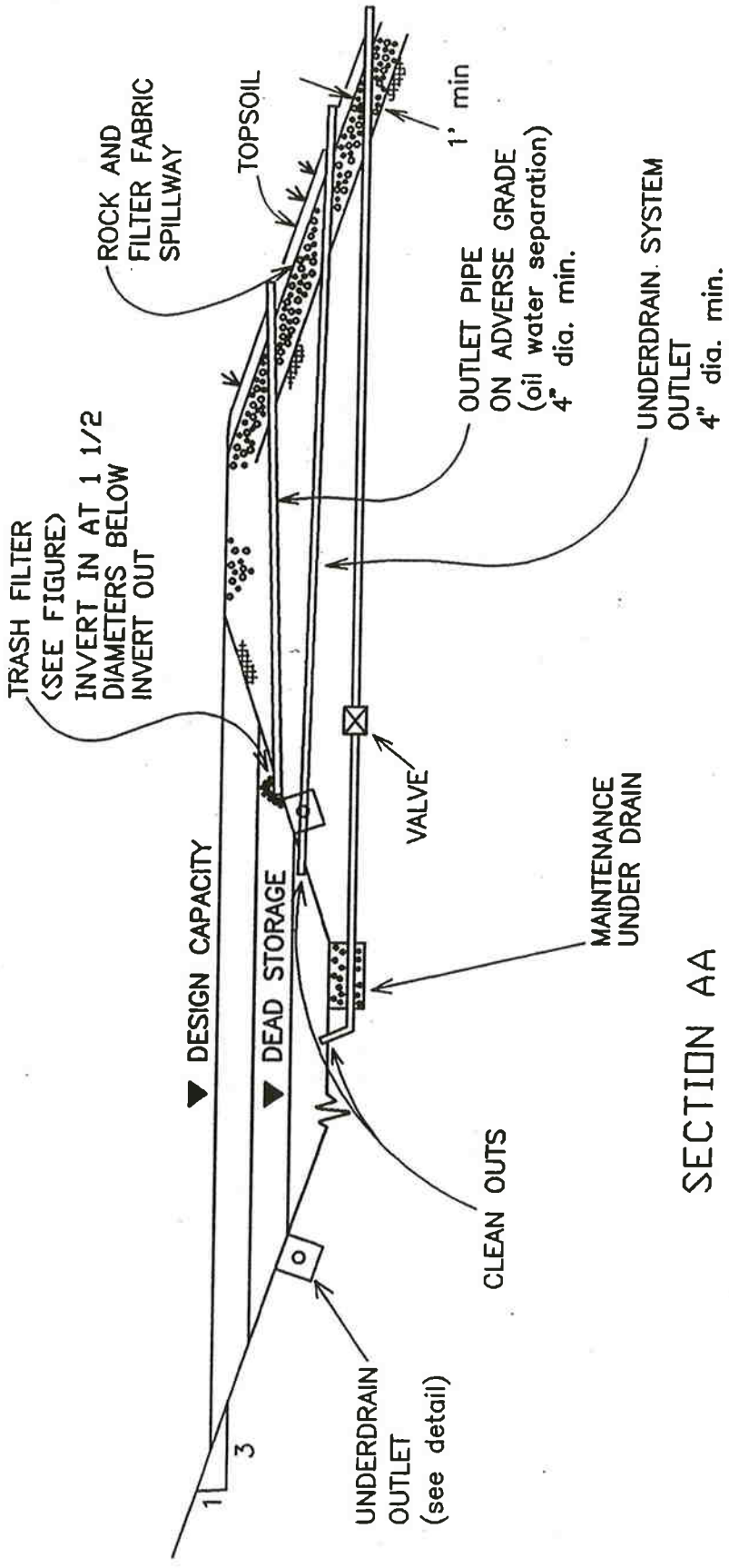
ALTERNATE GABION OUTFALL

STORM DRAINAGE DESIGN MANUAL | FIG A08



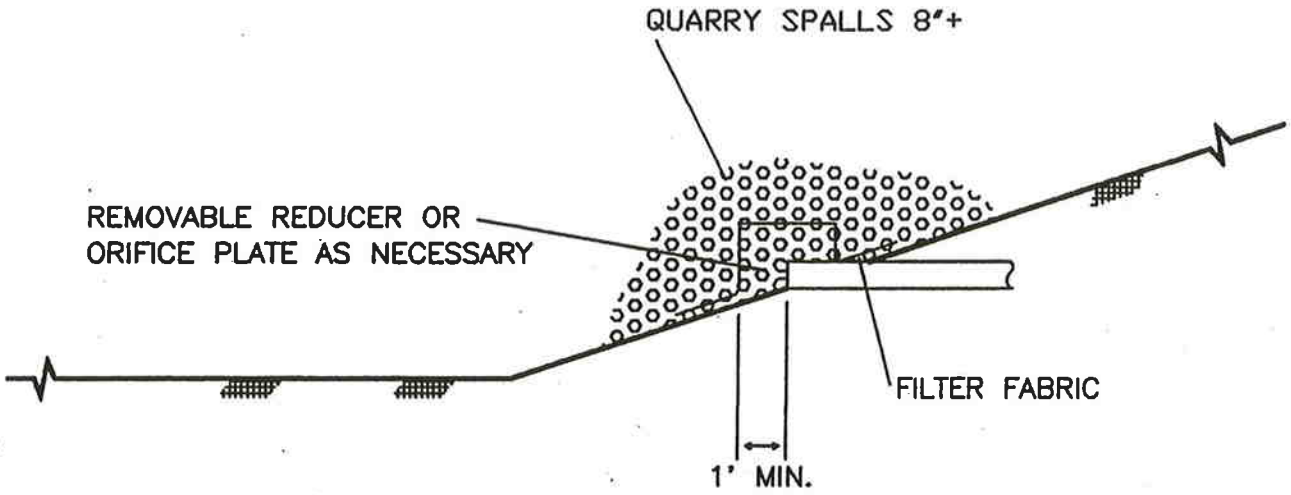
DATE: JUNE 1995

DETENTION SYSTEM SCHEMATIC - PLAN VIEW

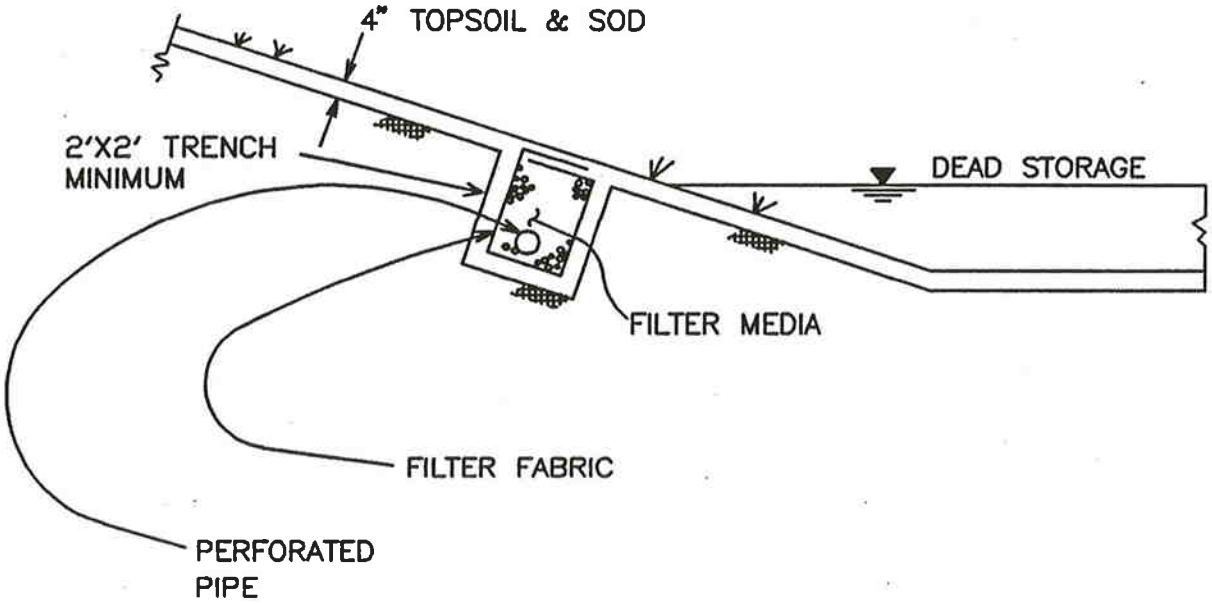


DATE: JUNE 1995

SECTION AA DETENTION SYSTEM

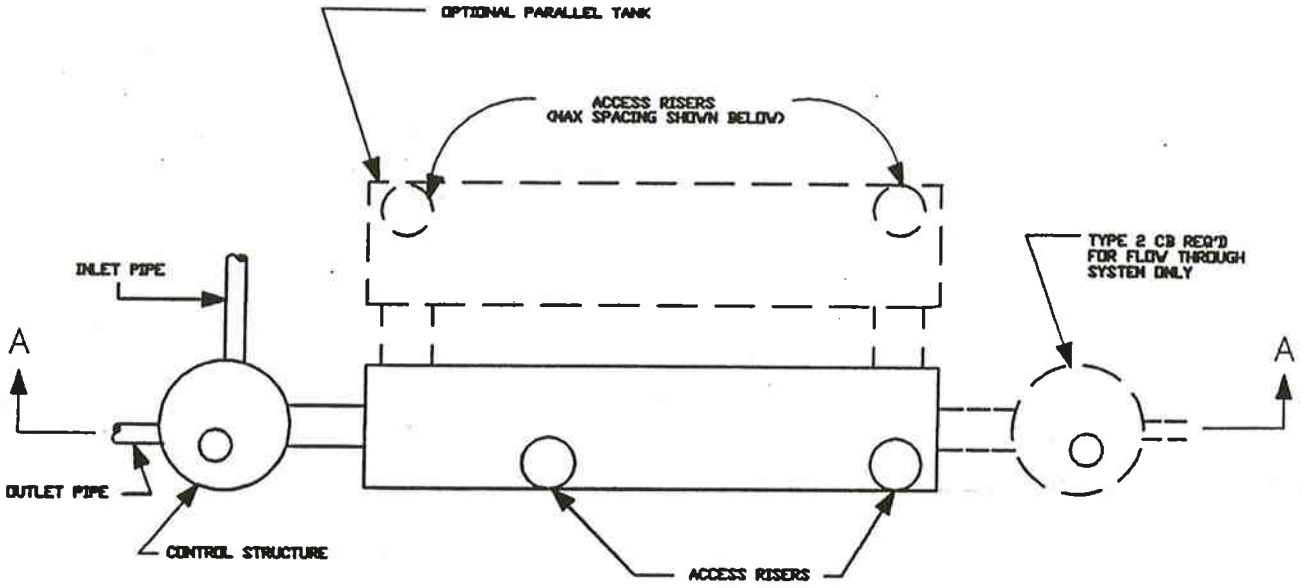


OUTLET PIPE TRASH RACK DETAIL



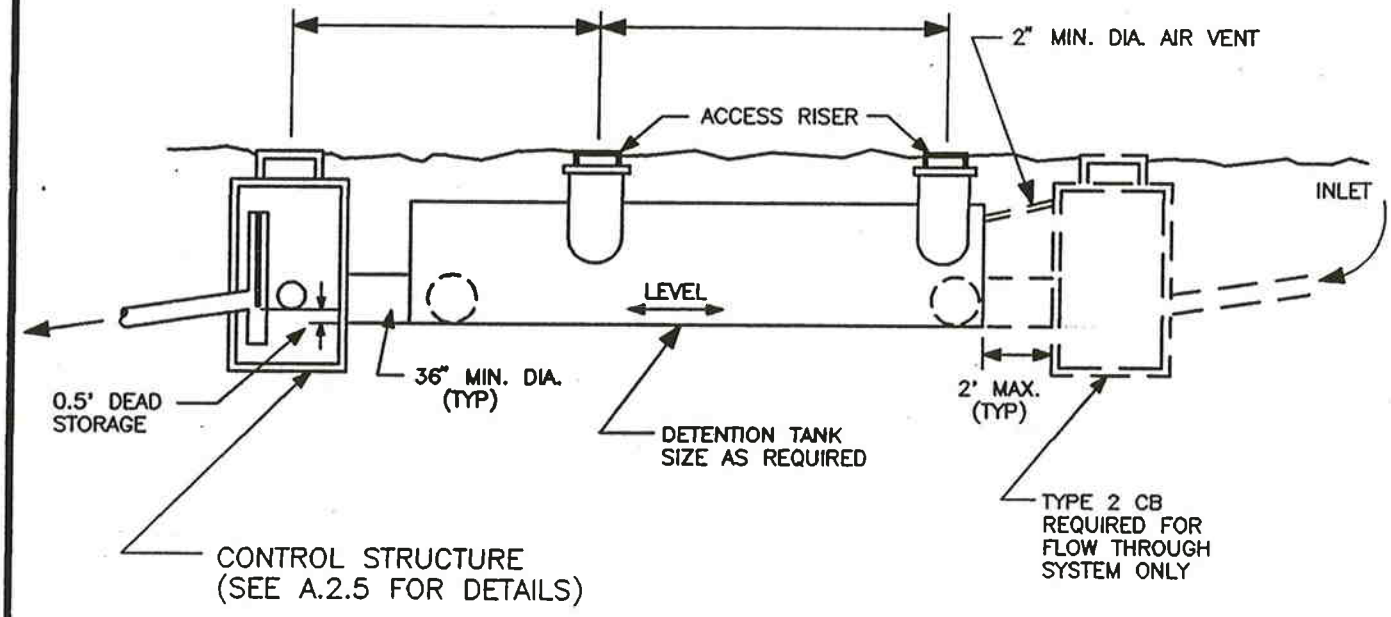
UNDERDRAIN FILTER OUTLET DETAIL

STORM DRAINAGE DESIGN MANUAL | FIG A11



PLAN VIEW

"FLOW BACK UP" SYSTEM SHOWN
OPTIONAL DESIGNS FOR "FLOW TROUGH" SYSTEM AND
PARALLEL TANKS SHOWN DASHED



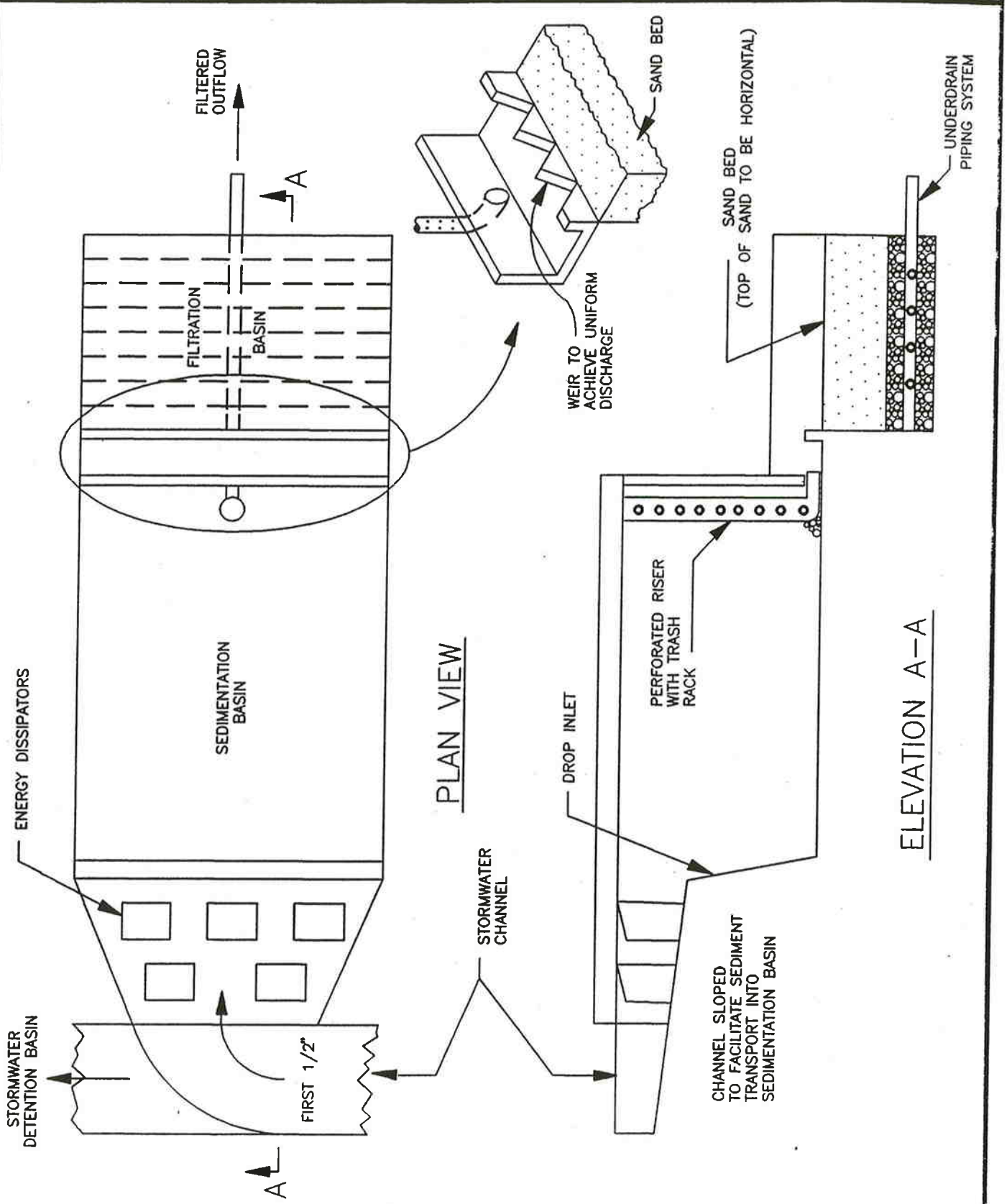
SECTION A–A

REFERENCE:
KING COUNTY, WASHINGTON, SURFACE WATER DESIGN MANUAL

DATE:
JUNE 1995

TYPICAL DETENTION TANK

STORM DRAINAGE DESIGN MANUAL | FIG A12

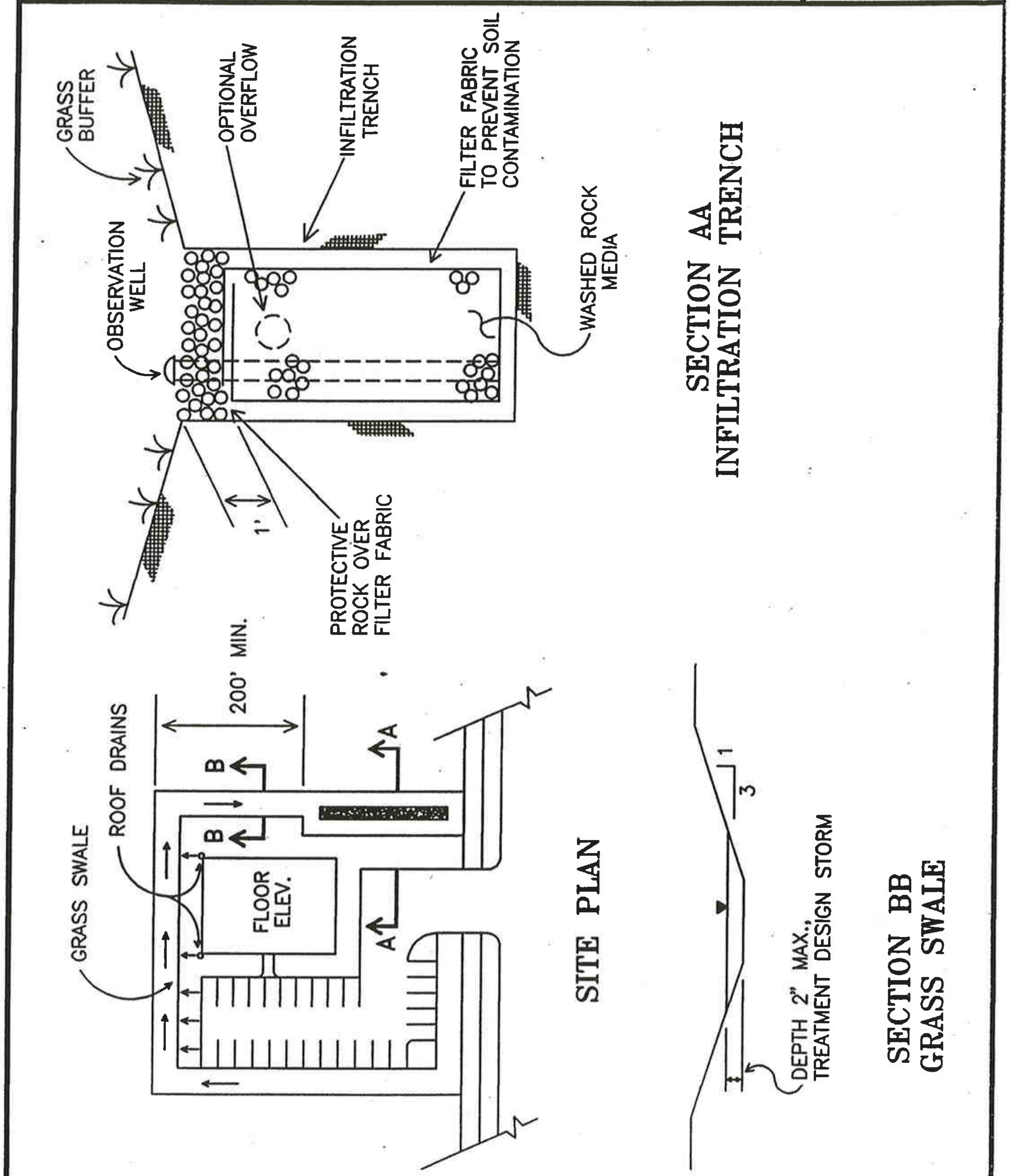


REFERENCE:
CITY OF AUSTIN, TEXAS, AUSTIN DRAINAGE MANUAL

DATE:
JUNE 1995

SAND FILTER

STORM DRAINAGE DESIGN MANUAL | FIG A13

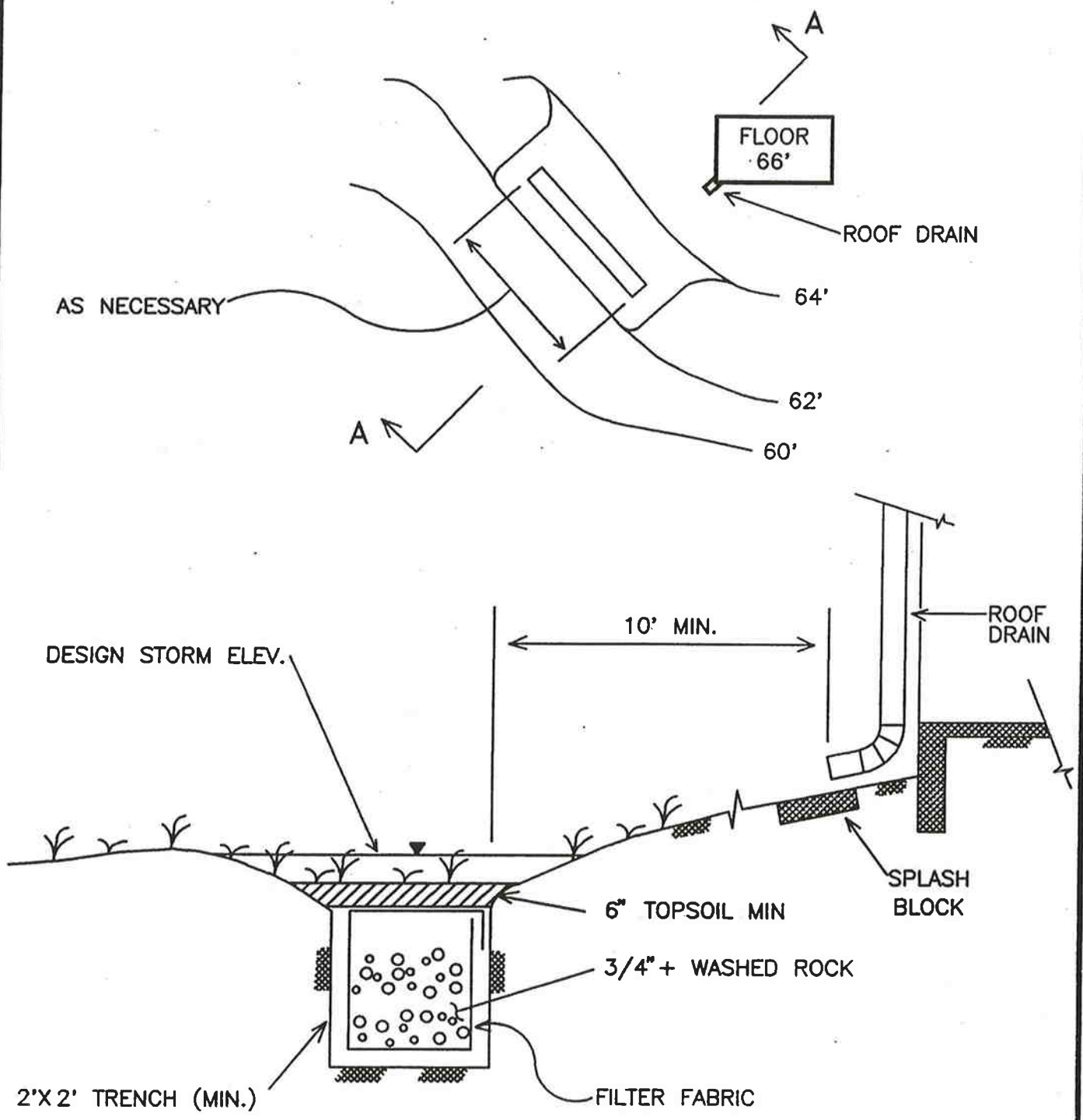


REFERENCE: "CONTROLLING URBAN RUNOFF" METRO COUNCIL OF GOVERNMENTS, WASHINGTON DC, 1987

DATE: JUNE 1995

INFILTRATION SYSTEM

STORM DRAINAGE DESIGN MANUAL | FIG A14



SECTION AA

DATE:
JUNE 1995

ROOF DRAIN DRYWELL EXAMPLE

STORM DRAINAGE DESIGN MANUAL	FIG A15

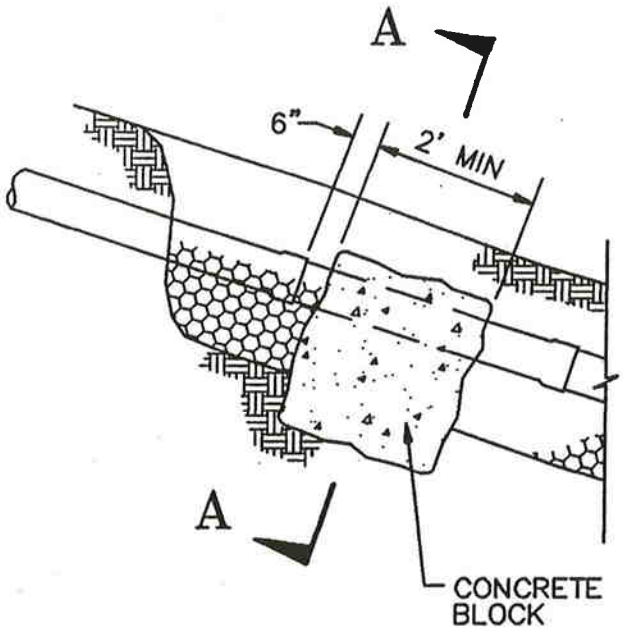
DUMP NO WASTE

DRAINS TO STREAM

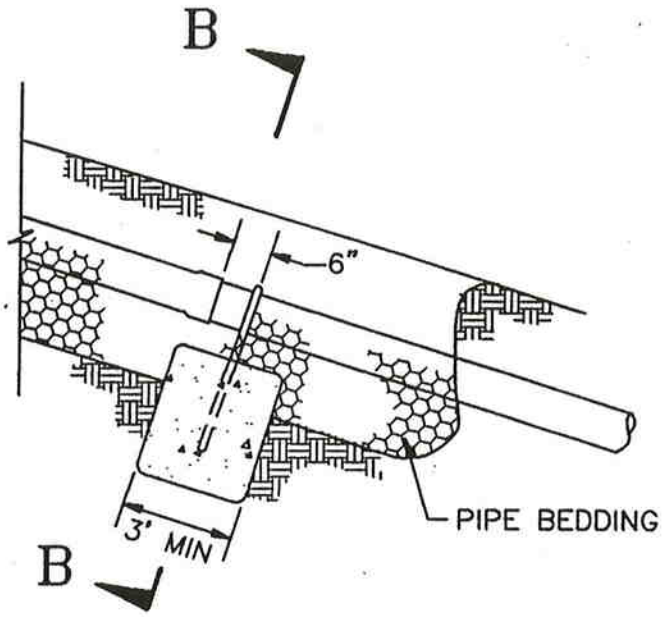
REFERENCE:

DATE: JUNE 1995	CATCH BASIN ANTI-DUMPING MESSAGE

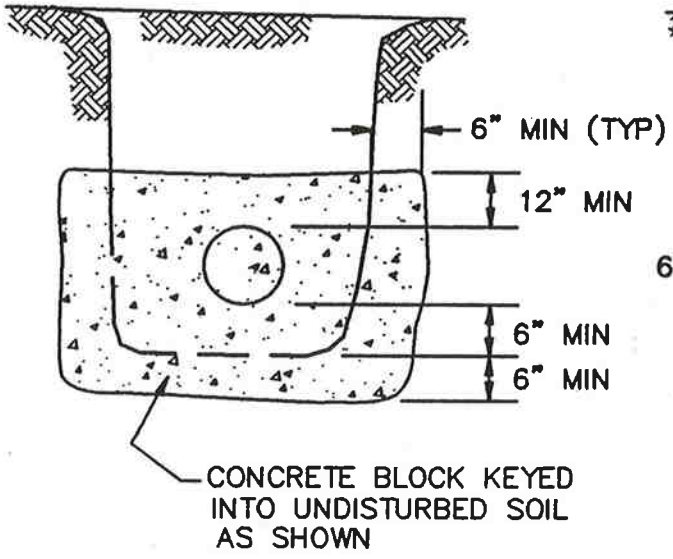
STORM DRAINAGE DESIGN MANUAL | FIG A16



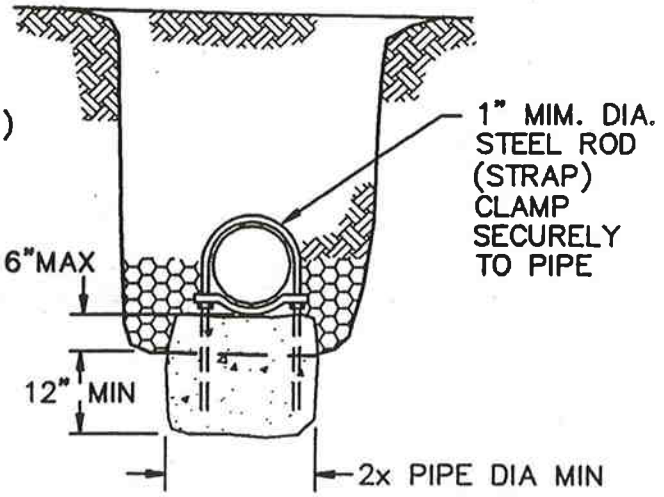
CONCRETE BLOCK ANCHOR



STRAP–FOOTING ANCHOR



CONCRETE BLOCK



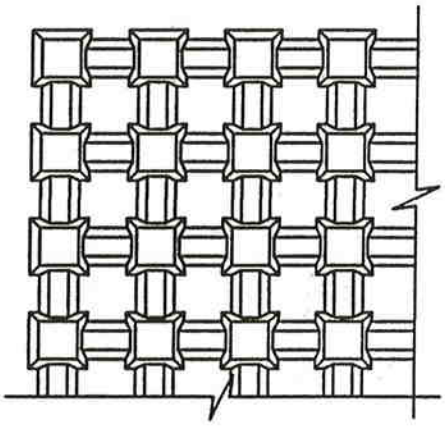
CONCRETE BLOCK

NOTE: SPACING FOR PIPE ANCHORS TO BE @ MAX. 20' INTERVALS.

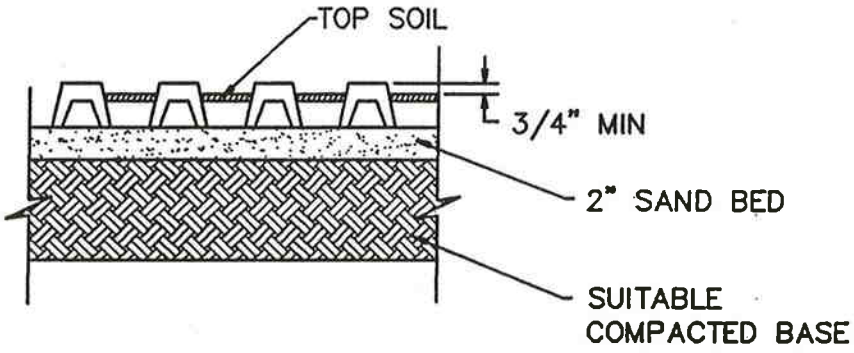
REFERENCE:
KING COUNTY, WASHINGTON, SURFACE WATER DESIGN MANUAL

DATE:
JULY 1988

PIPE ANCHOR DETAIL



PLAN

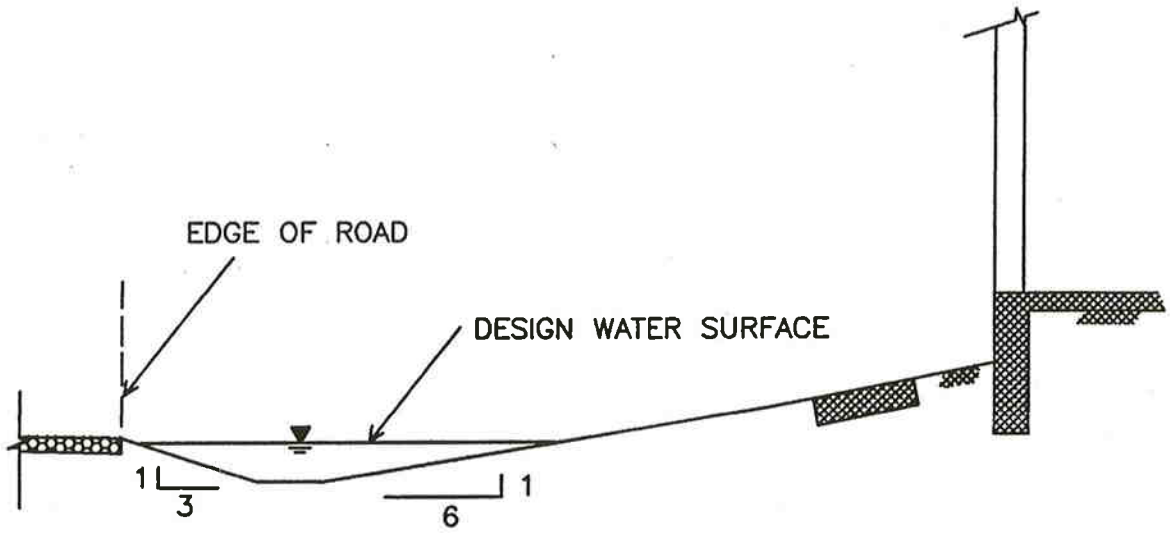


PROFILE

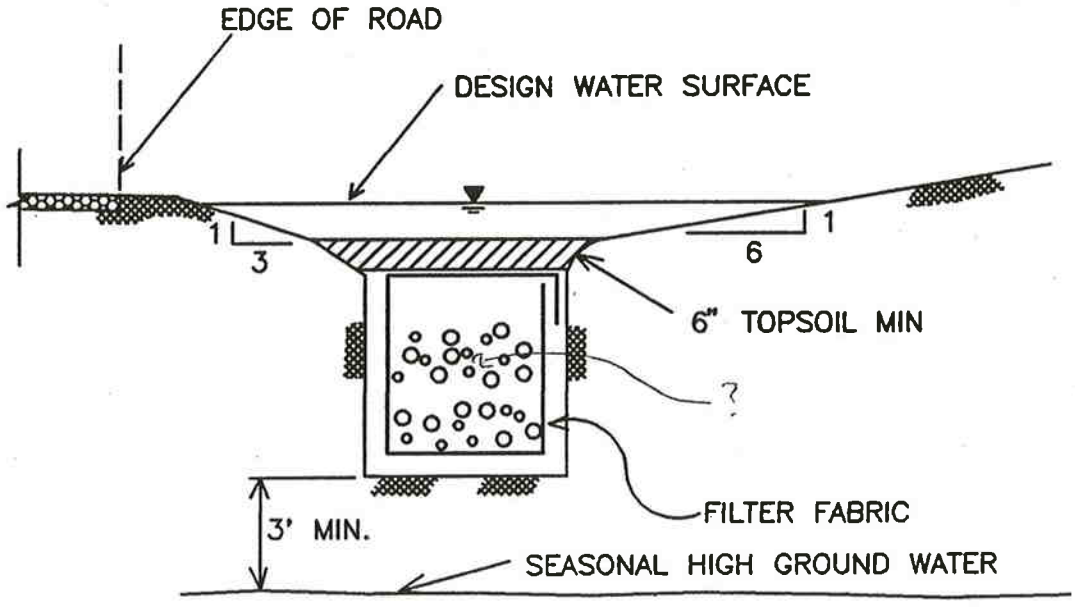
REFERENCE:

DATE:
JUNE 1995

LATTICE BLOCK PAVING EXAMPLE



CONVEYANCE BETWEEN ROAD AND STRUCTURES



ROADSIDE INFILTRATION SYSTEM

APPENDIX B STANDARD EROSION CONTROL DRAWINGS

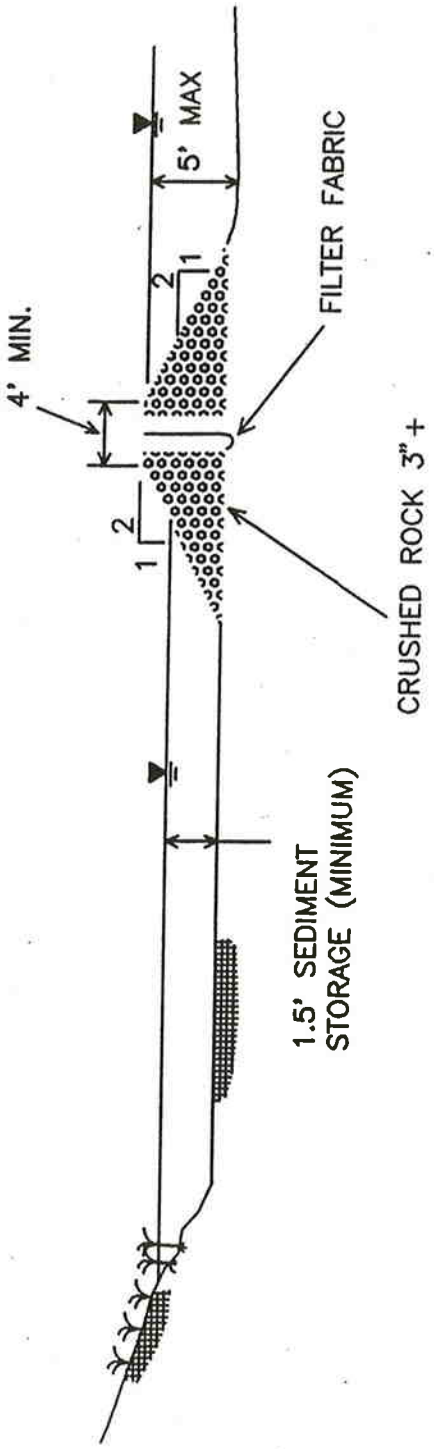
STANDARD EROSION CONTROL DRAWINGS

The following drawings are adopted by the District as standards for temporary sedimentation and erosion control:

Figure B1	Sediment Trap
Figure B2	Filter Fabric Fence Detail
Figure B3	Straw And Hay Bale Barriers
Figure B4	Cross Section of Straw Bale
Figure B5	Brush Barrier And Gravel Filter Berm
Figure B6	Sandbag Berm
Figure B7	Triangular Sediment Dikes
Figure B8	Inlet Sediment Protection
Figure B9	Filter Fabric Fence Inlet Filter
Figure B10	Pipe Slope Drains
Figure B11	Stair Stepping Cut And Grooving Slopes
Figure B12	Erosion Control Blankets
Figure B13	Temporary Swales And Dikes
Figure B14	Temporary Gravel Outlet Structure
Figure B15	Check Dams
Figure B16	Stabilized Construction Entrance
Figure B17	Small Parcel Erosion Control Plan

STORM DRAINAGE DESIGN MANUAL

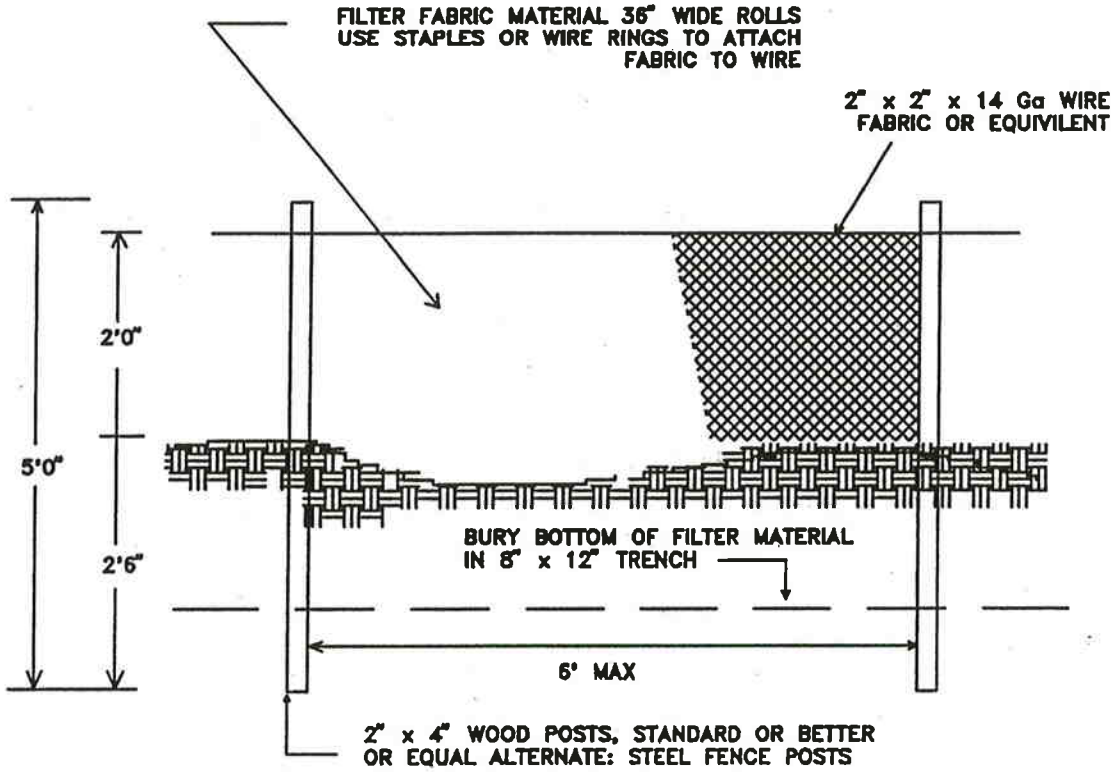
FIG B1

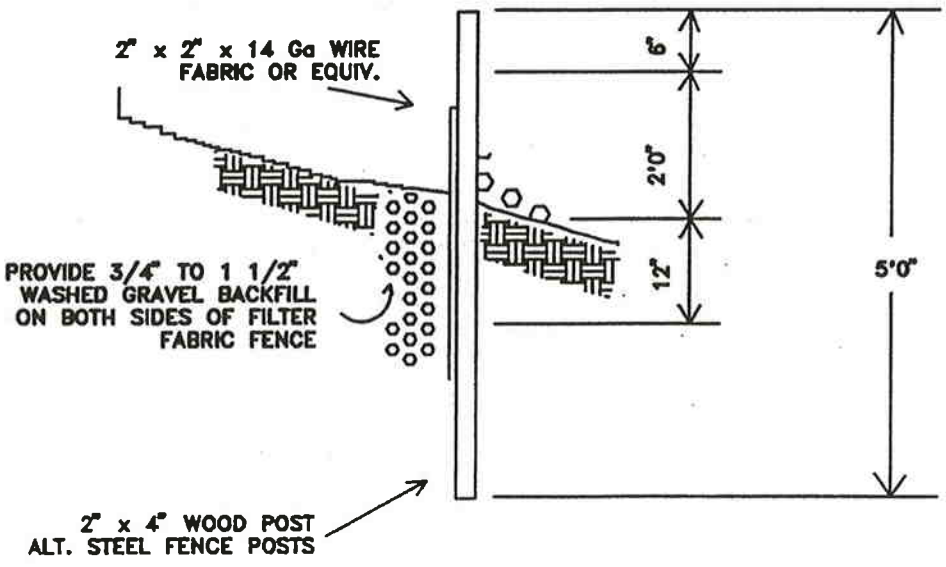


DATE:
JULY 1988

SEDIMENT TRAP

STORM DRAINAGE DESIGN MANUAL | FIG B2



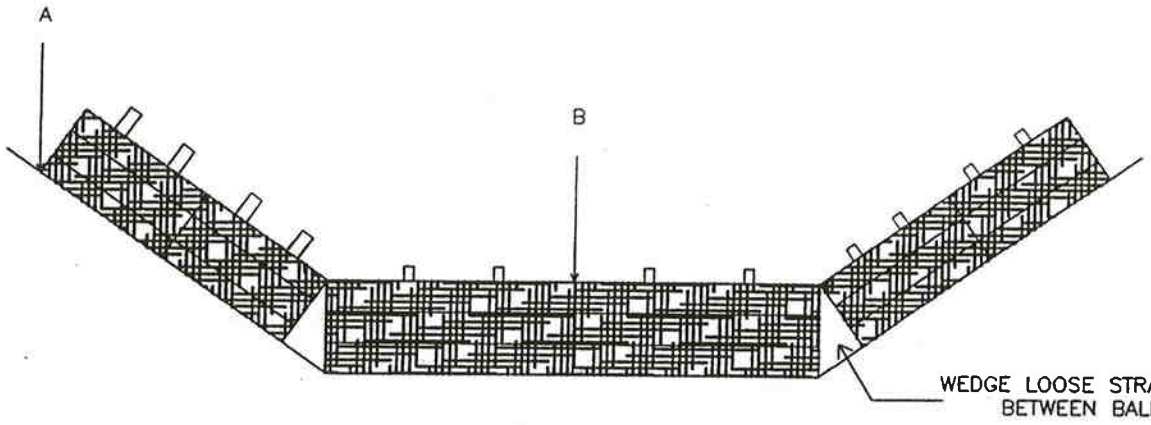


REFERENCE:
KING COUNTY, WASHINGTON, SURFACE WATER DESIGN MANUAL

DATE:
JULY 1988

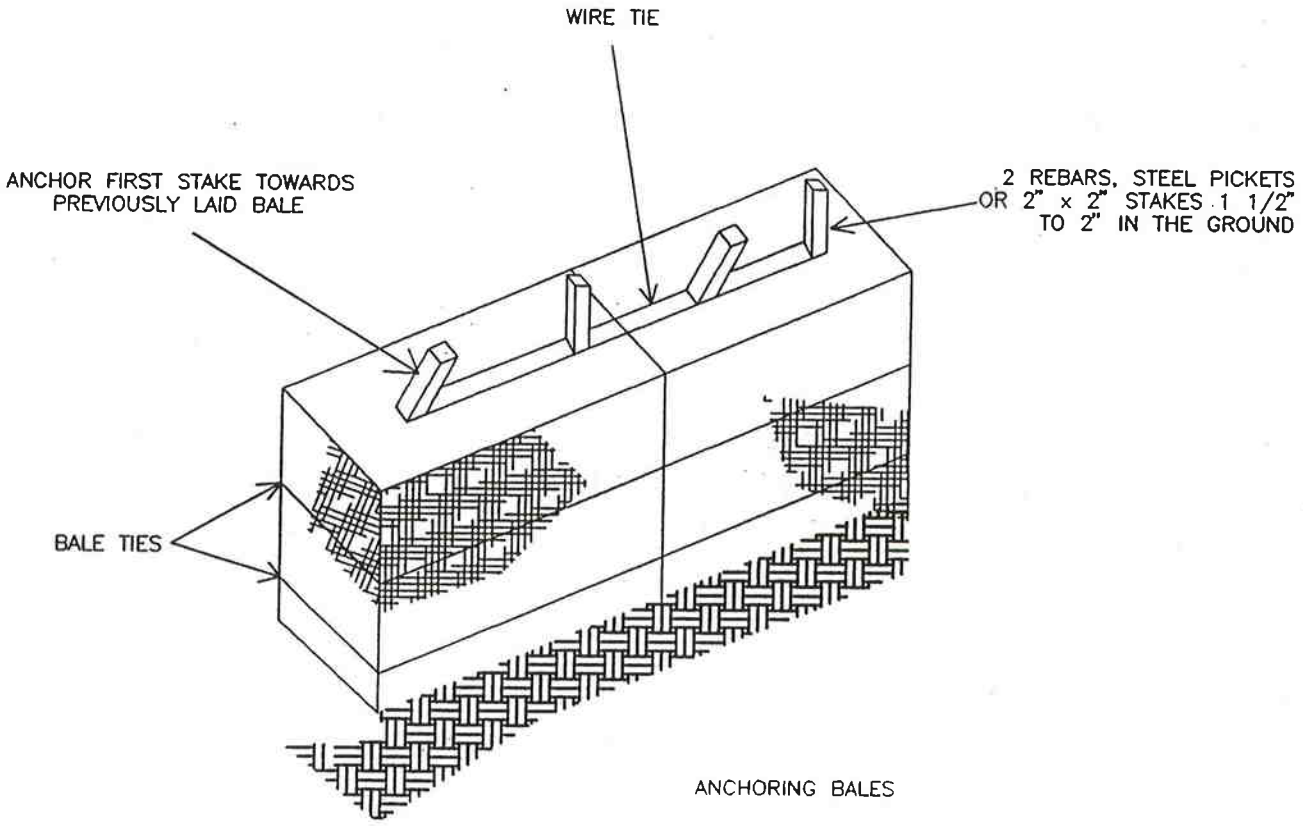
FILTER FABRIC FENCE DETAIL

STORM DRAINAGE DESIGN MANUAL | FIG B3



POINT A SHOULD BE HIGHER THAN POINT B

PROPER PLACEMENT OF STRAW BALE BARRIER IN DRAINAGE WAY



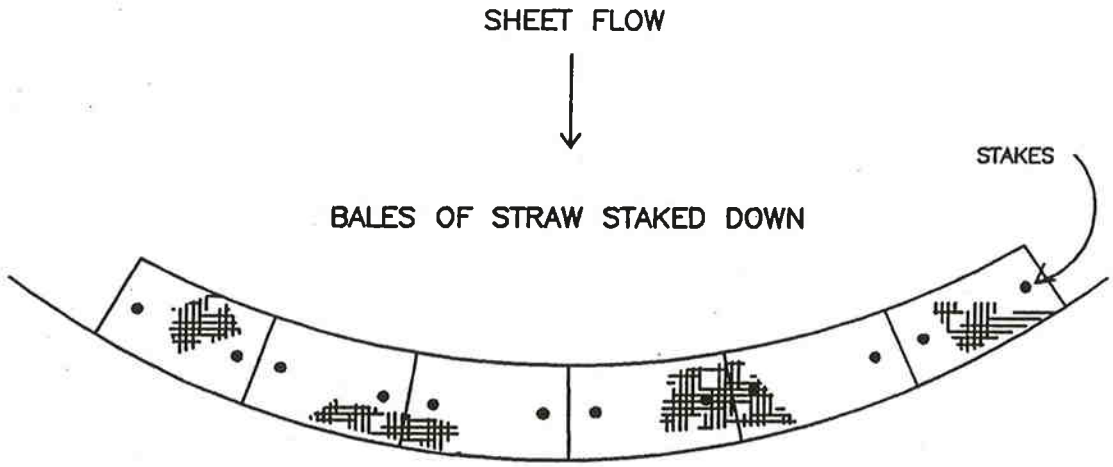
ANCHORING BALES

REFERENCE:
KING COUNTY, WASHINGTON, SURFACE WATER DESIGN MANUAL

DATE:
JULY 1988

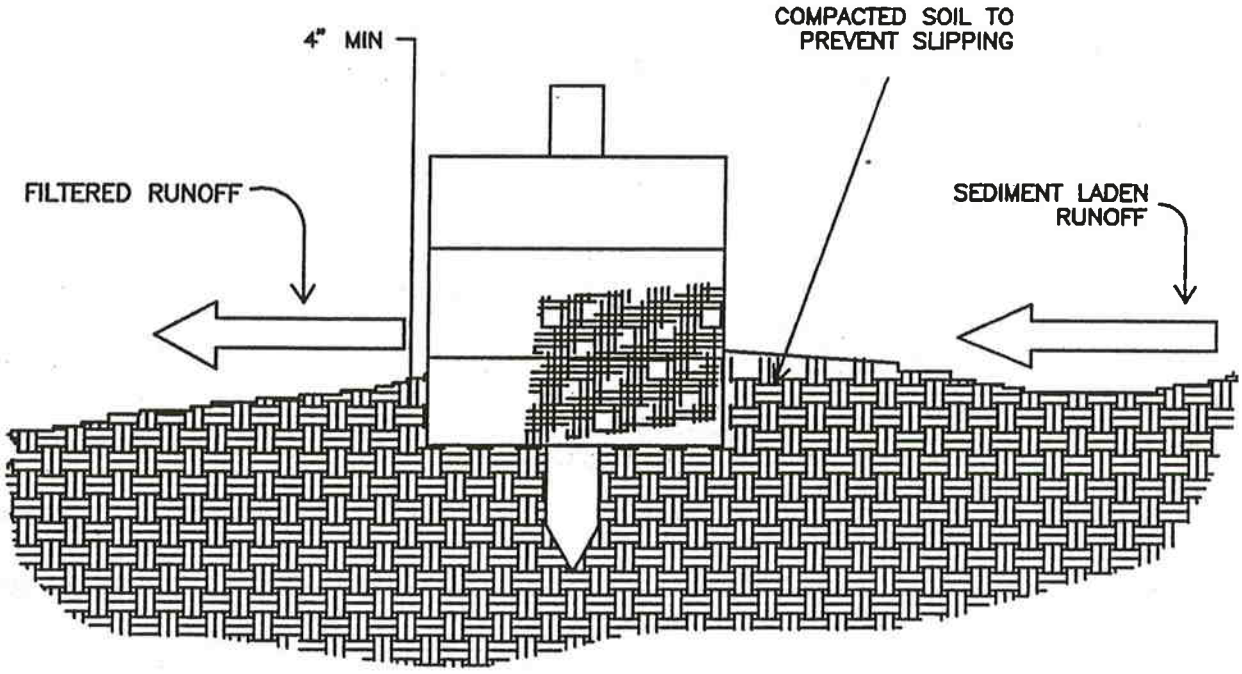
STRAW AND HAY BALE BARRIERS

STORM DRAINAGE DESIGN MANUAL | FIG B4



PLAN

SINGLE ROW OF BALES OF STRAW TO BE PLACED PRIOR TO THE START OF ROUGH GRADING



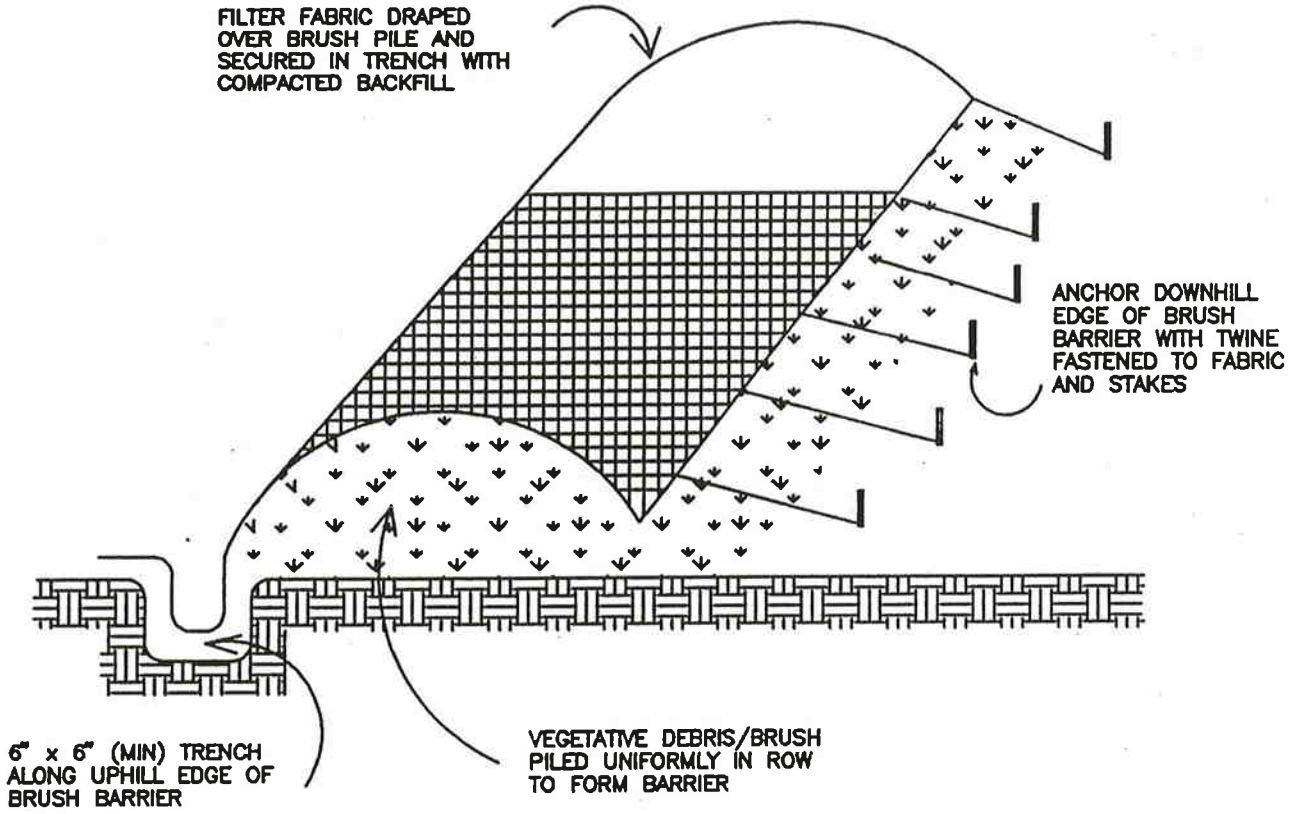
CROSS–SECTION OF A PROPERLY INSTALLED STRAW BALE

REFERENCE:
PUGET SOUND STORMWATER MANAGEMENT DRAFT

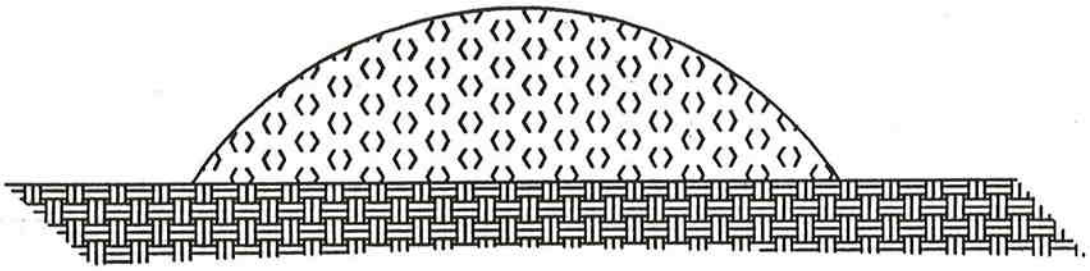
DATE:
JULY 1988

CROSS SECTION OF STRAW BALE

STORM DRAINAGE DESIGN MANUAL | FIG B5



BRUSH BARRIER



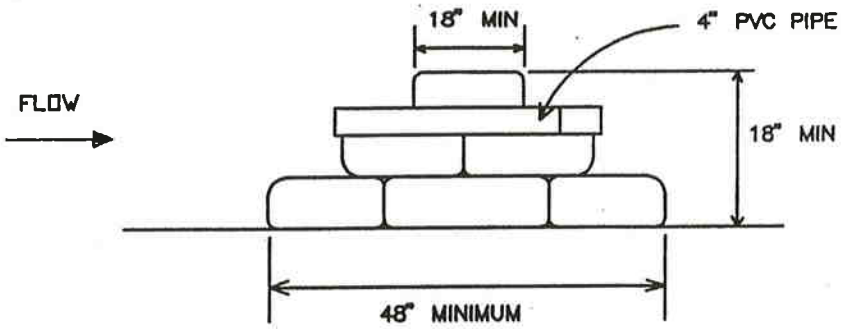
CROSS SECTION OF GRAVEL FILTER BERM

REFERENCE:
KING COUNTY, WASHINGTON, SURFACE WATER DESIGN MANUAL

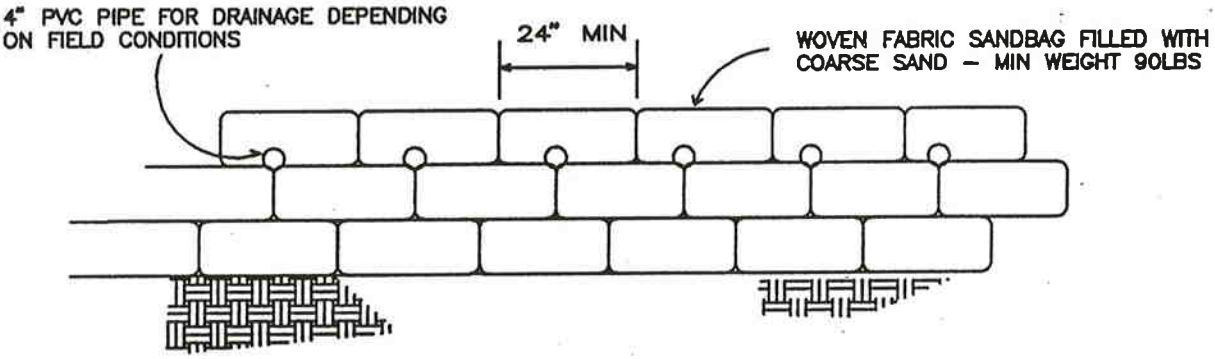
DATE:
JULY 1988

BRUSH BARRIER AND GRAVEL FILTER BERM

STORM DRAINAGE DESIGN MANUAL | FIG B6



CROSS SECTION



FRONT VIEW

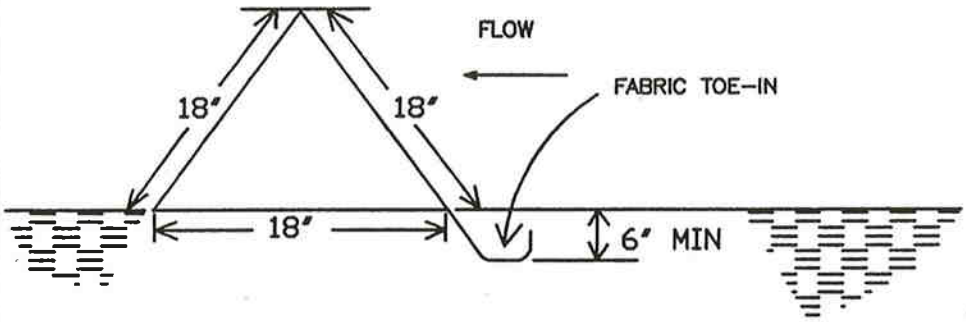
1) WHEN A SANDBAG IS FILLED WITH MATERIAL, THE OPEN END OF THIS SANDBAG SHOULD BE STAPLED OR TIED WITH NYLON OR POLY CORD.
2) SANDBAGS SHOULD BE STACKED IN AT LEAST THREE ROWS ABUTTING EACH OTHER, AND IN STAGGERED ARRANGEMENT.
3) THE BASE OF THE BERM SHOULD HAVE AT LEAST 3 SANDBAGS AND CAN BE REDUCED TO 2 AND 1 BAG IN THE SECOND AND THIRD ROWS RESEPECTIVELY.

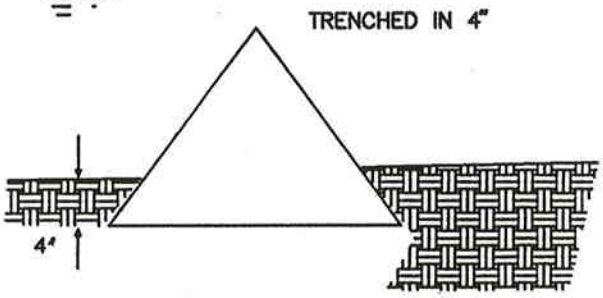
REFERENCE:
KING COUNTY, WASHINGTON, SURFACE WATER DESIGN MANUAL

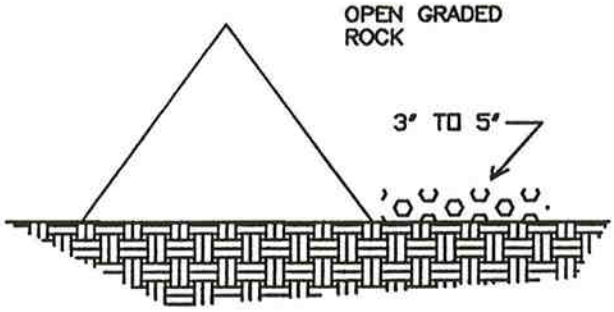
DATE:
JULY 1988

SANDBAG BERM

STORM DRAINAGE DESIGN MANUAL | FIG B7

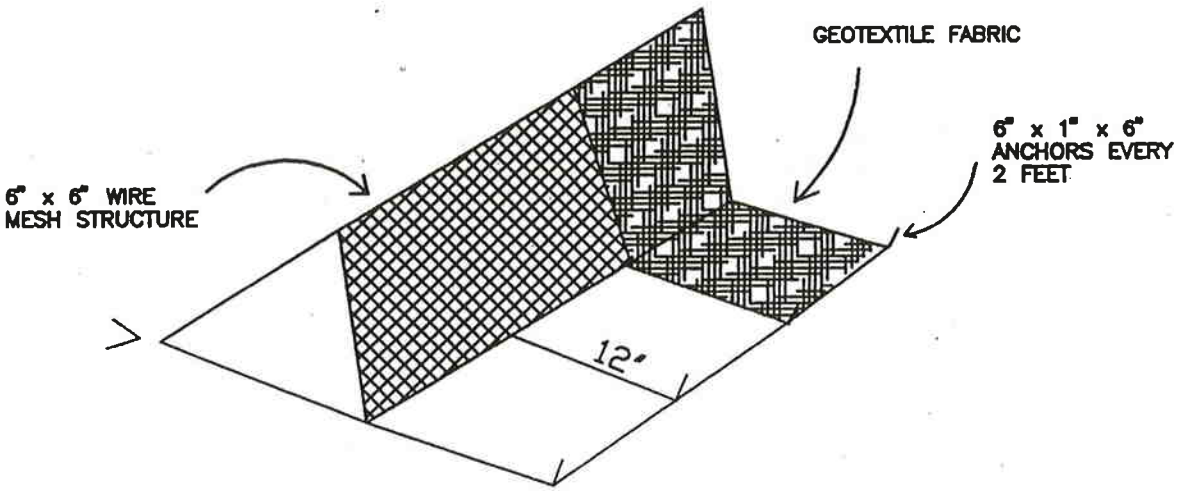






INSTALLATION DETAIL

OPTIONS
1) TOE-IN 6" MINIMUM
2) WEIGHTED WITH 3" TO 5" OPEN GRADED ROCK.
3) TRENCHED IN 4"



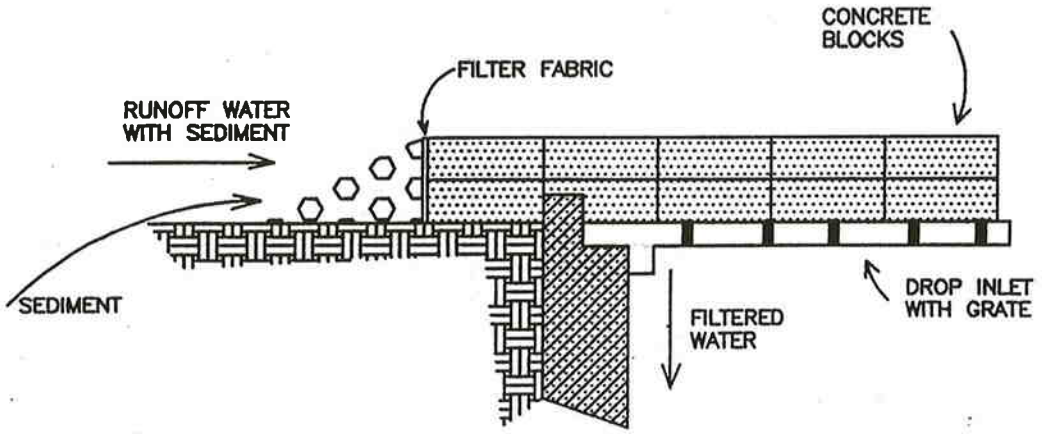
REFERENCE:
CITY OF AUSTIN TEXAS ENVIRONMENTAL CRITERIA MANUAL

DATE: JULY 1988

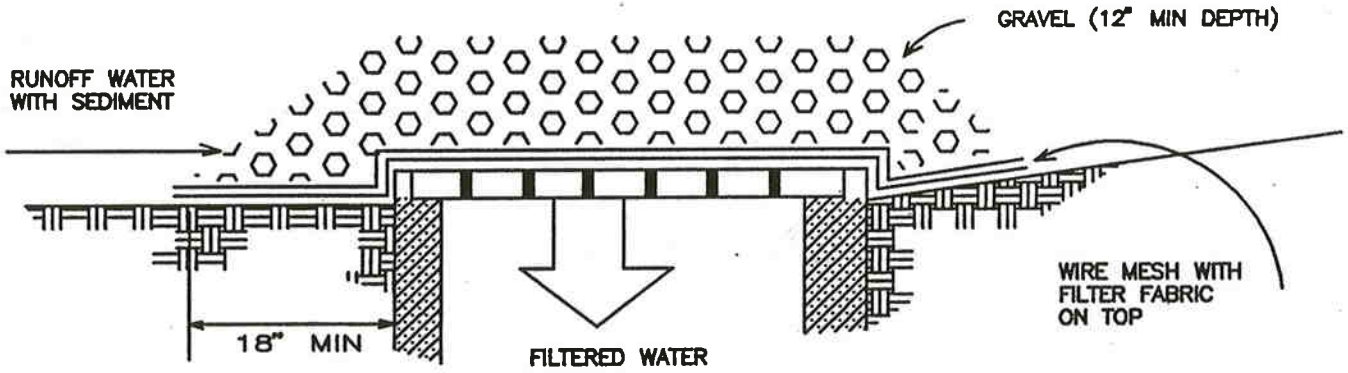
TRIANGULAR SEDIMENT DIKES

STORM DRAINAGE DESIGN MANUAL | FIG B8

BLOCK AND GRAVEL FILTER



GRAVEL AND WIRE MESH FILTER

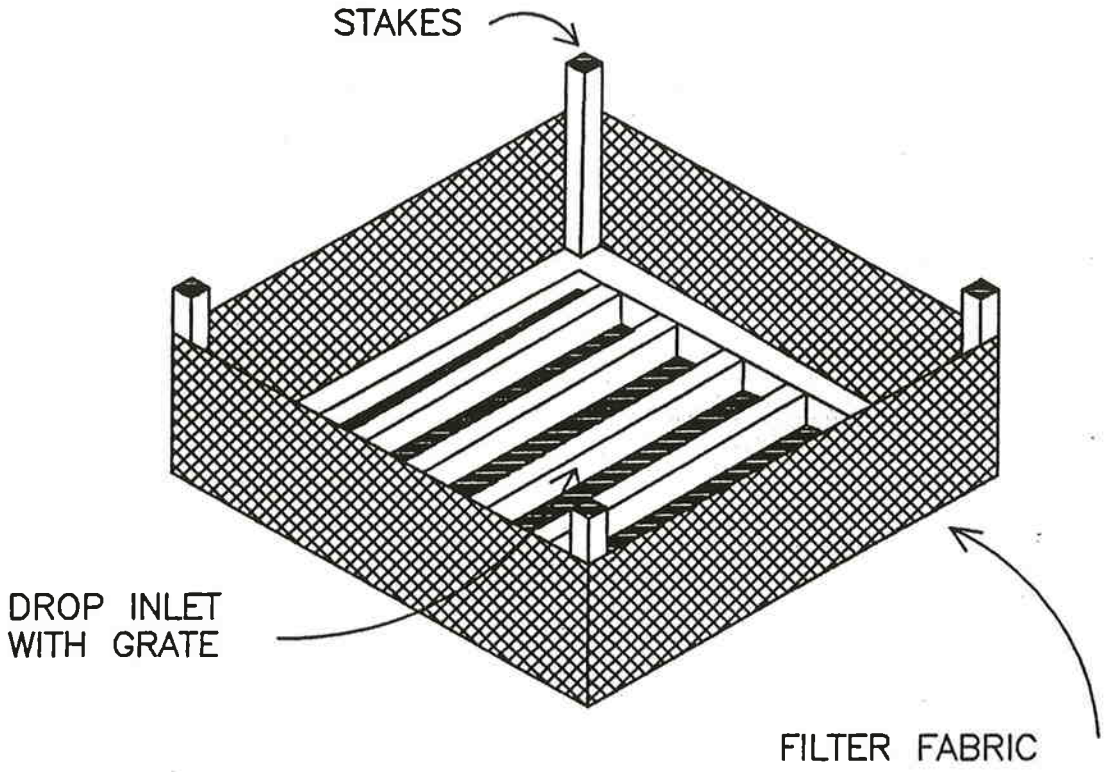


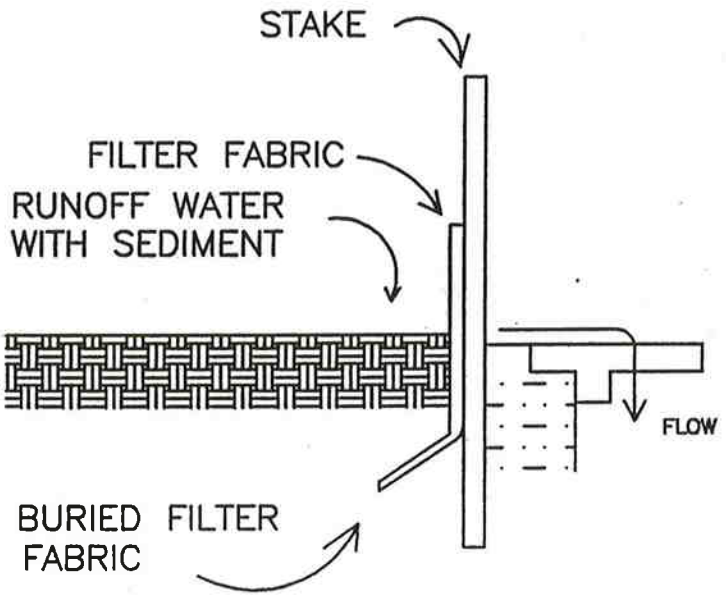
REFERENCE:
KING COUNTY, WASHINGTON, SURFACE WATER DESIGN MANUAL

DATE:
JULY 1988

INLET SEDIMENT PROTECTION

STORM DRAINAGE DESIGN MANUAL | FIG B9



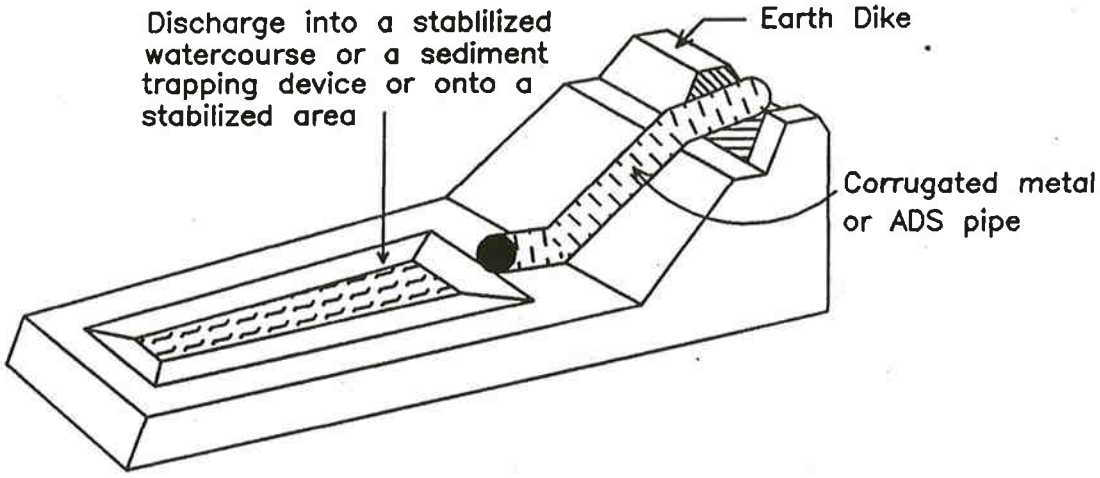


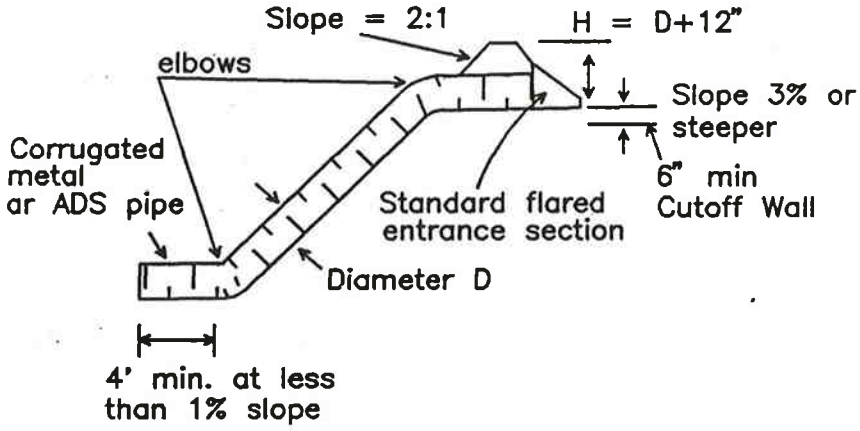
REFERENCE:
KING COUNTY, WASHINGTON, SURFACE WATER DESIGN MANUAL

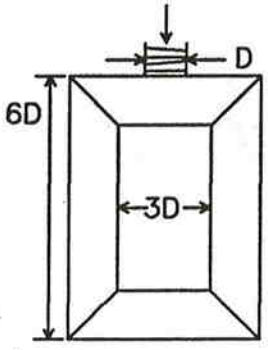
DATE:
JULY 1988

FILTER FABRIC FENCE INLET FILTER

STORM DRAINAGE DESIGN MANUAL | FIG B10







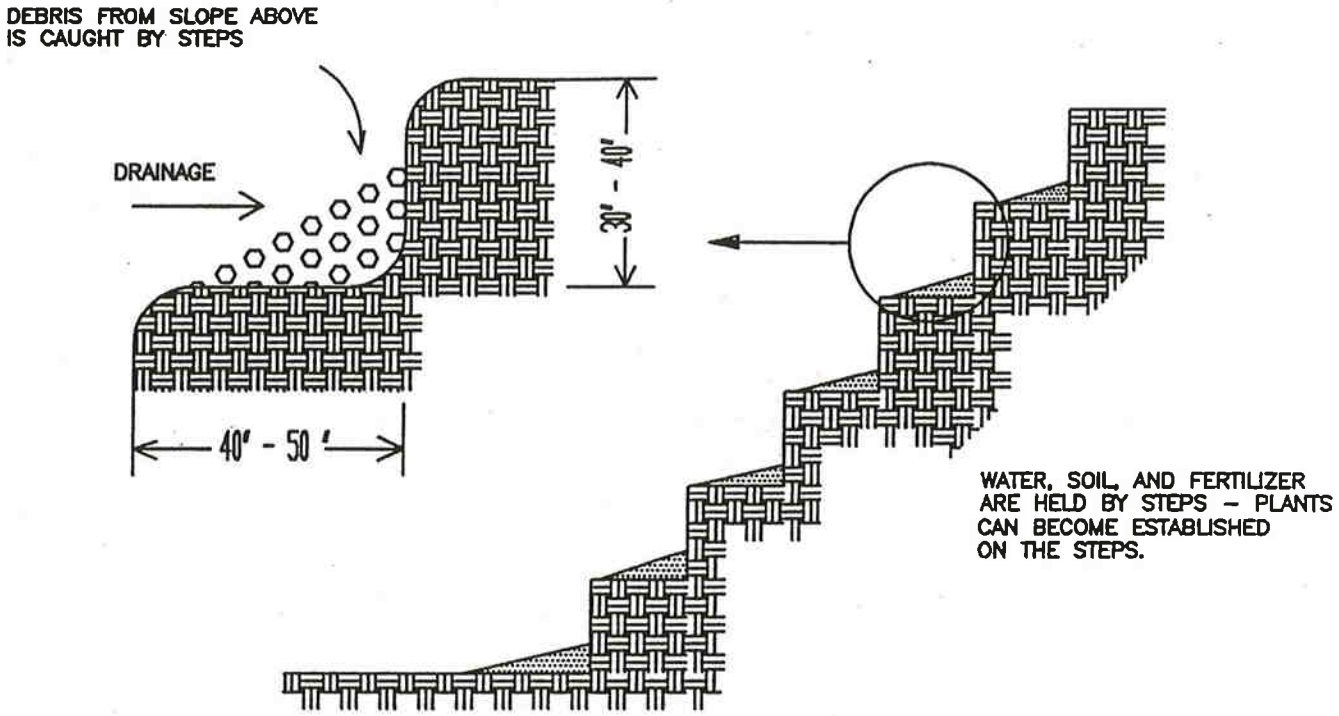
Riprap depth shall be equal to pipe diameter.

REFERENCE:
KING COUNTY, WASHINGTON, SURFACE WATER DESIGN MANUAL

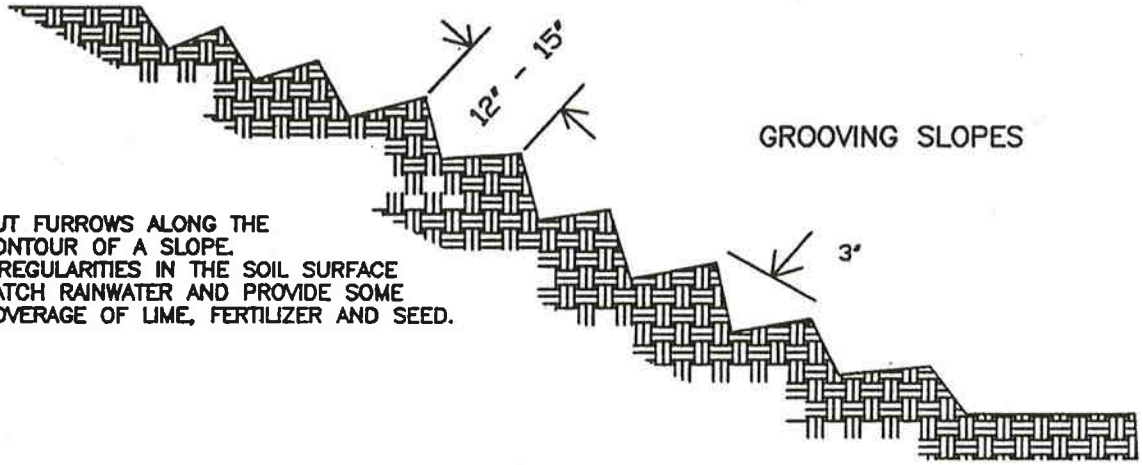
DATE:
JUNE 1995

PIPE SLOPE DRAINS

STORM DRAINAGE DESIGN MANUAL | FIG B11



STAIR STEPPING CUT SLOPES



GROOVING SLOPES

CUT FURROWS ALONG THE
CONTOUR OF A SLOPE.
IRREGULARITIES IN THE SOIL SURFACE
CATCH RAINWATER AND PROVIDE SOME
COVERAGE OF LIME, FERTILIZER AND SEED.

REFERENCE:
KING COUNTY, WASHINGTON, SURFACE WATER DESIGN MANUAL

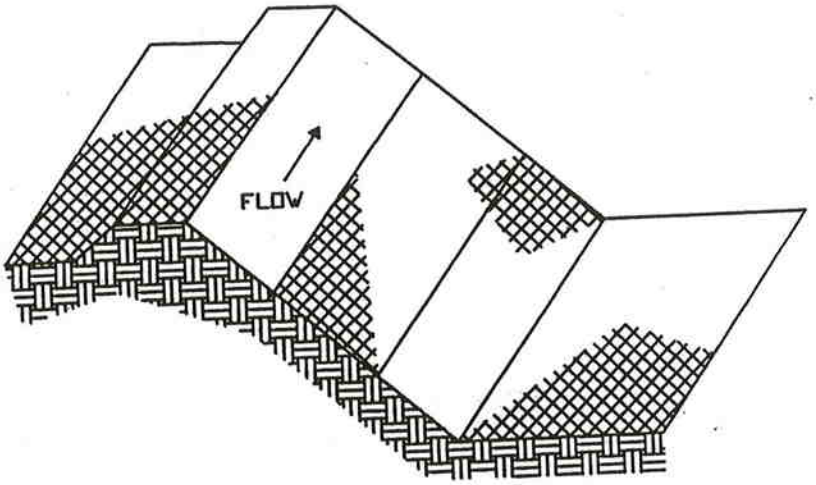
DATE:
JULY 1988

STAIR STEPPING CUT AND GROOVING SLOPES

STORM DRAINAGE DESIGN MANUAL

FIG B12

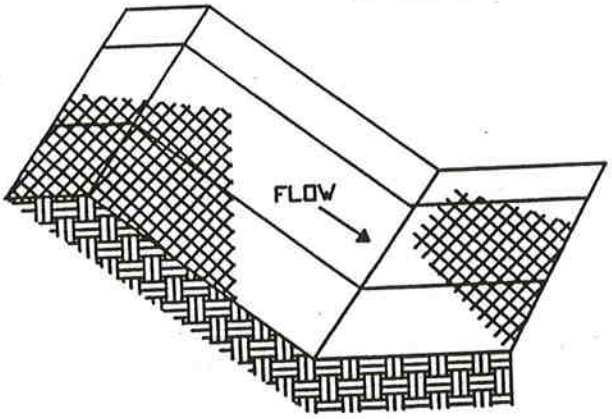
SHALLOW SLOPE



ON SHALLOW SLOPES, STRIPS OF NETTING MAY BE APPLIED ACROSS THE SLOPE.

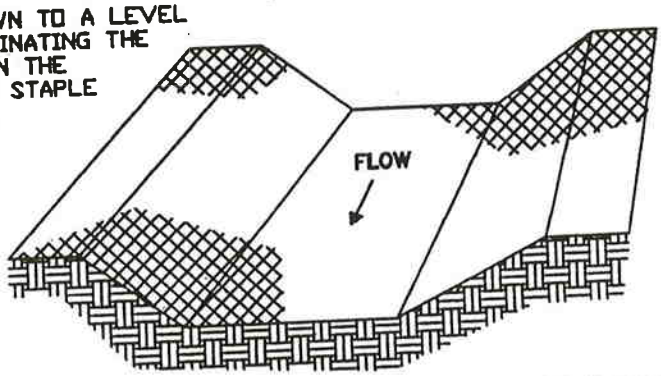
WHERE THERE IS A BERM AT THE TOP OF THE SLOPE, BRING THE NETTING OVER THE BERM AND ANCHOR IT BEHIND THE BERM.LINE

STEEP SLOPE



ON STEEP SLOPES, APPLY STRIPS OF NETTING PARALLEL TO THE DIRECTION OF FLOW AND ANCHOR SECURELY.

BRING NETTING DOWN TO A LEVEL AREA BEFORE TERMINATING THE INSTALLATION. TURN THE END UNDER 6" AND STAPLE AT 12" INTERVALS.



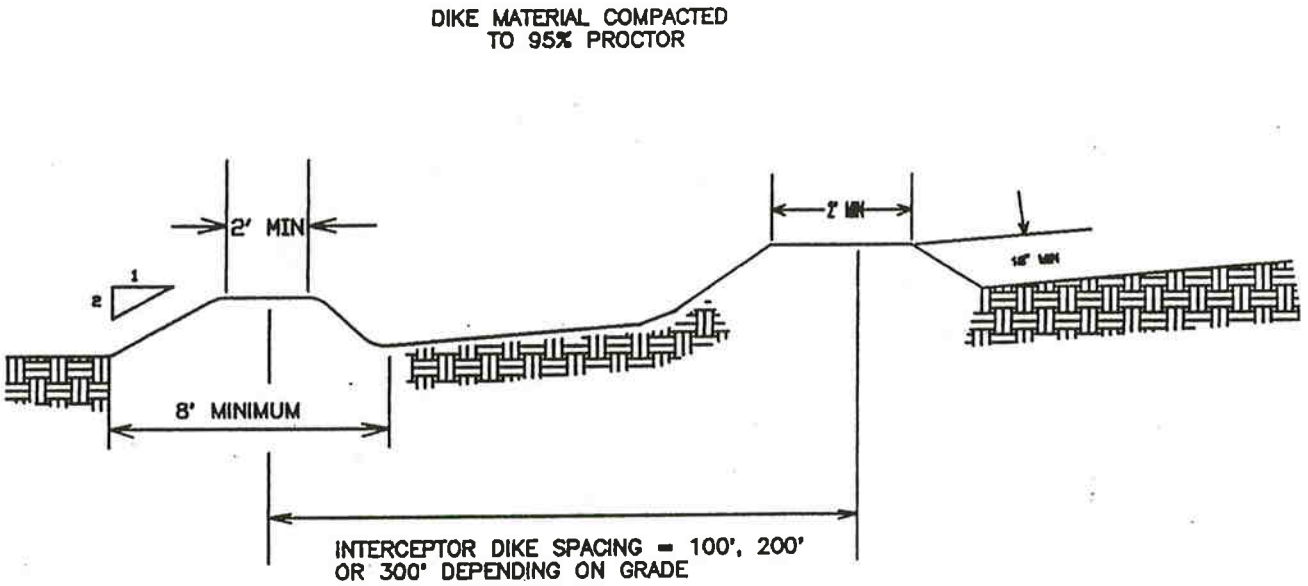
IN DITCHES, APPLY NETTING PARALLEL TO THE DIRECTION OF FLOW. USE CHECK SLOTS EVERY 15'. DO NOT JOIN STRIPS IN THE CENTER OF THE DITCH.

REFERENCE:
KING COUNTY, WASHINGTON, SURFACE WATER DESIGN MANUAL

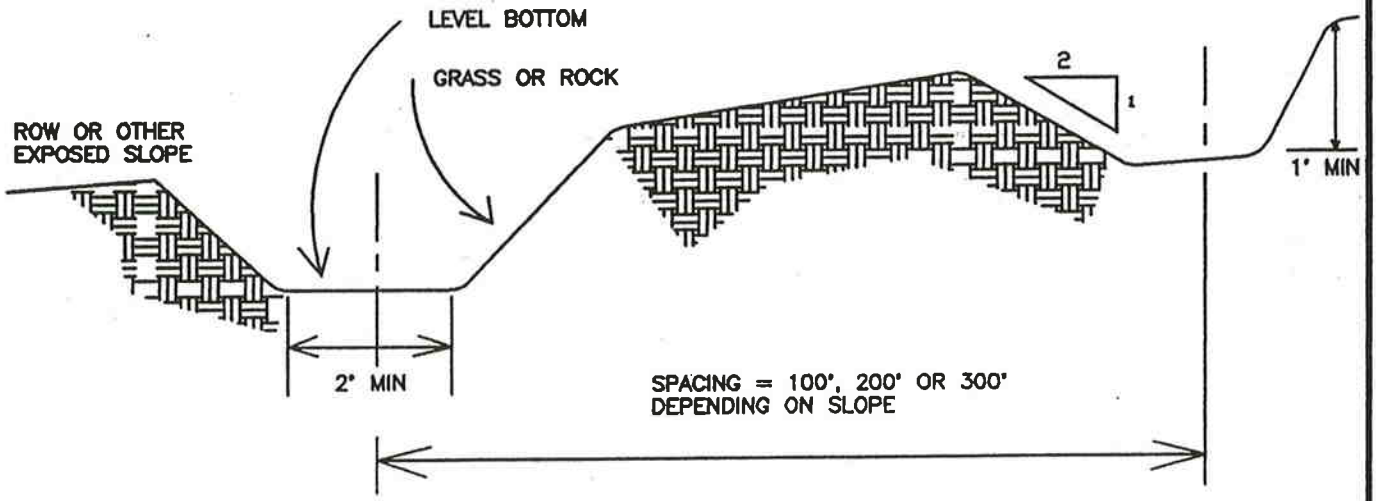
DATE:
JULY 1988

EROSION CONTROL BLANKETS

STORM DRAINAGE DESIGN MANUAL | FIG B13



INTERCEPTOR DIKES



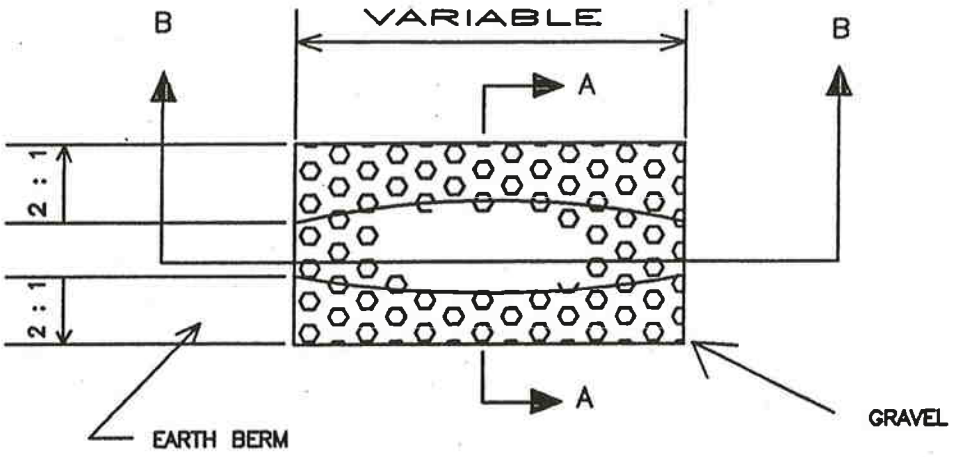
INTERCEPTOR SWALE

REFERENCE:
KING COUNTY, WASHINGTON, SURFACE WATER DESIGN MANUAL

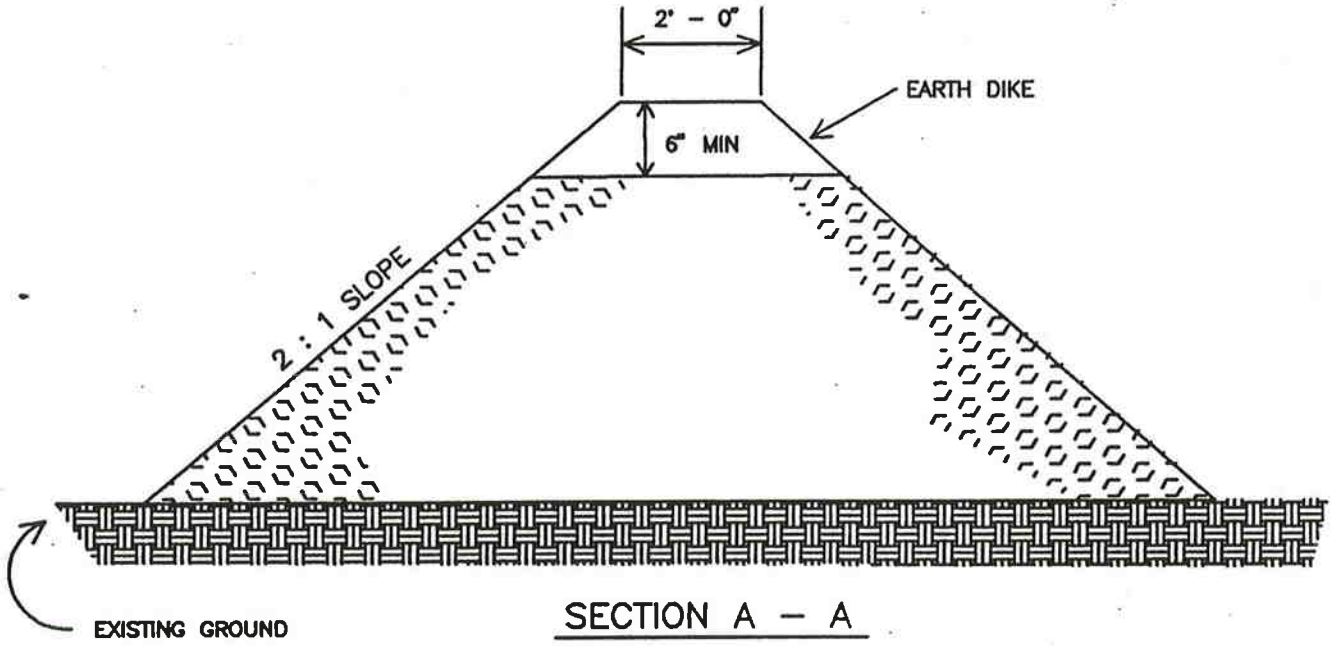
DATE:
JULY 1988

TEMPORARY SWALES AND DIKES

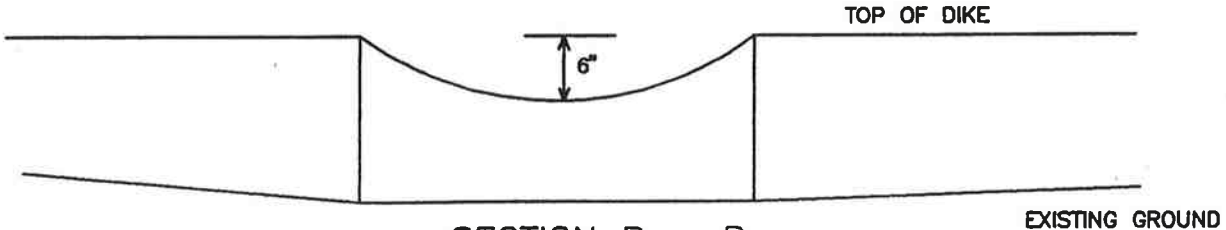
STORM DRAINAGE DESIGN MANUAL | FIG B14



PLAN



SECTION A – A



SECTION B – B

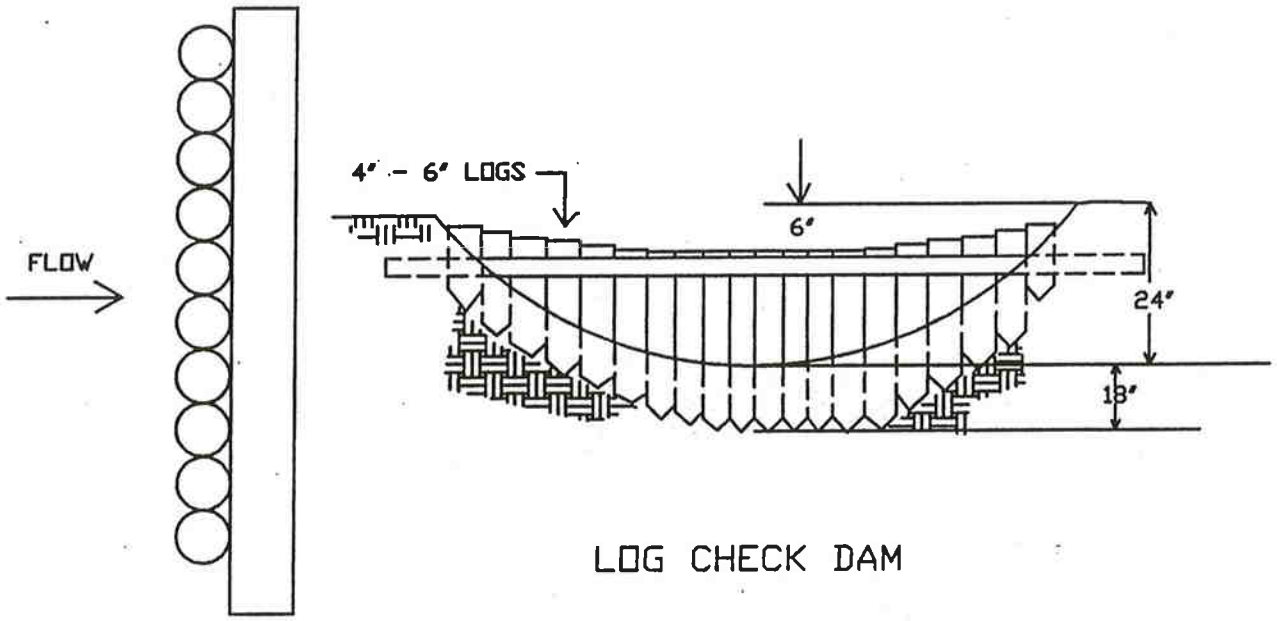
REFERENCE:
HENRICO COUNTY, VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

DATE:
JULY 1988

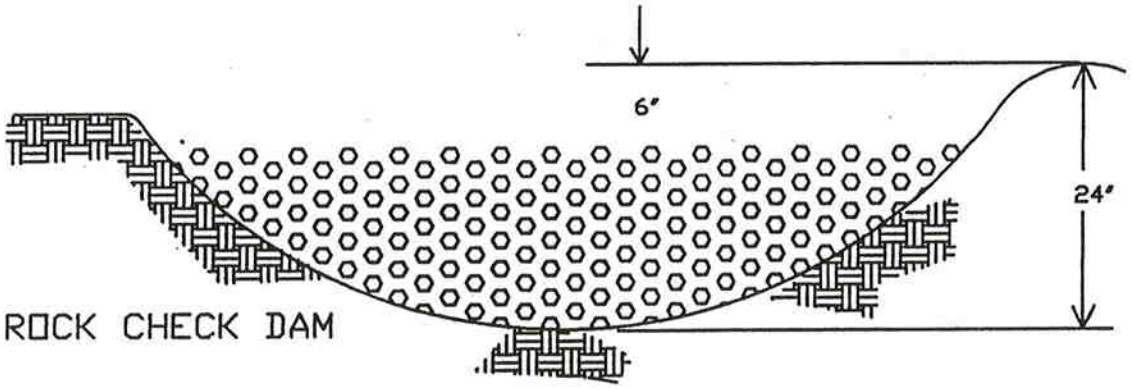
TEMPORARY GRAVEL OUTLET STRUCTURE

STORM DRAINAGE DESIGN MANUAL

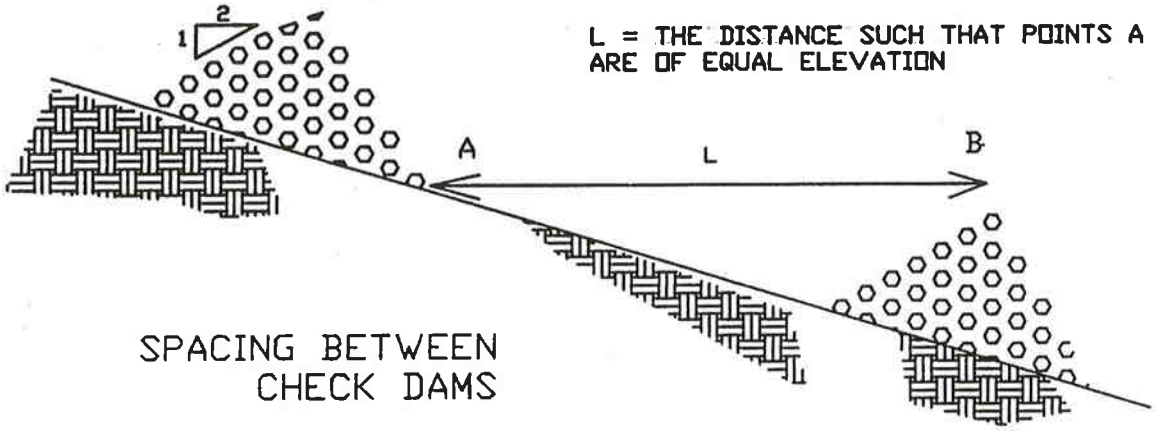
FIG B15



LOG CHECK DAM



ROCK CHECK DAM



L = THE DISTANCE SUCH THAT POINTS A & B ARE OF EQUAL ELEVATION

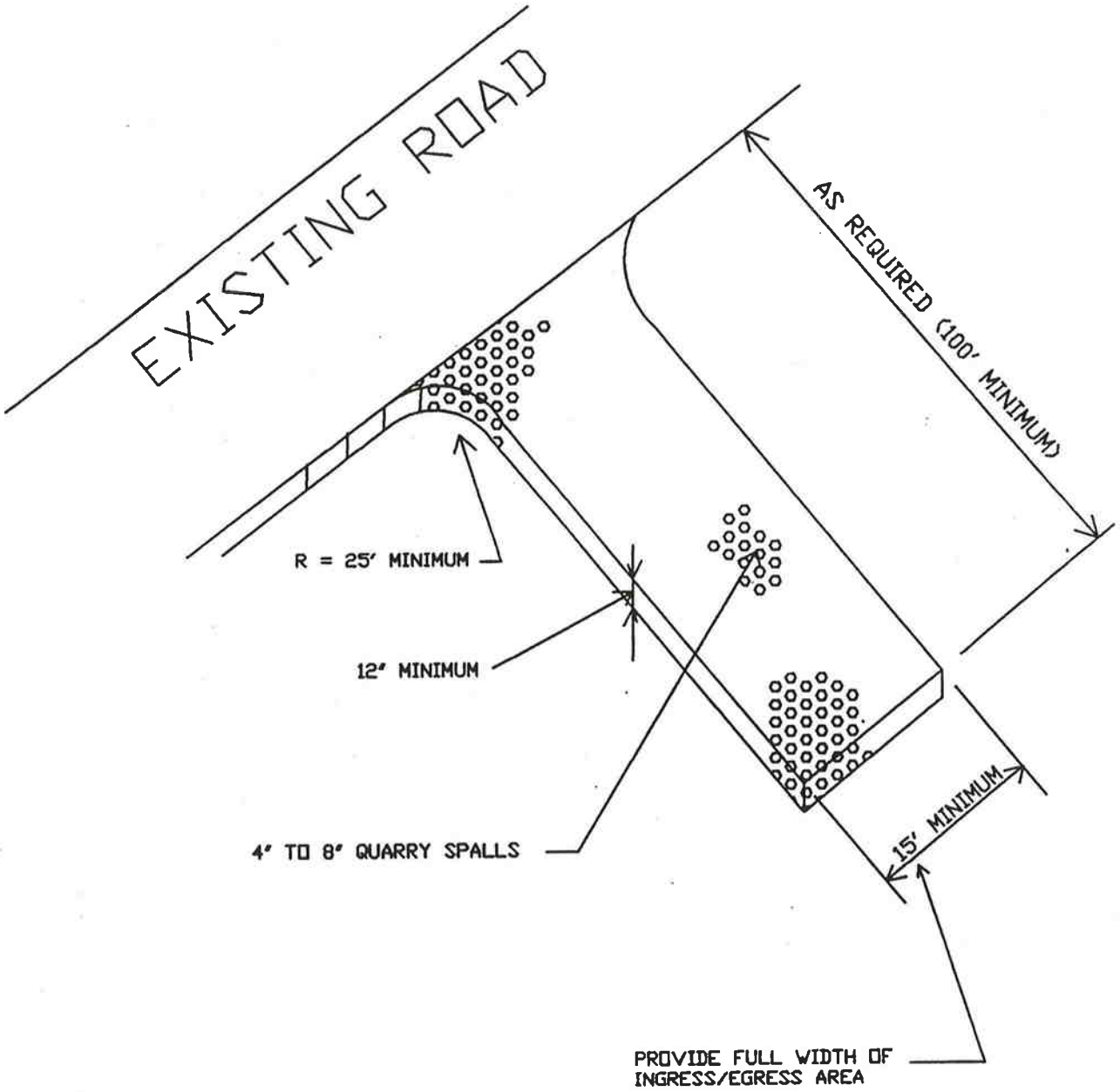
SPACING BETWEEN CHECK DAMS

REFERENCE:
KING COUNTY, WASHINGTON, SURFACE WATER DESIGN MANUAL

DATE:
JULY 1988

CHECK DAMS

STORM DRAINAGE DESIGN MANUAL | FIG B16



REFERENCE:
KING COUNTY, WASHINGTON, SURFACE WATER DESIGN MANUAL

DATE:
JUNE 1995

STABILIZED CONSTRUCTION ENTRANCE

APPENDIX C STANDARD NOTES

STANDARD NOTES

GENERAL

The following notes shall be affixed to all plans submitted for drainage review. Additional notes as needed to ensure that contractors have clear and complete instructions on installing and maintaining surface water control facilities and temporary erosion/sedimentation control practices shall also be affixed. Additional notes may also be required by the Administrator to meet the requirements of these Standards.

GRADING PLANS

The following notes shall be affixed to all Grading Plans:

1. The temporary sedimentation and erosion control facilities shown on the approved plans shall be constructed and implemented prior to any grading or land clearing in accordance with the approved plans. These facilities shall be satisfactorily maintained until the construction and permanent restoration is completed and the potential for on-site erosion has passed.

2. No final cut or fill slope shall exceed two (2) horizontal to one (1) vertical without stabilization.

TEMPORARY EROSION/SEDIMENTATION CONTROL PLANS

General Notes: The following notes shall be affixed to Temporary Erosion/Sedimentation Control Plans.

1. All construction shall be in accordance with the District Land Alteration Standards, Surface Water Control Standards, Permit Conditions, and all other applicable codes and ordinances.

2. The Temporary Erosion/Sedimentation Control system shall be installed prior to all other construction.

3. As construction progresses and seasonal conditions dictate, more siltation control facilities may be required to ensure complete siltation control. Therefore, during the course of construction, it shall be the obligation and responsibility of the Proponent to address any new conditions that may be created by his activities and to provide additional facilities over and above the minimum requirements as may be needed to achieve the performance standards required by the permit.

4. Temporary siltation ponds and temporary siltation and erosion controls shall be maintained until such time that clearing and/or construction is completed, permanent drainage facilities are operational, and the potential for erosion has passed. Ponds and controls shall be cleaned or replaced as required to maintain functionality.

5. All disturbed land areas unworked for seven (7) days or more shall be protected from erosion by hydroseeding. If required due to weather, timing, or site conditions, the hydroseeding shall be supplemented by mulching with straw a minimum of 1-inch thick and stapling jute or utility mesh over the mulch.

6. Approval of this temporary erosion and sedimentation control plan does not constitute an approval of design, nor location of pipes, restrictors, or retention facilities, or an approval of plans required for a building permit; but is an approval of grading and sedimentation control plan only, unless specifically noted on the plan approval stamp.

7. Prior to occupancy of the building, any permanent storm drainage systems shall be cleaned.

8. The Proponent shall be responsible for preventing water pollution due to construction materials, methods, or equipment. All exposed aggregate concrete shall be installed and constructed so that no wash water enters the storm drainage system. The contractor shall provide a separate area, a minimum of 200 square feet in size, for washing of concrete trucks. This area shall also be isolated so that no water enters the storm drainage.

Silt Fences: The following notes shall be affixed to drawings showing silt fences.

1. Filter fabric shall be purchased in a continuous roll cut to the length of the barrier to avoid use of joints. When joints are necessary, filter cloth shall be spliced together only at a support post, with a minimum 6-inch overlap, and securely fastened at both ends to post.

2. Posts shall be spaced a maximum of 6 feet apart and driven securely into the ground (minimum of 30 inches).

3. A trench shall be excavated approximately 8 inches wide and 12 inches deep along the line of posts and upslope from the barrier.

4. When standard strength filter fabric is used, a wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy-duty wire staples at least 1 inch long, tie wires or hog rings. The wire shall extend into the trench a minimum of 4 inches and shall not extend more than 36 inches above the original ground surface.

5. The standard strength filter fabric shall be stapled or wired to the fence, and 20 inches of the fabric shall be extended into the trench. The fabric shall not extend more than 36 inches above the original ground surface. Filter fabric shall not be stapled to existing trees.

6. When extra-strength filter fabric and closer post spacing is used, the wire mesh support fence may be eliminated. In such a case, the filter fabric is stapled or wired directly to the posts with all other provisions of above notes applying.

7. Filter fabric fences shall not be removed before the upslope area has been permanently stabilized.

8. Filter fabric fences shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.

Straw/Hay Bales: The following notes shall be affixed to drawings showing straw/hay bales.

1. Bales shall be placed in a single row, lengthwise, on the contour, with ends of adjacent bales tightly abutting one another.

2. All bales shall be either wire-bound or string-tied with bindings oriented around the sides rather than the tops and bottoms of the bales. This will prevent rapid deterioration of the bindings.

3. The barrier shall be entrenched and backfilled. A trench shall be excavated the length and width of the proposed barrier to a depth of at least 4 inches. After the bales are staked and cracks between bales chinked as necessary, the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 4 inches against the uphill side of the barrier.

4. Each bale shall be anchored by at least two stakes or rebars driven through the bale. The first stake in each bale shall be driven towards the previously laid bale in order to force the bales together.

Gravel Filter Berms: The following notes shall be affixed to drawings showing gravel filter berms.

1. Berm material shall be 3/4 to 3-inch well-graded gravel or crushed rock with less than 5% fines.

2. Berm dimensions: 1-foot high with 3H:1V side slopes; 8 lineal feet per 1 cfs runoff based on the 10-year frequency storm.

Sandbag Berms: The following notes shall be affixed to drawings showing sandbag berms.

1. The height of the berm shall be a minimum of 18 inches measured from the top of the existing ground at the upslope toe to the bottom of the berm.

2. The width of the berm shall be at least 48 inches at the bottom and 18 inches at the top.

3. Sandbags shall be 24 to 30 inches in length, 16 to 18 inches in width, and 6 to 8 inches in thickness. Each sandbag shall weigh between 90 and 125 pounds.

4. Suitable materials for sandbags are polypropylene, polyethylene, or polyamide woven fabric, minimum unit weight 4 ounces per square yard, Mullen burst strength exceeding 300 psi, and ultraviolet stability exceeding 70 percent.

5. Coarse grade sand shall be used.

Sediment Filter Dikes: The following notes shall be affixed to drawings showing triangular sediment filter dikes.

1. If the slope exceeds 10 percent, the length of the slope above the dike shall be less than 50 feet.

2. All dikes shall be placed on the contour and shall be placed in a row with the ends tightly abutting the adjacent dike. Filter material shall lap over ends 6 inches to cover dike to dike junction; each junction shall be secured by shoat rings.

3. Each side of the triangle shall be a minimum of 18 inches.

4. Nonwoven polypropylene, polyethylene or polyamide geotextile fabric may be used as filter material. This material shall have a minimum unit weight of four and one-half (4.5) ounces per square yard, Mullen burst strength exceeding 250 psi, ultraviolet stability exceeding 70 percent, and equivalent opening size exceeding 40. The fabric cover and skirt shall be a continuous wrapping of the fabric; the skirt shall be a continuous extension of the upstream face.

Inlet Protection: The following notes shall be affixed to drawings showing inlet protection.

1. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, so that the open ends face outward, not upward. The ends of adjacent blocks shall abut. The height of the barrier can be varied, depending on design needs, by stacking combinations of blocks that are 4 inches, and 12 inches wide. The row of blocks shall be at least 12 inches but no greater than 24 inches high.

2. Place wire mesh over the outside vertical face (open end) of the concrete blocks to prevent stone from being washed through the blocks. Use hardware cloth or comparable wire mesh with 1/2-inch openings.

3. Pile stone against the wire mesh to the top of the blocks. Use 3/4-to 3-inch gravel.

4. Place wire mesh over the drop inlet so that the wire extends a minimum of 1 ft beyond each side of the inlet structure. Use hardware cloth or comparable wire mesh with 1/2-inch openings. If more than one strip of mesh is necessary, overlap the strips. Place filter fabric over wire mesh.

5. Place 3/4-inch gravel over the wire mesh. The depth of stone shall be at least 12 inches over the entire inlet opening. Extend the stone beyond the inlet opening at least 18 inches on all sides.

6. If the stone filter becomes clogged with sediment, the stones shall be pulled away from the inlet and cleaned or replaced.

Slope Drains: The following notes shall be affixed to drawings showing pipe slope drains.

1. The soil around and under the pipe and entrance section shall be thoroughly compacted.

2. The flared inlet section shall be securely connected to the slope drain with watertight connecting bands.

3. Slope drain sections shall be securely fastened together with watertight fittings, and be securely anchored into the soil.

4. Interceptor dikes shall be used to direct runoff into a slope drain. The height of the dike shall be at least 1" higher of all points then the top of the inlet pipe.

5. The area below the outlet shall be stabilized with a rip-rap apron (see Chapter 6, Outfalls, for the appropriate protection).

Stairstepped Cut Slopes: The following notes shall be affixed to drawings showing stairstepped cut slopes.

1. Graded areas with slopes greater than 3H:1V but less than 2H:1V shall be roughened before seeding.

2. Graded areas steeper than 2H:1V shall be stair-stepped with benches.

Erosion Control Blankets: The following notes shall be affixed to drawings showing erosion control blankets.

1. Where soil is highly erodible, net shall only be used in conjunction with an organic mulch such as straw and wood fiber.

2. Jute net shall be heavy, uniform cloth woven of single jute yarn, which if 36 to 48 inches wide shall weigh an average of 1.2 lbs/linear yard. It shall be so applied that it is in complete contact with the soil.

3. Netting shall be securely anchored to the soil with No. 11 gauge wire staples at least 6 inches long.

Temporary Dikes and Swales: The following notes shall be affixed to drawings showing temporary dikes and swales.

1. Seed and mulch shall be applied within 5 days of dike construction (see vegetation).

2. The upslope side of the dike shall provide positive drainage to the dike outlet.

3. No erosion shall occur at the dike outlet. Provide energy dissipation measures as necessary.

4. Sediment laden runoff shall be released through a sediment trapping facility such as a pond, trap, or silt fence as appropriate to drainage area size.

Temporary Gravel Outlets: The following notes shall be affixed to drawings showing temporary gravel outlets.

1. Gravel shall be 5/8-inch minus washed rock. A layer of filter fabric shall be embedded in the gravel.

2. Minimum length in feet of the gravel outlet structure shall be equal to six times the number of acres of contributing drainage area.

3. The invert of the gravel outlet shall not be less than 6 inches lower than the minimum elevation of the top of the dike.

4. Water shall be discharged from the gravel outlet onto an already stabilized area or into a stable watercourse.

5. The gravel outlet structure shall be inspected and repaired after each runoff-producing rain. The gravel shall be replaced when the structure ceases to function as intended due to sediment accumulation among the gravel.

Check Dams: The following notes shall be affixed to drawings showing check dams.

1. The maximum spacing between the dams shall be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam.

2. Rock check dams shall be constructed of 2-to 4-inch diameter rock. The rock shall be placed by hand or mechanical placement (no dumping of rock to form dam) to achieve complete coverage of the ditch or swale and to insure that the center of the dam is lower than the edges.

3. Log check dams shall be constructed of 4- to 6-inch diameter logs. The logs shall be embedded into the soil at least 18 inches.

4. In the case of grass-lined ditches and swales, check dams shall be removed when the grass has matured sufficiently to protect the ditch or swale. The area beneath the check dams shall be seeded and mulched immediately after dam removal.

5. Check dams shall be checked for sediment accumulation after each significant rainfall. Sediment shall be removed when it reaches one half of the original dam height or before.

Plastic Covering: The following notes shall be affixed to drawings showing plastic covering.

1. Plastic sheeting shall have a minimum thickness of 6 mils and shall meet the requirements of Section 9-14.5 of the Standard Specifications.

2. Covering shall be installed and maintained tightly in place by using sandbags or tires on ropes with a maximum 10-foot grid spacing in all directions. All seams shall be taped or weighted down full length and there shall be at least a 12 inch overlap of all seams.

3. Clear plastic covering shall be installed immediately on areas seeded between November 1 and March 31 and remain until vegetation is firmly established.

4. When the covering is used on un-seeded slopes, it shall be kept in place until the next seeding period.

5. Plastic covering sheets shall be buried two feet at the top of slopes in order to prevent surface water flow beneath sheets.

6. Proper maintenance includes regular checks for rips and dislodged ends.

Mulching: The following notes shall be affixed to drawings showing mulching.

1. Mulch materials used shall be _____, and shall be applied at the rate of _____.

2. Mulches shall be applied in all areas with exposed slopes greater than 2H:1V.

3. Mulching shall be used immediately after seeding or in areas which cannot be seeded because of the season.

4. All areas needing mulch shall be covered by November 1.

Seeding: The following notes shall be affixed to drawings showing seeding

1. Seed mixture shall be _____, and shall be applied at the rate of _____ per acre.

2. Seed beds planted between May 1 and October 31 shall require irrigation and other maintenance as necessary to foster and protect the root structure.

3. For seed beds planted between October 31 and April 30, armoring of the seed bed shall be necessary. (e.g., geotextiles, jute mat, clear plastic covering).

4. Before seeding, install needed surface runoff control measures such as gradient terraces, interceptor dikes, swales, level spreaders and sediment basins.

5. The seedbed shall be firm with a fairly fine surface, following surface roughening. Perform all cultural operations across or at right angles to the slope.

6. Fertilizers are to be used according to suppliers recommendations. Amounts used shall be minimized, especially adjacent to water bodies and wetlands.

Topsoil Stockpiles: The following notes shall be affixed to drawings on projects where topsoil will be stockpiled.

1. Stockpiles shall be stabilized (with plastic covering or other approved device) daily between November 1 and March 31.

2. In any season, sediment leaching from stock piles shall be prevented.

3. Topsoil shall not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or when conditions exist that may otherwise be detrimental to proper grading or proposed sodding or seeding.

4. Previously established grades on the areas to be topsoiled shall be maintained according to the approval plan.

Sod: The following notes shall be affixed to drawings for projects where sod is to be placed.

1. Sod shall be machine cut at a uniform soil thickness of 3/4-inch at the time of curing. Measurements for thickness shall exclude top growth and thatch.

2. Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended by the end of a 3 foot section.

3. Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.

4. Sod shall be harvested, delivered and installed within a period of 36 hours.

Construction Entrances: Place the following standard notes on plans for projects with construction entrances.

1. Material shall be 4" to 6" quarry spalls and may be top-dressed with 1" to 3" rock.

2. The rock pad shall be at least 12 inches thick and 100 feet long. Width shall be the full width of the vehicle ingress and egress area. Smaller pads may be approved for single-family residential and small commercial sites.

3. Additional rock shall be added periodically to maintain proper function of the pad.

4. If the pad does not adequately remove the mud from the vehicle wheels, the wheels shall be hosed off before the vehicle enters a paved street. The washing shall be done on an area covered with crushed rock and wash water shall drain to a sediment retention facility or through silt fence.

SURFACE WATER CONTROL PLANS

The following notes shall be affixed to all Surface Water Control Plans:

1. All workmanship and materials shall be in accordance with County standards and the most current copy of the State of Washington Standard Specifications for Road, Bridge and Municipal Construction (WSDOT/APWA).

2. Temporary erosion/water pollution measures shall be required in accordance with Section 1-07.15 of the Standard Specifications and the Pacific County Flood Control Zone District No. 1 Surface Water Control Standards.

3. Proponent shall comply with all other permits and other requirements of the governing authority or agency.

4. A preconstruction meeting shall be held prior to the start of construction or staking of the site.

5. All storm mains and retention/detention areas shall be staked for grade and alignment by an engineering or survey firm licensed to perform such work.

6. Storm drain pipe shall be as specified in the District Surface Water Control Standards.

7. Special structures, oil/water separators, and outlet controls shall be installed per plans and manufacturers recommendations.

8. Provide traffic control plan(s) as required in accordance with MUTCD.

9. Call underground locate line 1-800-424-5555 minimum 48 hours prior to any excavations.

10. All surveying and staking shall be performed and/or directed by an engineer or surveyor licensed by the State of Washington.

11. The minimum staking of storm sewer systems shall be as follows:

    A. Stake location of all catch basins/manholes and other fixtures for grade and alignment.

    B. Stake location, size, and depth of retention/detention facility.

    C. Stake finished grade of all stormwater features, including but not limited to catch basin/manhole rim elevations, overflow structures, weirs, and invert elevations of all pipes in catch basins, manholes, and those pipes that daylight.

12. Pipe materials used for stormwater conveyance shall be as approved by the jurisdiction. Pipe size, slope, cover, etc., shall be as specified in the District Surface Water Control Standards.

13. All driveway culverts shall be of sufficient length to provide a minimum 3H:1V slope from the edge of the driveway to the bottom of the ditch. Culverts shall have beveled and sections to match the side slope.

14. If drainage outlets (stub-outs) are to be provided for each individual lot, the stub-outs shall conform to the following:

    A. Each outlet shall be suitably located at the lowest elevation on the lot, so as to service all future roof downspouts and footing drains, driveways, yard drains, and any other surface or subsurface drains necessary to render the lots suitable for their intended use. Each outlet shall have free-flowing, positive drainage to an approved storm water conveyance system or to an approved outfall location.

    B. Outlets on each lot shall be located with a five-foot-high, 2"x4" stake marked "storm" or "drain." The stub-out shall visibly extend above surface level and be secured to the stake.

    C. Pipe material shall be as approved by the District.

    D. Drainage easements are required for drainage systems designed to convey flows through individual lots.

    E. The Proponent and/or contractor is responsible for coordinating the locations of all stub-out conveyance lines with respect to the utilities (e.g., power, gas, telephone, television).

    F. All individual stub-outs shall be privately owned and maintained by the lot home owner.

15. The storm drainage system shall be constructed according to approved plans on file with the District. Any material deviation from the approved plans will require written approval from the jurisdiction.

16. A copy of the approved storm water plans shall be on the job site whenever construction is in progress.

17. All disturbed areas shall be seeded and mulched or similarly stabilized. For sites where grass has been planted through hydroseeding, the performance bond will not be released until the grass has been thoroughly established,.

18. All building downspouts on commercial sites shall be connected to the storm drainage system, unless otherwise approved by the District.

19. All erosion control and stormwater facilities shall be regularly inspected and maintained by the contractor during the construction phase of the development project.

20. The contractor shall be responsible for providing adequate safeguards, safety devices, protective equipment, flaggers, and any other needed actions to protect the life, health, and safety of the public, and to protect property in connection with the performance of work covered by the contract. Any work within the traveled right-of-way that may interrupt

normal traffic flow shall require at least one flagger for each lane of traffic affected. All sections of the current W.S.D.O.T. Standard Specifications for Traffic Control shall apply.

21. It shall be the sole responsibility of the Proponent to obtain street use and other related or required permits prior to any construction activity in the jurisdiction's right-of-way. It shall also be the responsibility of the contractor to obtain all required permits prior to any construction.

22. No final cut or fill slope shall exceed two (2) horizontal to one (1) vertical without stabilization.

23. Verify the locations, widths, thicknesses, and elevations of all existing pavements and structures, including utilities and other frontage improvements, that are to interface with new work, provide all trimming, cutting, saw cutting, grading, leveling, sloping, coating, and other work, including materials as necessary to cause the interface with existing works to be proper, without conflict, acceptable to the engineer and the jurisdiction, complete in place, and ready to use.

24. Compaction of all fill areas shall be in accordance with the Standard Specifications. Fill shall be provided in 6" maximum lifts and shall be compacted to 95 percent of its maximum relative density.

PUBLIC DRAINAGE FACILITIES

1. Submittal to the Administrator of reproducible as-built plans are required prior to acceptance of plat improvements.

2. Ends of each storm drain stub at the property line shall be capped and located with a 2"x4" board marked plainly and permanently "STORM". The depth shall be indicated on the marker.

3. All grates in the right-of-way shall be ductile iron, locking, vaned grates.

4. All solid covers in traveled roadways shall be ductile iron conforming to ASTM A536, Grade 80..

APPENDIX D DECLARATION OF COVENANT

DECLARATION OF COVENANT

A maintenance covenant shall be filed on the plat and recorded against each lot within the subdivision, and shall include the following language:

(Not included at this time.)

APPENDIX E PROPERTY OWNERS' ASSOCIATION COVENANT

PROPERTY OWNERS' ASSOCIATION COVENANT

A covenant stating the property owners' or property owners' association's specific maintenance responsibilities shall be included on the face of the plat and recorded against each lot in the subdivision. The covenant shall include the following or substantially similar language:

"Easements are hereby granted for the installation, inspection and maintenance of utilities and drainage facilities as delineated on the plat for subdivision _____. No encroachment which may damage or interfere with the installation, inspection, and maintenance of utilities shall be placed within the easements shown on the plat. The maintenance and expense of maintaining the utilities and drainage facilities shall be the responsibility of the property owners' or the property owners' association as established by covenant recorded under Pacific County Auditor's file number _____."

APPENDIX F FALLING HEAD PERCOLATION TEST PROCEDURE

FALLING HEAD PERCOLATION TEST PROCEDURE

Number and Location of Tests

A minimum of three tests shall be performed within the area proposed for an absorption system. They shall be spaced uniformly throughout the area. If soil conditions are highly variable, more tests may be required.

Preparation of Test Hole

The diameter of each test hole is 6 inches, dug or bored to the proposed depths of the absorption systems or to the most limiting soil horizon. To expose a natural soil surface, the sides of the hole are scratched with a sharp pointed instrument and the loose material is removed from the bottom of the test hole. Two inches of 1/2- to 3/4-inch rock are placed in the hole to protect the bottom from scouring when the water is added.

Soaking Period

The hole is carefully filled with at least 12 inches of clear water. The depth of water should be maintained for at least 4 hours and preferably overnight if clay soils are present. A funnel with an attached hose or similar device may be used to prevent water from washing down the sides of the hole. Automatic siphons or float valves may be employed to automatically maintain the water level during the soaking period. It is extremely important that the soil be allowed to soak for a sufficiently long period of time to allow the soil to swell if accurate results are to be obtained.

In sandy soils with little or no clay, soaking is not necessary. If, after filling the hole twice with 12 inches of water, the water seeps completely away in less than ten minutes, the test can proceed immediately.

Measurement of the Percolation Rate

Except for sandy soils, percolation rate measurements are made 15 hours but no more than 30 hours after the soaking period began. Any soil that sloughed into the hole during the soaking period is removed and the water level is adjusted to 6 inches above the gravel (or 8 inches above the bottom of the hole). At no time during the test is the water level allowed to rise more than 6 inches above the gravel.

Immediately after adjustment, the water level is measured from a fixed reference point to the nearest 1/16th-inch at 30 minute intervals. The test is continued until two successive water level drops do not vary by more than 1/16-inch within a 90 minute period. After each measurement, the water level is readjusted to the 6-inch level. The last water level drop is used to calculate the percolation rate.

In sandy soils or soils in which the first 6 inches of water added after the soaking period seeps away in less than 30 minutes, water level measurements are made at 10 minute intervals for a 1 hr period. The last water level drop is used to calculate the percolation rate.

Calculation of the Percolation Rate

The percolation rate is calculated for each test hole by dividing the time interval used between measurements by the magnitude of the last water level drop. This calculation results in a percolation rate in terms of minutes/inch. To determine the percolation rate for the area, the rates obtained from each hole are averaged. (If tests in the area vary by more than 20 minutes/inch, variations in soil type are indicated. Under these circumstances, percolation rates should not be averaged.)

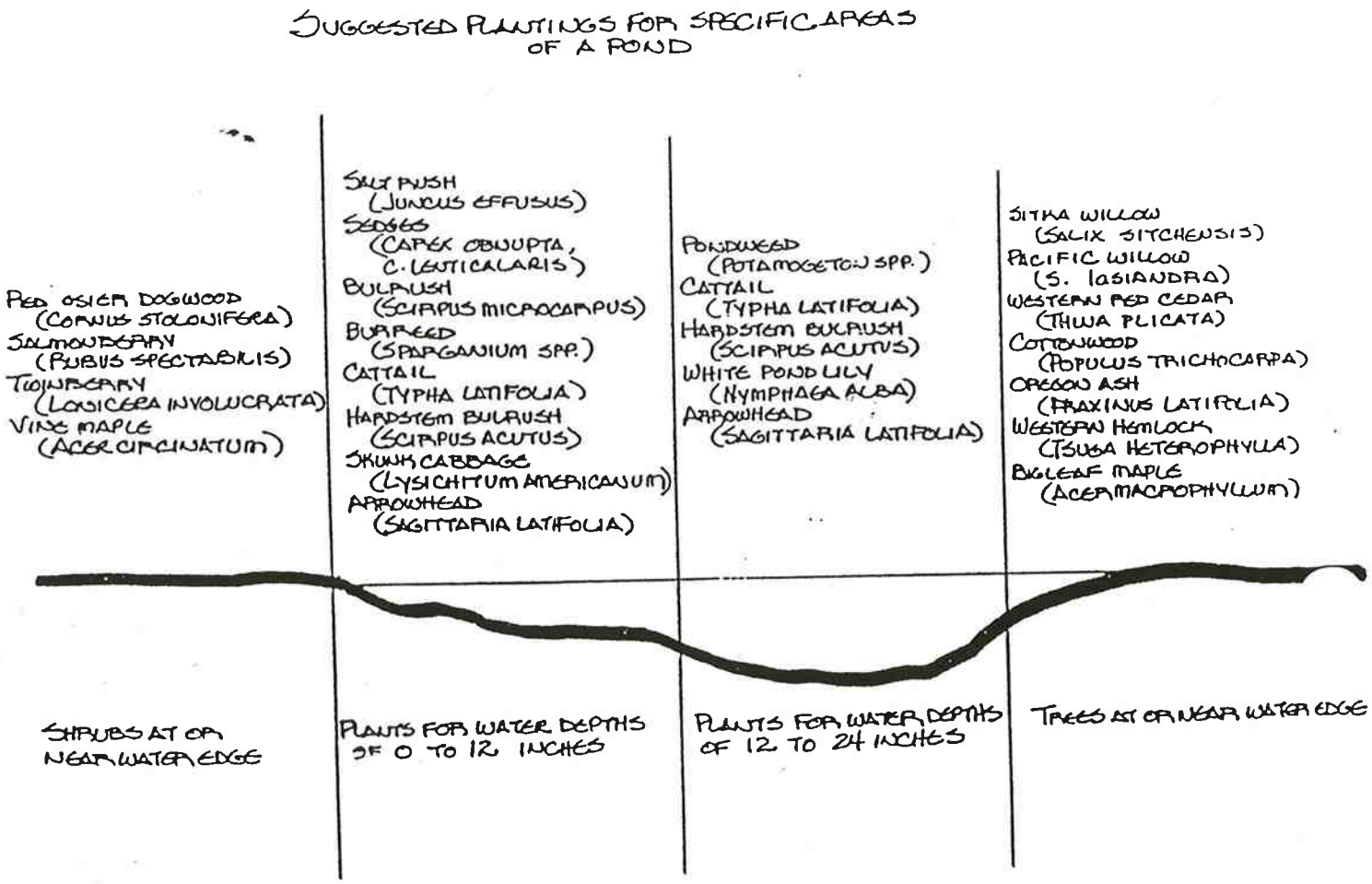
Example: If the last measured drop in water level after 30 minutes is 5/8-inch, then:

percolation rate = (30 minutes)/(5/8 inch) = 48 minutes/inch.

SOURCE: EPA, Onsite Wastewater Treatment and Disposal Systems, 1980.

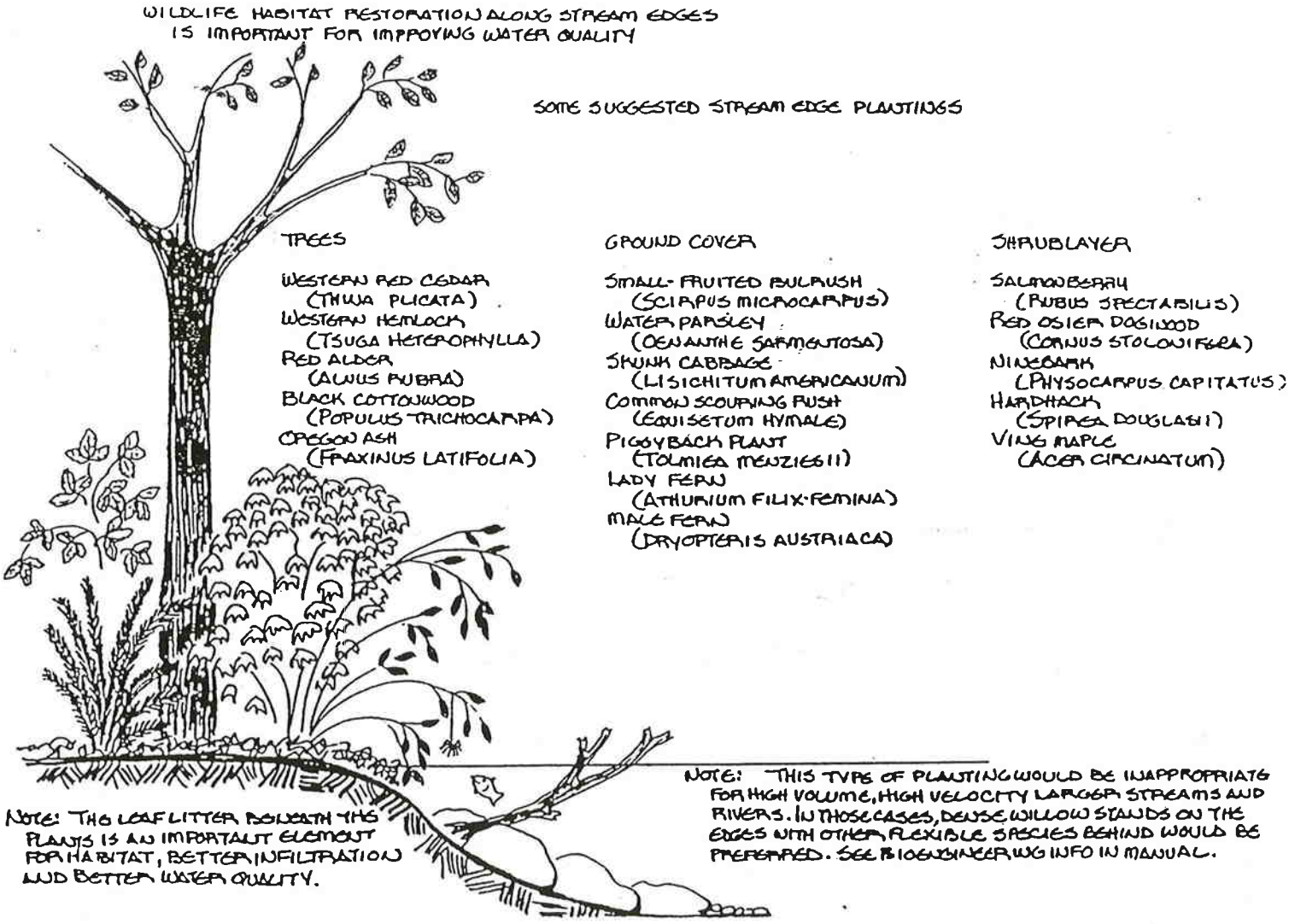
APPENDIX G WETLAND PLANTS FOR STORMWATER AREAS

Figure III-4.10 Suggested Plantings for Specific Depths of a Constructed Wetland



Reproduced with permission of Nadja Chamberlain and Ron Vanbianchi

Figure III-4.11 Suggested Stream Edge Plantings for a Constructed Wetland



Development of Guidance for Managing Urban Wetlands and Stormwater

Final Report

May 1991

King County
Environmental Division

Prepared by

King County Resource Planning Section
Environmental Division

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

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WETLANDS AND STORMWATER MANAGEMENT

APPENDIX D

NATIVE AND RECOMMENDED NONINVASIVE PLANT SPECIES FOR WETLANDS IN THE PUGET SOUND REGION

Caution: Extracting plants from an existing wetland donor site can cause a significant negative effect on that site. It is recommended that plants be obtained from native plant nursery stocks whenever possible. Collections from existing wetlands should be limited in scale and undertaken with care to avoid disturbing the wetland outside of the actual point of collection.

Plants preferred in Puget Trough freshwater wetlands

Open water zone:

- Potamogeton species (pondweeds)
- Sagittaria latifolia (arrowhead)
- Nymphaea odorata (pond lily)
- Brasenia shreberi (water shield)
- Nuphar polysepalum, N. variegatum (cow lily)
- Polygonum hydropiper (smartweed)
- Alisma plantago-aquatica (American water plantain)
- Ludwigia palustris (water purslane)
- Menanthes trifoliata (bogbean)
- Utricularia minor, U. vulgaris (bladderwort)

Emergent zone:

- Carex obnupta, C. rostrata, C. arcta, C. stipata, C. vesicaria C. aquatilis, C. pauciflora (sedge)
- Scirpus cyperinus (wool-grass bulrush)
- Scirpus microcarpus (small-fruited bulrush)
- Eleocharis palustris, E. ovata (spike rush)
- Epilobium watsonii (Watson's willow herb)
- Typha latifolia (common cattail)
- Veronica americana, V. scouleriana (speedwell)
- Mentha arvensis (mint)
- Lycopus americanus, L. uniflora (cut-leaved water horehound)
- Angelica species (angelica)
- Oenanthe sarmentosa (water parsley)
- Heracleum lanatum (cow parsnip)
- Glyceria grandis, G. elata (manna grass)
- Juncus acuminatus (tapered rush)
- Juncus ensifolius (daggerleaf rush)
- Juncus bufonius (toad rush)
- Mimulus guttatus (yellow monkey flower)

Scrub-shrub zone:

Salix lasiandra, S. rigida, S. sitchensis, S. scouleriana, S. pedicellaris (willow)
Lystichum americanus (skunk cabbage)
Athyrium filix-femina (lady fern)
Cornus stolonifera (red-osier dogwood)
Rubus spectabilis (salmonberry)
Physocarpus capitatus (ninebark)
Ribes species (gooseberry)
Rhamnus purshiana (cascara)
Sambucus racemosa (red elderberry) (occurs in wetland-upland transition)
Loniceria involucrata (black twinberry)
Oemleria cerafiformis (Indian plum)
Stachys cooleyae (Stachy's horsemint)
Prunus emarginata (bitter cherry)

Forested zone:

Populus trichocarpa (black cottonwood)
Fraxinus latifolia (Oregon ash)
Thuja plicata (western red cedar)
Picea sitchensis (Sitka spruce)
Alnus rubra (red alder)
Tsuga heterophylla (hemlock)
Cornus stolonifera (red-osier dogwood)
Acer cercinatum (vine maple)
Maianthemum dilatatum (wild lily-of-the-valley)
Ivzula pauciflora (small-flowered wood rush)
Puccinellia pauciflora (no common name)
Ribes species (currants)

Bog:

Sphagnum species (sphagnum mosses)
Ledum groenlandicum (Labrador tea)
Vaccinium oxycoccos (bog cranberry)
Kalmia occidentalis (bog laurel)

Exotic plants that should not be introduced to existing, created, or constructed Puget Trough freshwater wetlands

Phalaris arundinacea (reed canarygrass)
Lythrum salicaria (purple loosestrife)
Elaeagnus augustifolia (Russian olive)
Iris pseudocorus (yellow iris)

Native plants that should not be introduced to existing, created, or constructed Puget Trough freshwater wetlands

Potentilla palustris (Pacific silverweed)
Solarum dulcimana (nightshade)

APPENDIX H SOIL EVALUATION REPORT FORMS

FORM 1 SOIL EVALUATION REPORT GENERAL SITE INFORMATION	
Project Title:	
Project Number:	
Prepared By:	
1. Site Address or Legal Description (attach map):	
2. Project Description:	
3. Site Description:	
4. Summary of Soils Work Performed:	
5. Additional Soils Work Recommended:	
6. Project Site, Weighted Infiltration Rate:	Facility Infiltration Rate:
7. Other Findings:	
8. Recommendations:	
I hereby certify that I prepared this report and conducted or supervised the performance of related work. I certify that I am qualified to do this work. I represent my work to be complete and accurate within the bounds of uncertainty inherent to the practice of soil science, and to be suitable for its intended use: Signature: Date:	

FORM 1 SOIL EVALUATION REPORT INSTRUCTIONS

Form 1 is the "cover page" for all projects that require a soil evaluation report. One copy of Form 1 shall accompany all soil evaluation reports.

1. Site Address. Provide project name and address or legal description. Attach a legible map on 8½" by 11" paper showing site and major landmarks (e.g., roadways and surface waters) within approximately one-quarter mile radius around site.

2. Project Description. Provide acreage, parcel dimensions, type of development proposed, and approximate proposed coverage of impervious surfaces.

3. Site Description. Describe site topography, geomorphology, terrain, and natural cover. Distinguish among areas of the site with significantly different characteristics.

4. Summary of Soils Work Performed. Provide description and purpose of soils work done. List methods used to expose, sample, and test soils. Give number of test holes logged. Describe field and lab tests performed. Attach a scaled map of good accuracy on 8½" by 11" paper showing locations of soil logs. Except small projects, using soil log results, divide map area into sub-areas according to hydrologic group (A through D).

5. Additional Soils Work Recommended. Describe soils work still needed. For example, more work may be needed to obtain accurate percolation or infiltration rates for stormwater facilities not yet constructed.

6. Project Site and Facility Weighted Infiltration Rate. Provide average infiltration rate for the soils found on the site and in particular the location chosen for the retention / detention facility.

7. Other Findings. Describe results of soil logs and tests and compare with expected soils from SCS Soils maps. As appropriate for the project, give your best estimate of the (a) overall predeveloped site infiltration rate, (b) the saturated infiltration rate for the above-ground stormwater facility, or (c) the saturated percolation rate for the below-ground stormwater trench or drywell. Discuss soils factors related to erosion control, infiltration, percolation, and placement of buildings, as these vary on the site.

8. Recommendations. Describe the recommended general approach for managing stormwater on the site. For example, if stormwater can be infiltrated or percolated, indicate where and at what depth. If erosion, soil stability, or high ground water are problems, can these problems be avoided or mitigated?

Sign the form and affix any relevant professional seal (e.g., P.E., ARCPACS). The form becomes the cover page to one or more copies of Form 2, which has soil logs for each test hole evaluated.

FORM 2 SOIL EVALUATION REPORT
SOIL LOG INFORMATION

Project Title:	Project No.
Soil Log Location:	

1. Types of Tests:	2. SCS Soils Series	3. Land Form:

4. Deposition History:	5. Hydrologic Soil Group:	6. Depth to Seasonal GW:

7. Current Depth to Ground Water:	8a. Depth to Impervious Layer:	8b. Thickness of Impervious Layer:	9. Miscellaneous

10. Potential For Erosion:
11. Potential For Runoff:
12. Potential For Ponding:

13. Soil Strata Description

Horizon	Depth	Color	Texture	%Clay	%Organic	%CF	STR	MOT	IND	CEM	ROO	<X>	FSP

15. Site Infiltration Rate:
16. Findings and Recommendations:
Signature:

FORM 2 SOIL EVALUATION REPORT INSTRUCTIONS

Form 2 is the detailed record of soil information obtained on the development site. One copy of Form 2 shall be completed for each soil location where testing has been done. For tests other than soil logs for which the scientist wants to submit numerical results, please attach a separate sheet and briefly describe the results under "Findings and Recommendations". The summary information that heads the sheet should be self-explanatory. Regarding location, reference the location to features that are permanent and static, such as roads or property lines.

1. Types of Tests. State briefly tests that were done. Indicate whether tests were field, laboratory, or other.

2. SCS Soils Series Determine the soil series from the maps provided in the Soil Conservation Service (SCS) Soil Survey of Pacific County. Then, indicate what soil series was mapped as a result of the soil testing done.

3. Land Form Indicate land form (e.g., till plain).

4. Deposition History. Indicate depositional history (e.g., alluvial plain).

5. Hydrologic Soils Group. Indicate SCS hydrologic soil group (e.g., letter designation A through D).

6. Depth to Seasonal Groundwater. Indicate seasonal high water table depth based upon the presence of mottling, graying, or other evidence. Indicate how you determined this value under "Findings..." section. If information available is inadequate, state value to be "greater than" bottom of hole depth.

7. Current Depth to Groundwater. Indicate current water table depth based upon observation. If saturated conditions are not observed, state value to be "greater than" bottom of hole depth.

8a/b. Depth to and Thickness of Impervious Layer. Indicate depth to impervious layer (e.g., basal till). If information is inadequate, state value to be "greater than" bottom of hole depth. In till areas where the project will not discharge to a major water body, pits shall be at least 20 feet deep.

9. Miscellaneous. Space for other miscellaneous observations regarding setting of site (e.g., concave, convex, swale, hillslope).

10-12. Indicate susceptibility of area to erosion, runoff, and ponding problems. The susceptibility should be rated based upon relevant physical characteristics and development operations planned for the area, such as shape of the area (e.g., concave, convex, flat) removal or addition of fill, time of year, existing and planned vegetative cover, degree of soil compaction, etc. For erosion, the K-factor for the soils series in question might help in assessing relative erodibility.

13. Soil Strata Description. The profile description provides the minimum information on the physical attributes of the soil. Additional factors may be assessed at the option of the scientist, but data on these factors should be tabulated separately and summarized briefly in the "Findings and recommendations" section.

All information provided for the profile shall utilize standard SCS nomenclature and abbreviations. The following are the factors to be addressed, with brief examples of acceptable responses. Further information on most of these is provided in the SCS Soil Survey of Pacific County.

a. Horizon: A layer of soil with distinct characteristics, labeled A, AB, B, C, Ccw, etc.

b. Depth: Starting at 0" (surface), depth and interval of horizon.

c. Color: Munsell code for hue, value, and chroma, such as 10 YR 3/4. Indicate whether color is wet or dry.

d. Textural class: Class that best describes relative percentages of sand, silt, and clay in horizon, such as sandy loam (SL).

e. %Clay: Clay percentage is very useful as a guide to determining the drainage capability of a soil.

f. %Organic Matter: Organic matter percentage by volume is related to the infiltration as well as pollutant removal capability of soils.

g. %Coarse Fragments: Coarse fragment percentage is relevant to drainage and other site management factors.

h. Structure: Describes size and shape of soil "clods."

i. Mottling: Where present, describe using three-letter abbreviation to indicate abundance, size, and contrast, such as CFD (common, fine, distinct).

j. Induration: Physical compaction of a layer such as a glacial till. Where present, describe as weak, moderate, or strong.

k. Cementation: Aggregation of soil particles due to chemical processes. Describe as in induration.

l. Roots: Where present, describe using two-letter abbreviation to indicate abundance and size, such as CF (common, fine).

m. Generalized range of infiltration rates from SCS Soil Survey.

n. Field Saturated Percolation rate: Using all available information, estimate the field saturated percolation rate. This rate should be a single number, and may vary from that range (see previous column) published in the SCS Soil Survey due to horizon-specific factors.

15. Infiltration Rate. Provide overall site (location) field-saturated percolation rate. Rate should reflect effects of the entire soil column. Alternate rates may be provided if placement of the infiltration surface beneath finer surface soils (in coarser subsoils) would increase the rate. If the type of stormwater system to be employed is known (e.g., pond or trench, and depth), factor this knowledge into the assessment.

16. Findings and Recommendations. Discuss results of tests done on soil. Indicate features of soil that most affect stormwater management at this location. Provide recommendations to the Project Engineer on soil-related factors such as problems and controls, and for additional work needed (if necessary).

APPENDIX I RUNOFF CURVE NUMBERS

RUNOFF CURVE NUMBERS

Runoff curve numbers for selected agricultural, suburban and urban land use in Western Washington for Type 1a rainfall distribution, 24-hour storm duration. (Published by SCS in 1982).

TABLE D.2 SCS WESTERN WASHINGTON RUNOFF CURVE NUMBERS					
LAND USE DESCRIPTION	CONDITION	CURVE NUMBERS BY HYDROLOGIC SOILS GROUP			
		A	B	C	D
Cultivated Land	Winter	86	91	94	95
Mountain open areas	Low brush/Grassland	74	82	89	92
Meadow/Pasture		65	78	85	89
Wood or Forest	Undisturbed	42	64	76	81
Wood or Forest	Young 2nd growth/brush	55	72	81	86
Orchard	With cover crop	81	88	92	94
Lawns, Parks, Golflinks, etc.	75% or more grass cover	68	80	86	90
Lawns, Parks, Golflinks, etc.	50% to 75% cover	77	85	90	92
Commercial	85% impervious	92	94	95	96
Industrial	75% impervious	88	92	94	95
Residential (1/8-acre lot)	65% impervious	86	90	93	95
Residential (1/4-acre lot)	38% impervious	77	85	90	92
Residential (1/3-acre lot)	30% impervious	75	84	89	91
Residential (1/2-acre lot)	25% impervious	73	83	88	91
Residential (1-acre lot)	20% impervious	71	82	88	90
Gravel Roads/Car Parks		76	85	89	91
Dirt Roads/Car Parks		72	82	87	89
Impervious Surfaces		98	98	98	98
Water Bodies		100	100	100	100

For more detailed information refer to the National Engineering Handbook, Chapter 9, Hydrology, SCS.

APPENDIX J MAINTENANCE REQUIREMENTS FOR PRIVATELY MAINTAINED DRAINAGE FACILITIES

MAINTENANCE REQUIREMENTS FOR PRIVATELY MAINTAINED DRAINAGE FACILITIES

NO. 1 - PONDS

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	Any trash and debris which exceed 1 cubic foot per 1,000 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.	Trash and debris cleared from site.
	Poisonous Vegetation	Any poisonous vegetation which may constitute a hazard to County personnel or the public. Examples of poisonous vegetation include: tansy ragwort, poison oak, stinging nettles, devils club.	No danger of poisonous vegetation where County personnel or the public might normally be. (Coordination with Seattle/King County Health Department)
	Pollution	Oil, gasoline, or other contaminants of one gallon or more or any amount found that could: 1) cause damage to plant, animal, or marine life; 2) constitute a fire hazard; or 3) be flushed downstream during rain storms.	No contaminants present other than a surface film. (Coordination with Seattle/King County Health Department)
	Unmowed Grass/ Ground Cover	If 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.	When mowing is needed, grass/ground cover should be mowed to 2 inches in height.
	Rodent Holes	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.	Rodents destroyed and dam or berm repaired. (Coordination with Seattle/King County Health Department)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site.
	Tree Growth	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.	Trees do not hinder maintenance activities. Selectively cultivate trees such as alders for firewood.
Side Slopes of Pond	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.	Slopes should be stabilized by using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.
Storage Area	Sediment	Accumulated sediment that exceeds 10% of the designed pond depth.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
Pond Dikes	Settlements	Any part of dike which has settled 4 inches lower than the design elevation.	Dike should be built back to the design elevation.
Emergency Overflow/Spillway	Rock Missing	Only one layer of rock exists above native soil in are five square feet or larger, or any exposure of native soil.	Replace rocks to design standards.

NO. 3 - CLOSED DETENTION SYSTEMS (PIPES/TANKS)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Storage Area	Plugged Air Vents	One-half of the cross section of a vent is blocked at any point with debris and sediment.	Vents free of debris and sediment.
	Debris and Sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for 1/2 length of storage vault or any point depth exceeds 15% of diameter. Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.	All sediment and debris removed from storage area.
	Joints Between Tank/Pipe Section	Any crack allowing material to be transported into facility.	All joints between tank/pipe sections are sealed.
	Tank/Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape.	Tank/pipe repaired or replaced to design.
Manhole	Cover not In Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying 80 pounds of lift. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	King County Safety Office and/or maintenance person judges that ladder is unsafe due to missing rungs, misalignment, rust, or cracks.	Ladder meets design standards and allows maintenance persons safe access.
Catch Basins		See "Catch Basins" Standard No. 5	See "Catch Basins" Standard No. 5

NO. 5 - CATCH BASINS

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris (Includes Sediment)	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%.	No trash or debris located immediately in front of catch basin opening.
		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.	No trash or debris in the catch basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
		Dead animals or vegetation that could generate odors that would cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Structural Damage to Frame and/or Top Slab	Corner of frame extends more than 3/4 inch past curb face into the street (if applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch (intent is to make sure all material is running into the basin).	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in Basin Walls/Bottom	Cracks wider than 1/2 inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks, or maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
		Cracks wider than 1/2 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.	No cracks more than 1/4 inch wide at the joint of inlet/outlet pipe.
	Settlement/ Misalignment	Basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Fire Hazard	Presence of chemicals such as natural gas, oil, and gasoline.	No flammable chemicals present.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to basin.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.
	Pollution	Nonflammable chemicals of more than 1/2 cubic foot per three feet of basin length.	No pollution present other than surface film.

NO. 6 - DEBRIS BARRIERS (e.g. Trash Racks)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier clear to receive capacity flow.
Metal	Damaged/ Missing Bars	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4 inch.
		Bars are missing or entire barrier is missing.	Bars in place according to design.
		Bars are loose and rust is causing 50% deterioration to any part of barrier.	Repair or replace barrier to design standards.

NO. 8 - FENCING

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Missing or Broken Parts	Any defect in the fence that permits easy entry to a facility.	Parts in place to provide adequate security.
		Parts broken or missing.	Broken or missing parts replaced.
	Erosion	Erosion more than 4 inches high and 12-18 inches wide permitting an opening under a fence.	No opening under the fence that exceeds 4 inches in height.
Wire Fences	Damaged Parts	Posts out of plumb more than 6 inches.	Posts plumb to within 1-1/2 inches.
		Top rails bent more than 6 inches.	Top rail free of bends greater than 1 inch.
		Any part of fence (including posts, top rails, and fabric) more than 1 foot out of design alignment.	Fence is aligned and meets design standards.
		Missing or loose tension wire.	Tension wire in place and holding fabric.
		Missing or loose barbed wire that is sagging more than 2-1/2 inches between posts.	Barbed wire in place with less than 3/4-inch sag between posts.
		Extension arm missing, broken, or bent out of shape more than 1-1/2 inches.	Extension arm in place with no bends larger than 3/4 inch.
	Deteriorated Paint or Protective Coating	Part or parts that have a rusting or scaling condition that has affected structural adequacy.	Structurally adequate posts or parts with a uniform protective coating.
	Openings in Fabric	Openings in fabric are such that an 8-inch-diameter ball could fit through.	No openings in fabric.

NO. 10 - CONVEYANCE SYSTEMS (Pipes & Ditches)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Pipes	Sediment & Debris	Accumulated sediment that exceeds 20% of the diameter of the pipe.	Pipe cleaned of all sediment and debris.
	Vegetation	Vegetation that reduces free movement of water through pipes.	All vegetation removed so water flows freely through pipes.
	Damaged	Protective coating is damaged; rust is causing more than 50% deterioration to any part of pipe.	Pipe repaired or replaced.
		Any dent that decreases the cross section area of pipe by more than 20%.	Pipe repaired or replaced.
Open Ditches	Trash & Debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch and slopes.	Trash and debris cleared from ditches.
	Sediment	Accumulated sediment that exceeds 20% of the design depth.	Ditch cleaned/flushed of all sediment and debris so that it matches design.
	Vegetation	Vegetation that reduces free movement of water through ditches.	Water flows freely through ditches.
	Erosion Damage to Slopes	See "Ponds" Standard No. 1	See "Ponds" Standard No. 1
	Rock Lining Out of Place or Missing (If Applicable)	Maintenance person can see native soil beneath the rock lining.	Replace rocks to design standard.
Catch Basins		See "Catch Basins" Standard No. 5	See "Catch Basins" Standard No. 5
Debris Barriers (e.g., Trash Rack)		See "Debris Barriers" Standard No. 6	See "Debris Barriers" Standard No. 6

NO. 12 - ACCESS ROADS/EASEMENTS

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash and Debris	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.	Trash and debris cleared from site.
	Blocked Roadway	Debris which could damage vehicle tires (glass or metal).	Roadway free of debris which could damage tires.
		Any obstructions which reduce clearance above road surface to less than 14 feet.	Roadway overhead clear to 14 feet high.
		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.	Obstruction removed to allow at least a 12-foot access.
Road Surface	Settlement, Potholes, Mush Spots, Ruts	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.	Road surface uniformly smooth with no evidence of settlement, potholes, mush spots, or ruts.
	Vegetation in Road Surface	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.	Road surface free of weeds taller than 2 inches.
Shoulders and Ditches	Erosion Damage	Erosion within 1 foot of the roadway more than 8 inches wide and 6 inches deep.	Shoulder free of erosion and matching the surrounding road.
	Weeds and Brush	Weeds and brush exceed 18 inches in height or hinder maintenance access.	Weeds and brush cut to 2 inches in height or cleared in such a way as to allow maintenance access.

APPENDIX K DRAINAGE EASEMENT

DRAINAGE EASEMENT

(Not included at this time.)