

Public Works Department Engineering Division Policy	Number: ENG-DEV(STM)-2010-01
	Effective Date: July 6, 2011 Issued/Revision: Revision 1
Subject: Use of Permeable Pavement Systems on Private Property under the Stormwater Management Code (Edmonds Community Development Code Chapter 18.30).	Approved: 

1.0 INTRODUCTION

Edmonds Community Development Code (ECDC) 18.30.060.C, states that ... “Low Impact Development techniques shall be employed where feasible, reasonable, and appropriate.” Permeable pavement systems are a low impact development technique for reducing the impacts from increased stormwater runoff caused by development. Permeable pavement systems allow rainfall to percolate through the top course and into the spaces between the underlying aggregate (rock) storage reservoir, where stormwater is stored and can be infiltrated to underlying soil. The degree of infiltration is dependant on the soil type.

2.0 DESCRIPTION

A permeable pavement system consists of a pervious wearing course (e.g., permeable asphalt, permeable concrete, paver blocks, concrete open celled paving grids, or plastic lattices filled with turf or stone), and an aggregate base course installed over native soil. Some sites will require a leveling course (also known as choker or filler course) between the wearing course and the base course. Some systems also require the use of a geotextile layer to separate the base course from layers such as a sand layer or the native soil layer to prevent movement of fine material into the base course that could cause clogging of the void space.

3.0 APPLICABILITY

This policy applies to project sites classified as Category 1 or Category 2 Small Sites that intend to use a pervious pavement system for driveways, walkways, and other areas customarily covered with concrete, asphalt or other impermeable surfaces. Refer to City handout E72 for determining Site Classification.

This policy provides guidelines for projects using permeable pavement systems as a best management practice to fully or partially comply with the stormwater code. This policy does not apply to work in the City right-of-way.

This policy shall provide clarification of the following:

- Stormwater code applicability on sites proposing to use permeable pavement systems
- Siting and Design Criteria to meet the applicable minimum requirements
- Maintenance

4.0 STORMWATER CODE APPLICABILITY

For the purposes of site classification and determination of minimum requirements, all proposed permeable pavement shall be initially considered as “impervious” surface area. Refer to City handout E72 for determining the total regulated impervious surface for the project site.

5.0 SITING, SOIL TESTING, AND DESIGN REQUIREMENTS

5.1 Siting Requirements

Proper siting of a permeable pavement system is very important to ensure long term performance and to reduce the likelihood of causing an erosion, sedimentation, slope stability, or other problem. Permeable pavement systems shall **not** be located in:

- The North Edmonds Earth Subsidence and Landslide Hazard Area (ESLHA)¹
- Upgradient (east) of the ESLHA, or
- A Landslide Hazard Area²?

In addition, the following setback and slope requirements must be met for all permeable pavement systems:

- Outside of the setback requirements above a Landslide Hazard Area³.
- 5 feet from property lines and utility easements
- Meets building setbacks specified below⁴
- 10 feet from underground storage tanks
- 50 feet from proposed or existing septic systems or drain fields
- Slope of the base course underlying the permeable pavement shall be less than 5%.

In addition, the permeable pavement area should not receive runoff from any additional off-site or onsite areas (such as downspouts from roof runoff).

5.2 Soil Testing

Soil testing is NOT required for:

- Sites proposing a permeable pavement system with areas less than or equal to 1,000 sf over all soil types.
- Sites proposing a permeable pavement system with areas less than or equal to 2,000 sf over Type A “Everett gravelly sandy loam “soils. (green areas of soils map, Figure 2).

For project sites not meeting the above criteria, soil testing, per the Stormwater Code Supplement, Appendix C is required to ensure adequate infiltration capacity. Conducting a soils test per the Code supplement does not ensure approval for installation of a permeable pavement system. The design infiltration rate must be 0.13 inches per hour or greater for approval.

5.3 Design Requirements

The remaining sections of this policy detail the acceptable materials for proper installation of permeable pavement wearing course and leveling course. No under drain or impermeable layer shall be installed as part of the permeable pavement system.

¹ See ECDC Chapter 19.10.

² See ECDC Chapter 23.80.

³ For purposes of this chart, the setback is calculated as 10 times the height of the slope (maximum setback = 500 feet). Height of the slope is determined using methods described in ECDC Chapter 23.80.202.

⁴ If runoff is from an area less than 5,000 sf, setback is 5 feet from the foundation of a structure without a basement and 10 feet from the foundation of a structure with a basement. If runoff is from an area greater than or equal to 5,000 sf, a structure shall not intersect with a 1H:1V slope from the bottom edge of the facility (Minimum 5 feet from a structure without a basement and 10 feet for a structure with a basement.)

Permeable pavement systems for Category 1 Small Site Projects that comply with the siting, soil testing, and design requirements in this policy will meet Minimum Requirement (MR) #5 (On-Site Stormwater Management/Low Impact Development) and MR#7 (Flow Control) as described in ECDC Chapter 18.30.

Permeable pavement systems for Category 2 Small Site Projects that comply with the design requirements in this policy including having a base course slope of 2% or less will meet Minimum Requirement (MR) #5 (On-Site Stormwater Management/Low Impact Development) and MR#7 (Flow Control) as described in ECDC Chapter 18.30. For those Category 2 Small Site Projects with a base course slope of greater than 2% but less than or equal to 5% only achieves 84% of the Edmonds-specific flow control standard and MR#5 and MR#7 are not met. Contact the City Engineering Division for more information on this topic.

5.3.1 Wearing and Base Courses

The wearing course (or top layer) of any permeable pavement system shall be designed and constructed to sufficient depth to meet the anticipated vehicle loading requirements.

The base course (or reservoir) of any permeable pavement system shall be a minimum of 3 inches of open graded, crushed washed aggregate (see Table 1) or an equivalent as long as the volume of void space divided by the total volume of the layer (porosity) is not less than 20% to meet stormwater management requirements. The base course shall be designed and constructed to sufficient depth to meet the anticipated vehicle loading requirements.

Figure 3 provides several examples of pervious pavement systems.

Table 1 provides the design criteria for wearing and base courses of various permeable pavement systems for the purposes of stormwater management.

5.3.2 Leveling Course

The Leveling Course is an optional layer that lies between the pervious pavement wearing course and the base course. It is generally one inch to two inches in depth, and is intended to provide a uniformly graded surface over which to place the wearing course, reduce rutting from delivery vehicles during pavement installation, and more evenly distribute loads to the underlying material. The following options can be used as a leveling course:

- Pervious Concrete and Asphalt: Use 1.5-inch to ASTM Size No. 8 uniformly graded crushed (angular) thoroughly washed stone.
- Pervious Paving Blocks, Concrete Open Celled Paving Grids, and Plastic Lattices: Per the manufacturers specifications as long as the porosity of any layer is not less than 20%.

5.3.3 Geotextile

The geotextile layer can prevent migration of fines into the base course from the native soil or from any other layer it comes in contact with. The following options can be used as a geotextile layer:

- Pervious Concrete and Asphalt : As required to prevent fines from entering the base course . If specified by the engineer, use non-woven geotextile for separation (2010 WSDOT Standard Specifications, 9-33.2(1) Table 3, separation, non-woven).

- Pervious Paving Blocks, Concrete Open Celled Paving Grids, and Plastic Lattices: Per the manufacturers' specifications as long as the porosity is not less than 20%.

5.4 Maintenance Requirements

The foremost concern regarding the long-term effectiveness of permeable pavement is reduced porosity due to clogging. Experience has shown that because the initial infiltration rates of permeable pavement wearing courses easily exceed the design infiltration rate (up to hundreds of inches per hour), the long-term infiltration capacity often continues to meet or exceed the requirement rate of infiltration (relative to the underlying native soil) with minor clogging.. It is recommended that diligent maintenance be maintained over the life of the pavement system to prevent sediment loads (particularly fines) from reducing the overall effectiveness of the pervious pavement as part of a site's stormwater management system. Pavement permeability is typically maintained with regularly scheduled vacuum sweeping or pressure washing or, in the case of permeable pavers, replacing the aggregate between pavers.

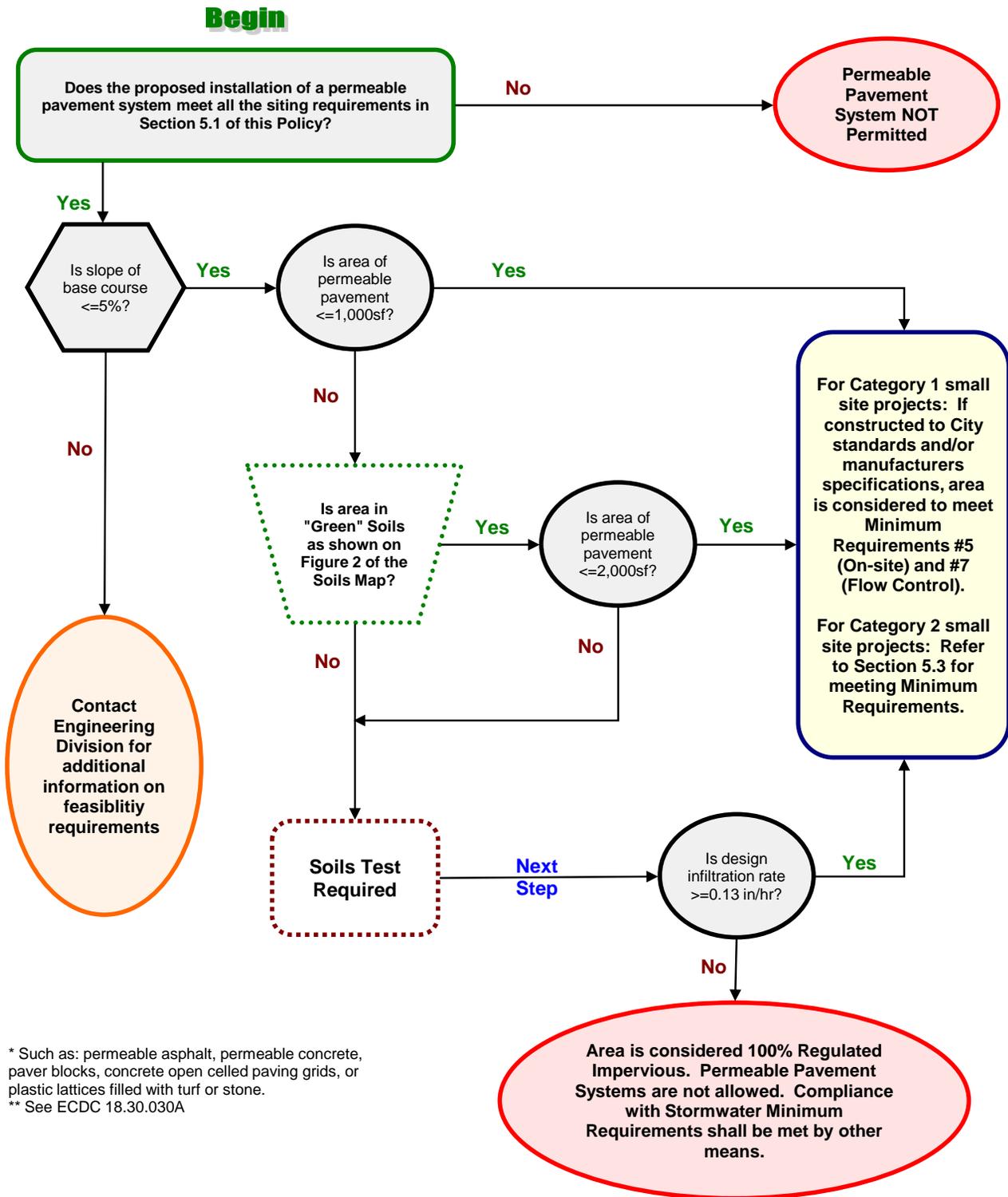
6.0 References

ASTM Standard C33, 2003, "Specification for Concrete Aggregates," ASTM International, West Conshohocken, PA, 2003, DOI: 10.1520/C0033-03, www.astm.org.

Thurston County, 2009. Drainage Design and Erosion Control Manual, August.

Figure 1
Permeable Pavement Systems Flow Chart

This flow chart is applicable to sites that propose permeable pavement systems* as New or Regulated Replaced Impervious surface and is to be used for determining compliance with Stormwater Code Requirements** for Category 1 and Category 2 Small Sites



* Such as: permeable asphalt, permeable concrete, paver blocks, concrete open celled paving grids, or plastic lattices filled with turf or stone.
** See ECDC 18.30.030A

Figure 2
Soils Map

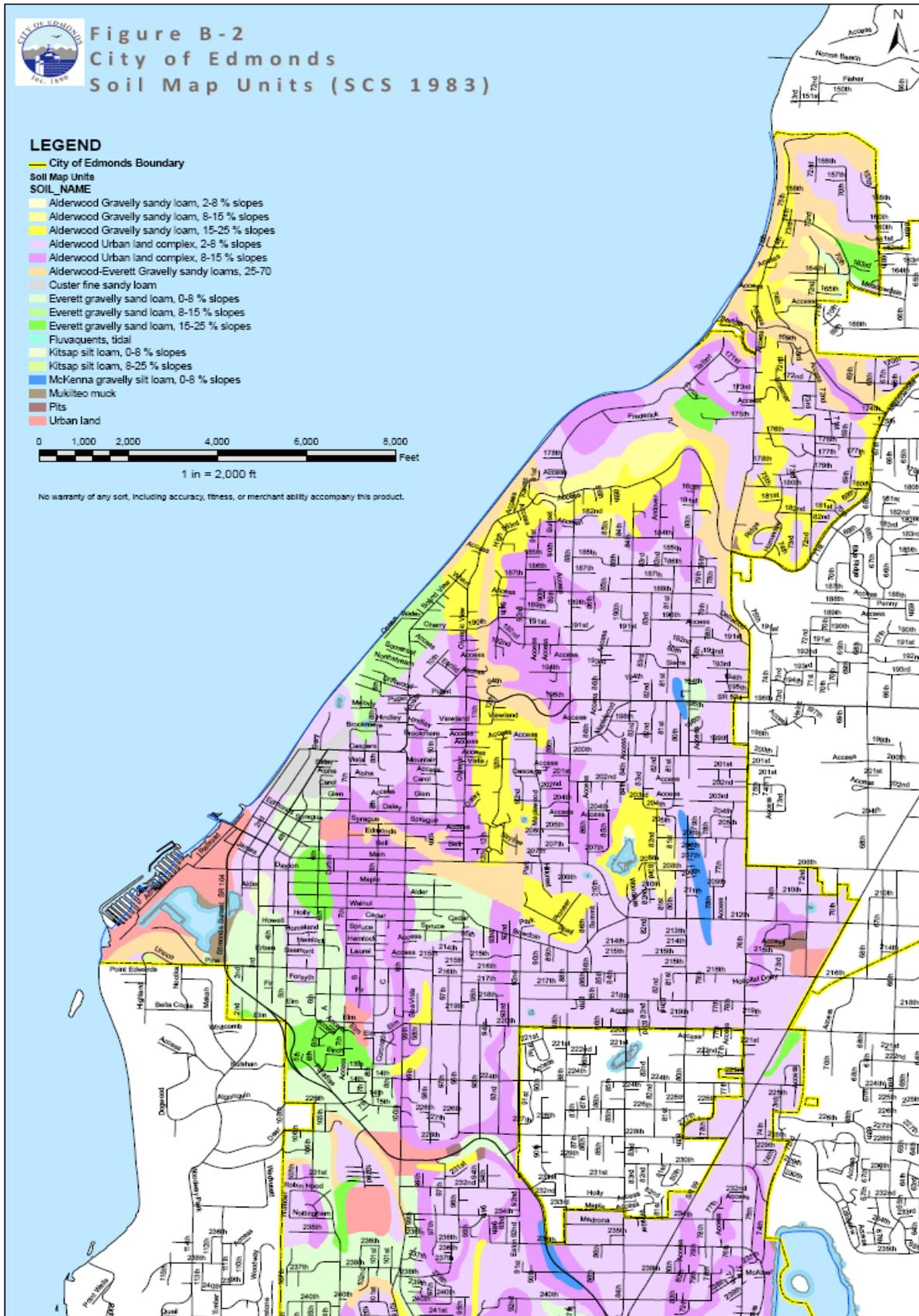
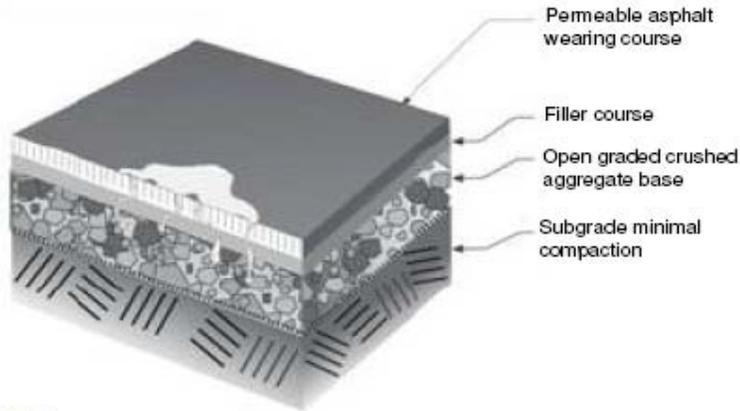


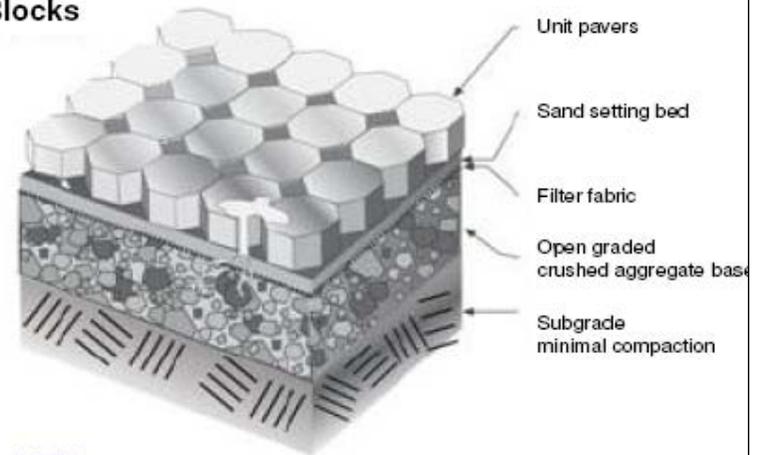
Figure 3 - Permeable Pavement Examples
FOR REFERENCE ONLY

Permeable Asphalt



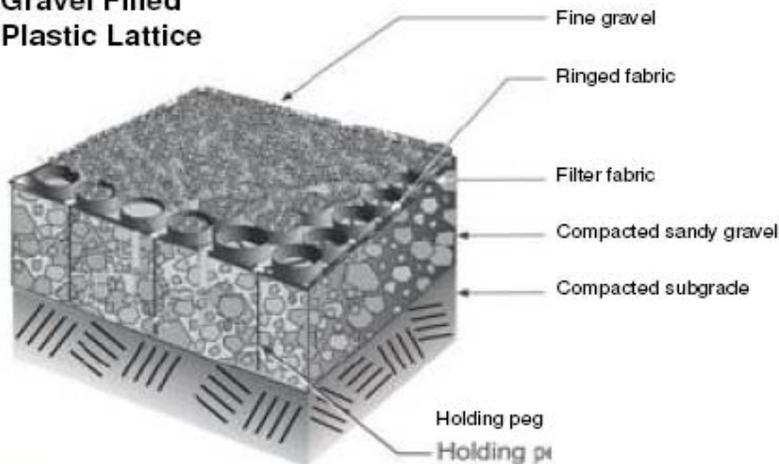
NOTE:
Refer to City standards for additional info on stormwater compliance. Permeable asphalt surfaces to be constructed per City specs or design by licensed engineer, as applicable.

Paving Blocks



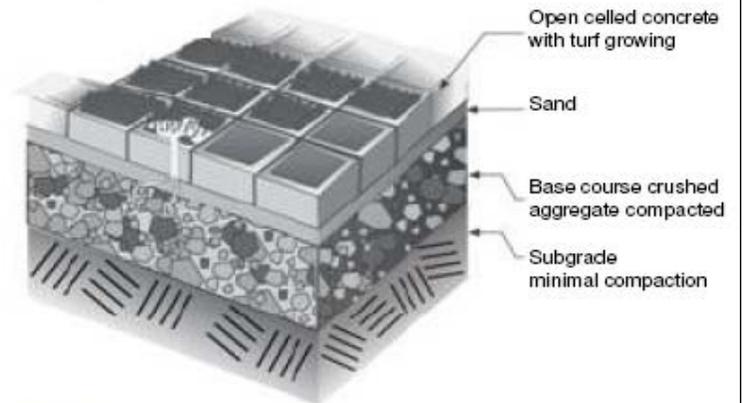
NOTE:
To be constructed per manufacturer's specifications.

Gravel Filled Plastic Lattice



NOTE:
To be constructed per manufacturer's specifications.

Open Celled Concrete



NOTE:
To be constructed per manufacturer's specifications.

Table 1
Design Criteria for Wearing and Base Courses for Various Permeable Pavement Systems

	Wearing Course	Base Course
Permeable Asphalt	<ul style="list-style-type: none"> • Low Impact Development: Technical Guidance Manual for Puget Sound (Puget Sound Partnership, 2005 or current version) for specifications and construction methods, (http://www.psp.wa.gov/downloads/LID/LID_manual2005.pdf) or • Seattle Stormwater Manual, Stormwater Manual Vol. 3, Stormwater Flow Control and Water Quality Treatment, Technical Requirements Manual, Director’s Rule 17-2009, (http://www.seattle.gov/dclu/codes/dr/DR2009-17.pdf), or • Per the designer or manufacturer. 	<p>All areas shall have a minimum depth of 3 inches for stormwater management purposes. For stormwater management purposes only, any one of the following are acceptable:</p> <ul style="list-style-type: none"> • 2.5 inch to 0.5 inch uniformly graded crushed (angular) thoroughly washed stone (ASTM Size No. 3) • Thoroughly washed clean Shoulder Ballast meeting the requirements of Washington Dept. of Transportation Standard Specifications 9-03.9(2) (http://www.wsdot.wa.gov/publications/manuals/M41-10.htm) • An alternate approved by the City Engineer
Permeable Concrete	<ul style="list-style-type: none"> • Seattle Stormwater Manual, Stormwater Manual Vol. 3, Stormwater Flow Control and Water Quality Treatment, Technical Requirements Manual, Director’s Rule 17-2009, (http://www.seattle.gov/dclu/codes/dr/DR2009-17.pdf), or • American Concrete Institute (ACI) 522.1-08 Specification for Pervious Concrete Pavement, Farmington Hills, Michigan or equivalent (http://www.concrete.org/bookstorenet/ProductDetail.aspx?itemid=522108). <p>For projects larger than 5,000 square feet, a test panel must be submitted to a Special Inspector prior to installation.</p>	
Pervious Paving Blocks⁵, Concrete Open Celled Paving Grids⁶, and Plastic Lattices⁷	All layers per the manufacturers specifications as long as the porosity ⁸ of any layer is not less than 20%.	

⁵ For example, Eco-Stone®, Eco-Priora™ or Aqua-Bric®

⁶ For example, TurfStone, Turf Block, or Grasscrete®

⁷ For example, GrassPave2 or GravelPave2

⁸ Volume of void space, divided by total volume of layer