

## Permeable Pavements – Reduce Runoff thru Pervious Layers

*This article was researched and developed by Cascadia Consulting Group on behalf of the Department of Ecology. Input was provided by Zsofia Pasztor and Rick Crooks.*

*Low Impact Development (LID) is coming to Washington State in the newest round of municipal stormwater permits, called National Pollution Discharge Elimination System (NPDES) Permits. These permits are issued by the Washington State Department of Ecology and cover more than 90 Cities and Counties in Western Washington and 24 cities and counties in Eastern Washington. By June 2015, Seattle, Tacoma, and unincorporated King, Snohomish, Pierce and Clark Counties will require the use of low impact development (LID) on both new and redevelopment projects. Most other Western Washington NPDES permittees will need to adopt these requirements by the end of 2016. The Eastern Washington NPDES permittees are required to update their codes, if needed, to allow the use of LID by the end of 2017.*

Permeable pavement is a good addition to Low Impact Development (LID) landscapes because it allows water to seep through designed voids in its structure. This allows the water to infiltrate into native soil, reducing and filtering stormwater before it enters nearby water bodies. But soil conditions, correct components, and base layers are critical to proper function.

### Start with the soil

Testing the soil on site to identify soil texture, organic matter content, ability to treat pollutants, compaction and infiltration rate will determine whether the soil will be adequate for absorbing stormwater and removing pollutants. Soils that don't drain well may not be suitable for installation of permeable pavements unless they include an overflow system or under-drains. Soils that do not allow for treatment of pollutants require an engineered sub layer to treat stormwater and receive credit on new or redeveloped LID sites.

### Does permeable pavement work on any site?

Just like any other LID Best Management Practice (BMP), a thorough site assessment will determine whether permeable pavement is appropriate. The site assessment should include an inventory of existing structures and function such as hardscaping, utilities, contributing impervious area, vegetation, soil quality including texture (clay, silt, and sand ratio) and compaction, natural drainage, infiltration rates, slope, and exposure.

### Types of permeable pavement:

- **Porous Asphalt** – Made from a standard hot-mix asphalt with reduced or no sand and fines to be open graded so that water drains through it.
- **Pervious Concrete** – An enhanced porosity concrete, made with reduced or no sand and fines to be open graded, allowing water to drain through.
- **Permeable pavers** – Strong structural materials containing regularly interspersed void areas filled with clean, crushed gravel.
- **Grid Pavers** – Open-celled concrete or plastic pavement products filled with gravel or planted with sod providing a green surface solution.
- **Specialty products** – decorative pavers, porous materials made of recycled glass and granite, and permeable tiles are examples of specialty products made in a variety of colors and materials.

Site conditions that are not appropriate for permeable pavements include areas with excessive sediment deposits; locations that could experience concentrated pollutant spills like gas stations or industrial chemical storage sites; seasonally high groundwater within one foot of the bottom of the aggregate storage course; steep slopes where water may cause erosion and structural failure; water seeps and; known flooding issues. When working on large or complex sites it is always recommended that you consult with an engineer to determine the suitability of permeable pavement for your site prior to getting started.

### **What are the common components of permeable pavement?**

Each type of permeable pavement has different installation specifications to allow for infiltration. Research and assessment of each project is important. Specifications will depend on the type of pavement product as well as the site requirements and local (municipal and county) specifications. Zsofia Pasztor emphasizes the importance of making sure the specifications being used are up to date. Each site typically includes these components:

**Subgrade** –the exposed native sub-soil under the storage or reservoir course (layer).

**Storage or reservoir course (layer)** –clean washed gravel, or aggregate with no fines, large enough to create adequate voids for water storage, and with angular surfaces that lock together to provide structural support.

**Bedding or “Choker” course** – clean washed aggregate with no fines, smaller than for storage or reservoir course. This layer provides a level, stable under-surface and is not necessary for all products.

**Surface or Wearing course** – the porous concrete, asphalt, pavers, or other permeable materials used at the surface of the installation.

**Geotextiles** are sometimes used between the sub grade and reservoir layers to keep sediments out of the subgrade.

**Drains or Overflow-** are used depending on the amount of rain water the site receives, the height of the water table, and the infiltration rate of the subgrade.

### **Do permeable pavements require a lot of maintenance?**

Rick Crooks of Mutual Materials describes, “While permeable pavements catch everything that falls on or flows to them, routine pavement maintenance will allow these systems to function properly for many years. Sites receiving large amounts of silt or with a large amount of falling organic material may clog more readily and will require more maintenance.” In addition to regular maintenance, Crooks recommends monitoring adjacent property activity for possible sediment sources. For example, debris from a construction project could spill over and fill the voids in permeable pavement.

Provide clear maintenance plans when installing permeable pavement projects that include:

- Periodic(at least once per year) evaluation of infiltration rate
- Periodic (at least once per year) evaluation of drains and overflow systems
- Cleaning of surfaces once or twice annually using suction, vacuum, or high pressure wash equipment (shop vacs are appropriate for smaller installations).
- Weed removal – weed flammers are effective for this purpose; avoid using herbicides

- Periodic replenishment of aggregate in joints, if required
- Drain and overflow system cleaning, as needed

**For more information, consult:**

The Department of Ecology Stormwater Management Manual for Western Washington,

<http://www.ecy.wa.gov/programs/wq/stormwater/manual.html>

The Department of Ecology Operations and Maintenance Guide,

<http://www.ecy.wa.gov/programs/wq/stormwater/municipal/LID/TRAINING/OperationsAndMaintenance.html>

The 2012 Low Impact Development Technical Guidance Manual for Puget Sound,

[http://www.psp.wa.gov/LID\\_manual.php](http://www.psp.wa.gov/LID_manual.php)

**What about using permeable pavement on small properties?**

Porous asphalt and concrete producers manufacture very large batches because demand is too low for separate machine productions of standard and porous products. Consequently, each production of porous asphalt or concrete requires machinery to be carefully cleaned and retooled. If you typically install on small sites, you may find materials are more readily available if you partner with a large installer who orders large quantities. Pavers, stone, and tiles are much easier to purchase in small quantities.

**How do I decide what to use?**

When choosing what type of materials to use on a project site, Zsofia Pasztor refers to the Snohomish County Sustainable Development Task Force check list. For example:

- **Installation issues** - What soil conditions are needed and present on site? What are the site conditions? What licensing and certifications are required to complete the installation?
- **Cost Per Area** – Have you considered both product *and* installation cost in your budget?
- **Durability and Longevity** – Does the lifespan meet your needs? Can the product handle the vehicle traffic on the site?
- **Lifetime Performance** – Will the product require renovation or special maintenance over its lifetime?
- **Look, Feel and Use** – What are the client’s aesthetic desires? Will it be easy for all users to traverse the surface? For example, is ADA compliance required? And does the product meet ADA specifications?
- **Short Term and Long Term Effects** –New concrete will temporarily leach lime and cause increased pH in surrounding beds for a short time. Asphalt may leach carcinogens like hydrocarbons into the surrounding environment.
- **Short Term and Long Term Benefits** – Will the product solve a drainage problem? Will the product contribute to the long term health of an adjacent water body?
- **Maintenance** – What kind of maintenance does the material require? For example, turf blocks with green, weed-free grass all year may require high maintenance.

- **End-of-life Solutions** –Will the material go to the landfill or can it be re-used or recycled when no longer on site?

**Be Creative!**

Be creative with permeable paving products! Porous concrete is available in many colors and can be installed in patterns. Recycled materials and pavers such as brick, stone and broken up concrete may also be installed in decorative patterns for lower cost projects. Careful consideration of texture, color, and material result in beautiful, environmentally responsible, and sustainable projects!