D-1. Stormwater Performance Standards

General Information

In the past several years, all of the Bay jurisdictions have adopted more stringent stormwater regulations, written new stormwater design criteria and shifted to low impact development practices. This means that new development and redevelopment will have less post-construction impact on water quality in local streams and the Bay, because nutrient and sediment loads will be closer to pre-development levels under these stormwater performance standards.

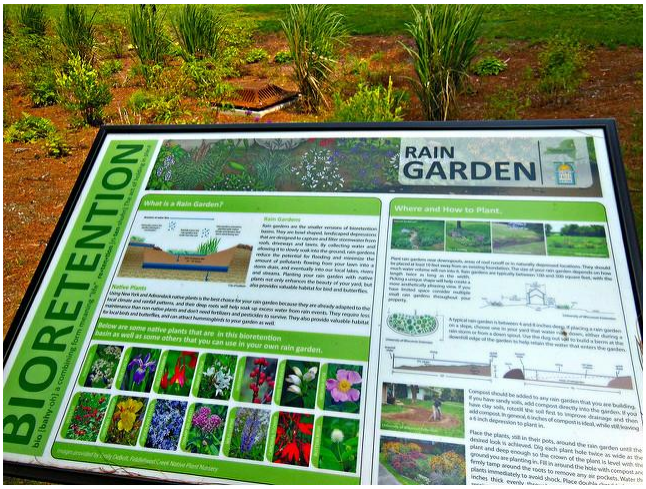


Figure D-1-1. Bioretention is one type of practice that can be used to reduce stormwater pollution that runs off from impervious areas such as roads, buildings and parking lots. Photo: Diane Cordell, Flickr

CBP Definition(s)

Stormwater Performance Standards (aka Stormwater Practices for New and Redevelopment Projects): This refers to the range of structural and non-structural measures installed over the entire development (or redevelopment) site to reduce runoff, flooding and downstream bank erosion, as well as improve stream water quality. These practices capture stormwater runoff generated over a wide range of storm events and then treat it through some combination of settling, filtering, adsorption or biological uptake to remove nutrients and sediment.

Runoff Reduction is the total post-development runoff volume that is reduced through canopy interception, soil amendments, evaporation, rainfall harvesting, engineered infiltration, extended filtration or evapo-transpiration. Stormwater practices that achieve at least a 25 percent reduction of the annual runoff volume are classified as *Runoff Reduction (RR) practices* and therefore earn a higher net removal rate. Stormwater practices that employ a permanent pool, constructed wetlands or sand filters are classified as *Stormwater Treatment (ST) practices* that have less runoff reduction capability and therefore lower removal rates than RR practices.

Common types of ST and RR practices are listed in Table D-1-1.

Table D-1-1. Classification of BMPs based on runoff reduction capability. Source: New State Performance Standards BMP Expert Panel, 2012.

Stormwater Treatment (ST) Practices	Runoff Reduction (RR) Practices
Constructed wetland Filtering practices (e.g., sand filter) Wet swale Wet pond	*Non-structural Practices* Landscape restoration/reforestation Riparian buffer restoration Impervious disconnection Sheet flow to vegetated filter strip or open space Non-Structural BMPs, Pennsylvania 2006 BMP Manual, Chapter 5 *Structural Practices* Environmental site design practices in 2007 Maryland Stormwater BMP Manual Bioretention and rain garden Dry channel regenerative stormwater conveyance (Dry Channel RSC) Dry swale Expanded tree pits Grass channels and bioswales Green roofs Green streets Infiltration practices (aka infiltration basin, infiltration bed, infiltration trench, dry well/seepage pit, landscape infiltration) Permeable pavement (aka porous pavement) Rainwater harvesting (aka capture and re-use)

Specifications or Key Qualifying Conditions

These are practices installed on a newly developed or a redeveloped site. Practices installed to treat an existing development that is untreated, or inadequately treated, are considered retrofits (see D-2: Stormwater Retrofits). Consult the expert panel report for additional suggested qualifying conditions and your corresponding state stormwater BMP manual for specific design specifications or requirements.

Nitrogen, Phosphorus and Sediment Reductions

Each pollutant (nitrogen, phosphorus and sediment) has its own equation and "adjustor curve" for RR and ST practices, as shown in Figure D-1-3 for nitrogen. The y-axis shows the percent of pollutant removal (%) based on the runoff depth captured by the practice per impervious acres in its drainage area (shown on the x-axis as inches per impervious acre).



Figure D-1-2. Permeable pavement is a type of runoff reduction (RR) practice because it allows processes such as filtration and evapo-transpiration to occur. This approach reduces runoff and removes a greater portion of pollutants than stormwater treatment (ST) practices that employ a permanent pool – such as wet ponds, wet swales, and constructed wetlands – because such practices simply provide storage and treatment before discharge. Photo: Chesapeake Bay Program

Specific Reporting and Modeling Information

Applicable Land Use Types (or other load sources) Treated by the BMP:

- All Developed Land Uses (Non-Regulated, MS4 and CSS) except construction

It is recommended that states report these practices on the appropriate land use group, i.e., either "Nonregulated," "MS4" or "CSS." Alternatively, the combined group "MS4CSSNonRegulated" can be used; this combined group is the default if one of the three is not specified.

Brief Description of BMP Simulation in the Model

All stormwater practices that comply with new performance standards are *Efficiency Value BMPs,* whose efficiency is determined by curves and underlying equations, such as those in Figure D-1-3 for total nitrogen. Pollutant loads from the site are reduced by the corresponding efficiency values.

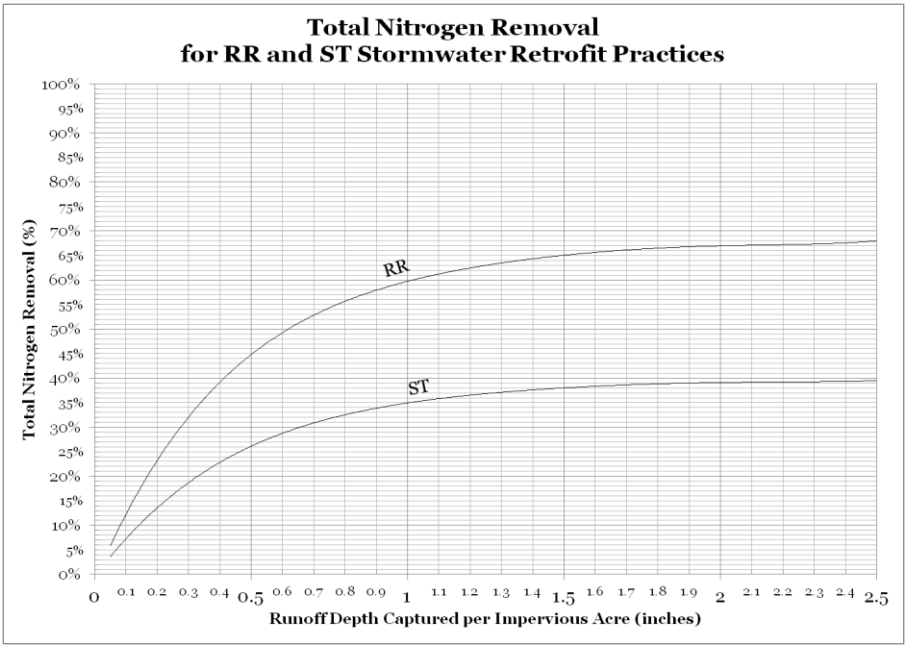


Figure D-1-3. "Adjustor" curves of estimated nitrogen removal for runoff reduction (RR) and stormwater treatment (ST) retrofit practices. Separate curves for phosphorus and sediment are not pictured here but are available in the expert panel report and other resources listed below. Source: Chesapeake Stormwater Network. Use the standard equation for "Runoff Depth Captured per Impervious Acre" (in inches) to find the appropriate location on the X-axis:

$$\text{Runoff depth captured per Impervious Acre} = \frac{12 \times RS}{IA}$$

RS = Runoff Storage Volume (acre-feet) is the amount of volume treated by the stormwater practice

IA = Impervious Area in acres

For example, Figure D-1-3 indicates that an ST practice that captures one inch of runoff per one impervious acre reduces nitrogen from the total treatment area by about 35 percent, whereas an RR practice that also treats one inch of runoff per one impervious acre reduces nitrogen from the total treatment area by about 60 percent. Multiple practices on a single site can be combined to calculate the removal for the whole site. In cases where both RR and ST practices are implemented on a site the dominant type of practice can be used to determine which curve applies for the site as a whole, unless your state stormwater contact indicates otherwise (see the resources listed under Additional Information).

Annual or Cumulative? Cumulative (10-year credit duration)

Can this practice be combined with other BMPs? Yes.

Key Elements for State BMP Reporting through NEIEN

- *BMP Name:*
  - Retrofit Runoff Reduction
  - Retrofit Stormwater Treatment
- *Measurement unit(s):* Runoff storage volume; impervious acres; acres treated
- *Land Use:* Approved NEIEN Developed load source groups (Non-Regulated, MS4, CSS); if none are reported the default load source group will be combination of all three (MS4CSSNonRegulated).
- *Geographic location:* Approved NEIEN geographies: County; County (CBW only); Hydrologic Unit Code (HUC12, HUC10, HUC8, HUC6, HUC4); State (CBW only)
- *Date of implementation:* Year practice was installed.

Table D-1-2. Synonymous BMP names for Watershed Model, NEIEN and other sources

CBP or Expert Panel term	NEIEN BMP name	Other common practice names
New State Stormwater Performance Standards (aka Stormwater Practices for New Development and Redevelopment), Runoff Reduction (RR) practices	New Runoff Reduction (RR)*	Bioretention, Dry swale, Infiltration, Permeable pavement, Green roof, Dry channel regenerative stormwater conveyance
New State Stormwater Performance Standards (aka Stormwater Practices for New Development and Redevelopment), Stormwater Treatment (ST) practices	New Stormwater Treatment (ST)*	Constructed wetland, Filtering practices (e.g., sand filter), Wet swale, Wet pond
* Stormwater Performance Standards (Sheet D-1) and Retrofits (Sheet D-2) BMPs are not distinguished within CAST. All BMPs in these two categories are listed only as "RR" or "ST". While there is no distinction in CAST, jurisdictions have separate goals and milestones based on whether the practices are for new or existing development and should thus report them differently in NEIEN. For planning purposes, please select "Stormwater Performance Standards" in CAST if you wish to simulate Retrofit BMPs.		

Additional Information

Expert panel report:
Comstock, S., Crafton, S., Greer, R., Hill, P., Hirschman, D., Karimpour, S., Murin, K., Orr, J., Rose, F., & S. Wilkins. 2012. Recommendations of the Expert Panel to Define Removal Rates for New State Stormwater Performance Standards. Prepared by T. Schueler and C. Lane, Chesapeake Stormwater Network. Revised with

updated curves January 2015. http://www.chesapeakebay.net/documents/Final-CBP-Approved-Expert-Panel-Report-on-Stormwater-Performance-Standards-LONG_012015.pdf

Chesapeake Stormwater Network, Good Recipes for the Bay Pollution Diet: U-2: Stormwater Practices for New and Redevelopment Projects. Available at: http://chesapeakestormwater.net/bay-stormwater/fact-sheets/

Chesapeake Stormwater Network, Archived (2014) webcast: Crediting BMPs used for New and Redevelopment Webcast: http://chesapeakestormwater.net/events/webcast-ms4-implementers-and-the-bay-tmdl-crediting-bmps-used-for-new-and-redevelopment/

Version and History Statement

This info sheet was first published on August 10, 2018 and reflects the BMP definitions and reductions approved by the WQGIT in October 2012.

All BMP effectiveness estimates are subject to potential future reviews according to the availability of new scientific information and CBP partnership needs, as defined in the BMP Review Protocol.