

### Section 3.10 Permeable Pavement (PP)



Permeable Pavements are alternative surfaces that allow stormwater runoff to filter through voids in the pavement surface into an underlying stone reservoir, where it is temporarily stored and/or infiltrated. All permeable pavement systems have a similar structure, consisting of a permeable surface layer, bedding layer, reservoir layer, and under drain with geotextile fabric installed underneath if needed based on site characteristics. A variety of Permeable Pavement surfaces are available, including pervious grid pavers, porous asphalt/concrete, and permeable interlocking pavers.

- Pervious Grid Pavers typically consist of a plastic or wire mesh grid filled with amended soil or sandy gravel.
- Porous Asphalt and Concrete consist of a pavement mix with fewer fines that create pores in the surface.
- Permeable Interlocking Pavers have gaps around the paver filled with sandy gravel or pea gravel.

#### A. Purpose

- Permeable Pavement is used as an alternative to conventional pavement at residential, commercial and institutions. This practice is not intended for industrial sites or areas with high sediment and debris loadings due to potential groundwater contamination and clogging of the practice.
- Permeable Pavement shall only be installed when it is either replacing impervious surface or when treating additional impervious surface that offsets the square footage of the practice footprint.
- Permeable Pavement can be used to replace gravel or paved driveways, patios, sidewalks and parking lots. Permeable pavement around pools is not eligible for cost share.

#### B. Site Criteria

- Contributing drainage area should be less than 0.5 acres and should be as close to 100% impervious as possible. The ratio of the contributing drainage area to practice surface area is recommended to be 2:1.
- Cannot be placed on wetland soils.
- Cannot be placed within the areas designated as the FEMA 100-year flood plain, 1% annual chance flood plain, or by the locality as within the 100-year flood plain, whichever is most stringent.
- Depth to water table and bedrock should be greater than 2 feet below the bottom of the practice excavation.
- If the seasonal high water table is identified as a potential concern based on field or desktop analysis, it should be verified by a professional soil scientist (Contact Extension, NRCS, or Society of Professional Soil Scientists for local providers).
- Shall be 10 feet from building foundation or use an impermeable liner.
- Excavation depth will above the 1:1 soil bearing zone slope of the foundation.

- Slopes greater than 5% should be avoided. The reservoir layer may need a terraced design to provide the necessary storage volume. It is recommended that terraced reservoirs do not exceed 2' of depth per chamber.

### C. Design Criteria

- Shall be sized to treat the 1-inch volume of runoff (See Appendix A.1 for Calculations).
- Permeable Pavement product should be selected based on the traffic loads, runoff loadings, and maintenance capacity of the applicant. The thickness of the product should be accounted for in the excavation depth.
- **Unless Manufacturer's Specifications differ, the following specifications apply:**
- A bedding layer is required for most products. Bedding should be composed of a minimum of 2-inches of #8 open graded, clean and washed stone.
- Minimum reservoir depth shall be 6 inches for all applications. Reservoir can be 4 inches of #57 stone and 2 inches of #3 stone--all clean, washed, and open graded.
- A separation layer is used to prevent the native soil from infiltrating the reservoir. This layer can be one of the following: 4-inches of coarse sand; 2-inches of #8 stones; or Class III nonwoven geotextile (weight of 6 oz per sq. inch or higher).
- The impact of freeze/thaw on the project should be considered in the design.
- Setback can be relaxed if an impermeable liner is used, extending along the sides of the practice from the surface to the bottom of the reservoir layer as an added precaution against seepage. Practice should not be hydraulically connected to structure foundations (including basement and crawl space walls, slabs on grade).
- Bottom of the reservoir shall be graded as flat as possible, with a 0.5% underdrain grade if underdrain is required.
- Underdrains are required when the soil infiltration rate is less than 0.5 inches/hour. Patios and sidewalks may use perforated HDPE piping. Perforated PVC piping should be used for parking lots or pavement with higher traffic loads. Minimum underdrain diameter shall be 4 inches. Use as necessary appropriate end caps, T's and Y's. For large scale projects or where high runoff loadings are expected, cleanouts should be provided. Upturned elbows may be used at the outlet to promote additional infiltration.
- Only when the soil infiltration rate has been confirmed to be 0.5 inches/hour or greater can underdrains be removed.
- Edge restraints should be used to prevent shifting of pavers. Edging blocks can be flush with surface or raised to divert contributing drainage area with high loadings. Edging on the downhill side of pavement may require footings to prevent shifting.
- Overflow weir/pipe sizing based on 10-year storm, if applicable.
- Pretreatment is required when the pavement is receiving runoff from pervious or gravel areas with high loadings potential. Usually, pretreatment will be gravel diaphragm trenches behind the edging. See Appendix B for more information.

### D. Design Plan Components

- The installed practice must be in accordance with the manufacturer's specifications and approved design plan. The district must be notified of any proposed changes to the approved design. Changes to the approved design may jeopardize cost share reimbursement. The Steering Committee has discretion to approve or deny cost share reimbursement in the event of design changes.
- Information required in the plan includes (see VCAP Submission Checklist for a comprehensive list):
  - The design plans should have a professional seal or be on licensed business letterhead; or Form-5 Release Agreement signed and attached to waive the requirement for the design plan to be certified by a licensed professional. Release Agreement may be accepted on a case-by-case basis.
  - Photo documentation of site and resource concern, noting downspouts that will be routed into the practice.

- Falling Head Infiltration Test completed and attached.
- Soil map with description of soil and depth to water table via Web Soil Survey.
- Confirmation BMP shall not be in wetlands soils or within 100-year/1% flood plain.
- Topographic map showing contributing drainage area, runoff flow paths, roads and waterways.
- Aerial photo with an outline of practice location and impervious area treated.
- Project design, aerial, including inlet, outlets, overflows, and—if used--underdrain location.
- Cross section and/or profile showing depth of layers, slope of reservoir/underdrain (if used), and inlet/outlet/underdrain (if used).
- Sizing calculations for the practice (See Calculations in Appendix A).
- Other calculations per practice standards (structural loading, pretreatment sizing, etc.)
- Installation requirements including timeline, sequence, and site stabilization.
- Material list and itemized cost estimates from contractor, vendor, and/or supplier.
- Site constraints identified (utilities, right-of-way, etc.).
- A statement regarding compliance with any permitting requirements or local codes.
- Other information as requested by the local District.
- Verification by a licensed professional may be required by the District to verify practice installation.

#### **E. Operation and Maintenance**

- Maintenance shall include all components of the practice including the surface material, underdrains, underdrain outlets, underdrain cleanouts and contributing drainage area.
- All operation and maintenance must follow the manufacturer's recommendations.
- Routine Maintenance:
  - Sweeping or leaf blowing coarse material off the practice surface.
  - Vacuum fines from joints and replace stones as necessary.
  - Repair or replace damaged pavement/paver areas.
  - Remove weeds from paver cracks.
  - Clean out pretreatment if applicable.
- The following activities must be avoided on all permeable pavements:
  - Oil changes or other car maintenance activities.
  - Ice melt products and/or sand during winter months.
  - Storage of mulch or soil materials.
  - Sealing and resurfacing with an impervious pavement.
  - Power washing.

#### **F. Cost-Share Rates/Incentives**

- See **District Guide to VCAP** for practice cost-share rates and caps.
- Eligible costs may include: excavation, grading, installation (backfill, leveling), stone aggregate, appropriate soil media for grids, interlocking pavers, plastic or concrete grids, porous concrete/asphalt, geotextile fabric, underdrain components, edge restraints, pretreatment, erosion and sediment control if needed.

#### **G. Technical References**

- Virginia Stormwater Management Handbook, Version 1.0. 2024. Virginia Department of Environmental Quality.
- Ferguson, B.K., editor. 2005. Porous Pavements. Boca Raton, FL, CRC Press LLC.
- Smith, David R. 2006. Permeable Interlocking Concrete Pavement: Selection, Design, Construction and Maintenance. Third Edition. Interlocking Concrete Pavement Institute.