



# Residential Permeable Pavement Design & Construction Guide

## City of Kelso

### ELIGIBILITY

This handout is intended to aid applicants using the **Abbreviated Stormwater Site Plan** who have determined that permeable pavement is a feasible method for managing stormwater from their residential site. Not all types of residential permeable pavement may be designed using this simplified design guidance. See the ineligible list below.

### **INELIGIBLE**

The following sites and pavement installations are not eligible to use this handout.

- Non-residential sites
- Sites where 5,000 square feet or more of new + replaced hard surfaces are being constructed
- Driveways longer than 150 feet
- Pavements on slopes greater than 12%
- Pavements placed on fill
- Pavements in the City's rights-of-way
- Parking areas for vehicles heavier than passenger vehicles, pick-up trucks, vans, or sport utility vehicles

### Tip!

If the construction site or type of pavement installation is ineligible to use this handout, hire a Professional Engineer to design the pavement.

### INSTRUCTIONS FOR USING THIS FORM

This handout gives instructions for constructing permeable pavement to manage stormwater from small residential construction sites. The information in this handout is adapted from the *Stormwater Manual for Western Washington* (<https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Stormwater-manuals>).

After you have completed the questions and drawings in this guide:

- Submit the entire form with your completed **Abbreviated Stormwater Site Plan**

### WHAT IS PERMEABLE PAVEMENT?

Permeable pavement is a type of pavement that allows rain to pass through the surface and be absorbed into the soil. Permeable pavements are hard and strong enough to support vehicles. Three types of permeable pavement are allowed for residential uses such as driveways and patios:

- Porous asphalt is similar to standard hot-mix or warm-mix asphalt, but sand and fine materials are reduced, and a special binder is used. Rain water passes through voids in the asphalt.
  - Porous asphalt may be used if the surface slope of the pavement is less than 5%.
- Pervious concrete is similar to standard concrete used for driveways, but the fine aggregate component is reduced or eliminated, and a different binder is used. Rain water passes through voids in the concrete.
  - Pervious concrete may be used if the surface slope of the pavement is less than 10%.
- Permeable interlocking concrete pavers (PICP) are solid impermeable concrete pavers. Joints between pavers are filled with a permeable rock mix that allows rain water to pass through the spaces between pavers.
  - PICP may be used if the surface slope of the pavement is less than 12%.

*This guidance is intended for use by property owners and is not a substitute for Kelso Municipal Code. We have substituted some technical language with plainer terms. In case of conflict, the meaning and intent adopted in the Kelso Municipal Code and the Kelso Engineering Design Manual shall prevail.*



Photo is courtesy of the United States Geological Service

## **WHAT ARE THE BENEFITS OF PERMEABLE PAVEMENT?**

As cities and suburbs grow, they replace forests and other open spaces with roofs, pavement, and other impervious surfaces. Most rain that falls on native forests and prairies is quickly absorbed into the soil or evaporated. When rain falls on impervious surfaces, it cannot be absorbed and quickly runs off. Runoff can cause erosion and flooding and carries pollutants such as pesticides, oil, and metals into lakes and streams. Permeable pavement mimics some aspects of natural conditions. Permeable pavements can help recharge aquifers and help protect streams and lakes from pollution.

## **WHERE CAN I USE PERMEABLE PAVEMENT?**

This design guidance is for design and construction of permeable pavement driveways, patios, pathways, and parking areas on residential (single-family or duplex) construction sites.

The detailed feasibility requirements for permeable pavement can be found in the **Abbreviated Stormwater Site Plan**, the **Final Feasibility Checklist** and the design guidelines of the *Stormwater Management Manual for Western Washington*.

Generally permeable pavement cannot be used:

- Over utilities – Make sure to have all utilities located and marked before digging. Contact utility locate services by calling 811.
- Near the edge of steep slopes or bluffs – The additional water soaking into the ground on steep slopes can cause landslides or unwanted settling. Do not place permeable pavement within 50 feet of a slope steeper than 20%.
- Near a septic tank, septic drainfield, or reserve drainfield area – Provide at least 10 feet between an existing or planned septic system.
- In low spots that do not drain well.
- Where there is high groundwater or bedrock within 1 foot of the bottom of the excavated area.
- Near wells – permeable pavement must be set back a minimum of 10 feet from drinking water wells or 100 feet if vehicles will park or drive on the pavement.
- Downslope of steep, erosion-prone areas that are likely to deliver sediment.

## **HOW ARE PERMEABLE PAVEMENTS DESIGNED?**

1. **Feasibility.** Ensure permeable pavement is feasible before beginning your design. Feasibility is established when filling out the **Abbreviated Stormwater Site Plan**.
2. **Soil infiltration rate.** Get the soil infiltration rate and the hydrologic soil group for your proposed location from information you gathered to fill out the **Abbreviated Stormwater Site Plan**:

Soil infiltration rate = \_\_\_\_\_ inches/hour (see page 13 of the **Abbreviated Stormwater Site Plan**)

Hydrologic soil group =  A     B     C     D (see page 4 of the **Abbreviated Stormwater Site Plan**)

3. **Select paving material.** For residential driveways and patios discussed in this handout, porous asphalt, pervious concrete, or PICP may be selected.

Material =  porous asphalt     pervious concrete     PICP

4. **Plan for the storage reservoir.** A drain rock storage reservoir beneath the paving layer temporarily holds water, allowing it to drain slowly into the ground. The minimum required depth of the storage reservoir is six inches.
5. **Geotextile.** If the subgrade is in hydrologic soil group “C,” a non-woven geotextile is required between the prepared subgrade and the storage reservoir.
6. **Overflow path.** In case of a large storm that exceeds the capacity of the storage reservoir or in case the pavement stops draining, a safe overflow path must be identified.

Providing a 2% minimum slope toward lawn or landscaping or to the street is acceptable. If sloped to lawn or landscaping, a minimum 10 foot width of vegetated area is required for each 20-foot width of permeable pavement. For example, a driveway that is 18 feet wide can slope at 2% toward a 10-foot wide area of lawn or landscaping on the property.

The overflow path should not result in runoff entering neighboring properties.

7. **Drainage onto permeable pavement.** Drainage from other surfaces adjacent to the permeable pavement – such as lawn and impermeable pavements – is discouraged. Drainage from roof downspouts or other concentrated flows onto the pavement is not allowed. Slope adjacent surfaces away from the permeable pavement, and direct roof downspouts to an appropriate location.

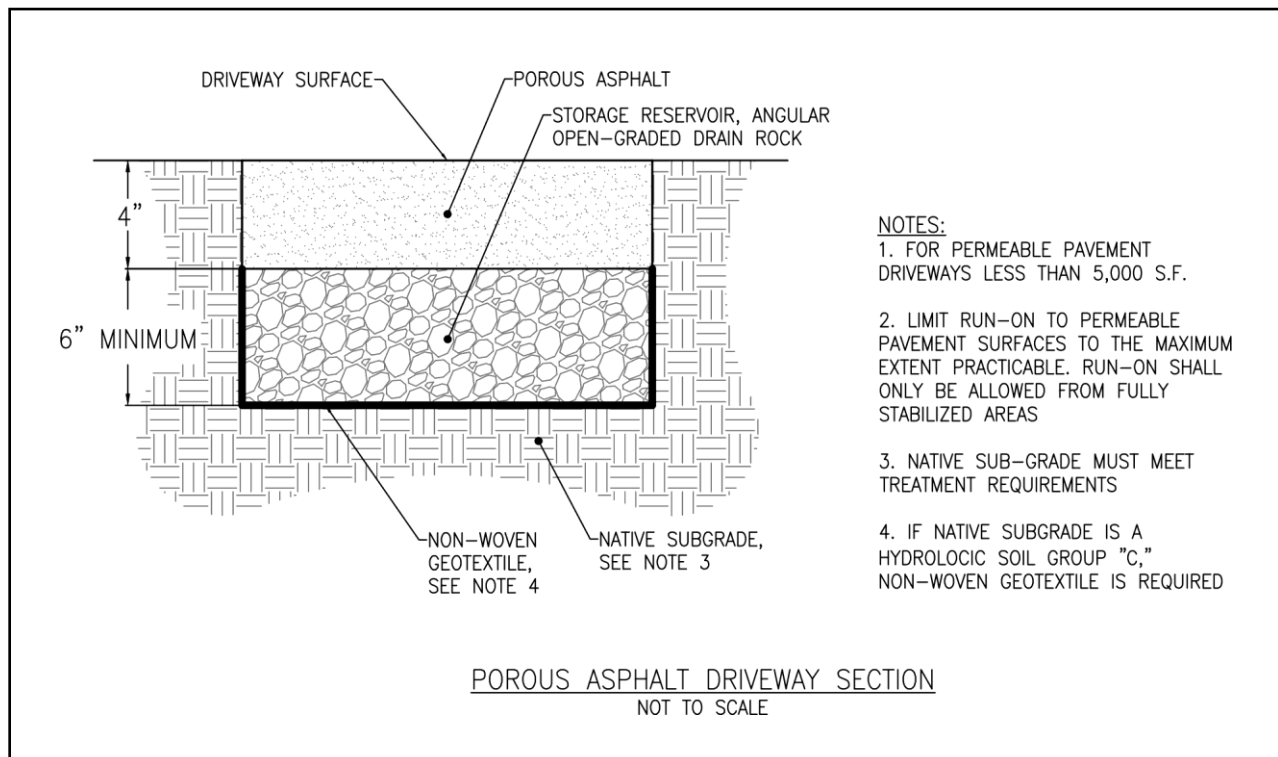
## **CONSTRUCTION SEQUENCE:**

1. **Protect area.** Areas designated for permeable pavement must be protected from compaction and muddy construction runoff. Prior to construction, ensure the temporary erosion and sediment controls selected to protect LID BMPs, shown on the **Small Project Erosion Control Plan**, have been properly installed.
2. **Excavation and Grading.** Excavate and grade the area where permeable pavement will be installed to the proper depth. If possible, avoid using excavating equipment inside the footprint of the permeable pavement.
3. **Prepare Subgrade.** Compact the subgrade to the minimum necessary for structural stability. Compaction may be specified as “firm and unyielding” or “90 to 92% Standard Proctor.” These specifications maintain the permeability of the soil. (Note: these specifications result in less compaction than many contractors are accustomed to.)

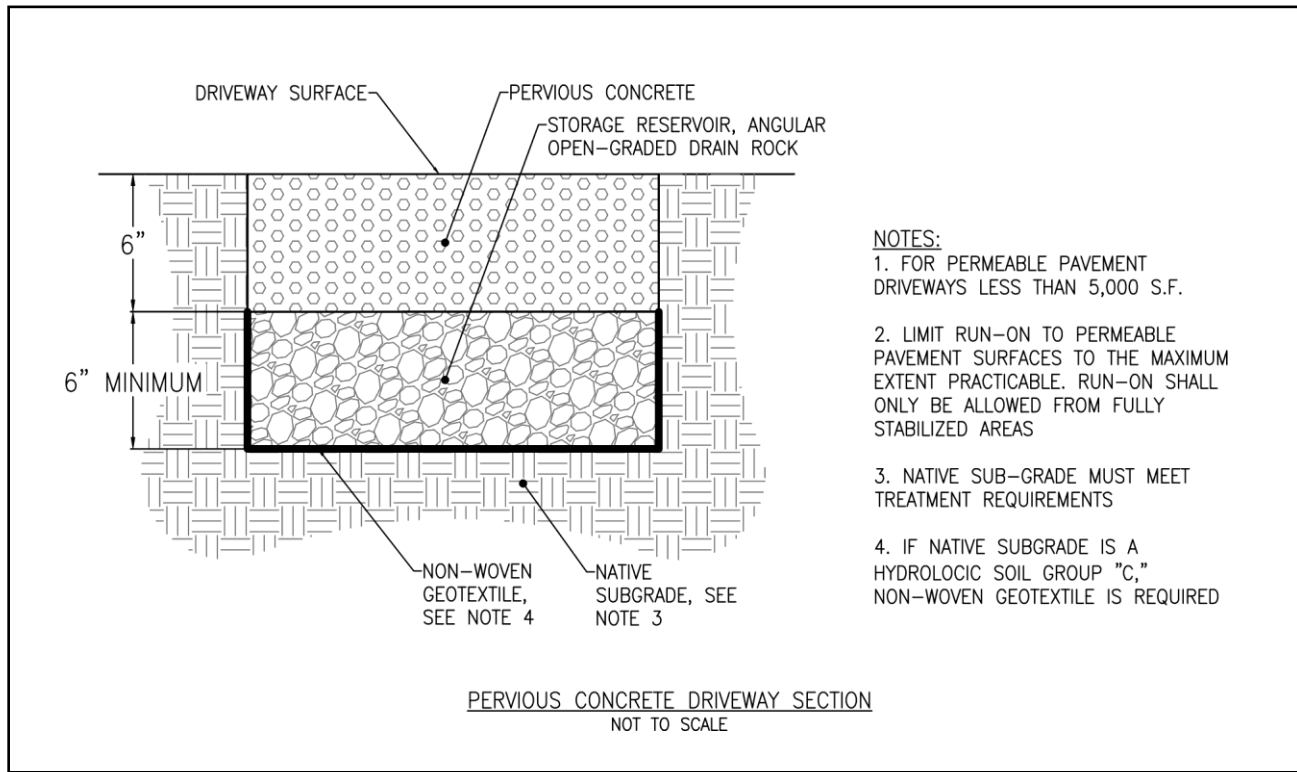
4. **Install geotextile.** If required, install the non-woven geotextile.
5. **Install storage reservoir.** To avoid further compacting the prepared subgrade, use the back-dumping method to install the storage reservoir. Dump drain rock onto the subgrade (or geotextile layer) starting at the forward edge of the installation (the edge where the dump truck or equipment first approaches the prepared subgrade). Push the drain rock out without walking or driving on the subgrade. For subsequent loads, repeat from the edge of the placed drain rock, working toward the far edge of the installation.
6. **Install leveling course.** For PICP, place the levelling course.
7. **Install pavement.** Install pavement using methods appropriate for the materials chosen.
8. **Curing.** Pervious concrete requires a 7-day curing period using proper methods before pedestrian or vehicular traffic is allowed.

### **PERMEABLE PAVEMENT DESIGN DRAWINGS:**

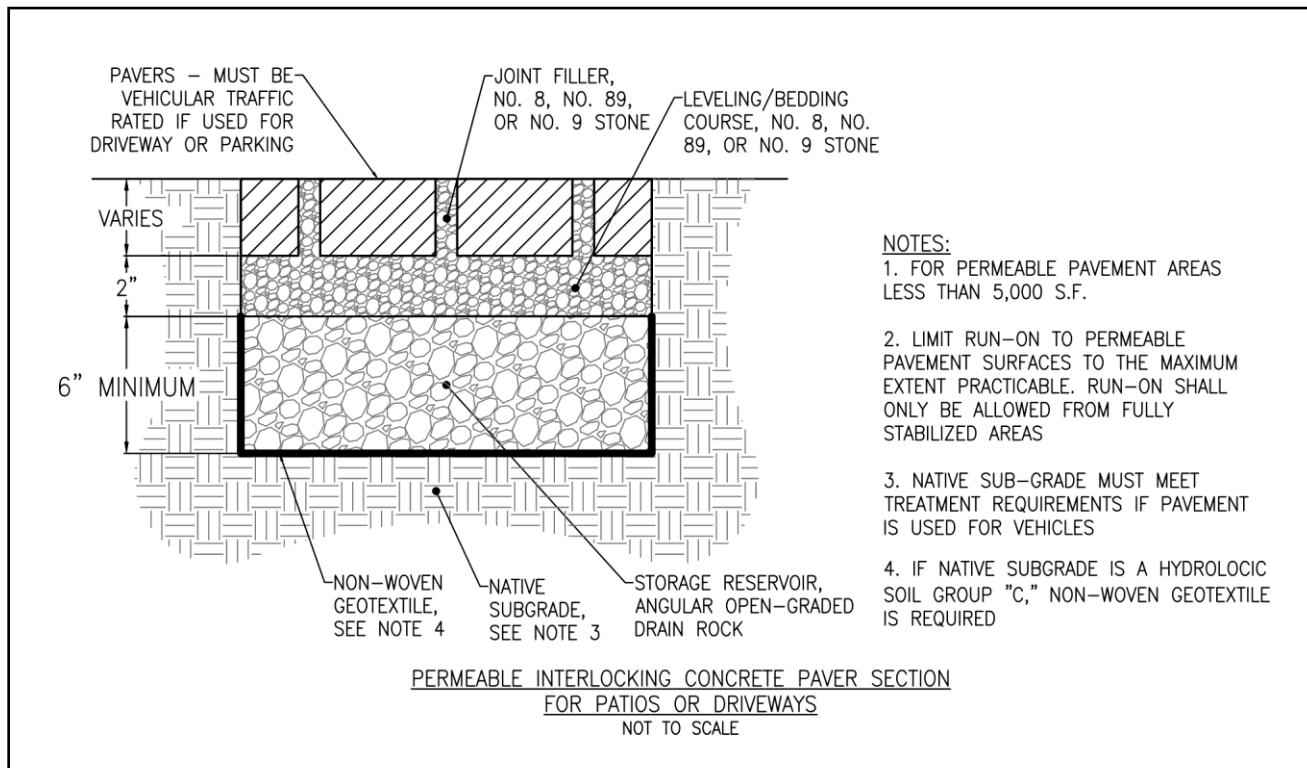
This drawing may be used for a porous asphalt driveway.



This drawing may be used for a pervious concrete driveway.



This drawing may be used for a driveway, patio, or other pedestrian surface made of PICP.



## Tips!

For permeable pavement to function properly, both paving material specifications and correct installation are vital. Construction methods are different than for traditional asphalt and concrete.

The following **recommendations** can help ensure your permeable pavement functions well:

- Hire a qualified contractor to install the pavement.
  - Pervious Concrete. The National Ready Mix Contractor Association (NRMCA) certifies pervious concrete technicians, installers, and craftsmen. We recommend the contractor be a certified installer or craftsman.
  - Porous asphalt. Request to see examples of successful porous asphalt installations, or hire a contractor who has completed the Washington State Low Impact Development Certificate Program or has received the LID Design Certificate.
  - PICP. Request to see examples of successful PICP installations.
  
- Products/Materials
  - Pervious Concrete. We recommend pervious concrete products meet the current version of American Concrete Institute (ACI) specifications 522.
  - Porous asphalt. We recommend products meet the performance grade (PG) 70-22.
  - PICP. If used for a driveway or parking area, pavers must be rated for vehicular traffic.
  
- Construction Contract
  - Incorrect installation or poorly designed concrete/asphalt mix can cause a permeable pavement to fail (not drain). Your contract with a contractor can protect you. Before closing out your permits at the end of your construction project, the Contractor must perform a test to verify the permeable pavement can drain water at a minimum of 20 inches/hour. A City Inspector will inspect the test. We recommend your construction contract provide for re-installation if the pavement does not pass the acceptance test.

## **PERMEABLE PAVEMENT SUBMITTAL INSTRUCTIONS:**

Your permeable pavement must be approved by the City as part of the **Abbreviated Stormwater Site Plan** before you may build it. You must submit two drawings for review with the **Abbreviated Stormwater Site Plan**.

The permeable pavement drawings show information necessary to construct the permeable pavement. For each drawing you may fill out the worksheets attached (starting on the following page) or may prepare your own following the instructions below.

### **1. Plan Drawing**

A plan drawing is an overhead or map view of the pavement.

<b>Select One Option</b>	
Option 1: Fill Out a Submittal Worksheet	Option 2: Draw Your Own
<ol style="list-style-type: none"> <li>1. Choose the submittal worksheet appropriate for your pavement type (porous asphalt, pervious concrete, or permeable interlocking concrete pavers).</li> <li>2. Write the site address and applicant name and contact information in the title block at the bottom of the Worksheet.</li> <li>3. Choose a scale for the drawing (how many feet each grid square represents), and place a checkmark next to the scale you will use at bottom right.</li> <li>4. Draw a north arrow.</li> <li>5. Draw and label the outline of the permeable pavement area. Include dimensions (length and width) for both.</li> <li>6. Write the area of the permeable pavement in the space provided below the grid.</li> </ol>	<ol style="list-style-type: none"> <li>1. Use 8½x11 or 11x17 graph paper.</li> <li>2. Label the paper with the site address and applicant name and contact information.</li> <li>3. Choose a scale for the drawing (how many feet each inch or grid square represents), and write the scale on the drawing.</li> <li>4. Draw a north arrow.</li> <li>5. Draw and label the outline of the permeable pavement area. Include dimensions (length and width).</li> <li>6. Write the area of the permeable pavement below the drawing.</li> </ol>

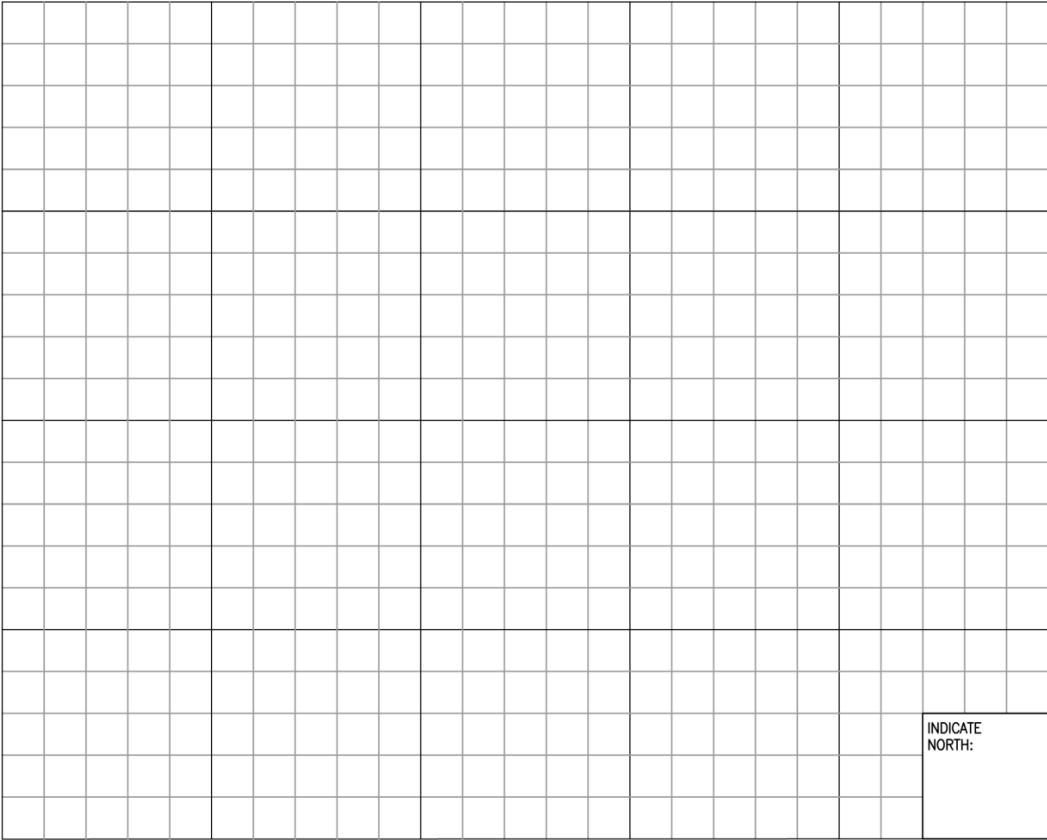
### **2. Cross-Section Detail Drawing**

A cross-section drawing depicts a hypothetical slice of the permeable pavement from top to bottom and side to side. For example, the illustrations on page 4 of this handout are cross-sections.

<b>Select One Option</b>	
Option 1: Fill Out a Submittal Worksheet	Option 2: Draw Your Own
<ol style="list-style-type: none"> <li>1. The bottom portion of each Worksheet shows a cross-section view of the permeable pavement already drawn.</li> <li>2. In the spaces and checkboxes provided, fill in the following information:               <ol style="list-style-type: none"> <li>a. The thickness of the reservoir storage layer.</li> <li>b. If permeable interlocking concrete pavers are used, the paver thickness.</li> <li>c. Mark whether a geotextile will be used (see note 4 on the notes starting on page 4).</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>1. Use 8½x11 or 11x17 graph paper.</li> <li>2. Label the paper with the site address and applicant name and contact information.</li> <li>3. Draw and label the pavement layer and storage layer.</li> <li>4. If permeable interlocking concrete pavers are used, draw and label the leveling/bedding course, and the paver joint filler.</li> <li>5. Write the thickness of the pavement/pavers, storage layer, and bedding course (if required).</li> <li>6. Write whether a geotextile will be used (see note 4 on the notes starting on page 4) and draw if used.</li> <li>7. The cross-section drawing does not need to be to scale.</li> </ol>

Refer to the Kelso Engineering Design Manual, online at [www.kelso.gov/engineering/engineering-documents](http://www.kelso.gov/engineering/engineering-documents), for more information or clarification of stormwater requirements within Kelso. You may also contact the City of Kelso's Engineering Department at (360) 423-6590 or at [engineering@kelso.gov](mailto:engineering@kelso.gov).

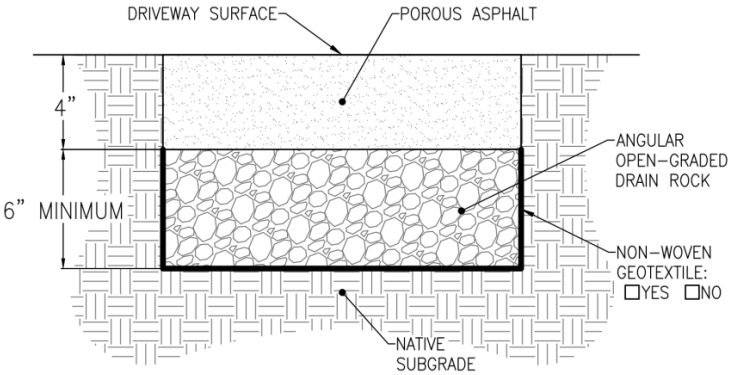
**SUBMITTAL WORKSHEET #1: POROUS ASPHALT PLAN AND SECTION**



PERMEABLE  
PAVEMENT AREA: \_\_\_\_\_ SQ. FT.

CHECK  ONE SQUARE = 1 FOOT  
SCALE  ONE SQUARE = 2 FEET  
USED:  ONE SQUARE = 5 FEET

PLAN VIEW

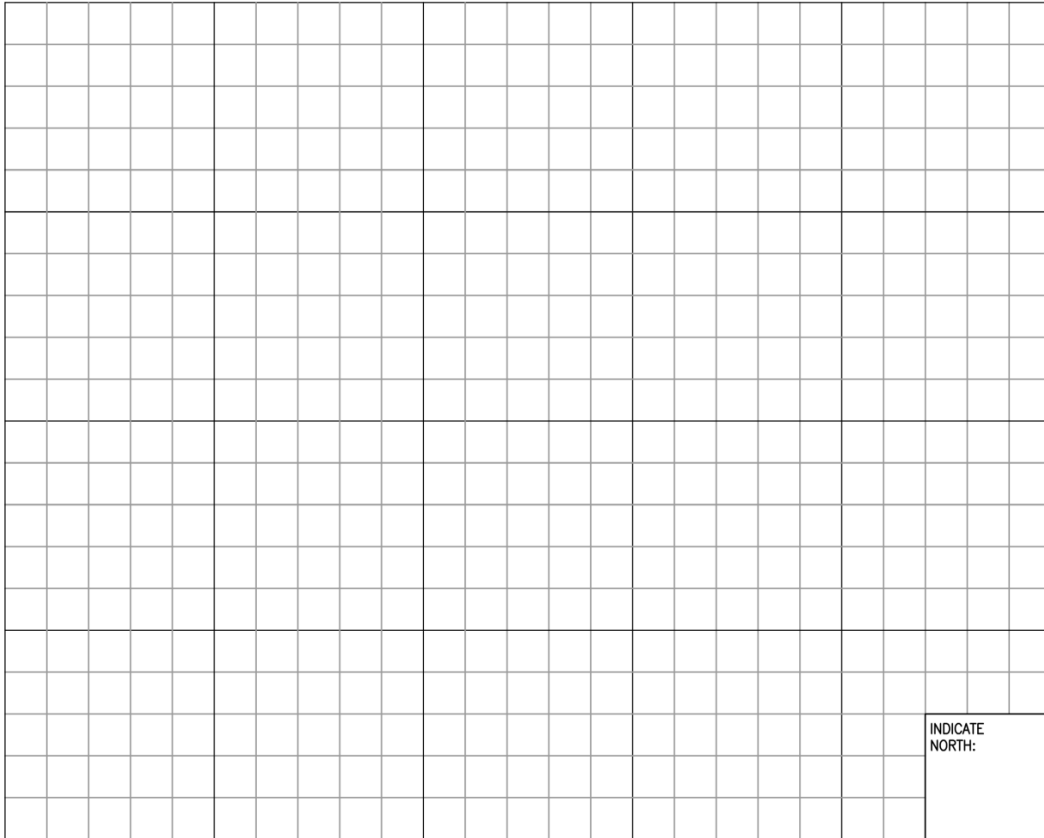


CROSS-SECTION VIEW  
NOT TO SCALE





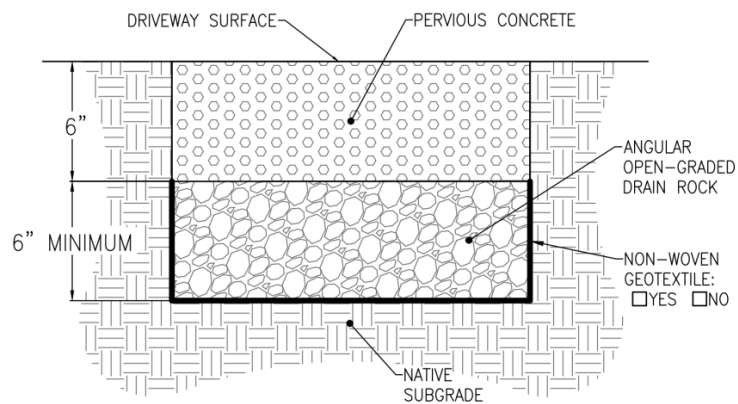
## SUBMITTAL WORKSHEET #2: PERVIOUS CONCRETE PLAN AND SECTION



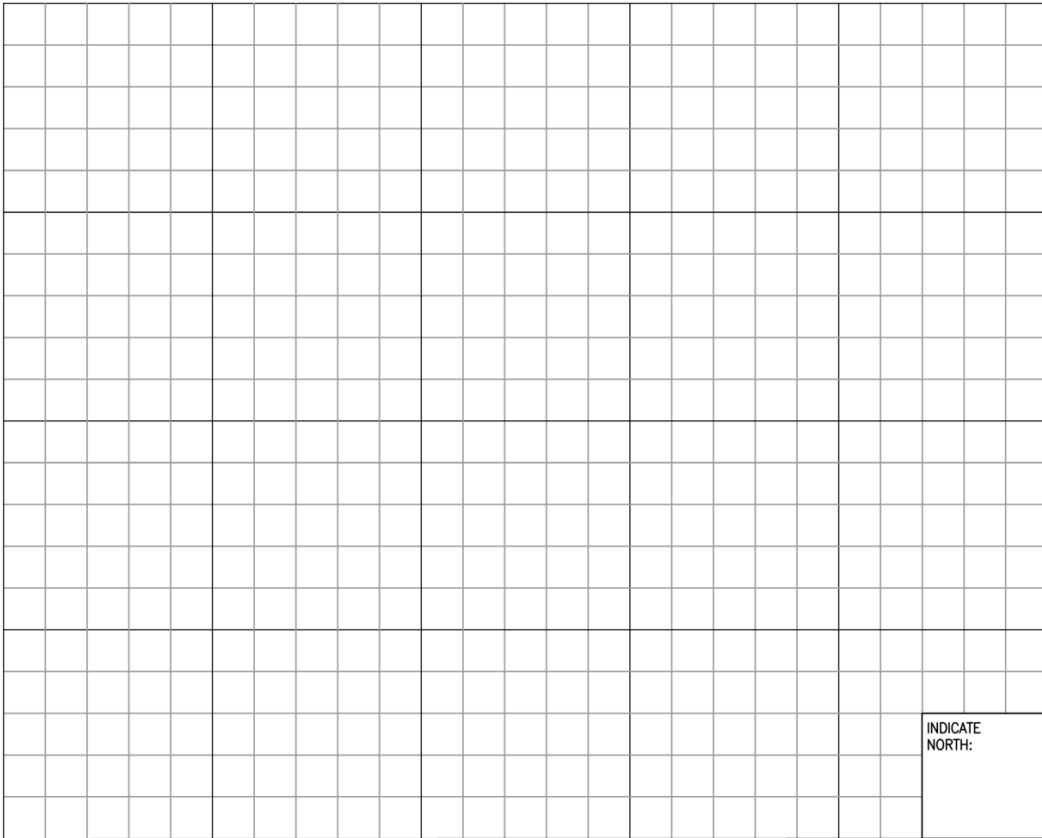
PERMEABLE  
PAVEMENT AREA: \_\_\_\_\_ SQ. FT.

CHECK  ONE SQUARE = 1 FOOT  
SCALE  ONE SQUARE = 2 FEET  
USED:  ONE SQUARE = 5 FEET

PLAN VIEW



**SUBMITTAL WORKSHEET #3: PERVIOUS INTERLOCKING PAVERS PLAN AND SECTION**



PERMEABLE  
PAVEMENT AREA: \_\_\_\_\_ SQ. FT.

CHECK  ONE SQUARE = 1 FOOT  
SCALE  ONE SQUARE = 2 FEET  
USED:  ONE SQUARE = 5 FEET

PLAN VIEW

