

VA Tech Non-Proprietary BMPs for VA 2014 Stormwater Regulations

Since the early 1980's, land developers, particularly in fast-growing regions of the United States, have been required by states and municipalities to manage the stormwater runoff from their development sites. Stormwater management has aimed at several specific goals: protecting the biological and physical integrity of stream channels downstream from development sites; protecting from frequent, localized flooding resulting from increased runoff volumes from the new impervious surfaces; and removing pollutants from the site runoff. Other goals that have been added over the years are mimicking the rate of groundwater recharge that existed prior to development, and protecting streams and properties from extreme flood damage.

An array of BMPs have been developed and used over that period of time. Probably the most-used practices have been filtering practices such as grass filter strips and channels, infiltration practices such as dry wells and infiltration trenches, permeable pavement, and impoundment practices, such as wet and dry ponds and constructed wetlands. These earlier practices were largely aimed at *controlling* the volume and discharge of runoff from the site, as well as *providing treatment* for the pollutants in the runoff.

In the last decade, a new type of BMP evolved, aimed at reducing the volume of stormwater runoff leaving the development site and, therefore, mimicking the hydrologic patterns that existed at a site before it was developed. This is a way to minimize our "human footprint" or interference in natural processes. These new kinds of practices have been labeled "low impact development" (LID) BMPs and include Green Roofs, Bioretention, Rain Gardens, Rooftop Disconnection, Dry Swales and Wet Swales. LID practices can be linked with Environmental Site Design (ESD) techniques, such as conserving open space and natural areas, and reducing the amount of imperviousness and infrastructure on lots, in residential streets, and in parking areas, to significantly reduce imperviousness and overall development costs while providing greater protection of natural systems and processes.

The movement toward use of LID practices has led to recognition that optimal protection of natural systems is achieved in land development projects by reducing runoff volume and mimicking the pre-development site hydrology, rather than just focusing on treating pollution in the runoff and controlling its release from the site. This recognition has been validated by a recent panel of experts at the National Academy of Sciences aimed at improving how we manage stormwater (http://www.nap.edu/catalog.php?record_id=12465#toc).

DCR has developed an updated set of non-proprietary BMP standards (stds) and specifications (specs) for use in complying with the Virginia Stormwater Management Law and Regulations. These updated stds & specs were developed with significant assistance from Tom Schueler of the Chesapeake Stormwater Network (CSN), staff of the Center for Watershed Protection (CWP), the Northern Virginia Regional Commission (NVRC), and the Engineers and Surveyors Institute (ESI) of Northern Virginia. These standards are based on both the more traditional BMPs and the newer LID practices. The advancements in these standards and specifications are a result of extensive reviews of BMP research studies incorporated into the CWP's National Pollution Removal Performance Database (NPRPD). In addition, we have liberally borrowed from the cutting-edge ideas expressed in the newer BMP stds & specs from other states in the region.

To assist in development of these BMP stds & specs, a literature search was performed to compile data to support updated runoff volume reduction and pollution removal capabilities for different BMPs. Based on the research findings, runoff volume reduction rates were assigned and removal rates for Total Phosphorus were updated for various BMPs, as shown in **Table 4.1**. The explanation for these decisions can be found in the [Technical Memorandum: The Runoff Reduction Method \[pdf\]](#) developed for DCR and others by the Center for Watershed Protection, in support of DCR's regulation and Handbook revision processes.

Table 4.1. BMP Pollutant Removal Efficiencies (March 1, 2011)

Practice Number	Practice	Removal of TP by Runoff Reduction (RR, as %) (based upon 1 inch of rainfall)	Removal of TP by Treatment – Pollutant (EMC) Reduction (PR, as %)	Total Mass Load Removal of Total Phosphorus (TR, as %)
1	Rooftop Disconnection	25 or 50 ¹	0	25 or 50 ¹
2	Sheetflow to Vegetated Filter or Conserved Open Space 1	25 to 50 ¹	0	25 to 50 ¹
	Sheetflow to Vegetated Filter or Conserved Open Space 2 ⁵	50 to 75 ¹	0	50 to 75 ¹
3	Grass Channel	10 to 20 ¹	15	23
4	Soil Amendments	Used to decrease runoff coefficient for turf cover at the site. See the design specs for Roof Disconnection, Sheet Flow to Vegetated Filter or Conserved Open Space, and Grass Channels		
5	Vegetated Roof 1	45	0	45
	Vegetated Roof 2	60	0	60
6	Rainwater Harvesting	Up to 90 ^{3,5}	0	Up to 90 ^{3,5}
7	Permeable Pavement 1	45	25	59
	Permeable Pavement 2	75	25	81
8	Infiltration 1	50	25	63
	Infiltration 2	90	25	93
9	Bioretention 1	40	25	55
	Bioretention 2	80	50	90
	Urban Bioretention	40	25	55
10	Dry Swale 1	40	20	52
	Dry Swale 2	60	40	76
11	Wet Swale 1	0	20	20
	Wet Swale 2	0	40	40
12	Filtering Practice 1	0	60	60
	Filtering Practice 2	0	65	65
13	Constructed Wetland 1	0	50	50
	Constructed Wetland 2	0	75	75
14	Wet Pond 1	0	50 (45) ⁴	50 (45) ⁴
	Wet Pond 2	0	75 (65) ⁴	75 (65) ⁴
15	Extended Detention Pond 1	0	15	15
	Extended Detention Pond 2	15	15	31

Notes ¹ Lower rate is for HSG soils C and D, Higher rate is for HSG soils A and B.

² The removal can be increased to 50% for C and D soils by adding soil compost amendments, and may be higher yet if combined with secondary runoff reduction practices.

³ Credit up to 90% is possible if all water from storms of 1-inch or less is used through demand, and tank is sized such that no overflow occurs. Total credit not to exceed 90%.

⁴ Lower nutrient removal in parentheses apply to wet ponds in coastal plain terrain.

⁵ See BMP design specification for an explanation of how additional pollutant removal can be achieved.

Complete standards and specifications are provided for the BMPs listed below, including information needed for design, construction, and long-term maintenance.