

# U-2 STORMWATER PRACTICES FOR NEW AND REDEVELOPMENT PROJECTS

### PRACTICE AT A GLANCE

- In the past few years, all of the Bay States have adopted more stringent stormwater regulations, written new stormwater design criteria, and shifted to low impact development practices.
- This profound shift in stormwater treatment 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 by the new impervious cover.
- In most scenarios, new stormwater practices can keep post-development sediment and nutrient loads to pre-development levels, unless the prior land use is 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 in your community going forward, are the new requirements to verify the performance of all of the new and older stormwater practices in your jurisdiction. To maintain the credits, each stormwater practice must be inspected in the field once a decade 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 in a distributed fashion 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

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some combination of settling, filtering, adsorption or biological uptake to remove sediment and nutrients.

The key difference is whether the stormwater practices just provide stormwater treatment or go further and actually reduce the runoff volume generated from the development project.

Stormwater practices can be classified as either **Stormwater Treatment (ST)** or **Runoff Reduction (RR)**.

**Stormwater Treatment** practices reduce pollutant loads through mechanisms such as settling or filtering through sand or other media while **Runoff Reduction** practices accomplish that but also do a good job of reducing runoff volumes through infiltration, interception by vegetation, absorption in a soil or similar media, or storage 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.

<b>Table 1. Classification of BMPs based on Runoff reduction capability</b>	
<b>Stormwater Treatment (ST) Practices</b>	<b>Runoff Reduction (RR) Practices</b>
	Non-Structural Practices
Constructed Wetland	Landscape Restoration/Reforestation
Filtering Practice (e.g., sand filter)	Riparian Buffer Restoration
Wet Swale	Impervious Disconnection
Wet Pond	Sheetflow to Vegetated Filter Strip or Open Space
	Non-Structural BMPs, PA 2006 BMP Manual, Chapter 5
	Practices
	All ESD practices in MD 2007
	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
<b>Special Notes:</b> <ul style="list-style-type: none"> <li>Many communities are asked whether Manufactured Treatment Devices can be used to earn the pollutant reduction credits. A group of experts are now working out the monitoring efforts needed 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.</li> </ul>	

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New stormwater practices can also provide other important benefits to a community, beyond water quality, 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
- Green up local streets, parks and schools and create urban wildlife habitat
- 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 habitat
- Help secure to special green building certification for projects
- Provide more attractive and functional urban land 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

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## GENERAL COST INFORMATION

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

Still, local government needs 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, construction inspection and ongoing project maintenance, as well as an investment in a GIS-based system to track the growing local stormwater project inventory 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

Most communities started years ago, and have a long history reviewing and inspecting stormwater practices as part of the local land development approval process.

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 can be accessed at the Chesapeake Stormwater Network's "College of Stormwater Knowledge" which can be accessed at: [www.chesapeakestormwater.net](http://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 somehow grand-fathered or exempted from meeting the new stormwater requirements, and therefore, perform at a lower level. The expert panel recommended specific procedures on how to estimate lower pollutant removal credits for these non-conforming practices and those procedures can be found in the final expert panel report.

## WHAT DEGREE OF TECHNICAL SUPPORT IS NEEDED

As noted earlier, most communities have a lot of stormwater experience, and have experienced in-house talent to manage the quality control role during plan review, construction inspection, ongoing maintenance and practice tracking and verification.

A common problem is that these important quality control functions are usually spread out over many different bureaus, departments and/or authorities in your community, which may not frequently interact with each other. Getting internal feedback and crosswalks on stormwater issues can never be over-emphasized, since it can directly improve the quality of the final product built in the community.

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Also, most communities should continue to improve their efforts in local planning and zoning, smart growth, natural resource conservation and better site design to ensure growth takes place in the right places while sensitive lands are conserved. The current watershed model does not directly credit or reward good local planning, but they still remain an indispensable element of local watershed protection.

### COMPUTING THE POLLUTANT REMOVAL CREDIT

The good news is that you don't need to compute the pollutant removal achieved for each project, the state will do it automatically based on the information that you submit. 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 change over time as a consequence of either new or redevelopment projects.

The expert panel had a challenge in that each Bay state has its own criteria for determining compliance with the new performance standards. Some of these criteria are associated with capturing a certain volume of water (water quality volume or treatment volume) and others with meeting other environmental site design, retention, or pollutant loading criteria (see **Table 2** for a simplified summary of the Bay state performance standards for New Development and Redevelopment).

**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 to 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.**

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The objective of the expert panel was to create a “level playing field” for crediting pollutant removal from new development and redevelopment projects, so that projects in any of the Bay states would be scored using a similar metric. The solution to this was to develop “performance curves” for Total Phosphorus, Total Nitrogen, and Total Sediment removal, and a standard equation that each state could use to account for the volume of water treated through a site’s stormwater plan and associated stormwater practices. **Table 3** shows the performance curves as well as the standard equation. The expert panel report goes into more detail on how to use the equation and curves.

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

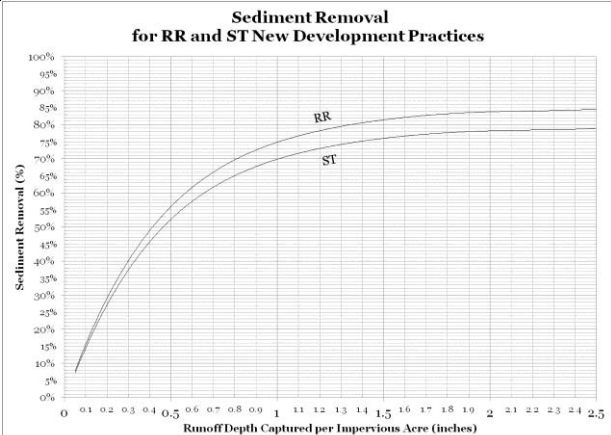
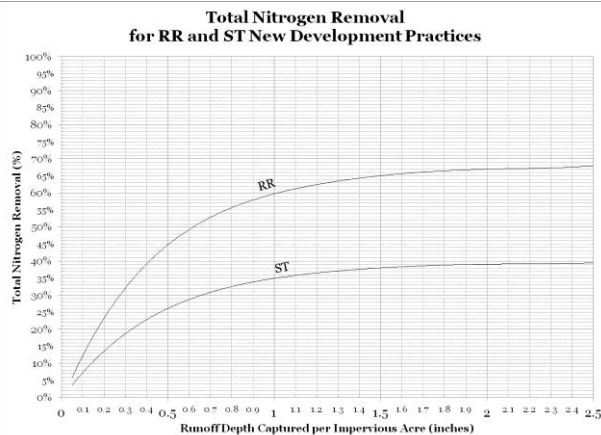
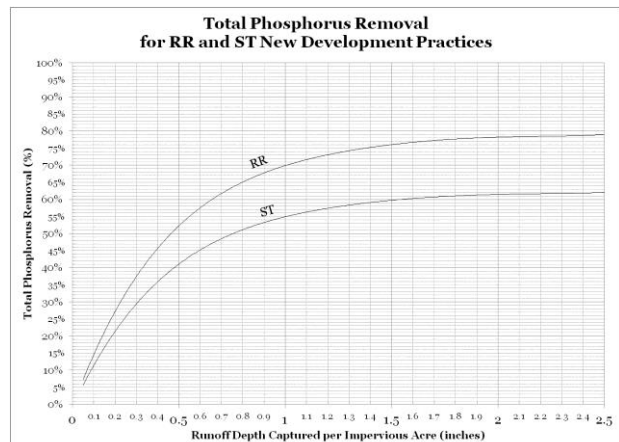
These are the 3 sets of performance curves for Total Phosphorus (top right) Total Nitrogen (bottom left), and Total Sediment (bottom right).

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





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## HOW TO REPORT THE PRACTICE TO THE STATE

To be revised by PA DEP after they define requirements for retrofits.

The answer depends on whether or not 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 to state-approved stormwater practice reporting database. Check with you state stormwater reporting contact person, to find out the specific procedures in your state (see state-specific section of the factsheet for contact information).

In general, all you need to report are 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 information be reported to the state:

- Project category (i.e., new development or redevelopment)
- GPS coordinates
- Year of installation (and expected rate duration)
- 12 digit watershed in which it is located
- Total drainage area and impervious cover area treated
- Runoff volume treated and identify “type” of practice (e.g., ST or RR)
- Projected sediment, nitrogen and phosphorus removal rates

## 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 is still performing its pollutant removal function.

Jurisdictions 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 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.



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## STATE-SPECIFIC INFORMATION

For more information about new development or redevelopment stormwater practices in the state of Pennsylvania:

<b>State Contact for MS4 Information</b>	Ken Murin	<a href="mailto:kmurin@state.pa.us">kmurin@state.pa.us</a>
<b>State Reporting Contact</b>	Ted Tesler	<a href="mailto:ttesler@state.pa.us">ttesler@state.pa.us</a>
<b>State Stormwater Design Manual</b>	<a href="http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-8305">http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-8305</a>	
<b>State Stormwater Compliance Spreadsheet</b>	<a href="http://chesapeakestormwater.net/training-library/state-specific-resources/pennsylvania/">http://chesapeakestormwater.net/training-library/state-specific-resources/pennsylvania/</a>	

## RESOURCES

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

Type of Resource	Title of Resource	Web link
<b>Expert Panel Report</b>	Recommendations of the Expert Panel to Define Removal Rates for New State Stormwater Performance Standards (2012)	<a href="http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2012/10/Final-CBP-Approved-Expert-Panel-Report-on-Stormwater-Performance-Standards-SHORT_0120151.pdf">http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2012/10/Final-CBP-Approved-Expert-Panel-Report-on-Stormwater-Performance-Standards-SHORT_0120151.pdf</a>
<b>Archived webcast on Accounting for New Stormwater Practices</b>	Crediting BMPs Used for New and Redevelopment Webcast (2014)	<a href="http://chesapeakestormwater.net/events/webcast-ms4-implementers-and-the-bay-tmdl-crediting-bmps-used-for-new-and-redevelopment/">http://chesapeakestormwater.net/events/webcast-ms4-implementers-and-the-bay-tmdl-crediting-bmps-used-for-new-and-redevelopment/</a>
<b>Archived webcasts on Techniques for Advanced Stormwater Design</b>	Advanced Stormwater Design of Bioretention and Dry Swales (2014)	<a href="http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-bioretention-and-dry-swales/">http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-bioretention-and-dry-swales/</a>
	Advanced Stormwater Design of Permeable Pavement (2014)	<a href="http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-permeable-pavement/">http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-permeable-pavement/</a>
	Advanced Stormwater Design of Infiltration Practices (2014)	<a href="http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-infiltration/">http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-infiltration/</a>
	Advanced Stormwater Design for Soil Amendments and Soil Restoration Techniques (2014)	<a href="http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-soils/">http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-soils/</a>
	Advanced Stormwater Design of Constructed Wetlands (2014)	<a href="http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-constructed-wetlands/">http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-constructed-wetlands/</a>



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<b>Urban Stormwater Verification Guidance</b>	Advanced Stormwater Design of Rainwater Harvesting (2014)	<a href="http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-rainwater-harvesting/">http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-rainwater-harvesting/</a>
	Advanced Stormwater Design of Disconnections and Filter Strips (2014)	<a href="http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-filter-strips-and-disconnections/">http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-filter-strips-and-disconnections/</a>
	Advanced Stormwater Design of Grass Swales and Channels (2014)	<a href="http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-grass-swales-and-channels/">http://chesapeakestormwater.net/events/webcast-advanced-stormwater-design-grass-swales-and-channels/</a>
	Final Recommended Guidance for Verification of Urban Stormwater BMPs (2014)	<a href="http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2013/01/USWG-Approved-Urban-BMP-Verification-Guidance-08112014.pdf">http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2013/01/USWG-Approved-Urban-BMP-Verification-Guidance-08112014.pdf</a>
<b>'FAQ' document</b>	Frequently Asked Questions for Urban Stormwater Retrofits (2013)	<a href="http://chesapeakestormwater.net/wp-content/uploads/downloads/2013/10/Perf-Standards-and-Retrofits_FAQ-Document_090913.pdf">http://chesapeakestormwater.net/wp-content/uploads/downloads/2013/10/Perf-Standards-and-Retrofits_FAQ-Document_090913.pdf</a>
<b>Expert Panel Appendix A</b>	Appendix A: Summary of Bay State Stormwater Performance Standards	<a href="http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2015/02/Appendix-A-Summary-of-Bay-State-Stormwater-Performance-Standards_012015.pdf">http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2015/02/Appendix-A-Summary-of-Bay-State-Stormwater-Performance-Standards_012015.pdf</a>
<b>Expert Panel Appendix B</b>	Appendix B: Evolution of Stormwater BMP Removal Rates	<a href="http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2015/02/Appendix-B-Evolution-of-Stormwater-BMP-Removal-Rates_012015.pdf">http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2015/02/Appendix-B-Evolution-of-Stormwater-BMP-Removal-Rates_012015.pdf</a>
<b>Expert Panel Appendix C</b>	Appendix C: Derivation of the New BMP Removal Rate Adjustor Curves	<a href="http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2015/02/Appendix-C-Derivation-of-the-New-BMP-Removal-Rate-Adjustor-Curves_012015.pdf">http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2015/02/Appendix-C-Derivation-of-the-New-BMP-Removal-Rate-Adjustor-Curves_012015.pdf</a>
<b>More Tools &amp; Resources</b>		<a href="http://chesapeakestormwater.net/training-library/state-specific-resources/">http://chesapeakestormwater.net/training-library/state-specific-resources/</a>