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SINGLE FAMILY RESIDENTIAL PERMEABLE PAVEMENT DRIVEWAY DESIGN GUIDE

2015 Pierce County Stormwater Management and Site Development Manual

Introduction

This guide is designed to aid you in designing a single family residence permeable pavement driveway. A number of the most commonly asked questions are included. Volume III, of the *2015 Pierce County Stormwater Management and Site Development Manual* has been simplified in this design guide to make the design and construction process easier. See Ordinance 2015-48s, *2015 Pierce County Stormwater Management and Site Development Manual* for a complete reference.

What is a permeable pavement system? It is a system that allows rainfall to penetrate the surface of the driveway and ultimately be absorbed into the underlying soils.

What are the pavement options? Permeable pavement includes porous asphalt, pervious concrete, permeable pavers, aggregate pavers, and grid systems permeable paver systems. Porous gravel is not an option within the City of Bonney Lake.

- **Porous hot or warm-mix asphalt pavement** is a flexible pavement similar to standard asphalt but uses a special binder to adhere aggregate together. Sand and fine material is reduced or eliminated and, as a result, voids form between the aggregate in the pavement surface and allow water to infiltrate.
- **Pervious Portland cement concrete** is a rigid pavement similar to conventional concrete that uses a special material to bind aggregate together. The fine aggregate component is reduced or eliminated and, as a result, voids form between the aggregate in the pavement surface and allow water to infiltrate.
- **Permeable interlocking concrete pavers** are solid, precast, manufactured modular units. The solid pavers are (impervious) high-strength Portland cement concrete. Pavements constructed with these units create joints that are filled with permeable aggregates and installed on an open graded aggregate bedding course.

Who can design a Single Family Permeable Pavement system? A homeowner or contractor may use this design packet to design a permeable pavement system with help from a Soils Professional. The Soils Professional is required to verify the soil type and determine the appropriate infiltration rate. For sites with proposed on-site sewage disposal systems, the same Soils Professional designing that system can provide the on-site soil type(s). Driveways greater than 5,000 square feet, placed in fill material, or designated as Emergency Vehicle Access must be designed by a Professional Engineer and are not covered in this guide.

What are the conditions that make permeable pavements infeasible? Citation of any of the following infeasibility criteria must be based on an evaluation of site-specific conditions and a written recommendation from an appropriate licensed professional (e.g., engineer, geologist, hydrogeologist):

1. Where infiltration not be used due to reasonable concerns about erosion, slope failure, or downgradient flooding
2. Limitations may exist and reports may be required when permeable pavement is within 300 feet of a landslide hazard area or within 200 feet of an erosion hazard area
3. Where infiltrating and ponded water below new permeable pavement area would compromise adjacent impervious pavements
4. Where infiltrating water below a new permeable pavement area would threaten existing below grade basements
5. Where infiltrating water would threaten shoreline structures such as bulkheads
6. Down slope of steep, erosion prone areas that are likely to deliver sediment
7. Where fill soils are used that can become unstable when saturated
8. Where installation of permeable pavement would threaten the safety or reliability of pre-existing underground utilities, pre-existing underground storage tanks, or pre-existing road subgrades.

What is a Soils Professional? A person (civil engineer, geotechnical engineer, licensed geologist, hydrogeologist, septic designer) who demonstrates proficiency in the practice of the science of soils, including their origin, character, and utilization for stormwater treatment and disposal.

What is needed in a soils report? A soils report must be prepared by a soils professional that summarizes site characteristics and demonstrates that sufficient permeable soil for infiltration exists at the proposed facility location. The report must contain a site plan showing the following:

- Topography within 100 feet of the proposed facility.
- Locations of any water supply wells within 200 feet of the proposed facility.

- A minimum of one soil log or test pit is required at each site. Locate the soil log in the center of the driveway. Additional soil logs may be required by your soils professional.

How do I apply for a permit? An application for a single family residential site development permit is not considered complete if a permeable pavement driveway is required and the worksheets are not submitted with the site development application. Incomplete applications cannot be accepted. Complete the attached Single Family Permeable Pavement Driveway Design Worksheets and submit it with site development plans. Make sure you attach the site plan and soil logs. Go to http://www.ci.bonney-lake.wa.us/section_business/business_licensing/building_permits.shtml to apply on line.

Setbacks: Permeable pavement driveways must meet the following setbacks.

Constraint	Horizontal setback	Vertical separation
Open water maximum surface elevation to structures within 25 feet		1 foot above
Seasonal high groundwater		1 foot between groundwater level or low permeable layer and subgrade.
Primary and reserve drainfield	30 feet up gradient or 10 feet down gradient	
Slopes steeper than 20% and more than 10 feet high	50 feet	
Landfill	100 feet	
Water wells & springs used for drinking	100 feet	
Underground storage tank & piping	10 feet	
Erosion hazard area	200 feet	
Landslide hazard area	300 feet	

Permeable Surface Course

Maximum Surface Slopes	
5 percent	Porous asphalt
10 percent	Pervious concrete
12 percent	Interlocking pavers and porous gravel

- *Porous Asphalt:* Products must meet performance grade (PG) 70-22. See Figure 1.
- *Pervious Concrete:* Products must meet the most current version of American Concrete Institute (ACI) 522. See Figure 1.

- *Permeable Interlocking Concrete Pavement:* Pavers need to be confined with a rigid edge system to prevent movement of the paving stones and must be vehicular traffic rated. See Figure 2.

Aggregate Storage Reservoir

Stormwater passes through the permeable surface course to an underlying aggregate storage reservoir where it is filtered and stored prior to infiltration into the underlying soil. The aggregate storage reservoir should consist of larger rock at the bottom and smaller rock directly under the top surface (e.g., a gradient from 2 to 5/8 inch).

Subgrade

Compact the subgrade to the minimum necessary for structural stability. Two guidelines to specify subgrade compaction are “firm and unyielding” (qualitative), and 90 to 92 percent Standard Proctor (quantitative).

Can non-driveway surfaces drain onto a permeable pavement driveway? No. The designs shown in this design guide do not have any provisions for additional run-on. Any additional run-on must be designed by a professional engineer.

Overflow Path

An overflow route must be identified for stormwater flows that overtop the permeable pavement surface when infiltration capacity is exceeded or the facility becomes plugged and fails. Show the overflow path on the site plan.

Subsurface Check Dams

When native subgrade exceeds 3 percent a subsurface check dam(s) shall be installed per Figure 3. If the applicant proposes to use a different design the design must be prepared and stamped by a professional engineer.

Construction of the permeable pavement driveway

Permeable pavement requires careful preparation of the subgrade and aggregate storage reservoir to ensure success in terms of strength and permeability. Design and installation of permeable pavement shall be according to the manufacturer’s recommendations. The owner should have the installation of the driveway performed by an experienced and knowledgeable installer. Pervious Portland cement concrete should be installed by a certified installer.

To prevent compaction when installing the storage reservoir, the following steps (back-dumping) should be followed:

- The storage reservoir material is dumped onto the subgrade from the edge of the installation and the aggregate is then pushed out onto the subgrade
- Trucks then dump subsequent loads from on top of the storage reservoir as the installation progresses. Do not drive on the subgrade after it has been properly compacted
- The various storage reservoir materials shall be prevented from intermixing with fines and sediment. All contaminated material must be removed and replaced.

Field infiltration test of the permeable surface shall be conducted after complete pavement section is installed to verify that it meets a minimum infiltration rate of 20 inches per hour.

I cannot design a system per the regulations. What do I do? Contact a professional civil engineer licensed in the State of Washington. They can design alternative systems that meet the requirements of the *2015 Pierce County Stormwater Management and Site Development Manual*.

When To Call For Inspection After the Permit is Issued: The drainage system must be completely constructed.

What is required to get a final inspection on my building permit? Prior to final inspection approval of construction, the contractor or applicant needs to have the permeable pavement system inspected and approved by the City or your retained engineer.

Soil Evaluation Reports. A soils professional must be utilized to verify if on-site soils are adequate. A minimum of one soil log shall be obtained for each proposed permeable pavement system location. It shall extend a minimum of 12 inches below the bottom of the subgrade. Each soil log shall be shown on a separate Soil Log Evaluation Form. The soils professional must sign, date, and stamp the Soil Log Evaluation Report. Soil log locations need to be shown on the site plan.

SFR PERMEABLE PAVEMENT DRIVEWAY SOIL LOG EVALUATION REPORT

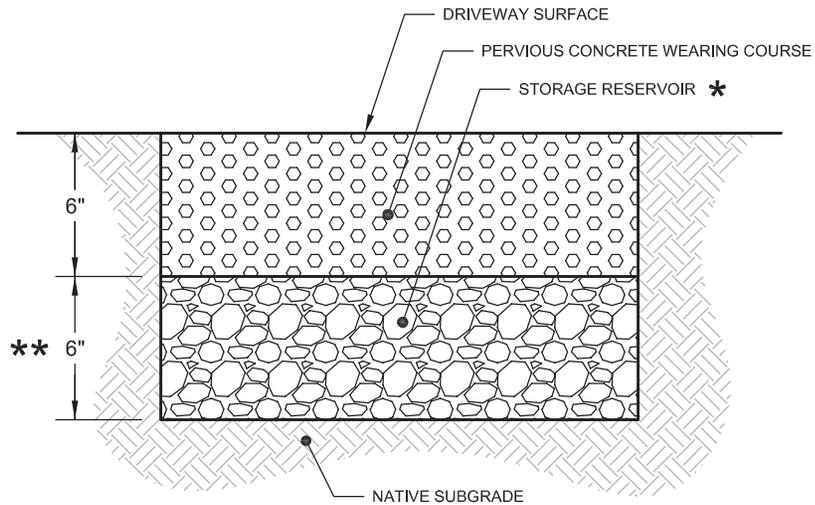
SOIL LOG NUMBER: (Number shall match site plan)		Sheet ___ of ___		
1. SITE ADDRESS:				
2. PARCEL NUMBER: _____ - _____				
3. SITE DESCRIPTION:				
4. LIST METHODS USED TO EXPOSE, SAMPLE AND TEST SOILS:				
5. NUMBER OF TEST HOLES LOGGED: _____		6. SATURATED INFILTRATION RATE: <div style="text-align: center;">Inches / Hour</div>		
7. HAS FILL MATERIAL BEEN PLACED OVER THE PROPOSED DRIVEWAY AREA? NO YES		8. DEPTH TO SEASONAL HIGH WATER:		
9. CURRENT WATER DEPTH:		10. DEPTH TO IMPERVIOUS LAYER:		11. PROFILE DESCRIPTION:
HORIZON	DEPTH	TEXTURAL CLASS	MOTTLING	INDURATION
<p>I hereby state that I prepared this report, and conducted or supervised the performance of related work. I state that I am qualified to do this work. I represent my work to be complete and accurate within the bounds of uncertainty inherent to the practice of soil science, and to be suitable for its intended use.</p> <p>SIGNED: _____</p> <p>DATE: _____ LICENSED STAMP: _____ (Sign & Date)</p>				

SOIL EVALUATION REPORT INSTRUCTIONS

The following instructions should give you the guidance needed to complete the form:

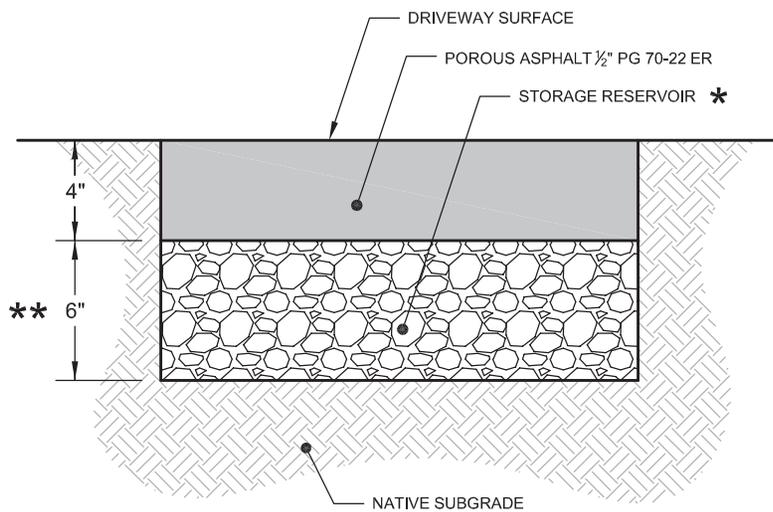
1. Provide site address, include house number and street name.
2. Note 10-digit parcel number.
3. Describe site topography and natural cover.
4. List methods used to expose, sample, and test soils.
5. Note number of test holes logged.
6. Describe the saturated percolation rate for the permeable pavement driveway area.
7. Indicate whether fill material has been placed over the permeable pavement driveway area. Circle the correct response. Designs placed in fill material must be prepared by a Professional Engineer.
8. Indicate seasonal high water table depth based upon the presence of mottling, or other evidence. If information available is inadequate, state value to be "greater than" the bottom of the hole depth.
9. Indicate current water table depth based upon observation. If saturated conditions are not observed, state value to be "greater than" bottom of the hole depth.
10. Indicate depth to impervious layer (e.g., basal till). If information is inadequate, state value to be "greater than" bottom of hole depth.
11. The profile description provides the minimum information on the physical attributes of the soil. All information provided for the profile shall utilize standard SCS nomenclature and abbreviations. The following are the factors to be addressed, with brief examples of acceptable responses. Further information on most of these is provided in the *SCS Soil Survey of Pierce County*. Use additional sheets if necessary. Identify limits of any outwash type soils (i.e. those meeting USDA soil texture classes ranging from coarse sand and cobbles to medium sand.
 - a. Horizon: A layer of soil with distinct characteristics, labeled A, AB, B, C, Ccw, etc.
 - b. Depth: Starting at 0" (surface), depth and interval of horizon.
 - c. Textural class: Class that best describes relative percentages of sand, silt, and clay in horizon, such as sandy loam (SL).
 - d. Mottling: Where present, describe using three-letter abbreviation to indicate abundance, size, and contrast, such as CFD (common, fine, distinct).
 - g. Induration: Physical compaction of a layer such as a glacial till. Where present, describe as weak, mod(erate), or str(ong).

Sign and date the form and affix any relevant professional seal (e.g., P.E., ARCPACS).



PERVIOUS CONCRETE DRIVEWAY SECTION

NOT TO SCALE



POROUS ASPHALT DRIVEWAY SECTION

NOT TO SCALE

* STORAGE RESERVOIR GRADING REQUIREMENTS:

SIEVE SIZE	PERCENT PASSING
2-1/2 inch	100
2 inch	90-100
1-1/2 inch	35-70
1 inch	0-15
1/2 inch	0-5
100	0-3
% FRACTURE	95

ALL PERCENTAGES ARE BY WEIGHT

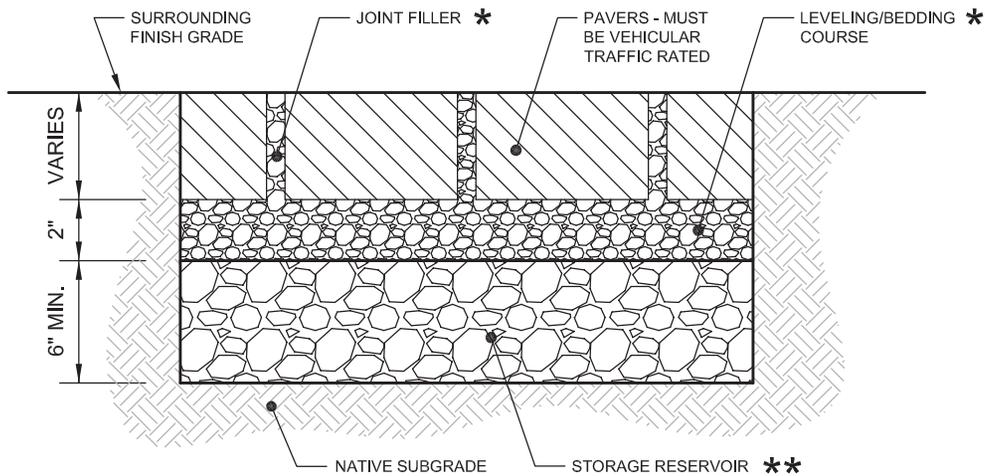
** STORAGE RESERVOIR TABLE:

INFILTRATION RATE	MINIMUM DEPTH
≥ 1" / hr	4"
≥ 0.25" TO < 1" / hr	6"

NOTES:

1. FOR PERMEABLE PAVEMENT DRIVEWAYS 5,000 S.F. OR LESS.
2. LIMIT RUN-ON TO PERMEABLE PAVEMENT SURFACES TO THE MAXIMUM EXTENT PRACTICABLE. RUN-ON SHALL ONLY BE ALLOWED FROM FULLY STABILIZED AREAS.

FIGURE 1



PERMEABLE INTERLOCKING CONCRETE PAVER SECTION

NOT TO SCALE

*** LEVELING/BEDDING COURSE & JOINT FILLER**
 ASTM NO. 8 BEDDING STONE
 GRADING REQUIREMENTS:

SIEVE SIZE	PERCENT PASSING
1/2 inch	100
3/8 inch	85-100
NO. 4	10-30
NO. 8	0-10
NO. 16	0-5
% FRACTURE	90

ALL PERCENTAGES ARE BY WEIGHT

**** STORAGE RESERVOIR**
 GRADING REQUIREMENTS:

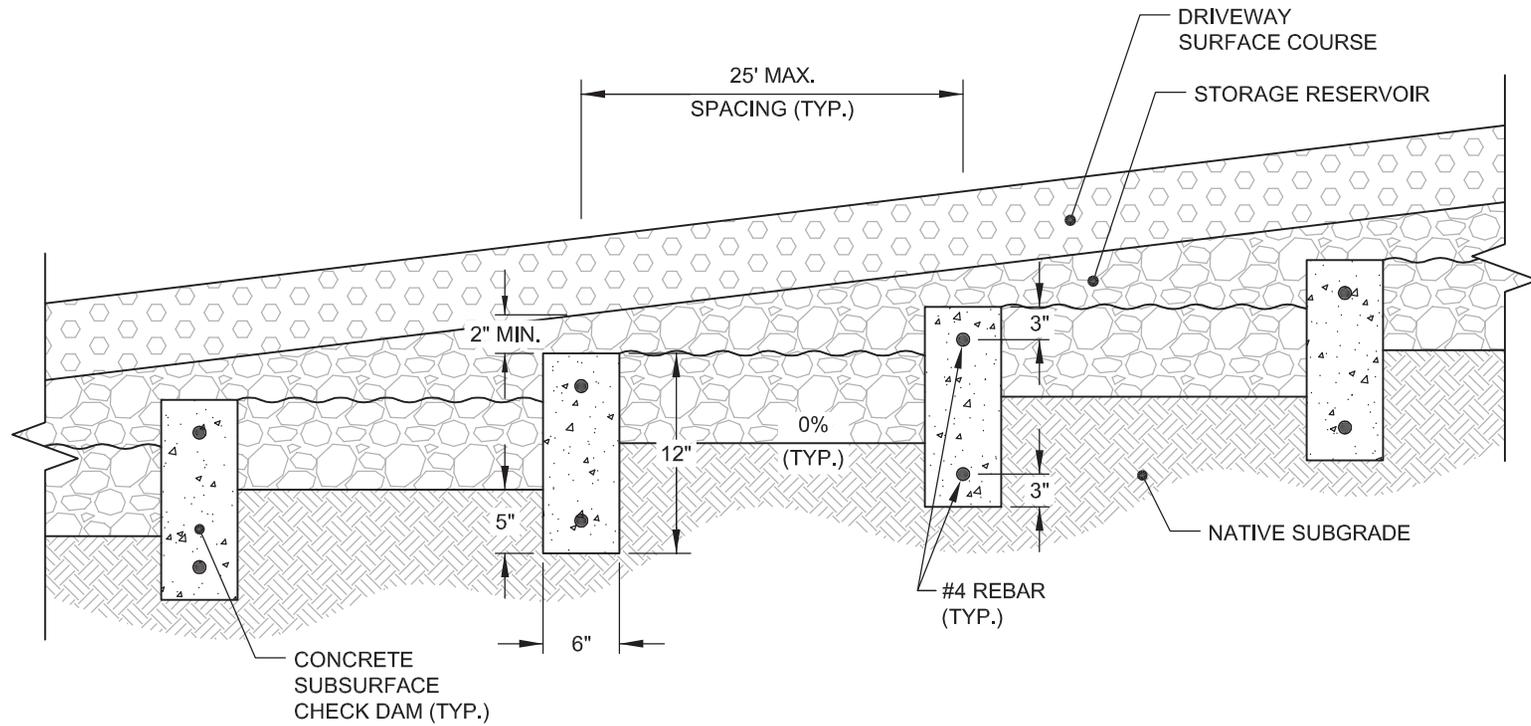
SIEVE SIZE	PERCENT PASSING
2-1/2 inch	100
2 inch	90-100
1-1/2 inch	35-70
1 inch	0-15
1/2 inch	0-5
100	0-3
% FRACTURE	95

ALL PERCENTAGES ARE BY WEIGHT

FIGURE 2

NOTES:

1. USE WHERE DRIVEWAYS LONGITUDINAL SLOPE IS GREATER THAN 3%.



SUBSURFACE CHECK DAM DETAIL

NOT TO SCALE

FIGURE 3