U-2 STORMWATER PRACTICES FOR NEW AND REDEVELOPMENT PROJECTS

PRACTICE AT A GLANCE

- All of the Bay States have adopted more stringent stormwater regulations, written new stormwater design criteria, and shifted to low impact development practices in the past few years.
- This profound shift in stormwater management technology should greatly reduce the impact of new development on the health of streams and the Chesapeake Bay, as they help prevent increased flooding and pollutant loads generated from impervious surfaces.
- Coupling more stringent stormwater regulations with low impact development techniques, can keep post-development nutrient and sediment loads to pre-development levels, unless the prior land use is predominantly forest land.
- Better yet, when new stormwater practices are applied to redevelopment projects, they can actually reduce pollutant loads below predevelopment levels, and thus "earn" a sediment and nutrient reduction credit for a jurisdiction. While reduction credits associated with individual redevelopment projects are not great, the aggregate load reduction can be significant in most communities over a decade or more.
- Perhaps the biggest impact to your community going forward, will be the new requirements to verify the performance of ALL stormwater practices in your jurisdiction. To maintain the credits, each stormwater practice must be inspected in the field once every ten years to confirm that it still exists, is adequately maintained and operating as originally designed.
- From a practical standpoint, this means that every Bay community will need to create a better database to track, report and verify all of the stormwater practices that exist in your community.

PRACTICE DESCRIPTION

New stormwater practices involve a range of structural and non-structural measures installed over the entire development site to reduce runoff, flooding and downstream bank erosion, as well as improve stream water quality. These stormwater 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 sediment and nutrients.

Stormwater practices can simply treat stormwater prior to discharge, classified as Stormwater Treatment, or go further and also reduce the runoff volume generated from the development project, classified as Runoff Reduction.

Stormwater Treatment (ST) practices reduce pollutant loads through mechanisms such as settling or filtering while Runoff Reduction (RR) practices reduce runoff volumes through infiltration, interception, evapotranspiration and very slow release of water through an underdrain. Correspondingly, the overall pollutant removal associated with Runoff Reduction practices is improved compared to Stormwater Treatment practices.

Table 1 below shows a list of common Bay state stormwater practices and in which category they are classified.

Table 1. Classification of BMPs based on Runoff reduction capability	
Stormwater Treatment (ST) Practices	**Runoff Reduction (RR) Practices**
	Non-Structural Practices
Constructed Wetland	Landscape Restoration/Reforestation
Filtering Practice (e.g., sand filter)	Riparian Buffer Restoration
Wet Swale	Impervious Disconnection
Wet Pond	Sheet Flow to Vegetated Filter Strip or Open Space
	Non-Structural BMPs, PA 2006 BMP Manual, Chapter 5
	Practices
	Environmental Site Design
	Bioretention and Rain Garden
	Dry Channel Regenerative Stormwater Conveyance
	Dry Swale
	Expanded Tree Pits
	Grass Channels and Bioswales
	Green Roofs
	Green Streets
	Infiltration Practices
	Permeable Pavement
	Rainwater Harvesting
Special Notes: • Many communities have asked whether Manufactured Treatment Devices can be used to earn pollutant reduction credits. A group of experts are now working to determine the sediment and nutrient reduction rates achieved by this class of proprietary BMPs. Consequently, no credits for these devices will be granted until their work is finished, which is not expected before 2016.	

New stormwater practices can also provide other important benefits to a community, such as:

- Remove toxic pollutants and harmful bacteria from local waterways
- Protect local streams from severe bank erosion and improve aquatic health
- Prevent or reduce flood damage to local property and infrastructure
- Improve the appearance of local streets, parks and schools
- Reduce the urban heat island effect
- Provide traffic calming and improve pedestrian safety
- Save energy to heat and cool buildings
- Increase tree canopy and provide urban wildlife habitat
- Help achieve special green building certification for projects
- Provide more attractive and functional urban spaces and streetscapes

NEW STORMWATER PRACTICES

Example of new stormwater practice providing habitat

Example of a water quality swale at the edge of a parking lot

Example of an urban stormwater management practice

Example of a residential rain garden

GENERAL COST INFORMATION

The good news for most communities is that- the cost to design and construct new stormwater practices generally falls to land developers, whereas the cost to maintain them generally falls to the future property owner. Consequently, local governments don't have to budget scarce local dollars to finance new stormwater practices.

Still, local governments will need to play a strong quality control role to ensure that the stormwater infrastructure built and maintained by the private sector meets public performance standards.

This can involve considerable staff time for plan review and approval, construction inspection and ongoing project maintenance, as well as investment in a system, preferably GIS-based, for tracking, reporting and verifying stormwater facilities over time. In addition, some staff resources need to be allocated to manage project data and submit reports to the state each year.

TIPS FOR GETTING STARTED IN YOUR COMMUNITY

Through their local land development approval process, most communities already have a pretty long history with stormwater practices.

Some additional training support is recommended to ease the transition to the new state stormwater design criteria. Hands on training for existing local staff on new stormwater practices is always a good idea, as well as time to learn the computational spreadsheets used to assess stormwater site compliance at a site. Many good training resources are available through the Chesapeake Stormwater Network's "College of Stormwater Knowledge," which can be accessed at: www.chesapeakestormwater.net.

For a few years, you may still need to deal with non-conforming projects, which are defined as older development projects that were grand-fathered or exempted from meeting the new stormwater requirements, and therefore, perform at a lower level. There is an "Expert Panel Report" which is linked in the "Resources" section of this document and which outlines specific procedures on how to estimate lower pollutant removal credits for non-conforming practices.

WHAT DEGREE OF TECHNICAL SUPPORT IS NEEDED

Many communities have a long track record with stormwater and even have experienced in-house staff to perform the quality control role during plan review, construction inspection, ongoing maintenance and practice tracking and verification.

A common problem is that important quality control functions are usually spread out over many different bureaus, departments and/or authorities, and inter-departmental interaction is uncommon. Facilitating inter-departmental communication and collaboration on local stormwater issues is important, since it can enhance the quality of the final stormwater management project built in the community.

Most communities should maintain their local planning and zoning, site design, smart growth and natural resource conservation efforts to ensure growth occurs in the right places while conserving the most sensitive lands. The current watershed model does not give a direct credit for these important local planning efforts, but they still remain an indispensable element of both thriving local communities and effective watershed protection.

COMPUTING THE POLLUTANT REMOVAL CREDIT

The good news is that you don't need to compute the pollutant removal achieved for each new land development or redevelopment project -- the state will do it automatically based on the stormwater practices you report. The bad news is that, for the moment, Bay states may not be able to routinely let you know how much your local pollutant loads will change over time as a consequence of the stormwater practices installed during new or redevelopment projects.

Each Bay state has adopted its own technical criteria to determine compliance with its stormwater performance standards. These criteria may involve capturing a certain runoff volume, providing on-site retention, or meeting a pollutant loading limit. **Table 2** provides a simplified summary of each state's stormwater performance standards for new and redevelopment projects.

Table 2. Brief Summary of State Stormwater Performance Standards for New Development & Redevelopment.

Jurisdiction	New Development Standard	Redevelopment Standard
DC	Retain runoff from 1.2 inches of rainfall on-site	Same as New Development
DE	Provide runoff reduction so “effective” impervious is zero	50% reduction of existing “effective” impervious
EPA	Control and retain 95% storm event on-site	Same as New Development
MD	Use environmental site design so that site functions like woods in good condition	Combination of reducing existing impervious or treating runoff from 1.0 inch of rainfall
NY	Provide runoff reduction for fraction of 90% storm event	Reduce volume by 25% through impervious reduction, BMPs, or alternative
PA	No increase in runoff volume for all events up to 2-year storm	Treat 20% of water quality volume
VA	Total Phosphorus load limit of 0.41 pounds/acre/year	Reduce existing Phosphorus load by 10 to 20%
WV	Retain runoff from 1.0 inch rainfall event	Retain runoff from 0.25 to 0.8 inch event, depending on redevelopment credits

NOTE: These are simplified descriptions of more complex criteria; see the state-specific resources for fuller descriptions.

Luckily, there is a "level playing field" to credit pollutant removal from new development and redevelopment projects, so that projects located in any Bay states can be scored using a similar metric. The approach is a series of "performance curves" for total phosphorus, total nitrogen, and sediment removal, which are used with a standard equation that accounts for the total stormwater runoff volume that is effectively treated by all the stormwater practices installed at each development sites. **Table 3** shows the performance curves as well as the standard equation. The "Expert Panel Report", which is linked in the Resources section of this document, provides several design examples to show how the equation and curves are used.

Table 3. Performance Curves and the Standard Equation for Using Them

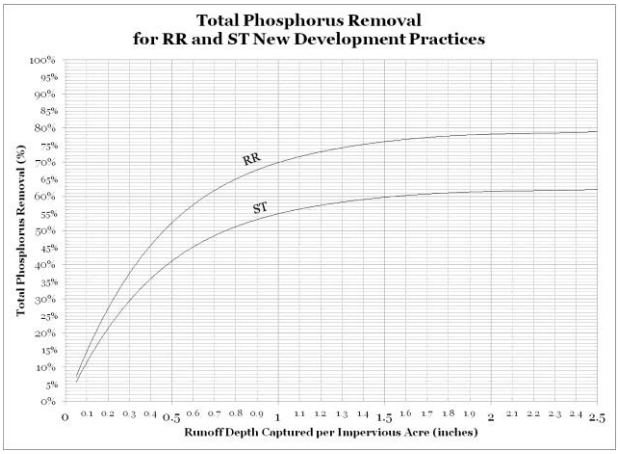
These are the 3 sets of performance curves for Total Phosphorus (top right) Total Nitrogen (bottom left), and Total Sediment (bottom right).

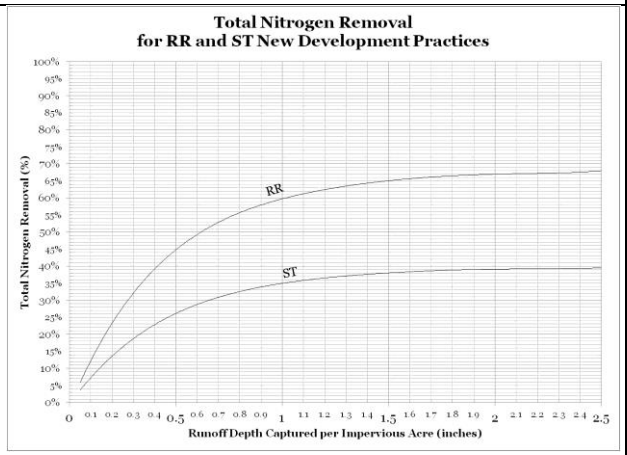
Use the standard equation for "Runoff Depth Captured per Impervious Acre" (in inches) to find the appropriate location on the X-axis:

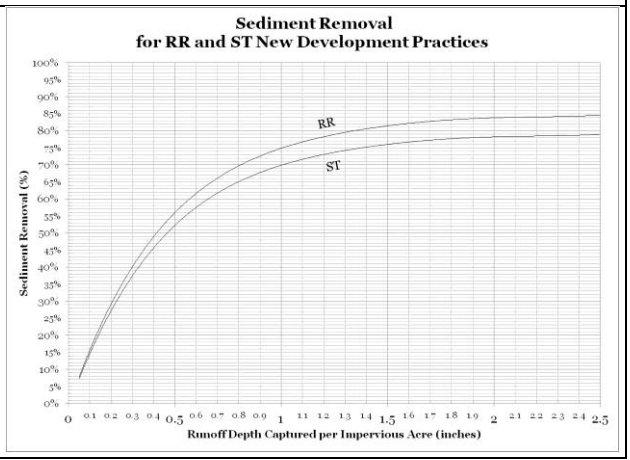
$$\frac{12 \times EP}{IA}$$

EP = Engineering Parameter (acre-feet) that reflects how each state accounts for volume treated by a BMP or stormwater plan

IA = Impervious Area in acres







HOW TO REPORT THE PRACTICE TO THE STATE

The answer depends on whether you have an MS4 stormwater permit or not. If you do, then stormwater practice data are reported in your annual MS4 permit report. If you are not covered by a permit, then you will need to electronically submit your stormwater practice data into a state-approved stormwater practice reporting database. Check with your state stormwater reporting contact person to learn about the specific procedures in your state (provided at the end of this factsheet).

In general, you need to report the acres of new development or redevelopment projects that are fully treated to the new state performance standard each year. It is recommended that the following *minimum* amount of information be reported to the state:

- BMP Name (e.g., ST or RR)
- Location: GPS coordinates, HUC, County or State
- Date of installation
- Total drainage area treated
- Total impervious area treated
- Volume of water treated by the practice (e.g., Runoff Storage Volume)

WHAT IS REQUIRED TO VERIFY THE PRACTICE OVER TIME

The maximum duration for the removal rate for new stormwater practices is 10 years but it can be renewed based on a field inspection that confirms that the practice still exists, is being properly maintained and is still performing its pollutant removal function.

These 'performance verification field inspections' can be piggybacked onto routine local regulatory inspections already slated to occur and can be done by the use of simple visual indicators to assess the facility for functionality. For more information on the visual indicator or verification guidance see the resources section.

Jurisdictions also need to provide a post-construction certification that the practice was installed properly, meets or exceeds the design standards under its classification and is achieving its hydrologic function.

The agency that installs or oversees the maintenance of the stormwater practice should maintain a more extensive project file for each project installed (i.e., construction drawings, as-built survey, digital photos, inspection records, and maintenance agreement, etc). The file should be maintained for the lifetime for which the removal rate will be claimed. Oftentimes, communities have found it helpful to record the BMP with the parcel deed and to record the maintenance requirements directly on the plans so that ownership changes don't result in a lack of maintenance for a properly installed BMP.

RESOURCES

The following resources are available for help with all aspects of this practice:

Type of Resource	Title of Resource	Web link
Expert Panel Report	Recommendations of the Expert Panel to Define Removal Rates for New State Stormwater Performance Standards (2012)	http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2012/10/Final-CBP-Approved-Expert-Panel-Report-on-Stormwater-Performance-Standards-SHORT_0120151.pdf
Archived webcast on Accounting for New Stormwater Practices	Crediting BMPs Used for New and Redevelopment Webcast (2014)	http://chesapeakestormwater.net/events/webcast-ms4-implementers-and-the-bay-tmdl-crediting-bmps-used-for-new-and-redevelopment/
Archived webcasts on Techniques for Advanced Stormwater Design	Advanced Stormwater Design of Bioretention and Dry Swales (2014)	http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-bioretention-and-dry-swales/
	Advanced Stormwater Design of Permeable Pavement (2014)	http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-permeable-pavement/
	Advanced Stormwater Design of Infiltration Practices (2014)	http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-infiltration/
	Advanced Stormwater Design for Soil Amendments and Soil Restoration Techniques (2014)	http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-soils/
	Advanced Stormwater Design of Constructed Wetlands (2014)	http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-constructed-wetlands/
	Advanced Stormwater Design of Rainwater Harvesting (2014)	http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-rainwater-harvesting/
	Advanced Stormwater Design of Disconnections and Filter Strips (2014)	http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-filter-strips-and-disconnections/
	Advanced Stormwater Design of Grass Swales and Channels (2014)	http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-grass-swales-and-channels/
Urban Stormwater Verification Guidance	Final Recommended Guidance for Verification of Urban Stormwater BMPs (2014)	http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2013/01/USWG-Approved-Urban-BMP-Verification-Guidance-08112014.pdf
'FAQ' document	Frequently Asked Questions for Urban Stormwater Retrofits (2013)	http://chesapeakestormwater.net/wp-content/uploads/downloads/2013/10/Perf-Standards-and-Retrofits_FAQ-Document_090913.pdf
Expert Panel Appendix A	Appendix A: Summary of Bay State Stormwater Performance Standards	http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2015/02/Appendix-A-Summary-of-Bay-State-Stormwater-Performance-Standards_012015.pdf

Expert Panel Appendix B	Appendix B: Evolution of Stormwater BMP Removal Rates	http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2015/02/Appendix-B-Evolution-of-Stormwater-BMP-Removal-Rates_012015.pdf
Expert Panel Appendix C	Appendix C: Derivation of the New BMP Removal Rate Adjustor Curves	http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2015/02/Appendix-C-Derivation-of-the-New-BMP-Removal-Rate-Adjustor-Curves_012015.pdf
More Tools & Resources	Final Recommended Guidance for Urban Stormwater BMP Verification	http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2013/01/USWG-Approved-Urban-BMP-Verification-Guidance-08112014.pdf
	Bioretention Illustrated: A Visual Guide for Constructing, Inspecting, Maintaining and Verifying the Bioretention Practice	http://chesapeakestormwater.net/wp-content/uploads/downloads/2013/10/FINAL-VERSION-BIORETENTION-ILLUSTRATED-102113.pdf
		http://chesapeakestormwater.net/training-library/state-specific-resources/