COMMONWEALTH OF VIRGINIA

Department of Environmental Quality
Division of Water Permitting

Subject: Guidance Memo No. 20-2003 – Chesapeake Bay TMDL Special Condition Guidance

To: Regional Directors, Deputy Regional Directors, Regional Water Permit Managers, Regional Compliance Managers

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Date: November 12, 2020

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Summary: This guidance document provides staff and permittees in the Chesapeake Bay Watershed with background information and procedures to meet the Chesapeake Bay TMDL Special Condition requirements in the 2018-2023 General Permit for Discharges of Stormwater from Small (Phase II) MS4s, the reissued Phase I MS4 permits, and any Individual Phase II permits that are issued. This document may also be used as a reference to meet the Chesapeake Bay TMDL load allocation for unregulated urban entities as well as local TMDL waste load allocations for nutrients and sediment. This document replaces Guidance Memo No. 15-2005.

Electronic Copy:
Once effective, an electronic copy of this guidance will be available on:

- The Virginia Regulatory Town Hall under the Department of Environmental Quality (http://www.townhall.virginia.gov/L/gdocs.cfm?agencynumber=440);
- The Department's website at http://www.deq.virginia.gov/waterguidance/.

Contact Information:
Please contact Jeff Selengut, Office of VPDES permits, at (804) 698-4265 or Jeffrey.selengut@deq.virginia.gov with any questions regarding the application of this guidance.

Certification:
As required by Subsection B of § 2.2-4002.1 of the APA, the agency certifies that this guidance document conforms to the definition of a guidance document in § 2.2-4101 of the Code of Virginia.

Disclaimer:

This document is provided as guidance and, as such, sets forth standard operating procedures for the agency. However, it does not mandate any particular method nor does it prohibit any alternative method. If alternative proposals are made, such proposals should be reviewed and accepted or denied based on their technical adequacy and compliance with appropriate laws and regulations.

Effective Date: _____

Initials: _____

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PART I – BACKGROUND

Municipal Separate Storm Sewer System (MS4) permittees do not need to update and resubmit their final Chesapeake Bay Total Maximum Daily Load (TMDL) action plans that were due November 01, 2019 using the procedures found within this guidance document, unless one of the following situations apply:

a. The permittee claimed credit for septic system disconnections that occurred prior to January 01, 2006
b. The permittee is relying on the previous mass loading or qualified lane miles street sweeping annual practices to help meet their Chesapeake Bay TMDL pollution reduction goals
c. The permittee updates or changes any of the proposed TMDL action plan activities found in their final Chesapeake Bay TMDL action plan

If the permittee needs to update their Chesapeake Bay TMDL action plan because of any of the situations found above, the entire action plan needs to be reviewed to ensure that all proposed activities meet the criteria set by this guidance document.

1. Definitions

For purposes of this guidance document, the following definitions apply:

Best Management Practices ("BMPs") – Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices, including both structural and nonstructural practices, to prevent or reduce the pollution of surface waters and groundwater systems

Existing Sources – Pervious and impervious urban land uses served by the MS4 as of June 30, 2009

Impervious Cover – A surface composed of material that significantly impedes or prevents natural infiltration of water into soil

Municipal Separate Storm Sewer - A conveyance or system of conveyances otherwise known as a municipal separate storm sewer system, including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains:

1. Owned or operated by a federal state, city, town, county, district, association, or other public body, created by or pursuant to state law, having jurisdiction or delegated authority for erosion and sediment control and stormwater management, or a designated and approved management agency under § 208 of the CWA that discharges to surface waters;
2. Designed or used for collecting or conveying stormwater;
3. That is not a combined sewer; and,
4. That is not part of a publicly owned treatment works

Municipal Separate Storm Sewer System ("MS4") – All separate storm sewers that are defined as "large" or "medium" or "small" municipal separate storm sewer systems or designated under 9VAC25-870-380 A 1

New Sources – Pervious and impervious urban land uses served by the MS4 developed or redeveloped on or after July 1, 2009

Pollutants of Concern ("POC") – Total nitrogen ("TN"), total phosphorous ("TP"), and total suspended solids ("TSS")

Prior Developed Lands ("Redevelopment") – Land that has been previously utilized for residential, commercial, industrial, institutional, recreation, transportation, or utility facilities or structures, and that will have the impervious areas associated with those uses altered during a land-disturbing activity

Regulated Land – Regulated land refers to the conveyances and drainage area served by the permittee's MS4. For Phase II MS4s regulated land is the conveyances and drainage area that falls within a Census Designated Urbanized Area.

Unregulated Land – Unregulated land means those acres that are not owned or operated by the MS4 permittee AND are located outside the permittee's regulated land.

For terms not defined above, please refer to the 9VAC25-890-1 or 9VAC25-870-10 of the Virginia Administrative Code.

2. Purpose

In the Chesapeake Bay TMDL Watershed Implementation Plan ("WIP") for the Chesapeake Bay Total Maximum Daily Load ("TMDL"), the Commonwealth is committed to a phased approach to reducing nutrients and suspended solids discharging from Municipal Separate Storm Sewer Systems ("MS4"). The Special Condition for the Chesapeake Bay TMDL ("Special Condition") in the General VPDES Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (VAR04), effective November 1, 2019, and the twelve individual MS4 permits, as they are reissued, requires MS4 operators to develop a Chesapeake Bay TMDL Action Plan ("Action Plan") and submit it to the Virginia Department of Environmental Quality ("Department").

The Action Plan should provide a review of the current MS4 program, which demonstrates the permittee's ability to ensure compliance with the Special Condition and include the means and methods the permittee will use to meet the cumulative 40% Level 2 (L2) scoping run reduction for existing development by the end of the second permit cycle, as well as any reductions that may be required for new sources **initiating construction** between July 1, 2009, and June 30, 2019, and grandfathered projects that **initiate construction** after July 1, 2014. Level 2 implementation equates to an average reduction of 9.0% of nitrogen loads, 16% of phosphorus loads, and 20% of sediment loads from impervious regulated acres and 6.0% of nitrogen loads, 7.25% of phosphorus loads and 8.75% sediment loads from pervious regulated acres beyond 2009 progress loads and beyond urban nutrient management reductions for pervious regulated acres.

The purpose of this guidance is to provide staff and permittees with methods for meeting the requirements of the Special Condition for the Chesapeake Bay TMDL and the WIP, with particular attention to the development of the Action Plan. It is intended to create consistency in reporting to the Department, as well as ensure that compliance and program evaluations are handled uniformly throughout the Commonwealth. This guidance is specific to the second reissuance of the Phase I MS4 permits since approval of the Chesapeake Bay TMDL and the 2018-2023 General Permit for Discharges of Stormwater from Small MS4s ("GP"). **If there are inconsistencies between the requirements described in this guidance document and the requirements in a permittee's individual permit, the individual permit is the controlling document. If additional guidance is needed concerning any inconsistencies, the permittee should contact the Department.**

The GP requires permittees to update their MS4 Program Plans to include the Action Plan no later than 12 months after permit coverage is initiated. As required by 9VAC25-890-40 Part II.A.11, Action Plans must be submitted by October 31, 2019. Permittees regulated by a VPDES individual permit are required to modify their MS4 Program Plans to include the Action Plan and submit it to the Department in accordance with the schedule listed in the individual permit. Permittees may modify the Action Plans during the permit cycle to include new opportunities for reductions or address projects that are deemed infeasible. Any updates should be submitted to the Department in accordance with the Program Plan Modification section of the permit (9VAC25-890-40 Part I.C.1).

For reference, the Special Condition as found in 9VAC25-890-40 Part II.A of the General Permit is provided in *Appendix I* of this guidance document.

PART II – REQUIRED REDUCTIONS

The permittee's Action Plan should provide the Department with the means and methods that will be implemented to meet the POC reductions required by the end of the second permit cycle. To develop this plan, the permittee will first need to determine the reductions required for each POC. This section identifies the scope of those reductions based on the Special Condition requirements and indicates the steps permittees should follow when delineating the extent of their MS4 system.

NOTE: As discussed below, existing sources ("pervious or impervious land uses served by the MS4 as of June 30, 2009") are subject to 9VAC25-890-40 Part II.A.3. New Sources ("pervious and impervious urban land uses served by the MS4 developed or redeveloped on or after July 1, 2009") are subject to 9VAC25-890-40 Part II.A.4. Please see *Part VI* of the guidance for additional information concerning the Department's expectations for meeting 9VAC25-890-40 Part II.A.4. Additionally, if projects meet the requirements for 9VAC25-890-40 Part II.A.4 or 9VAC25-890-40 Part II.A.5, additional reductions are required. For a more detailed description of when additional reductions are necessary under Special Condition 4 and Special Condition 5, see *Appendix II*.

1. Scope of Reductions Required by the Permit

Existing Development 9VAC25-890-40 Part II.A.3 The permit requires permittees to reduce 35.0% of the L2 Scoping Run POC reductions required for existing sources as of June 30, 2009, for a 40% cumulative total of L2 with the first permit cycle effort to meet the required reductions. During the second permit cycle, Phase II permittees will need to account for the expanded urbanized areas that were identified as a result of the 2010 US Census. Planning for these areas should have been included in the updated draft Action Plan that accompanied the application for reissuance of the permit. The full 40% POC reductions for those "expanded areas" are required by the end of the second permit cycle.

For newly designated Phase II permittees that are required to obtain a permit as a result of the 2010 Census, all regulated lands should be treated as "expanded areas." That means those permittees were not required to implement any BMPs during the first permit cycle, but must now meet the full 40% POC reductions on all regulated lands by the end of the second permit cycle, as required by 9VAC25-890-40 Part II.A.3.

New Sources with an Impervious Land Cover Condition Greater than 16% for the design of post-development stormwater management facilities (9VAC25-890-40 *Part II.A.4)*

If a "new source," where construction was initiated between July 1, 2009, and June 30, 2019, meets an average impervious land cover condition of 16% or less for the design of post development stormwater management facilities, no additional offsets are required under the Special Condition beyond those required for existing conditions (Part II.A.4). If the permittee has adopted an average impervious land cover condition that is greater than 16% or has a "fee-in-lieu of" or similar program that has allowed projects to be built at an average land cover condition greater than 16% for the design of post development stormwater management facilities, those projects may be subject to additional reductions under Special Condition Requirement 4 (Part II.A.4) if they disturb one acre or greater. For a more detailed description of when additional reductions are necessary under Special Condition 4, see *Appendix II*.

For accounting consistency, and in accordance with the permit language, permittees that adopted an established land cover condition greater than 16% should use the simple method to determine the excess TP that needs to be offset for projects subject to Special Condition 4. Table 4 in the permit should be used to determine the equivalent required load reductions necessary for TN and TSS. The loading rates from *Tables 3a-d* are not suitable to be used for site-by-site calculations to determine the reductions required under Special Condition 4. An example of how these calculations should be performed on a site-by-site basis is provided in *Appendix II, Example II.1*.

Permittees that adopted a "fee-in-lieu of" or similar program may have sites throughout their service area with variable final land cover conditions that may or may not have been offset through the implementation of BMPs. The Department acknowledges that it may represent a substantial burden to these permittees to determine reductions from these projects on a site-by-site basis. To simplify the accounting process, an aggregate accounting approach may be used. Aggregate accounting may be done by tracking the land use change on all regulated land between July 1, 2009, and June 30, 2019, to determine the increased loads that were not treated and must be addressed under Special Condition 4 (9VAV25-890-40 Part II.A.4). In order to use the calculated load (Column C) in Table 3a-d for this purpose, the aggregate approach is applied to a permittee's entire service area. Permittees should note that using an aggregate approach may capture lands beyond those that fall under this requirement (i.e. lands less than an acre, lands that have an average impervious land use cover of less than 16%).

The permittee should choose the most appropriate approach taking into consideration the (1) amount of development to be accounted for throughout the regulated area, (2) the resources required to perform these calculations on a site-by-site basis, and (3) the quality of development records available to the permittee.

Grandfathered Projects with an Impervious Land Cover Condition Greater than 16% for the design of post-development stormwater management facilities (9VAC25-890-40 Part II.A.5*)*
The permit also requires permittees to offset any increase in POC from grandfathered projects (as defined in 9VAC 25-870-48) that disturb one acre or greater and have a total phosphorus load greater than 0.45 lb/acre/year which is equivalent to an *impervious average* land cover condition greater than 16% for the design of post-development stormwater management facilities. Those increases should be offset no later than the expiration date of the 2018-2023 MS4 General Permit, in accordance with 9VAC25-890-40 Part II.A.5.[1] Projects are accounted for on a site-by-site basis and permittees should use the simple method, in conjunction with permit *Table 4*, to calculate the additional load reductions required under Special Condition 5, or the aggregate method outlined in Appendix II of this guidance. For a more detailed description of when additional reductions are required under Special Condition Requirement 5 (9VAC25-890-40 Part II.A.5), see *Appendix II*.

NOTE: Permittees are required to offset increased POC from grandfathered sources prior to the expiration of the permit. Therefore, to meet Special Condition 5, permittees should address the offset of any grandfathered projects initiated between July 1, 2014, that have not already been identified in previous first Chesapeake Bay TMDL action plan. Permittees should address reductions for grandfathered projects in the Chesapeake Bay TMDL Action Plan due November 1, 2019, and track progress toward making the offsets in future annual reports submitted during this permit cycle.

2. Calculating Reductions for this Permit Cycle

Permittees should use the appropriate basin values provided in the permit to estimate the pollutant source loads as of June 30, 2009, and calculate the pollutant reductions necessary to meet the permit requirements. In order to estimate these reductions, as well as calculate how the required reductions will be met, permittees will first need to estimate:

1. The size and extent of their regulated MS4 system as of June 30, 2009; and
2. The total regulated acres of urban pervious and urban impervious surface served by the MS4 as of June 30, 2009.

[1] The only exception to the June 30, 2019 date is for publicly funded projects financed by governmental bonding or public debt financing issued for a project prior to July 1, 2012. In these cases, there is no completion date requirement and projects shall be subject to the technical criteria of Part IIC.

If there is incomplete data concerning either the extent of the MS4 system or the number of pervious and impervious acres served, permittees should use their best professional judgment to make the best estimates possible. Diagrams have been included in *Appendix IV* to illustrate some of the potential delineation issues discussed in this section.

Size and Extent of the MS4

When estimating the size of the MS4 system, the permittee should not include in its service area the conveyances and drainage areas that are regulated by a separate MS4 permit. For permittees that have interconnected systems, MOUs should be considered as a method to clearly differentiate which operator is responsible for which part of the system. For this permit cycle, permittees may also exclude from their regulated urban impervious and regulated urban pervious cover calculations:

1. Land regulated under any General VPDES permit that addresses industrial stormwater, including the General VPDES Permit for Stormwater Associated with Industrial Activity (VAR05), the General VPDES Permit for Concrete Products Facilities (VAG11), and the Nonmetallic Mineral Processing General Permit (VAR84);

2. Lands regulated under an individual VPDES permit for industrial stormwater discharges;

3. Forested Lands[2];

4. Agricultural Lands;

5. Wetlands; and,

6. Open Waters.

Permittees should clearly document the areas within their jurisdiction that are not included in their regulated acres so the Department is able to verify that an appropriate methodology was used. Permittees are encouraged to provide maps depicting the MS4 boundaries, lands served by the MS4, and any lands that the permittee has excluded as allowed above.

For Phase II permittees, the Census designated urbanized areas and jurisdictional boundaries may be used as a conservative estimate of the area the MS4 serves. It is expected that this data will be refined as the permittee completes the mapping exercise required in Part I.E.3.a of the General Permit. Any expanded areas that resulted from the 2010 U.S. Census are required to be included in the second permit cycle reductions, and Phase II permittees that were identified and designated as a result of the 2010 Census are required to implement BMPs in the second permit cycle. By the end of the 2018-2023 permit cycle these permittees are expected to achieve the full 40% of the L2 scoping run reductions for existing sources in the expanded areas and should plan accordingly. Where data is unavailable or boundaries are unclear, the permittee will need to exercise its best professional judgment in determining the boundaries and service area of its MS4.

Mapping Tools - To estimate the regulated urban impervious and regulated urban pervious acres served by the MS4 as of June 30, 2009, the Department strongly encourages permittees to use the best GIS resources available. In all cases, permittees should use their best professional judgment and the best available data

[2] For the purpose of service area delineation and the land use change BMP "forested" lands must meet the tree density requirements described in Appendix V.H, be undeveloped, and be a minimum of 30m x 30m (900 m^2) contiguous. This minimum threshold is based on the resolution of the Bay Program Model. These minimum requirements do not apply to the forest buffer BMP.

to estimate the number of regulated urban pervious and regulated urban impervious acres served by their MS4 system. Permittees should include a summary of the methodology that was used to estimate the regulated urban impervious acres and regulated urban pervious acres as part of their Action Plan so the Department is able to verify that an appropriate method was used.

Base aerial imagery is available to permittees through the Virginia Base Mapping Program, which is administered by the Virginia Geographic Information Network (VGIN). These images can be viewed free of charge using the Virginia VEGIS viewer at: Virginia DEQ GIS link. The most recent aerial map can be found on this webpage by clicking on the dropdown labeled "World Topo Map." The "VGIN Most Recent Aerials" can be found in the selection of dropdown menu items. A dropdown menu including measurement "Tools" is also provided on the webpage. Permittees may also use the "Most Recent Imagery" map available through the Virginia GIS Clearinghouse which uses the VGIN Virginia Base Map and provides the link to view the most recent imagery in ArcMap with measurement tool capabilities to estimate the amount of pervious and impervious surface MS4 areas. This map is a composite of three years of aerial imagery including VBMP2017, VBMP2018, and VBMP2019 and can be used by action plan development permittees to develop their mapping information. This imagery is provided at 1'X1' resolution, which is the image and analytical resolution the Department recommends permittees use. *The VGIN service imagery is collected to meet ASPRS Class 1 orthoimagery standards. Most areas were collected at a 1-ft ground sample distance (GSD), with some urban areas upgraded to 6-inch and 3-inch GSD.* Additional Virginia imagery data can also be found on the VGIN site, the Virginia GIS Clearinghouse, at the following link: VGIN Virginia GIS Clearinghouse.

Permit Tables – Reductions for Existing Conditions

Once the regulated urban pervious acres and regulated urban impervious acres are estimated, the permittee can calculate the existing source loads and required reductions for the pollutants of concern. The 2018 MS4 GP provide Tables 3a-d which include necessary calculations for the source loads and needed reductions for each river basin. The previous MS4 GP Permit provided separate tables for calculation of load and reductions for each river basin. The combined table will provide a more streamlined method to calculate the load and the required reductions. If a permittee has lands that were under construction as of June 30, 2009, the Department recommends the permittee use the pre-construction land use as the baseline. If a permittee's MS4 system discharges to multiple river basins, the permittee will need to calculate pollutant loads and load reductions for each basin to which the MS4 discharges. The calculation for Load (Column C) in *Tables 3a-d* of the Special Condition provides an estimate of the total pollutant loads entering the applicable river basin based on the June 30, 2009, progress run. Using these values, permittees can determine the reductions required during this permit cycle.

NOTE: For reporting, permittees should round the calculated pounds of loading and reduction values greater than or equal to 10 pounds to the nearest pound without regard to mathematical rules of precision. The loading and reduction values that are less than 10 pounds should be calculated and reported in accordance with Part II.A.3; A.4; and A.5 to two significant digits. This is detailed in Part II.A.8 of the 2018 MS4 General Permit.

PART III – ELIGIBLE BMPS AND CREDIT OPPORTUNITIES[3]

To meet the reduction requirements for this permit cycle, permittees should implement BMPs that are in the Virginia Stormwater BMP Clearinghouse (*Appendix V.A*) or have been approved by the Chesapeake Bay Program ("Bay Program") (*Appendices V.B-V.K)*. As additional BMPs are approved by the Bay Program during the permit cycle, they may also be used to meet the implementation requirements of this permit. Permittees are encouraged to work with the Department throughout Action Plan development, including submitting draft plans for review. The permittee may acquire and use total nitrogen and total phosphorous credits in accordance with §62.1-44.19:21 of the Code of Virginia and total suspended solids in accordance with §62.1-44.19:21.1 of the Code of Virginia for purposes of compliance with the required reductions specified in the Chesapeake Bay TMDL, provided the use of credits has been approved by the Department.

In accordance with 9VAC25-890-40 Part II.A.11 the means and methods provided to the Department must show that, based on the information available at the time the Action Plan is submitted, the BMPs implemented by the permittee will meet the reductions required by the Special Condition for the Chesapeake Bay TMDL for this permit cycle. Implementation of the BMPs in the permittee's Action Plan that was made available for public comment will demonstrate compliance with the reduction requirements for this permit cycle regardless of any changes in BMP efficiencies or baseline requirements that may occur after the Action Plan is submitted. For structural BMPs only, after the Action Plan is submitted any changes in established efficiencies or baseline requirements will not be retroactively applied to projects approved to meet reductions for this permit cycle. This credit guarantee only applies to structural BMPs. It was not intended to apply to any annual practices. The same credit guarantee will apply to any BMP included in the second Action Plan that has had, at a minimum, funds approved as part of an adopted Capital Improvement Plan, or an equivalent funding plan for state and federal facilities, at the time the application for permit reissuance is submitted. Likewise, if the BMPs included in the initial Action Plan result in reductions beyond the required 5%, those reductions will also be guaranteed with the efficiencies and baseline requirements in effect at the time the Action Plan is submitted. For instance, if a permittee's initial Action Plan includes BMPs that result in a 7% reduction in TN and those BMPs are implemented, the permittee will need to reduce an additional 33% TN during the next permit cycle, not an additional 35%, to meet the reduction requirements for the second permit cycle.

Permittees should submit supporting documentation with the application for permit reissuance and the subsequent Action Plan that lists the projects that have not been implemented but have met this financing requirement. If funds have not been approved for a BMP prior to submission of the second Action Plan, the permittee will need to recalculate reductions from those BMPs based on the most up-to-date efficiencies and baseline requirements. For planning purposes, when multiple reduction efficiencies are available through Bay Program BMPs, expert panel reports, or other sources, the permittee is encouraged to use the most conservative efficiency values.

Permittees should note that projects may require local, state, or federal permits such as the General Permit for Discharges of Stormwater from Construction Activities or Virginia Water Protection Permits, and this should be taken into account as BMPs are selected. **NOTE: If a permittee has been awarded a grant for reductions based on efficiencies that are revised prior to submittal of the Action Plan, the award will not be revoked or altered due to these circumstances. However, to meet the Special Condition,**

[3] This guidance focuses solely on urban BMPs. If there are other types of land that are within a permittee's service area and/or drain to the permittee's system, the permittee should refer to the Bay Program's guidance for applicable BMPs to reduce pollutant loads. The application of these BMPs for credit will be reviewed on a case by case basis.

permittees will need to recalculate the reductions from those BMPs based on the most up-to-date efficiencies at the time the Action Plan is submitted. The Department's review of nutrient and sediment reductions included in the Action Plan is independent of the review of any previous grant applications for a given BMP.

1. Calculating Credits

Estimating the pollutant reductions provided by a BMP is primarily a two-step process. First, the permittee should calculate the pollutant load draining to the BMP. Second, the reductions created by a BMP should be applied to that calculated load (for most structural BMPs, this will be a percent efficiency). The result is the POC load reduced. Depending on the BMP installed this procedure may vary slightly. More detailed information concerning how to perform calculations for accepted BMPs can be found in *Appendix V*. **Permittees should report their BMP data using the DEQ BMP Warehouse MS4 General BMP Reporting Template and annually identify newly installed Chesapeake Bay TMDL Action Plan Action BMPs in the appropriate annual report.**

Permittees should not use the loading rates in Tables *3a-d* of the permit to calculate the pollutant loads draining to a BMP if those loads are from (1) forested lands or (2) agricultural lands. If a permittee has identified forested or agricultural acres that drain to a BMP, the permittee may receive credit for load reductions from those lands, regardless of whether or not they have been included in the initial service area delineation. However, it is not appropriate to use the loading rates found in the permit tables for these land uses. For forested lands, permittees should use the following loading rates:

Table III.1 - Forested loading rates by basin:

River Basin	TN (lbs/ac/yr)	TP (lbs/ac/yr)	TSS (lbs/ac/yr)
James	1.22	0.08	52.10
Potomac	1.16	0.07	57.54
Rappahannock	1.20	0.07	46.75
York	1.15	0.05	11.03

Due to the variability of agricultural lands, it is not appropriate to use a single set of loading rates for pollutants loads from these lands. If permittees have or plan to install BMPs that receive drainage from agricultural lands, the Department should be contacted for the appropriate loading rates.

Permittees may receive credit for:

1. *Structural BMPs* –To calculate the credits generated by structural BMPs, the permittees may use, as applicable, (1) the efficiencies in the Virginia Stormwater BMP Clearinghouse (*Appendix V.A*), (2) the retrofit performance curves provided by the Bay Program (*Appendix V.B*), or (3) the approved or interim Bay Program efficiencies (*Appendix V.C*). Permittees may also receive credit for BMP Enhancements, Conversions, and/or Restoration (*Appendix V.D*) or BMPs that were installed after 2009 to meet development requirements, but exceed those requirements and any applicable state standards (*Appendix V.E)*. The impact of treatment trains should also be considered by permittees (*Appendix V.F*).
2. *Land Use Change* – To calculate the credits generated by a land use change, permittees should use the conversion factors presented in *Appendix V.H*. Conversions to forested land will only be credited at areas greater than 30m x 30m ($900m^2$). In addition to the Land Use Change Credit, permittees may receive an efficiency credit for Forest Buffers, which is explained in greater detail in *Appendix V.I*.

3. *Urban Stream Restoration and Outfall Stabilization* – There are five methodologies permittees may use to calculate reductions from Stream Restoration (*Appendix V.J and Appendix V.K)*. In accordance with this guidance, any BMPs implemented on unregulated lands must exceed baseline reductions. In accordance with Part III.2 of this guidance, the credit for stream restoration projects must be adjusted to account for the baseline reduction required on the unregulated land draining to the restored stream.
4. *Urban Nutrient Management ("UNM")* – Permittees may receive credit for UNM plans that are developed for unregulated land, public lands that are one contiguous acre or less[4], and/or privately owned lands that are not golf courses where nutrients are applied. The recommended method for calculating reductions for Urban Nutrient Management is described in *Appendix V.K*.
5. *Nutrient Trading* – Permittees may utilize the DEQ nutrient trading or offset program in accordance with § 62.1-44.19:21.A and §62.1-44.19:21.1 of the Code of Virginia, governing trading and offsetting.
6. *Redevelopment* – Permittees may receive credit for redevelopment projects if the calculated pollutant load for the land cover condition prior to redevelopment is reduced (*Appendix V.L*). **NOTE:** Additional nutrient reductions beyond the VSMP requirements are also potentially creditable through the DEQ nutrient trading program; however, the MS4 permittee and land owner may not both take credit for the reductions. Reduction calculations for individual BMPs implemented on redeveloped land should be performed in the same manner as BMPs applied to existing development. Permittees may use the approved site development plans to determine the POC reductions from these projects.

Permittees may submit alternate POC reduction methods, which the Department will review on a case-by-case basis. The Department has developed guidance for the approval of Manufactured Treatment Devices ("MTD") that permittees may find useful. This guidance can be found on DEQ's website at: http://www.deq.virginia.gov/Portals/0/DEQ/Water/Guidance/142009.pdf. Currently, the MTD approval process only certifies a practice's TP reductions. Permittees should use the Bay Program curves and/or efficiencies to calculate reductions for TN and TSS if there is an analogous BMP. If there is not an analogous Bay Program BMP for an approved MTD, the Department will consider TN and TSS credits for those BMPs on a case-by-case basis.

[4] Permittees may not receive credit for UNM plans developed on "lands owned or operated by the MS4 operator where nutrients are applied to a contiguous area of more than one acre" because those plans are an existing permit requirement (9VAC25-890-40 Part I.E.6.i) and are assumed reductions in the WIP.

2. Calculating Credits for BMPs Implemented on Unregulated Lands[5]

In accordance with this Guidance permittees may receive credit for BMPs implemented on unregulated land provided any necessary baseline is met first. Depending on the BMP type, baseline means:

a. *Baseline for Structural BMPs* **–** The baseline for structural BMPs is the required L2 reductions for unregulated impervious and unregulated pervious acres for TN, TP and TSS. The number of POC reduction credits for a particular structural BMP whose treated drainage is wholly or partly derived from unregulated areas, is the difference between the calculated TN, TP and TSS reductions (using the procedures outlined in Part III.1.1 of this guidance document), and the required L2 reductions for TN, TP and TSS.

b. *Baseline for Stream Restoration* **–** Permittees may receive full credit (100%) for the proportion of regulated land (i.e. permittees' MS4, other MS4s and/or Industrial Stormwater permitted land) that drains to a stream restoration project and either 1. an adjusted credit (50% of the reductions) or 2. the difference between the calculated reductions and the required L2 reductions for the proportion of unregulated land that drains to the stream restoration project. Forested and Agricultural lands that drain to the project are credited at 100%).

c. *Baseline for Urban Nutrient Management* **–** Baseline for urban nutrient management is based on the commitments the Commonwealth made in the WIP, which calls for Nutrient Management Plans ("NMP"s) on 48% of urban pervious lands. If permittees develop NMPs for either public or privately owned lands (except golf courses) that fall outside of the regulated MS4 service area, the permittee may take credit for the lbs/TN and lbs/TP addressed in the plan minus the 48% required by the WIP. See *Appendix V.K* for additional information.

d. Baseline for Land Use Changes - Baseline for Land Use Change is the required L2 reductions for unregulated impervious and unregulated pervious acres for TN, TP and TSS.

3. BMPs Installed to meet Development or Redevelopment Requirements

In general, permittees may not receive credit towards the reductions that are required under 9VAC25-890-40 Part II.A.3 or may be required under 9VAC25-890-40 Part II.A.4 and/or 9VAC25-890-40 Part II.A.5 for BMPs installed after July 1, 2009, that were implemented to meet the minimum VSMP technical criteria phosphorous removal requirement (9VAC25-870 Part II B or Part II C) for new development or other minimum regulatory requirements. However, permittees may receive credit for these BMPs under the following circumstances:

a. Redevelopment **–** As is mentioned throughout this document permittees may receive credit for pollutant *reductions* as the result of a redevelopment project located within the regulated area, regardless of the initial land cover condition of the site. For redevelopment projects in unregulated areas, credit may be taken for any POC reductions in excess of L2. This applies to any redevelopment project completed after July 1, 2009.

[5] If the BMP was funded by a 319 nonpoint source grant, it may be contrary to the funding award to seek credit towards required reductions under the Special Condition.

b. Stricter Development Requirements **–** Permittees may have enacted development requirements that are stricter than the state standards, such as adopting an average land cover condition less than 16% for the design of post-development stormwater management facilities or requiring the implementation of stormwater management facilities for projects that disturb less than an acre. Any BMPs installed to meet these stricter standards after July 1, 2009, (or any BMP capacity that exceeds the state standards and/or average land cover condition) may be counted towards the reductions required under Special Condition 3, 4, and/or 5. **NOTE:** Permittees subject to the Chesapeake Bay Preservation Act (9VAC25-830) may not receive credit for BMPs installed to meet those requirements. It is assumed that these BMPs will be installed as a method for maintaining baseline conditions and do not result in an additional load reduction.

c. Oversized BMPs **–** If an oversized BMP is installed and the excess capacity has not been utilized to offset additional development, permittees may use that capacity to meet the POC reductions required under the TMDL. If permittees choose to use the remaining BMP capacity to meet their TMDL requirements, that capacity cannot be used to meet other regulatory requirements for future development. Please see *Appendix V.E* for additional information concerning the appropriate methods that should be used to calculate reductions from these BMPs.

4. **Revised or Phased out BMPs and Practices.** DEQ recognizes that some MS4 programs are using street sweeping for TMDL credit and that modifications to this item may have an impact on the MS4's ability to demonstrate compliance with their minimum pollution reduction requirements. This provision has been drafted to allow the MS4s time to determine whether any modifications to their Chesapeake Bay TMDL Action Plans are needed and to make those adjustments prior to the deadline for providing 40% of L2 reductions by the end of the permit term.

Street Sweeping. In their most recent report "*Recommendations of the Expert Panel to Define Removal Rates for Street and Storm Drain Cleaning Practices"* (May 19, 2016), the expert panel responsible for street sweeping has modified the calculation methodology for determining pollutant reductions via this practice. Specifically, they have removed both the mass loading calculation method and the qualifying lane mile method. In place of these two methods, a single method has been developed based on cleaning frequency and sweeper technology to allow street sweeping credits. The expert panel report does provide for mass based sediment and nutrient reduction credits for solids that are removed from catch basins and storm drain pipes. Please see Appendix V.G of this Guidance Memo for a more detailed description of the revised methodology, as well as example calculations.

DEQ recognizes that some MS4 permittees have relied on one of the two methodologies no longer recognized by the expert panel to meet their TMDL reduction goals and will need some time to make adjustments. DEQ will accept reductions generated using the mass loading and qualifying lane mile methodologies through June 30, 2022. Pollutant reduction calculations for street sweeping operations after June 30, 2022 are to be reported using the new methodology. If an MS4 is short of the minimum 40% cumulative reduction requirements, this shortfall will need to be addressed with increased sweeping effort, or some other strategy(s).

PART IV – REPORTING CONTROL MEASURES

1. Implementation for this Permit Cycle

For all BMPs that are implemented to meet the Special Condition requirements, **the permittee should report BMP information in accordance with Part I.E.5 of the General Permit. Permittees should report their BMP data using the DEQ BMP Warehouse Urban-Suburban General BMP template. General BMP Reporting and annual identification of newly installed Chesapeake Bay TMDL Action Plan BMPs need to be reported in the appropriate annual report.**

The method permittees use to estimate the acres treated by each BMP depends on the retrofit. *Appendix VII* provides guidelines for how the acres treated should be considered for each BMP type. In addition to the information required in Part II.A.13 of the General Permit, the permittees should submit calculation information (i.e. the method that is used) for the BMPs that are planned and implemented. This will ensure that the Department can verify the permittee will meet the POC reductions required by the permit.

PART V – CHESAPEAKE BAY TMDL ACTION PLAN ELEMENTS

This section describes the required and suggested elements that should be included in the Chesapeake Bay TMDL Action Plan. Providing this information as described in this guidance document should ensure consistency in reporting as well as the Action Plan review process. The Action Plan should allow the Department to verify that the permittee will be able to meet the requirements for the Special Condition for the Chesapeake Bay by the end of the second permit cycle.

The Action Plan should include sufficient supporting material to show that the permittee has:

1. Calculated the full scope of offsets for existing development and new sources that are required to be made by the end of the second permit cycle (See *Part II*, *Appendix II*, and *Appendix III*); and,
2. Determined the methods that will be used to meet the reductions required by the end of the second permit cycle (See *Part III* and *Appendix V*).

In addition to this, the permit requires that the Action Plan also include:

1. Any new or modified legal authorities, such as ordinances, permits, policy, specific contract language, orders, and inter-jurisdictional agreements, implemented or needing to be implemented to meet the requirements of Part II A 3, A 4, and A 5.
2. The load and cumulative reduction calculations for each river basin calculated in accordance with Part II A 3, A 4, and A 5.
3. The total reductions achieved as of July 1, 2018, for each pollutant of concern in each river basin.
4. A list of BMPs implemented prior to July 1, 2018, to achieve reductions associated with the Chesapeake Bay TMDL including:
   a) The date of implementation; and
   b) The reductions achieved.
5. The BMPs to be implemented by the permittee prior to the expiration of this permit to meet the cumulative reductions calculated in Part II A 3, A 4, and A 5, including as applicable:
   a) Type of BMP;
   b) Project name;
   c) Location;
   d) Percent removal efficiency for each pollutant of concern; and
   e) Calculation of the reduction expected to be achieved by the BMP calculated and reported in accordance with the methodologies established in Part II A 8 for each pollutant of concern; and
6. A summary of any comments received as a result of public participation required in Part II A 12, the permittee's response, identification of any public meetings to address public concerns, and any revisions made to Chesapeake Bay TMDL action plan as a result of public participation.
7. Prior to submittal of the action plan required in 9VAC25-890-40 Part II.A.11 , the permittee shall provide an opportunity for public comment on the additional BMPs proposed to meet the reductions not previously approved by the department in the first phase of the Chesapeake Bay TMDL Action Plan. This information on the proposed BMPs for this permit cycle that have not been previously approved must be public noticed for no less than 15 days.

The references in this section refer to the General Permit requirements, which can be found in *Appendix I*. The majority of requirements in the Phase I Individual Permits' Special Condition are the same as those in the General Permit.

As required by 9VAC25-890-40 Part II.A.11, no later than 12 months after the permit effective date, the permittee shall submit an updated Chesapeake Bay TMDL Action Plan as required according to Part II.A.11 of the General Permit. Permittees covered by individual permits must follow the schedule in their permits.

Permit Requirements

1. Existing, new, or modified legal authority (MS4 *General Permit Part II.A.11.a*)
Any new or modified legal authorities, such as ordinances, permits, policy, specific contract language, orders, and inter-jurisdictional agreements, implemented or needing to be implemented to meet the requirements of Part II A 3, A 4, and A 5;
Permittees should include by reference the components of their current MS4 program, or other relevant legal authorities, that will be used to meet the Special Condition. This should include a list of the relevant existing legal authorities (i.e. ordinances, permits, orders, contracts, inter-jurisdictional agreements, and/or other enforceable mechanisms).

New or modified legal authorities that were or will be developed to comply with the Special Condition should also be listed. The list should include either (1) why the legal authority was or will be developed or (2) why the existing legal authority needs to be modified. If no new legal authorities are required for permit compliance that should be stated in the Action Plan.

2. The Load and Cumulative Reduction Calculations for each River Basin (MS4 *General Permit Part II.A.11.b*) *The load and cumulative reduction calculations for each river basin calculated in accordance with Part II A 3, A 4, and A 5.*

a) A determination of the total pollutant load reductions necessary to reduce the annual POC loads from existing sources utilizing the applicable [Table/Tables] in this section based on the river basin to which the MS4 discharges.

The cumulative 40% reduction is the sum of (i) the first phase reduction of 5.0% of the L2 Scoping Run Reductions based on the lands located within the 2000 Census urbanized areas required by June 30, 2018; (ii) the second phase reduction of at least 35% of the L2 Scoping Run based on lands within the 2000 Census urbanized areas required by June 30, 2023; and (iii) the reduction of at least 40% of the expanded Census urbanized areas required by June 30, 2023. The required reduction is calculated using Tables 3a; 3b; 3c; and 3d. As required by 9VAC25-890-40 Part II.A.3 this shall be calculated by multiplying the total existing acres served by the MS4 by the second permit cycle required reductions. As required by 9VAC25-890-40 Part II.A..3 for the purposes of this determination, the operator shall utilize those existing acres identified by the 2010 U.S. Census Bureau urbanized area and served by the MS4.[6]

The POC loads and required reductions should be calculated using the tools described in this guidance document. The permittee should, at a minimum, provide a summary describing how pervious and impervious surface for the MS4 was estimated (e.g. the GIS resources that were used). The Department will need this information to verify that the method used is acceptable. Please see *Part II.2* for additional guidance concerning the delineation of these areas.

Completed calculation Tables 3a-d of the permit should be submitted.

[6] This last sentence applies to Phase II MS4s only.

b) Any “New Sources” should be addressed in the TMDL Action Plan in accordance with Part II.A.4. New source requirements apply to new development or redevelopment initiated on or after July 01, 2009.

No later than the expiration of this permit, the permittee will offset 40% of the increased loads from new sources initiating construction between July 1, 2009, and June 30, 2019, and designed in accordance with 9VAC25-870 Part II C ((VAC25-870-93 et seq.) if the following conditions apply:

- The activity disturbed one acre or greater; and
- The resulting total phosphorous load was greater than 0.45 lb/acre/year, which is equivalent to an average land cover condition of 16% impervious cover.

If a new source disturbs one acre or greater using an average impervious land cover condition greater than 16% for the design of post-development stormwater management facilities, the permittee should see Appendix II of this guidance document. Additional offsets may be necessary. As required by 9VAC25-890-40 Part II.A.4, for this second permit cycle, the permittee shall offset 35% of the calculated increased load from these new sources. The first permit cycle offset of 5% and a second permit cycle offset of 35% provide the cumulative 40% offset for the two permit cycles. Permittees can account for these additional offsets using the simple method on a site-by-site basis, but the Department recommends taking an aggregate approach to demonstrate compliance with this Special Condition as illustrated in Appendix II.

If the new source does not use an average impervious land cover condition greater than 16% for the design of post development stormwater management facilities, no additional offsets are required under the Special Condition beyond those for existing development. Similarly, if a new source disturbs less than 1 acre, no additional offsets are required under the Special Condition beyond those for existing development.

c) As required by 9VAC25-890-40 Part II.A.5, no later than the expiration date of this permit, the permittee shall offset the increased loads from projects grandfathered in accordance with 9VAC25-870-48 that begin construction after July 1, 2014, if the following conditions apply:

- The activity disturbs one acre or greater; and
- The resulting total phosphorous load was greater than 0.45 lb/acre/year, which is equivalent to an average land cover condition of 16% impervious cover.

As required by 9VAC25-890-40 Part II.A..4, the permittee shall utilize Table 4 of Part II.A.5 to develop the equivalent pollutant load for nitrogen and total suspended solids for grandfathered sources meeting the requirements of this condition.

Increases in the POC load from grandfathered projects initiating construction after July 14, 2014, must be offset prior to the expiration of the permit, in accordance with 9VAC25-890-40 Part II.A.5. Permittees should include an estimate of a number of acres impacted by grandfathered projects, which will be used to estimate the pollutant loadings created by these projects. The best available data should be used, but where data is unavailable, permittees should use their best professional judgement. The strategies that are used to address this type of development, including any nutrient trading, should also be included in the Action Plan.

Permittees should list projects that have been approved or have an obligation of locality, state of federal funding prior to July 1, 2012, but have not received coverage under the Construction Permit for Discharges of Stormwater from Construction Activities prior to July 1, 2014. This applies solely to new development, not redevelopment projects.

Explanation and sample calculations for the Special Condition 5 are provided in Appendix II of this guidance.

2. **The total reductions achieved as of July 1, 2018, for each pollutant of concern in each river basin** (MS4 *General Permit Part II.A.11.c*) *The total reductions achieved as of July 1, 2018, for each pollutant of concern in each river basin;*

   This section should list the management practices and retrofit programs (including improvements from redevelopment) that have or will be implemented between July 1, 2009, and the end of the second permit cycle to achieve the cumulative 40.0% reductions required for existing development. The permittee should support its plan with calculations that show how the reductions will be met. Any credit trading that is used to meet reductions should also be described.

   Permittees are encouraged to submit this information in an electronic spreadsheet with a summary page that serves as a ledger showing:

   - the total reductions required;
   - each practice that will be implemented;
   - the approximate location of the project, and;
   - the load that will be reduced by each project.

   Permittees should **not** submit full plans and specs for individual BMPs as part of the Action Plan. However, plans and specs should be available to the Department upon request as they are developed.

3. **A list of BMPs implemented prior to July 1, 2018, to achieve reductions for the Chesapeake Bay TMDL** (MS4 *General Permit Part II.A.11.d*) A list of BMPs implemented prior to July 1, 2018, to achieve reductions associated with the Chesapeake Bay TMDL including:

   a) The date of implementation; and

   b) The reductions achieved.

4. **BMPs implemented by the permittee prior to the expiration of this permit to meet cumulative reductions** (MS4 *General Permit Part II.A.11.e*) The BMPs to be implemented by the permittee prior to the expiration of this permit to meet the cumulative reductions calculated in Part II A 3, A 4, and A 5, including as applicable:

   a) Type of BMP;

   b) Project name;

   c) Location;

d) Percent removal efficiency for each pollutant of concern; and

e) calculation of the reduction expected to be achieved by the BMP calculated and reported in accordance with the methodologies established in Part II A 8 for each pollutant of concern; and

Permittees are encouraged to submit this information in an electronic spreadsheet with a summary page detailing the information listed in this section.

6. Public comments on draft Chesapeake Bay TMDL Action Plan (GENERAL PERMIT REQUIREMENTS MS4 *General Permit Part II.A.11.f and Phase I PERMIT REQUIREMENTS*). *A summary of any comments received as a result of public participation required in Part II A 12, the permittee's response, identification of any public meetings to address public concerns, and any revisions made to Chesapeake Bay TMDL action plan as a result of public participation; and (***MS4 General Permit Part II.A.12).** As required by 9VAC25-890-40 Part II.A.12, p*rior to submittal of the action plan, the permittee shall provide an opportunity for receipt of public comment on the Chesapeake Bay TMDL action plan; and a list of all public comments on the additional BMPs proposed to meet the reductions not previously approved by the department in the first phase Chesapeake Bay TMDL action plan for no less than 15 days.*

An opportunity for receipt and consideration of public comment regarding the draft Chesapeake Bay TMDL Action Plan. The public comment process and period should be described, including as follows: how the process was advertised to the public; a summary of comments received during the public participation process to include additional BMPs proposed to meet the reductions not previously approved by the department in the first phase of the Chesapeake Bay TMDL action plan; permittee response to public comments; a brief discussion of any public meeting proceedings to address public concerns; and changes made to the Chesapeake Bay TMDL action plan as a result of the public notice and participation. As required by 9VAC25-890-40 Part II.A.12, the opportunity for public comment must be provided for no less than 15 days.

APPENDIX I - SPECIAL CONDITION FOR THE CHESAPEAKE BAY TMDL FROM THE GENERAL PERMIT FOR DISCHARGES OF STORMWATER FROM SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS

9VAC25-890-40 Part II.A. Chesapeake Bay TMDL special condition.

1. The Commonwealth in its Phase I and Phase II Chesapeake Bay TMDL Watershed Implementation Plans (WIPs) committed to a phased approach for MS4s, affording MS4 permittees up to three full five-year permit cycles to implement necessary reductions. This permit is consistent with the Chesapeake Bay TMDL and the Virginia Phase I and II WIPs to meet the Level 2 (L2) scoping run for existing developed lands, as it represents an implementation of an additional 35% of L2 as specified in the 2010 Phase I and II WIPs. This, in combination with the 5.0% reduction of L2 that has already been achieved will total a reduction at the end of this permit term of 40% of L2. Conditions of future permits will be consistent with the TMDL or WIP conditions in place at the time of permit issuance.

2. The following definitions apply to Part II of this state permit for the purpose of the Chesapeake Bay TMDL special condition for discharges in the Chesapeake Bay Watershed:

   "Existing sources" means pervious and impervious urban land uses served by the MS4 as of June 30, 2009.

   "New sources" means pervious and impervious urban land uses served by the MS4 developed or redeveloped on or after July 1, 2009.

   "Pollutants of concern" or "POC" means total nitrogen, total phosphorous, and total suspended solids.

   "Transitional sources" means regulated land disturbing activities that are temporary in nature and discharge through the MS4.

3. Reduction requirements. No later than the expiration date of this permit, the permittee shall reduce the load of total nitrogen, total phosphorus, and total suspended solids from existing developed lands served by the MS4 as of June 30, 2009, within the 2010 Census urbanized areas by at least 40% of the Level 2 (L2) Scoping Run Reductions. The 40% reduction is the sum of (i) the first phase reduction of 5.0% of the L2 Scoping Run Reductions based on the lands located within the 2000 Census urbanized areas required by June 30, 2018; (ii) the second phase reduction of at least 35% of the L2 Scoping Run based on lands within the 2000 Census urbanized areas required by June 30, 2023; and (iii) the reduction of at least 40% of the L2 Scoping Run , which shall only apply to the additional lands that were added by the 2010 expanded Census urbanized areas required by June 30, 2023. The required reduction shall be calculated using Tables 3a, 3b, 3c, and 3d below as applicable:

Table 3a
Calculation Sheet for Estimating Existing Source Loads and Reduction Requirements for the James River, Lynnhaven, and Little Creek Basins

		A	B	C	D	E	F	G
Pollutant	Subsource	Loading rate (lbs/ac/yr)[1]	Existing developed lands as of 6/30/09 served by the MS4 within the 2010 CUA (acres)[2]	Load(lbs/yr)[3]	Percentage of MS4 required Chesapeake Bay total L2 loading re uc on	Percentage of L2 required reduction by 6/30/2023	40% cumulative reduction Required by 6/30/2023 (lbs/yr)[4]	Sum of 40% cumulative reduction (lb/yr)[5]
Nitrogen	Regulated urban impervious	9.39			9%	40%		
	Regulated urban pervious	6.99			6%	40%		
Phosphorus	Regulated urban impervious	1.76			16%	40%		
	Regulated urban pervious	0.5			7.25%	40%		
Total suspended solids	Regulated urban impervious	676.94			20%	40%		
	Regulated urban pervious	101.08			8.75%	40%		

[1]Edge of stream loading rate based on the Chesapeake Bay Watershed Model Progress Run 5.3.2.

[2]To determine the existing developed acres required in Column B, permittees should first determine the extent of their regulated service area based on the 2010 Census urbanized area (CUA). Next, permittees will need to delineate the lands within the 2010 CUA served by the MS4 as pervious or impervious as of the baseline date of June 30, 2009.

[3]Column C = Column A x Column B.

[4]Column F = Column C x Column D x Column E.

[5]Column G = The sum of the subsource cumulative reduction required by 6/30/23 (lbs/yr) as calculated in Column F.

Table 3b
Calculation Sheet for Estimating Existing Source Loads and Reduction Requirements for the Potomac River Basin

		A	B	C	D	E	F	G
Pollutant	Subsource	Loading rate (lbs/ac/yr)[1]	Existing developed lands as of 6/30/09 served by the MS4 within the 2010 CUA (acres)[2]	Load (lbs/yr)[3]	Percentage of MS4 required Chesapeake Bay total L2 loading reduction	Percentage of L2 required reduction by	40% cumulative reduction required by 6/30/2023 (lbs/yr)[4]	Sum of 40% cumulative reduction (lb/yr)[5]
Nitrogen	Regulated urban impervious	16.86			9%	40%		
	Regulated urban pervious	10.07			6%	40%		
Phosphorus	Regulated Urban Impervious	1.62			16%	40%		
	Regulated urban pervious	0.41			7.25%	40%		
Total suspended solids	Regulated urban impervious	1,171.32			20%	40%		
	Regulated urban pervious	175.8			8.75%	40%		

[1]Edge of stream loading rate based on the Chesapeake Bay Watershed Model Progress Run 5.3.2

[2]To determine the existing developed acres required in Column B, permittees should first determine the extent of their regulated service area based on the 2010 Census urbanized area (CUA). Next, permittees will need to delineate the lands within the 2010 CUA served by the MS4 as pervious or impervious as of the baseline date of June 30, 2009.

[3]Column C = Column A x Column B.

[4]Column F = Column C x Column D x Column E.

[5]Column G = The sum of the subsource cumulative reduction required by 6/30/23 (lbs/yr) as calculated in Column F.

Table 3c
Calculation Sheet for Estimating Existing Source Loads and Reduction Requirements for the Rappahannock River Basin

		A	B	C	D	E	F	G
Pollutant	Subsource	Loading rate (lbs/ac/yr)[1]	Existing developed lands as of 6/30/09 served by the MS4 within the 2010 CUA (acres)[2]	Load (lbs/yr)[3]	Percentage of MS4 required Chesapeake Bay total L2 loading reduction	Percentage of L2 required reduction by 6/30/2023	40% cumulative reduction Required by 6/30/2023 (lbs/yr)[4]	Sum of 40% cumulative reduction (lb/yr)[5]
Nitrogen	Regulated urban impervious	9.38			9%	40%		
	Regulated urban pervious	5.34			6%	40%		
Phosphorus	Regulated urban impervious	1.41			16%	40%		
	Regulated urban pervious	0.38			7.25%	40%		
Total suspended solids	Regulated urban impervious	423.97			20%	40%		
	Regulated urban pervious	56.01			8.75%	40%		

[1]Edge of stream loading rate based on the Chesapeake Bay Watershed Model Progress Run 5.3.2.

[2]To determine the existing developed acres required in Column B, permittees should first determine the extent of their regulated service area based on the 2010 Census urbanized area (CUA). Next, permittees will need to delineate the lands within the 2010 CUA served by the MS4 as pervious or impervious as of the baseline date of June 30, 2009.

[3]Column C = Column A x Column B.

[4]Column F = Column C x Column D x Column E.

[5]Column G = The sum of the subsource cumulative reduction required by 6/30/23 (lbs/yr) as calculated in Column F.

Table 3d
Calculation Sheet for Estimating Existing Source Loads and Reduction Requirements for the York River and Poquoson Coastal Basin

		A	B	C	D	E	F	G
Pollutant	Subsource	Loading rate (lbs/ac/yr)[1]	Existing developed lands as of 6/30/09 served by the MS4 within the 2010 CUA (acres)[2]	Load (lbs/yr)[3]	Percentage of MS4 required Chesapeake Bay total L2 loading reduction	Percentage of L2 required reduction by 6/30/2023	40% cumulative reduction required by 6/30/2023 (lbs/yr)[4]	Sum of 40% cumulative reduction (lb/yr)[5]
Nitrogen	Regulated urban impervious	7.31			9%	40%		
	Regulated urban pervious	7.65			6%	40%		
Phosphorus	Regulated urban impervious	1.51			16%	40%		
	Regulated urban pervious	0.51			7.25%	40%		
Total suspended solids	Regulated urban impervious	456.68			20%	40%		
	Regulated urban pervious	72.78			8.75%	40%		

[1]Edge of stream loading rate based on the Chesapeake Bay Watershed Model Progress Run 5.3.2.

[2]To determine the existing developed acres required in Column B, permittees should first determine the extent of their regulated service area based on the 2010 Census urbanized area (CUA). Next, permittees will need to delineate the lands within the 2010 CUA served by the MS4 as pervious or impervious as of the baseline date of June 30, 2009.

[3]Column C = Column A x Column B.

[4]Column F = Column C x Column D x Column E.

[5]Column G = The sum of the subsource cumulative reduction required by 6/30/23 (lbs/yr) as calculated in Column F.

4. No later than the expiration date of this permit, the permittee shall offset 40% of the increased loads from new sources initiating construction between July 1, 2009, and June 30, 2019, and designed in accordance with 9VAC25-870 Part II C (9VAC25-870-93 et seq.) if the following conditions apply:

   a. The activity disturbed one acre or greater; and

   b. The resulting total phosphorous load was greater than 0.45 lb/acre/year, which is equivalent to an average land cover condition of 16% impervious cover.

   The permittee shall utilize Table 4 of Part II A 5 to develop the equivalent pollutant load for nitrogen and total suspended solids for new sources meeting the requirements of this condition.

5. No later than the expiration date of this permit, the permittee shall offset the increased loads from projects grandfathered in accordance with 9VAC25-870-48 that begin construction after July 1, 2014, if the following conditions apply:

   a. The activity disturbs one acre or greater; and

   b. The resulting total phosphorous load was greater than 0.45 lb/acre/year, which is equivalent to an average land cover condition of 16% impervious cover.

   The permittee shall utilize Table 4 below to develop the equivalent pollutant load for nitrogen and total suspended solids for grandfathered sources meeting the requirements of this condition.

Table 4
Ratio of Phosphorus Loading Rate to Nitrogen and Total Suspended Solids Loading Rates for Chesapeake Bay Basins

Ratio of Phosphorus to Other POCs (Based on All Land Uses 2009 Progress Run)	Phosphorus Loading Rate (lbs/acre)	Nitrogen Loading Rate (lbs/acre)	Total Suspended Solids Loading Rate (lbs/acre)
James River Basin, Lynnhaven, and Little Creek Basins	1.0	5.2	420.9
Potomac River Basin	1.0	6.9	469.2
Rappahannock River Basin	1.0	6.7	320.9
York River Basin (including Poquoson Coastal Basin)	1.0	9.5	531.6

6. Reductions achieved in accordance with the General VPDES Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems effective July 1, 2013, shall be applied toward the total reduction requirements to demonstrate compliance with Part II A 3, A 4, and A 5.

7. Reductions shall be achieved in each river basin as calculated in Part II A 3 or for reductions in accordance with Part II A 4 and A 5 in the basin in which the new source or grandfathered project occurred.

8. Loading and reduction values greater than or equal to 10 pounds calculated in accordance with Part II A 3, A 4, and A 5 shall be calculated and reported to the nearest pound without regard to mathematical rules of precision. Loading and reduction values of less than 10 pounds reported in accordance with Part II A 3, A 4, and A 5 shall be calculated and reported to two significant digits.

9. Reductions required in Part II A 3, A 4, and A 5 shall be achieved through one or more of the following:

    b. BMPs approved by the Chesapeake Bay Program;

    c. BMPs approved by the department; or

    d. A trading program described in Part II A 10.

10. The permittee may acquire and use total nitrogen and total phosphorus credits in accordance with § 62.1-44.19:21 of the Code of Virginia and total suspended solids in accordance with § 62.1-44.19:21.1 of the Code of Virginia for purposes of compliance with the required reductions in Table 3a, Table 3b,Table 3c, Table 3d of Part II A 3; Part II A 4; and Part II A 5, provided the use of credits has been approved by the department. The exchange of credits is subject to the following requirements:

    e. The credits are generated and applied to a compliance obligation in the same calendar year;

    f. The credits are generated and applied to a compliance obligation in the same tributary;

    g. The credits are acquired no later than June 1 immediately following the calendar year in which the credits are applied;

    h. No later than June 1 immediately following the calendar year in which the credits are applied, the permittee certifies on an MS4 Nutrient Credit Acquisition Form that the permittee has acquired the credits;

    i. Total nitrogen and total phosphorus credits shall be either point source credits generated by point sources covered by the Watershed Permit for Total Nitrogen and Total Phosphorus Discharges and Nutrient Trading in the Chesapeake Bay Watershed general permit issued pursuant to § 62.144.19:14 of the Code of Virginia, or nonpoint source credits certified pursuant to § 62.1-44.19:20 of the Code of Virginia;

    j. Sediment credits shall be derived from one of the following:

        (1) Implementation of a BMP in a defined area outside of an MS4 service area, in which case the necessary baseline sediment reduction for such defined area shall be achieved prior to the permittee's use of additional reductions as credit; or

        (2) A point source wasteload allocation established by the Chesapeake Bay total maximum daily load, in which case the credit is the difference between the wasteload allocation specified as an annual mass load and any lower monitored annual mass load that is discharged as certified on an MS4 Sediment Credit Acquisition Form.

    k. Sediment credits shall not be associated with phosphorus credits used for compliance with the stormwater nonpoint nutrient runoff water quality criteria established pursuant to § 62.1-44.15:28 of the Code of Virginia.

11. No later than 12 months after the permit effective date, the permittee shall submit an updated Chesapeake Bay TMDL action plan for the reductions required in Part II A 3, A 4, and A 5 that includes the following information:

l. Any new or modified legal authorities, such as ordinances, permits, policy, specific contract language, orders, and inter-jurisdictional agreements, implemented or needing to be implemented to meet the requirements of Part II A 3, A 4, and A 5.

m. The load and cumulative reduction calculations for each river basin calculated in accordance with Part II A 3, A 4, and A 5.

n. The total reductions achieved as of July 1, 2018, for each pollutant of concern in each river basin.

o. A list of BMPs implemented prior to July 1, 2018, to achieve reductions associated with the Chesapeake Bay TMDL including:

(1) The date of implementation; and

(2) The reductions achieved.

p. The BMPs to be implemented by the permittee prior to the expiration of this permit to meet the cumulative reductions calculated in Part II A 3, A 4, and A 5, including as applicable:

(1) Type of BMP;

(2) Project name;

(3) Location;

(4) Percent removal efficiency for each pollutant of concern; and

(5) Calculation of the reduction expected to be achieved by the BMP calculated and reported in accordance with the methodologies established in Part II A 8 for each pollutant of concern; and

q. A summary of any comments received as a result of public participation required in Part II A 12, the permittee's response, identification of any public meetings to address public concerns, and any revisions made to Chesapeake Bay TMDL action plan as a result of public participation.

12. Prior to submittal of the action plan required in Part II A 11, the permittee shall provide an opportunity for public comment on the additional BMPs proposed to meet the reductions not previously approved by the department in the first phase Chesapeake Bay TMDL action plan for no less than 15 days.

APPENDIX II – MEETING SPECIAL CONDITION REQUIREMENT 4 AND/OR 5

Special Condition Requirements 4 (9VAC25-890-40Part II.A.4) and 5 (9VAC25-890-40 Part II.A.5) apply to permittees that (1) adopted an average impervious land cover condition greater than 16% for the design of post-development stormwater management facilities under the Chesapeake Bay Preservation Act or (2) have allowed projects to be built with an impervious land cover condition greater than 16% for the design of post-development stormwater management facilities through a "fee-in-lieu of" or similar program. The reductions required under these sections of the Special Condition are to offset *increased* loads from new sources and must be made *in addition* to those required for existing conditions as of June 30, 2009, (9VAC25-890-40 Part II.A.4).

For projects that initiate construction between July 1, 2009, and June 30, 2019, subject to Special Condition Requirement 4 (9VAC25-890-40 Part II.A.4), permittees must offset a cumulative 40% of the **increased** POC loads from those projects by the end of the permit cycle. For projects that are grandfathered in accordance with 9VAC25-870-48 and initiate construction or after July 1, 2014, subject to Special Condition Requirement 5 (9VAC25-890-40 Part II.A.5), permittees must offset the entire increased load no later than the expiration date of the permit.

NOTE: For "Grandfathered Activities" - **i**n cases where governmental bonding or public debt financing has been issued for a project prior to July 1, 2012, the project will remain subject to the old Part II C technical criteria in perpetuity. For all other private construction activities that are considered "grandfathered" by a VSMP Authority and require offsets, these are due at completion of the project.

These projects are subject to Technical Criteria II C under the VSMP regulations. If permittees use the technology-based criteria under 9VAC25-870-96.C, no additional reductions are required under the Special Condition beyond those for the existing conditions as of June 30, 2009, under 9VAC25-890-40 Part II.A.3. This is because the technology based criteria assumes an average land cover condition of 16% for the design of post-development stormwater management facilities.

Permittees using the performance-based criteria under 9VAC25-870-96.B may have projects that require additional reductions under 9VAC25-890-40Part II.A.4 or 9VAC25-890-40 PartII.A.5. The VSMP regulations organize the "performance-based criteria" into "four applicable land development situations." For clarity, this Appendix uses the same "situation" framework to explain when additional reductions are required for "new sources" under the Special Condition.

This Appendix is organized by "situation." Under each "situation" header the following information is provided:

1. Each "situation," as is described in 9VAC-25-870-96.B of the VSMP regulations,
2. The VSMP requirements for each performance-based criteria "situation," and;
3. An example diagram and the reduction requirements for each "situation" beyond those required under Part II.A.3 of the general permit for each of the following project types:
    a. Redevelopment with an Average Impervious Land Cover Condition of 16% or Less
    b. Redevelopment with an Average Impervious Land Cover Condition Greater than 16%
    c. New Development with an Average Impervious Land Cover Condition of 16% or Less
    d. New Development with an Average Impervious Land Cover Condition Greater than 16%

NOTE: In some of these "situations," meeting the VSMP requirements will result in POC reductions. If that is the case, permittees may take credit for those reductions on prior developed lands and apply those credits to their 2009 baseline reductions under Special Condition Requirement 6 (9VAC25-890-40 Part II.A.3). Where applicable, these instances are indicated throughout this section. They are also addressed in *Appendix V.L*.

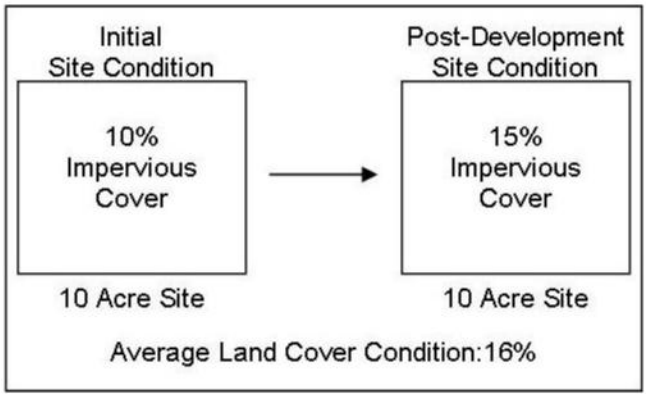
SITUATION 1

Land disturbing activities where the existing percent impervious cover is less than or equal to the average land cover condition and the proposed improvements will create a total percent impervious cover which is less than the average land cover condition.

VSMP Requirement: No reduction in the after disturbance pollutant discharge is required.

Special Condition Requirements*:*

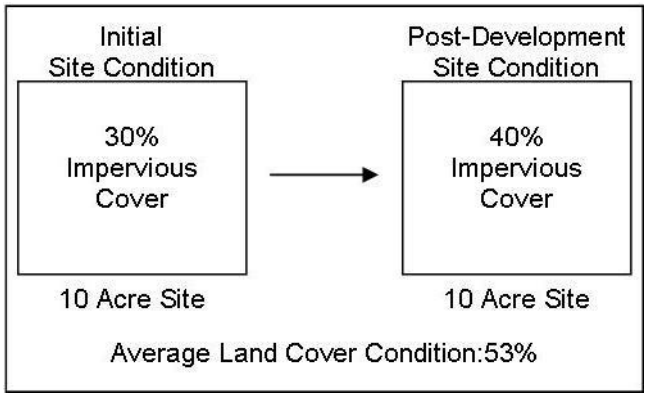
(a) Redevelopment with an Average Impervious Land Cover Condition of 16% or Less:



Special Condition Requirement 4: No additional reductions are required for this project type and situation because the average land cover condition is less than 16%.

Special Condition Requirement 5: No additional reductions are required for this project type and situation because the average land cover condition is less than 16%.

(b) Redevelopment with an Average Impervious Land Cover Condition Greater than 16%:

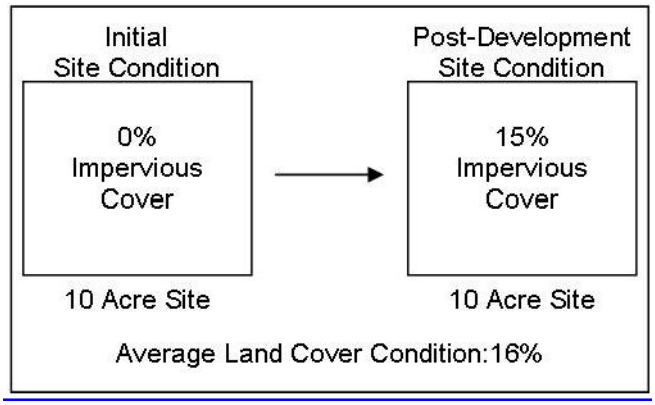


Special Condition Requirement 4: If construction on the project was initiated between July 1, 2009, and June 30, 2019, the permittee must create reductions *in addition* to those required

by Special Condition Requirement 3 (9VAC25-890-40 Part II.A.3). In this instance, the permittee must offset a cumulative 40.0% of the incremental[7] increased load from the impervious cover change.

Special Condition Requirement 5: If the project is grandfathered in accordance with 9VAC25-870-48 and initiated or initiates construction after July 1, 2014, the permittee must create reductions *in addition* to those required by Special Condition Requirement 3 (9VAC25-890-40 Part II.A.3). In this instance, the permittee must offset the entire incremental increased load from the impervious cover change no later than the expiration date of the permit.

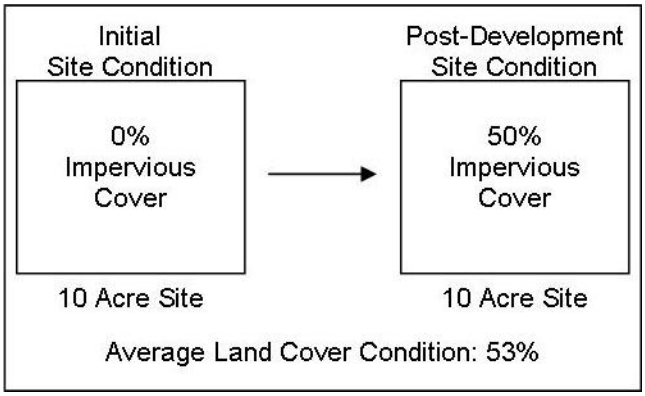
(c) New Development with an Average Impervious Land Cover Condition of 16% or Less:



Special Condition Requirement 4: No additional reductions are required for this project type and situation because the average land cover condition is less than 16%.

Special Condition Requirement 5: No additional reductions are required for this project type and situation because the average land cover condition is less than 16%.

(d) New Development with an Average Impervious Land Cover Condition Greater than 16%



[7] Throughout this section incremental refers to the difference between the site's initial impervious cover and the post-development impervious cover. However, permittees do not have to make reductions beyond the 16% average land cover condition or 0.45lbs TP/ac/yr.

Special Condition Requirement 4: If construction on the project was initiated between July 1, 2009, and June 30, 2019, the permittee must create reductions *in addition* to those required by Special Condition Requirement 3 (9VAC25-890-40 Part II.A.3). In this instance, the permittee must offset a cumulative 40.0% of the incremental increased load from the impervious cover change, down to the average land cover condition (50% impervious cover load – 16% impervious cover load).

Special Condition Requirement 5: If the project is grandfathered in accordance with 9VAC25-870-48 and initiated or initiates construction after July 1, 2014, the permittee must create reductions *in addition* to those required by Special Condition Requirement 3 (9VAC25-890-40 Part II.A.3). In this instance, the permittee must offset the entire incremental increased load from the impervious cover change, down to the average land cover condition (50% Impervious Cover – 16% Impervious Cover) no later than the expiration date of the permit.

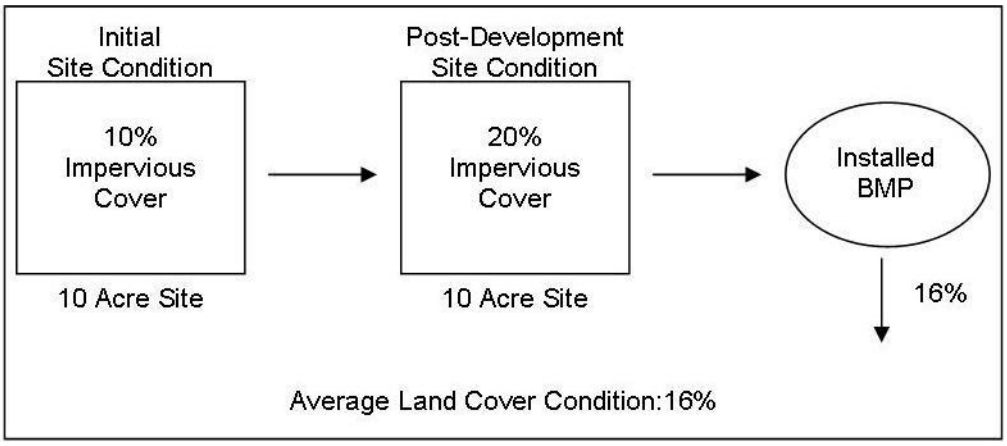
SITUATION 2

Land disturbing activities where the existing percent impervious cover is less than or equal to the average land cover condition and the proposed improvements will create a total percent impervious cover which is greater than the average land cover condition.

VSMP Requirement: The pollutant discharge after disturbance shall not exceed the existing pollutant discharge based on the average land cover condition. If the post-development impervious land cover condition exceeds the average land cover condition, BMPs must be installed on site to offset those increased loads using the techniques described in the Virginia Stormwater Management Handbook, which can be found on DEQ's website.

Special Condition Requirement:

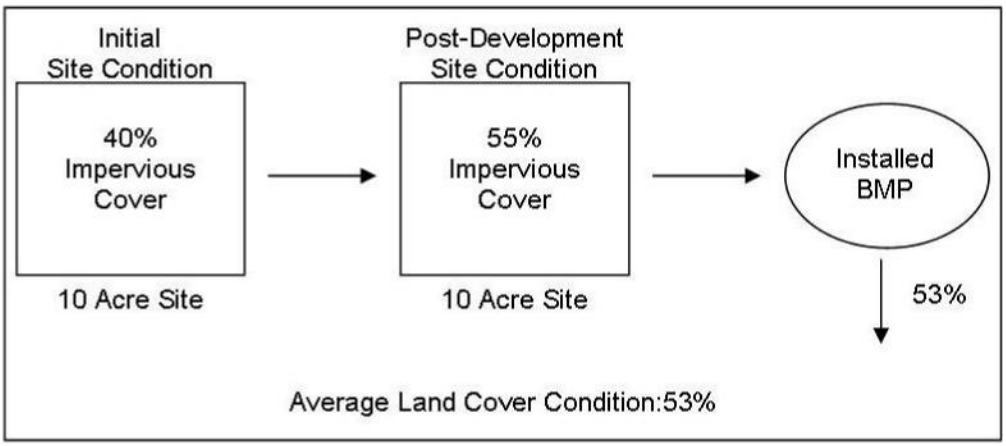
(a) *Redevelopment with an Average Impervious Land Cover Condition of 16% or Less:*



Special Condition Requirement 4: No additional reductions beyond those provided by the "Installed BMP" are necessary because the load draining from the site is equivalent to the load draining from a site with a 16% land cover condition.

Special Condition Requirement 5: No additional reductions beyond those provided by the "Installed BMP" are necessary because the load draining from the site is equivalent to the load draining from a site with a 16% land cover condition.

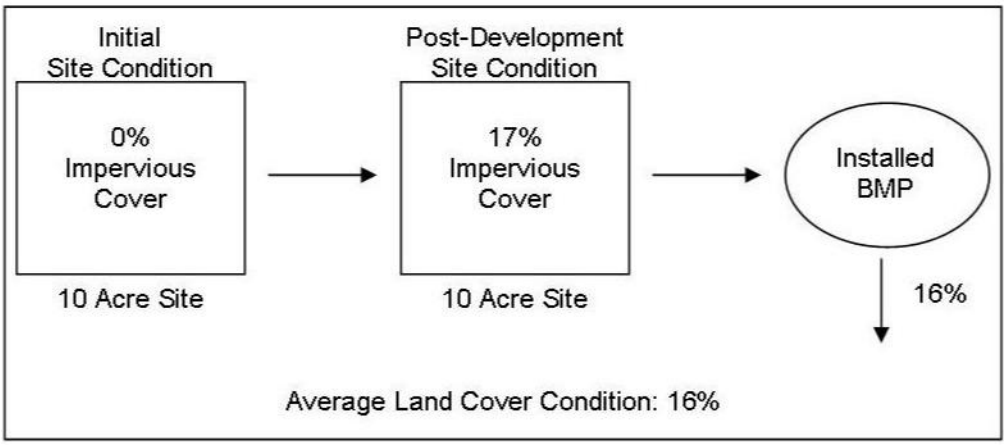
(b) Redevelopment with an Average Impervious Land Cover Condition Greater than 16%



Special Condition Requirement 4: If construction on the project was initiated between July 1, 2009, and June 30, 2019, the permittee must create reductions *in addition* to those required by Special Condition Requirement 3 (9VAC25-890-40 Part II.A.3). The "Installed BMP" meets the VSMP requirements, since it offsets the additional load to the Average Land Cover Condition. To meet Special Condition Requirement 4 the permittee must determine the remaining incremental load increase from the redevelopment project (53% impervious cover load – 40% impervious cover load). By the end of the second permit cycle, the permittee must offset a cumulative 40.0% of that load. (9VAC25-890-40 Part II.A.4)

Special Condition Requirement 5: If the project is grandfathered in accordance with 9VAC25-870-48 and initiated or initiates construction after July 1, 2014, the permittee must create reductions *in addition* to those required by Special Condition Requirement 3 (9VAC25-890-40 Part II.A.3). The "Installed BMP" meets the VSMP requirements, since it offsets the additional load to the Average Land Cover Condition. To meet Special Condition Requirement 5, the permittee must determine the remaining incremental load increase from the redevelopment project (53% impervious cover load – 40% impervious cover load). The permittee must offset the entire load no later than the expiration of the permit.(9VAC25-890-40 Part II.A.5)

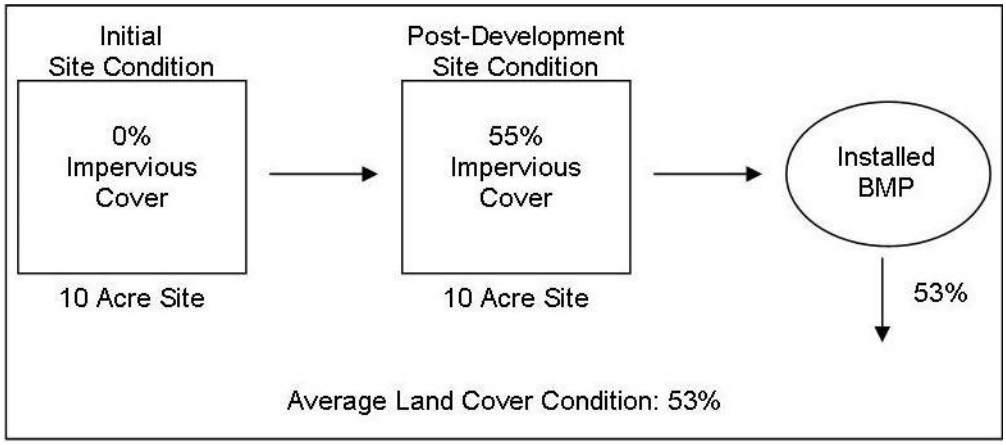
(c) New Development with an Average Impervious Land Cover Condition of 16% or Less



Special Condition Requirement 4: No additional reductions beyond those provided by the "Installed BMP" are necessary because the load draining from the site is equivalent to the load draining from a site with a 16% land cover condition.

Special Condition Requirement 5: No additional reductions beyond those provided by the "Installed BMP" are necessary because the load draining from the site is equivalent to the load draining from a site with a 16% land cover condition.

(d) *New Development with an Average Impervious Land Cover Condition Greater than 16%*



Special Condition Requirement 4: If construction on the project was initiated between July 1, 2009, and June 30, 2019, the permittee must create reductions *in addition* to those required by Special Condition Requirement 3 (9VAC25-890-40 Part II.A.3). The "Installed BMP" meets the VSMP requirements, since it offsets the additional load to the Average Land Cover Condition. To meet Special Condition Requirement 4, the permittee must determine the remaining incremental load increase from the redevelopment project, down to the 16% Average Land Cover Condition (53% impervious cover load – 16% impervious cover load). By the end of the second permit cycle, the permittee must offset a cumulative 40.0% of that load. (9VAC25-890-40 Part II.A.4)

Special Condition Requirement 5: If the project is grandfathered in accordance with 9VAC25-870-48 and initiated or initiates construction after July 1, 2014, the permittee must create reductions *in addition* to those required by Special Condition Requirement 3 (9VAC25-890-40 Part II.A.3). The "Installed BMP" meets the VSMP requirements, since it offsets the additional load to the Average Land Cover Condition. To meet Special Condition Requirement 5, the permittee must determine the remaining incremental load increase from the redevelopment project (53% impervious cover load – 16% impervious cover load). The permittee must offset the entire incremental load no later than the expiration of the permit (9VAC25-890-40 Part II.A.5).

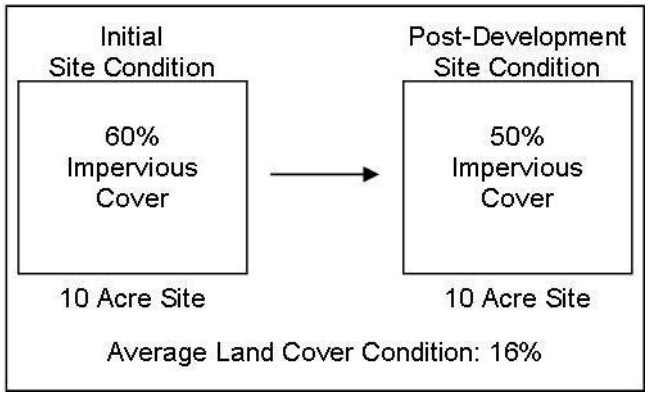
SITUATION 3

Land disturbing activities where the existing percent impervious cover is greater than the average land cover condition.

VSMP Requirement: The pollutant discharge after development shall not exceed 1) the pollutant discharge based on existing conditions less 10%; or 2) the pollutant discharge based on the average land cover condition, whichever is greater.

Special Condition Requirement:

(a) Redevelopment with an Average Impervious Land Cover Condition of 16% or Less

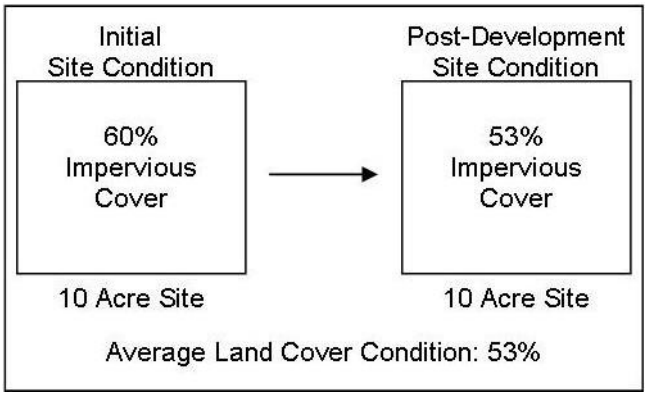


Special Condition Requirement 4: No additional reductions are required because there has not been an *increase* in the load draining from the site.

Special Condition Requirement 5: No additional reductions are required because there has not been an *increase* in the load draining from the site.

NOTE: The permittee may take credit for the 10% reductions and apply it to the existing source reductions required by Special Condition Requirement 3 (9VAC25-890-40 Part II.A.3). See *Appendix V.L* for additional information concerning credits for redevelopment.

(b) Redevelopment with an Average Impervious Land Cover Condition Greater than 16%



Special Condition Requirement 4: No additional reductions are required because there was *no increase* in loads from the post-developed site.

Special Condition Requirement 5: No additional reductions are required because there was *no increase* in loads from the post-developed site.

NOTE: The permittee may take credit for the 7.0% reductions and apply it to the existing source reduction required by Special Condition Requirement 3 (9VAC25-890-40 Part II.A.3). See *Appendix V.L* for additional information concerning credits for redevelopment.

(c) New Development with an Average Impervious Land Cover Condition of 16% or Less - This situation does not apply to new development.

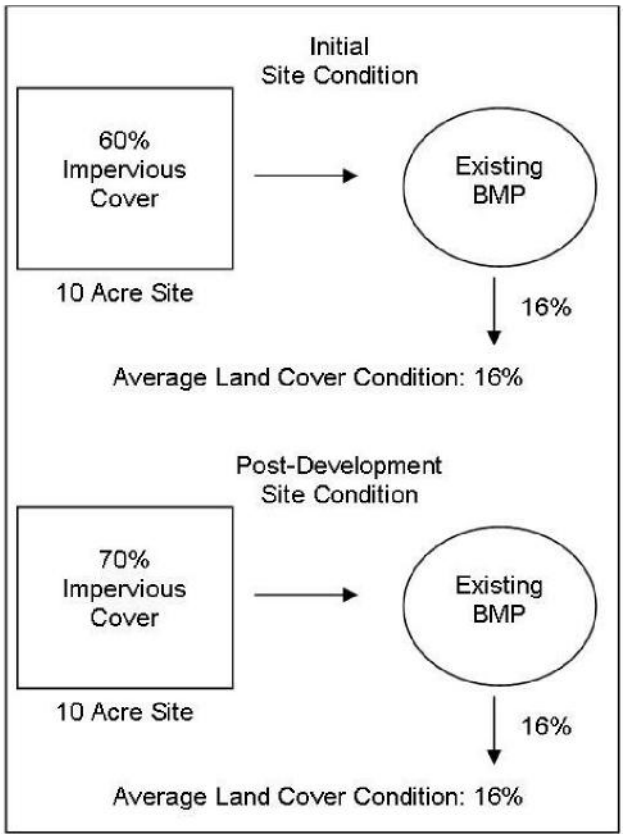
(d) New Development with an Average Impervious Land Cover Condition Greater than 16% - This situation does not apply to new development.

SITUATION 4

Land disturbing activities where the existing percent impervious cover is served by an existing stormwater management BMP(s) that addresses water quality.

VSMP Requirement: The pollutant discharge after disturbance shall not exceed the existing pollutant discharge based on the existing percent impervious cover while served by the existing BMP. The existing BMP shall be shown to have been designed and constructed in accordance with proper design standards and specifications and to be in proper functioning condition.

Special Condition Requirement:



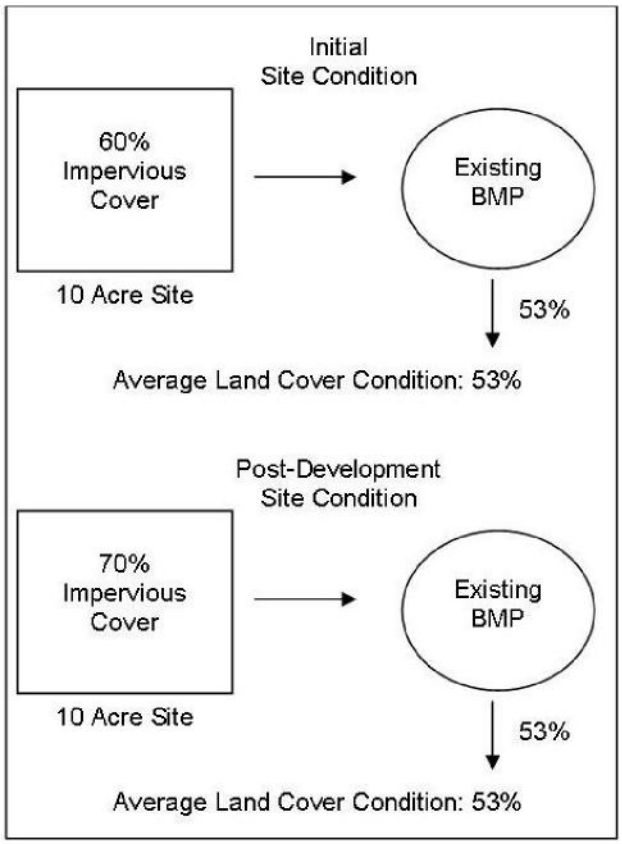
The site drains to an existing stormwater BMP before discharging to an impaired water body. The pollutant load discharged to the receiving stream from the regional BMP is less than or equal to the load from a site with an average land cover condition of 16 percent. If the BMP is overdesigned for the current site, it may be possible for redevelopment to result in an increase in impervious cover on the site, but not result in an increased load reaching the stream. If that is the case, additional reductions do not need to be made.

(a) *Redevelopment with an Average Impervious Land Cover Condition of 16% or Less*

Special Condition Requirement 4: No additional reductions are required because the load draining from the BMP to the receiving water body does not increase.

Special Condition Requirement 5: No additional reductions are required because the load draining from the BMP to the receiving water body does not increase.

(b) *Redevelopment with an Average Impervious Land Cover Condition Greater than 16%*



The site drains to an existing stormwater BMP before discharging to an impaired water body. The pollutant load discharged to the receiving stream from the regional BMP is less than or equal to the load from a site with an average land cover condition of 53 percent. If the BMP is overdesigned for the current site, it may be possible for redevelopment to result in an increase in impervious cover on the site, but not result in an increased load reaching the stream. If that is the case, additional reductions do not need to be made.

Special Condition Requirement 4: No additional reductions are required because the load draining from the BMP to the receiving water body does not increase.

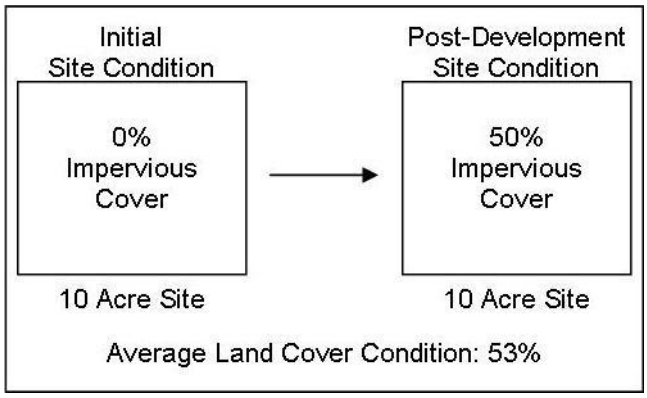
Special Condition Requirement 5: No additional reductions are required because the load draining from the BMP to the receiving water body does not increase.

(c) *New Development with an Average Impervious Land Cover Condition of 16% or Less* - This situation does not apply to new development.

(d) *New Development with an Average Impervious Land Cover Condition Greater than 16%* - This situation does not apply to New Development.

EXAMPLE II.1 – Site Specific Calculation to Meet Special Condition Requirement 4 or 5

A permittee in the James River Basin that adopted an average land cover condition of 53% under the Chesapeake Bay Preservation Act needs to calculate the additional reductions required under Special Condition Requirement 4 (9VAC25-890-40 Part II.A.4) for a 10 acre new development project where construction was initiated between July 1, 2009, and June 30, 2019. Once completed, the project will have an average land cover condition of 50%, which is less than the locality's adopted average land cover condition.



Step 1: Site Condition as of June 30, 2009, Calculation

The permittee must incorporate the site conditions as of June 30, 2009, into the acreage calculation under Special Condition Requirement 3 (9VAC25-890-40 Part II.A.3). Once the "existing condition" required reductions are determined using the tables, they do not need to be recalculated. In this example, all 10 acres of the pre-development site are pervious regulated acres (there are no forested acres on site).

Step 2: Identifying Additional Reductions under Special Condition 4 or 5

Next, the permittee must determine if the project is subject to additional reduction requirements. Referencing Appendix II.1 of this guidance document, the permittee identifies that this project falls under Situation 1.(d). In accordance with Special Condition Requirement 4 (9VAC25-890-40 Part II.A.4,) the permittee must offset a cumulative 40.0% of the *increased* load from the impervious cover change down to the statewide average land cover condition of 16% by the end of this permit cycle *in addition* to the reductions required under GP Part II.A.3. ***NOTE:*** *In cases where governmental bonding or public debt financing has been issued for a project prior to July 1, 2012, the project will remain subject to the old Part II C technical criteria in perpetuity.*

Step 3: Calculating Additional Required Reductions

The post-development 50% impervious land cover condition has an associated total phosphorous loading of 1.14 lbs TP/ac/yr (calculated using the Simple Method). To calculate the additional offsets that will be necessary for the site, the permittee should subtract the phosphorous loading associated with a 16% average impervious land cover condition (0.45 lbs TP/ac/yr) from the load calculated using the simple method for the higher average land cover condition:

1.14 lbs TP/ac/yr - 0.45 lbs TP/ac/yr = 0.69 lbs TP/ac/yr

By the end of the first permit cycle, the permittee is required to offset 35.0% of this increased load:

0.69 lbs TP/ac/yr * .35 = 0.242 lbs TP/ac/yr

Since the project is a 10 acre site, the total pounds that must be offset for this site for this permit cycle is:

10 acre site * 0.242 lbs/ac/yr = 2.42 lbs TP/yr (2.4 lbs TP/yr)

The permittee must offset 2.4 lbs TP/yr for this site by the end of the permit term. By the end of the next permit term, the permittee will need to offset an additional 60% of the increased load from this project, and it is expected that by the end of the third permit cycle, the increased loading from the site will be fully offset.

To calculate the TN loading rate reduction required by the end of this MS4 permit cycle and TSS loading rate reduction required by the end of this MS4 permit cycle, the permittee will need to use the ratio table provided in the permit. For the James River Basin, the POC ratios are those shown in GP Part II.A.5, *Table 4*, an excerpt of which is provided below (*Table II.1*):

Table II.1 – Ratio of Phosphorous Loading Rate to Nitrogen and Total Suspended Solids Loading Rates for the James River Basin[8]

Ratio of Phosphorous to Other POCs (Based on All Land Uses 2009 Progress Run)	Phosphorous Loading Rate (lbs/ac)	Nitrogen Loading Rate (lbs/ac)	Total Suspended Solids Loading Rate (lbs/ac)
James River Basin	1.0	5.2	420.9

To calculate the additional reductions required for TN for this project the permittee first needs to use the conversion table to calculate the lbs TN/ac/yr that must be reduced as a result of 50% impervious land cover condition:

2.42 lbs TP/ac/yr * $(5.2\ lbs\ TN/ac / 1.0\ lbs\ TP/ac)$ = 1.26 lbs TN/ac/yr

The permittee should then calculate the TN offsets that must be made for this 10 acre project:

1.26 lbs TN/ac/yr * 10 acres = 12.60 lbs TN/yr (13 lbs TN/yr)

Similar calculations must be performed to determine the offsets for total suspended solids loading rate. Again, the permittee first needs to use the conversion table provided in the permit to determine the lbs TSS/ac/yr that must be reduced as a result of 50% impervious land cover condition.

0.242 lbs TP/ac/yr * $(420.9\ lbs\ TSS/ac / 1.0\ lbs\ TP/ac)$ = 101.85 lbs TSS/ac/yr

The permittee should then calculate the TSS offsets that must be made for this 10 acre project:

101.85 lbs TSS/ac/yr * 10 acres = 1018.50 lbs TSS/yr (1019 lbs TSS/yr)

[8] Table values for the James River Basin can be found in the General Permit or Appendix 1 of this document.

For this project, by the end of the first permit cycle, the permittee must offset an additional 2.4 lbs TP/yr, 13 lbs TN/yr, and 1019 lbs TSS/yr. By the end of the next permit term, the permittee will need to offset an additional 60% of the increased load from this project, and it is expected that by the end of the third permit cycle, the increased loading from the site will be fully offset.

NOTE: Permittees may report the impact of offsets required under Special Condition 4 and/or 5 to the Department in aggregate. However, the data and calculations performed to determine these numbers should be kept on hand.

EXAMPLE II.2[9] – Aggregate Accounting for Special Condition Requirement 4

A permittee in the James River Basin had a fee-in-lieu of program in place through July 1, 2012. Due to the variability in the average land cover condition of projects built under this program, the permittee has decided to take an aggregate approach to addressing Special Condition 4. The permittee has 1000 acres of regulated land throughout its service area, which was 50% impervious and 50% pervious as of June 30, 2009. To estimate the POC reductions required under Special Condition Requirement 4, the permittee first needs to calculate the total POC loads as of June 30, 2009. The permittee should use the "2009 EOS Loading Rate" from Table 3a, Column A, in the permit for this calculation:

Table II.2 – POC Loads as of June 30, 2009 (Pre-Development)

Subsource	Pollutant	Total Existing Acres Served by MS4 as of 06/30/09	2009 EOS Loading Rate (lbs/acre/yr)	Estimated Total POC Load as of 06/30/09 (lbs/yr)
Regulated Urban Impervious	Nitrogen	*500*	9.39	*4,695*
Regulated Urban Pervious		*500*	6.99	*3,495*
Regulated Urban Impervious	Phosphorus	*500*	1.76	*880*
Regulated Urban Pervious		*500*	0.5	*250*
Regulated Urban Impervious	Total Suspended Solids	*500*	676.94	*338,470*
Regulated Urban Pervious		*500*	101.08	*50,540*

As of July 1, 2014, the permittee determines using GIS resources that, as a result of "new sources," the proportion of regulated urban pervious acres to regulated urban impervious acres has changed. The permittee should determine the "post-development" loading rates as a result of the land use change. Again, the "2009 EOS Loading Rate" from Table 3a, Column A, should be used for this calculation:

[9] **NOTE**: This aggregate method captures all changes in regulated urban impervious and regulated urban pervious loads. Permittees may submit alternative aggregate accounting strategies, but they must ensure that the submitted method captures all additional reductions required under Special Condition Requirement 4 (9VAC25-890-40 Part II.A.4).

Table II.3 - Post-Development Conditions July 1, 2014

Subsource	Pollutant	Total Existing Acres Served by MS4 (07/01/14)	2009 EOS Loading Rate (lbs/acre/yr)	Estimated Total POC Load as of 07/01/14 (lbs/yr)
Regulated Urban Impervious	Nitrogen	*600*	9.39	*5,634*
Regulated Urban Pervious		*400*	6.99	*2,796*
Regulated Urban Impervious	Phosphorus	*600*	1.76	*1,056*
Regulated Urban Pervious		*400*	0.5	*200*
Regulated Urban Impervious	Total Suspended Solids	*600*	676.94	*406,164*
Regulated Urban Pervious		*400*	101.08	*40,432*

The permittee should then calculate the difference between the post-development and pre-development land cover condition to estimate the Total Load Change (Regulated Urban Impervious Load Change + Regulated Urban Pervious Load Change).

Table II.4 – Total Load Change from "New Sources" between June 30, 2009 and July 1, 2014

Subsource	Pollutant	Estimated Total POC Load as of 07/01/14 (lbs/yr)	Estimated Total POC Load as of 06/30/09 (lbs/yr)	Load Change (lbs/yr)	Total Load Change (lbs/yr)
Regulated Urban Impervious	Nitrogen	*5,634*	*4,695*	939	
Regulated Urban Pervious		*2,796*	*3,495*	-699	240
Regulated Urban Impervious	Phosphorus	*1,056*	*880*	176	
Regulated Urban Pervious		*200*	*250*	-50	126
Regulated Urban Impervious	Total Suspended Solids	*406,164*	*338,470*	67,694	
Regulated Urban Pervious		*40,432*	*50,540*	-10,108	57,586

The permittee should also take into account BMPs that were installed on site during the development or redevelopment process to meet other VSMP requirements. The POC loads treated by those BMPs should be subtracted from the Total Load Change.

Table II.5 – Net Load Change (Total Load Change – Reductions from implemented BMPs)

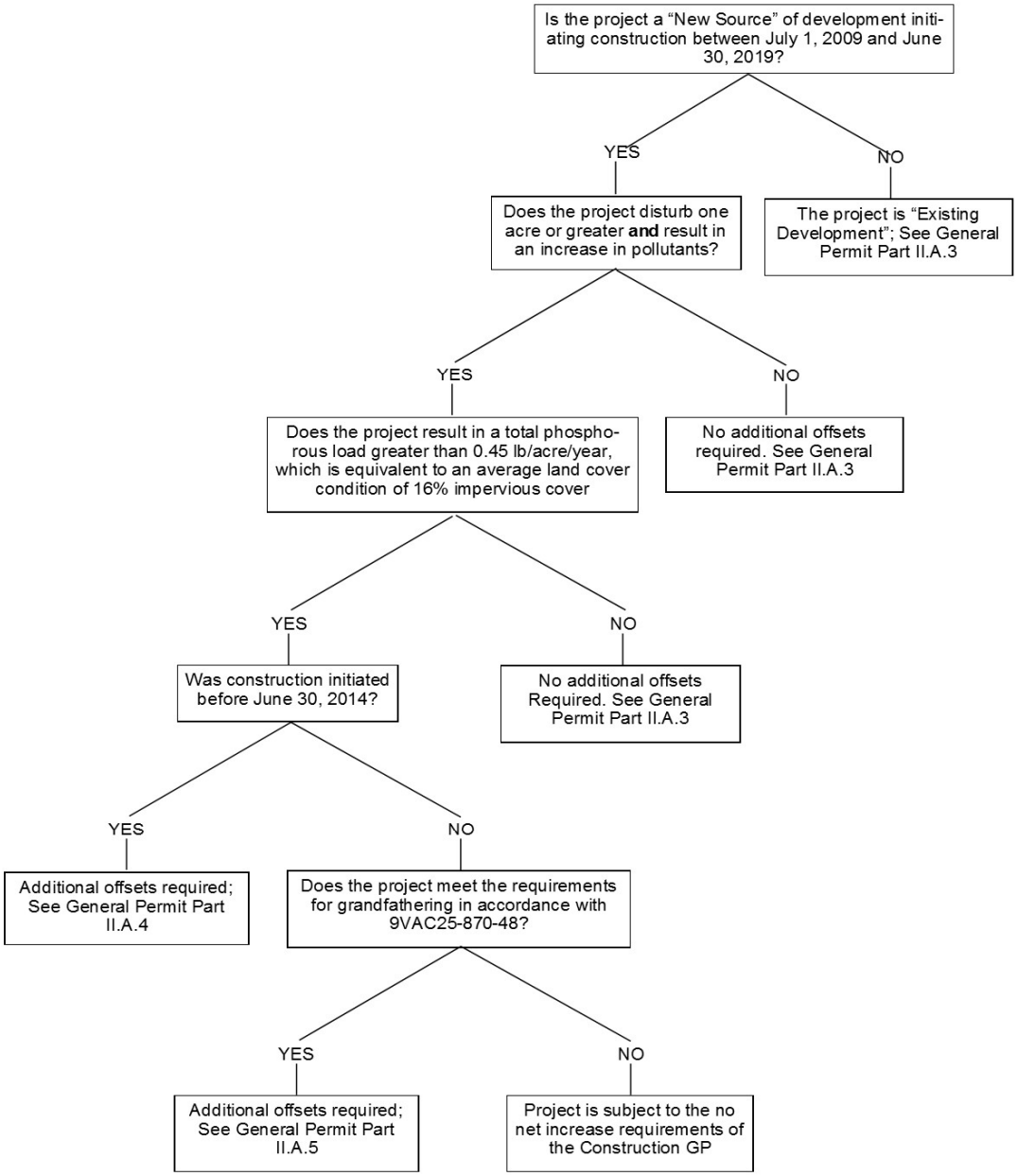
Pollutant	Total Load Change (lbs/yr)	Reductions from on-site BMPs (lbs/yr)	Net Load Change (lbs/yr)
Nitrogen	240	100	140
Phosphorus	126	25	101
Total Suspended Solids	57,586	20,000	37,586

The final column of Table II.5 represents the additional load from New Sources between June 30, 2009, and July 1, 2014, that must be offset. By the end of the second permit cycle, the permittee will need to offset 35.0% of the calculated “Net Load Change.”

Pollutant	Net Load Change (lbs/yr)	Required Reduction during second permit cycle	Additional Reductions Required by the end of the second permit cycle (lbs/yr)
Nitrogen	140	0.35	49
Phosphorous	101	0.35	35
Total Suspended Solids	37,586	0.35	13,155

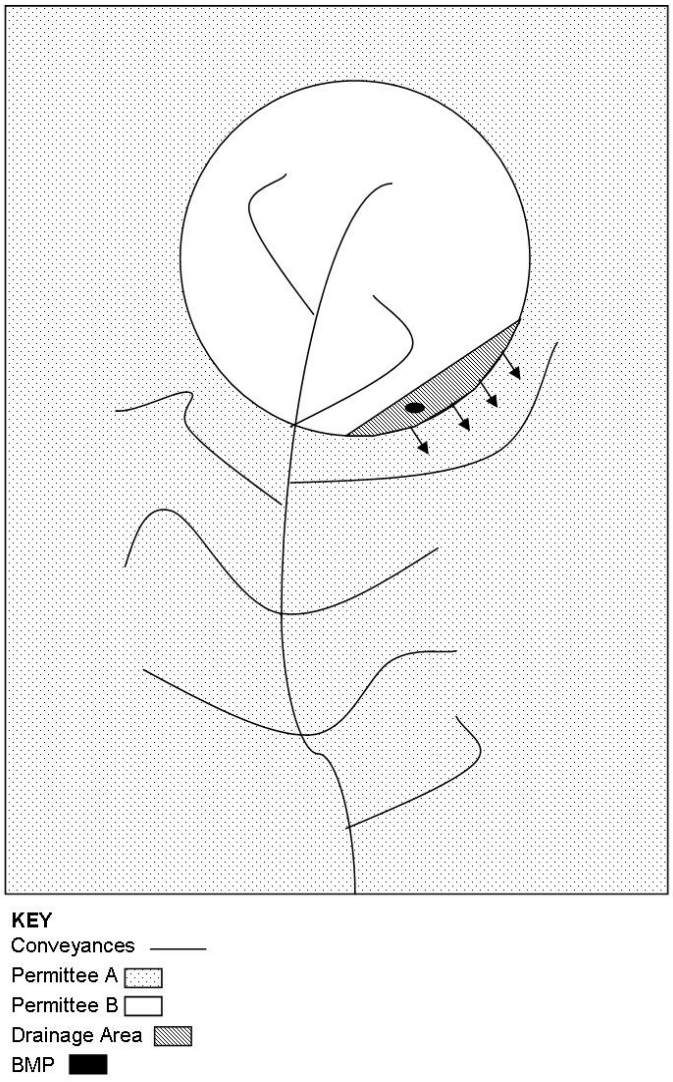
Although this was not the case in this example, if the total load change for any pollutant represents a reduction, the permittee may take credit for the difference and apply it towards the reduction requirements for existing sources.

APPENDIX III – PERMIT POC LOAD REDUCTION FLOW CHART TO DETERMINE OFFSET REQUIREMENTS



APPENDIX IV – MS4 BOUNDARY DIAGRAMS

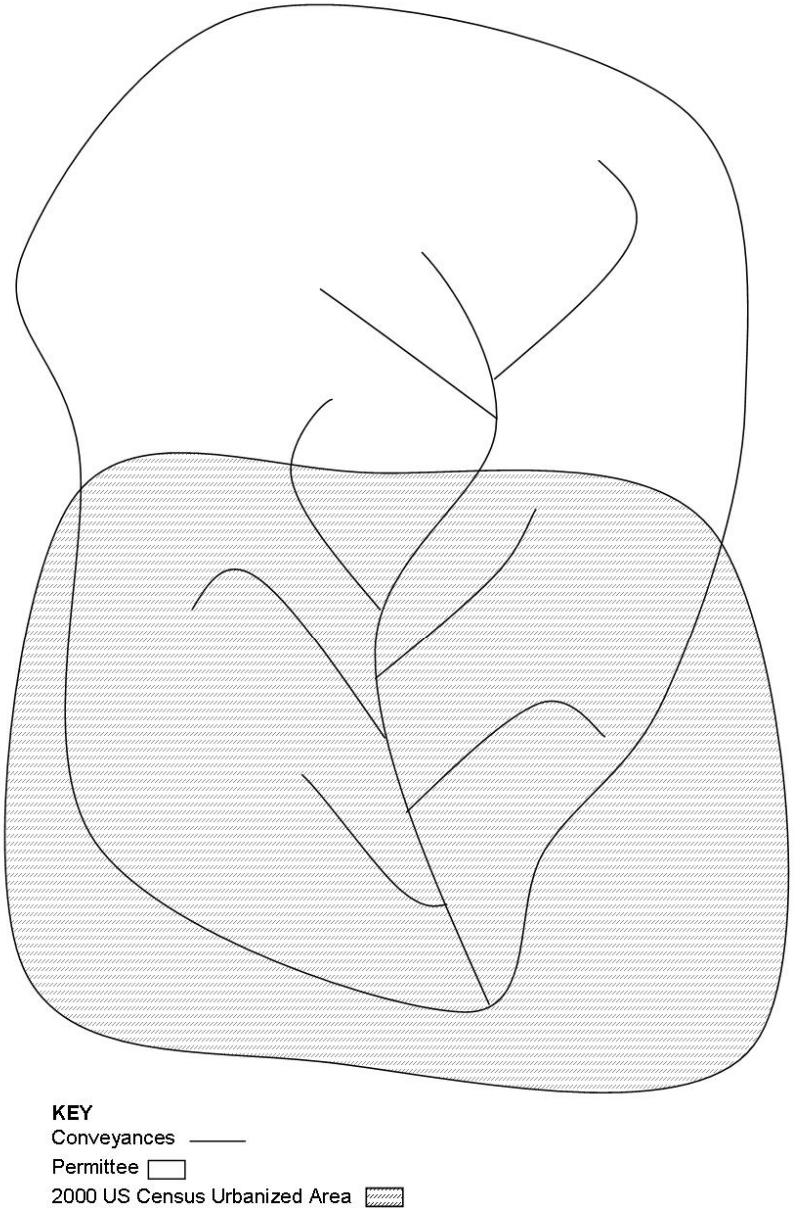
EXAMPLE IV.1 – OVERLAPPING DRAINAGE AREAS



In accordance with 9VAC25-890-40 Part II.A.3, permittees must determine the existing acres *served* by the MS4. The system's service area includes those acres that drain to the permittee's system. Permittee B is located within Permittee A's land area and both permittees are located entirely within a Census Designated Urbanized Area. A portion of Permittee B's land area drains, through sheetflow, to Permittee A's system. Although the shaded drainage area is located within Permittee B's jurisdiction, Permittee A is responsible for the POC loads draining from that land. Alternatives to this approach will be considered as long as all lands are accounted for in reduction calculations.

However, if Permittee B installs a BMP within the shaded Drainage Area, they will receive credit for reductions from the BMP. Regardless, it is highly recommended that permittees work together to reduce POC loads in these instances.

EXAMPLE IV.2 – JURISDICTION EXTENDS BEYOND URBANIZED AREA



A portion of the Phase II permittee's system falls outside of the 2000 US Census Urbanized Area. The Phase II permittee is not responsible for any land area draining to the portion of their system that falls outside the Urbanized Area.

APPENDIX V – CALCULATION METHODOLOGIES

Appendix V.A – Structural BMPs, Methodology I – Virginia Stormwater Clearinghouse BMPs

Appendix V.B – Structural BMPs, Methodology II – Bay Program Retrofit Curves

Appendix V.C – Structural BMPs, Methodology III – Bay Program Established Efficiencies

Appendix V.D – BMP Enhancement, Conversion, and Restoration

Appendix V.E – BMPs installed to Meet Development and Redevelopment Requirements

Appendix V.F – BMP Treatment Trains

Appendix V.G – Street Sweeping

Appendix V.H – Land Use Changes

Appendix V.I – Forest Buffers

Appendix V.J – Urban Stream Restoration

Appendix V.K – Outfall and Gully Stabilization

Appendix V.L – Urban Nutrient Management

Appendix V.M – Development on Prior Developed Lands (Redevelopment)

Appendix V.N – Urban Tree Canopy Expansion

Appendix V.O – Septic Disconnections

Calculated values will be rounded in accordance with the MS4 General Permit Part II.A.8. and displayed in parentheses.

APPENDIX V.A – Virginia Stormwater Clearinghouse BMPs[10]

To be eligible for these efficiencies, the BMP must meet all the design requirements that are listed in the Virginia Stormwater BMP Clearinghouse's technical specification for that BMP, not just the one inch requirement for runoff depth treated. There are no established efficiencies for TSS in the Virginia Stormwater BMP Clearinghouse. To calculate the TSS reductions, permittees should use the retrofit curves developed by the Bay Program or the Bay Program Established Efficiencies. The methodology for using the retrofit curves is detailed in *Appendix V.B*. For additional information about the Virginia Stormwater BMP Clearinghouse requirements, permittees should see the BMP design standards and specs, which can be found at the following link, Virginia Stormwater BMP Clearinghouse.[11]

[10] These efficiencies are up to date as of the publication of this guidance. The most up to date list of approved BMPs and their efficiencies can be found on the Virginia Stormwater BMP Clearinghouse website. If there is a discrepancy between this table and the website, the efficiencies on the website supersede those listed in this table. The TN efficiencies may be found in the bodies of the individual BMP reports.

[11] Virginia Stormwater BMP Clearinghouse, Virginia Department of Environmental Quality and the Virginia Water Resources Research Center, 2019.

Table V.A.1 - Virginia Stormwater BMP Clearinghouse BMPs, Established Efficiencies

Comparative Runoff Reduction and Nutrient Removal for Practices

No.	Practice	Design Level	Runoff Reduction	TN EMC Removal[3]	TN Load Removal	TP EMC Removal	TP Load Removal 6
1	**Rooftop Disconnect** Rooftop[12] Disconnection[15]	*1 2*	*25 to 50 1*	*0*	*25 to 50 1*	*0*	*25 to 50 1*
		No Level 2 Design					
2	**Sheet Flow to Veg. Filter or Conserve Open Space**	*1*	*25 to 50 1*	*0*	*25 to 50 1*	*0*	*25 to 50 1*
		2 5	*50 to 75 1*	*0*	*50 to 75 1*	*0*	*50 to 75 1*
3	**Grass Channels**	*1*	*10 to 20 1*	*20*		*15*	*23*
		No Level 2 Design					
4	**Soil Compost Amendment**	Can be used to Decrease Runoff Coefficient for Turf Cover at Site. See the design specs for Rooftop Disconnection, Sheet Flow to Vegetated Filter or Conserved Open Space, and Grass Channel					
5	**Vegetated Roof**	*1*	*45*	*0*	*45*	*0*	*45*
		2	*60*	*0*	*60*	*0*	*60*
6	**Rainwater Harvesting**	*1*	*Up to 90 3, 5*	*0*	*Up to 90 3, 5*	*0*	*Up to 90 3, 5*
		No Level 2 Design					
7	**Permeable Pavement**	*1*	*45*	*25*	*59*	*25*	*59*
		2	*75*	*25*	*81*	*25*	*81*
8	**Infiltration Practices**	*1*	*50*	*15*	*57*	*25*	*63*
		2	*90*	*15*	*92*	*25*	*93*
9	**Bioretention Practices**	*1*	*40*	*40*	*64*	*25*	*55*
		2	*80*	*60*	*90*	*50*	*90*
9	**Urban Bioretention**	*1*	*40*	*40*	*64*	*25*	*55*
		No Level 2 Design					
10	**Dry Swales**	*1*	*40*	*25*	*55*	*20*	*52*
		2	*60*	*35*	*74*	*40*	*76*
11	**Wet Swales**	*1*	*0*	*25*	*25*	*20*	*20*
		2	*0*	*35*	*35*	*40*	*40*
12	**Filtering Practices**	*1*	*0*	*30*	*30*	*60*	*60*
		2	*0*	*45*	*45*	*65*	*65*
13	**Constructed Wetlands**	*1*	*0*	*25*	*25*	*50*	*50*
		2	*0*	*55*	*55*	*75*	*75*
14	**Wet Ponds**	*1*	*0*	*30 (20) 4*	*30 (20) 4*	*50 (45) 4*	*50 (45) 4*
		2	*0*	*40 (30) 4*	*40 (30) 4*	*75 (65) 4*	*75 (65) 4*
15	**Ext. Det. Ponds**	*1*	*0*	*10*	*10*	*15*	*15*
		2	*15*	*10*	*24*	*15*	*31*

[12] **NOTE:** There are no Bay Program equivalent efficiency BMPs for Rooftop Disconnection and Rainwater Harvesting. Permittees must use the VA Stormwater Clearinghouse technical criteria and efficiencies to receive credit for these practices.

	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 the tank is sized such that no overflow occurs. The total credit may not 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. 6 Total mass load removed is the product of annual runoff reduction rate and change in nutrient EMC.

EXAMPLE V.A.1

A small Phase II MS4 with 1000 acres of regulated urban impervious surface and 1000 acres of regulated urban pervious surface is located in the James River Basin. The permittee is planning to implement a constructed wetland that will treat a 50 acre site that is 40% impervious surface and 60% pervious surface.

Prior to considering this project, the permittee has filled out Table 3a in their permit, which is incorporated into this example for reference. The permittee will use the loading rates in Table 3a, Column A to determine the loads draining to the proposed BMP and calculate the required reductions in the second permit cycle. This calculation will provide the necessary reductions for the second permit cycle in pounds.

Calculation Sheet for Estimating Existing Source Loads and Reductions for the James River Basin

(*Based on Chesapeake Bay Program Watershed Model Phase 5.3.2)

Table 3a
Calculation Sheet for Estimating Existing Source Loads and Reduction Requirements for the James River, Lynnhaven, and Little Creek Basins

		A	B	C	D	E	F	G
Pollutant	Subsource	Loading rate (lbs/ac/yr)[1]	Existing developed lands as of 6/30/09 served by the MS4 within the 2010 CUA (acres)[2]	Load(lbs/yr)[3]	Percentage of MS4 required Chesapeake Bay total L2 loading reduction	Percentage of L2 required reduction by 6/30/2023	35% reduction Required by 6/30/2023 (lbs/yr)[4]	Sum of 35% reduction (lb/yr)[5]
Nitrogen	Regulated urban impervious	9.39	1000	9,390	9%	35%	296	443
	Regulated urban pervious	6.99	1000	6,990	6%	35%	147	
Phosphorus	Regulated urban impervious	1.76	1000	1,760	16%	35%	99	112
	Regulated urban pervious	0.5	1000	500	7.25%	35%	13	
Total suspended solids	Regulated urban impervious	676.94	1000	676,940	20%	35%	47,386	50,482
	Regulated urban pervious	101.08	1000	101,080	8.75%	35%	3,096	

[1]Edge of stream loading rate based on the Chesapeake Bay Watershed Model Progress Run 5.3.2.

[2]To determine the existing developed acres required in Column B, permittees should first determine the extent of their regulated service area based on the 2010 Census urbanized area (CUA). Next, permittees will need to delineate the lands within the 2010 CUA served by the MS4 as pervious or impervious as of the baseline date of June 30, 2009.

[3]Column C = Column A x Column B.

[4]Column F = Column C x Column D x Column E.

[5]Column G = The sum of the subsource cumulative reduction required by 6/30/23 (lbs/yr) as calculated in Column F.

Based on the calculations in the table, the permittee must achieve reductions of 43 lbs TN, 112 lbs TP, and 50,482 lbs TSS within the second permit cycle. Although this table divides the loads by regulated impervious and regulated pervious, the BMP's efficiencies are applied to the entire POC load, not just the load from the impervious acres. The MS4 intends to offset a portion of this load by installing a constructed wetland to treat a 50 acre site that is 40% impervious (20 acres) and 60% pervious (30 acres).

The BMP being installed meets all the design requirements for the Virginia Stormwater BMP Clearinghouse "Constructed Wetland #1," which has a TN reduction efficiency of 25% and a TP reduction efficiency of 50% (*Table V.A 1*). The BMP's efficiency can be translated into pounds by first calculating the site's POC loading without the BMP. Recall that the BMP is being installed to treat land that is 20 acres impervious and 30 acres pervious surface. The acres should be multiplied by the 2009 EOS loading rate for the appropriate basin (*Appendix I, Table 3a)*. For TN:

$$20\ acres * 9.39\ lbs\ TN/ac/yr = 187.8\ lbs\ TN/yr$$

and for pervious surface:

$$30\ acres * 6.99\ lbs\ TN/ac/yr = 209.7\ lbs\ TN/yr$$

These calculated TN loads should be multiplied by the TN efficiency for a constructed wetland as provided in *Table V.A.1*.

$$187.8\ lbs\ TN/yr * 0.25 = 46.95\ lbs\ TN/yr$$

$$209.7\ lbs\ TN/yr * 0.25 = 52.43\ lbs\ TN/yr$$

Therefore, the total nitrogen reduction from the constructed wetland is:

$$46.95\ lbs\ TN/yr + 52.43\ lbs\ TN/yr = 99.38\ lbs\ TN/yr$$ (99 lbs TN/yr)

With the installation of this BMP, the permittee has reduced its annual load of nitrogen by 99 lbs. With this BMP, the permittee has met the reduction requirements for the first permit cycle for nitrogen. The reductions that are achieved for TP can be calculated using the same methodology. To calculate the reductions for TSS, see *Appendix V.B* or *Appendix V.C.*

APPENDIX V.B – Chesapeake Bay Program, Retrofit Curves/Equations

This credit calculation method should be used when a BMP cannot meet the Virginia Stormwater BMP Clearinghouse criteria. The *Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Retrofit Projects* (October 2012) provided "Retrofit Curves" as an acceptable method for determining BMP efficiency. A FAQ published by the Bay Program in May 2013 indicated that the log curves in the October report be superseded by 5th order polynomial equations. The Expert Panel report curves were updated to reflect this change in January 2015. These equations may not provide the same efficiencies as the retrofit curves previously incorporated into this section of the guidance document. To use the updated retrofit equations or curves, the permittee must first estimate the runoff depth treated per impervious acre by the BMP. This can be done using the following equation:

$$RD = \frac{(RS)(12)}{IA}$$

Where

RD = Runoff Depth Treated (inches)
RS = Runoff Storage (acre-feet)
IA = Impervious Acres (acres)

Runoff Depth or Runoff Storage can be estimated by the engineer who designed the BMP. **NOTE: The previous version of this guidance document stated that permittees could use the Runoff Reduction Method Spreadsheet to estimate a BMP's Runoff Storage for use in this equation. However, upon further review, it was determined that using the "Runoff Reduction" cell is not an appropriate method, as it results in the "runoff storage" being counted twice.**

BMPs are categorized as either a Runoff Reduction (RR) Practice or a Stormwater Treatment (ST) Practice (*Table V.B.1)*. Once the runoff depth treated ("X") and BMP type are defined, the user will be able to estimate the total removal percentage using the retrofit curves or equations. **NOTE: The Bay Program retrofit equations and/or curves CANNOT be used for dry ponds or extended detention ponds. Permittees may use either the Bay Program Established Efficiencies or the VA Clearinghouse efficiencies to determine reductions from these practices.**

Table V.B.1 - BMP Characterization for Nutrient Curves

Classification of BMPs based on Runoff reduction capability[1]	
Runoff Reduction Practices (RR)	*Stormwater Treatment Practices (ST)* [2]
Site Design/Non-Structural Practices	
Landscape Restoration/Reforestation	
Riparian Buffer Restoration	Constructed Wetlands
Rooftop Disconnection (aka Simple Disconnection to Amended Soils, to a Conservation Area, to a Pervious Area, Non-Rooftop Disconnection)	Filtering Practices (aka Constructed Filters, Sand Filters, Stormwater Filtering Systems)
Sheetflow to Filter/Open Space* (aka Sheetflow to Conservation Area, Vegetated Filter Strip)	Proprietary Practices (aka Manufactured BMPs)
All Non-structural BMPS – Chapter 5 of the 2006 Pennsylvania Stormwater BMP Manual	Wet Ponds (aka Retention Basin)
Practices	Wet Swale
All ESD practices in MD 2007	
Bioretention or Rain Garden (Standard or Enhanced)	
Dry Channel Regenerative Stormwater Conveyance (aka Step Pool Storm Conveyance)	
Dry Swale	
Expanded Tree Pits	
Grass Channels (w/ Soil Amendments, aka Bioswale, Vegetated Swale)	
Green Roof (aka Vegetated Roof)	
Green Streets	
Infiltration (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)	
*May include a berm or a level spreader [1]Refer to DC, MD, PA, VA or WV State Stormwater Manuals for more information [2] Dry ED ponds have limited removal capability , their efficiency is calculated using rates in Table A-4, Appendix A in the Expert Panel Report on Stormwater Retrofits referenced below	

More information concerning the retrofit equation calculations can be found in the Bay Program's:

- *Frequently Asked Questions (FAQ) for Recently Approved Urban BMPs*, May 2015 at: http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2013/10/Revised-Perf-Standards-and-Retrofits_FAQ-Document_052515.pdf and more information concerning the retrofit curves can be found in the Bay Program's:
- *Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Retrofit Projects*, January 2015, at: http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2012/10/Final-CBP-Approved-Expert-Panel-Report-on-Stormwater-Retrofits-long_012015.pdf

The retrofit polynomial equations and curves are provided below and also provide an effective method to determine removal efficiencies for TN, TP and TSS.

Table V.B.2 – Retrofit Equations

TN	RR	$y = 0.0308x^5 - 0.2562x^4 + 0.8634x^3 - 1.5285x^2 + 1.501x - 0.013$
	ST	$y = 0.0152x^5 - 0.131x^4 + 0.4581x^3 - 0.8418x^2 + 0.8536x - 0.0046$
TP	RR	$y = 0.0304x^5 - 0.2619x^4 + 0.9161x^3 - 1.6837x^2 + 1.7072x - 0.0091$
	ST	$y = 0.0239x^5 - 0.2058x^4 + 0.7198x^3 - 1.3229x^2 + 1.3414x - 0.0072$
TSS	RR	$y = 0.0326x^5 - 0.2806x^4 + 0.9816x^3 - 1.8039x^2 + 1.8292x - 0.0098$
	ST	$y = 0.0304x^5 - 0.2619x^4 + 0.9161x^3 - 1.6837x^2 + 1.7072x - 0.0091$

Please note that the TN adjustor curve has been revised and is provided below. It was determined that the original TN adjustor curves developed by the expert panel may have over-estimated the TN removal rates and were revised to reflect the movement of untreated nitrate from runoff reduction BMPs. The discounting is not needed for TKN, TP or TSS, as these pollutants are not mobile in urban groundwater. The revised parameter would not need to be defined for stormwater treatment (ST) practices as this factor has already been taken into account.

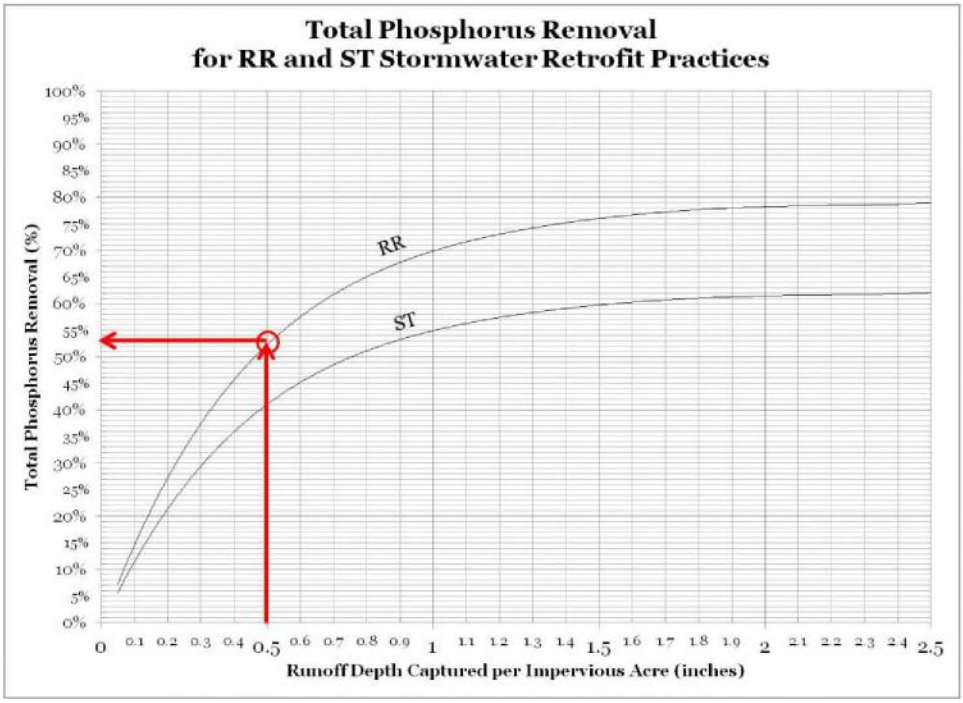


Figure 1 - Retrofit Pollutant Removal Adjustor Curve for Total Phosphorous (TP)

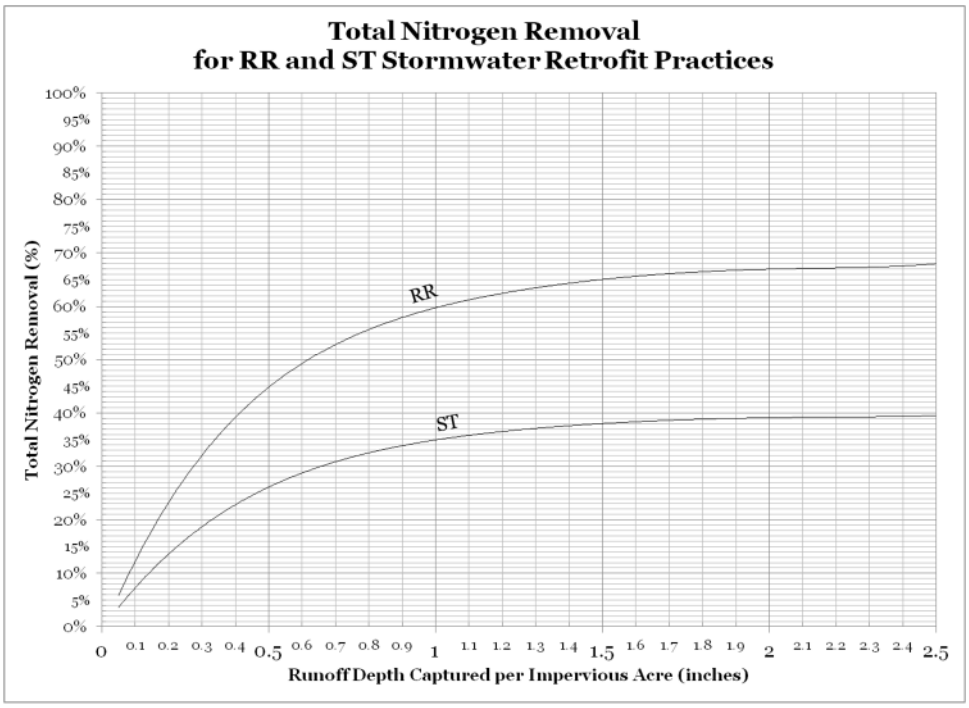


Figure 2 - Retrofit Pollutant Removal Adjustor Curve for Total Nitrogen (TN)

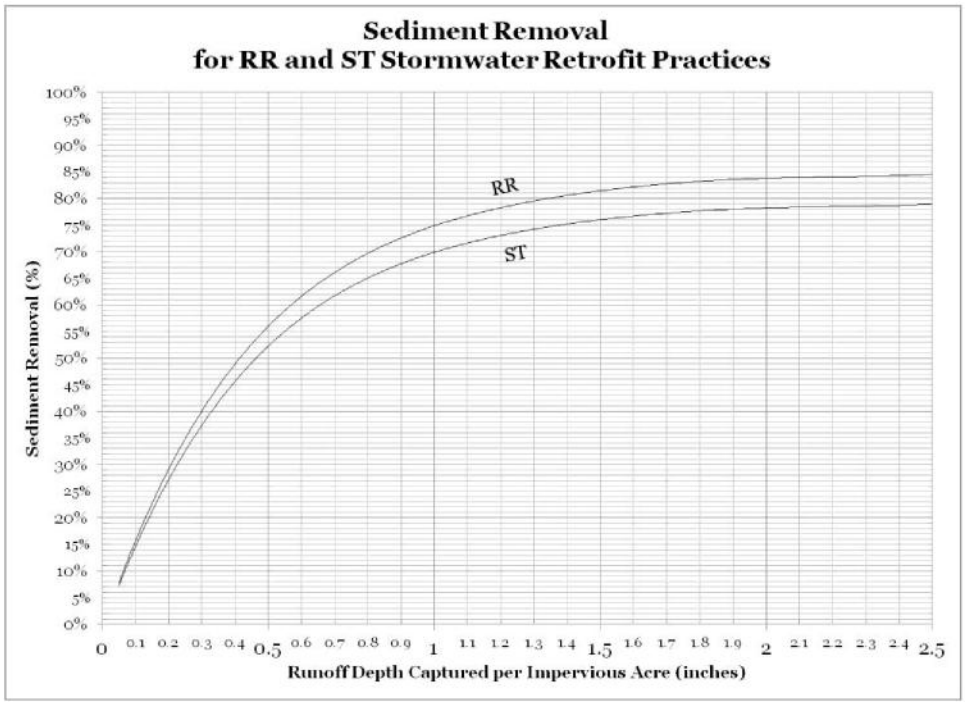


Figure 3 - Retrofit Pollutant Removal Adjustor Curve for Total Sediment (Suspended Solids)

EXAMPLE V.B.1

A small Phase II MS4 with 1000 acres of regulated urban impervious surface and 1000 acres of regulated urban pervious surface is located in the James River Basin. A constructed wetland is planned to treat a 50 acre site that is 40% impervious surface and 60% pervious surface.

Prior to considering this project, the permittee has filled out Table 3a in their permit, which is incorporated into this example for reference and must be used to calculate the required reductions for the second permit cycle. The permittee will use the loading rates in Table 3a, Column A to determine the loads draining to the proposed BMP. This calculation will provide the necessary reductions for the second permit cycle in pounds:

Table V.B.1 - Calculation Sheet for Estimating Existing Source Loads and Required Reductions for the James River Basin(*Based on Chesapeake Bay Program Watershed Model Phase 5.3.2)

Table 3a
Calculation Sheet for Estimating Existing Source Loads and Reduction Requirements for the James River, Lynnhaven, and Little Creek Basins

		A	B	C	D	E	F	G
Pollutant	Subsource	Loading rate (lbs/ac/yr)[1]	Existing developed lands as of 6/30/09 served by the MS4 within the 2010 CUA (acres)[2]	Load (lbs/yr)[3]	Percentage of MS4 required Chesapeake Bay total L2 loading reduction	Percentage of L2 required reduction by 6/30/2023	35% reduction Required by 6/30/2023 (lbs/yr)[4]	Sum of 35% reduction (lb/yr)[5]
Nitrogen	Regulated urban impervious	9.39	1,000	9,390	9%	35%	296	443
	Regulated urban pervious	6.99	1,000	6,990	6%	35%	147	
Phosphorus	Regulated urban impervious	1.76	1,000	1,760	16%	35%	99	112
	Regulated urban pervious	0.5	1,000	500	7.25%	35%	13	
Total suspended solids	Regulated urban impervious	676.94	1,000	676,940	20%	35%	47,386	50,482
	Regulated urban pervious	101.08	1,000	101,080	8.75%	35%	3096	

[1]Edge of stream loading rate based on the Chesapeake Bay Watershed Model Progress Run 5.3.2.
[2]To determine the existing developed acres required in Column B, permittees should first determine the extent of their regulated service area based on the 2010 Census urbanized area (CUA). Next, permittees will need to delineate the lands within the 2010 CUA served by the MS4 as pervious or impervious as of the baseline date of June 30, 2009.
[3]Column C = Column A x Column B.
[4]Column F = Column C x Column D x Column E.
[5]Column G = The sum of the subsource cumulative reduction required by 6/30/23 (lbs/yr) as calculated in Column F.

Based on the calculations in the table (9VAC25-890-40 Part II.A.3), the permittee must achieve reductions of443 lbs TN, 112 lbs TP, -and 50,482 lbs TSS within the second permit cycle. Although this table divides the loads by regulated urban impervious acres and regulated urban pervious acres, the BMP's efficiencies are applied to the entire POC load, not just the load from the impervious acres. The MS4 intends to offset a portion of this load by installing a constructed wetland to treat a 50 acre site that is 40% impervious (20 acres) and 60% pervious (30 acres).

A constructed wetland is an efficiency BMP. As recommended in the guidance, the permittee intends to use the retrofit curves to calculate the percent removal accomplished by the BMP. To do this, the permittee needs to estimate (1) the BMP's runoff storage in acre-feet and (2) the number of impervious acres draining to the BMP. The design engineer determines that the runoff storage of the BMP is 1.25 acre-feet. The runoff depth can be estimated using the "Runoff Depth Treated" equation:

$$\frac{(1.25\ acre-feet)(12)}{20\ acres} = 0.75\ in$$

The runoff depth treated by the constructed wetland is 0.75 inch. From there, the retrofit curves can be used to estimate the removal efficiencies for TP, TN, and TSS. Based on *Table V.B.1* the permittee determines that constructed wetlands are a stormwater treatment (ST) BMP. Using the curves in *Figures 1, 2, and 3,* the permittee estimates that the removal rates are:

TN	TP	TSS
30%	47%	60%

The BMP's efficiency can be translated into pounds by first calculating the site's POC loading without the BMP. Recall that the BMP is being installed to treat land that is 20 acres impervious and 30 acres pervious surface. The acres should be multiplied by the 2009 EOS loading rate for the appropriate basin (*Appendix I, Table 2a)*. For TN:

$$20\ acres * 9.39\ lbs\ TN/ac/yr = 187.8\ lbs\ TN/yr$$

and for pervious surface:

$$30\ acres * 6.99\ lbs\ TN/ac/yr = 209.7\ lbs\ TN/yr$$

These values should be multiplied by the BMP's efficiency for TN that was calculated above.

$$187.8\ lbs\ TN/yr * 0.30 = 56.34\ lbs\ TN/yr$$

$$209.7\ lbs\ TN/yr * 0.30 = 62.91\ lbs\ TN/yr$$

Therefore, the TN reduction from the constructed wetland is:

$$56.34\ lbs\ TN/yr + 62.91\ lbs\ TN/yr = 119.25\ lbs\ TN/yr$$ (119 lbs TN/yr)

With the installation of this BMP, the permittee has reduced its annual load of nitrogen by 119 lbs. With this BMP, the permittee has met the reduction requirements for the first permit cycle for nitrogen. The reductions that are achieved for the other POC can be calculated using the same procedure.

APPENDIX V.C - Chesapeake Bay Program, Established Efficiencies

As an alternative to using the Bay Program Curves, permittees may use the Bay Program's established efficiencies for BMPs that are provided in Table V.C.1 below. The Chesapeake Bay Program established efficiencies are listed at the following BMP Verification Committee website link:: Chesapeake Bay Program BMP established efficiencies. These efficiencies may be used for BMPs that do not meet the Virginia Stormwater BMP Clearinghouse design specifications.

Table V.C.1 – Chesapeake Bay Program BMPs, Established Efficiencies

BMP	Nitrogen Percent Effectiveness	Phosphorus Percent Effectiveness	Sediment Percent Effectiveness
Bioretention/raingardens	75	70	80
Bioswale	75	70	80
Dry Detention Ponds and Hydrodynamic Structures	5	10	10
Stormwater to the Maximum Extent Practicable (SW to the MEP)	50	60	90
Erosion and Sediment Control	25	40	40
Erosion and Sediment Control on non-regulated pervious urban	25	40	40
Erosion and Sediment Control on extraction land use	25	40	40
Dry Extended Detention Ponds	20	20	60
Urban Filtering Practices	40	60	80
*Urban Forest Buffers	*	*	*
Urban Infiltration Practices - no sand\veg no underdrain	80	85	95
Urban Infiltration Practices - with sandveg no underdrain	85	85	95
Permeable Pavement - no sandveg with underdrain with AB soils	50	45	70
Permeable Pavement - with sandveg with underdrain with AB soils	50	50	70
MS4 Permit-Required Stormwater Retrofit	25	35	65
*Street sweeping 25 times a year	*	*	*
Urban Nutrient Management	17	22	0
Vegetated Open Channel - Urban	45	45	70
Wet Ponds and Wetlands	20	45	60

* See most recent expert panel reports

BMP efficiencies for wetland restoration vary depending on hydrogeomorphic region as listed below in *Table V.C.2*. To use this table the permittee will need to determine which region their MS4 is in and use the appropriate efficiency. If the permittee is unsure which Hydrogeomorphic Region it is located in, resources are available through the Chesapeake Bay Program at:

https://www.chesapeakebay.net/what/maps/hydrogeomorphic_regions.

If you have questions regarding which region designation would apply to your project, please contact the Central Office of DEQ in Richmond.

Table V.C.2 – Chesapeake Bay Program BMPs, Established Efficiencies Regionally Impacted

Chesapeake Bay Program Hydrogeomorphic Region affected efficiencies				
BMPs	Region	TN	TP	TSS
Wetland Restoration	Appalachian Plateau Siliciclastic Non-Tidal; Appalachian Plateau Carbonate Non Tidal	7.0%	12%	4.0%
Wetland Restoration	Coastal Plain Dissected Uplands Non-Tidal; Coastal Plain Dissected Uplands Tidal; Coastal Plain Lowlands Tidal; Coastal Plain Uplands Tidal; Coastal Plain Lowlands Non-Tidal; Coastal Plain Uplands Non-Tidal	25%	50%	15%
Wetland Restoration	Blue Ridge Non-Tidal; Mesozoic Lowlands Non-Tidal; Valley and Ridge Carbonate Non-Tidal; Piedmont Crystalline Non-Tidal; Piedmont Carbonate Non-Tidal; Valley and Ridge Siliciclastic Non-Tidal	14%	26%	8.0%

EXAMPLE V.C.1

A small Phase II MS4 with 1000 acres of regulated urban impervious surface and 1000 acres of regulated urban pervious surface is located in the James River Basin. A bioswale is planned to treat a 5 acre site that is 40% impervious surface and 60% pervious surface.

Prior to considering this project, the permittee has filled out Table 3a in their permit. The loading rates provided in Table 3a, Column A for the James River Basin are incorporated into this example for reference. The permittee will use the loading rates in the Calculation Sheet below to determine the loads draining to the proposed BMP and the loading reduction rates for the second permit cycle. This calculation will provide the necessary reductions for the second permit cycle in pounds:

Calculation Sheet for Estimating Existing Source Loads for the James River Basin (Based on Chesapeake Bay Program Watershed Model Phase 5.3.2)

		A	B	C	D	E	F	G
Pollutant	Subsource	Loading rate (lbs/ac/yr)[1]	Existing developed lands as of 6/30/09 served by the MS4 within the 2010 CUA (acres)[2]	Load(lbs/yr)[3]	Percentage of MS4 required Chesapeake Bay total L2 loading reduction	Percentage of L2 required reduction by 6/30/2023	40% cumulative reduction Required by 6/30/2023 (lbs/yr)[4]	Sum of 40% cumulative reduction (lb/yr)[5]
Nitrogen	Regulated urban impervious	9.39	1,000	9,390	9%	35%	296	443
	Regulated urban pervious	6.99	1,000	6,990	6%	35%	147	
Phosphorus	Regulated urban impervious	1.76	1,000	1,760	16%	35%	99	112
	Regulated urban pervious	0.5	1,000	500	7.25%	35%	13	
Total suspended solids	Regulated urban impervious	676.94	1,000	676,940	20%	35%	47,386	50,482
	Regulated urban pervious	101.08	1,000	101,080	8.75%	35%	3,096	

[1]Edge of stream loading rate based on the Chesapeake Bay Watershed Model Progress Run 5.3.2.

[2]To determine the existing developed acres required in Column B, permittees should first determine the extent of their regulated service area based on the 2010 Census urbanized area (CUA). Next, permittees will need to delineate the lands within the 2010 CUA served by the MS4 as pervious or impervious as of the baseline date of June 30, 2009.

[3]Column C = Column A x Column B.

[4]Column F = Column C x Column D x Column E.

[5]Column G = The sum of the subsource cumulative reduction required by 6/30/23 (lbs/yr) as calculated in Column F.

Based on the calculations in the table (9VAC25-890-40 Part II.A.3), the permittee must achieve reductions of 60 lbs TN, 12 lbs TP, and 7110 lbs TSS within the first permit cycle. Although this table divides the loads by regulated urban impervious acres and regulated urban pervious acres, the BMP's efficiencies are applied to the entire POC load, not just the load from the impervious acres. The MS4 intends to offset a portion of this load by installing a bioswale to treat a 5 acre site that is 40% impervious (2 acres) and 60% pervious (3 acres).

The BMP's efficiency can be translated into pounds by first calculating what the site's POC loading would be without the BMP. Recall that the BMP is being installed to treat land that is 2 acres impervious and 3 acres pervious surface. The acres should be multiplied by the 2009 EOS loading rate for the appropriate basin (*Appendix I, Table 3a)*. For TN:

$$2\ acres * \ 9.39\ lbs\ TN/ac/yr = \ 18.78\ lbs\ TN/yr$$

and for pervious surface:

$$3\ acres * \ 6.99\ lbs\ TN/ac/yr = \ 20.97\ lbs\ TN/yr$$

These values should be multiplied by the BMP's efficiency for TN that was calculated above.

$$18.78\ \ lbs\ TN/yr\ * \ 0.75\ = \ 14.09\ lbs\ TN/yr$$

$$20.97\ lbs\ TN/yr * \ 0.75 = \ 15.73\ lbs\ TN/yr$$

Therefore, the total nitrogen reduction from the bioswale is:

$$14.09\ lbs\ TN/yr + \ 15.73\ lbs\ TN/yr = \ 29.82\ lbs\ TN/yr$$ (30 lbs TN/yr)

With the installation of this BMP, the permittee has reduced its annual load of nitrogen by 30 lbs. The permittee will need to implement additional BMPs to reduce the remaining 30 lbs of nitrogen. The reductions that are achieved for the other POC can be calculated using the same procedure.

Floating Treatment Wetlands, Urban Filter Strips and Shoreline Management have also been approved for allowable crediting with the installation of these type of BMPs. For more information regarding the requirements, please contact the DEQ Central Office.

APPENDIX V.D – BMP Enhancement, Conversion, and Restoration[13]

The credit permittees will receive for BMP Enhancement, Conversion, and/or Restoration should be calculated using an incremental rate (enhanced BMP efficiency minus existing BMP efficiency). The permittee should apply the difference between the existing BMPs efficiency and the enhanced or converted BMP's efficiency to the load that is draining to the BMP to calculate the POC reduction that will be credited.

To receive credit for BMP restoration, the project must meet the criteria for a "major restoration." Please see the *Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Retrofit Projects* to determine if a project qualifies as a major restoration. The report may be found at*:* *http://chesapeakestormwater.net/wp-content/uploads/dlmuploads/2012/10/Final-CBP-Approved-Expert-Panel-Report-on-Stormwater-Retrofits-long012015.pdf.*

EXAMPLE V.D.1

The same small MS4 is planning to convert a Dry Extended Detention Pond to a Wet Pond. A 10 acre site that is 50% impervious (5 acres) and 50% pervious (5 acres) drains to the existing Pond and the planned upgrades will not alter the BMP's drainage area. Using the same method that was used in *Example V.A.1* and *Example V.B.1* the permittee calculates that the loads draining to the pond are:

for impervious surface:

$$5\ acres * 9.39\ lbs\ TN/ac/yr = 46.95\ lbs\ TN/yr$$

and for pervious surface:

$$5\ acres * 6.99\ lbs\ TN/ac/yr = 34.95\ lbs\ TN/yr$$

To calculate the credits for this conversion, the permittee first needs to estimate the removal efficiency of the existing Dry Extended Detention pond. The initial pond was not built to meet VA Stormwater BMP Clearinghouse standards, so the permittee chooses to use the accepted Bay Program Efficiencies as its starting point. For Dry Extended Detention Ponds the accepted Bay Program removal efficiencies are:

TN	TP	TSS
20%	20%	60%

Next, the permittee must estimate the efficiency of the Wet Pond that will result from the conversion. For this, the permittee elects to use the Bay Program Curves since, as the result of design constraints, the newly converted pond cannot meet all of the Clearinghouse standards for that BMP type. Using the same process described in *Appendix V.B* the permittee estimates the new Wet Pond will have a runoff depth treated of one inch. Since Wet Ponds are an ST practice, the permittee uses the provided curves[14] to estimate that the pollutant removal rates are:

TN	TP	TSS
33%	52%	66%

[13] When enhancing, converting, or restoring existing BMPs and/or impoundments, any existing water quantity criteria should be maintained to avoid potential flooding or additional stream erosion downstream of the BMP.

[14] This example and all other examples in this guidance use the polynomial set of Bay Program Curves

To determine the credits, the permittee must subtract the efficiencies from the existing Dry Pond from the efficiencies for the new Wet Pond.

For TN

$$33\% - 20\% = 13\%$$

So, for the nitrogen loads draining to the new Wet Pond the permittee will receive credit for reductions of

13 percent.

$$46.95\ lbs\ TN/yr * 0.13 = 6.104\ lbs\ TN/yr \text{ (6.1 lbs TN/yr)}$$

$$34.95\ lbs\ TN/yr * 0.13 = 4.544\ lbs\ TN/yr \text{ (5.0 lbs TN/yr)}$$

The conversion results in a total increased reduction of 11 lbs TN/yr. The interim efficiencies and pollutant reductions can be calculated using the same method for the other POC.

Existing BMP Efficiency Modification

If the BMP being enhanced, converted, or restored is missing major design elements or is substantially undersized, the permittee may modify the "existing BMP efficiency" that is used to calculate the incremental rate. **NOTE**: Permittees may only use this modification method if the Bay Program Established Efficiencies are used to determine the initial BMP's efficiency prior to an enhancement, conversion, or restoration project. The VA BMP Clearinghouse efficiencies may only be used if all design elements are present. Likewise, the Bay Program curves should not require additional modification to account for missing design elements. Instead, any deficiencies should be captured in a reduced initial runoff storage value for the practice. Permittees will need to exercise their best professional judgment if applying an efficiency modification to an existing BMP. To receive credit for this type of modification, permittees should submit the appropriate supporting documentation to the Department for approval. All documentation supporting that modification should also be made available to the Department for verification upon request.

A Visual Inspection Checklist can be used for any design deficiencies that inhibit the full performance of a BMP when calculating credit for an enhancement, conversion, or restoration. Permittees should document how their modification decisions were made so that the Department may verify that the modification applied was appropriate. Supporting documentation, such as a visual inspection checklist and modification tables should be submitted to the Department in support of modifications. In all cases, best professional judgment should be used.

Permittees may apply a downward modification of up to 10% for each design criteria that is missing or each aspect of the practice that is undersized. The total modification should not exceed 50 percent.

EXAMPLE V.D.2

In reviewing the previous BMP conversion, the permittee determines through a field review that the initial dry pond is eligible for an efficiency modification. BMPs should be modified based on any specific deficiencies present.

For instance, elements specific to dry ponds or dry extended detention ponds that permittees might consider for a modification include:

Missing Design Criteria

For each missing design criterion, the permittee should apply an additional downward modification of 10% to the BMP's initial removal efficiency. Missing Design Criteria for a Dry Pond may include:

- *Absence of a sediment forebay*
- *Absence of a micro pool or other form of protection at the riser outlet*
- *Short-circuiting due to the initial inlet placement (note: short-circuiting can qualify for an efficiency modification only if it is the result of the initial BMP design. If short-circuiting is the result of sediment accumulation, it should not be considered for an efficiency modification)*

and

Undersized Practice

Permittees may modify the efficiency of the BMP downward by 10% if some aspect of the BMPs

original design is undersized. For a dry pond this may include:

- *Small Drainage Area – if the drainage area is 5 acres or less AND the drainage orifice is greater than 3 inches (pre 1999 BMPs only) OR if the Dry Pond has less than a minimum 12 hour draw down time*
- *If the minimum volume of the pond is less than 2 * WQv (where WQv is .5 inches * the area of the impervious cover draining to the pond).*

For the dry pond in question, the permittee determines it was constructed in 1994, is missing a sediment forebay and has no riser outlet protection. The permittee summarizes this information in a spreadsheet for submission to the Department:

Sample Modification Table/Spreadsheet

BMP Type	BMP Location	Modification Type	Downward Modification Applied (%)
Dry Pond	(*Lat, Long*)	Missing Sediment Forebay	10
		No Riser Outlet Protection	10
		Total	20

Based on the review of the BMP, the permittee would be able to apply a 20% downward modification to the initial efficiency of the Dry Extended Detention Pond being enhanced or converted. Therefore, instead of the initial practice having efficiencies of 20%, 20%, and 60% for TN, TP, and TSS (*Table V.C.1,)* the permittee would calculate the efficiencies 20% downward for initial efficiencies of 16%, 16% and 48 percent. These downward modified efficiencies are then used to calculate the incremental efficiencies applied to their POC loads.

Therefore, instead of the calculation shown in *Example V.D.1* to calculate the POC reductions for BMP enhancement from an existing dry extended detention pond to a Wet Pond, the permittee would perform the following calculation to estimate the increased POC reductions from the conversion:

$$33\% - 16\% = 17\%$$

This efficiency is then applied to the calculated load

$$46.95\ lbs\ TN\ /yr * 0.17 = 7.98\ lbs\ TN\ /yr\ (8.0\ \text{lbs TN/yr})$$

$$34.95\ lbs\ TN/yr * 0.17 = 5.94 lbs\ TN/yr\ (6.0\ \text{lbs TN/yr})$$

$$8.0\ lbs\ TN/yr + 6.0\ lbs\ TN\ /yr = 14\ lbs\ TN\ /yr$$

The conversion, with an appropriate modification applied to the existing BMP, results in a total load reduction of 14 lbs TN/yr.

APPENDIX V.E – BMPs installed to Meet Development and Redevelopment Requirements

Permittees will receive full credit for any POC reductions that result from redevelopment projects. For oversized BMPs and stricter development requirements, permittees may receive credit for the difference between the BMP's reductions and the reductions required under the VSMP regulations or other applicable state standards. Under the VSMP regulations, TP serves as an indicator pollutant for TN and TSS and permittees must account for the associated reductions required for those POCs prior to taking credit for reductions that exceed the VSMP requirements.

Permittees may use the conversion factors in Table 4 to account for load reductions that occur as the result of direct reductions in impervious cover. To estimate the credit for TN and TSS from an oversized BMP, the permittee should calculate the proportion of the implemented BMP's total reduction that is available for credit towards the TMDL for TP. The permittee may take credit for the same proportion of the BMP's total reductions for TN and TSS. The following example provides the calculation method permittees should follow to determine reductions from oversized BMPs.

EXAMPLE V.E.1

A permittee in the James River Basin has a new development project that disturbs 10 acres. The site's post-construction average land cover condition is 20%, which has an associated TP load of .52 lbs TP/ac/yr. To meet the VSMP requirements, the permittee needs to install a BMP that reduces the average site load to .45 lbs TP/ac/yr. The permittee decides to install a Wet Pond 1 to treat this site.

Step 1: Determine the proportion of the installed BMP's total TP reductions that may be applied towards the TMDL reduction requirements:

The total TP load for the post-development site is 5.2 lbs TP/yr (.52 lbs TP/ac/yr * 10 acres) and the permittee needs to reduce that site load to 4.5 lbs TP/yr (.45 lbs TP/ac/yr * 10 acres). The total reduction required on the site to meet the VSMP regulations is:

5.2 lbs TP/yr – 4.5 lbs TP/yr = .7 lbs TP/yr reduction required

The Wet Pond 1 the permittee installs has a 50% efficiency for TP in the VA BMP Clearinghouse. The permittee multiples the total site load for TP by the BMP's efficiency and determines that the total reduction the BMP provides for TP is:

5.2 lbs TP/yr * .5 = 2.6 lbs TP/yr

The permittee may take credit for the difference between the BMP's total reductions and the reductions that are required on site to meet the VSMP regulatory requirements. For TP, the permittee may take credit for:

2.6 lbs TP/yr – 0.7 lbs TP/yr = 1.9 lbs TP/yr

Likewise, the permittee may take credit for the same *proportion* of the BMP's total reductions for each POC. The proportion that is available for credit may be determined by dividing the creditable reduction for
TP by the BMPs total reduction for TP:

(1.9 lbs TP/yr) / (2.6 lbs TP/yr) = .7

Step 2: Determine the total site loads for TN and TSS:

The total associated site loads for TN and TSS should be calculated using *Table 4* in the permit:

TN: 5.2 lbs TP/yr * 5.2 lbs TN/lb TP = 27.04 lbs TN/yr

TSS: 5.2 lbs TP/yr * 420.9 lbs TSS/lb TP = 2188.68 lbs TSS/yr

Step 3: Determine the total BMP reductions for TN and TSS:

For TN, the permittee should use the VA BMP Clearinghouse efficiency for a Wet Pond 1, which is 30%:

TN: 27.04 * .30 = 8.112 lbs TN/yr

For TSS, the permittee may use either the Bay Program Established Efficiencies or the Bay Program Curves. In this example, the permittee decides to use the Bay Program Established Efficiency, which is 60% for a Wet Pond:

TSS: 2188.68 lbs TSS/yr * .6 = 1313.21 lbs TSS/yr

Step 4: Determine the credit the permittee may receive towards the TMDL reduction requirements for TN and TSS:

The permittee may take credit for the same proportion of the total pollutant load determined in **Step 1** for TN and TSS**:**

TN: 8.112 lbs TN/yr * .73 = 5.92 lbs TN/yr (6.0 lbs TN/yr)

TSS: 1313.21 lbs TSS/yr * .73 = 958.64 lbs TSS/yr (959 lbs TSS/yr)

The permittee may take credit for 1.9 lbs TP/yr, 6.0 lbs TN/yr, and 959 lbs TSS/yr towards its TMDL requirements for this oversized BMP.

APPENDIX V.F – Treatment Trains

Although BMPs should be reported to the Department individually, the permittee may receive credit for BMPs that are implemented as part of a treatment train. For treatment trains composed of BMPs from the Virginia Stormwater BMP Clearinghouse, the Runoff Reduction Method Spreadsheet can be used to account for the impact of the treatment train. If the retrofit curves are used, the permittee will need to use their best professional judgment to identify the predominant BMP that will be credited. If BMPs with Bay Program approved efficiencies are used, the permittee may calculate the reduced POC loading rate to each BMP in the treatment train to estimate the appropriate reductions for each step.

APPENDIX V.G – Street Cleaning and Storm Drain Cleaning

V.G.1 Street Cleaning. This section of the guidance has been revised to reflect the most recent Chesapeake Bay Program report, *"Recommendations of the Expert Panel to Define Removal Rates for Street and Storm Drain Cleaning Practices, Final Report," dated May 19, 2016,* and approved by the Chesapeake Bay Program Management Board. The method for calculating reductions from this practice have been revised.

Permittees previously received full credit for the POC pounds reduced through their street sweeping program as calculated using either the "mass loading approach" or the "qualifying street lanes method." The "mass loading approach" and "qualifying street lanes method" are being phased out and will no longer be accepted as a nutrient crediting method. The revised street cleaning module was calibrated to reflect data from real street solids information and uses the WINSLAMM model to determine the allowable street cleaning credits. Data provided shows that use of vacuum assisted and regenerative air sweepers increase sediment reduction, particularly with more intensive sweeping regimes. The data also indicated that when bi-weekly or even more frequent sweeping is conducted, sediment removal rates also increase significantly. These changes are reflected in the revised rates listed below in Table 1. Removal rates are provided for eleven different street cleaning practices in Table 1, with the largest listing for the advanced street cleaning technology practice removal rates.

The revised method provides for street cleaning nutrient reductions using an enhanced program that includes street sweeping at more regular intervals. There are lower reductions for mechanical sweeping and higher reductions for vacuum assisted or regenerative air sweeping technologies. The revised allowable nutrient removal rates are provided in Table 1 below. The information in the table is separated by street sweeping technology used and how often street sweeping is conducted.

Table 1. Street Cleaning Practices Available for Credit [1]

	Practice #	Description [2]	Passes/Yr (apx)[2]	% TSS Removal	% TN Removal	% TP Removal
Advanced Sweeping Technology	SCP-1	2 passes per week	-100	21	4	10
	SCP-2	1 pass per week	-50	16	3	8
	SCP-3	1 pass every 2 weeks	-25	11	2	5
	SCP-4	1 pass every 4 weeks	-10	6	1	3
	SCP-5	1 pass every 8 weeks	-6	4	0.7	2
	SCP-6	1 pass every 12 weeks	-4	2	0	1
	SCP-7	Seasonal scenario 1 or 2	-15	7	1	4
	SCP-8	Seasonal scenario 3 or 4	-20	10	2	5
Mechanical Broom Technology	SCP-9	2 passes per week	-100	1.0		
	SCP-10	1 pass per week	-50	0.5		
	SCP-11	1 pass every 4 weeks	-10	0.1		

[1] While there are many variations of street cleaning programs, only the street cleaning described are eligible for credit.

[2] Seasonal scenarios are defined as follows:

S1: Spring – One pass every week from March to April. Monthly otherwise

S2: Spring – One pass every other week from March to April. Monthly otherwise

S3: Spring and fall – One pass every week (March to April, October to November). Monthly otherwise

S4: Spring and fall – One pass every other week during the season. Monthly otherwise

The information listed in Table 1 is available from the Chesapeake Stormwater Newtwork website at the following link: U-8 Street Sweeping Fact Sheet Final Document, dated January 2017 Please note - the numbers provided in the "Passes/Yr (apx)[2]" column are not negative numbers, but indicate the approximate number of passes required for that practice. Please review the footnotes at the bottom of the table for more information.

Determining Pollutant Removal Crediting for Street Cleaning Practices

Street cleaning credit for sediment and nutrient reductions is provided for different street sweeping practices (SCPs). Removal rates are dependent upon use of the sweeping technology at different frequencies or times the sweeping is conducted. The standard street cleaning unit is the number of curb miles swept with one impervious acre equivalent to one curb-lane mile swept. This is assuming they are swept on one-side only. Credit is also provided for clearing municipal and commercial parking lots. For parking lots, the acres of parking lot swept are reported and converted to lane miles using the one acre = one curb lane mile rule of thumb.

To calculate the pollutant reduction for the street cleaning program, a three-step process as shown below will be used. For a street cleaning practice located in the Rappahannock River Basin using the loading rates provided in Part II.A.3 Table 2c, the following calculation would apply.

Step 1. *Determine which street cleaning scenario your program falls under.*

For this example, if you sweep 25 curb lane miles once per month using a regenerative air sweeper, according to Table 1, your program would be credited using SCP-4.

Step 2. *Calculate loading rate associated with the impervious area swept.*

Multiply the curb lane miles swept by the nutrient and sediment loading rates for urban impervious cover for your state. Please note that the rows provided for "Regulated Urban Pervious" cover are blacked out since this practice only applies to impervious roadway areas. To determine street cleaning credits, only the rows with "Regulated Urban Impervious" cover will need to be completed.

Table 2. Calculate Street Sweeping Loading Rate for the Rappahannock River Basin

Subsource	Pollutant	Curb Lane Miles Swept (1 curb lane mile swept = 1 Acre)	2009 EOS Loading Rate (lbs/acre/yr) Rappahannock River Basin[1]	Estimated Total POC Load Based on 2009 Progress Run (lbs/yr)
Regulated Urban Impervious	Nitrogen	*25*	9.38	*234.5*
Regulated Urban Pervious				
Regulated Urban Impervious	Phosphorus	*25*	1.41	*35.25*
Regulated Urban Pervious				
Regulated Urban Impervious	Total Suspended Solids	*25*	423.97	*3099.25*
Regulated Urban Pervious				

Step 3. *Calculate your load reductions.*

Multiply the loading rate by the removal rate percentage for SCP-4 in Table 1.

Table 3. Street Sweeping Load Reductions				
Subsource	Pollutant	Total Existing Acres Served by MS4 (06/30/09)	Removal Rate Percentage (lbs/acre/yr)[1]	Total Reduction Credit (lbs/yr)
Regulated Urban Impervious	Nitrogen	*234.5*	0.01	*2.36*
Regulated Urban Pervious				
Regulated Urban Impervious	Phosphorus	*35.25*	0.03	*1.06*
Regulated Urban Pervious				
Regulated Urban Impervious	Total Suspended Solids	*3099.25*	0.06	*185.96*
Regulated Urban Pervious				

Table 4 shows the estimated reductions in a Bay community that relies on varied operations using the advanced street cleaning technology at different frequencies across its 300-mile road network each year.

Table 4. Example of Estimating Pollutant Reduction by a Local Street Cleaning Program							
Lane Mile or Acres	**SCP**	**Removal Rate (%) 1**			**Mass Removed (lbs) 2**		
		TSS	**TN**	**TP**	**TSS**	**TN**	**TP**
150	SCP-2	16	3	8	31,200	69.8	23.16
50	SCP-7	7	1	4	4,550	7.8	3.8
25	SCP-4	6	1	4	1,950	3.8	1.9
75	SCP-9	1	0	0	975	0	0
300 miles	Total for Community				**38,675**	**81.4**	**28.86**

1 From Table 1, and assume one curb mile equals an acre

2 Assume annual load from impervious cover of 1,300 lbs/ac/year (sediment), 15.5 lbs/ac/yr (nitrogen) and 1.93 lbs/ac/yr (phosphorus) --Table 4

Additionally, the new approach includes the tracking and reporting of street sweeper operations to receive reductions. This will include maintaining records on their street sweeping efforts using either method. The following will be necessary to document the street sweeping activities as follows:

1. Actual sweeper routes (and type of road)
2. Total curb miles swept on each route
3. Average parking conditions and controls along the route (optional) Expert Panel Report on Street and Storm Drain Cleaning

4. Sweeper technology used (AST or MBT)
5. Number of sweeping passes per year on each qualifying route In addition, the locality should maintain records of the actual miles swept, by date, for entire the MS4 sweeper fleet, over the reporting year.

Permittees should note that street cleaning will be credited annually. If permittees commit to a level of pollutant removal to achieve their 40% reductions and fall short of meeting those pollutant reductions, additional reductions will need to be made in those years. Permittees may wish to be conservative in their estimates of the amount of pollutants that will be reduced by street sweeping annually to avoid shortfalls in the future.

Calculation procedures for the revised method can be provided through use of a calculation spreadsheet based upon the revised TSS, TN and TP removal rates as shown in Table 1 above.

For additional information regarding the revised crediting methodology and calculations procedure, please review the documents provided at the following links:

- *Chesapeake Stormwater Network, Urban Stormwater Workgroup, Recommendation of the Expert Panel to Define Removal Rates for Street and Storm Drain Cleaning Practices, Final Report, 6/19/2016.*
- *Chesapeake Stormwater Network, Urban Stormwater Workgroup, U-8 Street Sweeping Fact Sheet Final Document, January 2017*

V.G.2 Storm Drain Cleaning Credit

The Expert Panel Report provides a sediment and nutrient reduction credit for solids that are directly removed from catch basins, within storm drain pipes or captured at the storm drain outfall. The credit also applies to sediment removal from concrete-lined conveyance channels, but does not apply to sediment removal during ditch maintenance along open section roads. The aggregate load captured over the course of a year is reported for credit and is expressed in terms of pounds of sediment and nutrients.

Calculate the Storm Drain Cleaning Credit

1. Determine pounds of solids/organic matter collected within the catch basins, storm drain pipes, captured at the storm drain outfall or removed from concrete-lined conveyance channels. This credit must be conducted on an annual basis and all solids collected must be then be disposed of properly.

2. Convert the initial wet mass captured into dry weight using the following conversion factors and is dependent upon the type of material collected. The conversion factors are 0.7 for wet sediments (CSN, 2011) and 0.2 for wet organic matter (Stack et al, 2013). These conversion factors can be used to convert wet mass to dry weight in the absence of local data. See Table V.G.1 below:

Table V.G.1 Storm Drain Cleaning Dry Weight Calculation

Type of Solid Material	Weight of initial wet material	Conversion Factor	Dry Weight
Wet sediments		0.7	
Wet organic matter		0.2	

3. Multiply by the following factors for each POC to determine the reductions from Storm Drain Cleaning. Multiply the dry weight mass from Table V.G.1 above by the nutrient enrichment factor provided in Table V.G.2 below. The type of material captured, either sediment or organic in nature, will determine the nutrient enrichment factor that must be used. Note: locals may substitute their own enrichment factor if they sample the nutrient and carbon content of the materials they physically remove from the storm drain. Please see the calculations in the table below:

Table V.G.2 Mean Nutrient Enrichment Factor to Apply to Dry Weight Mass of Solids Physically Removed From Storm Drains				
Type of Material Captured*	Nutrient %	Enrichment Factor	Dry Weight (lbs)	Nutrient Credit
BMP and Catch Basin Sediments	% P	**0.06**		P
	% N	**0.27**		N
Organic Matter/Leaf Litter	% P	**0.12**		P
	% N	**1.11**		N
* Multiply the mass (dry weight) of sediment removed from the storm drain (in pounds) by a factor of 0.0006 and 0.0027, for TP and TN, respectively. The result is the lbs/year of TP and TN credited.				

There are also three qualifying conditions (*"Recommendations of the Expert Panel to Define Removal Rates for Street and Storm Drain Cleaning Practices, Final Report,"*)to achieve credits for the storm drain cleaning as follows:

(1) To maximize reduction, efforts should target catch basins that trap the greatest organic matter loads, streets with the greatest overhead tree canopy and/or outfalls with high sediment or debris loads.

(2) The loads must be tracked and verified using a field protocol to measure the mass or volume of solids collected within the storm drain system. The locality must demonstrate that they have instituted a standard operating procedure (SOP) to keep track of the mass of the sediments and/or organic matter that is removed.

(3) The material collected and measured for the credit must be properly disposed so that it cannot migrate back into the watershed.

APPENDIX V.H – Land Use Change

Permittees may receive credit for land use change conversions based on the number of acres converted. Conversion efficiencies for land use change are dependent on basin and are listed in Table V.H.1. Permittees may receive 100% credit for converting lands within their regulated MS4 area, but must deduct the L2 as the baseline within the unregulated area before taking any credit for the unregulated area. Please note that these numbers should be used for land use changes in urban areas only. If the land use change involves agricultural lands, contact DEQ and we will provide additional information on the calculation methodology.

Impervious to Forest – Permittees may receive credit for converting any Impervious Surface to Forest. To receive credit for the "Forest" land use, permittees should meet the tree density per acre described in the Virginia Department of Forestry's Land Use Tax Assessment Standards (*Table V.H.2*), which can be found on the Virginia Department of Forestry's website or the Virginia State Code, 4VAC10-20-10:

http://law.lis.virginia.gov/admincodeexpand/title4/agency10/chapter20

1. Impervious to Mixed Open – Permittees may receive credit for converting any Impervious Surface to Mixed Open. "Mixed Open" would be defined as herbaceous cover that is minimally disturbed (periodically bush hogged, meadows, etc.). To qualify for this credit, the "Mixed Open" must be unmanaged (i.e. no nutrient application).
2. Impervious to Turf – Permittees may receive credit for converting any Impervious Surface to a Turf Surface (managed grass or lawns).
3. Turf to Forest – Permittees may receive credit for converting any Turf Surface (managed grass or lawns) to Forest.
4. Turf to Mixed Open – Permittees may receive credit for converting any Turf Surface (managed grass or lawns) to Mixed Open.
5. Mixed Open to Forest – Permittees may receive credit for converting any Mixed Open Surface to Forest.

Table V.H.1 – Land Use Change Conversion Efficiency Table

Basin	Land Use from	Conversion	Edge of Stream Reductions TN(lbs/ac/year)	Edge of Stream Reductions TP(lbs/ac/year)	Edge of Stream Reductions TSS(lbs/ac/year)
James	Impervious	Forest	11.84	0.78	1327
James	Impervious	Mixed Open	11.36	0.50	389
James	Impervious	Turf	5.47	0.00	862
James	Turf	Forest	6.37	1.39	465
James	Turf	Mixed Open	5.89	1.12	0.00
James	Mixed Open	Forest	0.48	0.27	937
Potomac	Impervious	Forest	9.85	0.80	1797
Potomac	Impervious	Mixed Open	9.55	0.48	877
Potomac	Impervious	Turf	4.27	0.00	1240
Potomac	Turf	Forest	5.58	1.46	557
Potomac	Turf	Mixed Open	5.28	1.15	0.00
Potomac	Mixed Open	Forest	0.30	0.32	920
Rappahannock	Impervious	Forest	11.39	0.77	1477
Rappahannock	Impervious	Mixed Open	10.92	0.49	790
Rappahannock	Impervious	Turf	4.73	0.00	1021
Rappahannock	Turf	Forest	6.66	1.42	457
Rappahannock	Turf	Mixed Open	6.20	1.14	0.00
Rappahannock	Mixed Open	Forest	0.47	0.28	687
York	Impervious	Forest	12.35	0.77	699
York	Impervious	Mixed Open	11.83	0.54	308
York	Impervious	Turf	5.62	0.00	457
York	Turf	Forest	6.74	1.36	242
York	Turf	Mixed Open	6.21	1.13	0.00
York	Mixed Open	Forest	0.53	0.23	391

Table V.H.2 - Minimum Number of Trees Required Per Acre to Determine 30 Square Feet of Tree Basal Area of 40% Stocking For Classification as Forest Land

D.B.H.[1] Range	D.B.H. in 2" Classes	Basal Area Per Tree	Per Acre	Per 1/5 Acre	Per 1/10 Acre
up to 2.9"	Seedlings		400	80	40
3.0-4.9"	4	0.0873	400	80	40
5.0-6.9"	6	0.1964	153	31	15
7.0-8.9"	8	0.3491	86	17	9
9.0-10.9"	10	0.5454	55	11	6
11.0-12.9"	12	0.7854	38	8	4
13.0-14.9"	14	1.0690	28	6	3
15.0" +	16+	1.3963	21	4	2

[1] DBH refers to the tree diameter measured at 4.5 feet above the ground.

EXAMPLE V.H.1

A locality in the Potomac River Basin is converting 1.5 acres of contiguous land from impervious surface to forest. The trees being planted all fall between 1 and 2 inches in diameter at breast height (4.5 feet from ground level), so the permittee must plant at least 400 trees per acre or at least 600 trees on the site to qualify for the land use conversion. To calculate the credit the permittee will receive, the appropriate values from *Table V.H.1* should be used.

For TN:

$$1.5\ acres\ converted \frac{*\ 9.85\ lbs \frac{TN}{ac}}{yr} =\ 14.78\ lbs\ TN/yr$$ (15 lbs TN/yr)

For TP:

$$1.5\ acres\ converted *\ 0.80\ lbs\ TP/ac/yr = 1.2\ lbs\ TP/yr$$ (1.2 lbs TP/yr)

For TSS:

$$1.5\ acres\ converted *\ 1797\ lbs\ TSS/ac/yr =\ 2{,}695.5 lbs\ TSS/yr$$ (2,696 lbs TSS/yr)

Through the land use conversion the permittee has offset 15 lbs TN/yr, 1.2 lbs TP/yr, and 2,696 lbs TSS/yr.

EXAMPLE V.H.2

A locality in the Potomac River Basin is converting 2.0 acres of contiguous land from impervious surface to forest with one acre of regulated land and one acre of unregulated land. The trees being planted all fall between 1 and 2 inches in diameter at breast height (4.5 feet from ground level), so the permittee must plant at least 400 trees per acre or at least 600 trees on the site to qualify for the land use conversion. To calculate the credit the permittee will receive, the appropriate values from *Table V.H.1* should be used.

Regulated Land Area:

For the regulated land area the following calculations would apply:

For TN:

$$1.0\ acres\ converted\ (*\ 9.85\ lbs\ TN/ac)/yr = \quad 9.85\ lbs\ TN/yr$$ (10 lbs TN/yr)

For TP:

$$1.0\ acres\ converted\ (*\ 0.80\ lbs\ TP/ac)/yr = 0.8\ lbs\ TP/yr$$ (0.8 lbs TP/yr)

For TSS:

$$1.0\ acres\ converted\ (*\ 1797\ lbs\ TSS/ac)/yr = \ 1{,}797\ lbs\ TSS/yr$$

The land use conversion for the 1 acre of regulated land allows the permittee to offset 10 lbs TN/yr, 0.8 lbs TP/yr, and 1,797 lbs TSS/yr.

Unregulated Land Area:

The next step would be to determine the credit for the unregulated land area. First, it is necessary to calculate the credit before the baseline deduction. Since the land areas for both regulated and unregulated land are the same in the example, 1 acre, the calculation is the same as provided above for the regulated land area. It is provided again below:

For TN:

$$1.0\ acres\ converted\ (*\ 9.85\ lbs\ TN/ac)/yr = \quad 9.85\ lbs\ TN/yr$$ (10 lbs TN/yr)

For TP:

$$1.0\ acres\ converted\ (*\ 0.80\ lbs\ TP/ac)/yr = 0.8\ lbs\ TP/yr$$ (0.8 lbs TP/yr)

For TSS:

$$1.0\ \ acres\ converted\ (*\ 1797\ lbs\ TSS/ac)/yr = \ 1{,}797\ lbs\ TSS/yr$$ (1,797 lbs TSS/yr)

The land use conversion for the 1 acre of regulated land allows the permittee to offset 10 lbs TN/yr, 0.8 lbs TP/yr, and 1,797 lbs TSS/yr.

However, since there is 1 acre of land in the land conversion that is unregulated, it is necessary to calculate the L2 baseline for the unregulated land area to be converted. For the unregulated land area, the permittee would need to determine L2 baseline to calculate the allowable unregulated land credit. The L2 baseline for the given land area using the calculation sheet provided on the following page.

Calculation Sheet for Estimating Existing Source Loads and Reduction Requirements for the Potomac River Basin

(*Based on Chesapeake Bay Program Watershed Model Phase 5.3.2)

		A	B	C	D	E	F	G
Pollutant	Subsource	Loading rate (lbs/ac/yr)[1]	Existing developed lands as of 6/30/09 served by the MS4 within the 2010 CUA (acres)[2]	Load (lbs/yr)[3]	Percentage of MS4 required Chesapeake Bay total L2 loading reduction	Percentage of L2 required reduction by	35% reduction required by 6/30/2023 (lbs/yr)[4]	Sum of 35% reduction (lb/yr)[5]
Nitrogen	Regulated urban impervious	16.86	1	16.86	9%	35%	0.53	0.74
	Regulated urban pervious	10.07	1	10.07	6%	35%	0.21	
Phosphorus	Regulated Urban Impervious	1.62	1	1.62	16%	35%	0.09	0.01
	Regulated urban pervious	0.41	1	0.41	7.25%	35%	0.01	
Total suspended solids	Regulated urban impervious	1,171.32	1	1,171.32	20%	35%	81.9	87.28
	Regulated urban pervious	175.8	1	175.8	8.75%	35%	5.38	

[1]Edge of stream loading rate based on the Chesapeake Bay Watershed Model Progress Run 5.3.2

[2]To determine the existing developed acres required in Column B, permittees should first determine the extent of their regulated service area based on the 2010 Census urbanized area (CUA). Next, permittees will need to delineate the lands within the 2010 CUA served by the MS4 as pervious or impervious as of the baseline date of June 30, 2009.

[3]Column C = Column A x Column B.

[4]Column F = Column C x Column D x Column E.

[5]Column G = The sum of the subsource cumulative reduction required by 6/30/23 (lbs/yr) as calculated in Column F.

The calculated baseline for the unregulated area in this example is 0.74 lbs TN/yr, 0.01 lbs TP/yr, and 87.28 lbs TSS/yr. To calculate the allowable credit for the unregulated land we need to deduct the baseline L2 as follows:

For TN:

$$9.84\ TN\ lbs/yr - 0.74\ lbs\ TN/yr\ =\ 9.10\ lbs\ TN/yr$$ (9.1 lbs TN/yr)

For TP:

$$0.8\ TN\ lbs/yr -\ 0.01\ TP\ lbs/yr = 0.79\ lbs\ TP/yr$$ (0.8 lbs TP/yr)

For TSS:

1,797 TSS lbs/yr – 87.28 TSS lbs/yr = 1,710 lbs TSS/yr

For the regulated land area, the allowable credit after the deduction for baseline is 9.1 lbs TN/yr, 0.8 lbs TP/yr and 1,710 lbs TSS/yr.

For both regulated and unregulated land areas, the permittee is able to offset a combined credit of 19 lbs TN/yr, 1.6 lbs TP/yr, and 3,507 lbs TSS/yr.

APPENDIX V.I – Forest Buffers

Forest Buffers can be credited as both a land use change and efficiency BMP. The land use change component should be credited in accordance with the applicable section of *Table V.H.1* in *Appendix V.H*. The efficiency is applied at up to a 2-to-1 ratio for upland acres that drain to the buffer as sheetflow (i.e. if a one acre buffer is installed, but only 1.5 upland acres drain to the buffer as sheetflow, the permittee may only receive the efficiency credit for 1.5 acres). The following established efficiencies for TP, TN, and TSS should be used (*Table V.I.1*):

Table V.I.1 - Efficiencies for Forest Buffers Applied to Two Upland Acres per Acre of Buffer

Practice	TN	TP	TSS
Forest Buffer	25%	50%	50%

EXAMPLE V.I.1

A permittee in the Potomac River basin has identified an area of regulated land adjacent to a stream as a candidate site for a forest buffer. The site has 311.14 linear feet of stream that can be buffered with an average width of 35 feet for a total of a 0.25 acre forest buffer. The land the forest buffer will be implemented on and the land draining to the buffer is all urban pervious.

Calculating the nutrient reductions provided by this BMP is a two part process. The first step is to calculate the reductions that result from the land use conversion. The permittee is converting turf (pervious) surface to forest, so using *Table V.H.1* in *Appendix V.H*, the permittee can identify the appropriate conversion factor, which is 5.58 lbs/acre for nitrogen. The permittee should multiply this value by the acres changed to calculate the land use change reduction for the site:

$$5.58\ lbs\ TN/ac/yr * 0.25\ acres = 1.40\ lbs\ TN/yr$$

In addition to the land use change credit, the permittee will also receive an efficiency credit for this BMP. Again, the permittee should calculate the loading rate for the land draining to the BMP. Upland acres are treated by forest buffers at a ratio of 2:1, so there are:

$$0.25\ acres\ converted * 2 = 0.5\ upland\ acres\ treated$$

The permittee verifies that there are at least 0.5 upland acres draining to the buffer as sheetflow, so the permittee may take the full efficiency credit for this forest buffer.

The permittee should multiply the number of upland acres treated by the appropriate loading rate from Part II.A.3 in the MS4 permit, in this case *Table 3b* for the Potomac watershed. As noted above, all the land draining to the BMP is urban pervious so for TN the loading rate for all acres draining to the buffer is 10.07 lbs. To estimate the loading rate after the BMP is applied, the permittee should multiply the initial loading rate by the BMPs efficiency, which is 25% (*Table V.I.1*):

$$10.07\ lbs\ TN/ac/yr * 0.25 = 2.52\ lbs\ TN/ac/yr$$

The permittee should multiply the upland acres treated by this modified loading rate to calculate the pounds of nitrogen reduced:

$$2.52\ lbs\ TN/ac/yr * 0.5\ acres = 1.26\ lbs\ TN/yr$$

This result should be added to the result from the land use conversion for a total reduction of:

1.40 lbs TN/yr+ 1.26 *lbs TN /yr* = 2.66 *lbs TN /yr* (2.7 lbs TN/yr)

With the installation of the forest buffer, this permittee has reduced its annual load of TN by 2.7 lbs/yr. The same procedure can be followed to calculate the reductions for TP and TSS.

APPENDIX V.J – Urban Stream Restoration

There are four established protocols for urban stream restoration that a permittee may use to calculate reductions from urban stream restoration projects. For historical projects that cannot use one of the four protocols listed below, contact DEQ and these projects will be evaluated on a case-by-case basis. The four protocols are:

1. Prevented Sediment During Storm Flow
2. Instream and Riparian Nutrient Processing During Base Flow
3. Floodplain Reconnection Volume
4. Dry Channel Regenerative Stormwater Conveyance (RSC) as an Upland Stormwater Retrofit

These protocols may be applied to 0-5th order streams that meet the basic qualifying conditions described in the Expert Panel Report. Credit cannot be received for improvements to stream sections that are tidally influenced. The first three protocols require direct measurements to estimate pollutant reductions. Pollutant reductions for the fourth option can be calculated using the curves provided by the Bay Program for the other runoff reduction BMPs. Full requirements for each type of stream restoration and how they are credited in the Bay Program are described in greater detail in the following report:

> *Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects*, September 2014

In order to be considered for Chesapeake Bay TMDL nutrient and sediment credits, all projects should include the following; a map clearly identifying the project area including drainage areas, regulated and unregulated boundaries; photographs of the project area demonstrating the degraded nature of the project area; all pertinent calculations based on one or more of the methods above and if unregulated lands are involved, calculations demonstrating the final credits for the project based on the ratio of regulated to unregulated lands; and proposed verification activities such as periodic visual inspections to demonstrate ongoing performance of the project.

Once the credits from an urban stream restoration project are calculated using one or more of the accepted Protocols, the credits a permittee may receive must be adjusted to account for the baseline required for the proportion of unregulated land that drains to the restored stream section, if any. Regulated lands are any lands within the MS4 service area and/or lands covered under an Industrial Stormwater Permit outside the MS4 service area. Projects done entirely within regulated lands may take full credit (100%) as calculated from the chosen Protocols. Projects that receive drainage entirely from unregulated lands (excluding forested and agricultural lands which receive 100%) may take half (50%) of the total credit calculated from the chosen Stream Restoration Protocols or the difference between the calculated credits minus the required L2 reductions, whichever is less. Stream restoration projects that receive drainage from both regulated and unregulated lands, may take full credit (100%) for the drainage from regulated lands and half credit (50%) or the difference between the calculated credits and the required L2 reductions whichever is less for loads draining off unregulated lands.

EXAMPLE V.J.1

To meet its TMDL reduction requirements, a Phase II permittee in the James River basin has decided to implement a stream restoration project. Permittees may receive full credit (100%) for the proportion of regulated land (i.e. permittees' MS4, other MS4s and/or Industrial Stormwater permitted land) that drains to a stream restoration project and either 1. an adjusted credit (50% of the reductions) or 2. the difference between the calculated reductions and the required L2 reductions for the proportion of unregulated land

that drains to the stream restoration project. Forested and Agricultural lands that drain to the project are credited at 100%.

Step 1: Calculate the POC Reductions from the Proposed Stream Restoration Project:

The permittee uses Protocol 1 to calculate the stream restoration project's POC reductions. The project results in POC reductions of:

TN: 23 lbs/yr

TP: 20 lbs/yr

TSS: 13,464 lbs/yr.

Step 2: Calculate the Project Credit Ratio:

To quantify the stream restoration project reductions that can be credited toward meeting the TMDL, the permittee must first characterize the acres that drain to the project:

	Urban Impervious Acres	Urban Pervious Acres	Total Urban Acres	Forested Acres	
Regulated Land[1]	9.1	6.4	15.5	1.9	
Unregulated Land	400	2,200	2,600	7.4	Total
		Total	2,615.5	9.3	2,624.8

1 Regulated Land means acres that drain to any MS4 system

Using this information, ratios of regulated, unregulated, and forested acres to total acres can be calculated:

15.5 acres regulated land/2624.8 total acres = 0.006 regulated acreage ratio

2,600 unregulated acres/2,624.8 = 0.99 unregulated acreage ration

9.3 forested acres/2,624.8 = 0.004 forested acres ratio

Step 3: Calculate the Total Reductions for Regulated and Unregulated Lands:

To calculate the total pollutant reductions for this stream restoration project, the permittee should multiply the total project POC reductions calculated in step 1 by the ratios calculated in step 2:

TN for regulated acres: 22.5 lbs TN * 0.006 = 0.14 lbs TN

TP for regulated acres: 20.4 lbs TP * 0.006 = 0.12 lbs TP

TSS for regulated acres: 13,464 lbs TSS * 0.006 = 80.8 lbs TSS

TN for unregulated acres: 22.5 lbs TN * 0.99 = 22.3 lbs TN

TP for unregulated acres: 20.4 lbs TP * 0.99 = 20.2 lbs TP

TSS for unregulated acres: 13,464 lbs TSS * 0.99 = 13,329 lbs TSS

TN for forested acres: 22.5 lbs TN * 0.004 = 0.09 lbs TN

TP for forested acres: 20.4 lbs TP * 0.004 = 0.08 lbs TP

TSS for forested acres: 13,464 lbs TSS * 0.004 = 53.9 lbs TSS

Step 4: Account for the Total L2 Baseline Reductions on Unregulated Land

The load reductions calculated for unregulated acres must be adjusted to account for the L2 baseline reduction required on unregulated land. These calculations are based on the loading rates found in Tables 3a-d of the permit. To get the total L2 reduction required, multiply the acreage for each land use by the basin loading rates in Column A and the L2 required reduction in Column D from Table 3 of the General Permit.

Pollutant	Subsource	A Loading rate	B Unregulated Acres	C Load (lbs/yr)	D Total L2 Loading	F 100% L2 Reduction Required	G Sum of L2 Reductions
Nitrogen	Unregulated Urban Impervious	9.39	400	3756	9%	338	1261
	Unregulated Urban Impervious	6.99	2200	15378	6%	923	
Phosphorus	Unregulated Urban Impervious	1.76	400	704	16%	113	193
	Unregulated Urban Impervious	0.5	2200	1100	7.25%	80	
Total Suspended Solids	Unregulated Urban Impervious	676.94	400	270776	20%	54155	73613
	Unregulated Urban Impervious	101.08	2200	222376	8.75%	19458	

These are the baseline reduction requirements for the portion of the project associated with unregulated urban lands. Alternatively, the permittee may choose 50% of the reductions associated with the unregulated urban land to serve as baseline. The alternative baselines are calculated as follows:

TN 22.3 lbs * 0.5 = 11.15 lbs

TP 20.2 lbs * 0.5 = 10.10 lbs

TSS 13,329 lbs * 0.5 = 6,664.5 lbs

In this example, the 50% criteria is less stringent than the L2 reductions calculated above and will be used to calculate the total creditable reductions for the project:

Creditable reductions = Reductions associated with regulated lands + Reductions associated with forest lands + (Reductions associated with unregulated urban lands – baseline)

TN = 0.14 + 0.09 + (22.3 – 11.15) = 11.38 lbs

TP = 0.12 + 0.08 + (20.2 – 10.1) = 10.3 lbs

TSS = 80.8 + 53.9 + (13,329 – 6,664.5) = 6,799.2 lbs

APPENDIX V.K – Outfall and Gully Stabilization

The expert panel report "Recommendations for Crediting Outfall and Gully Stabilization Projects (OGSPs) in the Chesapeake Bay Watershed" was approved on October 15, 2019. Permittees wishing to undertake gully and outfall stabilization projects, and receive Chesapeake Bay pollution reduction credits must follow the 5-step methodology described in the expert panel report. As with the revised stream restoration procedures, projects utilizing the default values will not be eligible for Chesapeake Bay pollution reduction credits. Only projects meeting the qualifying conditions, and that adhere to the 5-step methodology will be eligible for crediting. Since this is a recently approved methodology, it is likely that there will be updates to certain aspects of the expert panel report. As such, in order for projects to receive the appropriate pollution reduction credits, permittees should coordinate with DEQ throughout the project development and implementation process.

OGSPs are typically applicable to the headwater transition zone (HTZ) that lacks perennial or seasonal flow. The following series of qualifying conditions **must** be met for a project to be eligible for Chesapeake Bay pollution reduction credits in these conditions:

1. The channel or gully slope below the source must exhibit predictive indicators for severe erosion or hill-slope failure and must be observed to be actively enlarging or degrading.
2. The project should utilize a comprehensive approach to stream channel design, addressing long-term stability and resiliency of the channel, banks, and floodplain.
3. Each project must comply with all state and federal permitting requirements, including 404 and 401 permits, which usually contain conditions for pre and post-project assessment and post construction monitoring.
4. Before credits are granted, outfall and gully stabilization projects will need to meet post-construction stability criteria and successfully establish needed vegetation. Projects should maintain or improve existing native riparian vegetation in the headwater stream corridor to the extent possible. Projects should follow regulatory agency guidance regarding compensation for any losses of forest, wetlands and sensitive habitats within the project work areas.

Headcuts within perennial and intermittent stream channels are a major source of sediment erosion, and the OGSP protocol is intended to provide a better option for estimating prevented sediment erosion in headwater channels with severe vertical incision (progressive bed-lowering). Therefore, the OGSP protocol may be applied as an alternative to Protocol 1 (stream restoration expert panel report), **only** in headcut areas of perennial or intermittent channels (the credit is not additive), if it meets the qualifying conditions found above as well as the following additional qualifying conditions:

5. The project **must** meet the more stringent stream restoration qualifying criteria outlined in the Stream restoration Expert Panel report for Protocol 1. Additional information can be found at: https://chesapeakestormwater.net/download/9928/
6. The project **must** meet the conditions of any and all state and federal permits.

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[1] **Predictive Indicators** (for severe erosion): Visible and measurable indicators that severe erosion is imminent in a bank face, bank toe, or channel bed in an outfall or headwater stream channel. These include indicators of fluvial erosional processes and mass failure mechanisms such as: a higher value of existing slope to equilibrium slope of greater than 25%, observations of tension cracks in a sediment profile upstream of a stream bed, knickpoints or head cuts greater than 6 inches in height, bulging of material at a headwater feature toe of slope indicative of planar/slab failures, rotational failures, or composite bank failures

The project **must not** introduce barriers or challenges to aquatic organism passage or degrade instream habitat. Projects should always seek to improve passage of aquatic organisms and aquatic habitat where possible.

7. Drop structures, extension of any existing storm drain pipes, stormwater collection features, and scour protection or other hard armoring techniques used in OGSPs are not eligible for credit in perennial channels.

In addition to the above qualifying conditions, Protocol 5 is restricted in how it applies to, or is combined with, stream restoration practices constructed under the other four crediting protocols.

Protocol 5 cannot overlap Protocol 1 (Prevented Sediment) within the same project reach. Protocol 5 can overlap Protocols 2 and 3 in the same project reach, as long as it meets the conditions for hyporheic exchange and/or flood plain reconnection, which is exceedingly unlikely. Protocol 1 or 5 applications should be based on which best fits the dominant erosion mechanism along the channel profile. Protocol 1 should be used in reaches dominated by lateral erosion and protocol 5 in areas of vertical degradation.

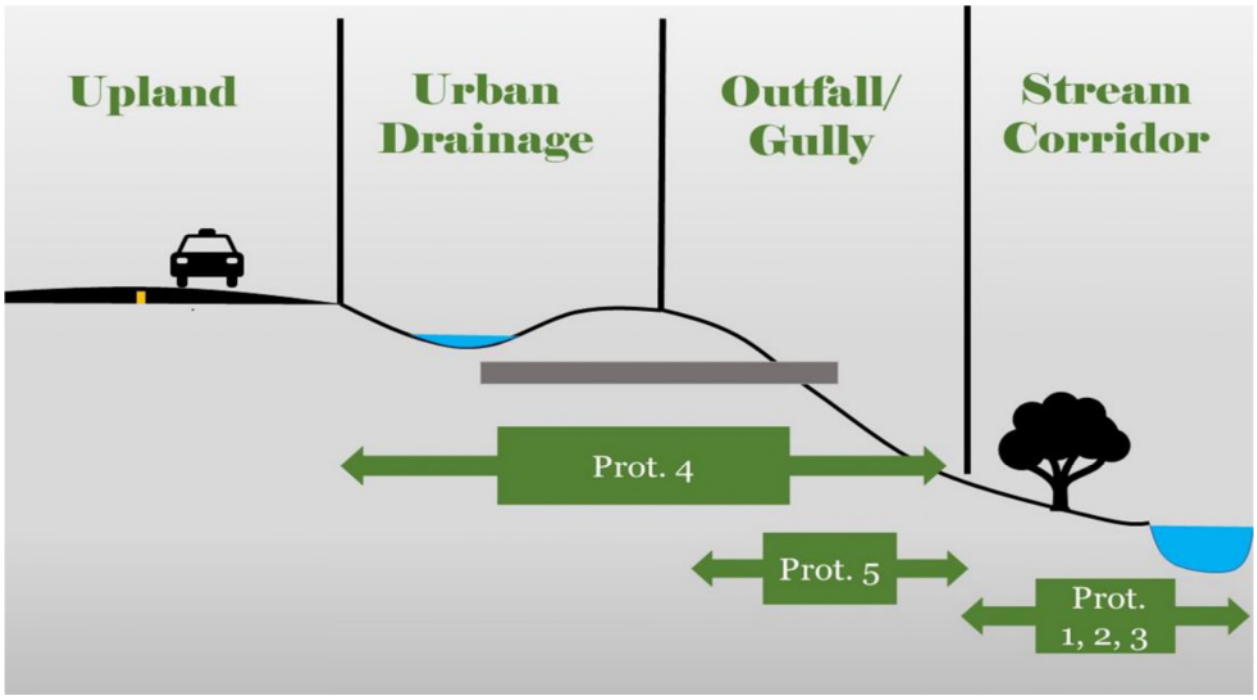
Protocol 1 or 5 may be used for wet-channel regenerative stormwater conveyance (RSC) practices installed on perennial or intermittent stream channels, but the two credits **cannot** overlap.

Protocol 4 (stormwater retrofit) and Protocol 5 can both be used for dry channel practices installed in ephemeral stream channels.

The pollutant reduction impact of outfall restoration projects is independent of any reduction achieved by upstream retrofits or other approved urban practices in the contributing drainage area.

Please note that Protocol 5 does not need to meet the Protocol 1 100’ minimum project length.

Figure V.K.1 – Schematic of Headwater Transition Zone showing most probable Protocol overlap – (Figure from *Recommendations for Crediting Outfall and Gully Stabilization Projects in the Chesapeake Bay Watershed* Final Memo October 15, 2019)



There are 5-steps that make up the Protocol 5 methodology, as follows:

1. Define the existing channel conditions
2. Define the equilibrium channel conditions
3. Calculate total volume of prevented sediment erosion
4. Convert total sediment volume to annual prevented sediment volume
5. Determine annual prevented nutrient loads

Step 1: Define the Existing Channel Conditions

The following measurements need to be collected from the existing headwater channel:

- Length of proposed project reach (ft)
- Channel slope (ft/ft)
- Bank height (ft)
- Bottom width (ft)
- Top width (ft)
- Bulk density (lb/ft^3)

The channel slope, bank height and top and bottom width should be taken at three representative cross-sections within the project reach prior to construction. The average of the three cross-sections will be used for the calculations. Bulk density samples should be taken roughly every 200 ft along the project reach. For sites shorter than 200 ft, one sample is sufficient.

Step 2: Define the Equilibrium Channel Conditions

There are four components of an equilibrium channel that must be defined:

- Base level control
- Equilibrium bed slope (ft/ft)
- Equilibrium bank slope (ft/ft)
- Future channel bottom width (ft)

Base Level Control:

Base level controls are the site constraints that bound the upstream and downstream extent of the equilibrium channel design and define the maximum extent of vertical scour at the project site in the absence of stabilization. Determine if the prospective project reach contains any of the following base level controls:

- Hard point control (ex. Bedrock or existing infrastructure)
- Confluence (elevation of larger, stable, receiving stream)
- Channel at equilibrium (existing slope is within 5% of the equilibrium slope)
- Upstream limit of erosion (pipe outfall or other defining structure)
- Downstream limits of equilibrium slope must be set at the downstream limits of project be stabilization features

The upstream limit of the credit calculation method may not always be defined by a pipe outfall or defining infrastructure. Migrating knickpoints caused by the breach of mill dams (Merritts et al. 2013) are an example of a vertical erosion force where a pipe outfall may not be the defining upstream limit. If no pipe outfall or other defining infrastructure is present upstream of the restoration site, the upstream limit is determined by the equation:

$$L_{max}=153A_d^{0.6}$$

Where L_{max} is the maximum upstream channel length (ft) from a given point, and A_d is the drainage area (acres). Upstream limits of erosion should be field verified.

Equilibrium Bed Slope:

To calculate the equilibrium bed slope, use the equation(s) in Table V.K.1 for the applicable bed conditions at the project site. The equilibrium slope analysis is based on methods from Technical Supplement 14B (TS14B) – Scour Calculations-of Part 654 of the National Engineering Handbook-Stream Restoration Design (National Resource Conservation Service (NRCS), 2007)

Table V.K.1 – Equilibrium Bed Slope Equations

Bed Condition	Slope Equation
Cohesive Bed	$S_{eq}=0.0028A^{-0.33}$
Sand and Fine Gravel (0.1-5mmparticle size)	$S_{eq}=0.06/(y*62.43)$
Beds coarser than sand (>5mm particle size)	Average of 4 equations, Details can be found in 2.1.3 of appendix A of the Recommendations for Crediting Outfall and Gully Stabilization Projects in the Chesapeake Bay Watershed expert panel report
S_{eq} is equilibrium slope (m/m or ft/ft), A is drainage area (km^2), and y is mean flow depth (ft). When estimating the critical shear stress, a 10-year recurrence interval cab be used for the design discharge, and intermediate suspended sediment concentration (1,000 to 2,000 ppm) can be assumed.	

Equilibrium Bank Slope:

The equilibrium bank slope for this analysis has been defined as 1.76:1. According to methods from Technical Supplement 14A (NRCS 2007), it has been shown that equilibrium bank slopes range from 1.4:1 to 2.1:1 in the absence of the influence of seepage. Utilizing the equilibrium bank slope for medium dense sand of 1.76:1 provides a conservative estimate for this analysis.

Future Bottom Width:

Select a representative reach within the study reach (from the groundwater origin or outfall location to the selected base level control feature) and take the average of three reference cross sections. This average will represent the future bottom width.

Step 3: Calculate the Total Prevented Sediment

To calculate the total volume of prevented sediment, you must take the difference between the equilibrium channel condition and the existing channel condition. This can be done using 3D surface modeling programs. (See Protocol 5 expert panel report for examples of 3D surface modeling programs) To run this analysis, you will need the information summarized in Table V.K.2

Table V.K.2 – Summary of Information Needed for 3D Surface Analysis

	Parameter	Source
Pre-Restoration Channel	Length of Project Reach	Measured
	Average Bank Height	3 measured cross sections
	Average Bottom Width	3 measured cross sections
	Average Top Width	3 measured cross sections
	Base Level Controls	Fixed start and end points determined by bedrock, existing infrastructure or downstream confluence
Equilibrium Channel	Equilibrium Bed Slope	Equations in Table V.K.1
	Equilibrium Bank Slope	1.76:1
	Average Bottom Width	3 measure cross sections from reference reach

Three-dimensional surface modeling can be a time and labor intensive process. To aid with initial site evaluation and project screening, it is recommended that interested parties review Appendix C of the OGSP Expert Panel Report.

Step 4: Convert the Total Sediment Volume to Annual Prevented Sediment Load

To convert the total volume of prevented sediment erosion to an annual timescale, divide the total volume by 30. Thirty years is recommended as a conservative estimate of the amount of time it would take an eroding outfall channel to export the total volume of sediment calculated in Step 3.

To maintain consistency with the Stream Restoration Expert Panel report, the mass load reductions should then be discounted to account for the fact that projects will not be 100% effective in preventing bed and bank erosion and that some sediment transport occurs naturally in a stable stream channel.

Consequently, a conservative approach assumes that projects will be 50% effective in reducing sediment and nutrients from the channel reach. Efficiencies greater than 50% may be allowed for projects that have shown through monitoring that the higher rates can be justified (subject to approval by DEQ). This conservative factor should be multiplied by the annual prevented sediment load.

$$S_p=0.5(S_v/30)$$

Where S_p represents the annual volume of prevented sediment and S_v represents the total volume of prevented sediment calculated in Step 3.

The annual volume of prevented sediment must also be adjusted by the bulk density of the soil to determine the final annual prevented sediment load. Bulk density measurements can be highly variable and each project site should have one sample collected every 200 ft throughout the reach to determine a representative bulk density value. The NRCS Soil Series data (NRCS 2019) may be used to provide an estimate value for preliminary calculations. Multiply the annualized sediment volume by the bulk density to determine the annual prevented sediment load.

Step 5: Determine the Annual Prevented Nutrients

Pollutant load reduction credits are awarded based on the amount of pollutant reduction estimated to occur as a result of the proposed project. The amount of TN and TP present along a project reach is determined by applying TN and TP concentrations to the annual sediment loading rate. Nutrient concentrations are highly variable from site to site. Because of this high variability, samples from the project reach should be collected and analyzed for TN and TP concentrations. Samples should be taken from the same locations as the bulk density samples and analyzed using the following methods:

Total P concentration: Total-sorbed P – EPA Method 3051+6010 (USEPA 1986)

Total N concentration: Total N combustion testing (Bremner 1996)

APPENDIX V.L – Urban Nutrient Management

Permittees are required under Part I.E.6.i of the MS4 GP to maintain and implement Nutrient Management Plans (NMPs) on "all lands owned or operated by the MS4 operator where nutrients are applied to a contiguous area greater than one acre." Permittees cannot receive credit towards the TMDL reduction requirements for the development of NMPs that are required by Virginia statute or regulation. However, permittees may receive credit for NMPs that are developed for lands outside the MS4 service area[15], public lands within the MS4 service area that are one contiguous acre or less, or privately owned lands where nutrients are applied that are not golf courses. Urban Nutrient Management plans can be applied and reported in partial acres. If any BMPs are installed downstream of land where a credited urban nutrient management plan has been applied, permittees will need to account for the reduced pollutant load going to that BMP. The efficiency accepted for nutrient management is based on the risk level for the site. Where the risk level is unknown, permittees should use the blended efficiency (*Table V.L.1*).

Table V.L.1 – Urban Nutrient Management Removal Rate

Site Risk Level	TN	TP
High	20%	10%
Low	6%	3%
Unknown (Blended)	9%	4.5%

The removal rate represents a percent reduction of pervious load based on the number of acres the UNM plan covers. The load that is reduced should be calculated based on the loading rates in permit Tables 2a-d. How risk for the site is estimated is discussed in greater detail in the following report:

- *Recommendation of the Expert Panel to Define Removal Rates for Urban Nutrient Management,* March 2013, which can be found at: http://www.chesapeakebay.net/documents/Final_CBP_Approved_Expert_Panel_Report_on_Urban_Nutrient_Management--short.pdf

EXAMPLE V.L.1 – Nutrient Management on Unregulated Land

A permittee in the York River Basin develops an NMP for 5 acres of privately owned turf fields that are located outside of their regulated MS4 service area. Since the NMP is for unregulated land, the permittee will receive an adjusted credit for the NMP after the baseline reductions are subtracted from the total expected NMP reductions.

To calculate the reductions from the NMP that will be credited towards the TMDL reduction requirements the permittee should first calculate the POC reductions from the NMP based on the *Recommendation of the Expert Panel to Define Removal Rates for Urban Nutrient Management*. The permittee references the regulated urban pervious numbers in Table 3d in the permit to calculate the POC loads for the 5 acre project:

5 acres * 7.65 lbs TN/ac/yr = 38.25 lbs TN/yr

5 acres * 0.51 lbs TP/ac/yr = 2.55 = lbs TP/yr

The risk level for the 5 acres is unknown, so the permittee uses the blended efficiency to calculate the reductions from the NMP:

[15] If the BMP was funded by a 319 nonpoint source grant, it may be contrary to the funding award to seek credit towards required reductions under the Special Condition.

38.25 lbs TN/yr * 0.09 = 3.44 lbs TN/yr

2.55 lbs TP/yr * 0.045 = 0.11 lbs TP/yr

In accordance with the Code of Virginia § 62.1-44.19:20B.2.e, the permittee must account for baseline reductions on unregulated land prior to taking credit for any BMP reductions**. For NMPs, baseline is the 48% reduction on all urban pervious lands that is assumed under the WIP. The permittee may receive credit for the remaining 52% of the project's reductions:**

3.44 lbs TN/yr * .52 = 1.79 lbs TN/yr (1.8 lbs TN/yr)

.11 lbs TP/yr * .52 = 0.06 lbs TP/yr (0.06 lbs TP/yr)

For developing an NMP for 5 acres of privately owned turf fields outside of the permittee's MS4 service area, the permittee may take credit for reductions of 1.8 lbs TN/yr and 0.06 lbs TP/yr.

All NMPs implemented for nutrient credits following this guidance should be entered into the BMP Warehouse tracking template for MS4s to provide a record of the credits achieved.

APPENDIX V.M – Development on Prior Developed Lands (Redevelopment)

Permittees may receive credit for redevelopment projects if the pre-development pollutant load is reduced, regardless of the initial land use condition. Under VSMP regulations (9VAC25-870), development projects may be subject to either Technical Criteria II B or Technical Criteria II C:

Projects Subject to Technical Criteria II B:

Under VSMP regulations, those projects subject to Technical Criteria II B permittees are (1) required to reduce phosphorous by 20% for land-disturbing activities disturbing greater than or equal to one acre that result in no net increase in impervious cover from the predevelopment condition or (2) reduce phosphorous by 10% for land-disturbing activities disturbing less than one acre that result in no net increase in impervious cover from the predevelopment condition. Permittees may take credit for these reductions. Permittees may also take credit for any Nitrogen and/or Sediment reductions that are created by the BMPs that are implemented to meet these requirements.

Projects Subject to Technical Criteria II C:

Technical Criteria II C applies to those projects that initiate construction prior to July 1, 2014, or are grandfathered in accordance with 9VAC-25-870-48. For these projects, permittees may use either the (1) performance-based criteria or the (2) technology- based criteria:

(1) Performance Based Criteria – Reductions may be credited to the permittee if the phosphorous load is reduced through development of prior developed lands (See Appendix II – Situation 3).
(2) Technology Based Criteria – If this approach is used, no additional reductions are required under the Special Condition beyond those for existing development under Special Condition requirement 3 GP Part II.A.3.

APPENDIX V.N - Urban Tree Canopy Expansion

Permittees may receive credit for the Urban Tree Canopy Expansion BMP, which is defined as the planting of trees in urban areas on developed land. This would be tree planting on impervious or turf grass that would provide for an increase in tree canopy, but is not intended to result in forest-like conditions. The Urban Tree Canopy Expansion practice provides pollution reduction credits for new individually planted trees in developed areas; the trees can be street trees, residential plantings, or other small scale plantings. There is not a planting density requirement, and trees would not have to be planted in a contiguous area for this BMP. There are good opportunities for tree planting in both new and redevelopment sites, and on public lands.

There are two other allowable practices that would provide credit for tree plantings that are different from the Urban Tree Canopy BMP: the Urban Forest Planting practice, and the Urban Forest Buffer practice. The Urban Forest Planting practice is intended to provide tree plantings to establish forest-like conditions, which includes meeting state planting density and understory management requirements. The Urban Tree Canopy BMP is also different from the Urban Forest Buffer practice that provides credit for trees planted along streams or bodies of water.

The primary way that urban trees affect water quality is by reducing the amount of stormwater runoff that reaches surface waters. Benefits of tree canopy expansion include: detention of rainfall and gradually releasing it; regulating the volume and peak flow of stormwater runoff downstream; reducing the transfer to local waterways and the amount of pollutants in rainfall. Additional benefits would include better air quality, wildlife habitat and reductions in urban heat islands within communities. Because of these benefits, the Urban Tree Canopy practice can now be implemented for nutrient and sediment reductions as part of the Chesapeake Bay TMDL action plan requirements.

The new acres achieved through Urban Tree Canopy Expansion projects will be tracked and reported as BMPs since they represent on-the-ground actions. A strategy for a holistic approach for managing the urban tree canopy is recommended to maintain the tree canopy BMP. This would include incorporating planning, protection and maintenance actions needed to sustain a healthy urban tree program.

Other factors to consider to obtain credit for the Urban Tree Canopy BMP include:

1. Tree planting projects are encouraged to use a selection of native species.
2. To avoid double counting with the existing tree canopy land use, annual tracking and reporting of new acres of tree canopy will be reported as a land use change BMP and tracked separately from the existing land uses.
3. The credit for the Urban Tree Canopy practices is cumulative so that the acres reported in a previous year carry over into the next year.
4. The annual acreage credit is based upon 10 years of projected growth after planting.

Finally, it is important to note that the following list of tree planting activities and their definitions listed below should not be submitted as part of the Urban Tree Canopy Expansion BMP. These are separate types of BMPs and would be credited differently and **entered into the DEQ BMP Warehouse tracking tool under their own designation.**

1. Urban Forest Planting BMPs - Larger plantings in developed areas that are managed to create forest-like conditions/understory following forestry guidelines: https://law.lis.virginia.gov/admincodeexpand/title4/agency10/chapter20/ .
2. Urban Forest Buffer BMPs –Trees planted for the Urban Tree Canopy BMP cannot be part of a riparian forest buffer, which would exist along streams and rivers within a minimum width of 35 ft.
3. Trees planted as part of a structural BMP (bioretention, tree planter, enhanced tree pits) are considered part of stormwater BMP reporting and should not be reported under Urban Tree Planting; and

4. Trees planted for mitigation plantings which simply replace existing trees that have been removed should not be reported.[16]

In the Chesapeake Bay Watershed Model, the BMP credit duration for this practice is 10 years. Re-verification is required to extend the credit duration. The credit of this BMP is cumulative, which means that the acres reported in a previous year be applied into the next year. Once high resolution imagery is available, the trees will be captured through the tree canopy land uses rather than an annual BMP submissions and changes in the aerial extent of tree canopy will be captured through this data.

[16]Chesapeake Tree Canopy Network, "A Guide for Forestry Practices in the Chesapeake TMDL Phase III WIPs"

Calculation of Credit for Urban Tree Canopy Expansion BMP

The actions required to qualify for the Urban Tree Canopy Expansion BMP credit in the Chesapeake Bay TMDL Action Plan include: record keeping and tracking of the newly planted trees; submittal of the Urban Tree Canopy Expansion BMP practice information into the DEQ BMP Warehouse and upload of the information by October 1 annually. Maintenance of tree planting records and verification will also need to be updated in the BMP Warehouse to maintain the credit. The length of credit is 10 years and reverification is required continue the credit.

To calculate the allowable crediting for the UTC Expansion BMP, tables for the average land use loading rates and the recommended allowable reductions for Nitrogen, Phosphorus and sediment are provided below. An example calculation to determine the allowable credit for this practice is also included below.

A locality in the Potomac River Basin is planning two tree canopy projects and would like to know how much pollution credit they will earn. The first project will plant 400 new street trees. The second project will create a forest-like area on a 2 acre grassy lot in the city.

Step 1. *Apply a conversion factor to convert the number of street trees to acres of tree canopy.*

300 trees planted are equivalent to 1 acre of tree canopy coverage.

400 trees * 1/300 acre = 1.33 acres

Step 2. *Calculate the pollution loads prior to the tree plantings.*

The canopy from the street trees will cover the existing “Roads” land use, so you will need to determine the pollutant load from 1.33 acres of Roads. Similarly, the forest planting is converting a grassy or Turf lot to forest, so you will calculate the existing pollutant load from 2.00 acres of Turf.

Table 1. Average Land Use Loading Rates

River Basin	TN (lbs/acre/year)	TP (lbs/acre/year)	TSS (lbs/acre/year)
VA James River Basin (CBWSOnly)			
Turf	8.21	1.45	242.92
Roads	15.25	0.96	761.09
Other Impervious	12.08	0.77	684.42
Forest	1.22	0.08	52.10
VA Potomac River Basin (CBWSOnly)			
Turf	6.61	1.51	646.73
Roads	11.70	0.95	1,784.89
Other Impervious	9.48	0.78	1,791.66
Forest	1.16	0.07	57.54
VA Rappahannock River Basin (CBWSOnly)			
Turf	6.50	1.35	482.71
Roads	11.98	0.87	1,258.84
Other Impervious	9.12	0.71	1,359.66
Forest	1.20	0.07	46.75
VA York River Basin (CBWSOnly)			
Turf	9.56	1.55	128.25
Roads	17.26	1.02	419.63
Other Impervious	13.68	0.84	372.54
Forest	1.15	0.05	11.03
Sediment loading rates are based upon MS4 average loading rates. These loading rates are applicable for Urban Tree Canopy BMPs in MS4 regulated areas only.			

The loading rates are provided in Table 1 by river basin, similar Appendix V.H, Land Use Change section within this guidance. Roads have a nitrogen loading rate of 11.70 lbs/acre/year, while Turf has a nitrogen loading rate of 6.61.lbs/acre/year in the Potomac River basin.

Street Trees, Potomac River Basin, Roads: 1.33 acres *11.70 lb/ac/yr = 15.56. lbs/yr TN

Forest Planting: 2.00 acres * 6.61 lb/ac/yr = 13.22. lbs/yr TN

Step 3. *Calculate the pollution load reductions for each tree planting project.*

Table 2. Tree canopy relative land use loading rates based on the underlying land use land cover (Source Hynicka and Divers 2016)

Land Use	TN Reduction (%)	TP Reduction (%)	TSS Reduction (%)
Canopy Over Turf	23.8	23.8	5.8
Canopy Over Roads	8.5	11.0	7.0
Forest	85.0	90.7	81.6*
*Percent reduction is based on average MS4 land use loading rate for sediment.			

For each planting, multiply the pollutant load prior to the planting, by the percent reduction associated with the new land use cover (Table 2). For the street trees, you convert “Roads” to “Canopy over Roads.” For “Turf”, you convert “Turf” to “Canopy over Turf.”

Canopy over Roads: 15.56/yr lbs TN * 0.085 = 1.32 lbs/yr TN reduced (1.3 lbs TN/yr)

Forest Planting: 13.22 lbs/yr TN * 0.85 = 11.24 lbs/yr TN reduced (11 lbs TN/yr)

Step 4. *Repeat steps 2-3 for phosphorus and total suspended solids.*

In this example, the community reduced 1.32 lbs TN for their street tree planting, and 11 lbs TN for their forest tree Planting on the Turf (grassy) lot.

The calculation methodology is based upon information provided in the expert panel report, *Recommendations of the Expert Panel to Define BMP Effectiveness for Urban Tree Canopy Expansion* (Final Approval by the Water Quality Goal Implementation Team, September 12, 2016 Chesapeake Stormwater Network)

Law, Neely L, PhD et al. (2016) Final Approval by the Water Quality Goal Implementation Team, September 12, 2016. *Recommendations of the Expert Panel to Define BMP Effectiveness for Urban Tree Canopy Expansion.*

U-11: Urban Tree Canopy Expansion. U-11 Urban Tree Planting Practices Fact Sheet, Chesapeake Stormwater Network.

APPENDIX V.O – Septic Disconnections

Connections made after January 1, 2006, can be credited; connections made prior to this date will not be eligible for crediting.

Credit for disconnections can be claimed by the jurisdiction in which the septic system is located, unless a credit sharing agreement with an adjoining locality with which the sewerage system is shared has be provided to the Department.

Total Nitrogen reductions are calculated using a load of 8.8 lbs N/person/yr at the edge of the septic field minus a 60% attenuation factor to the edge of stream or a net reduction of 3.5 lbs/TN/person/yr. There is no Phosphorus or Sediment credit for septic disconnects. The number of persons per household should be established using the latest US Census data for the locality unless the actual number of people living in each house being taken off of septic has been determined.

APPENDIX VI – Credit for BMPs installed prior to July 1, 2009

For all BMPs or impoundments that were installed prior to July 1, 2009, permittees may receive credit for any incremental increase in treatment that is the result of an enhancement, conversion, or restoration project. Restoration projects must meet the minimum requirements that are listed in the *Expert Panel to Define Removal Rates for Urban Stormwater Retrofits* report to be eligible for credit. Permittees may not receive full credit for BMPs that were installed prior to January 1, 2006, regardless of whether or not they were previously reported to the Department.

Note: Permittees that participated in the "Historical Data Clean-Up effort" and provided the required BMP data by the September 1, 2015, deadline may continue to receive full credit for BMPs within the MS4 regulated service area that were initially installed on or after January 1, 2006, and prior to July 1, 2009.

APPENDIX VII – REPORTING ELEMENTS

Table VI.1 – Reporting Elements for Individual BMPs

Virginia Stormwater BMP Clearinghouse BMP	
Practice	Reporting Elements
Rooftop Disconnection	Impervious acres disconnected
Sheetflow to Vegetated Filter or Conserved Open Space 1 & 2	area in acres treated
Grass Channel	area in acres treated by grass channel
Vegetated Roof 1 & 2	area in acres treated by vegetated roof
Rainwater Harvesting	volume of rainwater captured
Permeable Pavement 1	area in acres treated by permeable pavement and upgradient area draining to pavement, so long as it does not exceed a ratio of 2:1
Permeable Pavement 2	area in acres treated by permeable pavement
Infiltration 1 & 2	area in acres treated by infiltration practices
Bioretention 1 & 2, Urban Bioretention	area in acres treated by bioretention practices
Dry Swale 1 & 2	area in acres treated by dry swale
Wet Swale 1 & 2	area in acres treated by wet swale
Filtering Practice 1 & 2	area in acres treated by filtration practices
Constructed Wetland 1 & 2	area in acres treated by constructed wetlands
Wet Pond 1 & 2	area in acres treated by Wet Ponds
Extended Detention Pond 1 & 2	area in acres treated by Extended Detention Ponds
Chesapeake Bay Program BMPs	
Wet Ponds and Wetlands	area in acres treated by Wet Ponds or wetlands
Dry Detention Ponds and Hydrodynamic Structures	area in acres treated by Dry Detention Ponds or Hydrodynamic Structures
Dry Extended Detention Ponds	area in acres treated by Dry Extended Detention Ponds
Infiltration Practices w/o Sand, Veg.	area in acres treated by infiltration practices
Infiltration Practices w/ Sand, Veg.	area in acres treated by infiltration practices
Filtering Practices	area in acres treated by filtration practices
Bioretention C/D soils, underdrain	area in acres treated by bioretention practices
Bioretention A/B soils, underdrain	area in acres treated by bioretention practices
Bioretention A/B soils, no underdrain	area in acres treated by bioretention practices
Vegetated Open Channels C/D soils, no underdrain	area in acres treated by vegetated Open Channels C/D soils, no underdrain
Vegetated Open Channels A/B soils, no underdrain	area in acres treated by vegetated Open Channels A/B soils, no underdrain
Bioswale	area in acres treated by bioswale
Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	area in acres of permeable pavement w/o Sand, Veg. C/D soils, underdrain
Permeable Pavement w/o Sand, Veg. A/B soils, underdrain	area in acres of permeable pavement w/o Sand, Veg. A/B soils, underdrain
Permeable Pavement w/o Sand, Veg. A/B soils, no underdrain	area in acres of permeable pavement w/o Sand, Veg. A/B soils, no underdrain
Permeable Pavement w/Sand, Veg. C/D soils, underdrain	area in acres of permeable pavement w/Sand, Veg. C/D soils, underdrain
Permeable Pavement w/Sand, Veg. A/B soils, underdrain	area in acres of permeable pavement w/Sand, Veg. A/B soils, underdrain
Permeable Pavement w/Sand, Veg. A/B soils, no underdrain	area in acres of permeable pavement w/Sand, Veg. A/B soils, no underdrain

Performance Standard Curve ST or RR, Establishment Retrofit Curve ST or RR, Enhancement Retrofit Curve ST or RR, Restoration Retrofit Curve Pre-restoration condition ST or RR, Restoration Retrofit Curve Post restoration condition ST or RR	total area of runoff collection, impervious area within the total, inches of runoff captured
Wetland Restoration	area in acres of restored wetlands
Stream Restoration	linear feet of stream restoration
Land Use Change BMPs	
Impervious Urban Surface Reduction	area in acres of reduced impervious surface
Forest Buffers	area in acres converted to riparian forest
Grass Buffers	area in acres converted to riparian grasses or herbaceous plants
Urban Forest Planting	area in acres converted to forest
Urban Tree Canopy Expansion	number of trees planted