

**CITY OF SEATAC
DISTRIBUTION SCHEDULE**

Ord/Res No.: 16-1021	Subject: AN ORDINANCE of the City Council of the City of SeaTac, Washington, amending Chapters 11.05, 11.10 & 12.10 to the SeaTac Municipal Code, related to road standards, right-of-way use, and stormwater management.
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AMR Confirmation of Exhibits (See Agenda Bill 4436)

Date passed by City Council: 11/22/2016 **Date Published:** 11/28/2016 **Date Effective:** 1/1/2017

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| <u>N/A</u> | Date mailed to: John Wilson, King County Assessor (zoning) (per RCW 36.70B.230)
<i>Ordinances passed July 1 through June 30 are due to the Assessor by July 31.</i> |
| <u>N/A</u> | Date mailed to: Washington Department of Commerce
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| <u>N/A</u> | Date mailed to: Planning Department Secretary (zoning and Development Agreements) |
| <u>N/A</u> | Date mailed to: GIS Analyst (Street Vacations, ROW acquisition) |
| <u>N/A</u> | Date mailed to: King County for recording (certified copy)
<i>fully executed Agreement or Ord. upon effective date</i> |
| <u>N/A</u> | Fax recorded copy of Street Vacation Ordinances to the
Assessor's Office 206.296.0106 ATTN: Abstract |
| <u> </u> | Date scanned into ONBASE |

Other: _____

CERTIFIED COPIES PROVIDED AS FOLLOWS:


Kristina Gregg, City Clerk

ORDINANCE NO. 16-1021

AN ORDINANCE of the City Council of the City of SeaTac, Washington, amending Chapters 11.05, 11.10 & 12.10 to the SeaTac Municipal Code, related to road standards, right-of-way use, and surface and stormwater management.

WHEREAS, the 2013 Western Washington Phase II Municipal Stormwater Permit (the Permit) issued and administered by the Washington State Department of Ecology (Ecology) requires permittees to update applicable codes, standards and policies to mandate the use of low impact development (LID) techniques where feasible by December 31, 2016.

WHEREAS, the Permit specifies that the intent of the above required code updates is to make LID the preferred and commonly used approach to development; and

WHEREAS, the City of SeaTac desires to meet the terms of the Permit;

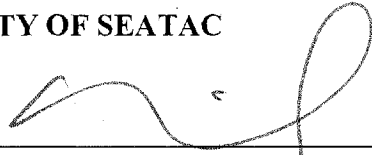
NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF SEATAC, WASHINGTON, DO ORDAIN as follows:

Section 1. Portions of Chapters 11.05, 11.10 and 12.10 of the SeaTac Municipal Code are hereby amended to read as shown in Appendix A. City Staff is also authorized to create a City addendum to the King County Surface Water Design Manual and an addendum to the Road Standards.

Section 2. This Ordinance shall be in full force and effect on January 1, 2017.

ADOPTED this 22nd day of November, 2016, and signed in authentication thereof on this 22nd day of November, 2016.

CITY OF SEATAC



Michael J. Siefkes, Mayor

ATTEST:

Kristina Gregg
Kristina Gregg, City Clerk

Approved as to Form:

Mary E. Mirante Bartolo for
Mary E. Mirante Bartolo, City Attorney

[Effective Date: 1/1/17]

[Amends SMC 11.05, 11.10 & 12.10.010]

APPENDIX A

Amendments to SMC Chapter 11.05

11.05.040 Standard specifications for road and bridge construction.

The ~~1991~~–2016 edition of the Standard Specifications for Road, Bridge and Municipal Construction, published by the American Public Works Association and the Washington State Department of Transportation, as presently existing or as may subsequently be amended, is hereby adopted by reference. Amendments to requirements outlined in the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction are documented in the City of SeaTac Addendum to Road Standards document.

11.05.050 Road construction rules.

The King County Road Construction Rules, as authorized by Section 14.24.010 of the King County Code, are adopted by reference as the City road construction rules, except Sections 2.02, 2.03 and 2.04 thereof, which are hereby replaced with the City's standards for urban public streets promulgated by the City Department of Public Works. Amendments to requirements outlined in the King County Road Standards are documented in the City of SeaTac Addendum to Road Standards document. The Department of Public Works shall print copies of the City standards, and subsequent revisions and additions thereto, and make the same available to anyone proposing to do work on City rights-of-way. The Department shall also prepare and periodically update a City bonding schedule for use in determining appropriate construction, maintenance or restoration bonds for road and drainage facilities developed in compliance with the adopted standards.

11.05.100 City road standards.

The following sections of Chapter 14.42 King County Code as now in effect, and as may be subsequently amended, are hereby adopted by reference, except that, unless the context indicates otherwise, the word "County" and the words "King County" shall refer to the City:

- 14.42.010 Adoption.
- 14.42.020 Terms.
- 14.42.030 Applicability.
- 14.42.040 Developments.
- 14.42.050 References.
- 14.42.060 Variances.

14.42.062 Appeals from decisions on variances.

14.42.070 Penalties.

14.42.080 Severability.

The City has developed a City of SeaTac Addendum to Road Standards document that amends the WSDOT Standard Specifications for Road, Bridge and Municipal Construction and the King County Road Standards and includes City-specific requirements.

Amendments to SMC Chapter 11.10

11.10.080 Right-of-way use permits.

The following classes of right-of-way use permits are hereby established.

A. Class A and B – Short-Term.

1. Class A and B permits may be issued for use of a right-of-way for seventy-two (72) or less continuous hours for the purposes which do not involve the physical disturbance of the right-of-way. These classes of use may involve disruption of pedestrian and vehicular traffic or access to private property and may require inspections, cleanup, and police surveillance. For periods longer than seventy-two (72) hours, these uses will be considered Class D, long-term and permanent.

2. Class A permits include but are not limited to the following:

- a. Assemblies;
- b. Bicycle races;
- c. Block parties;
- d. Parades;
- e. Parking;
- f. Processions;
- g. Nonmotorized vehicle races;
- h. Street dances;
- i. Street runs and walks.

3. Class B permits include but are not limited to the following:

- a. Fairs;
- b. House or other large structure moves other than those which require a Class E permit;
- c. Temporary sale of goods;
- d. Temporary street closures.

B. Class C – Disturbance of City Right-of-Way.

1. Class C permits may be issued for use of a right-of-way, for a period not in excess of one hundred eighty (180) days, for activities that may alter the appearance of or disturb the surface or subsurface of the right-of-way on a temporary or permanent basis. For those projects associated with a building permit, Class C permit duration may be extended by the Director or designee to a maximum of two years in order to match building permit duration.

2. Class C permits include but are not limited to:

- a. Boring;
- b. Culverts;
- c. Curb cuts;
- d. Paving;
- e. Drainage facilities;
- f. Driveways;
- g. Fences;
- h. Landscaping;
- i. Maintaining or removing street trees;
- j. Painting;

j. Sidewalks;

k. Street trenching.

C. Class D – Long-Term and Permanent.

1. Class D permits may be issued for use of a right-of-way, for a period not in excess of one hundred eighty (180) days, for activities for extended periods of time but which will not physically disturb the right-of-way.

2. The use of a right-of-way for structures, facilities, and uses that involve capital expenditures and long-term commitments of use require this type of permit.

3. Class D permits include but are not limited to:

a. Air rights and aerial facilities;

b. Bus shelters and stops;

c. Access to construction sites and haul roads;

d. Loading zones;

e. Newspaper sale, distribution, and storage facilities;

f. Recycling facilities;

g. Sales structures;

h. Sidewalk cafes;

i. Special and unique structures, such as: awnings, benches, clocks, decorations, flagpoles, fountains, kiosks, marquees, private banners, public mailboxes, and street furniture;

j. Underground rights;

k. Utility facilities;

l. Waste facilities.

D. Class E – Potential Disturbance of City Right-of-Way.

1. Class E permits may be issued for use of a right-of-way, for a period not in excess of one hundred eighty (180) days or as specified on the permit by the Director or designee, for those activities that have the potential of altering the appearance of or disturbing the surface or subsurface of the right-of-way on a temporary or permanent basis.

2. Class E permits include but are not limited to:

a. Frequent use hauling involving an average of six (6) vehicles per hour during any eight (8) hour period in one (1) day, for two (2) or more consecutive days;

b. Any hazardous waste hauling.

3. Class E permits may be issued to a general contractor to authorize construction, excavation and fill hauling activities by the said general contractor and by subcontractors.

4. Access Routes and Hours. All hauls in excess of fifty thousand (50,000) CY or hauling more than one hundred (100) working days will be required to use the following routes. The following roadways are limited for use as haul routes and the maximum ~~number of one-way trips per hour~~ number of one-way trips per hour is identified by time of day.

Roadway Segments and Hours	Maximum One-Way Trips
a. South 188th Street, West of Tunnel	
6:00 a.m. – 8:00 a.m.	45
8:00 a.m. – 3:30 p.m.	45
3:30 p.m. – 5:30 p.m.	45 westbound 18 eastbound with no lane closure allowed
5:30 p.m. – 6:00 a.m.	45
b. South 188th Street, between SR99 and Tunnel	
6:00 a.m. – 8:00 a.m.	18
8:00 a.m. – 3:30 p.m.	30
3:30 p.m. – 5:30 p.m.	18 with no lane closure allowed
5:30 p.m. – 6:00 a.m.	30
c. South 188th Street, East of SR99	
6:00 a.m. – 8:00 a.m.	6

8:00 a.m. – 3:30 p.m.	12
3:30 p.m. – 5:30 p.m.	6 with no lane closure allowed
5:30 p.m. – 6:00 a.m.	6

d. International Blvd. (SR99), South of South 188th Street

6:00 a.m. – 8:00 a.m.	6
8:00 a.m. – 3:30 p.m.	12
3:30 p.m. – 5:30 p.m.	6 with no lane closure allowed
5:30 p.m. – 6:00 a.m.	12

e. International Blvd. (SR99), North of South 188th Street

6:00 a.m. – 8:00 a.m.	6
8:00 a.m. – 3:30 p.m.	6
3:30 p.m. – 5:30 p.m.	6 with no lane closure allowed
5:30 p.m. – 6:00 a.m.	12

5. Work Hour Limitations. Any hauling operation within the following hours will require a noise variance application submittal and approval from the Department prior to implementation:

10:00 p.m. to 7:00 a.m.	Monday to Friday
10:00 p.m. to 9:00 a.m.	Saturday and Sunday

11.10.250 Backfilling.

Backfilling in a right-of-way opened or excavated pursuant to a permit issued under the provisions of this chapter shall be compacted to a degree equivalent to that of the undisturbed ground in which the excavation was begun, unless the Director or designee determines a greater degree of compaction is necessary to produce a satisfactory result. All backfilling shall be accomplished according to City standards and specifications. If trenching or backfilling will be performed in areas where infiltration BMPs or vegetated LID BMPs exist, deviation from the City standards and specifications for compaction requirements may be allowed. All backfills shall be inspected and approved by the Director or designee prior to any overlaying or patching.

11.10.270 Coordination of right-of-way construction.

The permittee, at the time of receiving a Class C right-of-way use permit, shall notify all other public and private utilities known to be using or proposing to use the same right-of-way of the applicant's proposed construction and the proposed timing of such construction. A utility so

notified may, within seven (7) days of such notification, request of the Director or designee a delay in the commencement of any proposed construction for the purpose of coordinating other right-of-way construction with that proposed by the permittee. The Director or designee may delay the commencement date of the permittee's right-of-way construction for up to ninety (90) days, except in emergencies, if the Director or designee finds that such delay will reduce inconvenience to City right-of-way uses and if the Director or designee finds that from construction activities such delay will not create undue economic hardship on the applicant. The permittee must document and restore all paved areas and stormwater facilities, including permeable pavement.

Amendments to SMC Chapter 12.10

12.10.010 King County Surface Water Design Manual adopted by reference.

The ~~2009~~ 2016 King County Surface Water Design Manual (KCSWDM) and the City of SeaTac Addendum to the KCSWDM are hereby adopted by reference. They are collectively referred to in this title as the Surface Water Design Manual (SWDM). The above stormwater standards are adopted in compliance with the 2013 Western Washington (NPDES) Phase II Municipal Stormwater Permit.

12.10.015 Definitions (New Section)

A. "Best management practice (BMP)" means any schedule of activities, prohibition of practices, maintenance procedures, or structural and/or managerial practices that, when used singly or in combination, prevents or reduces the release of pollutants and other adverse impacts to surface water, stormwater and groundwater, while minimizing the potential for flooding, soil creep and soil instability.

B. "Low Impact Development (LID)" means a stormwater and land use management strategy that strives to mimic natural hydrologic processes of infiltration, filtration, storage, evaporation and transpiration by emphasizing conservation, use of on-site natural features, site planning, and distributed stormwater management practices that are integrated into a project design, while also minimizing the potential for off-site flooding and soil instability.

C. "Low Impact Development (LID) Best Management Practices (BMP)" means distributed stormwater management practices, integrated into a project design, that emphasize natural hydrologic processes of infiltration, filtration, storage, evaporation and transpiration, while protecting against off-site flooding and soil instability . LID BMPs include, but are not limited to, bioretention, permeable pavement, cast in place pavers, limited infiltration systems, roof downspout controls, dispersion, soil amendments, and minimal excavation foundations.

D. "Low Impact Development (LID) principles" means land use management strategies that emphasize conservation, use of on-site natural features, and site planning to utilize infiltration and native vegetation to minimize stormwater runoff, while protecting against remote area flooding and soil instability.

E. "Stormwater facilities" means drainage facilities or features used to meet water quality treatment and/or flow control requirements by utilizing processes such as infiltration, dispersion, storage, conveyance, evaporation, and transpiration.

F. "Surface Water Design Manual" means the King County Surface Water Design Manual (KCSWDM), as amended by the City of SeaTac Addendum to the KCSWDM adopted in SMC 12.10.010.

12.10.075 Site Planning and Design. (New Section)

The following site planning and design principles shall be applied where feasible: Site planning and design shall consider stormwater management, especially the design and integration of LID BMPs, as early as possible in the project planning phase; Locate buildings away from soils that provide effective infiltration; Site LID BMPs in areas with good infiltration capacity; Reduce impervious surfaces and retain native vegetation.

12.10.100 Procedures and conditions related to construction timing and final approval.

A. No work related to permanent or temporary storm drainage control shall proceed without the approval of the City Manager, or designee.

B. Erosion/sedimentation control measures associated with both the interim and permanent drainage facilities shall be:

1. Constructed in accordance with the approved plan prior to any grading or land clearing other than that associated with the erosion/sedimentation control plan;
2. Satisfactorily maintained until all improvements, restoration, landscaping and other requirements of the Surface Water Design Manual are completed and the potential for on-site erosion has passed.

C. Prior to the construction of any improvements and/or buildings on the site, those portions of the ~~drainage~~ stormwater facilities necessary to accommodate the control of surface and stormwater runoff discharge from the site must be constructed, ~~and be in operation approved, and functioning properly.~~ Existing LID BMPs and proposed LID locations shall be protected throughout site construction to ensure that they are not compacted, damaged, or filled with sediments.

D. Subdivisions only: Recording may occur prior to the construction of drainage facilities when approved in writing by the City Manager, or designee, but only to minimize impacts that may result from construction during inappropriate times of the year.

12.10.110 Bonds and liability insurance required.

The City Manager, or designee, is authorized to require all persons constructing ~~retention/detention-stormwater flow control and/or treatment facilities and other drainage facilities~~ to post bonds. Where such persons have previously posted, or are required to post, other

bonds covering either the facility itself or other construction related to the facility, such person may, with the permission of the Public Works Director, or designee and to the extent allowable by law, combine all such bonds into a single bond; provided, that at no time shall the amount thus bonded be less than the total amount which would have been required in the form of separate bonds; and provided further, that such bond shall on its face clearly delineate those separate bonds which it is intended to replace.

12.10.120 ~~Stormwater~~ Drainage facilities restoration and site stabilization bond.

Prior to commencing construction, the ~~person required to construct the drainage facility pursuant to the Surface Water Design Manual~~ permittee shall post a ~~drainage-stormwater~~ facilities restoration and site stabilization bond (performance bond) in an amount sufficient to cover the cost of corrective work on or off the site which is necessary to provide adequate drainage, stabilize and restore disturbed areas, and remove sources of hazard associated with work which has been performed and is not completed. After determination by the ~~City Manager~~ Public Works Director, or designee, that all facilities are constructed in compliance with approved plans, the ~~drainage facilities restoration and site stabilization performance~~ bond shall be released. The City may collect against the ~~drainage facilities restoration and site stabilization performance~~ bond when work is not completed in reasonable fashion and is found to be in violation of the conditions of the Surface Water Design Manual. The ~~City Manager~~ Public Works Director, or designee, shall have discretion to determine whether the site is in violation of the requirements of this chapter, and whether the bond shall be collected to remedy the violation. Prior to final approval and release of the ~~drainage facilities restoration and site stabilization performance~~ bond, the ~~City Manager~~ Public Works Director, or designee, shall conduct a comprehensive inspection for the purpose of observing that the ~~retention/detention facilities and other drainage~~ stormwater facilities have been constructed according to plan, applicable specifications and standards.

12.10.130 Defect and maintenance bond.

After ~~satisfactory completion and approval of the drainage-stormwater facility or~~ prior to final plat approval, whichever occurs last, the ~~person required to construct the facility pursuant to this chapter~~ the permittee shall post a defect and maintenance bond (stormwater maintenance bond) warranting the satisfactory performance and maintenance of the ~~drainage-stormwater~~ facility and guaranteeing the workmanship and materials used in the construction of the facility. Commercial facilities shall be bonded for a minimum period of two (2) one (1) years. New residential developments must post the stormwater maintenance bond until 90% of the lots are constructed or when construction is stopped and the site is fully stabilized. For subdivision retention/detention facilities over which the City may assume maintenance, pursuant to SMC 12.10.160, the defect and maintenance bond shall be posted for a period of two (2) years or until the City assumes maintenance, whichever is longer. The Public Works Director, or designee shall not release the ~~defect-stormwater~~ and maintenance bond until all inspection fees are paid.

12.10.160 Maintenance of retention/detention facilities.

A drainage facility or retention/detention facility located within and servicing only an individual parcel shall not be accepted by the City for maintenance and will remain the responsibility of persons holding title to the property within which the facility is located.

Maintenance of all subdivision drainage facilities or retention/detention facilities shall remain the responsibility of the person required to construct the facilities until all conditions of this section have been met.

Only after all of the following conditions have been met shall the City assume maintenance of the subdivision retention/detention facility:

A. All of the requirements of SMC 12.10.110 through 12.10.150 have been fully met.

B. All necessary easements or tracts entitling the City to ingress and egress and to properly maintain the retention/detention facility have been conveyed to the City and boundary survey stakes established.

C. The Public Works Director, or designee has conducted an inspection and determined that the facility has been properly maintained and is operating as designed. This inspection shall occur within two (2) years after posting of the defect and stormwater maintenance bond.

12.10.220 Surface water management program.

A. There is hereby created and established a Surface Water Utility and surface water management program, implementation of which shall be governed by the Surface Water Design Manual adopted pursuant to SMC 12.10.010.

B. The surface water management program is necessary in order to promote public health, safety and welfare by establishing and operating a comprehensive approach to surface and storm water problems which would reduce flooding, erosion and sedimentation, prevent and mitigate habitat loss, enhance groundwater recharge and prevent water quality degradation. This comprehensive approach includes the following elements: basin and subbasin planning, land use regulation, construction of facilities, maintenance, public education, and provision of surface water management services. The most cost effective and beneficial approach to surface water management is through preventative actions and protection of the natural drainage system. In approaching surface water problems the surface water management program shall give priority to methods which provide protection or enhancement of the natural surface water drainage system, such as LID BMPs and principles which promote infiltration and dispersion, over means methods which primarily involve construction of new-traditional drainage facilities or systems, such as detention pipes, vaults, and ponds. The purpose of the rates and charges established at SMC 12.10.225 is to provide a method for payment of all or any part of the cost and expense of surface water management services or to pay or secure the payment of all or any portion of any issue of general obligation or revenue bonds issued for such services and facilities. These rates

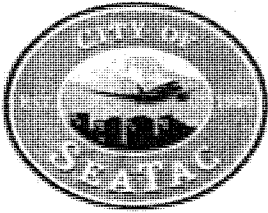
and charges are necessary in order to promote the public health, safety and welfare by minimizing uncontrolled surface and storm water, erosion, and water pollution; to preserve and utilize the many values of the City's natural drainage system including water quality, open space, fish and wildlife habitat, recreation, education, urban separation and drainage facilities; and to provide for the comprehensive management and administration of surface water.

C. The following sections of Chapter 9.08 King County Code as now in effect, and as may be subsequently amended, are adopted by reference, except that, unless the context indicates otherwise, the word "County" and the words "King County" shall refer to the City, and references to County codes shall be deemed references to the Surface Water Design Manual or Municipal Code, as applicable:

9.08.060(B) through (L)

and (N) through (Q) Policy.

9.08.090 Billing procedure.



SeaTac City Council
Request for Council Action
Agenda Bill #: 4436

Council consideration: An Ordinance amending Chapters 11.05, 11.10 and 12.10 to the SeaTac Municipal Code, related to road standards, right-of-way use, and surface and stormwater management.

Date Action Requested: RCM: 11/22/2016

Review Dates: T&PW: 09/06/16, 09/16/16, 09/20/16, 10/17/16; CSS: 11/08/2016

Prepared By: Don Robinett, Stormwater Compliance Manager

Amount: N/A

Budgeted?: No

Applicable Fund Name: N/A

Director Approval: William Appleton, Director of Public Works, 10/28/2016

City Manager Approval: Acting City Manager, Joseph Scorcio

Purpose: The purpose of the proposed amendments to portions of Chapters 11.05, 11.10 and 12.10 of the SeaTac Municipal Code is to comply with the requirements of the 2013 Western Washington Phase II Municipal Stormwater Permit (NPDES Permit).

ANALYSIS: The City's NPDES Permit requires an update to codes, standards and enforceable documents to make low impact development (LID) the preferred and commonly used approach to development. Pursuant to the NPDES Permit, said updates must go into effect by January 1, 2017. The proposed code amendments are a portion of those necessary to meet the terms of the NPDES Permit; proposed amendments to land use and development codes are identified in a separate ordinance.

The proposed amendments represent the minimum necessary changes to the City code related to road standards, right-of-way use, and surface and stormwater management, to meet the requirements of the NPDES Permit. Proposed amendments include: adoption of the 2016 King County Surface Water Design Manual (KCSWDM), adoption of the updated City of SeaTac Addendum to the KCSWDM; updates to right-way use requirements; adoption of updated Washington State Department of Transportation road standards; and the adoption of the newly created City of SeaTac Addendum to the Road Standards.

Stake holder meetings were held on September 16th and October 14th to obtain feedback on the proposal. The proposed amendments have been reviewed by the Transportation and Public Works Committee over four (4) meeting. The Committee forwarded the proposal to the Council with a recommendation for approval on Oct 17, 2016.

BUDGET SIGNIFICANCE: The proposed Ordinance has no direct impact on the City's Budget. However, these new regulations will likely increase the cost of future Capital Improvement Projects within the City, in terms of design, construction and maintenance costs.



FINAL DRAFT
Addendum to
the King County
Surface Water Design Manual

Effective date
~~February 15, 2010~~ January 1, 2017

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Acknowledgements

~~The City of SeaTac gratefully acknowledges the contributions the City of Federal Way has made in the development of this document.~~

Introduction

This addendum to the ~~2009~~ 2016 King County Surface Water Design Manual (KCSWDM) applies to development and redevelopment proposals within the City of SeaTac (City). The KCSWDM has been adopted to meet the requirements of the Clean Water Act, the Endangered Species Act and State Growth Management Act. This addendum includes minor revisions to the KCSWDM to address the differences between King County's and the city's organization and processes, as well as to address equivalency requirements. No major substantive changes have been made to the KCSWDM in order to maintain equivalency in review requirements and level of protection provided by the manual.

[**Note:** Clarifications and interpretations to the KCSWDM or this addendum will be documented and made available through policy statements within the City's Development Standards.]

Addendum Organization

The information presented in this addendum is organized as follows:

- **Terminology:** At times King County and City of SeaTac use different terminology to describe or refer to equivalent subject matter. This section identifies these terms and the City of SeaTac's equivalent terminology.
- **Key Revisions:** This section specifically identifies the minor revisions the City has made to the KCSWDM. These revisions are necessary to maintain equivalency to the stormwater standards identified in the NPDES Phase II Permit, as well as to address deficiencies within the KCSWDM.
- **Supplemental ~~Manuals~~ Documents:** This section identifies technical guidance manuals and documents which shall be used to supplement the KCSWDM. These ~~manuals~~ documents are necessary to maintain equivalency to the stormwater standards identified in the NPDES Phase II Permit, as well as to address deficiencies within the KCSWDM.
- **Code Reference Tables:** King County code is referenced in many places throughout the KCSWDM. This section identifies these code references and equivalent city code where applicable.
- ~~Reference Materials:~~ This section identifies which reference materials provided in the KCSWDM are applicable and which are not. It also identifies if equivalent City of SeaTac reference materials are available. This section also includes supporting documentation.
- ~~Mapping:~~ City of SeaTac equivalents to the Flow Control Applications Map and the Water Quality Applications Map are included in this section.

Supplemental information in the appendices includes the following:

- Appendix A: Hydrologic Analysis of the Des Moines Creek Regional Detention Facility (July 23, 2003 Memorandum from the Department of Ecology)
- Appendix B: Soil Amendment Requirements
- Appendix C: Design and Maintenance Criteria for BMPs/Facilities not included in the KCSWDM
- Appendix D: Flow Control and Water Quality Applications Maps

Terminology

At times King County and City of SeaTac use different terminology to describe or to refer to equivalent subject matter. This section identifies these terms and the City of SeaTac's equivalent terminology.

~~Department of Development and Environmental Services (DDES) = City of SeaTac Public Works and Planning & Community Development Departments.~~

~~Department of Natural Resources and Parks (DNRP) = City of SeaTac Parks & Recreation Department of Planning and Community Development Services.~~

~~Department of Permitting and Environmental Review (DPER) = City of SeaTac Public Works and Community and Economic Development Departments.~~

Director = City of SeaTac Public Works Director.

Drainage facilities restoration and site stabilization guarantee and drainage defect and maintenance guarantee = SeaTac stormwater facilities restoration and site stabilization bond (Performance Bond) and defect and maintenance bond/ (Stormwater Maintenance Bond).

King County = City of SeaTac.

King County Code (KCC) = SeaTac Municipal Code (SMC). Check code reference table for equivalent code sections.

King County Designated/Identified Water Quality Problem - This determination is made on a case-by-case basis.

King County Road Standards = City of SeaTac Development Standards.

Master Drainage Planning - Not applicable, no SMC equivalent.

Sensitive Area Folio = In addition to the King County Sensitive Area Folio, Stream, Wetland and Steep Slope maps are also available on the ~~Planning and Community Development Department~~ of Community and Economic Development web page at

www.ci.seatac.wa.us/department/planninghome<http://www.ci.seatac.wa.us/index.aspx?page=42>
under Planning maps.

Urban Planned Development = Not applicable, no SMC equivalent.

Water and Land Resources (WLR) Division = City of SeaTac ~~Stormwater Compliance and Engineering Divisions~~ Public Works Department.

Zoning Classifications: Where the KCSWDM references Agricultural (A) Zoning, Forest (F) Zoning, or Rural (R) Zoning - These zoning classifications are intended for areas outside of the Urban Growth Boundary, therefore the City of SeaTac contains no equivalent zoning. Refer to City zoning maps to determine which zoning classifications apply to your project.

Key Revisions

This section specifically identifies the minor revisions the City has made to the KCSWDM. These revisions are necessary to maintain equivalency to the stormwater standards identified in the NPDES Phase II Permit, as well as to address deficiencies within the KCSWDM.

Mitigation of Impacts from Construction Site Runoff – Property owners and construction site managers are responsible for mitigating off-site impacts from construction regardless of the size of the project or whether a construction permit was required by the City of SeaTac.

Des Moines Creek Basin Flow Control – New and redevelopment projects may use the Basic Flow Control standard as identified in the KCSWDM, and the 1994 land use condition as the pre-development conditions for sizing flow control facilities. This adjustment is established based on the Des Moines Creek Basin Plan, the Des Moines Creek Regional Capital Improvement Project and the Hydrologic Analysis of the Des Moines Creek Regional Detention Facility as specified in a letter from the Department of Ecology, dated July 23, 2003 signed by Kevin Fitzpatrick (included in Appendix A Reference Section).

Soil Amendment Requirements – The City has developed a Soil Amendment Standards handout that is included in Appendix B of this document. In the absence of City of SeaTac standards for the preservation of duff soil layers and specific soil amendment requirements, the City will rely on King County standards established in King County Clearing and Grading Code sections KCC 16.82.100(F) & (G) included in Reference Section.

~~**Impervious Surface Percentage Exemption** – This exemption, which is listed in 1.2.3 of the KCSWDM, is not allowed within the City of SeaTac in order to maintain equivalency with the 2005 Stormwater Management Manual for Western Washington (DOE Manual).~~

~~**Flow Control Continuous Modeling for LID BMPs** – Neither the KCSWDM, nor the 2005 Low Impact Development (LID) Technical Guidance Manual fully address how infiltration rates shall be included in flow control modeling for all low impact development BMPs. In an effort to encourage the use of LID techniques SeaTac will allow the Western Washington Hydrology Model (WWHM), MGSFlood, or HSPF to be used to determine for sizing stormwater facilities to meet flow control, treatment, or the LID performance standard requirements for projects containing LID BMPs, until the KCSWDM had been updated to adequately address infiltration rates. Explicit modeling of BMP infiltration for facility sizing is also allowed instead of applying the flow control BMP facility sizing credits included in Table 1.2.9.A in Chapter 1 of the KCSWDM.~~

~~**Additional Flow Control Facility Options for Core Requirement #3** – The KCSWDM does not include vegetated roofs, but they are allowed in the City of SeaTac. Design and maintenance guidelines for vegetated roofs can be found in Appendix C of this document~~

~~**Additional Water Quality Facility Options for Core Requirement #8** – The following facilities are available as options on the Basic WQ Menu: Compost-amended Vegetated Filter Strips (CAVFS), Media Filter Drains (MFDs) (previously referred to as the Ecology Embankment), and Bioretention.~~

Emerging technologies currently approved by Ecology (<http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html>) can be used as options on the Basic WQ Menu if they have received a General Use Level Designation (GULD) for Basic Treatment. Emerging technologies currently approved by Ecology can be used as options on the Enhanced WQ Menu if they have received a GULD for Enhanced Treatment.

Design and maintenance guidelines for CAVFS and MFDs can be found in Appendix C of this document. Design guidelines for Bioretention can be found in Appendix C of this document. Maintenance guidelines for Bioretention can be found in the KCSWDM. Design and maintenance guidelines for emerging technologies should be requested from the manufacturer.

Additional Flow Control BMP Options for Core Requirement #9 – In addition to engineered bioretention facilities, non-engineered rain gardens are allowed for small lots in the City of SeaTac with less than 5,000 square feet of impervious surface. Rain gardens shall be sized to have a minimum horizontal projected surface area below the overflow which is at least 5% of the area draining to it. Design and maintenance guidelines for rain gardens can be found in the Rain Garden Handbook for Western Washington. [Note: Rain gardens can be used to meet Core Requirement #9, but cannot be used to meet Core Requirements #3 or #8.]

Overflows to City ROW – Where feasible based on topography, private stormwater facilities should be designed to overflow to the City Right-of-Way (ROW) or a receiving water.

Underdrains – Underdrains are allowed in permeable pavement designs. No underdrains are allowed for bioretention until a new bioretention soil mix has been approved by Ecology and King County.

Flow Control and Water Quality Applications Maps – City of SeaTac equivalents to the Flow Control Applications Map and Water Quality Applications Map can be found in Appendix D of this document. In lieu of a SeaTac equivalent to the County Landslide Hazard Drainage Areas Map, the City will rely on King County's map.

Supplemental ~~Manuals~~ Documents

This section identifies technical guidance manuals and documents which shall be used to supplement the KCSWDM. These ~~manuals~~ documents are necessary to maintain equivalency to the stormwater standards identified in the NPDES Phase II Permit, as well as to address deficiencies within the KCSWDM.

King County Stormwater Pollution Prevention Manual – The most recent edition of the King County Stormwater Pollution Prevention Manual (KCSWPPM) shall be used as technical guidance for water quality best management practices (BMPs). This BMP manual shall also be used as the technical guidance for identifying and implementing source control measures for private residents, businesses, and industries when applying SMC 12.12 (Surface and Stormwater – Illicit Discharge Detection and Elimination Code).

Low Impact Development Technical Guidance Manual for Puget Sound – The ~~2005-2012~~ Low Impact Development Technical Guidance Manual for Puget Sound created by the Puget Sound ~~Action Team~~ Partnership, or as hereafter amended, shall be used as the supplemental technical guidance for the KCSWDM for the use of LID ~~techniques~~ principles and LID BMPs. ~~See the City of SeaTac Development Standards for clarification on the limitations of use for the different LID techniques within the City:~~

Rain Garden Handbook for Western Washington: A Guide for Design, Installation, and Maintenance - The 2013 Rain Garden Handbook created by Ecology, the Washington State University Extension, and Kitsap County, or as hereafter amended, shall be used as the supplemental technical guidance for the KCSWDM for the design, installation, and maintenance of rain gardens.

Stormwater Standard Plans – The City of Tacoma Standard Plans currently found at www.cityoftacoma.org/government/city_departments/public_works/engineering/city_of_tacoma_right_of_way_design_manual are approved by the City of SeaTac on a conceptual basis. City of SeaTac development review staff will work with applicants to review and implement these standard details.

Stormwater System Maintenance Standards – The Maintenance Standards for both public and private stormwater systems are identified in Chapter 6, ~~and Appendix A,~~ and Appendix C of the KCSWDM and Appendix C of this document.

~~Operations and Maintenance Standards~~ Supplemental Guidelines for Public Right of Way Operations and Maintenance – The most recent edition of the Regional Road Maintenance - Endangered Species Act Program Guidelines currently found at <http://www.kingcounty.gov/transportation/kedot/Roads/environment/RegionalRoadMaintenanceESAGuidelines/ESAProgramGuidelines.aspx> ~~www.kingcounty.gov/depts/transportation/roads/endangered-species-act-reports.aspx~~, or as hereafter amended, shall be used to supplement the above mentioned stormwater system maintenance standards for work done in the public right of way, as well as public stormwater systems.

Supplemental Snow and Ice Policy – The City of SeaTac ~~shall will~~ use snow melt materials (i.e., salt brine) ~~as often as necessary on public roads during snow and ice events in an effort to maintain safe travel on roadways while public safety and commerce.~~ Snow melt materials shall be applied ~~as often as necessary, to the minimum extent necessary in an effort to minimizeing the~~ potential of water quality impacts (i.e., debris entering the storm system).

Vegetation and Land Management Standards - The most recent edition of the City of SeaTac Integrated Pest and Vegetation Management Plan shall be used as guidance for pest, vegetation and land management activities for all properties or facilities owned or operated by the City of SeaTac.

Code Reference Tables

King County Code is referenced in many places throughout the KCSWDM. The following tables identify these code references and equivalent city code where applicable.

King County Code to SeaTac Municipal Code (SMC) Reference Table			
King County Code Reference	Subject of Reference	SMC Equivalent	Comment
KCC 2.98	Adoption Procedures	1.01	
KCC 2.98	Critical Drainage Areas (CDAs), adoption procedures	12.10.080	
Title 9	Surface Water Management	12.10 & 12.30	
KCC 9.04	Surface Water Run-off Policy: Variances	No Equivalent	The City relies on the adjustment process identified in the KCSWDM
<u>KCC 9.04</u>	<u>Stormwater Runoff and Surface Water and Erosion Control</u>	<u>No Equivalent</u>	<u>In the absence of equivalent SMC, the City will use the King County Code for all general references to KCC 9.04</u>
KCC 9.04.030	Definitions: Targeted Drainage Review/abbreviated evaluation	No Equivalent	In the absence of equivalent SMC, the City will use King County's definition
KCC 9.04.030	<u>Drainage review – when required - type</u>	No Equivalent	In the absence of equivalent SMC, the City will use King County's definition
KCC 9.04.030	Large Project Full Drainage Review	No Equivalent	The SMC does not list additional drainage review requirements and relies on the KCSWDM
KCC 9.04.050	Drainage review - requirements	No Equivalent	The SMC does not list additional drainage review requirements and relies on the KCSWDM
KCC 9.04.070	Engineering plans for the purposes of drainage review	Not Applicable	County Code refers to internal DDES procedures and is referenced only in definition of DDES
KCC 9.04.090	Construction timing and final approval	12.10.100	<u>The City also has Subdivision Standard Plan Notes</u>

King County Code to SeaTac Municipal Code (SMC) Reference Table

King County Code Reference	Subject of Reference	SMC Equivalent	Comment
9.04.100	<u>Liability Requirements insurance required</u>	12.10.110 - 12.10.150	
KKCC 9.04.115	Drainage facilities accepted by King County <u>for maintenance</u>	No Equivalent	SeaTac generally does not accept stormwater facilities unless they are constructed in the public ROW
KCC 9.04.120	Drainage facilities <u>not</u> accepted by King County <u>for maintenance</u>	No Equivalent	SeaTac generally does not accept stormwater facilities unless they are constructed in the public ROW
K.C.C. 9.05.050	Drainage review - requirements	Not Applicable	King County Code section does not exist. Presumed typo. See KCC 9.04.050
KCC 9.12.025	<u>Prohibited, allowable, and conditional discharges in the Water Quality Section</u>	<u>12.12.020, 12.12.030, and 12.12.040</u>	
KCC 9.12	Water Quality	12.12 No Equivalent	In the absence of equivalent SMC, the City will use the King County Code for all general references to KCC 9.12
KCC 9.12.035	<u>Water Quality: Stormwater Pollution Prevention Manual Adoption</u>	No Equivalent	Adopted via SeaTac Addendum to KCSWDM
<u>Title 10</u>	<u>Seattle-King County Department of Public Health solid waste regulations</u>	<u>7.40</u>	
KCC 16.62	Erosion and Sediment Control	Not Applicable	King County Code section does not exist. Presumed typo. See KCC 16.82 below.
KCC 16.82	Clearing and Grading Code: Bridge Design	No Equivalent	In the absence of City standards for bridge design, the City will rely on King County <u>Road Design and Construction standards and the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction</u>
KCC 16.82	Clearing and Grading Code: Clearing Limit	13.190.150 No Equivalent	In the absence of City standards for clearing limits, the City will rely on King

King County Code to SeaTac Municipal Code (SMC) Reference Table

King County Code Reference	Subject of Reference	SMC Equivalent	Comment
			<u>County standards.</u>
<u>KCC 16.82.095(A)</u>	<u>Erosion and sediment control standards</u>	<u>No Equivalent</u>	<u>In the absence of City standards for seasonal construction limitations, the City will rely on King County standards</u>
KCC 16.82.095(A)	Erosion and sediment control standards-seasonal limitation period	No Equivalent	In the absence of City standards for seasonal construction limitations, the City will rely on King County standards
KCC 16.82.100(F)	Grading Standards: Preservation of Duff Layer	No Equivalent	<u>Appendix B of this addendum includes the City's Soil Amendment requirements. In the absence of City standards for preservation of the duff layer, the City will rely on King County standards</u>
KCC 16.82.100(G)	Grading Standards: Soil Amendments	No Equivalent	<u>Appendix B of this addendum includes the City's Soil Amendment requirements. In the absence of City standards for soil amendments, the City will rely on King County standards</u>
KCC 16.82.150	Clearing standards for individual lots in the rural zone	Not Applicable	SMC does not contain rural zoning classification
KCC 16.82.150 (C)	Clearing standards for individual lots in the rural zone	Not Applicable	SMC does not contain rural zoning classification
<u>KCC 16.85</u>	<u>Clearing and Grading Code: Flood protection facilities</u>	<u>Not Applicable</u>	<u>King County Code section does not exist. Presumed typo. See KCC 16.82 below.</u>
KCC 20.20 or Title 20.20	Land Use Review Procedures	16A	
<u>KCC 20.70.020</u>	<u>Critical aquifer recharge area map adoption</u>	<u>15.700</u>	

King County Code to SeaTac Municipal Code (SMC) Reference Table

King County Code Reference	Subject of Reference	SMC Equivalent	Comment
KCC 21A or Title 21A	Critical Areas Requirements	45.30 15.700	
KCC 21A	Definitions: Critical Aquifer Recharge Area	45.30.370	
KCC 21A.06	Definitions: Erosion Hazard Area	45.10.245 15.700	
KCC 21A.06	Definitions: Flood Hazard Area	15.700 45.10.267	
KCC 21A.06	Definitions: Landslide Hazard Area	No Equivalent	SMC does not contain an equivalent definition
KCC 21A.06	Definitions: Steep Slope Hazard Area	15.700 45.10.613	
KCC 21A.06	Definition: Structure	15.700 45.10.634	
KCC 21A.06	Definitions: Critical Aquifer Recharge Area	15.700 45.30.370	
KCC 21A.06	Definitions: Flood, Erosion, Steep Slope Hazard Areas	45.10	
KCC 21A.06	Definitions: Flood Hazard Area	45.10.267	
KCC 21A.06	Definitions: (Nonconversion) Forest Practices	Not Applicable	City of SeaTac only reviews Type IV - Conversion, forest practice permits
K.C.C. 21A.06.1340	Urban planned development land use designation	Not Applicable	SMC contains no equivalent comprehensive plan land use designation
KCC 21A.08	Definitions: Land Zoned for Agriculture (A zoned lands)	Not Applicable	SMC does not contain agricultural zoning classification

King County Code to SeaTac Municipal Code (SMC) Reference Table

King County Code Reference	Subject of Reference	SMC Equivalent	Comment
KCC 21A.12	Definitions: Urban Residential Development	Not Applicable <u>15.200</u>	<u>The City of SeaTac Zoning Map contains Urban Low Density Residential (UL), Urban Medium Density Residential (UM), and Urban High Density Residential (UH). SMC contains no equivalent comprehensive plan land use designation.</u>
KCC 21A.12.030	Impervious Surface Coverage	<u>15.400.015</u> <u>15.13.111</u>	<u>Only one zone in the City (Business Park [BP]) contains a maximum impervious surface coverage development standard.</u>
KCC 21A.12.030	Impervious Surface Coverage for Residential Subdivisions	Not Applicable <u>15.15.180</u>	<u>The City does not have impervious surface coverage development standards for residential subdivisions.</u>
KCC 21A.14.180	Onsite recreational space	<u>15.510.500 – 15.510.560</u> <u>15.19.500, 15.23.350, 15.35.400, 15.38.500, 15.39.400 & 14.21.010(E)</u>	<u>The City allows vegetated roofs that are accessible to the general public and permeable pavement trails to count towards multi-purpose outdoor recreation and open space.</u>
KCC 21A.14.180.D	21A.14.180 On-site recreation - space required.	<u>15.510.510</u> <u>15.19.500, 15.23.350, 15.35.400, 15.38.500, 15.39.400 & 14.21.010(E)</u>	<u>The City allows vegetated roofs that are accessible to the general public and permeable pavement trails to count towards multi-purpose outdoor recreation and open space.</u>
KCC 21A.24	Critical Areas Code: 100-Year Floodplain	<u>15.700</u> <u>15.30.210</u>	
KCC 21A.24	Critical Areas Code: Bridge Design	No Equivalent	<u>In the absence of City standards for bridge design, the City will rely on King County Road Design and Construction standards and the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction.</u>

King County Code to SeaTac Municipal Code (SMC) Reference Table

King County Code Reference	Subject of Reference	SMC Equivalent	Comment
KCC 21A.24	Critical Areas Code: Bridge pier and abutment locations	No Equivalent	In the absence of City standards for bridge and pier location, the City will rely on King County <u>Road Design and Construction standards and the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction</u>
<u>KCC 21A.24</u>	<u>Critical Areas Code: Critical Area Buffers</u>	<u>15.700</u>	
KCC 21A.24	Critical Areas Code: Building Setbacks	15.30.190 <u>15.700</u>	
KCC 21A.24	Critical Areas Code: Channel Migration Zone	No Equivalent	In the absence of City standards for channel migration zones, the City will rely on King County standards
KCC 21A.24	Critical Areas Code: Definition Streams	15.10.620 <u>15.700</u>	
<u>KCC 21A.24</u>	<u>Critical Areas Code: Requirements of crossing streams</u>	<u>15.700</u>	
KCC 21A.24	Critical Areas Code: Definition Wetlands/Wetland Soils	15.10.675 <u>15.700</u>	
KCC 21A.24	Critical Areas Code: Fish Passage Requirements	15.30.350 <u>15.700</u>	
KCC 21A.24	Critical Areas Code: Flood Hazard Area regulations	15.30.200 15.30.250 <u>15.700</u>	
KCC 21A.24	Critical Areas Code: Floodplain/Floodway Delineation	15.30.200 15.30.250 <u>15.700</u>	
KCC 21A.24	Critical Areas Code: Floodplain Data	15.30.200 15.30.250 <u>15.700</u>	
KCC 21A.24	Critical Areas Code: Flood Protection facility	No Equivalent	In the absence of City standards for flood protection facilities, the City will rely on King County standards

King County Code to SeaTac Municipal Code (SMC) Reference Table

King County Code Reference	Subject of Reference	SMC Equivalent	Comment
KCC 21A.24	Critical Areas Code: Notice on Title	15.30.170 15.700	
KCC 21A.24	Critical Areas Code: Regulation of Wetlands	15.30.290 - 15.30.330 15.700	
KCC 21A.24	Critical Areas Code: zero-rise and compensatory storage provisions	No Equivalent15.700	In the absence of City standards for zero-rise and compensatory storage, the City will rely on King County standards
KCC 21A.24	Definitions: Critical Area Ordinance (CAO)	15.30 15.700	See - Environmentally Sensitive Areas Code
KCC 21A.24	Farm Management Plans	Not Applicable	The City does not have Farm Management Plan code.
KCC 21A.24	Floodplain Development Standards: Bridges	No Equivalent	In the absence of City standards for bridge design, the City will rely on King County <u>Road Design and Construction standards</u> and the <u>WSDOT Standard Specifications for Road, Bridge, and Municipal Construction</u>
KCC 21A.24	Notice on Title: Erosion Hazard Areas	15.30.170	
KCC 21A.24, KCC 16.82	Rural Stewardship Plan or Farm Management Plan	Not Applicable	The City does not have Rural Stewardship Plan code.
KCC 21A.24	Sensitive Area	15.10.564 15.700	
KCC 21A.24	Sensitive Area Tract	15.700 15.30.180	
KCC 21A.24.100	Critical Area Review	15.700 15.30.400	
KCC 21A.24.110	Critical Area Reports	15.700 15.30.110 - 15.30.120	
KCC 21A.24.170	Notice on Title	15.700 15.30.170	

King County Code to SeaTac Municipal Code (SMC) Reference Table

King County Code Reference	Subject of Reference	SMC Equivalent	Comment
KCC 21A.24.230	Floodplain and Flood Hazard Areas	15.70015.30.210 15.30.250	
KCC 21A.24.270	Notice on Title FEMA Elevation Certification	15.700 15.30.170	
KCC 21A.24.275	channel migration zone development standards	<u>Not Applicable</u> No Equivalent	In the absence of City standards for development in the channel migration zone, the City will rely on King County standards
KCC 21A.25	Shorelines code	Title 18	
K.C.C. 21A.38	Property-specific development standards or special-district overlays	15.28	
K.C.C. 23.20	Code Compliance: Citations	1.15.065	
K.C.C. 23.24	Code Compliance: Notice and Orders	1.15.120 – 1.15.140	
K.C.C. 23.28	Code Compliance: Stop-Work Orders	1.15.120 – 1.15.140	
KCC 23.40	Code Compliance: Liens references on declaration of covenants form	1.15.200	
KCC 25 <u>or</u> <u>Title 25</u>	Shoreline Management: Bridge Design	No Equivalent <u>Not Applicable</u>	In the absence of City standards for bridge design, the City will rely on King County standards

Reference Materials

This section identifies which reference materials provided in the 2009 KCSWDM are applicable and which are not. It also identifies if equivalent City of SeaTac reference materials are available.

Notes:

~~Reference materials that have been struck through (i.e. struck through) are not applicable to projects in the City of SeaTac.~~

~~Reference materials that have been struck through and highlighted (i.e. struck through and highlighted) are not applicable, however equivalent City of SeaTac documents are available through the Public Works Department, Development Services Se~~

1. ~~KCC 9.04 – Surface Water Runoff Policy~~
2. ~~Adopted Critical Drainage Areas~~
3. ~~Other Adopted Area Specific Drainage Requirements~~
 - A. ~~RA Zone Clearing Restrictions~~
4. ~~Other Drainage Related Regulations and Guidelines~~
 - A. ~~Grading Code Soil Amendment Standard~~
 - B. ~~Clearing & Grading Seasonal Limitations~~
 - C. ~~Landscape Management Plan Guidelines~~
 - D. ~~Shared Facility Maintenance Guidance~~
5. ~~Wetland Hydrology Protection Guidelines~~
6. ~~Hydrologic/Hydraulic Design Methods~~
 - A. ~~EPA Infiltration Rate Test~~
 - B. ~~Pond Geometry Equations~~
7. ~~Engineering Plan Support~~
 - A. ~~King County Standard Map Symbols~~
 - B. ~~Standard Plan Notes and Example Construction Sequence~~
 - C. ~~Stormfilter Access and Cartridge Configuration~~
8. ~~Forms and Worksheets~~
 - A. ~~Technical Information Report (TIR) Worksheet~~
 - B. ~~Offsite Analysis Drainage System Table~~
 - C. ~~Water Quality Facility Sizing Worksheets~~
 - D. ~~Flow Control and Water Quality Facility Summary Sheet and Sketch~~
 - E. ~~CSWPPP Worksheet Forms~~
 - F. ~~Adjustment Application and Process Guidelines~~
 - G. ~~Dedication and Indemnification Clause – Final Recording~~
 - H. ~~Bond Quantities Worksheet~~
 - I. ~~Maintenance and Defect Agreement~~
 - J. ~~Drainage Facility Covenant~~
 - K. ~~Drainage Release Covenant~~
 - L. ~~Drainage Easement~~
 - M. ~~Flow Control BMP Covenant~~
 - N. ~~Impervious Surface Limit Covenant~~
 - O. ~~Clearing Limit Covenant~~
 - P. ~~River Protection Easement~~
 - Q. ~~Leachable Metals Covenant~~
9. ~~Interim Changes to Requirements~~
10. ~~King County Identified Water Quality Problem~~

Appendix A – Hydrologic Analysis of the Des Moines
Creek Regional Detention Facility (July 23, 2003
Memorandum from the Department of Ecology)

~~Additional Reference Materials~~



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Northwest Regional Office • 3190 160th Avenue SE • Bellevue, Washington 98008-5452 • (425) 649-7000

July 23, 2003

Mr. David Masters, Project Coordinator
Des Moines Creek Regional Detention Facility Planning Committee
P.O. Box 4008
Seattle, WA 98194

Dear Mr. Masters;

Re: Hydrologic Analysis of the Des Moines Creek Regional Detention Facility

We have reviewed the following reports submitted by you on behalf of the members of the Des Moines Creek Planning Committee:

- *Hydrologic Analysis of the Des Moines Creek Regional Detention Facility Using HSPF*
- *Des Moines Creek Regional Capital Improvement Project, Preliminary Design Report (including the Alternatives Analysis, Alternative Analyses Addendum, and Appendices A, B, D, and E).*
- *Des Moines Creek Basin Plan*

We find that these documents are responsive to the Department of Ecology's *Stormwater Management Manual for Western Washington, Appendix A, Guidance for Altering the Minimum Requirements Through Basin Planning*. The information submitted provides sufficient technical data to justify an alternative to the department's recommended minimum requirement for flow control within the Des Moines Creek Watershed. The alternative receiving the department's concurrence requires the implementation of three recommendations from the subject reports:

- A Des Moines regional detention facility in the Tyee Golf Course at the southern end of Sea-Tac airport, north of South 200th St., including two new stormwater detention ponds referred to as the Northwest Pond and the Approach Light Road Pond, as further described in the documents.
- Two bypass pipelines; a 48-inch diameter line to carry flow from the existing Tyee Regional Stormwater Pond to the Northwest Pond, and a 30-inch diameter line from the Tyee Pond to an abandoned sanitary sewer line that will be refurbished to carry stormwater to Puget Sound.

Hydrologic Analysis of the Des Moines Creek Regional Detention Facility

July 23, 2003

Page 2 of 2

- Application of the King County Runoff Time Series (KCRTS) flow model or other DOE approved models, the King County Level 1 flow control standard, and the 1994 land use condition as the pre-developed condition for sizing flow control facilities for new development and redevelopment once the regional facilities and bypass lines are constructed and operational.

This concurrence should not be construed as the issuance of the necessary permits for construction of the above projects.

Because the planning documents do not provide alternative recommendations to the water quality treatment guidance provided in the 2001 Stormwater Management Manual for Western Washington, the Department of Ecology encourages the local governments to use the manual recommendations for new development and redevelopment. In addition, the Department encourages the Basin Committee to continue planning to address the existing water quality problems of the creek. The chemical parameters identified in the planning documents that exceed applicable water quality standards include: fecal coliform bacteria, temperature, dissolved copper and zinc. In addition, because of the relatively urbanized nature of the watershed, it is likely that concentrations of various polycyclic aromatic hydrocarbons and pesticides are periodically problematic.

We congratulate the local governments on their foresight, determination, and commitment to identify and implement a strategy that should give Des Moines Creek and its biologic resources a much improved chance at not only surviving, but thriving.

Sincerely,



Kevin C. Fitzpatrick
Water Quality Manager
Northwest regional Office

KCF:ha:jc

Cc: Donald Althausen, P.E., King County
Ed O'Brien, P.E., DOE, Water Quality, HQ
Ed Abbasi, Water Quality, NWRO

Appendix B – Soil Amendment Requirements

~~Soil Amendment Requirements~~

~~{King County Clearing and Grading Code 16.82.100 (F) & (G)}~~

~~F. The duff layer and native topsoil shall be retained in an undisturbed state to the maximum extent practicable. Any duff layer or topsoil removed during grading shall be stockpiled on-site in a designated, controlled area not adjacent to public resources and critical areas. The material shall be reapplied to other portions of the site where feasible.~~

~~G.1. Except as otherwise provided in subsection G.2. of this section, areas that have been cleared and graded shall have the soil moisture holding capacity restored to that of the original undisturbed soil native to the site to the maximum extent practicable. The soil in any area that has been compacted or that has had some or all of the duff layer or underlying topsoil removed shall be amended to mitigate for lost moisture holding capacity. The amendment shall take place between May 1 and October 1. The topsoil layer shall be a minimum of eight inches thick, unless the applicant demonstrates that a different thickness will provide conditions equivalent to the soil moisture holding capacity native to the site. The topsoil layer shall have an organic matter content of between five to ten percent dry weight and a pH suitable for the proposed landscape plants. When feasible, subsoils below the topsoil layer should be scarified at least four inches with some incorporation of the upper material to avoid stratified layers. Compost used to achieve the required soil organic matter content must meet the definition of "composted materials" in WAC 173-350-220.~~

~~G2. This subsection does not apply to areas that:~~

- ~~a. Are subject to a state surface mine reclamation permit; or~~
- ~~b. At project completion are covered by an impervious surface, incorporated into a drainage facility or engineered as structural fill or slope. (King County Ord. 16267 § 5, 2008: Ord. 15053 § 10, 2004: Ord. 13190 § 4, 1998: Ord. 3108 § 8, 1977: Ord. 1488 § 11, 1973).~~



Soil Amendment ~~Standards~~ Requirements

(Required as of Effective February 15, 2010)
Revised December 31, 2016

Preserving and Restoring Healthy Soils on Site Developments

Healthy soil is vital to a clean environment and healthy landscapes. Deep soil that is rich in organic material absorbs rainwater, helps prevent flooding and soil erosion, and filters out water pollutants. Healthy soil also stores water and nutrients for plants to use in dry times, promoting healthy plants that require less irrigation, toxic pesticides, and other resources. Land development and landscaping practices can damage these valuable soil functions by removing or compacting topsoil. The result is erosion, unhealthy landscapes that are difficult and expensive to maintain, polluted water, destroyed fish habitat, and increased need for costly stormwater management structures. (King County 20112005 "Achieving the Post-construction Soil Standard")

Purpose

This document is intended to describe how to meet these soil amendment requirements, as well as provide clarifications and minor modifications to King County's soil amendment requirements in terms of seasonal restrictions and cash assignment requirements. Additional guidance for this BMP can be found in *Building Soil: Guidelines and Resources for Implementing Soil Quality and Depth BMP T5.13* (Stenn et al. 2012), which is available at www.buildingsoil.org.



Infeasibility Criteria

Exemptions:

The following portions of the project area are considered to be infeasible for soil amendment:

- Areas covered by an impervious surface, ~~or~~

- o Areas incorporated into a drainage facility, or
- o Areas that are subject to a state surface mine reclamation permit
- o Structural fill or engineered slopes
- o Till soils with slopes greater than 33 percent

Soil Amendment Standards Requirements

The City of SeaTac's soil amendment ~~standards~~ requirements apply to projects that:

~~As of February 15, 2010 the City of SeaTac adopted King County's soil amendment requirements (KCC 16.82.100.F & G), in the absence of City of SeaTac standards, as a part of the City's National Pollutant Discharge Elimination System (NPDES) compliance efforts. These soil standards apply to projects that:~~

1. Create 2,000 square feet or more of new impervious surface, or
2. Result in 7,000 square feet or more of land disturbing activity.

Key Requirements and Modifications of King County's Standards

KCC 16.82.100.F & G have been amended by the City of SeaTac to include the following:

- The duff layer and native topsoil shall be retained in an undisturbed state to the maximum extent practicable. Any duff layer or topsoil removed during grading shall be stockpiled on-site in a designated, controlled area not adjacent to public resources and critical areas. The material shall be reapplied to other portions of the site where feasible.
- Areas that have been cleared and graded shall have the soil moisture holding capacity restored to that of the original undisturbed soil native to the site to the maximum extent practicable. The soil in any area that has been compacted or that has had some or all of the duff layer or underlying topsoil removed shall be amended to mitigate for lost moisture-holding capacity.
- Soil amendment calculations and a site map indicating projected soil amendment areas are due at the time of project application submittal.
- Unlike King County, the City of SeaTac **does not** limit the installation of soil amendments to the growing season (May 1 – October 1). However, soil amendments, whether compost or topsoil, shall be installed in a manner that will prevent off-site impacts from construction site run-off. Further, soil amendments are subject to "Wet Season Construction" requirements (2009-2016 KCSWDM).
- Cash Assignments:
 - o Owners/contractors may provide a cash assignment for soil amendments if requesting final approval between October 1 – May 1 (during the rainy season)
 - o Cash assignment amounts shall equal to ~~150~~120% x (materials + labor)
 - o Owners/contractors must provide documentation ensuring legal access to the site (via construction easement, condition of sale, etc.) to install soil amendments as a condition of cash assignment acceptance/approval
 - o Cash assigned soil amendments shall take place ~~the during the following year during the growing season~~ (May 2 – September 30) immediately following the date of the cash assignment
 - ~~Plats/subdivision are allowed to extend the cash assignment period for single family lots (only) for one year beyond period identified above~~

- Imported Topsoil layer requirements:
 - Topsoil must be a minimum 8 inches thick
 - Topsoil must have an organic matter content of 5% dry weight in turf areas – and 10% dry weight in planting beds between 5% – 10%
 - Topsoil must have a suitable pH for proposed landscape plants
 - When feasible, the subsoil layer shall be scarified at least 4 four to six inches with some incorporation of upper material to avoid stratified layers
- Compost used to achieve the required soil organic matter content must meet the definition of "composted materials" in WAC 173-350-220.

Table B-1. Optimal soil pH range for various plant types.

Plant Type	Soil pH Range
Lawn	5.5 to 7.5
Shrubs (except acid-tolerant plants)	5.5 to 7.0
Acid-tolerant shrubs (rhododendrons, azaleas, mountain laurels, camellias, blueberries, native plants)	4.5 to 5.5
Annual flower and vegetable gardens	6.0 to 7.0

Note: A nursery can provide specific information about suitable soil pH ranges for landscape plants.

Source: King County 2011 "Achieving Post-construction Soil Standard"

Options for Meeting Soil Amendment Standards Requirements (Soil Amendment Calculations)

1) Amend Existing Soils in Place

- Turf Areas
 - Import 6.178 cubic yards compost (in accordance with 2016 KCSWDM compost specifications) per 1,000 sq. ft. of disturbed soil area
 - Spread compost evenly over the disturbed soils in a 2 2.5-inch layer
 - Rototill compost in 12 inches deep where feasible (8 inch minimum depth)
- Planting Beds
 - Import 9.25 cubic yards compost (in accordance with 2016 KCSWDM compost specifications) per 1,000 sq. ft. of disturbed soil area
 - Spread compost evenly over the disturbed soils in a 3 inch layer
 - Rototill compost in 12 inches deep where feasible (8 inch minimum depth)

Soil Amendment Calculations Example

Amount of imported compost needed to amend soils on site equals the total square footage of disturbed site soils divided by 1,000 times 6.178 cubic yards.

$$\left(\frac{\text{square feet disturbed soils}}{1,000} \right) \times 6.178 \text{ cubic yards} = \text{cubic yards of imported compost}$$

Example: Single Family Home with 3,500 square feet of post construction disturbed soil
 $(3,500 \text{ square feet disturbed soils} / 1,000) \times 6.178 \text{ cubic yard} = \text{imported compost needed}$
 $(3.5) \times 6.178 \text{ cubic yards} = \text{imported compost needed}$
 $22.28 \text{ cubic yards} = \text{imported compost needed}$

Table B-2. Soil Amendment Calculation Examples.

Other Soil Amendment Options

King County's soil amendment guide "Achieving the Post-construction Soil Standard" identifies three ~~two~~ additional options, which the City considers less feasible in an urban construction environment (i.e., non-native/disturbed soils, limited staging areas) and are not included in this document. However, these options are still available for projects within the City of SeaTac and can be found at: <http://your.kingcounty.gov/solidwaste/greenbuilding/documents/Post-Construction-Soil-Standard.pdf>~~http://your.kingcounty.gov/edes/forms/ls-inf-SoilPost-ConStd.pdf~~. These options ~~include~~ are listed in King County's guidance document as:

- **Option 1: Leave native soil undisturbed, and protect from compaction during construction**
[Note: This option is only available for sites which contain previously undisturbed native soils, such as undisturbed forested lots.]
- ~~• **Native Soil: Stockpile site duff and topsoil, and reapply after grading and construction**
[Note: This option is only available for sites which contain previously undisturbed native soils, such as undisturbed forested lots.]~~
- **Option 4: Disturbed Soil: Stockpile site soil, reapply, and amend in place**

Inspection Approval of Soil Standards Requirements

Soil amendments should take place at the final stage of construction, to ensure soil amendments are not damaged by construction activities. Contractors/property owners needing a soil amendment inspection should call the City at 206.973.4764 and request a Final Erosion Sedimentation Control Inspection (FESC). For single family construction call 206.973.4764. For commercial or multifamily construction call 206.973.4730.

- Call in FESC inspection after installation of soil amendments, prior to installation of landscaping.
- Provide City inspector with a site map indicating areas needing soil amendments, as well as soil amendment calculations (see for formulas calculation examples on previous pages).
- If amending soil in place, provide City inspector with copies of site specific receipts of delivered compost indicating the volume of materials delivered in cubic yards.
- If importing topsoil mix, provide City inspector with copies of site specific receipts of delivered materials indicating volumes in cubic yards and organic content of topsoil.
 - The contractor shall also provide documentation to confirm that the imported top soil is at an appropriate pH for the proposed landscaping (refer to Table B-2).
- The inspector may require random locations for test pits to be dug to confirm depths of soil amendments and scarification.
- If soil ~~standards~~ requirements have been met, the City inspector will indicate a partial approval "soil ~~standards~~ requirements met" on the Inspection Card.

Soil pH by Plant Type

A nursery can provide specific information about suitable pH for landscape plants. Here are optimal soil pH ranges for various plant types:

Lawns — 5.5 to 7.5 pH

Shrubs (except acid-tolerant plants) — 5.5 to 7.0 pH

Acid-Tolerant Shrubs (Rhododendrons, Azaleas, Mountain Laurels, Camellias, Blueberries, native plants) — 4.5 to 5.5 pH

Annual Flower and Vegetable Gardens — 6.0 to 7.0 pH

(King County 2005 "Achieving Post-construction Soil Standard")

Appendix C – Design and Maintenance Criteria for
BMPs/Facilities not included in the KCSWDM

BMP T5.17: Vegetated Roofs

Purpose and Definition

Vegetated roofs (also known as ecoroofs and green roofs) are thin layers of engineered soil and vegetation constructed on top of conventional flat or sloped roofs. Vegetated roofs can provide multiple benefits, including stormwater volume reduction and flow attenuation. The range of benefits for a green roof depends on a number of design factors such as plant selection, depth and composition of soil mix, location of the roof, orientation and slope, weather patterns, and the maintenance plan.

All vegetated roofs consist of four basic components: a waterproof membrane, a drainage layer, a light-weight growth medium, and vegetation (see [Figure 5.3.7](#)). In addition to these basic components, many systems may also incorporate a protection layer and root barrier to preserve the integrity of the waterproof membrane, a separation/filter layer to stabilize fine particles, capillary mats and mulch/mats to retain moisture and prevent surface erosion due to rain and wind scour.

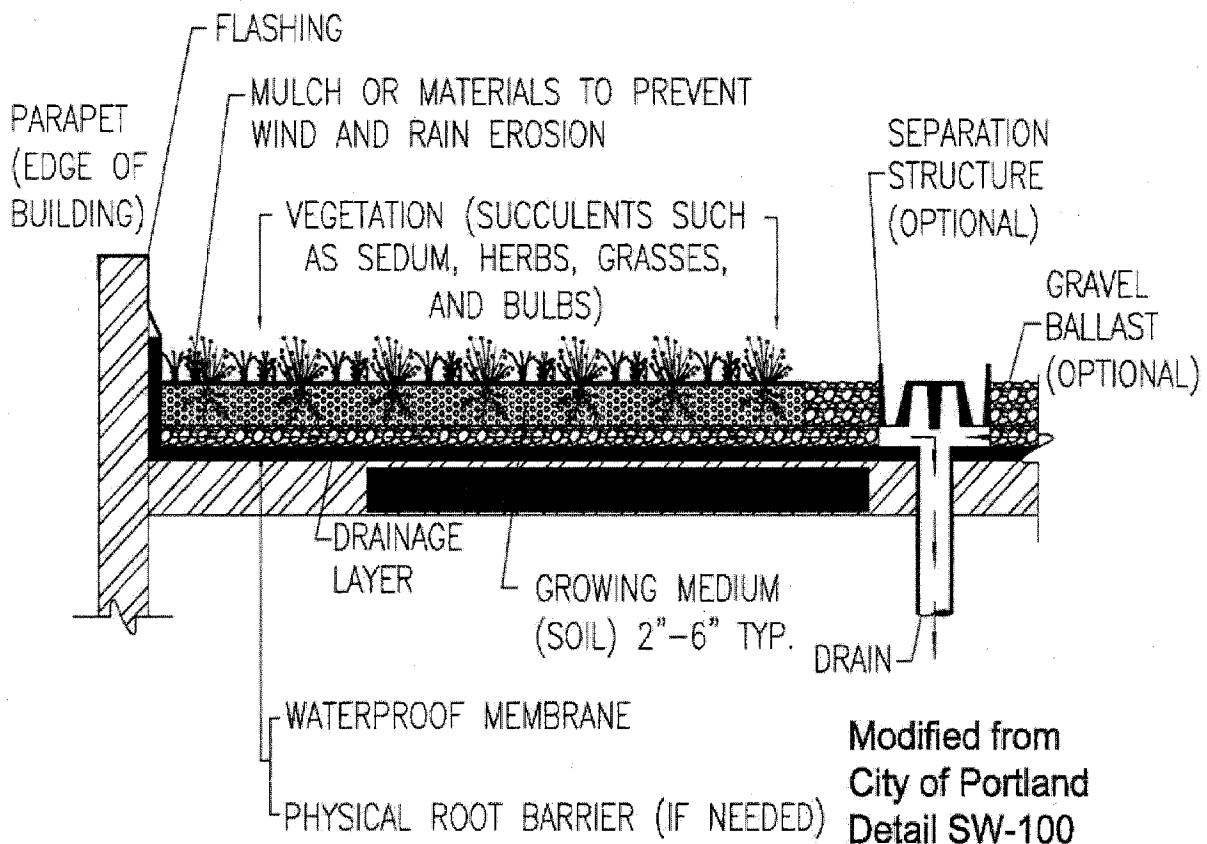


Figure 5.3.7 – Example of a Vegetated Roof Section

***Applications and
Limitations***

While vegetated roofs can be installed on slopes up to 40 degrees, slopes between 5 and 20 degrees (1:12 and 5:12) are most suitable and can provide natural drainage by gravity. Roofs with slopes greater than 10 degrees (2:12) require an analysis of engineered slope stability.

Vegetated roofs are not included in the lists referenced under Minimum Requirement #5. However, they are an option available to project designers who want to use other methods to meet the LID Performance Standard option of Minimum Requirement #5.

Design Criteria

The reader is directed to the *LID Technical Guidance Manual for Puget Sound* (2012), for a more detailed description of the components of and design criteria for vegetated roofs. It also includes references to other sources of information and design guidance.

Note that the *LID Technical Guidance Manual for Puget Sound* (2012) is for additional informational purposes only. You must follow the guidance within this manual if there are any discrepancies between this manual and the *LID Technical Guidance Manual for Puget Sound* (2012).

***Runoff Model
Representation***

See Appendix III-C in Volume III for a summary of how vegetated roofs may be entered into the approved continuous runoff models.

Table 11. Maintenance Standards and Procedures for Vegetated Roofs.

Component	Recommended Frequency ^a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Growth medium area				
Growth medium	A ^b		Water does not permeate growth media (runs off soil surface) or crusting is observed	Aerate (e.g., rake) or replace medium taking care not to damage the waterproof membrane
	A		Growth medium thickness is less than design thickness (due to erosion and plant uptake)	Supplement growth medium to design thickness
	B, W		Fallen leaves or debris are present	Remove/dispose
	A, W, S		Growth media erosion/scour is visible (e.g., gullies)	<ul style="list-style-type: none"> Take steps to repair or prevent erosion Fill, hand tamp, or lightly compact, and stabilize with additional soil substrate/growth medium (similar in nature to the original material) and additional plants
Erosion control measures	B ^c		Mat or other erosion control is damaged or depleted during plant establishment period	<ul style="list-style-type: none"> Repair/replace erosion control measures until 90% vegetation coverage attained Avoid application of mulch on extensive vegetated roofs
System Drainage and Structural Components				
Roof drain	B, S		Sediment, vegetation, or debris reducing capacity of inlet structure	<ul style="list-style-type: none"> Clear blockage Identify and correct any problems that led to blockage
	A		Pipe is clogged	Remove roots or debris
	A		Inlet pipe is in poor condition	Repair/replace

^a Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least once during the wet season (for debris/clog related maintenance, this visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm events with a 10-year or greater recurrence interval).

^b Inspection should occur during storm event.

^c Inspection should occur during plant establishment period (typically first 2 years).

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Table 11 (continued). Maintenance Standards and Procedures for Vegetated Roofs.

Component	Recommended Frequency ^a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
System Drainage and Structural Components (cont'd)				
Border zone	A		Vegetation is encroaching into border zone aggregate	Remove and dispose of weeds and transplant desirable vegetation to growth medium area
Flashing, gravel stops, utilities, or other structures on roof	A		Flashing, utilities or other structures on roof are deteriorating (can serve as source of metal pollution in vegetated roof runoff)	Repair (e.g., recoat) or replace to eliminate potential pollutant source. Note that any work done around flashings and drains should be done with care to protect the waterproof membrane.
Access and safety	B		Insufficient egress/ingress routes and fall protection	<ul style="list-style-type: none"> Maintain egress and ingress routes to design standards and fire codes Ensure appropriate fall protection
Vegetation				
Plant coverage	B		Vegetative coverage falls below 90% (unless design specifications stipulate less than 90% coverage)	<ul style="list-style-type: none"> Plant bare areas with vegetation If necessary, install erosion control measures until percent coverage goal is attained
Sedums		A (first 2 years in Spring); As needed (after first 2 years)	Extensive roof with low density sedum population	<ul style="list-style-type: none"> Mulch mow sedums- creating cuttings from existing plants to encourage colonization
Dead plants	Fall and Spring		Dead vegetation is present	Normally dead plant material can be recycled on the roof; however, specific plants or aesthetic considerations may warrant removing and replacing dead material (see manufacturer's recommendations).
Trees and shrubs—intensive vegetated roof		All pruning seasons (timing varies by species)	Pruning as needed	All pruning of mature trees should be performed by or under the direct guidance of an ISA certified arborist

^a Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least once during the wet season (for debris/clog related maintenance, this visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

^b Inspection should occur during storm event.

^c Inspection should occur during plant establishment period (typically first 2 years).

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Table 11 (continued). Maintenance Standards and Procedures for Vegetated Roofs.

Component	Recommended Frequency ^a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Vegetation (cont'd) Fertilization— extensive vegetated roof	A		Poor plant establishment and possible nutrient deficiency in growth medium	<ul style="list-style-type: none"> • Allow organic debris to replenish and maintain long-term nutrient balance and growth medium structure • Conduct annual soil test 2-3 weeks prior to the spring growth flush to assess need for fertilizer. Utilize test results to adjust fertilizer type and quantity appropriately. • Apply minimum amount slow-release fertilizer necessary to achieve successful plant establishment. • Apply fertilizer only after acquiring required approval from facility owner and operator. Note that extensive vegetated roofs are designed to require zero to minimal fertilization after establishment (excess fertilization can contribute to nutrient export)
Fertilization— intensive vegetated roof	A		Fertilization may be necessary during establishment period or for plant health and survivability after establishment	<ul style="list-style-type: none"> • Conduct annual soil test 2-3 weeks prior to the spring growth flush to assess need for fertilizer. Utilize test results to adjust fertilizer type and quantity appropriately. • Apply minimum amount slow-release fertilizer necessary to achieve successful plant establishment. • Apply fertilizer only after acquiring required approval from facility owner and operator. • Intensive vegetated roofs may require more fertilization than extensive vegetated roofs

^a Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least once during the wet season (for debris/clog related maintenance, this visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm events with a 10-year or greater recurrence interval).

^b Inspection should occur during storm event.

^c Inspection should occur during plant establishment period (typically first 2 years).

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Table 11 (continued). Maintenance Standards and Procedures for Vegetated Roofs.

Component	Recommended Frequency ^a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Vegetation (cont'd)				
Weeds		M (March – October, preceding seed dispersal)	Weeds are present	<ul style="list-style-type: none"> Remove weeds with their roots manually with pincer-type weeding tools, flame weeders, or hot water weeders as appropriate Follow IPM protocols for weed management (see “Additional Maintenance Resources” for more information on IPM protocols) By law, class A & B noxious weeds must be removed, bagged and disposed as garbage immediately Reasonable attempts must be made to remove and dispose of class C noxious weeds It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions
Noxious weeds		M (March – October, preceding seed dispersal)	Listed noxious vegetation is present (refer to current county noxious weed list)	
Irrigation System (or Watering)				
Irrigation system (if any)		Based on manufacturer's instructions	Irrigation system present	Follow manufacturer's instructions for operation and maintenance
Summer watering – extensive vegetated roof		Once every 1-2 weeks as needed during prolonged dry periods As needed	Vegetation in establishment period (1-2 years) Established vegetation (after 2 years)	Water weekly during periods of no rain to ensure plant establishment (30 to 50 gallons per 100 square feet) Water during drought conditions or more often if necessary to maintain plant cover (30 to 50 gallons per 100 square feet)

^a Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least once during the wet season (for debris/clog related maintenance, this visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm events with a 10-year or greater recurrence interval).

^b Inspection should occur during storm event.

^c Inspection should occur during plant establishment period (typically first 2 years).

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Table 11 (continued). Maintenance Standards and Procedures for Vegetated Roofs.

Component	Recommended Frequency ^a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Irrigation System (or Watering) (cont'd)				
Summer watering – intensive vegetated roof		Once every 1-2 weeks as needed during prolonged dry periods	Vegetation in establishment period (1-2 years)	<ul style="list-style-type: none"> Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist Use soaker hoses or spot water with a shower type wand when irrigation system not present
		As needed	Established vegetation (after 2 years)	Water during drought conditions or more often if necessary to maintain plant cover
Pest Control				
Mosquitoes	B, S		Standing water remains for more than 3 days after the end of a storm	<ul style="list-style-type: none"> Identify the cause of the standing water and take appropriate actions to address the problem (e.g., aerate or replace medium, unplug drainage) Manually remove standing water and direct to storm drainage system Do not use pesticides or <i>Bacillus thuringiensis israelensis</i> (Bti)
Nuisance animals	As needed		Nuisance animals causing erosion, damaging plants, or depositing large volumes of feces	<ul style="list-style-type: none"> Reduce site conditions that attract nuisance species Place predator decoys Follow IPM protocols for specific nuisance animal issues (see "Additional Maintenance Resources" in Bioretention Facilities section for more information on IPM protocols)

^a Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least once during the wet season (for debris/clog related maintenance, this visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

^b Inspection should occur during storm event.

^c Inspection should occur during plant establishment period (typically first 2 years).
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BMP T7.40: Compost-amended Vegetated Filter Strips (CAVFS)

Description

The CAVFS is a variation of the basic vegetated filter strip that adds soil amendments to the roadside embankment (See [Figure 7.4.3](#)). The soil amendments improve infiltration characteristics, increase surface roughness, and improve plant sustainability. Once permanent vegetation is established, the advantages of the CAVFS are higher surface roughness; greater retention and infiltration capacity; improved removal of soluble cationic contaminants through sorption; improved overall vegetative health; and a reduction of invasive weeds. Compost-amended systems have somewhat higher construction costs due to more expensive materials, but require less land area for runoff treatment, which can reduce overall costs.

**Soil Design
Criteria**

The CAVFS design incorporates composted material into the native soils per the criteria in BMP T5.13 for turf areas. However, as noted below, the compost shall not contain biosolids, or manure. The goal is to create a healthy soil environment for a lush growth of turf.

Soil/Compost Mix:

- Presumptive approach: Place and rototill 1.75 inches of composted material into 6.25 inches of soil (a total amended depth of about 9.5 inches), for a settled depth of 8 inches. Water or roll to compact soil to 85% maximum. Plant grass.
- Custom approach: Place and rototill the calculated amount of composted material into a depth of soil needed to achieve 8 inches of settled soil at 5% organic content. Water or roll to compact soil to 85% maximum. Plant grass. The amount of compost or other soil amendments used varies by soil type and organic matter content. If there is a good possibility that site conditions may already contain a relatively high organic content, then it may be possible to modify the pre-approved rate described above and still be able to achieve the 5% organic content target.
- The final soil mix (including compost and soil) should have an initial saturated hydraulic conductivity less than 12 inches per hour, and a minimum long-term hydraulic conductivity of 1.0 inch/hour per ASTM Designation D 2434 (Standard Test Method for Permeability of Granular Soils) at 85% compaction per ASTM Designation D 1557 (Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort. Infiltration rate and hydraulic conductivity are assumed to be approximately the same in a uniform mix soil. Note: Long term saturated hydraulic conductivity is determined by applying the appropriate infiltration correction factors as explained under “Determining Bioretention soil mix infiltration rate” under BMP T7.30.
- The final soil mixture should have a minimum organic content of 5% by dry weight per ASTM Designation D 2974 (Standard Test Method for Moisture, Ash and Organic Matter of Peat and Other Organic Soils) (Tackett, 2004).
- Achieving the above recommendations will depend on the specific soil and compost characteristics. In general, the recommendation can be achieved with 60% to 65% loamy sand mixed with 25% to 30% compost or 30% sandy loam, 30% coarse sand, and 30% compost.
- The final soil mixture should be tested prior to installation for fertility, micronutrient analysis, and organic material content.
- Clay content for the final soil mix should be less than 5%.
- Compost must not contain biosolids, manure, any street or highway sweepings, or any catch basin solids.

- The pH for the soil mix should be between 5.5 and 7.0 (Stenn, 2003). If the pH falls outside the acceptable range, it may be modified with lime to increase the pH or iron sulfate plus sulfur to lower the pH. The lime or iron sulfate must be mixed uniformly into the soil prior to use in LID areas (Low-Impact Development Center, 2004).
- The soil mix should be uniform and free of stones, stumps, roots, or other similar material larger than 2 inches.
- When placing topsoil, it is important that the first lift of topsoil is mixed into the top of the existing soil. This allows the roots to penetrate the underlying soil easier and helps prevent the formation of a slip plane between the two soil layers.

Soil Component:

The texture for the soil component of the LID BMP soil mix should be loamy sand (USDA Soil Textural Classification).

Compost Component:

Follow the specifications for compost in BMP T7.30 – Bioretention

Design Modeling Method

The CAVFS will have an “Element” in the approved continuous runoff models that must be used for determining the amount of water that is treated by the CAVFS. To fully meet treatment requirements, Ninety-one percent of the influent runoff file must pass through the soil profile of the CAVFS. Water that merely flows over the surface is not considered treated. Approved continuous runoff models should be able to report the amount of water that it estimates will pass through the soil profile.

Maintenance

Compost, as with sand filters or other filter mediums, can become plugged with fines and sediment, which may require removal and replacement. Including vegetation with compost helps prevent the medium from becoming plugged with sediment by breaking up the sediment and creating root pathways for stormwater to penetrate into the compost. It is expected that soil amendments will have a removal and replacement cycle; however, this time frame has not yet been established.

No. 20 – COMPOST AMENDED VEGETATED FILTER STRIP (CAVFS)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment accumulation on grass	Sediment depth exceeds 2 inches.	Remove sediment deposits. Relevel so slope is even and flows pass evenly through strip.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow grass and control nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 6 inches.
	Trash and debris	Trash and debris have accumulated on the vegetated filter strip.	Remove trash and debris from filter.
	Erosion/scouring	Areas have eroded or scoured due to flow channelization or high flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with a 50/50 mixture of crushed gravel and compost. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the vegetated filter strip should be regraded and reseeded. For smaller bare areas, overseed when bare spots are evident.
	Flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width

BMP T8.40: Media Filter Drain (previously referred to as the Ecology Embankment)

General Description

The media filter drain (MFD), previously referred to as the *ecology embankment*, is a linear flow-through stormwater runoff treatment device that can be sited along highway side slopes (conventional design) and medians (dual media filter drains), borrow ditches, or other linear depressions. Cut-slope applications may also be considered. The media filter drain can be used where available right of way is limited, sheet flow from the highway surface is feasible, and lateral gradients are generally less than 25% (4H:1V). The media filter drain has a General Use Level Designation (GULD) for basic, enhanced, and phosphorus treatment. Updates/changes to the use-level designation and any design changes will be posted in the *Postpublication Updates* section of the [HRM Resource Web Page](#).

Media filter drains (MFDs) have four basic components: a gravel no-vegetation zone, a grass strip, the MFD mix bed, and a conveyance system for flows leaving the MFD mix. This conveyance system usually consists of a gravel-filled underdrain trench or a layer of crushed surfacing base course (CSBC). This layer of CSBC must be porous enough to allow treated flows to freely drain away from the MFD mix.

Typical MFD configurations are shown in Figures [8.5.8](#), [8.5.9](#), and [8.5.10](#).

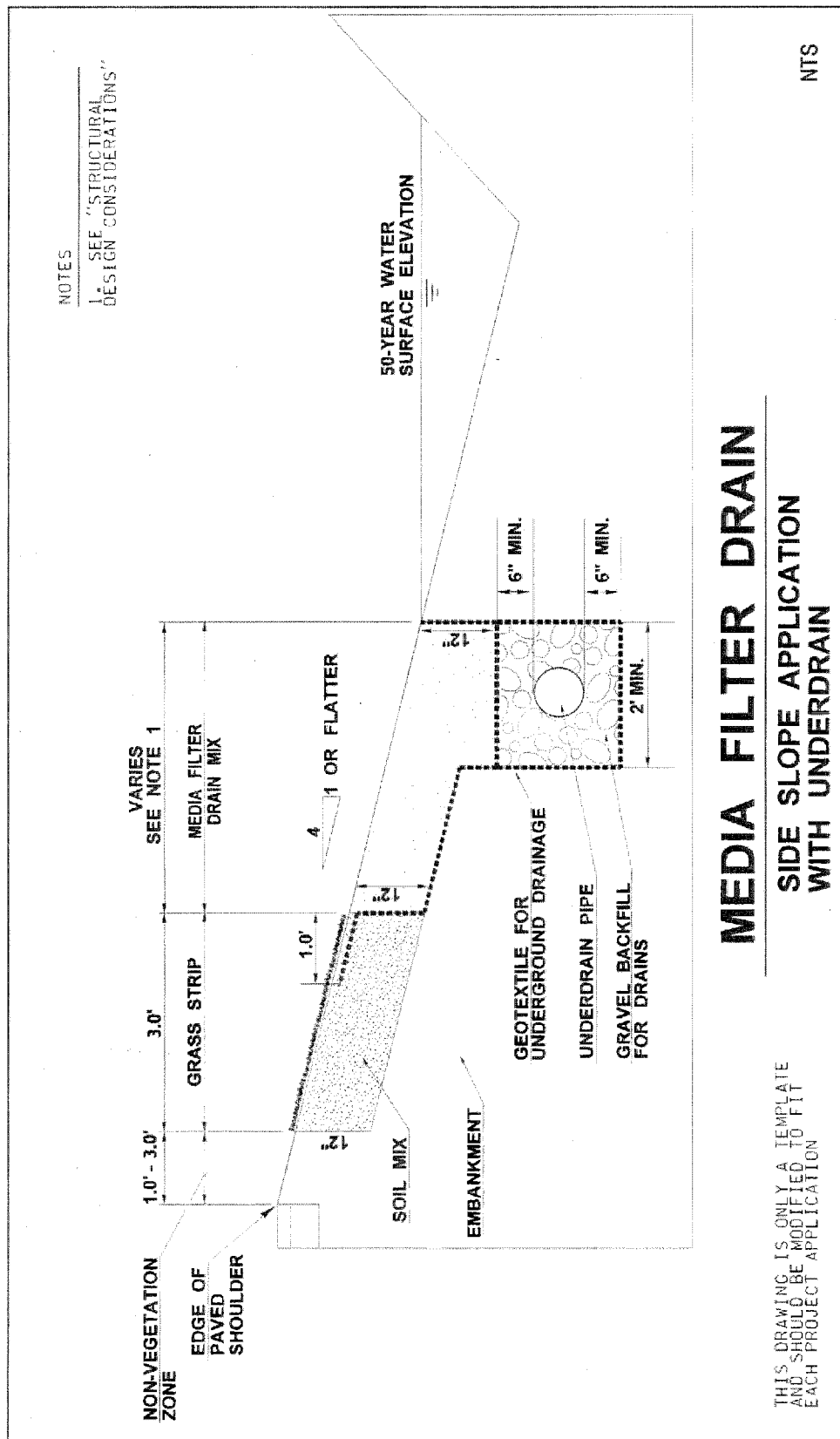


Figure 8.5.8 – Media filter drain: Cross section

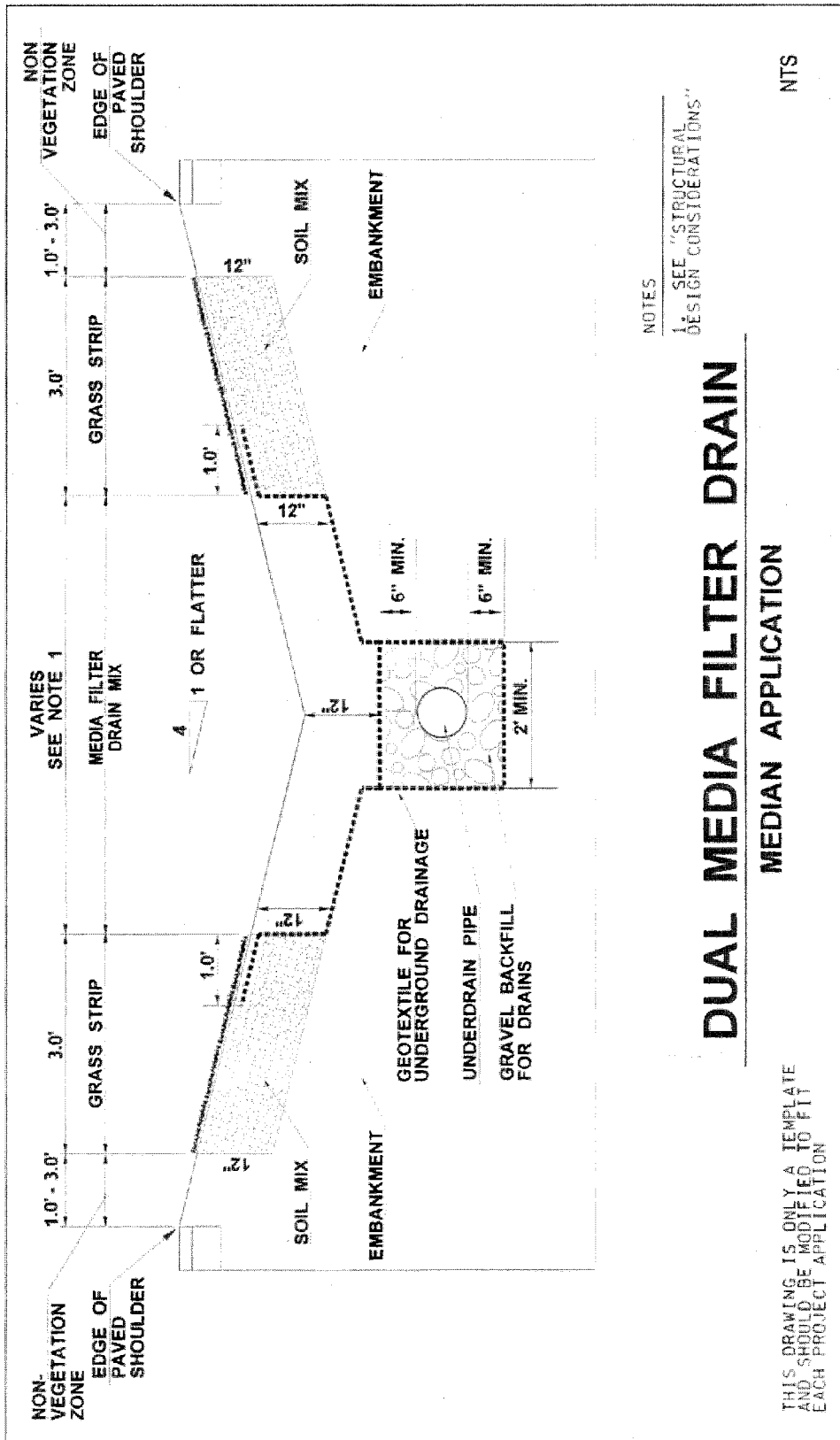


Figure 8.5.9 – Dual media filter drain: Cross section

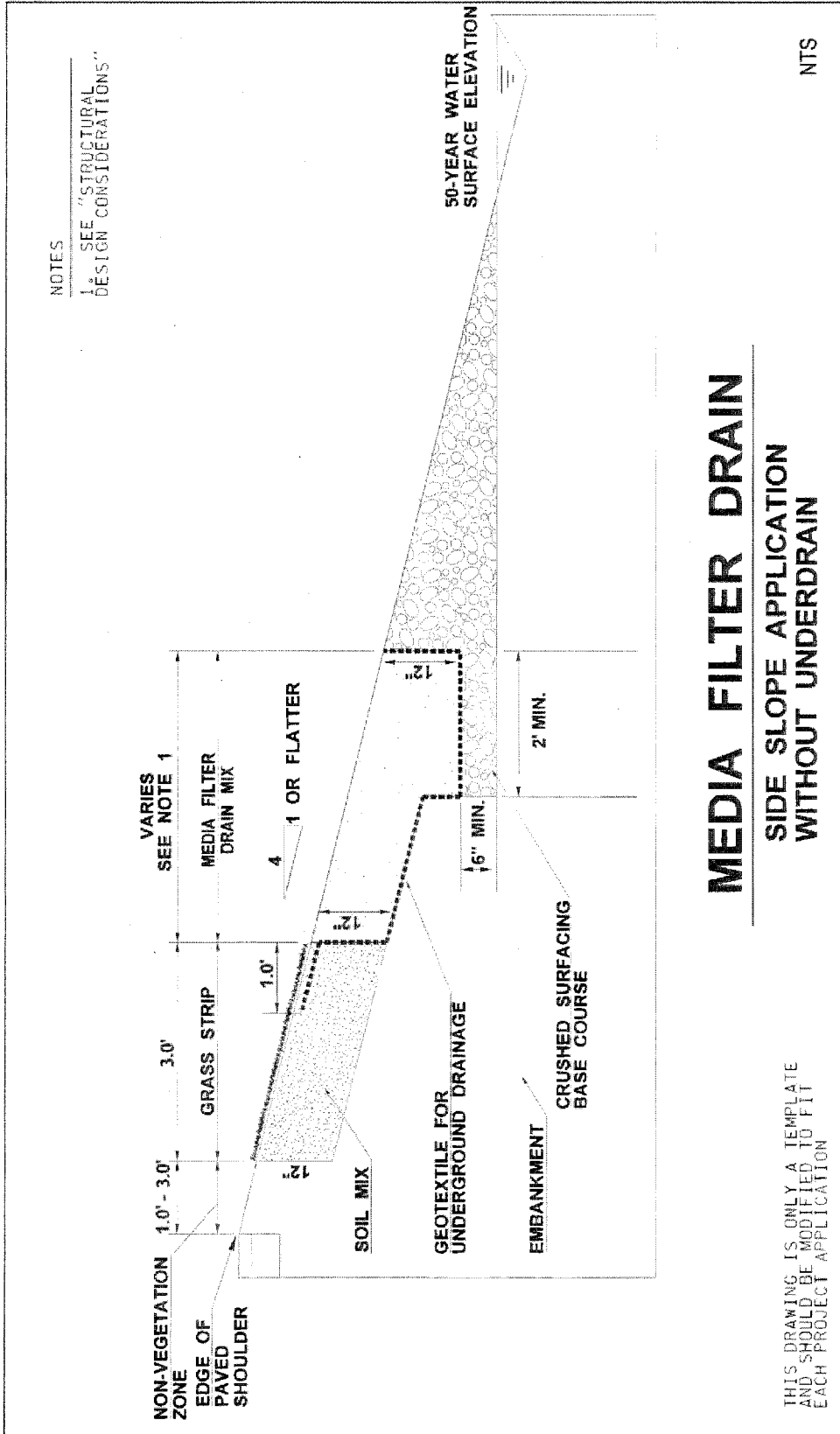


Figure 8.5.10 – Media filter drain without underdrain trench

***Functional
Description***

The media filter drain removes suspended solids, phosphorus, and metals from highway runoff through physical straining, ion exchange, carbonate precipitation, and biofiltration.

Stormwater runoff is conveyed to the media filter drain via sheet flow over a vegetation-free gravel zone to ensure sheet dispersion and provide some pollutant trapping. Next, a grass strip, which may be amended with composted material, is incorporated into the top of the fill slope to provide pretreatment, further enhancing filtration and extending the life of the system. The runoff is then filtered through a bed of porous, alkalinity-generating granular medium—the media filter drain mix. Media filter drain mix is a fill material composed of crushed rock (sized by screening), dolomite, gypsum, and perlite. The dolomite and gypsum additives serve to buffer acidic pH conditions and exchange light metals for heavy metals. Perlite is incorporated to improve moisture retention, which is critical for the formation of biomass epilithic biofilm to assist in the removal of solids, metals, and nutrients. Treated water drains from the media filter drain mix bed into the conveyance system below the media filter drain mix. Geotextile lines the underside of the media filter drain mix bed and the conveyance system.

The underdrain trench is an option for hydraulic conveyance of treated stormwater to a desired location, such as a downstream flow control facility or stormwater outfall. The trench's perforated underdrain pipe is a protective measure to ensure free flow through the media filter drain mix and to prevent prolonged ponding. It may be possible to omit the underdrain pipe if it can be demonstrated that the pipe is not necessary to maintain free flow through the media filter drain mix and underdrain trench.

It is critical to note that water should sheet flow across the media filter drain. Channelized flows or ditch flows running down the middle of the dual media filter drain (continuous off-site inflow) should be minimized.

***Applications and
Limitations***

In many instances, conventional runoff treatment is not feasible due to right of way constraints (such as adjoining wetlands and geotechnical considerations). The media filter drain and the dual media filter drain designs are runoff treatment options that can be sited in most right of way confined situations. In many cases, a media filter drain or a dual media filter drain can be sited without the acquisition of additional right of way needed for conventional stormwater facilities or capital-intensive expenditures for underground wet vaults.

Applications

Media Filter Drains

The media filter drain can achieve basic, phosphorus, and enhanced water quality treatment.

Since maintaining sheet flow across the media filter drain is required for its proper function, the ideal locations for media filter drains in highway settings are highway side slopes or other long, linear grades with lateral side slopes less than 4H:1V and longitudinal slopes no steeper than 5%. As side slopes approach 3H:1V, without design modifications, sloughing may become a problem due to friction limitations between the separation geotextile and underlying soils. The longest flow path from the contributing area delivering sheet flow to the media filter drain should not exceed 150 feet.

If there is sufficient roadway embankment width, the designer should consider placing the grass strip and media mix downslope when feasible. The project office should ensure the MFD does not intercept seeps, springs, or ground water.

Dual Media Filter Drain for Highway Medians

The dual media filter drain is fundamentally the same as the side-slope version. It differs in siting and is more constrained with regard to drainage options. Prime locations for dual media filter drains in a highway setting are medians, roadside drainage or borrow ditches, or other linear depressions. It is especially critical for water to sheet flow across the dual media filter drain. Channelized flows or ditch flows running down the middle of the dual media filter drain (continuous off-site inflow) should be minimized.

Limitations

Media Filter Drains

- **Steep slopes.** Avoid construction on longitudinal slopes steeper than 5%. Avoid construction on 3H:1V lateral slopes, and preferably use less than 4H:1V slopes. In areas where lateral slopes exceed 4H:1V, it may be possible to construct terraces to create 4H:1V slopes or to otherwise stabilize up to 3H:1V slopes. (For details, see *Geometry, Components and Sizing Criteria, Cross Section* in the Structural Design Considerations section below).
- **Wetlands.** Do not construct in wetlands and wetland buffers. In many cases, a media filter drain (due to its small lateral footprint) can fit within the highway fill slopes adjacent to a wetland buffer. In those situations where the highway fill prism is located adjacent to wetlands, an interception trench/underdrain will need to be incorporated as a design element in the media filter drain.
- **Shallow ground water.** Mean high water table levels at the project site need to be determined to ensure the media filter drain mix bed and the underdrain (if needed) will not become saturated by shallow ground water.
- **Unstable slopes.** In areas where slope stability may be problematic, consult a geotechnical engineer.

- **Areas of seasonal ground water inundations or basement flooding.** Site-specific piezometer data may be needed in areas of suspected seasonal high ground water inundations. The hydraulic and runoff treatment performance of the dual media filter drain may be compromised due to backwater effects and lack of sufficient hydraulic gradient.
- **Narrow roadway shoulders.** In areas where there is a narrow roadway shoulder that does not allow enough room for a vehicle to fully stop or park, consider placing the MFD farther down the embankment slope. This will reduce the amount of rutting in the MFD and decrease overall maintenance repairs.

Design Flow Elements

Flows to Be Treated

The basic design concept behind the media filter drain and dual media filter drain is to fully filter all runoff through the media filter drain mix. Therefore, the infiltration capacity of the medium and drainage below needs to match or exceed the hydraulic loading rate.

Structural Design Considerations

Geometry

Components

No-Vegetation Zone

The no-vegetation zone (vegetation-free zone) is a shallow gravel zone located directly adjacent to the highway pavement. The no-vegetation zone is a crucial element in a properly functioning media filter drain or other BMPs that use sheet flow to convey runoff from the highway surface to the BMP. The no-vegetation zone functions as a level spreader to promote sheet flow and a deposition area for coarse sediments. The no-vegetation zone should be between 1 foot and 3 feet wide. Depth will be a function of how the roadway section is built from subgrade to finish grade; the resultant cross section will typically be triangular to trapezoidal. Within these bounds, width varies depending on maintenance spraying practices.

Grass Strip

The width of the grass strip is dependent on the availability of space within the highway side slope. The baseline design criterion for the grass strip within the media filter drain is a 3-foot-minimum-width, but wider grass strips are recommended if the additional space is available. The designer may consider adding aggregate to the soil mix to help minimize rutting problems from errant vehicles. The soil mix should ensure grass growth for the design life of the media filter drain. Composted material used in the grass strip shall meet the specifications for compost used in Bioretention Soil Media (BSM). See BMP T7.30.

Media Filter Drain Mix Bed

The media filter drain mix is a mixture of crushed rock, dolomite, gypsum, and perlite. The crushed rock provides the support matrix of the medium; the dolomite and gypsum add alkalinity and ion exchange capacity to promote the precipitation and exchange of heavy metals; and the perlite improves moisture retention to promote the formation of biomass within the media filter drain mix. The combination of physical filtering, precipitation, ion exchange, and biofiltration enhances the water treatment capacity of the mix. The media filter drain mix has an estimated initial filtration rate of 50 inches per hour and a long-term filtration rate of 28 inches per hour due to siltation. With an additional safety factor, the rate used to size the length of the media filter drain should be 10 inches per hour.

Conveyance System Below Media Filter Drain Mix

The gravel underdrain trench provides hydraulic conveyance when treated runoff needs to be conveyed to a desired location such as a downstream flow control facility or stormwater outfall.

In Group C and D soils, an underdrain pipe would help to ensure free flow of the treated runoff through the media filter drain mix bed. In some Group A and B soils, an underdrain pipe may be unnecessary if most water percolates into subsoil from the underdrain trench. The need for underdrain pipe should be evaluated in all cases. The underdrain trench should be a minimum of 2 feet wide for either the conventional or dual media filter drain.

The gravel underdrain trench may be eliminated if there is evidence to support that flows can be conveyed laterally to an adjacent ditch or onto a fill slope that is properly vegetated to protect against erosion. The media filter drain mix should be kept free draining up to the 50-year storm event water surface elevation represented in the downstream ditch.

Sizing Criteria

Width

The width of the media filter drain mix bed is determined by the amount of contributing pavement routed to the embankment. The surface area of the media filter drain mix bed needs to be sufficiently large to fully infiltrate the runoff treatment design flow rate using the long-term filtration rate of the media filter drain mix. For design purposes, a 50% safety factor is incorporated into the long-term media filter drain mix filtration rate to accommodate variations in slope, resulting in a design filtration rate of 10 inches per hour. The media filter drain mix bed should have a bottom width of at least 2 feet in contact with the conveyance system below the media filter drain mix.

Length

In general, the length of a media filter drain or dual media filter drain is the same as the contributing pavement. Any length is acceptable as long as the surface area media filter drain mix bed is sufficient to fully infiltrate the runoff treatment design flow rate.

Cross Section

In profile, the surface of the media filter drain should preferably have a lateral slope less than 4H:1V (<25%). On steeper terrain, it may be possible to construct terraces to create a 4H:1V slope, or other engineering may be employed if approved by Ecology, to ensure slope stability up to 3H:1V. If sloughing is a concern on steeper slopes, consideration should be given to incorporating permeable soil reinforcements, such as geotextiles, open-graded/ permeable pavements, or commercially available ring and grid reinforcement structures, as top layer components to the media filter drain mix bed. Consultation with a geotechnical engineer is required.

Inflow

Runoff is conveyed to a media filter drain using sheet flow from the pavement area. The longitudinal pavement slope contributing flow to a media filter drain should be less than 5%.

Although there is no lateral pavement slope restriction for flows going to a media filter drain, the designer should ensure flows remain as sheet flow.

Media Filter Drain Mix Bed Sizing Procedure

The media filter drain mix should be a minimum of 12 inches deep, including the section on top of the underdrain trench.

For runoff treatment, sizing the media filter drain mix bed is based on the requirement that the runoff treatment flow rate from the pavement area, $Q_{Highway}$, cannot exceed the long-term infiltration capacity of the media filter drain, $Q_{Infiltration}$:

$$Highway\ Infiltration\ Q \leq Q$$

For western Washington, $Q_{Highway}$ is the flow rate at or below which 91% of the runoff volume for the developed TDA will be treated, based on a 15-minute time step and can be determined using an approved continuous runoff model.

The long-term infiltration capacity of the media filter drain is based on the following equation:

$$\frac{LTIR * L * W}{C * SF} = Q_{Infiltration}$$

where: *LTIR* = Long-term infiltration rate of the media filter drain mix (use 10 inches per hour for design) (in/hr)

L = Length of media filter drain (parallel to roadway) (ft)

W = Width of the media filter drain mix bed (ft)

C = Conversion factor of 43200 ((in/hr)/(ft/sec))

SF = Safety Factor (equal to 1.0, unless unusually heavy sediment loading is expected)

Assuming that the length of the media filter drain is the same as the length of the contributing pavement, solve for the width of the media filter drain:

$$W \geq \frac{Q_{Highway} * C * SF}{LTIR * L}$$

Western Washington project applications of this design procedure have shown that, in almost every case, the calculated width of the media filter drain does not exceed 1.0 foot. Therefore, [Table 8.5.3](#) was developed to simplify the design steps and should be used to establish an appropriate width.

Pavement width that contributes runoff to the media filter drain	Minimum media filter drain width*
≤ 20 feet	2 feet
≥ 20 and ≤ 35 feet	3 feet
> 35 feet	4 feet

* Width does not include the required 1–3 foot gravel vegetation-free zone or the 3-foot filter strip width (see [Figure 8.5.8](#)).

Underdrain Design

Underdrain pipe can provide a protective measure to ensure free flow through the media filter drain (MFD) mix and is sized similar to storm drains. For MFD underdrain sizing, an additional step is required to determine the flow rate that can reach the underdrain pipe. This is done by

comparing the contributing basin flow rate to the infiltration flow rate through the media filter mix and then using the smaller of the two to size the underdrain. The analysis described below considers the flow rate per foot of MFD, which allows you the flexibility of incrementally increasing the underdrain diameter where long lengths of underdrain are required. When underdrain pipe connects to a storm drain system, place the invert of the underdrain pipe above the 25-year water surface elevation in the storm drain to prevent backflow into the underdrain system.

The following describes the procedure for sizing underdrains installed in combination with media filter drains.

1. Calculate the flow rate per foot from the contributing basin to the media filter drain. The design storm event used to determine the flow rate should be relevant to the purpose of the underdrain. For example, if the MFD installation is in western Washington and the underdrain will be used to convey treated runoff to a detention BMP, size the underdrain for the 50-year storm event. (See the *Hydraulics Manual*, Figure 2-2.1; for conveyance flow rate determination.)

$$\frac{Q_{highway}}{ft} = \frac{Q_{highway}}{L_{MFD}}$$

where:

$$\frac{Q_{highway}}{ft} = \text{contributing flow rate per foot (cfs/ft)}$$

$$L_{MFD} = \text{length of MFD contributing runoff to the underdrain}$$

(ft)

2. Calculate the MFD flow rate of runoff per foot given an infiltration rate of 10 in/hr through the media filter drain mix.

$$\frac{Q_{MFD}}{ft} = \frac{f \times W \times 1ft}{ft} \times \frac{1ft}{12in} \times \frac{1hr}{3600sec}$$

where:

$$\frac{Q_{MFD}}{ft} = \text{flow rate of runoff through MFD mix layer (cfs/ft)}$$

$$W = \text{width of underdrain trench (ft) - see Standard Plan B-55.20-00; the minimum width is 2 ft}$$

$$f = \text{infiltration rate through the MFD mix (in/hr) = 10 in/hr}$$

- Size the underdrain pipe to convey the runoff that can reach the underdrain trench. This is taken to be the smaller of the contributing basin flow rate or the flow rate through the MFD mix layer.

$$\frac{Q_{UD}}{ft} = \text{smaller} \left\{ \frac{Q_{highway}}{ft} \text{ or } \frac{Q_{MFD}}{ft} \right\}$$

where:

$\frac{Q_{UD}}{ft}$ = underdrain design flow rate per foot (cfs/ft)

- Determine the underdrain design flow rate using the length of the MFD and a factor of safety of 1.2.

$$Q_{UD} = 1.2 \times \frac{Q_{UD}}{ft} \times W \times L_{MFD}$$

where:

Q_{UD} = estimated flow rate to the underdrain (cfs)

W = width of the underdrain trench (ft) – see Standard Plan B-55.20-00; the minimum width is 2 ft

L_{MFD} = length of MFD contributing runoff to the underdrain (ft)

- Given the underdrain design flow rate, determine the underdrain diameter. Round pipe diameters to the nearest standard pipe size and have a minimum diameter of 6 inches. For diameters that exceed 12 inches, contact either the Region or HQ Hydraulics Office.

$$D = 16 \left(\frac{(Q_{UD} \times n)}{s^{0.5}} \right)^{3/8}$$

where:

D = underdrain pipe diameter (inches)

n = Manning's coefficient

s = slope of pipe (ft/ft)

Materials

Media Filter Drain Mix

The media filter drain mix used in the construction of media filter drains consists of the amendments listed in [Table 8.5.4](#). Mixing and transportation must occur in a manner that ensures the materials are thoroughly mixed prior to placement and that separation does not occur during transportation or construction operations.

These materials should be used in accordance with the following *Standard Specifications*:

- Gravel Backfill for Drains, 9-03.12(4)
- Underdrain Pipe, 7-01.3(2)
- Construction Geotextile for Underground Drainage, 9-33.1

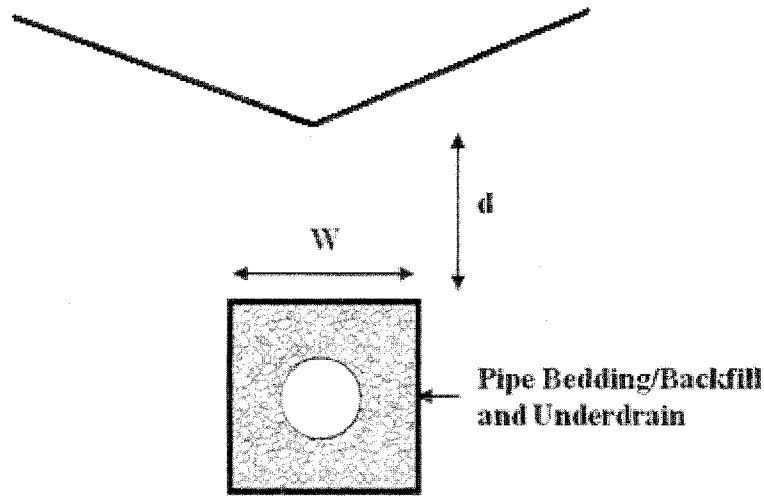


Figure 8.5.4 - Media filter drain underdrain installation

Crushed Surfacing Base Course (CSBC)

If the design is configured to allow the media filter drain to drain laterally into a ditch, the crushed surfacing base course below the media filter drain should conform to Section 9-03.9(3) of the *Standard Specifications*.

Berms, Baffles, and Slopes

See *Geometry, Components and Sizing Criteria, Cross Section* under Structural Design Considerations above.

Table 8.5.4 Media filter drain mix

Amendment	Quantity												
<p>Mineral aggregate: Aggregate for Media Filter Drain Mix Aggregate for Media Filter Drain Mix shall be manufactured from ledge rock, talus, or gravel in accordance with Section 3-01 of the <i>Standard Specifications for Road, Bridge, and Municipal Construction (2002)</i>, which meets the following test requirements for quality. The use of recycled material is not permitted.:</p> <p>Los Angeles Wear, 500 Revolutions 35% max. Degradation Factor 30 min.</p> <p>Aggregate for the Media Filter Drain Mix shall conform to the following requirements for grading and quality:</p> <table border="0"> <thead> <tr> <th>Sieve Size</th> <th>Percent Passing (by weight)</th> </tr> </thead> <tbody> <tr> <td>1/2" square</td> <td>100</td> </tr> <tr> <td>3/8" square</td> <td>90-100</td> </tr> <tr> <td>U.S. No. 4</td> <td>30-56</td> </tr> <tr> <td>U.S. No. 10</td> <td>0-10</td> </tr> <tr> <td>U.S. No. 200</td> <td>0-1.5</td> </tr> </tbody> </table> <p>% fracture, by weight, min. 75</p> <p>Static stripping test Pass</p> <p>The fracture requirement shall be at least two fractured faces and will apply to material retained on the U.S. No. 10.</p> <p>Aggregate for the Media Filter Drain shall be substantially free from adherent coatings. The presence of a thin, firmly adhering film of weathered rock shall not be considered as coating unless it exists on more than 50% of the surface area of any size between successive laboratory sieves.</p>	Sieve Size	Percent Passing (by weight)	1/2" square	100	3/8" square	90-100	U.S. No. 4	30-56	U.S. No. 10	0-10	U.S. No. 200	0-1.5	<p>3 cubic yards</p>
Sieve Size	Percent Passing (by weight)												
1/2" square	100												
3/8" square	90-100												
U.S. No. 4	30-56												
U.S. No. 10	0-10												
U.S. No. 200	0-1.5												
<p>Perlite:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Horticultural grade, free of any toxic materials) <input type="checkbox"/> 0-30% passing US No. 18 Sieve <input type="checkbox"/> 0-10% passing US No. 30 Sieve 	<p>1 cubic yard per 3 cubic yards of mineral aggregate</p>												
<p>Dolomite: CaMg(CO₃)₂ (calcium magnesium carbonate)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Agricultural grade, free of any toxic materials) <input type="checkbox"/> 100% passing US No. 8 Sieve <input type="checkbox"/> 0% passing US No. 16 Sieve 	<p>10 pounds per cubic yard of perlite</p>												
<p>Gypsum: Noncalcined, agricultural gypsum CaSO₄•2H₂O (hydrated calcium sulfate)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Agricultural grade, free of any toxic materials) <input type="checkbox"/> 100% passing US No. 8 Sieve <input type="checkbox"/> 0% passing US No. 16 Sieve 	<p>1.5 pounds per cubic yard of perlite</p>												

Site Design Elements

Landscaping (Planting Considerations)

Landscaping for the grass strip is the same as for biofiltration swales unless otherwise specified in the special provisions for the project's construction documents.

Operations and Maintenance

Maintenance will consist of routine roadside management. While herbicides must not be applied directly over the media filter drain, it may be necessary to periodically control noxious weeds with herbicides in areas around the media filter drain as part of a roadside management program. The use of pesticides may be prohibited if the media filter drain is in a critical aquifer recharge area for drinking water supplies. The designer should check with the local area water purveyor or local health department. Areas of the media filter drain that show signs of physical damage will be replaced by local maintenance staff in consultation with region hydraulics/water quality staff.

Construction Criteria

Keep effective erosion and sediment control measures in place until grass strip is established.

Do not allow vehicles or traffic on the MFD to minimize rutting and maintenance repairs

Signing

Nonreflective guideposts will delineate the media filter drain. This practice allows personnel to identify where the system is installed and to make appropriate repairs should damage occur to the system. If the media filter drain is in a critical aquifer recharge area for drinking water supplies, signage prohibiting the use of pesticides must be provided.

No. 19 – MEDIA FILTER DRAIN (MFD)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment accumulation on grass filter strip	Sediment depth exceeds 2 inches or creates uneven grading that interferes with sheet flow.	Remove sediment deposits on grass treatment area of the embankment. When finished, embankment should be level from side to side and drain freely toward the toe of the embankment slope. There should be no areas of standing water once inflow has ceased.
	No-vegetation zone/flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire embankment width.	Level the spreader and clean to spread flows evenly over entire embankment width.
	Poor vegetation coverage	Grass is sparse or bare, or eroded patches are observed in more than 10% of the grass strip surface area.	Determine why grass growth is poor and correct the offending condition. Reseed into loosened, fertile soil or compost; or, replant with plugs of grass from the upper slope.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow vegetation or remove nuisance vegetation to not impede flow. Mow grass to a height of 6 inches.
	Media filter drain mix replacement	Water is seen on the surface of the media filter drain mix long after the storms have ceased. Typically, the 6-month, 24-hour precipitation event should drain within 48 hours. More common storms should drain within 24 hours. Maintenance also needed on a 10-year cycle and during a preservation project.	Excavate and replace all of the media filter drain mix contained within the media filter drain.
	Excessive shading	Grass growth is poor because sunlight does not reach embankment.	If possible, trim back overhanging limbs and remove brushy vegetation on adjacent slopes.
	Trash and debris	Trash and debris have accumulated on embankment.	Remove trash and debris from embankment.
	Flooding of Media filter drain	When media filter drain is inundated by flood water	Evaluate media filter drain material for acceptable infiltration rate and replace if media filter drain does not meet long-term infiltration rate standards.

Design Criteria for Bioretention

These design criteria are from the *LID Technical Guidance Manual for Puget Sound* (2012). Refer to that document for additional explanations and background.

Note that the *LID Technical Guidance Manual for Puget Sound* (2012) is for additional information purposes only. You must follow the guidance within this manual if there are any discrepancies between this manual and the *LID Technical Guidance Manual for Puget Sound* (2012).

Flow entrance and presettling

Flow entrance design will depend on topography, flow velocities and volume entering the pretreatment and bioretention area, adjacent land use and site constraints. Flow velocities entering bioretention should be less than 1.0 ft/second to minimize erosion potential. Five primary types of flow entrances can be used for bioretention:

- *Dispersed, low velocity flow across a landscape area:* Landscape areas and vegetated buffer strips slow incoming flows and provide an initial settling of particulates and are the preferred method of delivering

flows to the bioretention cell., Dispersed flow may not be possible given space limitations or if the facility is controlling roadway or parking lot flows where curbs are mandatory.

- *Dispersed or sheet flow across pavement or gravel and past wheel stops for parking areas.*
 - *Curb cuts for roadside, driveway or parking lot areas:* Curb cuts should include a rock pad, concrete or other erosion protection material in the channel entrance to dissipate energy. Minimum curb cut width should be 12 inches; however, 18 inches is recommended. Avoid the use of angular rock or quarry spalls and instead use round (river) rock if needed. Removing sediment from angular rock is difficult. Flow entrance should drop 2 to 3 inches from curb line and provide an area for settling and periodic removal of sediment and coarse material before flow dissipates to the remainder of the cell.
 - Curb cuts used for bioretention areas in high use parking lots or roadways require increased level of maintenance due to high coarse particulates and trash accumulation in the flow entrance and associated bypass of flows. The following are methods recommended for areas where heavy trash and coarse particulates are anticipated:
 - Curb cut width: 18 inches.
 - At a minimum the flow entrance should drop 2 to 3 inches from gutter line into the bioretention area and provide an area for settling and periodic removal of debris.
 - Anticipate relatively more frequent inspection and maintenance for areas with large impervious areas, high traffic loads and larger debris loads.
 - Catch basins or forebays may be necessary at the flow entrance to adequately capture debris and sediment load from large contributing areas and high use areas. Piped flow entrance in this setting can easily clog and catch basins with regular maintenance are necessary to capture coarse and fine debris and sediment.
- *Pipe flow entrance:* Piped entrances should include rock or other erosion protection material in the channel entrance to dissipate energy and disperse flow.
- *Catch basin:* In some locations where road sanding or higher than usual sediment inputs are anticipated, catch basins can be used to settle sediment and release water to the bioretention area through a grate for filtering coarse material.

- *Trench drains:* can be used to cross sidewalks or driveways where a deeper pipe conveyance creates elevation problems. Trench drains tend to clog and may require additional maintenance.

Woody plants can restrict or concentrate flows and can be damaged by erosion around the root ball and should not be placed directly in the entrance flow path.

Bottom area and side slopes

Bioretention areas are highly adaptable and can fit various settings such as rural and urban roadsides, ultra urban streetscapes and parking lots by adjusting bottom area and side slope configuration. Recommended maximum and minimum dimensions include:

- Maximum planted side slope if total cell depth is greater than 3 feet: 3H:1V. If steeper side slopes are necessary rockeries, concrete walls or soil wraps may be effective design options. Local jurisdictions may require bike and/or pedestrian safety features, such as railings or curbs with curb cuts, when steep side slopes are adjacent to sidewalks, walkways, or bike lanes.
- Minimum bottom width for bioretention swales: 2 feet recommended and 1 foot minimum. Carefully consider flow depths and velocities, flow velocity control (check dams) and appropriate vegetation or rock mulch to prevent erosion and channelization at bottom widths less than 2 feet.

Bioretention areas should have a minimum shoulder of 12 inches (30.5 cm) between the road edge and beginning of the bioretention side slope where flush curbs are used. Compaction effort for the shoulder should 90 percent proctor.

Ponding area

Ponding depth recommendations:

- Maximum ponding depth: 12 inches (30.5 cm).
- Surface pool drawdown time: 24 hours

For design on projects subject to Minimum Requirement #5, and choosing to use List #1 or List #2 of that requirement, a bioretention facility shall have a horizontally projected surface area below the overflow which is at least 5% of the total impervious surface area draining to it. If lawn/landscape area will also be draining to the bioretention facility, Ecology recommends that the bioretention facility's horizontally projected surface area below the overflow be increased by 2% of the lawn/landscape area.

The ponding area provides surface storage for storm flows, particulate settling, and the first stages of pollutant treatment within the cell. Pool

depth and draw-down rate are recommended to provide surface storage, adequate infiltration capability, and soil moisture conditions that allow for a range of appropriate plant species. Soils must be allowed to dry out periodically in order to: restore hydraulic capacity to receive flows from subsequent storms; maintain infiltration rates; maintain adequate soil oxygen levels for healthy soil biota and vegetation; provide proper soil conditions for biodegradation and retention of pollutants. Maximum designed depth of ponding (before surface overflow to a pipe or ditch) must be considered in light of drawdown time.

For bioretention areas with underdrains, elevating the drain to create a temporary saturated zone beneath the drain is advised to promote denitrification (conversion of nitrate to nitrogen gas) and prolong moist soil conditions for plant survival during dry periods (see Underdrain section below for details).

Surface overflow

Surface overflow can be provided by vertical stand pipes that are connected to underdrain systems, by horizontal drainage pipes or armored overflow channels installed at the designed maximum ponding elevations. Overflow can also be provided by a curb cut at the down-gradient end of the bioretention area to direct overflows back to the street. Overflow conveyance structures are necessary for all bioretention facilities to safely convey flows that exceed the capacity of the facility and to protect downstream natural resources and property.

The minimum freeboard from the invert of the overflow stand pipe, horizontal drainage pipe or earthen channel should be 6 inches unless otherwise specified by the local jurisdiction's design standards.

Default Bioretention Soil Media (BSM)

Projects which use the following requirements for the bioretention soil media do not have to test the media for its saturated hydraulic conductivity (aka. Infiltration rate). They may assume the rates specified in the subsection titled "Determining Bioretention Soil Mix Infiltration Rate."

Mineral Aggregate

Percent Fines: A range of 2 to 4 percent passing the #200 sieve is ideal and fines should not be above 5 percent for a proper functioning specification according to ASTM D422.

Aggregate Gradation

The aggregate portion of the BSM should be well-graded. According to ASTM D 2487-98 (Classification of Soils for Engineering Purposes (Unified Soil Classification System)), well-graded sand should have the following gradation coefficients:

- Coefficient of Uniformity ($C_u = D_{60}/D_{10}$) equal to or greater than 4, and

- Coefficient of Curve ($C_c = (D_{30})^2 / D_{60} \times D_{10}$) greater than or equal to 1 and less than or equal to 3.

Table 7.4.1 provides a gradation guideline for the aggregate component of a Bioretention Soil Mix specification in western Washington (Hinman, Robertson, 2007). The sand gradation below is often supplied as a well-graded utility or screened. With compost this blend provides enough fines for adequate water retention, hydraulic conductivity within recommended range (see below), pollutant removal capability, and plant growth characteristics for meeting design guidelines and objectives.

Table 7.4.1 General Guideline for Mineral Aggregate Gradation	
Sieve Size	Percent Passing
3/8"	100
#4	95-100
#10	75-90
#40	25-40
#100	4-10
#200	2-5

Where existing soils meet the above aggregate gradation, those soils may be amended rather than importing mineral aggregate.

Compost to Aggregate Ratio, Organic Matter Content, Cation Exchange Capacity

- Compost to aggregate ratio: 60-65 percent mineral aggregate, 35 – 40 percent compost by volume.
- Organic matter content: 5 – 8 percent by weight.
- Cation Exchange Capacity (CEC) must be ≥ 5 milliequivalents/100 g dry soil Note: Soil mixes meeting the above specifications do not have to be tested for CEC. They will readily meet the minimum CEC.

Compost

To ensure that the BSM will support healthy plant growth and root development, contribute to biofiltration of pollutants, and not restrict infiltration when used in the proportions cited herein, the following compost standards are required.

- Meets the definition of “composted material” in WAC 173-350-100 and complies with testing parameters and other standards in WAC 173-350-220.
- Produced at a composting facility that is permitted by the jurisdictional health authority. Permitted compost facilities in Washington are included on a list available at <http://www.ecy.wa.gov/programs/swfa/organics/soil.html>

- The compost product must originate a minimum of 65 percent by volume from recycled plant waste comprised of as "yard debris," "crop residues," and "bulking agents" as those terms are defined in WAC 173-350-100. A maximum of 35 percent by volume of "post-consumer food waste" as defined in WAC 173-350-100, but not including biosolids, may be substituted for recycled plant waste.
- Stable (low oxygen use and CO₂ generation) and mature (capable of supporting plant growth) by tests shown below. This is critical to plant success in a bioretention soil mixes.
- Moisture content range: no visible free water or dust produced when handling the material.
- Tested in accordance with the U.S. Composting Council "Test Method for the Examination of Compost and Composting" (TMECC), as established in the Composting Council's "Seal of Testing Assurance" (STA) program. Most Washington compost facilities now use these tests.
- Screened to the following size gradations for Fine Compost when tested in accordance with TMECC test method 02.02-B, Sample Sieving for Aggregate Size Classification."

Fine Compost shall meet the following gradation by dry weight

Minimum percent passing 2"	100%
Minimum percent passing 1"	99%
Minimum percent passing 5/8"	90%
Minimum percent passing 1/4"	75%

- pH between 6.0 and 8.5 (TMECC 04.11-A). "Physical contaminants" (as defined in WAC 173-350-100) content less than 1% by weight (TMECC 03.08-A) total, not to exceed 0.25 percent film plastic by dry weight.
- Minimum organic matter content of 40% (TMECC 05.07-A "Loss on Ignition)
- Soluble salt content less than 4.0 dS/m (mmhos/cm) (TMECC 04.10-A "Electrical Conductivity, 1:5 Slurry Method, Mass Basis")
- Maturity indicators from a cucumber bioassay (TMECC 05.05-A "Seedling Emergence and Relative Growth) must be greater than 80% for both emergence and vigor")
- Stability of 7 mg CO₂-C/g OM/day or below (TMECC 05.08-B "Carbon Dioxide Evolution Rate")
- Carbon to nitrogen ratio (TMECC 05.02A " Carbon to Nitrogen Ratio" which uses 04.01 "Organic Carbon" and 04.02D "Total Nitrogen by Oxidation") of less than 25:1. The C:N ratio may be up to

35:1 for plantings composed entirely of Puget Sound Lowland native species and up to 40:1 for coarse compost to be used as a surface mulch (not in a soil mix).

Design Criteria for Custom Bioretention Soil Mixes

Projects which prefer to create a custom Bioretention Soil Mix rather than using the default requirements above must demonstrate compliance with the following criteria using the specified test method:

- CEC \geq 5 meq/100 grams of dry soil; USEPA 9081
- pH between 5.5 and 7.0
- 5 - 8 percent organic matter content before and after the saturated hydraulic conductivity test; ASTM D2974(Standard Test Method for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils)
- 2-5 percent fines passing the 200 sieve; TMECC 04.11-A
- Measured (Initial) saturated hydraulic conductivity of less than 12 inches per hour; ASTM D 2434 (Standard Test Method for Permeability of Granular Soils (Constant Head)) at 85% compaction per ASTM D 1557 (Standard Test Method s for Laboratory Compaction Characteristics of Soil Using Modified Effort). Also, use Appendix V-B, Recommended Procedures for ASTM D 2434 When Measuring Hydraulic Conductivity for Bioretention Soil Mixes.
- Design (long-term) saturated hydraulic conductivity of more than 1 inch per hour. Note: Design saturated hydraulic conductivity is determined by applying the appropriate infiltration correction factors as explained above under “Determining Bioretention soil mix infiltration rate.”
- If compost is used in creating the custom mix, it must meet all of the specifications listed above for compost except for the gradation specification. An alternative gradation specification must indicate the minimum percent passing for a range of similar particle sizes.

Soil Depth:

Soil depth must be a minimum of 18 inches to provide water quality treatment and good growing conditions for selected plants

Filter Fabrics:

Do not use filter fabrics between the subgrade and the Bioretention Soil Mix. The gradation between existing soils and Bioretention Soil Mix is not great enough to allow significant migration of fines into the Bioretention Soil Mix. Additionally, filter fabrics may clog with downward migration of fines from the Bioretention Soil Mix.

Hydraulic restriction layers:

Adjacent roads, foundations or other infrastructure may require that infiltration pathways are restricted to prevent excessive hydrologic loading. Two types of restricting layers can be incorporated into bioretention designs:

- Clay (bentonite) liners are low permeability liners. Where clay liners are used underdrain systems are necessary. See Volume V section 4.4.3 for guidelines.
- Geomembrane liners completely block infiltration to subgrade soils and are used for ground water protection when bioretention facilities are installed to filter storm flows from pollutant hotspots or on sidewalls of bioretention areas to restrict lateral flows to roadbeds or other sensitive infrastructure. Where geomembrane liners are used to line the entire facility underdrain systems are necessary. The liner should have a minimum thickness of 30 mils and be ultraviolet (UV) resistant.

Plant materials

In general, the predominant plant material utilized in bioretention areas are facultative species adapted to stresses associated with wet and dry conditions. Soil moisture conditions will vary within the facility from saturated (bottom of cell) to relatively dry (rim of cell). Accordingly, wetland plants may be used in the lower areas, if saturated soil conditions exist for appropriate periods, and drought-tolerant species planted on the perimeter of the facility or on mounded areas. See the *LID Technical Guidance Manual for Puget Sound* (2012) for additional guidance and recommended plant species.

Note that the *LID Technical Guidance Manual for Puget Sound* (2012) is for additional informational purposes only. You must follow the guidance within this manual if there are any discrepancies between this manual and the *LID Technical Guidance Manual for Puget Sound* (2012).

Mulch layer

You can design Bioretention areas with or without a mulch layer. When used, mulch shall be:

- Coarse compost in the bottom of the facilities (compost is less likely to float during cell inundation). Compost shall not include biosolids or manures.
- Shredded or chipped hardwood or softwood on side slopes above ponding elevation and rim area. Arborist mulch is mostly woody trimmings from trees and shrubs and is a good source of mulch material. Wood chip operations are a good source for mulch material that has more control of size distribution and consistency. Do not use shredded construction wood debris or any shredded wood to which preservatives have been added.
- Free of weed seeds, soil, roots and other material that is not **bole** or branch wood and bark.
- A maximum of 2 to 3 inches thick.

Mulch shall **not** be:

- Grass clippings (decomposing grass clippings are a source of nitrogen and are not recommended for mulch in bioretention areas).
- Pure bark (bark is essentially sterile and inhibits plant establishment).

In bioretention areas where higher flow velocities are anticipated an aggregate mulch may be used to dissipate flow energy and protect underlying Bioretention Soil Mix. Aggregate mulch varies in size and type, but 1 to 1 1/2 inch gravel (rounded) decorative rock is typical.

Installation

Excavation

Soil compaction can lead to facility failure; accordingly, minimizing compaction of the base and sidewalls of the bioretention area is critical. Excavation should never be allowed during wet or saturated conditions (compaction can reach depths of 2-3 feet during wet conditions and mitigation is likely not be possible). Excavation should be performed by machinery operating adjacent to the bioretention facility and no heavy equipment with narrow tracks, narrow tires, or large lugged, high pressure tires should be allowed on the bottom of the bioretention facility. If machinery must operate in the bioretention cell for excavation, use light weight, low ground-contact pressure equipment and rip the base at completion to refracture soil to a minimum of 12 inches. If machinery operates in the facility, subgrade infiltration rates must be field tested and compared to design rates. Failure to meet or exceed the design infiltration rate will require revised engineering designs to verify achievement of treatment and flow control benefits that were estimated in the Stormwater Site Plan.

Prior to placement of the BSM, the finished subgrade shall:

- Be scarified to a minimum depth of 3 inches.
- Have any sediment deposited from construction runoff removed. To remove all introduced sediment, subgrade soil should be removed to a depth of 3-6 inches and replaced with BSM.
- Be inspected by the responsible engineer to verify required subgrade condition.

Sidewalls of the facility, beneath the surface of the BSM, can be vertical if soil stability is adequate. Exposed sidewalls of the completed bioretention area with BSM in place should be no steeper than 3H:1V. The bottom of the facility should be flat.

Soil Placement

On-site soil mixing or placement shall not be performed if Bioretention Soil Mix or subgrade soil is saturated. The bioretention soil mixture should be placed and graded by machinery operating adjacent to the bioretention facility. If machinery must operate in the bioretention cell for soil placement, use light weight equipment with low ground-contact pressure. If machinery operates in the facility, subgrade infiltration rates must be field tested and compared to design rates. Failure to meet or exceed the design infiltration rate will require revised engineering designs to verify achievement of treatment and flow control benefits that were estimated in the Stormwater Site Plan.

The soil mixture shall be placed in horizontal layers not to exceed 6 inches per lift for the entire area of the bioretention facility.

Compact the Bioretention Soil Mix to a relative compaction of 85 percent of modified maximum dry density (ASTM D 1557). Compaction can be achieved by boot packing (simply walking over all areas of each lift), and then apply 0.2 inches (0.5 cm) of water per 1 inch (2.5 cm) of Bioretention Soil Mix depth. Water for settling should be applied by spraying or sprinkling.

Temporary Erosion and Sediment Control (TESC)

Controlling erosion and sediment are most difficult during clearing, grading, and construction; accordingly, minimizing site disturbance to the greatest extent practicable is the most effective sediment management.

During construction:

- Bioretention facilities should not be used as sediment control facilities and all drainage should be directed away from bioretention facilities after initial rough grading. Flow can be directed away from the facility with temporary diversion swales or other approved protection. If introduction of construction runoff cannot be avoided see below for guidelines.
- Construction on Bioretention facilities should not begin until all contributing drainage areas are stabilized according to erosion and sediment control BMPs and to the satisfaction of the engineer.
- If the design includes curb and gutter, the curb cuts and inlets should be blocked until Bioretention Soil Mix and mulch have been placed and planting completed (when possible), and dispersion pads are in place.

Every effort during design, construction sequencing and construction should be made to prevent sediment from entering bioretention facilities. However, bioretention areas are often distributed throughout the project area and can present unique challenges during construction. See the LID Technical Guidance Manual for Puget Sound (2012) for guidelines if no other options exist and runoff during construction must be directed through the bioretention facilities.

Note that the LID Technical Guidance Manual for Puget Sound (2012) is for additional informational purposes only. You must follow the guidance within this manual if there are any discrepancies between this manual and the LID Technical Guidance Manual for Puget Sound (2012).

Erosion and sediment control practices must be inspected and maintained on a regular basis.

Verification

If using the default bioretention soil media, pre-placement laboratory analysis for saturated hydraulic conductivity of the bioretention soil media is not required. Verification of the mineral aggregate gradation, compliance with the compost specifications, and the mix ratio must be provided.

If using a custom bioretention soil media, verification of compliance with the minimum design criteria cited above for such custom mixes must be provided. This will require laboratory testing of the material that will be used in the installation. Testing shall be performed by a Seal of Testing Assurance, AASHTO, ASTM or other standards organization accredited laboratory with current and maintained certification. Samples for testing

must be supplied from the BSM that will be placed in the bioretention areas.

If testing infiltration rates is necessary for post-construction verification use the Pilot Infiltration Test (PIT) method or a double ring infiltrometer test (or other small-scale testing allowed by the local government with jurisdiction). If using the PIT method, do not excavate Bioretention Soil Mix (conduct test at level of finished Bioretention Soil Mix elevation), use a maximum of 6 inch ponding depth and conduct test before plants are installed.

Maintenance

Bioretention areas require annual plant, soil, and mulch layer maintenance to ensure optimum infiltration, storage, and pollutant removal capabilities. In general, bioretention maintenance requirements are typical landscape care procedures and include:

- **Watering:** Plants should be selected to be drought tolerant and not require watering after establishment (2 to 3 years). Watering may be required during prolonged dry periods after plants are established.
- **Erosion control:** Inspect flow entrances, ponding area, and surface overflow areas periodically, and replace soil, plant material, and/or mulch layer in areas if erosion has occurred. Properly designed facilities with appropriate flow velocities should not have erosion problems except perhaps in extreme events. If erosion problems occur the following should be reassessed: (1) flow volumes from contributing areas and bioretention cell sizing; (2) flow velocities and gradients within the cell; and (3) flow dissipation and erosion protection strategies in the pretreatment area and flow entrance. If sediment is deposited in the bioretention area, immediately determine the source within the contributing area, stabilize, and remove excess surface deposits.
- **Sediment removal:** Follow the maintenance plan schedule for visual inspection and remove sediment if the volume of the ponding area has been compromised.
- **Plant material:** Depending on aesthetic requirements, occasional pruning and removing dead plant material may be necessary. Replace all dead plants and if specific plants have a high mortality rate, assess the cause and replace with appropriate species. Periodic weeding is necessary until plants are established.
- **Weeding:** Invasive or nuisance plants should be removed regularly and not allowed to accumulate and exclude planted species. At a minimum, schedule weeding with inspections to coincide with important horticultural cycles (e.g., prior to major weed varieties dispersing seeds). Weeding should be done manually and without herbicide applications. The weeding schedule should become less frequent if the appropriate plant species and planting density are used and the selected plants grow to capture the site and exclude undesirable weeds.

- Nutrient and pesticides: The soil mix and plants are selected for optimum fertility, plant establishment, and growth. Nutrient and pesticide inputs should not be required and may degrade the pollutant processing capability of the bioretention area, as well as contribute pollutant loads to receiving waters. By design, bioretention facilities are located in areas where phosphorous and nitrogen levels may be elevated and these should not be limiting nutrients. If in question, have soil analyzed for fertility.
- Mulch: Replace mulch annually in bioretention facilities where heavy metal deposition is high (e.g., contributing areas that include gas stations, ports and roads with high traffic loads). In residential settings or other areas where metals or other pollutant loads are not anticipated to be high, replace or add mulch as needed (likely 3 to 5 years) to maintain a 2 to 3 inch depth.

Soil: Soil mixes for bioretention facilities are designed to maintain long-term fertility and pollutant processing capability. Estimates from metal attenuation research suggest that metal accumulation should not present an environmental concern for at least 20 years in bioretention systems, but this will vary according to pollutant load. Replacing mulch media in bioretention facilities where heavy metal deposition is likely provides an additional level of protection for prolonged performance. If in question, have soil analyzed for fertility and pollutant levels.

Appendix D – Flow Control and Water Quality Applications Maps

Mapping

~~City of SeaTac equivalents to the Flow Control Applications Map and the Water Quality Applications Map are attached. In lieu of a SeaTac equivalent to the County Landslide Hazard Drainage Areas Map, the City will rely on King County's map.~~

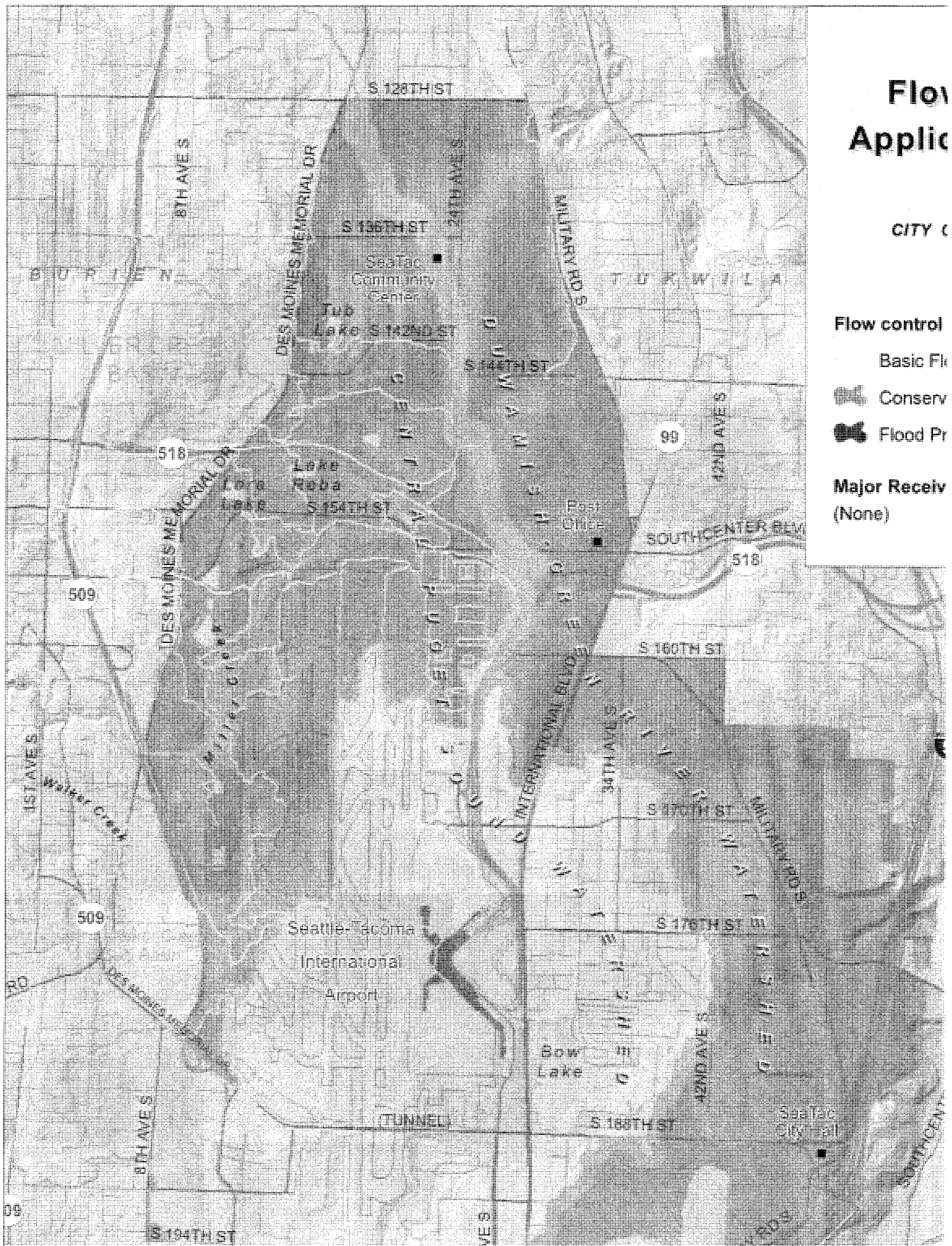
Flow Application

CITY C

Flow control

- Basic Fl
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(None)





NEW DOCUMENT
City of SeaTac
Addendum to Road Standards

Effective date
January 1, 2017

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Introduction

This document is organized into two sections:

- **Section 1:** Addendum to the 2007 King County Road Standards (KCRS)
- **Section 2:** Addendum to the 2016 Washington Department of Transportation (WSDOT) Standard Specifications for Road, Bridge, and Municipal Construction

This document applies to development and redevelopment proposals within the City of SeaTac (City). This addendum includes revisions to the KCRS and WSDOT Standard Specifications for Road, Bridge, and Municipal Construction to address differences in the City's organization and processes. No major substantive changes have been made to the KCRS or the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction.

[**Note:** Clarifications and interpretations will be documented and made available through policy statements within the City's Development Standards.]

The information presented in each section is organized as follows:

- **Terminology:** At times King County, WSDOT, and the City use different terminology to describe or refer to equivalent subject matter. This subsection identifies these terms and the City's equivalent terminology.
- **Key Revisions:** This subsection specifically identifies revisions the City has made to the KCRS and the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction. These revisions are necessary to meet the intent of the low impact development (LID) code and enforceable document review and revision requirement in the National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater Phase II Permit and to address differences between King County, WSDOT, and City procedures.
- **Supplemental Documents (Section 1 only):** This section identifies technical guidance manuals and documents which shall be used to supplement the KCRS.
- **Code Reference Table (Section 1 only):** The King County Code (KCC) is referenced in several places in the KCRS. This subsection identifies these code references and equivalent city code where applicable.

Supplemental information in the appendices includes the following:

- **Appendix A:** City Road and Stormwater Design Details
- **Appendix B:** WSDOT General Special Provisions (GSPs) for Permeable Pavement
- **Appendix C:** Reference Materials

Section 1. Addendum to the 2007 King County Road Standards

1.1 Terminology

At times King County and the City use different terminology to describe or to refer to equivalent subject matter. This subsection identifies these terms and the City's equivalent terminology.

County Road Engineer = Public Works City Engineer or designee.

Department of Development and Environmental Services (DDES) = City of SeaTac Public Works and Community and Economic Development Departments.

Department of Natural Resources and Parks (DNRP) = City of SeaTac Department of Parks & Recreation.

Department of Transportation = City of SeaTac Public Works Department.

King County = City of SeaTac.

King County Adopted Basin Plans = City of SeaTac Adopted Basin Plans.

King County Capital Improvement Program = City of SeaTac Capital Improvement Program.

King County Code (KCC) = SeaTac Municipal Code (SMC). Check code reference table for equivalent code sections.

King County Comprehensive Plan = City of SeaTac Comprehensive Plan.

King County Flood Hazard Plan = City of SeaTac requirements in Chapter 15.700 SMC Environmentally Sensitive Areas.

King County Historic Preservation Program = No equivalent.

King County Landmarks Register = No equivalent.

King County Parks and Open Space Plan = City of SeaTac Parks, Recreation, and Open Space Element of the Comprehensive Plan.

King County Regional Trails Plan = City of SeaTac Trails Plan.

King County Road Standards = King County Road Standards as amended by this document.

King County Non-Motorized Transportation Plan = City of SeaTac Transportation Master Plan.

Reviewing Agency = City of SeaTac Community and Economic Development Department.

Surface Water Design Manual = King County Surface Water Design Manual (KCSWDM) as amended by the City Addendum to the KCSWDM.

Water and Land Resources (WLR) Division = City of SeaTac Public Works Department.

Zoning Classifications: Where the KCRS references Agricultural (A) Zoning, Forest (F) Zoning, or Rural (R) Zoning = These zoning classifications are intended for areas outside of the Urban Growth Boundary, therefore the City of SeaTac contains no equivalent zoning. Refer to City zoning maps to determine which zoning classifications apply to your project.

1.2 Key Revisions

This subsection identifies revisions the City has made to the KCRS. These revisions are necessary to meet the intent of the low impact development (LID) code and enforceable document review and revision requirement in the National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater Phase II Permit and to address differences between King County and City procedures.

1.2.1 General Revisions

Cul-de-sac Islands – The City allows vegetated or bioretention islands as an optional feature for any cul-de-sac when bulb paved diameter is 80 feet or less and mandatory when bulb paved diameter exceeds 80 feet. Vegetated islands shall have full depth vertical curb with a minimum diameter of 20 feet. Bioretention islands shall have extruded curb with curb cuts to allow stormwater to enter the facility and a minimum diameter of 15 feet. The paved travel way around the circumference shall be a minimum of 20 feet. Vegetated and bioretention islands shall be landscaped with native and drought tolerant vegetation and maintained by the adjoining landowners or the homeowners' association.

Curb and Gutter Exemptions – Curb cuts and grates can be incorporated to allow water to enter stormwater facilities and LID BMPs.

Compaction Requirements for Permeable Pavement Base Course – The City allows 90-92 percent compaction and deviations in base course requirements for permeable pavement as documented in WSDOT's GSPs (see Permeable Pavement Guidance below).

Compaction Requirements for Bioretention – The City allows 85 compaction for bioretention facilities.

Separation Requirements – Stormwater BMPs shall not have utilities located within them unless approved by the City. Adequate separation (as determined by the City) between stormwater facilities and other utilities will also be required. Perpendicular utility crossings within stormwater BMPs are allowed with the following conditions:

- Water service lines/piping may be located within the bioretention facility footprint when necessary. City approval is required.
- Water meters shall be located outside of bioretention facility footprint.
- Fire hydrants shall be located at least 5 feet outside of bioretention facility footprint.
- No plantings except groundcover and sods within 5 feet of hydrant.

- New side sewers and service drains may be located within bioretention facility footprint with approved pipe sleeves and/or liners.
- New infiltration facilities are allowed over existing PVC or ductile iron side sewer crossings with approved pipe sleeves and/or liners.
- Franchise utilities (power, gas, communication) are allowed with approval from the Public Works Director or designee and the franchisee.

Soil Amendments – The City requires soil amendments for disturbed areas in accordance with the KCSWDM as amended by the City Addendum to the KCSWDM.

Street Trees and Landscaping – City-specific requirements for street trees and landscaping are included in the following SMC sections:

- Planting strip landscaping shall be designed in accordance with SMC 15.445.120
- Street tree diameters and heights shall be designed in accordance with SMC 15.445.120
- Requirements for on-site street frontage landscaping are described in SMC 15.445.200.
- Requirements for retaining significant trees are described in SMC 15.445.400 through 15.445.450
- Irrigation requirements are described in SMC 15.445.140

Shared Utility Trenches – The City promotes the use of joint or common trenches by all utilities and rights-of-way franchise holders where feasible as described in SMC 11.20.070.

Permeable Pavement Guidance – The City allows the use of WSDOT’s General Special Provisions (GSPs) for Porous Hot Mix Asphalt (PHMA), Porous Warm Mix Asphalt (PWMA), and Pervious Concrete (PConcrete) developed by the Construction Materials Committee of the American Public Works Association (APWA) Washington dated March 9, 2016. These GSPs are included in Appendix B of this document.

1.2.2 Specific Revisions

City Revisions to the King County Road Standards		
KCRS Reference	KCRS Existing Requirement	City Specific Revision
1.02	These Standards shall apply prospectively to all newly constructed road and right-of-way facilities, both public and private, within King County. In the event of conflict with the Surface Water Design Manual, improvements within the roadway right-of-way shall meet the requirements of these Standards.	The City requires that the KCSWDM as amended by the Addendum to the KCSWDM govern in the case of conflict with the KCRS.
1.11.A.	Required elements on Engineering Plans, Final Corrected Plans, and Final Plat Plans.	The City requires all plan submittals to meet the minimum requirements in the KCSWDM as amended by the Addendum to the KCSWDM.
1.11.B	Waiver of Plan Requirements	The City requires all projects to meet the minimum requirements in the KCSWDM as amended by the Addendum to the KCSWDM. The City does not allow waiver 1.11.B.4.
1.12	Variances	The City requires that the KCSWDM as amended by the Addendum to the KCSWDM govern in the case of conflict with the KCRS.
1.14.A.	Performance/ Restoration Financial Guarantees	The City's performance requirements are provided in SMC 11.05.120.
1.14.B.	Maintenance/Defect Guarantees	The City's maintenance/defect guarantees are provided in SMC 11.05.120.
2.06.C.	King County will not accept private streets for maintenance as public streets until such streets are brought into conformance with current King County Code and these Standards.	The City does not accept maintenance responsibilities for private roads.
2.06.E.	King County will not accept private streets within short plats when the roads providing access to the plat are private and already have the potential to serve more than the number of lots specified in Section 2.06(B.7). If a short plat has been proposed on a property to which the only access is over private streets that fail to meet the standards specified in this section, the proposal shall be denied.	The City does not accept maintenance responsibilities for private roads.
Chapter 3 Figures	2 percent sidewalk slope towards curb inlet	The City allows sidewalks adjacent to bioretention facilities to drain towards the facility.

City Revisions to the King County Road Standards		
KCRS Reference	KCRS Existing Requirement	City Specific Revision
3.01.E-F. 4.02 Figures 3-003, through 3-009, Figures 3-012 through 3-014	Driveways	The City allows permeable pavement (porous concrete, pervious asphalt, and permeable pavers) for driveways. The City also allows two-track driveways.
5.03.D.	Requirements for placing planter strip next to the curb.	The City requires a root barrier for trees planted next to the curb.
7.01.C.	Drainage Conflicts Where technical conflicts may occur between this document and the Surface Water Design Manual, the County Road Engineer shall decide which document governs.	Where technical conflicts may occur between this document and the KCSWDM as amended by the Addendum to the KCSWDM, the Public Works Director or designee shall decide which document governs.
9.02	All roadway and drainage infrastructures must be inspected. Subgrade inspection will not commence until density tests confirm that the compaction is in accordance with the specifications. Prior to any critical task being started the applicant/developer must schedule in advance with LUIS (206) 296-6642: At a minimum the following critical tasks require advance notification:	The City identifies the following as additional critical tasks: N. Inspect, prior to clearing and construction, all permitted development sites that have a high potential for sediment transport as determined through plan review O. Inspect all permitted development sites during construction to verify proper installation and maintenance of required erosion and sediment controls. P. Inspect all permitted development sites upon completion of construction and prior to final approval or occupancy to ensure proper installation of permanent stormwater facilities. Verify that a maintenance plan is completed and responsibility for maintenance is assigned for stormwater treatment and flow control BMPs/facilities.
9.05.B.2.	Compaction Reports Compaction reports are required for all projects. The reports shall include a sketch showing the locations the tests were taken. Compaction testing shall be accomplished as backfill or embankment construction progresses. At a minimum, compaction tests are required at the following locations. Additional tests and/or shorter intervals may be required by the inspector.	Compaction reports are also required for LID BMP installations, including bioretention and permeable pavement, as required by the KCSWDM as amended by the Addendum to the KCSWDM.
9.07.C.	Haul Routes	Haul routes are prohibited on permeable pavement streets, unless approved by the Public Works Director, or designee.

City Revisions to the King County Road Standards		
KCRS Reference	KCRS Existing Requirement	City Specific Revision
Figure 5-013	Minor fill around trees	The City requires one of the following modifications to preserve gas exchange and avoid burying the tree trunk: 1. Additional perforated aeration system connected to the gravel around collar of tree or 2. Extending gravel around the tree trunk up to soil surface.

1.3 Supplemental Documents

This section identifies technical guidance manuals and documents which shall be used to supplement the KCRS.

Stormwater Standard Plans – The City of Tacoma Standard Plans currently found at www.cityoftacoma.org/government/city_departments/public_works/engineering/city_of_tacoma_right_of_way_design_manual are approved by the City of SeaTac on a conceptual basis. City of SeaTac development review staff will work with applicants to review and implement these standard details.

1.4 Code Reference Table

King County Code (KCC) is referenced in several places in the KCRS. The following table identifies these code references and equivalent SeaTac Municipal Code (SMC) where applicable.

King County Code to SeaTac Municipal Code (SMC) Reference Table			
KCC Reference	Subject of Reference	SMC Equivalent	Comment
Title 9	Surface Water Management	Title 12	KCRS 1.06 General References
KCC 9.04	Drainage, erosion/sedimentation control and sensitive areas	No Equivalent	See Addendum to KCSWDM
KCC 13.04.230	Water & Sewer Systems	Title 12	
Title 14	Roads and Bridges	Title 11	KCRS 1.06 General References
KCC 14.40	ROW vacation process	11.05.090	
Title 16	Building and Construction Standards	Title 13	KCRS 1.06 General References
Title 17 or KCC 17	Fire Code and Fire access requirements (Driveways)	Title 13.150	KCRS 1.06 General References

King County Code to SeaTac Municipal Code (SMC) Reference Table			
KCC Reference	Subject of Reference	SMC Equivalent	Comment
Title 19A	Subdivisions	Title 14	KCRS 1.06 General References
KCC 19A.08.130	Vertical and horizontal survey controls	14.26.050	
Title 20	Planning	No Equivalent	KCRS 1.06 General References
KCC 20.62	Avoid impacts to cultural resources	No Equivalent	
Title 21A or KCC 21A	Zoning	Title 15	KCRS 1.06 General References
KCC 23	Enforcement	1.15	
Title 27	Variance review fee	No Equivalent	Variance fees are outlined in the City's adopted fee schedule.
Title 27A (KC ordinance 12020)	Financial Guarantees	Title 3	KCRS 1.06 General References
Titles 46 and 47	Traffic	Title 9	KCRS 1.06 General References

Section 2. Addendum to the 2016 WSDOT Standard Specifications for Road, Bridge, and Municipal Construction

2.1 Terminology

At times WSDOT and the City use different terminology to describe or to refer to equivalent subject matter. This section identifies these terms and the City's equivalent terminology.

All Regional Administrators of the Department = Public Works Director or designee

County Engineer = Public Works City Engineer or designee

Contracting Agency = City of SeaTac

Ecology's Stormwater Management Manuals = King County Surface Water Design Manual (KCSWDM) as amended by the City Addendum to the KCSWDM.

Engineer = Public Works City Engineer or designee

2.2 Key Revisions

This section identifies revisions the City has made to the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction. These revisions are necessary to meet the intent of the LID Code Review and revision requirement in the NPDES Municipal Stormwater Phase II Permit and to address differences between WSDOT and City procedures.

2.2.1 General Revisions

Soil Amendments – The City requires soil amendments for disturbed areas in accordance with the KCSWDM as amended by the City Addendum to the KCSWDM. This requirement amends sections including, but not limited to, 8-02.3(6).

Compaction Requirements for Permeable Pavement Base Course – The City allows 90-92 percent compaction and deviations in base course requirements for permeable pavement as documented in WSDOT's GSPs (see Permeable Pavement Guidance below). This requirement amends sections including, but not limited to, 2-03.3(14)C, 7-08.3, and 7-09.3(11).

Compaction Requirements for Bioretention – The City allows 85 compaction for bioretention facilities. This requirement amends sections including, but not limited to, 2-03.3(14)C, 7-08.3, and 7-09.3(11).

Curb and Gutter Exemptions – Curb cuts and grates can be incorporated to allow water to enter stormwater facilities and LID BMPs. This requirement amends sections including, but not limited to, 8-04.3.

Permeable Pavement Guidance – The City allows the use of WSDOT's General Special Provisions (GSPs) for Porous Hot Mix Asphalt (PHMA), Porous Warm Mix Asphalt (PWMA),

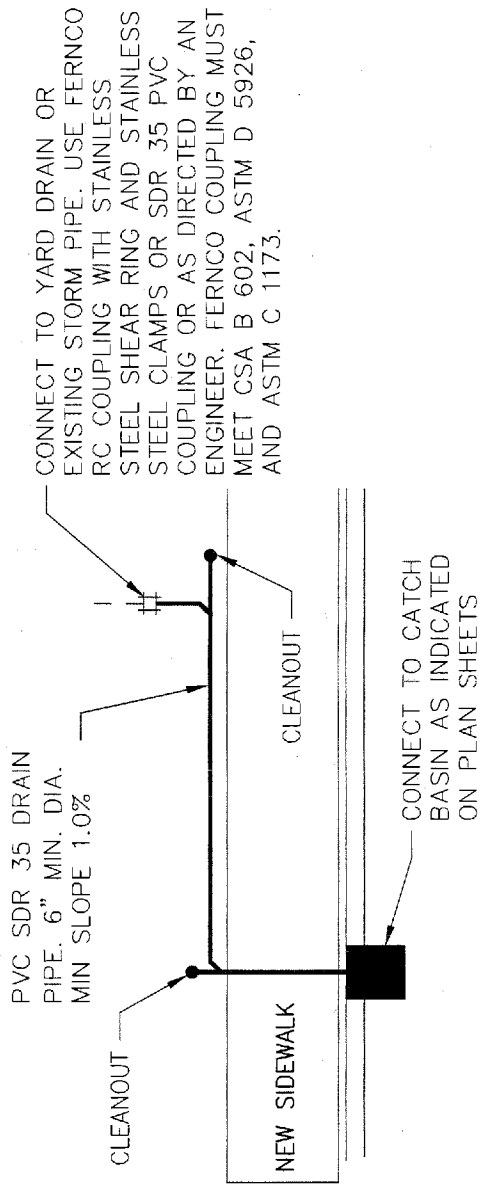
and Pervious Concrete (PConcrete) developed by the Construction Materials Committee of the American Public Works Association (APWA) Washington dated March 9, 2016. These GSPs are included in Appendix B of this document.

2.2.2 Specific Revisions

City Revisions to the WSDOT Standard Specifications		
WSDOT Reference	WSDOT Existing Requirement	City Specific Revision
1-02.9	Delivery of Proposal	Refer to Requests for Proposals for bid submittal instructions.
2-01.3(1)	Clearing, Grubbing, and Roadside Clean Up - Clearing	Where the clearing requirements in 2-01.3(1) are in conflict with SMC, Chapter 13.190 (Clearing and Grading Code) and SMC, Chapter 15.445.430 (Tree Retention – Clearing of Multi-Family, Commercial, and Industrial Zoned Lots), the SMC governs.
2-03.3(10)	Roadway Excavation and Embankment – Selected Material - Stockpiling	The City allows stockpiling of excavated materials for use on site if it meets organic matter and pH requirements specified in the Soil Amendment Standards in Appendix B of the Addendum to the KCSWDM. Laboratory testing may be required.
7-01.3(2)	Drains - Underdrain pipe	Refer to the KCSWDM as amended by the Addendum to the KCSWDM for underdrain pipe design criteria for bioretention and permeable pavement.
8-01.3(1)D	Erosion Control and Water Pollution Control - Dispersion/ Infiltration	The City requires that construction of dispersion/ infiltration areas are protected from compaction and sedimentation in accordance with the KCSWDM as amended by the City's Addendum to the KCSWDM.
8-02.3(2)A	Roadside Restoration – Roadside Work Plan	Refer to the KCSWDM as amended by the Addendum to the KCSWDM.
8-02.3(3)B	Roadside Restoration – Chemical Pesticides	Refer to the KCSWDM as amended by the Addendum to the KCSWDM and the City's Integrated Pest Management Plan (IPMP).
8-02.3(8)	Roadside Restoration – Planting Timing	The City supplements the planting timings defined in this section with the following: "unless otherwise specified in the KCSWDM and the City's Addendum to the KCSWDM."
8-14	Cement Concrete Sidewalks	Porous concrete is also allowed for sidewalks unless otherwise specified by the City. Silva cells under cement concrete sidewalk are preferred to porous concrete sidewalk.
9-14	Erosion Control and Roadside Planting	Refer to the KCSWDM as amended by the Addendum to the KCSWDM.

City Revisions to the WSDOT Standard Specifications		
WSDOT Reference	WSDOT Existing Requirement	City Specific Revision
9-14.4(8)	Compost specifications	The City requires compost to meet the requirements in the KCSWDM and the City's Addendum to the KCSWDM.
9-20	Concrete Patching Material, Grout, and Mortar	Existing permeable pavements must use steel plates for temporary patching. Permeable pavement shall be replaced in-kind where feasible. Patching porous asphalt with conventional asphalt is acceptable if it is less than 10 percent of the total facility area and does not impact the overall facility function. Take appropriate precautions during pavement repair and replacement efforts to prevent clogging of adjacent surfaces. Base aggregates shall be washed crushed aggregate. Permeable pavement shall conform to the requirements outlined in the WSDOT GSPs for permeable pavement. City inspection approval of the setup for the permeable pavement patch repair is required prior to commencing work.

Appendix A – City Road and Stormwater Standard Details



- NOTES:**
1. PROVIDE CLEANOUT AT ALL BENDS
 2. CONNECT YARD DRAINS AS SHOWN ON THE PLAN SHEETS.
 3. MAXIMUM 100' BETWEEN CLEANOUTS.

TYPICAL AREA DRAIN CONNECTION


DETAIL

NO SCALE



NO.	DATE	BY	APPR.	REVISION

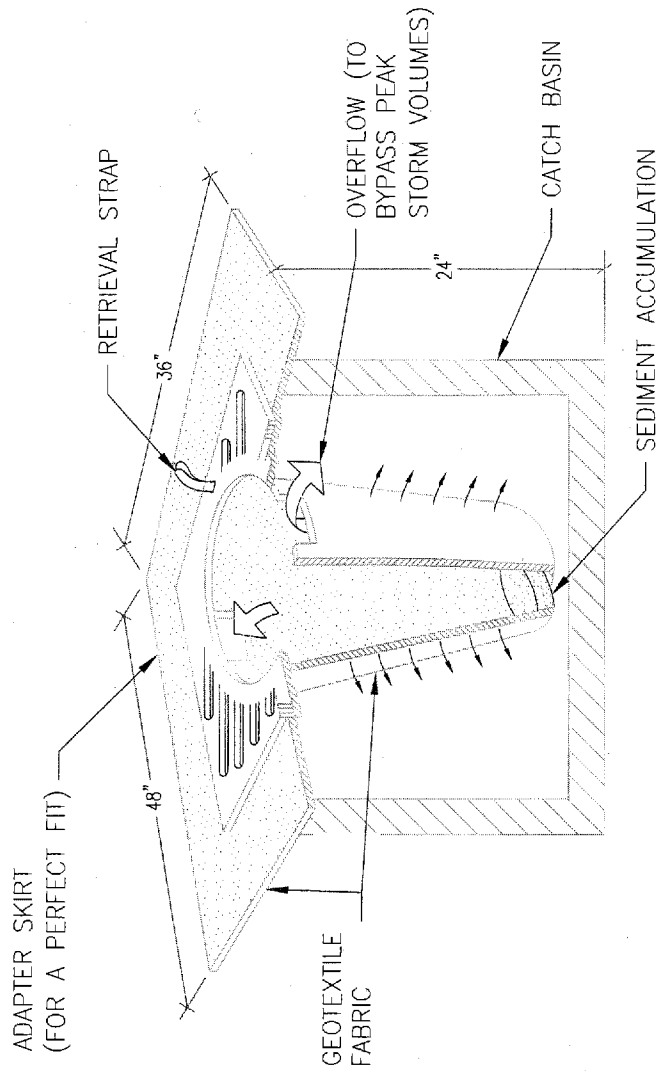
DRN. TK	DSCR. TK	CHCD. MAP
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 Tom Gut, P.E., Public Works Director
 Susan Sanderson, P.E., City Engineer
 4930 South 189th Street, Seatac, WA 98148-3625
 Telephone: (206) 972-4134; Engineering Director

CITY OF SEATAC
 24TH AVENUE SOUTH OVERLAY PROJECT
 PARALLEL CURB RAMP
 DETAILS

DATE: 03/06/2015 JOB # ST-864 SCALE: NTS



STORM DRAIN INLET PROTECTION

DETAIL

NO SCALE



NO.	DATE	BY	APPR.	REVISION

DRN. TK. DISGR. TK. CHGD. RHP



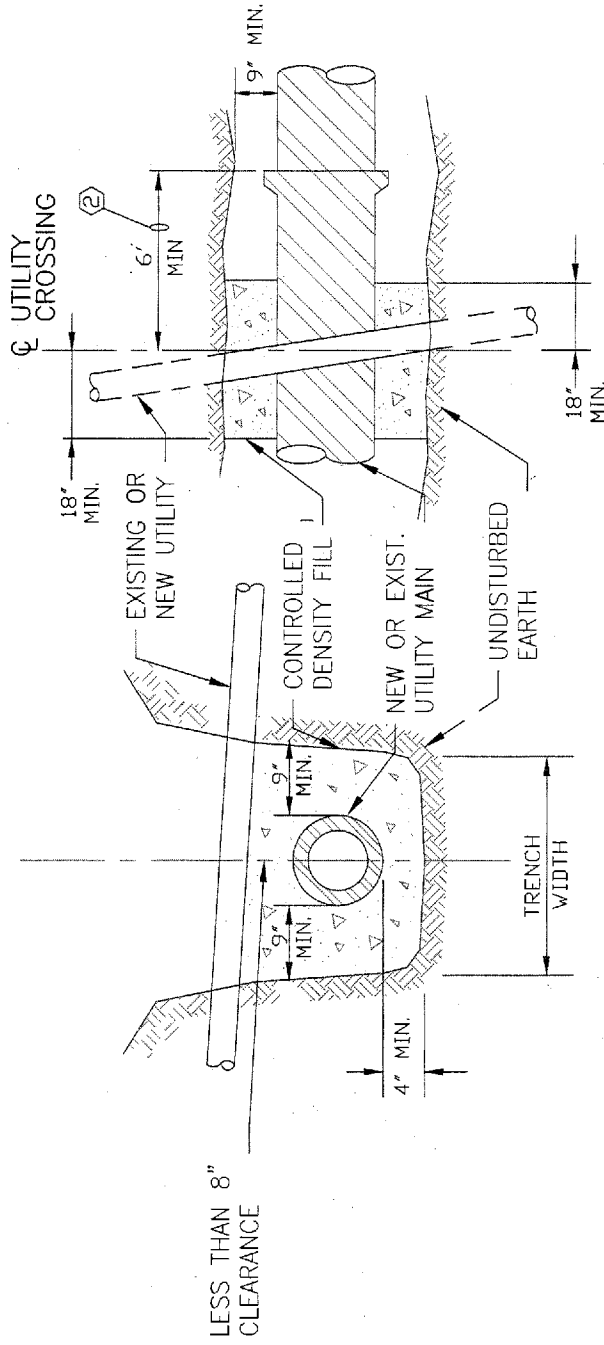
Public Works Department
 Tom Galt, P.E., Public Works Director
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CITY OF SEATTLE
24TH AVENUE SOUTH OVERLAY PROJECT
PARALLEL CURB RAMP
DETAILS

DATE: 03/26/2015 JOB # SI-884 SCALE: NTS

SHEET NO: **20**

20 OF 20

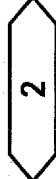


NOTES:

- ① CONTRACTOR SHALL PROVIDE CONTROLLED DENSITY FILL (CDF) PIPE ENCASEMENT AT ALL UTILITY CROSSINGS IN THE EVENT THAT AN 8" SEPARATION CANNOT BE PROVIDED. THE CONTRACTOR SHALL FAMILIARIZE THEMSELVES WITH THE SITE UTILITIES TO ANTICIPATE PROVIDING AND INSTALLING CDF ENCASEMENTS WHERE NECESSARY.
- ② CONTRACTOR SHALL NOT CONSTRUCT ANY NEW PIPE JOINT WITHIN 6 FEET OF THE EXISTING CENTERLINE OF THE UTILITY CROSSING.

CONTROLLED DENSITY FILL PIPE ENCASEMENT DETAIL

DETAIL
NO SCALE



NO.	DATE	BY	APPR.	REVISION



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DRN. TK DSGN. TK CHR.D. EMP

CITY OF SEATAC
24TH AVENUE SOUTH OVERLAY PROJECT
PARALLEL CURB RAMP
DETAILS

DATE: 03/06/2015 JOB # ST-864 SCALE: NTS

SHEET NO: 20

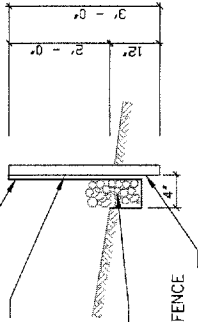
20 OF 20

STD. SPEC. 9-33.2(1), TABLE 6

2" X 4" BY 14 GA. WIRE
FABRIC OR EQUIVALENT

4"X4" MIN. TRENCH BACKFILL
WITH SUITABLE COMPACTED
NATIVE MATERIAL OR
3/4"-1.5" WASHED GRAVEL

2" X 4" WOOD POSTS, STEEL FENCE
POSTS, REBAR OR EQUIVALENT

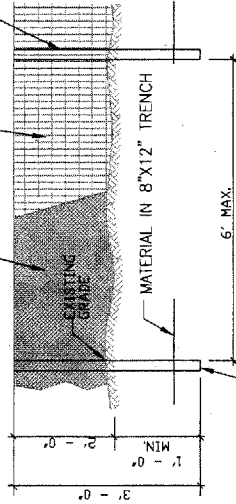


CROSS SECTION

FILTER FABRIC MATERIAL PER
STD. SPEC. 9-33.2(1), TABLE 6.
60" WIDE ROLLS - USE
STAPLES OR RINGS TO ATTACH
FABRIC TO WIRE.

2" X 4" BY 14 GA. WIRE
FABRIC OR EQUIVALENT

JOINTS IN FILTER FABRIC
SHALL BE SPLICED AT
POSTS. USE STAPLES, WIRE
RINGS OR EQUIVALENT TO
ATTACH FABRIC TO POSTS



MATERIAL IN 8"X12" TRENCH

6" MAX.

2" X 4" WOOD POSTS, STEEL FENCE
POSTS, REBAR OR EQUIVALENT

ELEVATION

NOTES

1. MAXIMIZE DETENTION OF STORMWATER BY PLACING FENCE AS FAR AWAY FROM TOE OF SLOPE AS POSSIBLE WITHOUT ENCRoACHING ON SENSITIVE AREAS OR OUTSIDE OF THE CLEARING BOUNDARIES.
2. INSTALL SILT FENCING ALONG CONTOURS WHENEVER POSSIBLE.
3. INSTALL THE ENDS OF THE SILT FENCE TO POINT SLIGHTLY UP-SLOPE TO PREVENT SEDIMENT FROM FLOWING AROUND THE ENDS OF THE FENCE.
4. PERFORM MAINTENANCE IN ACCORDANCE WITH STANDARD SPECIFICATIONS 8.01.3(9)A AND 8.01.3(15).
5. POST SPACING MAY BE INCREASED TO BE 8' IF WIRE BACKING IS USED.

**SILT FENCE
DETAIL**

NO SCALE

1

NO.	DATE	BY	APPR.	REVISION



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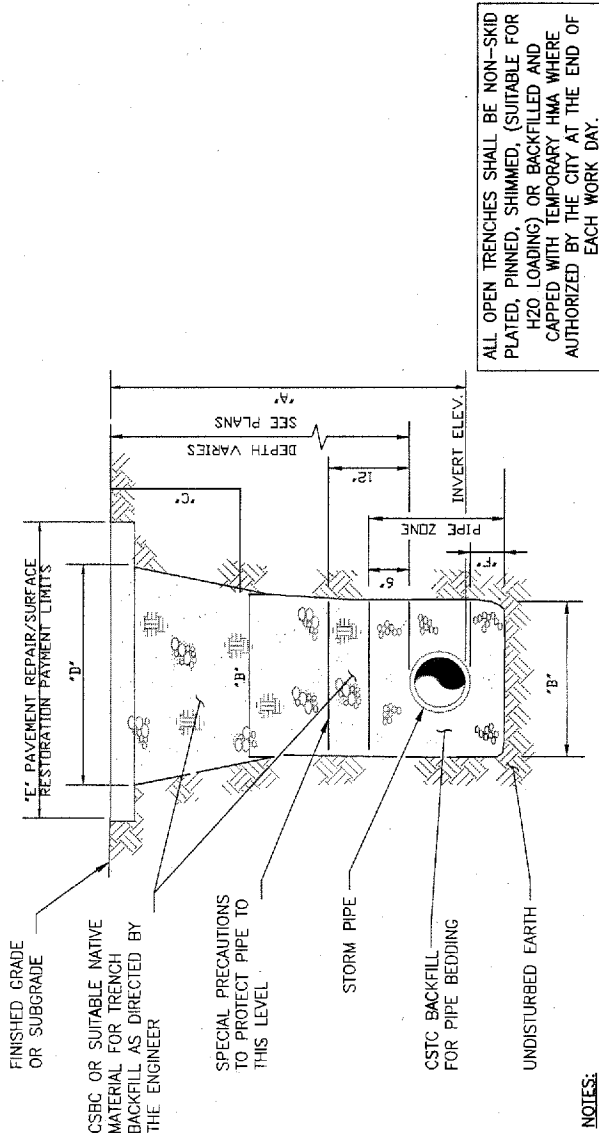
DRN. TK DSGN. TK CHGD. EAP

SHEET NO:

20

CITY OF SEATAc
24TH AVENUE SOUTH OVERLAY PROJECT
PARALLEL CURB RAMP
DETAILS

DATE: 03/06/2015 JOB # 51-884 SCALE: NTS 20 OF 20



NOTES:

1. THE TRENCH SECTIONS SHOWN ON THE PLANS ARE FOR THE PAYMENT LIMITS FOR CSBC FOR TRENCH BACKFILL. PAYMENT FOR ALL CSBC FOR TRENCH BACKFILL SHALL BE COMPUTED FROM THE MEASUREMENT OF THE CONSTRUCTED TRENCH SECTION, TO THE MAXIMUM LIMITS AS INDICATED IN THE TABLES.
2. WHERE A "NEW ROADWAY SECTION" OR PAVEMENT REPAIR IS PROPOSED, THE TRENCH SECTION PAYMENT LIMIT LINE WILL BE BOUNDED AT THE TOP BY SUBGRADE, PER TYPICAL ROADWAY SECTION DETAILS.

PIPE DIAMETER(IN)	6 TO 8	12	18	24	36
A	8' OR LESS				
B	2.50'	3.00'	3.75'	4.50'	6.00'
C	1.50'				
D	5.50'	6.00'	6.75'	7.50'	9.00'
E	6.50'	7.00'	7.75'	9.50'	10.00'
F	4 IN				
	6 IN				

STORM PIPE TRENCH SECTION

DETAIL
NO SCALE

5

NO.	DATE	BY	APP.	REVISION

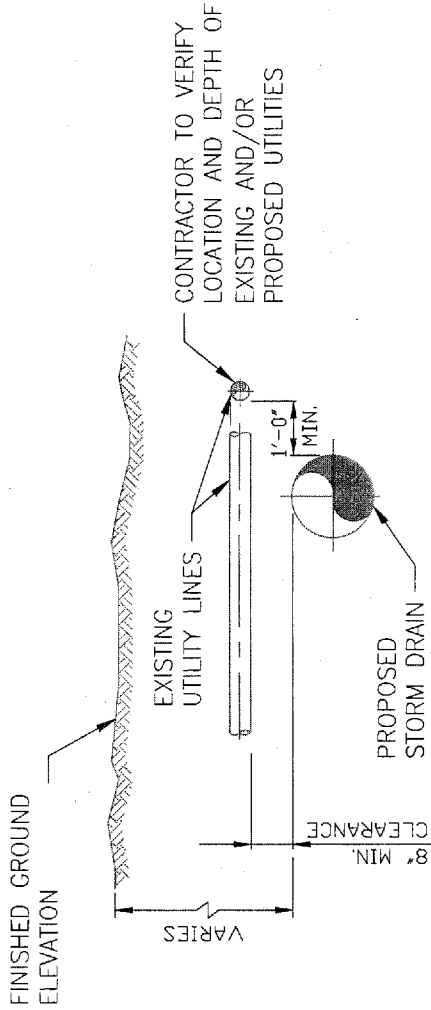
DRN. TK	DSGN. TK	CHKD. EAP



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CITY OF SEATAC
24TH AVENUE SOUTH OVERLAY PROJECT
PARALLEL CURB RAMP
DETAILS
DATE: 03/06/2015 JOB # ST-884 SCALE: NTS

SHEET NO. **20**
20 OF 20



NOTE: CONCRETE ENCASEMENT (BEDDING) SHALL BE UTILIZED AT LOCALIZED UTILITY CROSSING IF MINIMUM PIPE SEPARATION (ELEVATION) CANNOT BE MAINTAINED / ACHIEVED.

TYPICAL UTILITY CROSSING

DETAIL

NO SCALE



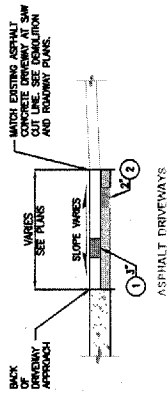
NO.	DATE	BY	REVISION

CITY OF SEATTLE
Public Works Department
 Tom Ott, P.E., Public Works Director
 Susan Sanderson, P.E., City Engineer
 5000 South 188th Street, Seattle, WA 98148-3905
 Telephone: (206) 972-1130, Engineering Division

DATE: 03/06/2015
 JOB # SF-884

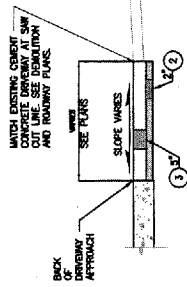
CITY OF SEATTLE
 24TH AVENUE SOUTH OVERLAY PROJECT
 PARALLEL CURB RAMP
 DETAILS

SCALE: NTS
 SHEET NO: 20
 20 OF 20



DRIVEWAY NOTES:

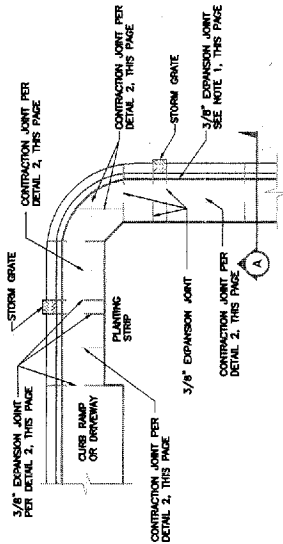
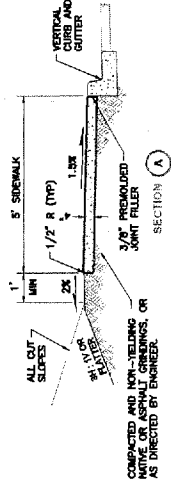
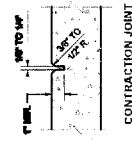
- ACCESS TO ALL PROPERTIES SHALL BE PROVIDED TO RESIDENTS AT ALL TIMES.
 - DETAILS SHOWN ARE TYPICAL AND THE ENGINEER RESERVES THE RIGHT TO MAKE ACCOMMODATE FIELD CONDITIONS.
- (1) COMMERCIAL HMA
 - (2) CRACKED SURFACING TOP COURSE
 - (3) CLASS 4000 CEMENT CONCRETE PAVEMENT



DRIVEWAY REPAIR
DETAIL
NO SCALE



CEMENT CONCRETE JOINTS
DETAIL
NO SCALE



NOTES

- 1" EXPOSED GROOVE MAY REPLACE 3/8" EXPANSION JOINT AT INTERFACE BETWEEN CURB AND ADJACENT SIDEWALK FOR SEPARATE POUR AND JOINT REQUIREMENTS.
- GRATINGS, ACCESS COVERS, FLUNCTION BOXES, APPURTENANCES WITHIN THE SIDEWALK MUST BE SET AT 1/4" BELOW FINISHED SURFACE AND MATCH GRADE OF THE SIDEWALK.
- ALL CONCRETE SHALL BE "CLASS 4000"

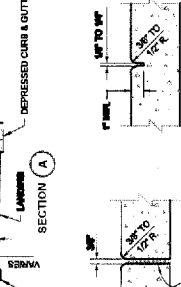
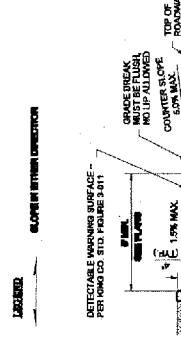
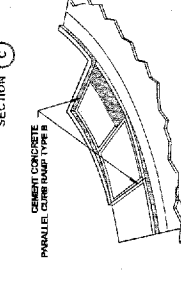
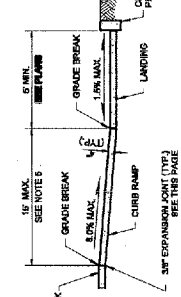
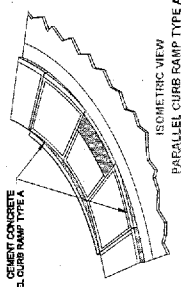
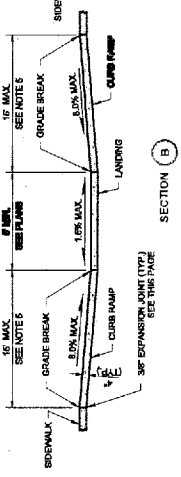
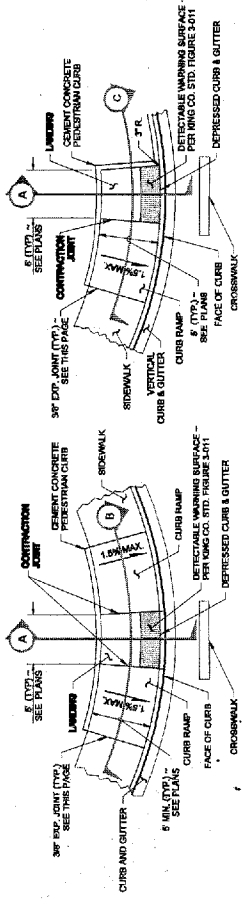
CEMENT CONCRETE SIDEWALK AND JOINTS
DETAIL
NO SCALE



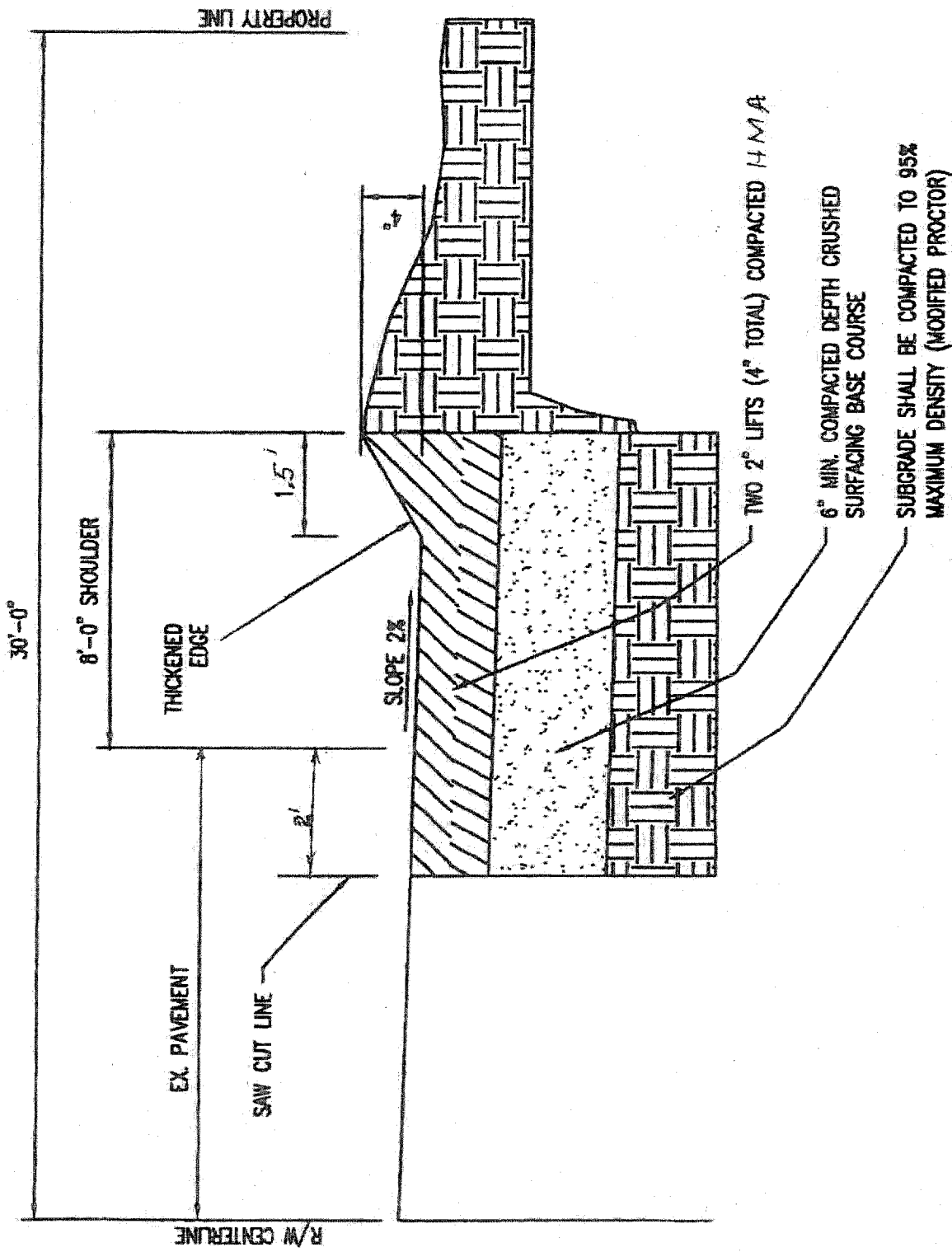
CEMENT CONCRETE SIDEWALK AND JOINTS
DETAIL
NO SCALE

CEMENT CONCRETE SIDEWALK AND JOINTS
DETAIL
NO SCALE

- NOTES**
1. CURB RAMP LOCATION SHALL BE PLACED WITHIN THE WIDTH OF THE ASSOCIATED CROSSWALK OR LANE STRIP IN THE PLANE.
 2. THESE CURB RAMP IS TO BE USED ONLY FOR THE WIDTH OF THE RAMP AND NOT FOR THE TWO ADJACENT SERVICE PLACES SHALL BE PLACED.
 3. CONTRACTOR SHALL PROVIDE ACCESS COVERING ON OTHER APPLICABLE RAMP SHALL NOT BE LOCATED IN FRONT OF THE CURB RAMP OR AT ANY OTHER PART OF THE CURB RAMP OR LANDING.
 4. THE CURB RAMP, LANDING, AND PLANS SHALL BE SMOOTH FINISHED WITH POLISHED BENCHING.
 5. THE CURB RAMP INCREASE IN SLOPE SHALL NOT EXCEED THE RAMP LENGTH TO AVOID TO AVOID OVERSLOPE THE CURB RAMP. THE 8" FOOT MINIMUM LENGTH, THE FINISHED SLOPE OF THE CURB RAMP SHALL BE AS PLAT AS POSSIBLE.
 6. THE 8" MINIMUM CEMENT CONCRETE PARALLEL CURB RAMP TYPE "A" DOES NOT INCLUDE THE ADJACENT CURB AND GUTTER, FOOTSTRAIN CURB AND GUTTER.

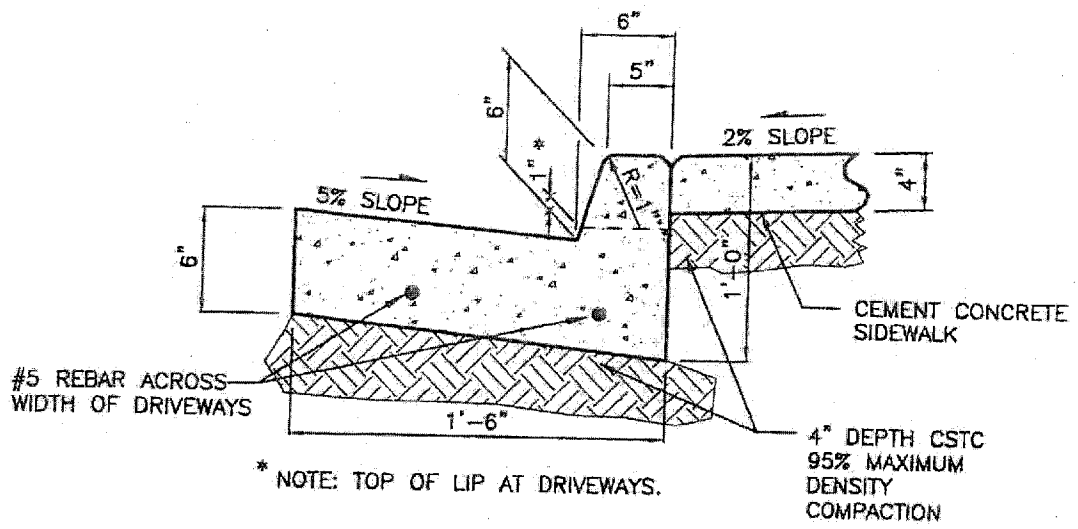


PARALLEL CURB RAMP



SECTION AA FRONTAGE IMPROVEMENTS

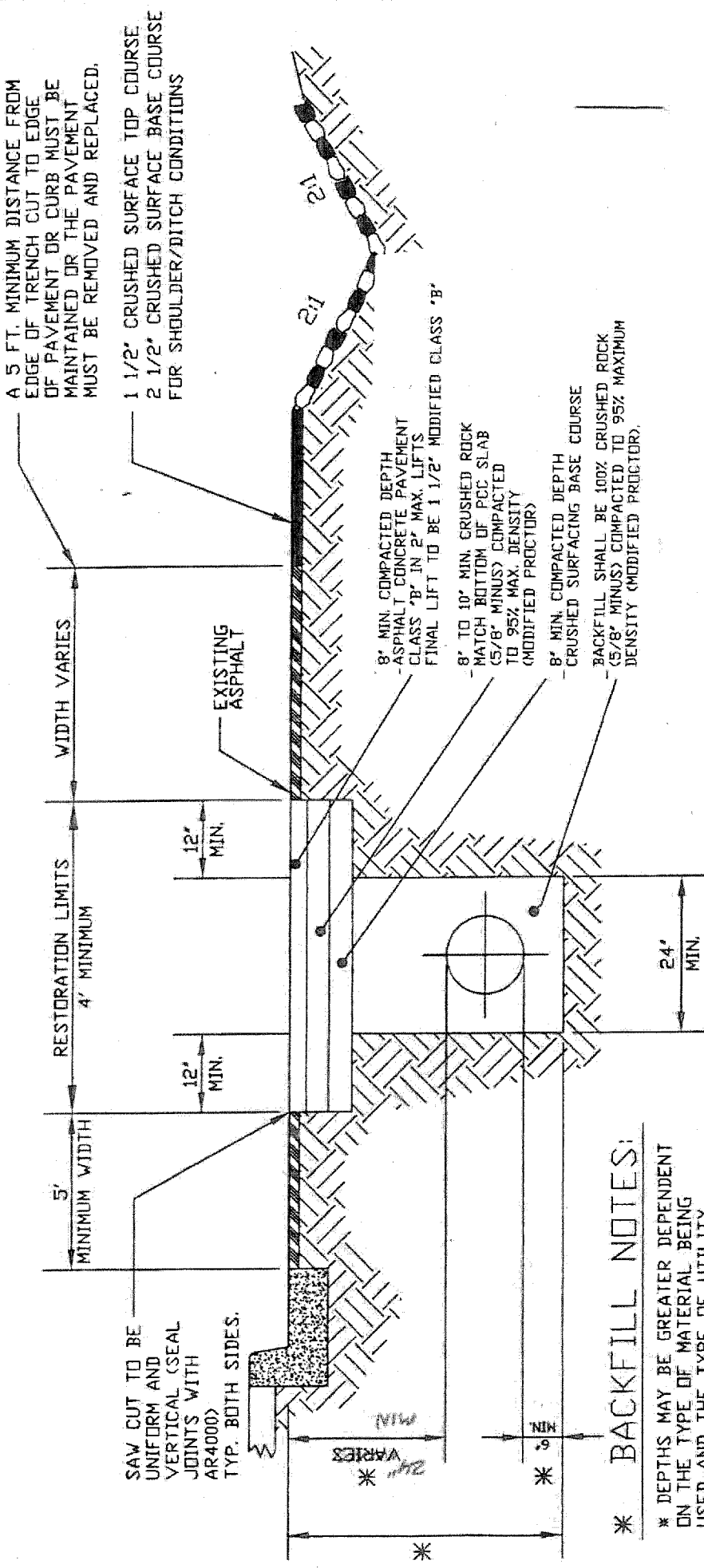
NTS



NOTES:

1. SEE SEC. 3.04 K.C.R.S. FOR JOINT REQUIREMENTS.
2. ROLL GUTTER TO MATCH POSITIVE SUPERELEVATION.
3. SEE DRAWING NO. 1-006 FOR CONFIGURATION OF FILL & WALKWAY BEHIND CURB IF REQUIRED.
4. SEE SEC. 3.03 FOR EXTRUDED CURB ANCHORAGE.

CEMENT CONCRETE VERTICAL CURB & GUTTER



*** BACKFILL NOTES:**

* DEPTHS MAY BE GREATER DEPENDENT ON THE TYPE OF MATERIAL BEING USED AND THE TYPE OF UTILITY BEING CONSTRUCTED.

* TRENCH BACKFILL IS TO BE 100% CRUSHED, EXCEPT THOSE TRENCHES PARALLEL TO THE RIGHT-OF-WAY CENTERLINE THAT ARE GREATER THAN 100 FT. IN LENGTH AND THOSE TRENCHES THAT ARE OUTSIDE PAVED OR IMPROVED AREAS. THE CITY WILL CONSIDER TRENCHES GREATER THAN 100 FT. IN LENGTH AND AREAS UNDER PAVEMENT AND OTHER RIGHT-OF-WAY IMPROVEMENTS ON A CASE BY CASE BASIS. FACTORS TO CONSIDER INCLUDE GEOTECH REPORTS AND COMPACTION TESTING UNDER PAVED AND IMPROVED AREAS AND POTENTIAL FUTURE IMPROVEMENTS OUTSIDE EXISTING IMPROVED AREAS.

NOTES:

1. DAMAGE TO PAVEMENT SURFACE SEAL COATS DURING BACKFILL OPERATIONS WILL REQUIRE THAT A FOG SEAL OF CSS-1 AT THE RATE OF 0.05 TO 0.10 (0.03 TO 0.05 RESIDUAL) GALLONS PER SQUARE YARD BE APPLIED TO THE PAVEMENT TO RETURN THE PAVEMENT SEAL TO ORIGINAL OR BETTER CONDITION. ADDITIONAL STRUCTURAL DAMAGE TO THE PAVEMENT SHALL REQUIRE BUT NOT BE LIMITED TO SQUARE CUT PATCHING AND OR OVERLAYS.
2. DITCH SIDE SLOPES AND FLOW LINE ARE TO BE STABILIZED BY PLACING RIP RAP OR OTHER TREATMENTS AS REQUIRED BY THE PUBLIC WORKS DIRECTOR'S REPRESENTATIVE.



**Public Works Department
Engineering Division**

Date Schroeder, P.E., Director

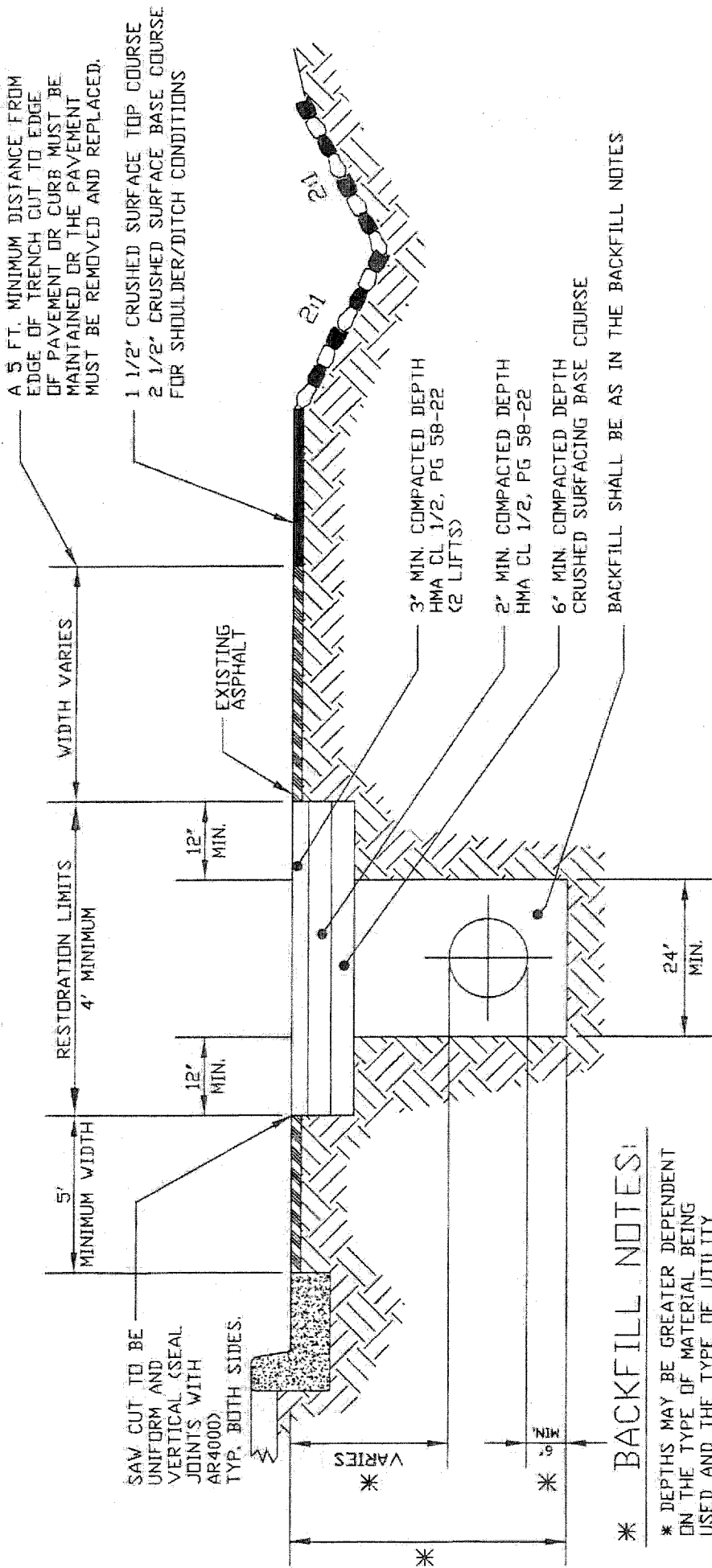
4500 S. 188th St., SeaTac, WA 98188-8805
Telephone: 206-973-4750

CHECKED: DLS
DRAWN: DLH
REV: 8/30/2006
DATE: 9/1/1994

ARTERIAL
NEIGHBORHOOD STREET
TYP. ROADWAY REPAIR

K:\ENGR\CADD\DETAILS\SR_1

DETAIL NO. SR-1



A 5 FT. MINIMUM DISTANCE FROM EDGE OF TRENCH CUT TO EDGE OF PAVEMENT OR CURB MUST BE MAINTAINED OR THE PAVEMENT MUST BE REMOVED AND REPLACED.

1 1/2" CRUSHED SURFACE TOP COURSE
 2 1/2" CRUSHED SURFACE BASE COURSE
 FOR SHOULDER/DITCH CONDITIONS

3' MIN. COMPACTED DEPTH
 HMA CL 1/2, PG 58-22
 (2 LIFTS)

2' MIN. COMPACTED DEPTH
 HMA CL 1/2, PG 58-22

6' MIN. COMPACTED DEPTH
 CRUSHED SURFACING BASE COURSE

BACKFILL SHALL BE AS IN THE BACKFILL NOTES

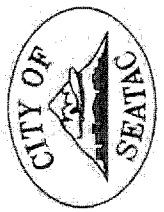
*** BACKFILL NOTES:**

* DEPTHS MAY BE GREATER DEPENDENT ON THE TYPE OF MATERIAL BEING USED AND THE TYPE OF UTILITY BEING CONSTRUCTED.

* TRENCH BACKFILL IS TO BE 100% CRUSHED, EXCEPT THOSE TRENCHES PARALLEL TO THE RIGHT-OF-WAY CENTERLINE THAT ARE GREATER THAN 100 FT. IN LENGTH AND THOSE TRENCHES THAT ARE OUTSIDE PAVED OR IMPROVED AREAS. THE CITY WILL CONSIDER TRENCHES GREATER THAN 100 FT. IN LENGTH AND AREAS UNDER PAVEMENT AND OTHER RIGHT-OF-WAY IMPROVEMENTS ON A CASE BY CASE BASIS. FACTORS TO CONSIDER INCLUDE GEOTECH REPORTS AND COMPACTION TESTING UNDER PAVED AND IMPROVED AREAS AND POTENTIAL FUTURE IMPROVEMENTS OUTSIDE EXISTING IMPROVED AREAS.

NOTES:

1. DAMAGE TO PAVEMENT SURFACE SEAL COATS DURING BACKFILL OPERATIONS WILL REQUIRE THAT A FOG SEAL OF CSS-1 AT THE RATE OF 0.05 TO 0.10 (0.03 TO 0.05 RESIDUAL) GALLONS PER SQUARE YARD BE APPLIED TO THE PAVEMENT TO RETURN THE PAVEMENT SEAL TO ORIGINAL OR BETTER CONDITION. ADDITIONAL STRUCTURAL DAMAGE TO THE PAVEMENT SHALL REQUIRE BUT NOT BE LIMITED TO SQUARE CUT PATCHING AND DR OVERLAYS.
2. DITCH SIDE SLOPES AND FLOW LINE ARE TO BE STABILIZED BY PLACING RIP RAP OR OTHER TREATMENTS AS REQUIRED BY THE PUBLIC WORKS DIRECTORS REPRESENTATIVE.



**Public Works Department
 Engineering Division**

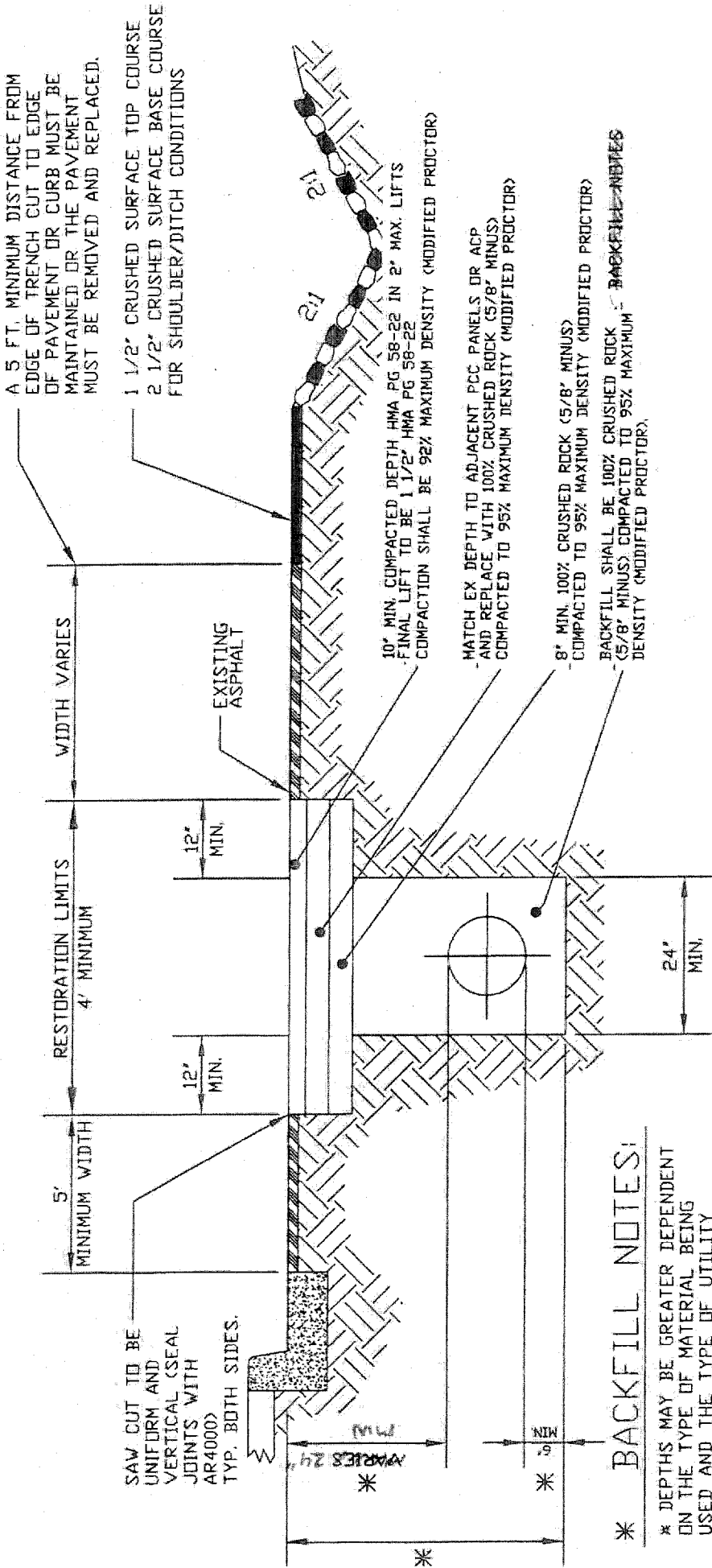
Date Schroeder, P.E., Director
 4800 S. 188th St., Seattle, WA 98188-8605
 Telephone: 206-973-4730

CHECKED: DLS
DRAWN: DLH
REV: 8/30/2006
DATE: 9/1/1994

**NEIGHBORHOOD STREET
 ROADWAY REPAIR**

K:\ENGR\CADD\DETAILS\SR-1

DETAIL NO. SR-1



A 5 FT. MINIMUM DISTANCE FROM EDGE OF TRENCH CUT TO EDGE OF PAVEMENT OR CURB MUST BE MAINTAINED OR THE PAVEMENT MUST BE REMOVED AND REPLACED.

1 1/2" CRUSHED SURFACE TOP COURSE
 2 1/2" CRUSHED SURFACE BASE COURSE FOR SHOULDER/DITCH CONDITIONS

10" MIN. COMPACTED DEPTH HMA PG 58-22 IN 2" MAX. LIFTS
 FINAL LIFT TO BE 1 1/2" HMA PG 58-22
 COMPACTED TO 92% MAXIMUM DENSITY (MODIFIED PROCTOR)

MATCH EX DEPTH TO ADJACENT PCC PANELS OR ACP AND REPLACE WITH 100% CRUSHED ROCK (5/8" MINUS) COMPACTED TO 95% MAXIMUM DENSITY (MODIFIED PROCTOR)

8" MIN. 100% CRUSHED ROCK (5/8" MINUS) COMPACTED TO 95% MAXIMUM DENSITY (MODIFIED PROCTOR)
 BACKFILL SHALL BE 100% CRUSHED ROCK (5/8" MINUS) COMPACTED TO 95% MAXIMUM DENSITY (MODIFIED PROCTOR)

*** BACKFILL NOTES:**

* DEPTHS MAY BE GREATER DEPENDENT ON THE TYPE OF MATERIAL BEING USED AND THE TYPE OF UTILITY BEING CONSTRUCTED.

* TRENCH BACKFILL IS TO BE 100% CRUSHED, EXCEPT THOSE TRENCHES PARALLEL TO THE RIGHT-OF-WAY CENTERLINE THAT ARE GREATER THAN 100 FT. IN LENGTH AND THOSE TRENCHES THAT ARE OUTSIDE PAVED OR IMPROVED AREAS. THE CITY WILL CONSIDER TRENCHES GREATER THAN 100 FT. IN LENGTH AND AREAS UNDER PAVEMENT AND OTHER RIGHT-OF-WAY IMPROVEMENTS ON A CASE BY CASE BASIS. FACTORS TO CONSIDER INCLUDE GEOTECH REPORTS AND COMPACTION TESTING UNDER PAVED AND IMPROVED AREAS AND POTENTIAL FUTURE IMPROVEMENTS OUTSIDE EXISTING IMPROVED AREAS.

NOTES:

1. DAMAGE TO PAVEMENT SURFACE SEAL COATS DURING BACKFILL OPERATIONS WILL REQUIRE THAT A FDG SEAL OF CSS-1 AT THE RATE OF 0.05 TO 0.10 (0.03 TO 0.05 RESIDUAL) GALLONS PER SQUARE YARD BE APPLIED TO THE PAVEMENT TO RETURN THE PAVEMENT SEAL TO ORIGINAL OR BETTER CONDITION. ADDITIONAL STRUCTURAL DAMAGE TO THE PAVEMENT SHALL REQUIRE BUT NOT BE LIMITED TO SQUARE CUT PATCHING AND OR OVERLAYS.
2. DITCH SIDE SLOPES AND FLOW LINE ARE TO BE STABILIZED BY PLACING RIP RAP OR OTHER TREATMENTS AS REQUIRED BY THE PUBLIC WORKS DIRECTORS REPRESENTATIVE.
3. COMPACTON TESTS FOR BACKFILL AND ASPHALT SHALL BE REQUIRED EVERY 25 FEET ALONG THE TRENCH BY AN INDEPENDANT CONTRACTOR.



**Public Works Department
 Engineering Division**

Dale Schroeder, P.E., Director

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REV.:	8/30/2006
DATE:	9/1/1994

INTERNATIONAL ROAD
NEIGHBORHOOD STREET
 TYP. ROADWAY REPAIR

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DETAIL NO. SR-1

Appendix B – WSDOT GSPs for Permeable Pavement

- These GSPs may not be used on WSDOT Projects.
- See the log of changes/additions to these GSPs, for the reasons and history behind each GSP; this will give you guidelines for their use.
- These GSPs are written assuming the spec writer will include in their Bid Documents, all related Division 1 Amendments to the Standard Specifications.
- Please read notes at http://www.wsdot.wa.gov/partners/apwa/HMA-WMA_Notes.pdf before using

DIVISION 2

- 2-06.3(3).RTF Subgrade for Permeable Pavements**
(March 9, 2016)
May be used on FHWA funded projects.
For use when specifying Permeable pavement.
- 2-06.5.RTF Subgrade for Permeable Pavements**
(March 9, 2016)
May be used on FHWA funded projects.
For use when specifying Permeable pavement.

DIVISION 4

- 4-04.2(9-03.9(2)).OPT1.RTF Permeable Ballast**
(March 9, 2016)
May be used on FHWA funded projects.
Use when specifying Permeable pavements.
- 4-04.2(9-03.9(2)).OPT2.RTF Crushed Surfacing Choker Course**
(March 9, 2016)
May be used on FHWA funded projects.
Use when specifying Permeable pavements.
Optional - at the discretion of the Engineer. Use with 2-06.3 RTF and 4-04.2 opt1.RTF or, consider using Asphalt Treated Permeable Base over Permeable Ballast.
- Do NOT use Crushed Surfacing Choker Course for Pervious Concrete installations. For Porous Asphalt you may want to consider Asphalt Treated Permeable Base (ATPB) instead of Crushed Surfacing Choker Course.
- 4-04.2(9-03.9(2)).OPT3.RTF Aggregates for Permeable Base**
(March 9, 2016)
May be used on FHWA funded projects.
Must use with 4-04.2(9-03.9(2)).OPT1.rtf and/or 4-04.2(9-03.9(2)).OPT2.rtf.
- 4-04.3(5).RTF Shaping and Compaction**
(March 9, 2016)
May be used on FHWA funded projects.

Use when specifying Porous HMA or Pervious Concrete.

Because of the high void content in the aggregates, there will be some displacement of the aggregate surface under load. Crushed Surfacing Choker Course is used to minimize the displacement in preparation for paving. The use of Asphalt Treated Permeable Base (ATPB) directly over the Permeable Ballast Base Course eliminates the need for Crushed Surfacing Choker Course.]

4-04.4.RTF

Measurement

(March 9, 2016)

May be used on FHWA funded projects.

Use when specifying Crushed Surfacing Choker Course.

4-04.5.RTF

Payment

(March 9, 2016)

May be used on FHWA funded projects.

Use when specifying Crushed Surfacing Choker Course.

4-SA2.RTF

Asphalt Treated Permeable Base (ATPB)

(March 9, 2016)

May be used on FHWA funded projects.

Optional - May be used as a Base for Porous Hot Mix Asphalt, when used, also use 2-06.3(3).rtf.

DIVISION 5

5-04.1.RTF

Description

(March 9, 2016)

Hot Mix Asphalt

May be used on FHWA funded projects.

Use when specifying Porous HMA.

5-04.2(9-03.8).RTF

Materials

(March 9, 2016)

Aggregates for Porous Hot Mix Asphalt/Porous Warm Mix Asphalt (PHMA/PWMA)

May be used on FHWA funded projects.

Use when specifying Porous HMA.

5-04.3.RTF

Construction Requirements

(March 9, 2016)

Porous Asphalt (PHMA/PWMA) Acceptance Infiltration Test

May be used on FHWA funded projects.

Use when specifying Porous HMA.

5-04.3(1).RTF

Hot Asphalt Mixing Plant

(March 9, 2016)

Fiber Supply System

May be used on FHWA funded projects.

Use when specifying Porous HMA.

- 5-04.3(7)A.RTF** **Mix Design**
(March 9, 2016)
May be used on FHWA funded projects.
Use when specifying Porous HMA.
- 5-04.3(8)A1.OPT2.RTF** **General**
(March 9, 2016)
May be used on FHWA funded projects.
Use when specifying Porous HMA.
- 5-04.3(8)A6.OPT2.RTF** **Test Methods**
(March 9, 2016)
May be used on FHWA funded projects.
- 5-04.3(9).RTF** **Spreading and Finishing**
(March 9, 2016)
May be used on FHWA funded projects.
Use when specifying Porous HMA.
- 5-04.3(10)A.RTF** **General**
(March 9, 2016)
May be used on FHWA funded projects.
Use when specifying Porous HMA.
- 5-04.4.RTF** **Measurement**
(March 9, 2016)
May be used on FHWA funded projects.
Use when specifying Porous HMA.
- 5-04.5.RTF** **Payment**
(March 9, 2016)
May be used on FHWA funded projects.
Use when specifying Porous HMA.
- 5-06.SA.RTF** **Pervious Concrete Pavement**
(March 9, 2016)
May be used on FHWA funded projects.
When used, include 2-06.3(3).rtf, 4-04.2(9-03.9(2)).OPT1.rtf, or 4-04.2(9-03.9(2)).OPT1.rtf and 4-SA2.rtf or 4-04.2(9-03.9(2)).OPT2.rtf as sub base and base courses.

Add the following new section:

2-06.3(3) Subgrade for Permeable Pavements

(March 9, 2016 APWA GSP)

Before placing permeable ballast for Porous HMA/WMA, the Contractor shall bring the Subgrade to the required line, grade, and cross-section. The Contractor shall compact the Subgrade to a depth of 6 inches to at least 90 percent, but not more than 92 percent, of the maximum density as determined by the compaction control tests described in Section 2-03.3(14)D. Two (2) density tests will be conducted for every 5,000 square feet of prepared subgrade; or four (4) tests per 200 lineal feet of roadway or sidewalk. All subgrade shall be firm and unyielding as determined by the Engineer.

The Contractor shall take measures to protect the prepared and approved subgrade from traffic, water run-on, standing water, or other damage. Subgrade that has been over compacted, shall be scarified to a minimum depth of eight (8) inches and recompact.

Material used to protect the Subgrade from traffic or provide access to adjacent facilities shall be removed and the subgrade compacted prior to placing geotextile, if used and/or permeable ballast.

2-06.5 Measurement and Payment
(March 9, 2016 APWA GSP)

Supplement this section with the following:

Measurement for Subgrade for Permeable Pavement will be in accordance with 2-06.5.

4-04.2 Gravel Base
 (March 9, 2016 APWA GSP)

Revise section 9-03.9(2) to read:

Permeable Ballast

Permeable ballast shall meet the requirements of Section 9-03.9(1) for ballast except for the following special requirements.

The grading and quality requirements are:

Grading No. 1		Grading No. 2 (AASHTO No. 3)	
Sieve Size	Percent Passing	Sieve Size	Percent Passing
2-1/2"	99-100	2-1/2"	100
2"	65-100	2"	90-100
3/4"	40-80	1-1/2"	35-70
No. 4	0-5	1"	0-15
No. 100	0-2	1/2"	0-5
% Fracture	95	No. 100	0-3
All percentages are by weight.		% Fracture	95

The sand equivalent value and dust ratio requirements do not apply.

Los Angeles Wear, 500 Rev. 30% maximum
 Degradation Factor 30 minimum

The fracture requirement shall be at least two (2) fractured faces and will apply to the combined aggregate retained on the No. 4 sieve in accordance with WSDOT FOP for AASHTO T 335.

The minimum void ratio of the aggregate shall be 30 percent as determined by AASHTO T 19.

Permeable ballast material may be conditionally approved based on Contractor submitted sampled materials prior to delivery to the site. Final Acceptance will be based on conformance testing completed on material that has been delivered, installed, and compacted on site. The exact point of acceptance will be determined by the Engineer. Material out of conformance with the project specifications will be removed and replaced at the Contractor's expense.

4-04.2 Gravel Base
(March 9, 2016 APWA GSP)

Supplement section 9-03.9(2) with the following:

Crushed Surfacing Choker Course

Crushed Surfacing Choker Course shall be manufactured from ledge rock, talus, or gravel in accordance with the provisions of Section 3-01. Recycled concrete is not permitted. The materials shall be uniform in quality and substantially free from wood, roots, bark, and other extraneous material and shall meet the following quality test requirements:

Los Angeles Wear, 500 Rev 30% maximum
Degradation Factor 30 minimum
Minimum Void Content: 30% as determined by AASHTO T19 or ASTM
C29, rodding procedure.

The grading and quality requirements are:

Sieve Size	Percent Passing
1-1/2 inch	100
1 inch	95-100
½ inch	25-60
#4	0-10
#8	0-5
% Fracture	95

All percentages are by weight.

The fracture requirement shall be at least two (2) fractured faces and will apply to the combined aggregate retained on the No. 4 sieve in accordance with WSDOT FOP for AASHTO T 335.

4-04.2 Gravel Base
(March 9, 2016 APWA GSP)

Supplement section 9-03.9(2) with the following:

Aggregates for permeable base shall meet the requirements for grading and quality when placed in hauling vehicles for delivery to the site, after placement in temporary stockpiles on site, during installation, and after installation and compaction.

Acceptance of aggregates shall be as provided under non-statistical evaluation.

The Contractor's submittal for the aggregate material shall provide description of sampling methodology, identify where and how the sample was collected, total weight of sample collected, description of sample preparation procedures, total weight of sample sieved to determine grain size distribution, and test results. Sampling and preparation shall be in conformance with ASTM D75 and ASTM C702.

4-04.3(5) Shaping and Compaction
(March 9, 2016 APWA GSP)

Supplement this section with the following:

Immediately following spreading and final shaping each layer of surfacing shall be lightly compacted in one lift until no visible movement of aggregate is observed resulting in a firm and unyielding condition, as determined by the Engineer.

4-04.4 Measurement
(March 9, 2016 APWA GSP)

Supplement this section with the following:

Crushed Surfacing Choker Course will be measured by the ton in accordance with Section 1-09.2, based on certified truck tickets collected by the Contractor and provided to the inspector at the end of each working day.

4-04.5 Payment
(March 9, 2016 APWA GSP)

Supplement this section with the following:

“Crushed Surfacing Choker Course”, per ton.

Supplement Division 4 with the following:
(March 9, 2016 APWA GSP)

ASPHALT TREATED PERMEABLE BASE (ATPB)

Description

Asphalt treated permeable base (ATPB) consists of a compacted course of base material which has been weatherproofed and stabilized by treatment with an asphalt binder.

This work consists of constructing one or more courses of asphalt treated permeable base (ATPB) upon a prepared foundation or base in accordance with these Specifications and in conformity with the lines, grades, thicknesses, and typical cross-sections shown in the Plans or as established by the Engineer.

Materials

Materials shall meet the requirements of the following sections:

Asphalt 9-02.1
Anti-Stripping Additive 9-02.4

Aggregates for Asphalt Treated Permeable Base (ATPB)

General Requirements

Aggregates for asphalt treated permeable base shall be manufactured from ledge rock, talus, or gravel, in accordance with the provisions of Section 3-01 that meet the following test requirements:

Los Angeles Wear, 500 Rev. 30% maximum
Degradation Factor 15 minimum

Grading

Aggregates for asphalt treated permeable base (ATPB) shall meet the following requirements for grading:

Sieve Size	Percent Passing *
¾" square	100
½" square	90 - 100
3/8" square	40 - 80
U.S. No. 4	0 - 30
U.S. No. 8	0 - 20
U.S. No. 16	0 - 10

* All percentages are by weight.

The aggregate shall consist of a combination of crushed and natural aggregates with a percent fracture greater than 75% on one face on the No. 4 sieve and above, in accordance with the field operating procedures for AASHTO T 335.

Test Requirements

When the aggregates are combined within the limits set forth in Section 9-03.6(2) and mixed in the laboratory with the designated grade of asphalt, the mixture shall meet the following test values:

% of Theoretical Maximum Specific Gravity (Gmm)	70 @ 75 gyrations (approximate = 30% void space)
AASHTO T324, WSDOT TM T718 or ASTM D3625	Pass (Acceptable anti-strip evaluation tests)

The sand equivalent value of the mineral aggregate for asphalt treated permeable base (ATPB) shall not be less than 35.

Paving Asphalt

The grade of paving asphalt binder shall be PG70-22ER unless otherwise specified by the Contract.

The manufacture of ATPB may include warm mix asphalt (WMA) processes in accordance with these Specifications. WMA processes include organic additives, chemical additives, and foaming that allow for lower mixing and placement temperatures without impacting the final ATPB pavement properties.

Construction Requirements

Asphalt Mixing Plant

Asphalt mixing plants for ATPB shall meet the following requirements:

Heating

The plant shall be capable of heating the aggregates to the required temperature.

Proportioning

The mixing plant shall be capable of proportioning: the aggregates to meet the Specifications, and the asphalt binder at the rate specified in the approved job mix formula (JMF). If the aggregates are supplied in two or more sizes, means shall be provided for proportioning or blending the different sizes of aggregates to produce material meeting the Specification requirements

Mixing

The mixer shall be capable of producing a uniform mixture of uniformly coated aggregates meeting the requirements of these Specifications.

Preparation of Aggregates

Aggregates for ATPB shall be stockpiled before use in accordance with the requirements of Section 3-02. The aggregates shall be heated in the Asphalt Mixing

Plant in compliance with the JMF and related temperature viscosity curves for the asphalt binder grade specified.

Mix Design

The asphalt binder for ATPB shall be PG 70-22ER polymer modified or higher grade unless otherwise stated. Binder content shall be between 3.0% and 4.5% by total weight of the mix, and will be the highest percentage that passes void requirements test at $N_{design} = 75$ gyrations. The binder content tolerance shall be $\pm 0.3\%$ during production/ placement of the ATPB. The Contractor shall adjust the aggregate to meet the targeted void space specification.

Target void space shall be approximately 30% per ASTM D3203.

The Contractor shall include a mix design submittal documenting the ATPB mix design test results presented alongside the mix design specification criteria included in this Specification, along with the submittal temperature-viscosity curves from the polymer-modified asphalt binder supplier showing the recommended mixing and compaction temperatures developed for dense graded HMA applications.

The Contractor shall determine anti-strip requirements for ATPB and provide data for anti-strip dosage as part of the mix design approval process. The ATPB mix shall be tested for its resistance to stripping by water in accordance with ASTM D-3625. If the estimated coating area is not above 95 percent, a Qualified Products List (QPL) anti-stripping agent shall be added to the ATPB to a level that achieves 95 percent plus asphalt binder retention using ASTM D-3625. The Contractor shall be responsible for conducting the anti-stripping evaluation and providing a report to the Engineer. A documented anti-strip evaluation (either AASHTO T324 or WSDOT TM T718) of an existing dense graded hot mix asphalt (HMA) from the same aggregate source and binder supplier as the proposed ATPB may be used to document acceptable anti-strip dosage rates in lieu of ASTM D-3625 testing.

Mixing

The asphalt treated permeable base shall be mixed in accordance with the requirements of Section 5-04.3(8).

Hauling Equipment

Hauling equipment for asphalt treated permeable base shall conform to the requirements of Section 5-04.3(2).

Spreading and Finishing

Asphalt treated permeable base shall be spread with a spreading machine equipped with a stationary, vibratory, or oscillating screed or cut-off device, subject to the approval of the Engineer. Approval of the equipment shall be based on a test section demonstrating that the finished product will meet all requirements of the Specifications. Automatic controls will not be required.

The internal temperature of the ATPB mixture at the time final rolling and targeted consolidation is achieved shall be a minimum of 185°F. Rollers shall only be operated in the static mode when the internal temperature of the ATPB is less than 175°F.

Unless otherwise directed by the Engineer the nominal compacted depth for any layer of asphalt treated permeable base shall not exceed 0.40 feet. A light tack coat (approximately 0.02 gallons/square yard residual asphalt) shall be applied between lifts of ATPB. A tack coat shall also be applied between the ATPB surface and the subsequent paving lifts when cleaning of the ATPB surface is necessary.

Tack coat shall be uniformly applied to cover the existing porous pavement with a thin film of residual asphalt free of streaks and bare spots. A heavy application of tack coat shall be applied to all joints. The spreading equipment shall be equipped with a thermometer to indicate the temperature of the tack coat material.

Equipment shall not operate on tacked surfaces until the tack has broken and cured. If the Contractor's operation damages the tack coat it shall be repaired prior to placement of the PHMA.

Unless otherwise approved by the Engineer, the tack coat shall be CSS-1 or CSS-1h emulsified asphalt. The CSS-1 and CSS-1h emulsified asphalt may be diluted with water at a rate not to exceed one part water to one part emulsified asphalt. The tack coat shall not exceed the maximum temperature recommended by the emulsified asphalt manufacturer.

Subgrade Protection Course

Unless otherwise specified by the Engineer, the Contractor shall place the asphalt treated permeable base as a protection for the prepared foundation or base on all sections of individual Roadways which are to receive ATPB as soon as 10,000 square yards of prepared foundation or base is completed. This requirement shall not be limited to contiguous areas on the project.

The surface of the prepared foundation or base protection layer when constructed on a grading project shall conform to grade and smoothness requirements that apply to the prepared foundation or base upon which it is placed.

Finish Course

The final surface course of the ATPB, excluding shoulders, shall not deviate at any point more than $\frac{3}{8}$ inch from the bottom of a 10-foot straightedge laid in any direction on the surface on either side of the Roadway crown. Failure to meet this requirement shall necessitate sufficient surface correction to achieve the required tolerance, as approved by the Engineer, at no expense to the Contracting Agency.

When portland cement concrete pavement is placed on an asphalt base, the surface tolerance of the asphalt base shall be such that no elevation lies more than 0.05 feet below nor 0.00 feet above the plan grade minus the specified plan depth of portland cement concrete pavement. Prior to placing the portland cement concrete pavement, any such irregularities shall be brought to the required tolerance by grinding or other means approved by the Engineer, at no expense to the Contracting Agency.

Density & Infiltration Testing for Acceptance

The asphalt treated permeable base shall be consolidated to a firm and unyielding state. The Contractor will develop a roller pattern that will initially consolidate the pavement structure and then use static rolling only thereafter. Density testing targeting 15 to 20% final air voids (80% to 85% of maximum theoretical (Rice)

density) in the ATPB will be performed by the Contractor to monitor the consolidation effort and to avoid over compaction. The frequency of these tests shall be at the discretion of the Engineer. The use of equipment which results in damage to the materials, over consolidates the ATPB or produces substandard workmanship will not be permitted.

Pneumatic tire rollers shall not be used.

The Contractor shall conduct infiltration tests on the finished ATPB per ASTM C1701 at locations chosen by the Engineer. Newly-placed ATPB shall have a minimum infiltration rate of 150 inches/hour. Infiltration tests shall be completed every 150 linear feet of roadway and conducted in accordance with ASTM C1701. Target density may be adjusted and used for acceptance, at the discretion of the Engineer, if the ATPB is consistently meeting the 150 inches/hour acceptance standard.

If the measured infiltration rate is less than 150 inches/hour, the Contractor shall conduct four additional tests as follows in line with the paver direction of travel. Two tests upstream and two tests downstream of the initial test location shall be taken at distances of 20 feet and 40 feet. Results of the additional tests will be averaged. The Contractor shall conduct additional testing upstream and downstream to identify areas to be removed. If the average infiltration rate is less than required the Contractor shall remove and replace the failing ATPB areas at the direction of the Engineer and at no cost to the Contracting Agency.

Measurement

ATPB will be measured by the ton in accordance with Section 1-09.2, based on certified truck tickets collected on the day of placement. No deductions will be made for the weight of asphalt binder, anti-stripping additive, tack coating between lifts or any other component of the mixture.

Payment

Payment will be made for the following Bid item:

“Asphalt Treated Permeable Base, PG ____ ER”, per ton.

The unit contract price per ton for “Asphalt Treated Permeable Base, PG ____ ER” shall be full pay for all labor, equipment, and materials required to construct the ATPB including joints, where required, haul, compaction, tack coat, anti-stripping additive, if required, and Contractor testing as specified.

5-04.1 Description
(March 9, 2016 APWA GSP)

Supplement this section with the following:

This Work shall also consist of providing and placing one or more layers of plant-mixed porous hot mix asphalt (PHMA) on a prepared foundation or base in accordance with these Specifications and the lines, grades, thicknesses, and typical cross-sections shown in the Plans or established by the Engineer. The manufacture of PHMA may include porous warm mix asphalt (PWMA) processes in accordance with these Specifications. PWMA processes include organic additives, chemical additives, and foaming.

5-04.2 Materials
(March 9, 2016 APWA GSP)

Supplement section 9-03.8 with the following:

Aggregates for Porous Hot Mix Asphalt/Porous Warm Mix Asphalt (PHMA/PWMA)

General Requirements

Aggregates for Porous Hot Mix Asphalt (PHMA) or Porous Warm Mix Asphalt (PWMA) shall be manufactured from ledge rock, talus, or gravel, in accordance with the provisions of Section 3-01 that meet the following test requirements:

Los Angeles Wear, 500 Rev.	30% max.
Degradation Factor	15 min.

Grading

Aggregates for PHMA/PWMA shall meet the following requirements for grading:

Sieve Size	Percent Passing
3/4" square	100
1/2" square	90 - 100
3/8" square	55 - 90
U.S. No. 4	10 - 40
U.S. No. 8	0 - 20
U.S. No. 40	0 - 13
U.S. No. 200	0 - 5

* All percentages are by weight.

The aggregate for PHMA/PWMA shall consist of crushed stone with a percent fracture greater than 90% on two faces on the No. 4 sieve and above, and shall be tested in accordance with the field operating procedures for AASHTO T 335.

5-04.3 Construction Requirements
(March 9, 2016 APWA GSP)

Supplement this section with the following:

Porous Asphalt (PHMA/PWMA) Acceptance Infiltration Test

Contractor shall conduct infiltration tests on the finished PHMA/PWMA per ASTM C1701 at locations chosen by the Engineer. Newly-placed PHMA/PHWA shall have a minimum infiltration rate of 100 inches/hour. Infiltration tests shall be completed every 150 linear feet of roadway and conducted in accordance with ASTM C1701.

If the measured infiltration rate is less than 100 inches/hour, the Contractor shall conduct an additional four infiltration tests in line with the paver direction of travel. Two tests upstream and two tests downstream of the initial test locations shall be taken at distances of 20 feet and 40 feet. Results of the additional tests will be averaged. The Contractor shall conduct additional testing upstream and downstream to identify area to be removed. If the average infiltration rate is less than required remove and replace the failing section at the direction of the Engineer and at no cost to the Contracting Agency.

5-04.3(1) Hot Asphalt Mixing Plant

(March 9, 2016 APWA GSP)

Supplement this section with the following:

Plants used for preparation of PHMA shall conform to the following requirements:

Fiber Supply System

When fiber stabilizing additives are determined necessary to achieve drain down criteria per APWA GSP 5-04.3(7)A of these Specifications, a separate feed system that meets the following shall be required:

1. Accurately proportions by weight the required quantity into the mixture in such a manner that uniform distribution will be obtained.
2. The fibers shall be uniformly distributed prior to the injection of the asphalt binder into the mixture. When a continuous or drier-drum type plant is used, the fiber shall be added to the aggregate and uniformly dispersed prior to the injection of asphalt binder.

Surge and Storage Systems

The storage time for PHMA/PWMA mixtures shall be no more than four (4) hours for non-insulated silos or eight (8) hours for insulated silos. Placement temperature specifications shall be met regardless of silo storage time.

5-04.3(7)A Mix Design
(March 9, 2016 APWA GSP)

Supplement this section with the following:

Mix Designs for PHMA shall be submitted to the Engineer on Washington State DOT Form 350-042 with the additional PHMA test data required by this specification provided as a one page supplemental attachment. The supplemental test data form is available at <http://www.wsdot.wa.gov/partners/apwa/PorousAsphaltPavement.pdf>.

The asphalt binder for PHMA/PWMA shall be PG 70-22ER polymer modified or higher grade. Binder content shall be between 6.0% and 7.0% by total weight of the mix, and will be the highest percentage that passes both the drain down and void requirements tests at $N_{\text{design}} = 75$ gyrations. The binder content tolerance shall be $\pm 0.3\%$ during production/ placement of the PHMA/PWMA. The Contractor shall adjust the aggregate to meet the maximum drain down test requirements within the ranges provided below.

1. Drain down shall be 0.3 %, maximum, according to ASTM D6390
2. Void ratio shall be 16% to 25% per ASTM D3203 at $N_{\text{design}} = 75$ gyrations.

The Contractor shall include with the submittal temperature-viscosity curves from the polymer-modified asphalt binder supplier showing the recommended mixing and compaction temperatures developed for dense graded HMA applications.

The Contractor shall determine anti-strip requirements for PHMA/PWMA and provide data for anti-stripping. The asphaltic mix shall be tested for its resistance to stripping by water in accordance with ASTM D-3625. If the estimated coating area is not above 95 percent, anti-stripping agents shall be added to the asphalt. Contractor shall be responsible for conducting the anti-stripping evaluation and providing a report to the Engineer.

Alternately, anti-strip evaluation of an existing dense graded hot mix asphalt of the same maximum nominal aggregate class and from the same aggregate materials source may be used to set the anti-stripping requirements for PHMA/PWMA. The anti-strip requirement for the PHMA/PWMA shall be equivalent to the anti-stripping requirement for the HMA.

5-04.3(8)A1 General
(March 9, 2016 APWA GSP)

Supplement this section with the following:

Commercial evaluation will be the basis for acceptance of PHMA/ PWMA.

5-04.3(8)A6 Test Methods
(March 9, 2016 APWA GSP)

Supplement this section with the following:

The temperature of the mix at the time of discharge from the haul vehicle shall be within the temperature range identified in the approved PHMA submittal.

5-04.3(9) Spreading and Finishing
(March 9, 2016 APWA GSP)

Supplement this section with the following:

Placement temperature of the mixture shall be within the temperature range identified in the approved PHMA/PWMA submittal.

5-04.3(10)A General
(March 9, 2016 APWA GSP)

Supplement this section with the following:

Pneumatic tire rollers shall not be used for compaction of PHMA/PWMA.

The Contractor shall develop a roller pattern that will initially consolidate the pavement structure as well as target 15% to 18% final air voids (82% to 85% of maximum theoretical (Rice) density). The Contractor shall monitor compaction during placement of PHMA/PWMA with a pavement density gauge.

5-04.4 Measurement
(March 9, 2016 APWA GSP)

Supplement this section with the following:

PHMA/PWMA will be measured by the ton in accordance with Section 1-09.2, with no deduction being made for the weight of asphalt binder, blending sand, mineral filler, or any other component of the HMA. If the Contractor elects to remove and replace mix as allowed in Section 5-04.3(11), the material removed will not be measured.

5-04.5 Payment
(March 9, 2016 APWA GSP)

Supplement this section with the following:

"PHMA CL. 1/2" In. PG 70-22ER", per ton.

The unit Contract price per ton for "PHMA CL. 1/2 In. PG 70-22ER" shall be full compensation for all costs, including anti-stripping additive and tack coat, incurred to carry out requirements of Section 5-04 except for those costs included in other items which are included in this Subsection and which are included in the Proposal.

Supplement Division 5 with the following:
(March 9, 2016 APWA GSP)

5-06 PERVIOUS CONCRETE PAVEMENT

5-06.1 Description

This work shall consist of constructing a pervious cementitious pavement composed of portland cement concrete on a prepared subgrade or subbase in accordance with these Specifications and in conformity with the lines grades, thicknesses, and typical cross-sections shown in the Plans or established by the Engineer.

5-06.2 Materials

Materials shall meet the requirements of the following sections:

Portland Cement	9-01
Aggregates for Portland Cement Concrete	9-03.1
Premolded Joint Filler for Expansion Joints	9-04.1(2)
Curing Materials and Admixtures	9-23
Water	9-25

Hydration stabilizing admixtures shall conform to the requirements of Section 9-23.6(3) or 9-23.6(5).

Synthetic Fibers for Concrete

When specified synthetic fibers to be included in the mix for portland cement concrete shall conform to the requirements of ASTM D 7508/7508M.

5-06.3 Construction Requirements

5-06.3(1) Pervious Concrete Preconstruction Meeting

Prior to the start of construction of the pervious concrete pavement section, including excavation of the pavement section, the Contractor shall coordinate, schedule and attend a preconstruction meeting for the pervious concrete pavement. The following are required to attend the meeting:

1. Contracting Agency representative.
2. General Contractor's representative(s).
3. Engineer of Record for the pervious concrete pavement.
4. Concrete placement lead person(s).
5. Associated Subcontractor's representative.
6. Pervious concrete Supplier's representative.
7. Material Testing Laboratory's representative.

The meeting shall cover all aspects of the work including, but not limited to:

1. Submittals.
2. Short and long term schedule.
3. Inspection of the Work.
4. Protection of the Work.
5. Pervious concrete placement.
6. Curing.

7. Materials.
8. Specifications.
9. Testing.
10. Test panel and JMF.
11. Acceptance criteria.

5-06.3(2) Pervious Concrete Mix Design

The Contractor shall provide a mix design for pervious concrete and shall submit the mix design to the Engineer in writing. Pervious concrete shall not be placed in the test panels without a mix design that has been reviewed and accepted by the Engineer.

5-06.3(2)A Mix Design Criteria

The Contractor shall include the following elements and results of the described procedures in the proposed mix design:

1. A unique identification number for the mix design that is approved for the Job Mix Formula (JMF).
2. Portland cement shall be Type I, Type II, Type I-II Type IP, or Type IS.
3. The cementitious content, including pozzolans if used, shall be a minimum of 480 pounds per cubic yard.
4. The mix shall incorporate a hydration stabilizing admixture.
5. Synthetic microfibers may be utilized at the manufacturer's recommended dosage rate.
6. The water / cement ratio shall not exceed 0.35.
7. No more than 25 percent of portland cement in the mix, by weight, may be replaced by fly ash, ground granulated blast furnace slag, or a combination of both.
8. Coarse aggregate shall conform to Section 9-03.1(4), AASHTO Grading No.8.

5-06.3(2)B Job Mix Formula (JMF)

The approved mix design established through the approved test panel becomes the JMF.

5-06.3(3) Submittals

In accordance to Section 1-05.3, the Contractor shall submit the following items to the Engineer for acceptance prior to placing any pervious concrete pavement:

1. The source of all materials proposed for use in constructing pervious concrete pavement.
2. Batch weights for all constituents of one (1) cubic yard of the proposed pervious concrete mix.
3. The specific gravity (SSD) of all aggregates to be used in the proposed pervious concrete mix.
4. The proposed gradation of coarse aggregates used in pervious concrete.
5. The designed volume in cubic feet of all proposed components for 1(one) cubic yard of the proposed pervious concrete mix.
6. The design water / cement ratio of the proposed mix design.
7. The fresh density of the proposed pervious concrete mixture as determined by ASTM C1688.
8. Catalogue cuts and Certificates of Compliance for all proposed admixtures.

9. Mill Certification of the portland cement and pozzolans, if used, for the current lot to be used in the production of the proposed pervious concrete mix. The Contractor shall maintain this submittal throughout the duration of the project as lots change.
10. Current certification by the National Ready Mix Concrete Association (NRMCA) for the batch plant(s) to be used in the production of pervious concrete.
11. Current certifications by the NRMCA for the trucks to be used in transporting pervious concrete from the batch plant to the point of placement.
12. Qualification documentation for current certifications by the NRMCA for the Contractor's personnel who will be installing pervious concrete. See Section 5-06.3(10)A. Valid acceptable documentation is the NRMCA issued wallet card or certification certificate.
13. At the time of delivery of the material to the site, the Contractor shall provide an original Certificate of Compliance for each truckload of pervious concrete. The Certificate of Compliance shall include information noted in Section 6-02.3(5)B. If the Certificate of Compliance from the concrete producer is not provided to the Engineer upon delivery, the truckload shall not be placed.

5-06.3(4) Equipment

Equipment necessary for handling materials, mixing, delivering, and performing all parts of the Work, shall be in good repair, designed for the task, and operated by trained and qualified personnel.

5-06.3(4)A Batching Plant and Equipment

Pervious concrete shall be centrally mixed in a plant with a current NRMCA certification.

5-06.3(4)B Mixer Trucks

Pervious concrete shall be transported to the location by truck mixers, non-agitating trucks shall not be used for the transport of pervious concrete. The drums on mixer trucks used to transport pervious concrete shall have fins that are not excessively worn, damaged or have excessive concrete buildup. Mixer trucks shall have a current NRMCA certification.

5-06.3(4)C Side Forms

Pervious concrete shall be placed in stationary forms. If pervious concrete is to be placed against a curb, previously placed concrete, or other existing structure, they may be used as a side form for the pervious concrete paving. Forms for pervious concrete shall be made of steel or wood and shall be in good condition, and shall be capable of being anchored in place so that they will be true to grade, line and slope. Forms shall be sufficiently rigid to maintain specified tolerances and capable of supporting concrete and mechanical concrete placing equipment. Forms shall be in good condition, straight, clean, free of debris, non-adherent rust and hardened concrete.

Set, align, and brace forms so that they hardened pavement meets the lines, grades and slopes as shown in the drawings. Apply form-release agent to the form face, which will be in contact with concrete, immediately before placing concrete. Form release agent shall not be applied to previously placed concrete. Previously placed pavement shall be protected from damage.

The Contractor shall inspect all forms for line, grade and slope. No pervious concrete shall be placed until the forms have been inspected by the Engineer.

5-06.3(4)D Finishing Equipment

Finishing equipment for pervious concrete paving shall be designed for the intended work, shall be clean and in good operating condition.

Equipment used for striking off the pervious concrete shall leave a smooth surface at the planned grades and shall not cause excess paste to be left on, or drawn to, the surface. If rollers or spinning screeds are used to compact, they shall be of sufficient weight and width to compact the pervious concrete uniformly through its depth and to grade without marring the surface. Equipment used for compacting pervious concrete shall not cause the surface to close or otherwise clog and shall produce a surface that is free of ridges or other imperfections. Tools used for producing joints shall be designed and manufactured for the purpose and shall not otherwise damage or mar the surface.

Vibrating equipment shall not be used for placement or compaction of pervious concrete.

5-06.3(5) Measuring and Batching Materials

Measuring and batching materials for pervious concrete pavement shall conform to the requirements of Section 5-05.3(4).

5-06.3(6) Acceptance

For acceptance, pervious concrete pavement will be divided into lots as follows: A single lot (lot) is represented by the lesser of: one (1) day's production or 360 square yards of pervious concrete in place. Where the Contractor has more than one crew placing pervious concrete, lots will be associated with each crew. Representative lot size will be determined to the nearest square yard. If no sample is taken on a Day, that Day's quantities may be included in the next or previous Day's lot(s). The Engineer may isolate an area of pervious concrete within a lot that is deemed to be defective in any way and such an area will be considered to be a new lot for purposes of acceptance. New lots determined in this manner shall be extended as necessary such that they are bounded by planned joints. Acceptance of a lot of pervious concrete pavement will be based on the following criteria:

1. **Grade:** Conform to the dimensions, lines, slopes and grades specified on the plans. Pervious concrete pavement shall be true to planned grades and shall not deviate from grade more than $\frac{1}{4}$ inch in ten (10) feet. Where abutting existing facilities such as sidewalks, walkways, curbs, driveways or other pavements, the pervious concrete shall be flush.
2. **Conformance to JMF:** The pervious concrete pavement used shall conform to the mix design for the JMF within the limits as set forth in Section 6-02.3(5)C and as determined from the accepted test panel.
3. **Compacted Thickness and Average Hardened Density:** After a minimum of seven (7) calendar days of curing, remove and measure three (3) cores from each lot. Remove cores in accordance with ASTM C42/C42M. Measure the length of each core in accordance with ASTM C1542/1542M. No single core shall be less than $\frac{3}{4}$ inch of the design depth on the drawings. The average of all cores from a lot shall be within minus $\frac{3}{8}$ inch of the design depth on the plans.

- After length is measured, measure hardened density of each core in the lot in accordance with ASTM C1754/C1754M. The hardened density from a lot must be within +/- 5 percent of the average hardened density of the JMF (approved test panel).
- 4. **Infiltration Rate:** The infiltration rate at any single test point shall not be less than 100 inches per hour.
- 5. **Fresh Density:** The fresh density of each lot will be measured by ASTM C1688 at the point of placement shall be within +/- five (5) pounds per cubic foot of the fresh density determined from the JMF (approved test panel).
- 6. **Appearance:** The appearance of each lot shall be consistent with the JMF (approved test panel). The pervious concrete pavement shall have a consistent surface texture, shall not be raveled, shall be free of ridges or other surface imperfections, shall have joints that are in the specified location and are constructed per specification, and shall be free of cracks.

Testing for acceptance will be performed by the Engineer.

5-06.3(6)A Infiltration Rate of the Placed Pavement

The infiltration rate of the pervious concrete shall be determined at four (4) random locations within each lot. The locations for conducting infiltration tests will be determined by the Engineer. The Contractor shall coordinate and schedule testing with the Engineer a minimum of five (5) Working Days in advance. The infiltration rate on the finished surface will be determined in accordance with ASTM C1701, except the infiltration ring diameter may be 12-inches to 24-inches in diameter. The infiltration test will be conducted after a minimum of seven (7) calendar days of curing has occurred.

If the measured infiltration rate is less than 100 inches/hour at any test location, the Contractor may request in writing that the Engineer perform additional infiltration tests for the purpose of assessing overall infiltration performance and/or determining a defective lot in accordance with Section 5-06.3(6). The determination of a defective lot, or lots, and the extent(s), will be by the Engineer. The cost of additional testing shall borne by the Contractor at a rate of (\$\$1\$\$) per test.

5-06.3(7) Rejection

Pervious concrete may be rejected by the Contractor for any reason.

A truckload of pervious concrete will be rejected if the Certificate of Compliance is not provided at the time of delivery of the material to the site. See Section 5-06.3(4)B.

Pervious concrete that is improperly cured or is allowed to freeze during the initial seven (7) day curing period will be rejected.

Pervious concrete pavement that does not meet the acceptance criteria put forth in Section 5-06.3(6) will be rejected by the Engineer on a lot by lot basis.

During the removal process of the rejected pavement, The Contractor shall implement measures to protect the adjacent pervious concrete pavement to remain. If pervious concrete pavement becomes damaged by the Contractor during removal

of the rejected pavement then additional pavement areas may be rejected by the Engineer to the next planned joint.

Fresh pervious concrete that has been rejected by the Engineer, or the Contractor, shall not be placed, or shall be removed and replaced, at no additional cost.

5-06.3(8) Mixing Pervious Concrete

Batch, mix and deliver pervious concrete in compliance with ASTM C94/C94M except that pervious concrete shall not be transit mixed or shrink mixed. If water is added to the mix after it is delivered on site, the fresh density for the pervious concrete shall meet the requirements of the approved JMF referenced in this section.

5-06.3(8)A Limitations of Mixing Pervious Concrete

Mixing and placing concrete shall be discontinued when a descending air temperature in the shade away from artificial heat reaches 40° F and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 40° F.

The temperature of fresh pervious concrete shall not be less than 55° F, nor more than 90° F when placed.

Pervious concrete shall not be mixed with aggregates at less than 32° F.

5-06.3(9) Subgrade Preparation and Subbase

Prepare and protect subgrade in accordance with Section 2-06.

Prepare and protect subbase in accordance with Section 4-04.

5-06.3(10) Placing, Spreading, Finishing, Edging, Tolerances and Curing

Pervious concrete shall not be placed, compacted or finished when the natural light is inadequate, unless an adequate lighting system is in operation. The adequacy of light will be determined by the Engineer.

Wet the surface of the subbase with water immediately before placing pervious concrete. Deposit concrete either directly from the transporting equipment or by conveyor on the subbase, unless otherwise specified. Pervious concrete shall not be placed on frozen subbase. Deposit concrete between the forms to an approximately uniform height. Spread the concrete using mechanized equipment or hand tools. Vibrating equipment shall not be used for spreading pervious concrete.

Strike off concrete between forms using a form-riding paving machine, roller screed, or spinning screed.

Compact concrete to a uniformly dense structure without clogging the surface with paste.

Finish the pervious concrete to a uniform, open-textured surface to match the appearance of the approved JMF test panel.

Edges shall be hand tooled to a radius of ¼ inch.

Curing materials for pervious concrete shall be in place no more than 20 minutes of discharge onto the subbase. The pavement surface and all exposed edges shall be completely covered with sheet curing materials conforming to Section 9-23.1. The curing material shall be secured at all exterior edges and interior laps without damaging the pervious concrete. The method of securing the curing material shall prevent wind from removing the sheet and from blowing under the sheet across the surface of the concrete. Cure the pavement for a minimum of seven (7) uninterrupted days.

All traffic (foot and vehicular), staging, stockpiling or other work shall be kept off of the pervious concrete pavement during the curing period. Any testing for acceptance shall not occur until the end of the curing period.

Protect concrete from freezing and cold weather in accordance with 5-06.3(12).

5-06.3(10)A Contractor's Qualifications

The contractor shall employ no less than one (1) National Ready Mixed Concrete Association (NRMCA) certified Pervious Concrete Craftsman for each crew, who must be on site, over-seeing the work during all pervious concrete placement; or employ no less than three (3) NRMCA Certified Pervious Concrete Installers per crew, who must be on site working during each pervious concrete placement. The minimum number of certified individuals must be present on each crew for every pervious concrete placement, including the test panel placements, and a certified individual must be in charge of the placement crew and procedures.

If, in the opinion of the Engineer, personnel used for installing pervious concrete are unqualified, inattentive to quality, or unsafe, they shall be removed or reassigned from installation of pervious concrete at the written request of the Engineer.

5-06.3(10)B Test Panel

Production placement of pervious concrete shall not occur until the Contractor has completed a test panel of pervious concrete pavement that meets all of the acceptance criteria described herein and is accepted by the Engineer.

The Contractor shall construct a test panel utilizing a minimum of seven (7) cubic yards of pervious concrete. If multiple pavement section depths are shown on the plans, a test panel shall be constructed for each pavement section depth/thickness. The width of the test panel shall have a width no smaller than the greatest width to be used during the construction and installation of the pervious concrete onsite. The test panel(s) shall include at least one joint and at the spacing specified on the plans and specifications. Test panels may be placed non-contiguously. The test panel(s) shall be equivalent and representative of the production pervious concrete pavement in all aspects including subbase, depth, joints, method of placement, curing, and preparation. Construction and evaluation of the test panel shall occur as follows:

1. Notify the Engineer at least ten (10) Working Days before installing pervious concrete test panels.
2. Coordinate the location of the test panel with the Engineer.
3. Install the test panel in accordance with the Specifications and Drawings.
4. Notify the Engineer when the test panel is ready for inspection and acceptance testing.
5. Acceptance testing will be conducted in accordance with Section 5-03.3(6).

6. Remove, replace, and dispose of any unsatisfactory portions of test panels as determined by the Engineer, at no additional cost to the Contracting Agency. Failure to install acceptable test panel(s) of pervious concrete will indicate an unapproved test panel(s) and require new test panel(s) for review.

The completed and approved test panel(s) shall establish the JMF.

The approved test panel shall meet the requirements of Section 5-03.3(6).

Upon successful completion of the infiltration test, unless otherwise determined by the Engineer, three (3), cores will be cut in accordance with ASTM C42 and will be used to validate the mix design under the acceptance criteria of Section 5-06.3(6). Cores shall be taken at the same location where the infiltration test was conducted. The average hardened density of the cores shall be the hardened density used for the JMF. The hardened density of each core used for determining the JMF shall be within five (5) percent of the mean value of the three cores. Core holes shall be filled by the Contractor with pervious concrete meeting the proposed JMF and shall match adjacent pavement color, texture and grade.

The completed and accepted test panels shall be maintained and protected throughout the duration of the Work and may not be demolished and disposed of without written permission from the Engineer. If the test panel(s) is incorporated into the Work, it shall remain in place accepted as a single lot.

5-06.3(11) Joints

Construct joints at the locations, depths and with horizontal dimensions indicated on plans unless noted otherwise in this section. Joints shall be of three (3) types: construction, contraction, isolation. Construction joints shall be formed at the end of a day's work or when necessary to stop production for any reason. Contraction joints shall be used to control random cracking. Isolation joints shall be used where the pervious concrete abuts existing facilities or where shown on the Plans.

5-06.3(11)A Construction Joints

Construction joints shall be located at the location of a planned contraction or isolation joint. Construction joints are to be formed by placing a header between the forms, at right angles, to the full depth of the finished pervious concrete, and set to the height of the forms. Pervious concrete shall be placed against the header and compacted and finished as normal, including edging. The header shall remain in place until paving resumes.

5-06.3(11)B Contraction Joints

Contraction joints (transverse and longitudinal) shall be constructed at the locations and intervals shown in the Contract. Contraction joints shall be a depth of 1/3 the thickness of the pervious concrete pavement section and have a width of no more than 1/4 inch. Contraction joints shall not be saw cut unless specifically noted on the Plans. Saw cut joints shall have a minimum width of 1/8 inch. Plastic formed contraction joints shall be tooled on both sides of the joint with a radius of 1/2 inch. Tool joint to the depth and width in fresh concrete immediately after the concrete is compacted.

5-06.3(11)C Isolation Joints

Isolation joints shall be placed where the pervious concrete abuts existing structures or where shown on the Plans. Isolation joints shall continue through the depth of the pervious concrete using a 3/8 inch premolded joint filler meeting the requirements of Section 9-04.1(2). Isolation joints may be formed by forming a construction joint and affixing the premolded joint filler against one side of the joint and placing fresh pervious concrete against it. Isolation joints and filler shall be flush with the surrounding pervious concrete and shall not deviate from the acceptance criteria for smoothness as shown in Section 5-06.3(6). The edge of the pervious concrete adjacent the premolded joint filler shall be hand tooled with a 1/2 inch radius.

5-06.3(12) Cold Weather Work

When concrete is being placed and the ambient air temperature is expected to drop below 35° F during the day or night, the Contractor shall protect the concrete from freezing. The Contractor shall submit for approval a Cold Weather Plan prior to placing concrete when ambient air temperature below 35° F is anticipated, or when requested by the Engineer. When a Cold Weather Plan is required, pervious concrete shall not be placed without an approved Cold Weather Plan.

Under the Cold Weather Plan, the Contractor shall, provide a sufficient supply of straw, hay, blankets, or other suitable blanketing material and spread it over the pavement to a sufficient depth to prevent freezing of the concrete. The blanket material shall be placed on top of the sheet curing materials and covered with a layer of burlap or plastic sheeting, weighted or anchored to prevent the wind from displacing the insulation. At no time during the curing period shall the temperature of the pervious concrete be allowed to drop below 55° F. The Engineer may require recording thermometers if daytime temperature is below 50°. The curing period may be extended by the Engineer if the pervious concrete temperature has been allowed to drop below 55° F.

The cold weather protection shall be maintained for seven (7) days. Pervious concrete that has frozen during this period will be rejected.

5-06.3(13) Protection of Pervious Concrete Pavement

As part of the Construction Stormwater Pollution Prevention plan (SWPPP), rain runoff, surface water of any kind and sediment shall be prevented from entering the area of pervious concrete construction, including excavation, until the pervious concrete application has cured, testing is completed and determined to meet specifications and the adjacent areas that sheet flow/drain onto the pervious concrete are permanently stabilized from erosion and plantings are established. Once pavement is placed, flow diversion measures and protective covers shall continually be maintained until adjacent areas are permanently stabilized and concrete has been accepted. Construction vehicular traffic shall not be allowed onto the pervious concrete pavement.

Do not open the pavement to vehicular traffic until the concrete has cured for at least seven (7) uninterrupted days, testing has been completed, and the pavement has been accepted by the Engineer.

The Contractor shall take every precaution to protect the pervious concrete pavement from damage, including the introduction of foreign materials to the surface,

throughout the course of the work. Pervious concrete pavement that is damaged or has been adversely impacted by the introduction of foreign materials shall be remediated to the satisfaction of the Engineer or rejected and replaced to the nearest joint.

5-06.4 Measurement

Measurement for "Pervious Concrete Pavement - Sidewalk" will be by the square yard of finished surface of pervious concrete walk. No measurement will be made for blocked out areas, castings or other discontinuities in the sidewalk nine (9) square feet or larger.

Measurement for "Pervious Concrete Pavement-Vehicular" will be by the square yard for the finished surface of pervious concrete pavement. No Measurement will be made for blocked out areas, castings or other discontinuities in the pavement nine (9) square feet or larger.

5-06.5 Payment

Payment will be made in accordance with Section 1-04.1, for each of the following Bid Items that are included in the Proposal:

"Pervious Concrete Pavement - Sidewalk", per square yard.

The Unit contract price per square yard for "Pervious Concrete Pavement - Sidewalk" shall be full pay for furnishing all labor, tools, equipment and materials required to construct the pervious concrete sidewalk as specified in this Section, including but not limited to; performing mix designs, and placing pervious concrete.

"Pervious Concrete Pavement- vehicular", per square yard.

The Unit contract price for "Pervious Concrete Pavement-Vehicular" shall be full pay for furnishing all labor, tools, equipment and materials required to construct the pervious concrete pavement as specified in this Section, including but not limited to; performing mix designs, and placing pervious concrete.

Appendix C – Reference Materials

WSDOT Environmental Procedures Manual (M 31-11), last modified June 2015:
<http://www.wsdot.wa.gov/Publications/Manuals/M31-11.htm>

WSDOT Geotechnical Design Manual (M 46-03), last modified May 2015:
<http://www.wsdot.wa.gov/Publications/Manuals/M46-03.htm>

WSDOT Materials Manual (M 46-01), last modified January 2016:
<http://www.wsdot.wa.gov/Publications/Manuals/M46-01.htm>

WSDOT General Special Provisions (GSPs):
http://www.wsdot.wa.gov/Partners/APWA/Division_5_Page.htm

The Seattle Times

City of Seatac
A/P Helen Carnes
4800 S 188th St

Seatac, WA 98188

FINANCE DEPT.

DEC 02 2016

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Re: Advertiser Account # 101430

Agency Account #: 0

Ad #: 695507

Agency Name:

Affidavit of Publication

STATE OF WASHINGTON
Counties of King and Snohomish

The undersigned, on oath states that he/she is an authorized representative of The Seattle Times Company, publisher of The Seattle Times of general circulation published daily in King and Snohomish Counties, State of Washington. The Seattle Times has been approved as a legal newspaper by others of the Superior Court of King and Snohomish Counties.

The notice, in the exact form annexed, was published in the regular and entire issue of said paper or papers and distributed to its subscribers during all of the said period.

Newspaper and Publication Date(s)	
Seattle Times	11/28/16

Agent MAUREEN E DUGGAN Signature Maureen E Duggan



Subscribed and sworn to before me on Nov 25 2016 DATE Christina C. McKenna

Christina C. McKenna
(Notary Signature) Notary Public in and for the State of Washington, residing at Seattle

The Seattle Times

Re: Advertiser Account # 101430

Ad #: 695507

Agency Account #: 0

Agency Name:

AD TEXT

CITY OF SEATAC
SEATAC CITY HALL
4800 SOUTH 188TH STREET
SEATAC, WA 98188
206.973.4800

(LEGAL NOTICE)
NOVEMBER 23, 2016.

NOTICE OF ORDINANCE ADOPTED BY THE SEATAC CITY COUNCIL

Following is a summary of Ordinances adopted by the City of SeaTac City Council on the 22nd day of November, 2016:

ORDINANCE NO. 16-1021

AN ORDINANCE amending Chapters 11.05, 11.10 and 12.10 of the SeaTac Municipal Code, related to road standards, right-of-way use and surface and stormwater management, to comply with the requirements of the 2013 Western Washington Phase II Municipal Stormwater Permit (NPDES Permit). Effective January 1, 2017.

ORDINANCE NO. 16-1022

AN ORDINANCE amending portions of Titles 13, 14, 15 and 18 of the SeaTac Municipal Code, to integrate Low Impact Development principles for stormwater management into the City's land use codes, to comply with the requirements of the 2013 Western Washington Phase II Municipal Stormwater Permit (NPDES Permit). Effective January 1, 2017.

ORDINANCE NO. 16-1023

AN ORDINANCE authorizing the City's 2017 Property Tax Levy, based on preliminary estimates received to date from the King County Assessor's Office. Effective five (5) days after passage and publication.

ORDINANCE NO. 16-1024

AN ORDINANCE adopting the City's 2017 - 2018 Biennial Budget. Effective five (5) days after passage and publication.

ORDINANCE NO. 16-1025

AN ORDINANCE approving the 2017 - 2019 labor agreement as negotiated between the City of SeaTac and Washington State Council of County and City Employees American Federation of State, County and Municipal Employees (AFSME) AFL-CIO, Local 3830. Effective five (5) days after passage and publication.

ORDINANCE NO. 16-1026

AN ORDINANCE amending Sections 3.70.010 and 3.70.020 of the SeaTac Municipal Code, relating to local option transportation taxes and adjusting the commercial parking tax rate. Effective five (5) days after passage and publication.

The full text of each Ordinance is available at the City Clerk's Office, SeaTac City Hall, 4800 South 188th Street, SeaTac, Washington 98188, 206.973.4800. A copy will be mailed upon request.
/s/Kristina Gregg, City Clerk

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DEC 02 2016

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