

**HENRICO COUNTY
CHESAPEAKE BAY TMDL ACTION PLAN**

CHESAPEAKE BAY TMDL ACTION PLAN

SECTION 1. OVERVIEW

Henrico County's Chesapeake Bay TMDL Action Plan (Action Plan) has been developed in accordance with the requirements of the County's MS4 Permit and the applicable recommendations contained in *Chesapeake Bay TMDL Special Condition Guidance* (Guidance), developed by the Virginia Department of Environmental Quality and dated May 18, 2015. The County's MS4 Permit requires this Action Plan to document a minimum 5% reduction of the applicable total pollutants of concern (nitrogen, phosphorus, and sediment) during the first MS4 Permit cycle (April 1, 2016 through March 31, 2020.) As stated in the Guidance, **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.**

SECTION 2. MS4 PERMIT LANGUAGE

PART I.D. TMDL ACTION PLAN AND IMPLEMENTATION

1. Chesapeake Bay Special Condition

The Commonwealth in its Phase I and Phase II Chesapeake Bay TMDL Watershed Implementation Plans (WIP) committed to a phased approach for MS4s permittees to implement necessary reductions. This state 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 5% of L2 as specified in the 2010 Phase I WIP. Conditions of future permits will be consistent with the TMDL or WIP conditions in place at the time of permit issuance.

a) Definitions

The following definitions apply to this state permit for the purpose of the Special Condition for Discharges in the Chesapeake Bay Watershed:

- 1) "Existing Sources" means pervious and impervious urban land uses served by the MS4 as of June 30, 2009.
- 2) "New Sources" means pervious and impervious urban land uses served by the MS4 developed or redeveloped on or after July 1, 2009.
- 3) "Transitional Sources" means regulated land disturbing activities which are temporary in nature and discharge through the MS4.

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- 4) "Pollutants of concern" or "POC" means total nitrogen, total phosphorus and total suspended solids.
- b) Chesapeake Bay Watershed TMDL Planning
- 1) No later than 24-months after the effective date of this state permit, the permittee shall develop and submit to the Department for its review and acceptance an approvable phased Chesapeake Bay TMDL Action Plan that includes:
 - (a) A review of the current MS4 Program Plan including existing legal authorities and the permittee's ability to ensure compliance with this special condition;
 - (b) Identifies any new or modified legal authorities, such as ordinances, permits, orders, contracts and inter-jurisdictional agreements, implemented or needing to be implemented to meet the requirements of this special condition;
 - (c) The means and methods utilized to address discharges into the MS4 from new sources.
 - (d) An estimate of the annual POC loads discharged from the existing sources as of June 30, 2009 based on the 2009 progress run. The permittee shall utilize Table 1 and multiply the total existing acres served by the MS4 on June 30, 2009 and the 2009 Edge of Stream (EOS) Loading Rate.

Table 1: Calculation Sheet for Estimating Existing Source Loads for the James River Basin (Based on Chesapeake Bay Program Watershed Model Phase 5.3.2)				
Subsource	Pollutant	Total Existing Acres Served by MS4 (6/30/09)	2009 EOS Loading Rate (lbs/ac/yr)	Estimated Total POC Load Based on 2009 Progress Run (lb/yr)
Regulated Urban Impervious	Nitrogen		9.39	
Regulated Urban Pervious			6.99	
Regulated Urban Impervious	Phosphorus		1.76	
Regulated Urban Pervious			0.5	
Regulated Urban	Total Suspended		676.94	

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Impervious	Solids			
Regulated				
Urban			101.08	
Pervious				

- (e) A determination of the total pollutant load reductions necessary to reduce the annual POC existing loads using Table 2 by multiplying the *Total Existing Acres Served by MS4* by the *First Permit Cycle Required Reduction in Loading Rate*.

Table 2: Calculation Sheet for Determining Total POC Reductions Required During this State Permit Cycle for the James River Basin (Based on Chesapeake Bay Program Watershed Model Phase 5.3.2)				
Subsource	Pollutant	Total Existing Acres Served by MS4 (6/30/09)	First Permit Cycle Required Reduction in Loading Rate (lbs/ac/yr)	Total Reduction Required During First Permit Cycle (lbs/yr)
Regulated Urban Impervious	Nitrogen		0.04	
Regulated Urban Pervious			0.02	
Regulated Urban Impervious	Phosphorus		0.01	
Regulated Urban Pervious			0.002	
Regulated Urban Impervious	Total Suspended Solids		6.67	
Regulated Urban Pervious			0.44	

- (f) The means and methods, such as the management practices and retrofit programs that will be utilized to meet the required reductions identified in Part I.D.1.b)(1)(e) and a schedule to achieve those reductions. The schedule should include annual benchmarks to demonstrate the on-going progress in meeting the reductions.
- (g) The means and methods to offset the increased loads from new sources initiating construction between July 1, 2009 and June 30, 2014 that

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disturb one acre or greater as a result of the utilization of an average land cover condition greater than 16% impervious cover for the design of post development stormwater management facilities. The permittee shall utilize Table 3 to develop the equivalent pollutant load for nitrogen and total suspended solids. The permittee shall offset 5% of the calculated increased load from these new sources during the permit cycle.

- (h) The means and methods to offset the increased loads from grandfathered projects in accordance with 9VAC25-870-48, that disturb one acre or greater that begin construction after July 1, 2014 where the project utilized an average land cover condition greater than 16% impervious cover in the design of post development stormwater management facilities. The permittee shall utilize Table 3 to develop the equivalent pollutant load for nitrogen and total suspended solids.

Table 3: Ratio of Phosphorus Loading Rate to Nitrogen and Total Suspended Solids Loading Rates for Chesapeake Bay Basins (Based on Chesapeake Bay Program Watershed Model Phase 5.3.2)			
<u>Ratio of Phosphorus to Other POCs (Based on All Land Uses 2009 Progress Run)</u>	<u>Phosphorus Loading Rate (lbs/ac/yr)</u>	<u>Nitrogen Loading Rate (lbs/ac/yr)</u>	<u>Total Suspended Solids Loading Rate (lbs/ac/yr)</u>
James River Basin	1.0	5.2	420.9

- (i) A list of future projects and associated acreage that qualify as grandfathered in accordance with 9VAC25-870-48.
- (j) An estimate of the expected cost to implement the necessary reductions during the permit cycle;
- (k) An opportunity for receipt and consideration of public comment on the draft Chesapeake Bay TMDL Action Plan; and,
- (l) A list of all comments received as a result of public comment and any modifications made to the draft Chesapeake Bay TMDL Action Plan as a result of the public comments.
- 2) As part of development of the Chesapeake Bay TMDL Action Plan, the permittee shall consider use of the following:
- (a) Implementation of BMPs on unregulated lands provided the baseline reduction is subtracted from the total reduction prior to application of the reduction towards meeting the required reductions.
- (b) Utilization of stream restoration projects provided the baseline reduction from the unregulated acreage treated by the stream restoration project is subtracted from the total reduction prior to application of the reduction towards meeting the required reductions.

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- (c) Establishment of a memorandum of understanding (MOU) with other MS4 permittees that discharge to the same or adjacent eight digit hydrologic unit within the same basin to implement BMPs collectively. The MOU shall include a mechanism for dividing the POC reductions created by BMP implementation between the cooperative MS4s.
 - (d) Utilization of any pollutant trading or offset program in accordance with §62.1-44.19:20 through 62.1-44.19:23 et seq. of the Code of Virginia governing trading and offsetting.
 - (e) A more stringent average land cover condition based on less than 16% impervious cover for new sources initiating construction between July 1, 2009, and June 30, 2014, and all grandfathered projects where allowed by law; and
 - (f) Any BMPs installed after June 30, 2009, as part of a retrofit program may be applied towards meeting the required load reductions provided any necessary baseline reductions are not included.
 - 3) The permittee shall address any modification to the TMDL or watershed implementation plan that occurs during the term of this state permit as part of its permit reapplication as required in Part II.M of this state permit.
 - 4) The Chesapeake Bay TMDL Action Plan shall become effective and enforceable upon written approval from the Department.
- c) Chesapeake Bay TMDL Action Plan Implementation
- 1) The permittee shall implement the TMDL action plan required in Part I.D.1.b)1) of this state permit according to the schedule therein. Compliance with this requirement represents adequate progress for this state permit term towards achieving TMDL wasteload allocations consistent with the assumptions and requirements of the TMDL.
 - 2) For the purposes of this state permit, the implementation of the following represents implementation to the maximum extent practicable and demonstrates adequate progress:
 - (a) Implementation of turf and landscape nutrient management plans in accordance Part I.B.2.d);
 - (b) Implementation of construction site runoff controls in Part I.B.2.a) in accordance with this state permit shall address discharges from transitional sources;
 - (c) Implementation of the means and methods to address discharges from new sources in accordance with requirements in Part I.B.2.a) for post-construction runoff from areas of new development and development on prior developed lands to offset 5% of the total increase in POC loads between July 1, 2009 and June 30, 2014 required in Part I.D.1.b)1)(g) and to offset increases in the POC load from grandfathered projects initiating

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construction after July 1, 2014 prior to completion of the project as required in Part I.D.1.b)1)(h); and,

- (d) Implementation of means and methods sufficient to meet 5% required reductions of POC loads from existing sources defined in this state permit in accordance with the Chesapeake Bay TMDL Watershed Implementation Plan as required in Part I.D.1.b)1)(e).

d) Annual Reporting Requirements

- 1) In accordance with Part I D.1.b)1), the permittee shall submit the Chesapeake Bay TMDL Action Plan with the annual report due March 31, 2017.
- 2) Beginning with the annual report due March 31, 2018, each annual report shall include a list of control measures implemented during the reporting period and the cumulative progress toward meeting the compliance targets for total nitrogen, phosphorus, and total suspended solids.
- 3) Beginning with the annual report due March 31, 2018, each annual report shall include a list of control measures that were implemented during the reporting cycle and the estimated reduction achieved by the control. For stormwater management controls, the report shall include the information required in Part I.C.3.a) and shall include whether an existing stormwater management control was retrofitted, and if so, the existing stormwater management control type retrofit used.
- 4) Beginning with the annual report due March 31, 2018, each annual report shall include a list of control measures that are expected to be implemented during the next reporting period and the expected progress toward meeting the compliance targets for total nitrogen, total phosphorus, and total suspended solids.
- 5) The permittee shall include the following as part of its reapplication package due in accordance with Part II.M:
 - (a) Documentation that sufficient control measures have been implemented (or documentation detailing that implementation will be complete by the expiration date of this state permit) to meet the compliance target identified in this Special Condition. If temporary credits or offsets have been purchased in order to meet the compliance target, the list of temporary reductions utilized to meet the 5% reduction in this state permit and a schedule of implementation to ensure a permanent 5% reduction shall be provided; and
 - (b) A draft second phase Chesapeake Bay TMDL Action Plan designed to reduce the existing POC loads by an additional seven times the required reductions in loading rates using Table 2 of Part I.D.1.b) of this state

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- permit unless alternative calculations have been provided by the Commonwealth;
- (c) An additional 35% reduction in new sources developed between 2009 and 2014 and for which the land use cover condition was greater than 16%; and
 - (d) Accounting for any modification to the applicable loading rate provided to the permittee as a result of TMDL modification.

SECTION 3. APPLICABLE WASTELOAD ALLOCATIONS

Total Nitrogen

Wasteload Allocation (lbs / year)	Watershed(s)	TMDL Report	EPA Approval Date	SWCB Approval Date
25,385.25	Chickahominy River oligohaline estuary	Chesapeake Bay TMDL	12/29/2010	N/A
150,930.68	James River upper tidal freshwater estuary	Chesapeake Bay TMDL	12/29/2010	N/A

From **Attachment A: Applicable TMDL Wasteload Allocations** in the County's MS4 Permit

Total Phosphorus

Wasteload Allocation (lbs / year)	Watershed(s)	TMDL Report	EPA Approval Date	SWCB Approval Date
13,337.88	Chickahominy River oligohaline estuary	Chesapeake Bay TMDL	12/29/2010	N/A
20,531.88	James River upper tidal freshwater estuary	Chesapeake Bay TMDL	12/29/2010	N/A

From **Attachment A: Applicable TMDL Wasteload Allocations** in the County's MS4 Permit

Total Suspended Solids

Wasteload Allocation (lbs / year)	Watershed(s)	TMDL Report	EPA Approval Date	SWCB Approval Date
522,195.38	Chickahominy River oligohaline estuary	Chesapeake Bay TMDL	12/29/2010	N/A
4,435,348.87	James River upper tidal freshwater estuary	Chesapeake Bay TMDL	12/29/2010	N/A

From **Attachment A: Applicable TMDL Wasteload Allocations** in the County's MS4 Permit

SECTION 4. CHESAPEAKE BAY WATERSHED TMDL PLANNING

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Henrico County's Phase One Chesapeake Bay TMDL Action Plan addresses the following:

SECTION 4.1

A review of the current MS4 Program Plan including existing legal authorities and the permittee's ability to ensure compliance with this special condition.

Henrico has reviewed its current MS4 Program Plan and has determined that the legal authorities as stated in the current MS4 Program Plan are sufficient for compliance with this special condition. Please refer to Part I.A.3 of the MS4 Program Plan for a listing of the legal authorities.

SECTION 4.2

Identifies any new or modified legal authorities, such as ordinances, permits, orders, contracts and inter-jurisdictional agreements, implemented or needing to be implemented to meet the requirements of this special condition.

As stated in Section 4.1 above, existing legal authorities are sufficient for compliance with this special condition. Therefore, no new or modified legal authorities beyond those listed in Part I.A.3 of the MS4 Program Plan are necessary.

SECTION 4.3

The means and methods utilized to address discharges into the MS4 from new sources.

The means and methods used to address discharges into the MS4 from new sources (pervious and impervious urban land uses served by the MS4 developed or redeveloped on or after July 1, 2009) are the stormwater management programs implemented since 1991. These programs applied to all development / redevelopment exceeding 2,500 square feet of land disturbance.

From 1991 and until July 1, 2014, an average land cover condition of 16% was used to compute pollutant removal requirement and for the design of required BMPs consistent with the CBPA Regulations and stormwater management regulations in place at that time. Beginning July 1, 2014, the County began

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requiring stormwater pollutant reductions consistent with the revised VSMP Regulations using the Virginia Runoff Reduction Method. Since implementing stormwater pollutant reductions programs in 1991, the County's application of those programs has been determined to be consistent with applicable laws and regulations by applicable State agencies.

Therefore, there are no additional increases in POCs from new sources that must be addressed by this TMDL Action Plan.

SECTION 4.4

An estimate of the annual POC loads discharged from the existing sources as of June 30, 2009 based on the 2009 progress run. The permittee shall utilize Table 1 and multiply the total existing acres served by the MS4 on June 30, 2009 and the 2009 Edge of Stream (EOS) Loading Rate.

Table 1: Calculation Sheet for Estimating Existing Source Loads for the James River Basin (Based on Chesapeake Bay Program Watershed Model Phase 5.3.2)				
<u>Subsource</u>	<u>Pollutant</u>	<u>Total Existing Acres Served by MS4 (6/30/09)¹</u>	<u>2009 EOS Loading Rate (lbs/ac/yr)</u>	<u>Estimated Total POC Load Based on 2009 Progress Run (lb/yr)</u>
Regulated Urban Impervious ²	Nitrogen	14,187.16	9.39	133,217.06
Regulated Urban Pervious ³		17,529.11	6.99	122,528.48
Regulated Urban Impervious	Phosphorus	14,187.16	1.76	24,969.33
Regulated Urban Pervious		17,529.11	0.5	8,764.56
Regulated Urban Impervious	Total Suspended Solids	14,187.16	676.94	9,603,829.01
Regulated Urban Pervious		17,529.11	101.08	1,771,842.44

¹ See Attachment 1

² See Attachment 2

³ See Attachment 2

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SECTION 4.5

A determination of the total pollutant load reductions necessary to reduce the annual POC existing loads using Table 2 by multiplying the *Total Existing Acres Served by MS4* by the *First Permit Cycle Required Reduction in Loading Rate*.

Table 2: Calculation Sheet for Determining Total POC Reductions Required During this State Permit Cycle for the James River Basin (Based on Chesapeake Bay Program Watershed Model Phase 5.3.2)				
<u>Subsource</u>	<u>Pollutant</u>	<u>Total Existing Acres Served by MS4 (6/30/09)⁴</u>	<u>First Permit Cycle Required Reduction in Loading Rate (lbs/ac/yr)</u>	<u>Total Reduction Required During First Permit Cycle (lbs/yr)</u>
Regulated Urban Impervious ⁵	Nitrogen	14,187.16	0.04	567.48
Regulated Urban Pervious ⁶		17,529.11	0.02	350.58
Regulated Urban Impervious	Phosphorus	14,187.16	0.01	141.87
Regulated Urban Pervious		17,529.11	0.002	35.06
Regulated Urban Impervious	Total Suspended Solids	14,187.16	6.67	94,628.09
Regulated Urban Pervious		17,529.11	0.44	7,712.81

⁴ See Attachment 1

⁵ See Attachment 2

⁶ See Attachment 2

SECTION 4.6

The means and methods, such as the management practices and retrofit programs that will be utilized to meet the required reductions identified in Part I.D.1.b)(1)(e) and a schedule to achieve those reductions. The schedule should include annual benchmarks to demonstrate the on-going progress in meeting the reductions.

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Mean / Method	Type	Applicable Reductions (lbs)			Anticipated / Completion Date
		N	P	TSS	
Woodman Park Energy Dissipator ⁷	Outfall Retrofit	25.63	3.60	1981.76	Completed September, 2016
Jamestown Apartments ⁸	Stream Restoration	103.73	94.04	62,069.04	Completed December, 2006
Henrico Communications ⁹	Stream Restoration	95.83	86.89	57,345.42	Completed June, 2009
BMPs Installed prior to July 1, 2009 ¹⁰	Stormwater Compliance BMPs	405.31	79.09	44688.62	Complete
Energy Dissipators installed prior to June 30, 2014 that weren't previously claimed ¹¹	Additional Outfall Treatment	1979.07	254.72	94691.94	Complete
Septic-to-Sewer Connections from 2006 to 2016 ¹²	Annual Program	2106.54	0	0	Ongoing
Skipwith Elementary ¹³	Stream Restoration	44.57	40.41	26671.43	Completed May, 2012
TOTAL		4760.68	558.75	28,7448.21	

⁷ See Attachment 3

⁸ See Attachment 4

⁹ See Attachment 5

¹⁰ See Attachment 6

¹¹ See Attachment 7

¹² See Attachment 8

¹³ See Attachment 9

As shown in the table below, pollutant reductions achieved to date exceed those required during the first permit cycle. Overages will be applied to reduction requirements in future permit cycles.

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Pollutant	Total Reduction Required During First Permit Cycle (lbs/yr)	Total Reductions Achieved to Date (lbs/yr)
Nitrogen	918.06	4,760.68
Phosphorus	176.93	558.75
Total Suspended Solids	102,340.90	287,448.21

SECTION 4.7

The means and methods to offset the increased loads from new sources initiating construction between July 1, 2009 and June 30, 2014 that disturb one acre or greater as a result of the utilization of an average land cover condition greater than 16% impervious cover for the design of post development stormwater management facilities. The permittee shall utilize Table 3 to develop the equivalent pollutant load for nitrogen and total suspended solids. The permittee shall offset 5% of the calculated increased load from these new sources during the permit cycle.

From 1991 and until July 1, 2014, an average land cover condition of 16% was used to compute pollutant removal requirement and for the design of required BMPs consistent with the CBPA Regulations and stormwater management regulations in place at that time. Beginning July 1, 2014, the County began requiring stormwater pollutant reductions consistent with the revised VSMP Regulations using the Virginia Runoff Reduction Method. At no time has an average land cover condition greater than 16% impervious cover been used to compute the pollutant removal requirement or the design of post development stormwater management facilities.

Since implementing stormwater pollutant reductions programs in 1991, the County's application of those programs has been determined to be consistent with applicable laws and regulations by applicable State agencies.

Therefore, there are no increases in increased loads from new sources initiating construction between July 1, 2009 and June 30, 2014 that disturb one acre or greater as a result of the utilization of an average land cover condition greater than 16% impervious cover for the design of post development stormwater management facilities that must be addressed with this action plan.

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SECTION 4.8

The means and methods to offset the increased loads from grandfathered projects in accordance with 9VAC25-870-48, that disturb one acre or greater that begin construction after July 1, 2014 where the project utilized an average land cover condition greater than 16% impervious cover in the design of post development stormwater management facilities. The permittee shall utilize Table 3 to develop the equivalent pollutant load for nitrogen and total suspended solids.

From 1991 and until July 1, 2014, an average land cover condition of 16% was used to compute pollutant removal requirement and for the design of required BMPs consistent with the CBPA Regulations and stormwater management regulations in place at that time. Beginning July 1, 2014, the County began requiring stormwater pollutant reductions consistent with the revised VSMP Regulations using the Virginia Runoff Reduction Method with the exception of projects determined to be “grandfathered”. “Grandfathered” projects comply with pollutant removal reductions based on the average land cover condition of 16%. At no time has an average land cover condition greater than 16% impervious cover been used to compute the pollutant removal requirement or the design of post development stormwater management facilities.

Since implementing stormwater pollutant reductions programs in 1991, the County’s application of those programs has been determined to be consistent with applicable laws and regulations by applicable State agencies.

Therefore, there are no increases in increased loads from grandfathered projects in accordance with 9VAC25-870-48, that disturb one acre or greater that begin construction after July 1, 2014 that disturb one acre or greater as a result of the utilization of an average land cover condition greater than 16% impervious cover for the design of post development stormwater management facilities that must be addressed with this TMDL Action Plan.

SECTION 4.9

A list of future projects and associated acreage that qualify as grandfathered in accordance with 9VAC25-870-48.

Future Projects Determined to be Grandfathered	Project Acreage
New Dawn Assisted Living Center Master Plan	5.47

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Shirley Subdivision	20.5
Rocketts Landing Section 7	1.2
Rocketts Landing Phase IV Block 19	1.287
Daves Auto Spa	1.09
Club Court Subdivision	26.3
Discount Tire at Staples Mill	1.22
Settler's Ridge Section C	18.8
RIA Maintenance Storage Building	6.48
Savannah Station	9.74
Midview Farms Section C	4.37
Kings Manor Subdivision	2.19

SECTION 4.10

An estimate of the expected cost to implement the necessary reductions during the permit cycle

The total estimated cost of the means and methods listed in Section 4.6 that can be estimated is \$1,471,000.

SECTION 4.11

An opportunity for receipt and consideration of public comment on the draft Chesapeake Bay TMDL Action Plan

No comments were received.

SECTION 4.12

A list of all comments received as a result of public comment and any modifications made to the draft Chesapeake Bay TMDL Action Plan as a result of the public comments.

The following table lists the comments that were received as a result of posting the draft Chesapeake Bay TMDL Action Plan on the County's website. Revisions made to the document as a result of these comments are also listed.

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SECTION 4.13

As part of development of the Chesapeake Bay TMDL Action Plan, the permittee shall consider use of the following:

- a. Implementation of BMPs on unregulated lands provided the baseline reduction is subtracted from the total reduction prior to application of the reduction towards meeting the required reductions.
- b. Utilization of stream restoration projects provided the baseline reduction from the unregulated acreage treated by the stream restoration project is subtracted from the total reduction prior to application of the reduction towards meeting the required reductions.
- c. Establishment of a memorandum of understanding (MOU) with other MS4 permittees that discharge to the same or adjacent eight digit hydrologic unit within the same basin to implement BMPs collectively. The MOU shall include a mechanism for dividing the POC reductions created by BMP implementation between the cooperative MS4s.
- d. Utilization of any pollutant trading or offset program in accordance with §62.1-44.19:20 through 62.1-44.19:23 et seq. of the Code of Virginia governing trading and offsetting.
- e. A more stringent average land cover condition based on less than 16% impervious cover for new sources initiating construction between July 1, 2009, and June 30, 2014, and all grandfathered projects where allowed by law; and
- f. Any BMPs installed after June 30, 2009, as part of a retrofit program may be applied towards meeting the required load reductions provided any necessary baseline reductions are not included.

Noted.

SECTION 4.14

The permittee shall address any modification to the TMDL or watershed implementation plan that occurs during the term of this state permit as part of its permit reapplication as required in Part II.M of this state permit.

Noted.

SECTION 4.15

The Chesapeake Bay TMDL Action Plan shall become effective and enforceable

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upon written approval from the Department.

Noted.

SECTION 4.16 ANNUAL REPORTING REQUIREMENTS

In accordance with Part I D.1.b)1), the permittee shall submit the Chesapeake Bay TMDL Action Plan with the annual report due March 31, 2017.

Noted.

Beginning with the annual report due March 31, 2018, each annual report shall include a list of control measures implemented during the reporting period and the cumulative progress toward meeting the compliance targets for total nitrogen, phosphorus, and total suspended solids.

Noted.

Beginning with the annual report due March 31, 2018, each annual report shall include a list of control measures that were implemented during the reporting cycle and the estimated reduction achieved by the control. For stormwater management controls, the report shall include the information required in Part I.C.3.a) and shall include whether an existing stormwater management control was retrofitted, and if so, the existing stormwater management control type retrofit used.

Noted.

Beginning with the annual report due March 31, 2018, each annual report shall include a list of control measures that are expected to be implemented during the next reporting period and the expected progress toward meeting the compliance targets for total nitrogen, total phosphorus, and total suspended solids.

Noted.

SECTION 4.17 PLANS FOR THE NEXT PERMIT CYCLE

The permittee shall include the following as part of its reapplication package due in accordance with Part II.M:

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1. Documentation that sufficient control measures have been implemented (or documentation detailing that implementation will be complete by the expiration date of this state permit) to meet the compliance target identified in this Special Condition. If temporary credits or offsets have been purchased in order to meet the compliance target, the list of temporary reductions utilized to meet the 5% reduction in this state permit and a schedule of implementation to ensure a permanent 5% reduction shall be provided;
2. A draft second phase Chesapeake Bay TMDL Action Plan designed to reduce the existing POC loads by an additional seven times the required reductions in loading rates using Table 2 of Part I.D.1.b) of this state permit unless alternative calculations have been provided by the Commonwealth;
3. An additional 35% reduction in new sources developed between 2009 and 2014 and for which the land use cover condition was greater than 16%; and
4. Accounting for any modification to the applicable loading rate provided to the permittee as a result of TMDL modification.

Noted.

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ATTACHMENT 1
MS4 SERVICE AREA

SECTION 1. OVERVIEW

The MS4 Service Area is the land area that drains into and through the County's MS4 infrastructure. There are both privately-owned and publicly-owned lands within the County's MS4 Service Area. The publicly-owned land consists of local, state and federal properties and rights-of-way.

SECTION 2. DELINEATION

The limits of the County's MS4 Service Area were determined by delineating the drainage areas to each outfall the County owns and/or operates. These drainage areas were then aggregated into the MS4 Service Area. As required by the County's MS4 Permit, the current delineation of the MS4 Service Area was delivered to DEQ in September of 2016.

For purposes of calculating the pollutant load reductions required during the first MS4 Permit cycle for the Chesapeake Bay TMDL, the MS4 Service Area as of June 30, 2009 is required (see Table 2 of the MS4 Permit). In order to develop the MS4 Service Area as it existed in June of 2009, certain individual drainage areas were excluded from the current MS4 Service Area. These excluded areas included drainage areas associated with MS4 infrastructure that was approved for construction after June 30, 2009 and infrastructure that had been installed but not accepted by the County prior to June 30, 2009.

There are approximately 156,800 acres located within the boundaries of Henrico County.

As of December 2016, approximately 50,314 acres of the County were located within the MS4 Service Area.

As of June 2009, approximately 49,284 acres of the County were located within the MS4 Service Area.

ATTACHMENT 2

REGULATED URBAN IMPERVIOUS AND PERVIOUS AREAS

SECTION 1. OVERVIEW

Calculating the pollutant reduction requirements associated with the Chesapeake Bay TMDL requires the *regulated impervious* acreage and the *regulated pervious* acreage within the MS4 Service Area as of June 30, 2009 are required. In the absence of a data set depicting land cover as of June 30, 2009, several land use data sets were used to estimate the required acreages.

SECTION 2. APPLICABLE LAND COVER DATA SETS

2008 Henrico Land Cover Data Set

The 2008 land cover data set was created from the 2008 planimetric data. The following is from the 2008 planimetric metadata. "Planimetric features" are collected and updated from the digital orthophotography. They were collected in MicroStation and exported out as DGN or DWG (CAD) files. These were then converted to ESRI shapefiles and finally to ESRI coverages for editing and final attribution. The finished coverages were then used to load the ESRI geodatabase feature classes."

The land cover data consists of four feature classes;

- a. *Water* was generated from the waterbodies feature class a representation of any water feature equal to or greater than three feet wide. Meaning any stream three feet or wider is contained in the feature class.
- b. *Trees* was generated from the trees feature class which is any tree covered area equal to or greater than fifty square feet. The tree cover in the landcover data took only tree covered areas equal to or greater than ninety square meters. For the tree covered areas less than ninety square meters the data was assigned the neighboring coverage designation. If the small tree covered area was surrounded by other or impervious it took on that designation.
- c. *Impervious* was derived from the buildings, driveways, parking, and roads feature classes. The roads and parking lots that had any landscape islands or divided roads median strips were added to the other land cover feature class.

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- d. *Other* was the remainder of the above process. Any area that was not covered by water, trees, buildings, driveways, parking, and roads became other.

2011 Henrico Land Cover Data Set

The 2011 land cover data set was created from the 2011 planimetric data. The following is from the 2011 planimetric metadata.

Buildings, Driveways, Parking, Roads

Planimetric features are collected and updated from the digital orthophotography. They are collected in MicroStation and exported out as DGN or DWG (CAD) files. These are then converted to ESRI shapefiles and finally to ESRI coverages for editing and final attribution. The finished coverages are then used to load the ESRI geodatabase feature classes.

Waterbodies (Compiled from Lidar)

Using MARS software Hydrologic features (streams, rivers and lakes) are compiled in a 3d environment. These features are used in both the breaklines feature class (3d) and the waterbodies feature class (2d). ESRI shape files are created and these are imported into the geodatabase feature class.

Trees (Compiled from Lidar)

Using MARS software tree polygons larger than 50 square feet were created from the lidar dataset. ESRI shape files were created by tiles which were then merged together and dissolved to create the final geodatabase feature class.

The land cover data consists of four feature classes;

- a. *Water* was generated from the waterbodies feature class which is a representation of any water feature equal to or greater than three feet wide. Meaning any stream three feet or wider is contained in the feature class.
- b. *Trees* was generated from the trees feature class which is any tree covered area equal to or greater than fifty square feet. The tree cover in the landcover data took only tree covered areas equal to or greater than ninety square meters. For the tree covered areas less than ninety square meters the data was assigned the neighboring coverage designation. If the small tree covered area was surrounded by other or impervious it took on that designation.

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- c. *Impervious* was derived from the buildings, driveways, parking, and roads feature classes. The roads and parking lots that had any landscape islands or divided roads median strips were added to the other land cover feature class.
- d. *Other* is the remainder of the above process. Any area that was not covered by water, trees, buildings, driveways, parking, and roads became other.

2014 Virginia Statewide Land Cover Data Set

The Virginia Statewide 2014 land cover data set was created, in part, from the 2011-2014 VBMP 4-band orthophotography. Resolution is provided at 1 meter and produced in both raster and vector formats using Textron Systems Feature Analyst Software for ESRI. The following is from the 2014 Technical Plan of Operations document Version 7 dated May 6, 2016.

The four classes used to develop area measurements are below.

Water: This classification includes all areas of open water; typically 25 percent or greater pixel cover of water, and all areas characterized by perennial cover of ice/snow as defined by the EPA. Includes drainage network and basins such as rivers, streams, lakes, canals, waterways, reservoirs, ponds, bays, estuaries, and ocean as defined by the NHD. Only features greater than 1 acre in size will remain in this classification.

Impervious: This classification includes areas characterized by a high percentage of constructed materials such as asphalt and concrete, buildings and parking lots, and infrastructure such as roads and rail-roads as defined by the EPA.

Turf Grass: This classification includes vegetation (primarily grasses) planted in developed settings for erosion control or aesthetic purposes, as well as natural herbaceous vegetation and undeveloped land, including upland grasses and forbs, as defined by the EPA. Examples include but are not limited to recreational areas, lawns, and vacant lands. Any grasses or managed turf that fall into this description will be included if the land is less than 1 acre in size, or visually determined to be recreational from the imagery.

Other: Includes all remaining land cover classifications, including Forest, Scrub/Shrub, Agriculture, Wetlands, and Barren.

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Methodologies for Determining Land Cover classes:

Water: These are polygonal features representing open water features. Existing National Hydrology Dataset (NHD) data will be delivered as an overlay to the full dataset. This overlay will include flow polylines that will be buffered based on a general 15ft representation of perennial stream features. The Eliminate tool will be ran against the Feature Analyst hydrography output to reclassify incorrect and smaller features of this type to the closest competing feature classification of the greatest size. This will ensure that shadows from buildings will dissolve into the surrounding land features, while anomalies of green and brown land that may have been misclassified as water be corrected to forest or turf. The minimum area criteria will decide which extracted features stay in the dataset. VGIN DTM Data will also be analyzed for capability in filtering of potential water surfaces using a terrain deviation parameter (e.g., filtering features with a deviation from the terrain of <1 meter).

Impervious: Impervious and Building layers were originally created separately in order to utilize the Feature Analyst Building Toolkit to extract more precise footprints for localities that did not already maintain them. These two feature classifications will be combined grouping all impervious features together. The next step to developing the impervious features will be the input of existing vector data sources. Feature Analyst impervious surface features will be supplemented with available local, regional and state basemap data by erasing and appending these datasets to the extracted output. This will ensure that the land cover data represent impervious surfaces regardless of overhanging tree canopy. Where vector features provide a more accurate representation of impervious surfaces for any given feature, we will defer to this source. Where they are less accurate or not available we will defer to the spectral classification method for the impervious feature.

Turf Grass: Turf Grass will start as a set of training samples that define those non-forested and non-agricultural areas of flat land into large classifications including spectral variation between yellows, greens, and browns. Any attempt to distinguish between what is actually agricultural, turf, etc. within the image extraction process ends up as blended results, so although this class will also capture agricultural land, these areas will be removed later on as they are processed first. Areas that are extracted in this classification that are greater than

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or equal to 2 acres will, and are within parcels greater than 3 acres, will be reevaluated as possible reclassification into Pasture. For those areas where parcel data is unavailable, all features meeting the size threshold will be reviewed. There will be a stage of manual cleanup for falsely identified features.

Other: After the three previous classes (water, impervious and turf grass) have been extracted, the remaining classes are grouped into the Other category. The previously referenced document outlines specific criteria for each.

SECTION 3. REGULATED IMPERVIOUS ACREAGE SERVED BY THE MS4 SERVICE AREA AS OF JUNE 30, 2009

Using the available land cover data sets described above and the 2009 MS4 Service Area described in Attachment 1, the various acreages for impervious cover were developed:

Impervious Cover

Available Land Cover Data Sets	Acreage within the MS4 Service Area as of June 30, 2009	Notes
2008 Henrico Land Cover Data Set	14,310.85	includes 233.96 acres within VDOT rights-of-way
2011 Henrico Land Cover Data Set	14,476.65	includes acreage within VDOT rights-of-way
2014 Virginia Statewide Land Cover Data Set	17,253.64	includes acreage within VDOT rights-of-way

A linear interpolation between the 2008 and 2011 data results in a value 14,421.12 acres of impervious land cover within the MS4 Service Area as of June 30, 2009. Of this area, 14,187.16 acres (14,421.12 less 233.96 acres regulated by VDOT) are regulated by the County through its MS4 Permit.

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SECTION 4. REGULATED PERVIOUS ACREAGE SERVED BY THE MS4 SERVICE AREA AS OF JUNE 30, 2009

Pervious Cover

Available Land Cover Data Sets	Acreage within the MS4 Service Area as of June 30, 2009	Notes
2008 Henrico Land Cover Data Set		Data is not available to determine the extent of pervious (turf) land cover
2011 Henrico Land Cover Data Set		Data is not available to determine the extent of pervious (turf) land cover
2014 Virginia Statewide Land Cover Data Set	17,529.11	

Since only the 2014 Virginia Statewide Land Cover Data Set includes a turf feature class, **17,529.11 acres** is used as an estimate of the pervious area within the MS4 Service Area as of June 30, 2009 that is regulated by the County through its MS4 Permit. This results in an overestimation of the required value.

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ATTACHMENT 3
WOODMAN PARK ENERGY DISSIPATOR

SECTION 1. OVERVIEW

The Woodman Park Energy Dissipator is a retrofit of two existing MS4 outfalls located in a residential area of the County. The project routed the stormwater discharge from two drainage areas (38.99 acres total) into a newly constructed facility designed in accordance with *Virginia DEQ Stormwater Design Specification No. 2 - Sheet Flow to a Vegetated Filter Strip or Conserved Open Space* on C/D/soils.

In accordance with the Chesapeake Bay TMDL Guidance document distributed by DEQ on May 18, 2015:

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.

As explained in this analysis, the Woodman Park Energy Dissipator generates excess pollutant reductions that are applicable to the TMDL.

SECTION 2. LOCATION

The Woodman Park Energy Dissipator is located at 37.6515 / -77.4867 (latitude / longitude) in the central portion of the County.

SECTION 3. STATUS

Construction of the Woodman Park Energy Dissipator was completed on September 23, 2016.

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SECTION 4. POLLUTANT LOAD REDUCTIONS

Total Nitrogen					
Subsource	Acreage ¹	2009 EOS Loading Rate ² (lbs/ac/yr)	Total Load (lbs/yr)	Removal Efficiency	Load Reduction (lbs/yr)
Regulated Urban Impervious	8.04	9.39	75.50	50% ³	37.75
Regulated Urban Pervious	7.39	6.99	51.66	50% ³	25.83
TOTAL					63.58
Total Phosphorus					
Regulated Urban Impervious	8.04	1.76	14.15	50% ³	7.08
Regulated Urban Pervious	7.39	0.5	3.70	50% ³	1.85
TOTAL					8.93
Total Suspended Solids					
Regulated Urban Impervious	8.04	676.94	2,993.43	55% ⁴	4,505.03
Regulated Urban Pervious	7.39	101.08	746.98	55% ⁴	410.84
TOTAL					4,915.87

¹ based on Virginia Statewide 2014 Land Cover Data Set

² from Table 1 in the County's MS4 Permit

³ from the Virginia Runoff Reduction Spreadsheet

⁴ from Figure 5 in the *Recommendations of the Expert panel to Define Removal Rates for urban Stormwater Retrofit Projects* assuming a Runoff Depth Treated of 0.5 inches – the runoff treatment depth associated with the removal rate specified in the VRRM for Total Phosphorus

SECTION 5. COST

The total cost (design and construction) of the Woodman Park Energy Dissipator project was \$73,886.28.

Funding for the project came from two sources:

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SLAF Grant	=	\$31,234.64
Environmental Fund	=	\$42,651.64

SECTION 6. POLLUTANT LOAD REDUCTIONS APPLICABLE TO THE TMDL

As stated above, a portion of the funding used for this project came from the Environmental Fund, a product of development projects' compliance with the Stream Assessment / Watershed Management Program administered by the County from August 2001 through June 2014. The Environmental Fund is used to fund watershed projects such as stream restoration, outfall retrofits, and educational programs as one aspect of stormwater compliance for development in the County. Therefore, a portion of the pollutant load reductions achieved by the Woodman Park Energy Dissipator is obligated for development project compliance and is not applicable to the pollutant load reductions associated with the TMDL.

Since development projects' contributions to the Environmental Fund were based on a rate of \$8,000.00 per pound of phosphorus, the phosphorus load reduction achieved by the Woodman Park Energy Dissipator project that is applicable to the pollutant load reductions associated with the TMDL must be reduced by 5.33 lbs/year (\$42,651.64 ÷ \$8,000.00 per pound). Discounting the load reductions for both nitrogen and sediment by a similar percentage results in the following pollutant load reductions that are applicable to the requirements of the TMDL:

Pollutant	Total Reduction (lbs/year)	Environmental Fund Obligation (lbs/year)	Applicable to the TMDL (lbs/year)
Total Nitrogen	63.58	37.95	25.63
Total Phosphorus	8.93	5.33	3.60
Total Suspended Solids	4,915.87	2,934.11	1,981.76

ATTACHMENT 4 JAMESTOWN APARTMENTS STREAM RESTORATION

SECTION 1. OVERVIEW

The Jamestown Apartments Stream Restoration project involved restoration of 1,383 linear feet of an urban stream located in a predominantly residential watershed in the western portion of the County. Natural channel design concepts were applied in the design of the project.

In accordance with the Chesapeake Bay TMDL Guidance document distributed by DEQ on May 18, 2015:

All permittees may receive credit for any stormwater quality BMPs installed between Jan 1, 2006 and June 30, 2009 within the MS4 service area if the permittee provides a full historical accounting, to the maximum extent practical, of BMPs in their jurisdiction.

The guidance document also states:

To receive credit for previously unreported BMPs installed on or after January 1, 2006 and prior to July 1, 2009, permittees will need to include the following in their Action Plan:

- 1. An affirmative statement that a complete list, to the maximum extent practicable, of historical BMPs was or will be submitted to the Department by September 1, 2015. Permittees may submit this data as part of the "Historical Data Clean-Up" effort that is currently ongoing.*
- 2. Appropriate calculations for the BMPs that the permittee is claiming for credit towards its required POC load reductions.*

As requested, a historical accounting of the Jamestown Apartments Stream Restoration project was submitted to DEQ in September of 2015.

SECTION 2. LOCATION

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The Jamestown Apartments Stream Restoration project is located at 37.5941 / -77.5787 (latitude / longitude) in the western portion of the County.

SECTION 3. STATUS

Construction of the Jamestown Apartments Stream Restoration project was completed in December 2006.

SECTION 4. POLLUTANT LOAD REDUCTIONS

As noted, the project was completed in December of 2006. In accordance with the Guidance document,

...urban stream restoration projects that have been installed on or after January 1, 2006 and those that cannot conform to any of the four protocols for stream restoration, permittees should use the interim approved removal rates developed by the Bay Program to calculate credits.

Therefore the pollutant load reductions achieved by the project are as follows:

Pollutant	Removal Rates (lbs/ft)	Length	% of Drainage Area that is regulated	Pollutant Removal (lbs)
N	0.075	1,383	100	103.73
P	0.068			94.04
Sediment	44.88			62,069.04

SECTION 5. COST

The total cost (design and construction) of the Jamestown Apartments Stream Restoration project was \$314,038.

ATTACHMENT 5
HENRICO COMMUNICATIONS STREAM RESTORATION

SECTION 1. OVERVIEW

The Henrico Communications Stream Restoration project involved restoration of 1,345 linear feet of an urban stream located in a predominantly commercial / municipal watershed in the western portion of the County. Natural channel design concepts were applied in the design of the project.

In accordance with the Chesapeake Bay TMDL Guidance document distributed by DEQ on May 18, 2015:

All permittees may receive credit for any stormwater quality BMPs installed between Jan 1, 2006 and June 30, 2009 within the MS4 service area if the permittee provides a full historical accounting, to the maximum extent practical, of BMPs in their jurisdiction.

The guidance document also states:

To receive credit for previously unreported BMPs installed on or after January 1, 2006 and prior to July 1, 2009, permittees will need to include the following in their Action Plan:

- 1. An affirmative statement that a complete list, to the maximum extent practicable, of historical BMPs was or will be submitted to the Department by September 1, 2015. Permittees may submit this data as part of the "Historical Data Clean-Up" effort that is currently ongoing.*
- 2. Appropriate calculations for the BMPs that the permittee is claiming for credit towards its required POC load reductions.*

As requested, a historical accounting of the Henrico Communications Stream Restoration project was submitted to DEQ in September of 2015.

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SECTION 2. LOCATION

The Henrico Communications Stream Restoration project is located at 37.6294 / -77.5259 (latitude / longitude) in the western portion of the County.

SECTION 3. STATUS

Construction of the Henrico Communications Stream Restoration project was completed in June 2009.

SECTION 4. POLLUTANT LOAD REDUCTIONS

As noted, the project was completed in June of 2009. In accordance with the Guidance document,

...urban stream restoration projects that have been installed on or after January 1, 2006 and those that cannot conform to any of the four protocols for stream restoration, permittees should use the interim approved removal rates developed by the Bay Program to calculate credits.

Therefore the pollutant load reductions achieved by the project are as follows:

Pollutant	Removal Rates (lbs/ft)	Length	% of Drainage Area that is regulated	Pollutant Removal (lbs)
N	0.075	1,345	95	95.83
P	0.068			86.89
Sediment	44.88			57,345.42

SECTION 5. COST

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The total cost (design and construction) of the Henrico Communications Stream Restoration project was \$454,544.

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ATTACHMENT 6
BMPS INSTALLED BETWEEN
JANUARY 1, 2006 AND JUNE 30, 2009

SECTION 1. OVERVIEW

In accordance with the Chesapeake Bay TMDL Guidance document distributed by DEQ on May 18, 2015:

All permittees may receive credit for any stormwater quality BMPs installed between Jan 1, 2006 and June 30, 2009 within the MS4 service area if the permittee provides a full historical accounting, to the maximum extent practical, of BMPs in their jurisdiction.

The guidance document also states:

To receive credit for previously unreported BMPs installed on or after January 1, 2006 and prior to July 1, 2009, permittees will need to include the following in their Action Plan:

- 1. An affirmative statement that a complete list, to the maximum extent practicable, of historical BMPs was or will be submitted to the Department by September 1, 2015. Permittees may submit this data as part of the "Historical Data Clean-Up" effort that is currently ongoing.*
- 2. Appropriate calculations for the BMPs that the permittee is claiming for credit towards its required POC load reductions.*

As requested, the County's full historical accounting of BMP data was submitted to DEQ in September of 2015. This submission included all the facilities in the County, both in and outside the MS4 Service Area.

The following pollutant removal evaluation includes those BMPs that are within the MS4 Service Area that were installed between January 1, 2006 and June 30, 2009.

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SECTION 2. LOCATION

As stated above, the BMPs included in this evaluation are located within the MS4 Service Area throughout the County.

SECTION 3. STATUS

Each of the BMPs included in this evaluation were brought online between January 1, 2006 and June 30, 2009 and continue to be maintained and operated as approved.

SECTION 4. POLLUTANT LOAD REDUCTIONS

Calculating the pollutant load reductions achieved by the BMPs brought online between January 1, 2006 and June 30, 2009 requires removal efficiencies for the various types of BMPs. The historical BMPs within the MS4 Service Area were grouped based on BMP types from Table V.C.1 – Chesapeake Bay Program BMPs, Established Efficiencies in the TMDL Guidance.

Chesapeake Bay Program BMP Type	County BMP Type
Dry Detention Ponds and Hydrodynamic Structures	50/10 Basin
	50/10 Underground
	Stormceptor
Bioretention C/D soils, underdrain	Bioretention Basin/Trench
Dry Extended Detention Ponds	Extended Detention Basin
Infiltration Practices w/o Sand, Veg – A/B soils, no underdrain	Infiltration Trench/Basin
Wet Ponds and Wetlands	Retention basin
	Extended Detention w/a Shallow Marsh
Filtering Practices	Filterra
	Stormwater360

The removal efficiencies for these Chesapeake Bay Program BMPs are:

Chesapeake Bay Program BMP	Removal Efficiencies
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Type	TN	TP	TSS
Dry Detention Ponds and Hydrodynamic Structures	5%	10%	10%
Bioretention C/D soils, underdrain	25%	45%	55%
Dry Extended Detention Ponds	20%	20%	60%
Infiltration Practices w/o Sand, Veg – A/B soils, no underdrain	80%	85%	95%
Wet Ponds and Wetlands	20%	45%	60%
Filtering Practices	40%	60%	80%

Based on the BMP design data, the total drainage area and impervious and pervious areas served by these BMPs are:

Chesapeake Bay Program BMP Type	Acres Served		
	Drainage Area	Impervious Area	Pervious Area
Dry Detention Ponds and Hydrodynamic Structures	118.68	19.92	98.76
Bioretention C/D soils, underdrain	4.20	2.28	1.92
Dry Extended Detention Ponds	82.53	38.71	43.82
Infiltration Practices w/o Sand, Veg – A/B soils, no underdrain	3.56	1.65	1.91
Wet Ponds and Wetlands	36.80	13.23	23.57
Filtering Practices	40.62	25.34	15.28

The pollutant loads generated by these areas are calculated using the 2009 EOS Loading Rates for the James River Basin from Table 1 in the MS4 Permit.

2009 EOS Loading Rates (lbs/acre/year)			
Source	TN	TP	TSS
Urban Impervious	9.39	1.76	676.94
Urban Pervious	6.99	0.5	101.08

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Pollutant Loading to BMPs			
Chesapeake Bay Program BMP Type	TN	TP	TSS
Dry Detention Ponds and Hydrodynamic Structures	877.38	84.44	23,467.31
Bioretention C/D soils, underdrain	34.83	4.97	1,737.50
Dry Extended Detention Ponds	669.79	90.04	30,633.67
Infiltration Practices w/o Sand, Veg – A/B soils, no underdrain	28.84	3.86	1,310.01
Wet Ponds and Wetlands	288.98	35.07	11,383.37
Filtering Practices	344.75	52.24	18,698.16

Application of the removal efficiencies identified previously from Table V.C.1 – Chesapeake Bay Program BMPs, Established Efficiencies in the TMDL Guidance yields the following load reductions for the BMPs that are within the MS4 Service Area that were installed between January 1, 2006 and June 30, 2009

Pollutant Loading Removed by BMPs			
Chesapeake Bay Program BMP Type	TN	TP	TSS
Dry Detention Ponds and Hydrodynamic Structures	43.87	8.44	2,346.73
Bioretention C/D/ soils, underdrain	8.71	2.24	955.62
Dry Extended Detention Ponds	133.96	18.01	18,380.20
Infiltration Practices w/o Sand, Veg – A/B soils, no underdrain	23.08	3.28	1,244.51
Wet Ponds and Wetlands	57.80	15.78	6,803.02
Filtering Practices	137.90	31.34	14,958.53
TOTAL	405.31	79.09	44,688.62

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SECTION 5. COST

The cost associated with these BMPs is unknown.

ATTACHMENT 7
ENERGY DISSIPATORS INSTALLED BETWEEN
JANUARY 1, 2006 AND JUNE 30, 2014

SECTION 1. OVERVIEW

Since 2001, the County has required the installation of Energy Dissipators at select stormwater outfalls as a requirement of the development process in addition to meeting the required pollutant removal requirement associated with the proposed impervious cover. The County's Energy Dissipator is also listed as an acceptable alternative to Virginia DEQ Stormwater Design Specification No. 2 – Sheet Flow to a Vegetated Filter Strip or Conserved Open Space and as of July 1, 2014 is an approved BMP for complying with the pollutant removal requirement dictated by Virginia's stormwater program.

In accordance with the Chesapeake Bay TMDL Guidance distributed by DEQ on May 18, 2015:

Permittees may receive credit for:

...BMPs that were installed to meet development requirements, but exceed those requirements and any applicable state standards...

An accounting of these Energy Dissipators was submitted to DEQ in September of 2015 in response to the historical BMP data request.

The following pollutant removal evaluation includes those Energy Dissipators that were installed between January 1, 2006 and June 30, 2014 within the MS4 Service Area and exceeded any applicable state standards in place at the time of installation.

SECTION 2. LOCATION

As stated above, the Energy Dissipators included in this evaluation are located within the MS4 Service Area throughout the County.

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SECTION 3. STATUS

Each of the Energy Dissipators included in this evaluation were installed between January 1, 2006 and June 30, 2014 and continue to be maintained and operated as approved.

SECTION 4. POLLUTANT LOAD REDUCTIONS

To calculate the pollutant load reductions achieved by these Energy Dissipators, removal efficiencies are required. Removal efficiencies for TN and TP can be found in the Virginia Runoff Reduction Method (VRRM).

Pollutant	Removal Efficiency	
	A / B Soils	C / D Soils
TN	75%	50%
TP	75%	50%

Since quantification of sediment reduction is not provided for any of the BMPs listed in the VRRM, the performance curves provided by the Bay Program were used to establish a removal efficiency for TSS. Assuming a runoff depth of 0.5 inches (the approximate runoff depth that results in a 50% efficiency for TN and TP), the performance curve for TSS yields a removal efficiency for TSS of 55%.

To calculate the pollutant load entering each of the Energy Dissipators, an analysis of the drainage areas to each Energy Dissipator was conducted to determine the impervious and pervious acreage that drains to each facility. This analysis is based on the 2014 Virginia Statewide Land Cover Data Set. The location of the Energy Dissipator was also studied to determine whether the facility is on an A / B soil or a C / D soil.

The 2009 EOS Loading Rates for the James River Basin from Table 1 in the MS4 Permit were then used to determine the pollutant load entering each facility from these acreages.

2009 EOS Loading Rates (lbs/acre/year)			
Source	TN	TP	TSS
Urban Impervious	9.39	1.76	676.94

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Urban Pervious	6.99	0.5	101.08
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Application of the removal efficiencies identified previously to the incoming loads results in the following load reductions for the Energy Dissipators that were installed prior to July 1, 2014 within the MS4 Service Area and exceeded any applicable state standards in place at the time of installation.

Pollutant Loading Removed by the Energy Dissipators		
TN	TP	TSS
1,979.07	254.72	94,691.94

SECTION 5. COST

The cost associated with these Energy Dissipators is unknown.

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	A	C	D	G	H	I	P	Q	R	Y	Z	AA
	End Treatment ID	IMPERVIOUS AC	TURF AC	P_LOAD_FROM_DA	N_LOAD_FROM_DA	S_LOAD_FROM_DA	P_EFFICIENCY	N_EFFICIENCY	S_EFFICIENCY	NET_P_REDUCTION_BY_EN	NET_N_REDUCTION_BY_EN	NET_S_REDUCTION_BY_EN
1	EN00000000196	1,907	4,025	5.4	46.0	1697.7	50.00%	50.00%	55.00%	2.68	23.02	933.72
2	EN00000000197	1,896	1,690	3.8	27.7	1319.1	75.00%	75.00%	55.00%	2.87	20.80	725.53
3	EN00000000282	3,316	5,160	8.4	67.2	2766.5	50.00%	50.00%	55.00%	4.21	33.60	1,521.56
4	EN00000000283	1,919	1,756	4.3	30.3	1476.6	50.00%	50.00%	55.00%	2.13	15.15	812.11
5	EN00000000284	4,442	6,670	11.2	88.3	3681.2	50.00%	50.00%	55.00%	5.58	44.17	2,024.65
6	EN00000000646	8,984	12,538	22.1	172.0	7349.2	50.00%	50.00%	55.00%	11.04	86.00	4,042.08
7	EN00000000652	0,546	0,697	1.3	10.0	441.1	50.00%	50.00%	55.00%	0.66	5.01	242.61
8	EN00000000653	1,157	1,630	2.9	22.3	948.1	50.00%	50.00%	55.00%	1.43	11.13	521.48
9	EN00000000655	0,461	2,243	1.9	20.0	538.1	50.00%	50.00%	55.00%	0.97	10.01	296.50
10	EN00000000659	5,543	8,228	13.9	109.6	4583.8	50.00%	50.00%	55.00%	6.93	54.78	2,521.11
11	EN00000000666	1,328	1,487	3.1	22.9	1049.2	50.00%	50.00%	55.00%	1.54	11.43	577.07
12	EN00000000909	0,921	1,349	2.3	18.1	759.9	50.00%	50.00%	55.00%	1.15	9.04	417.97
13	EN00000000913	26,061	45,732	72.3	583.2	23618.4	50.00%	50.00%	55.00%	36.13	291.58	12,990.14
14	EN00000000919	1,562	3,866	4.7	41.7	1448.3	50.00%	50.00%	55.00%	2.34	20.85	796.56
15	EN00000000920	1,691	2,968	4.5	36.6	1445.0	50.00%	50.00%	55.00%	2.23	18.31	794.73
16	EN00000000922	2,297	9,924	9.0	90.9	2557.8	50.00%	50.00%	55.00%	4.50	45.47	1,406.78
17	EN00000001350	1,932	0,880	3.8	24.3	1396.5	50.00%	50.00%	55.00%	1.92	12.14	788.08
18	EN00000001351	0,375	0,268	0.8	5.4	280.7	50.00%	50.00%	55.00%	0.40	2.70	154.39
19	EN00000001353	0,335	0,164	0.7	4.3	243.1	50.00%	50.00%	55.00%	0.34	2.14	133.73
20	EN00000001354	3,213	1,094	6.2	37.8	2285.9	75.00%	75.00%	55.00%	4.65	28.37	1,257.23
21	EN00000005162	3,574	5,002	8.8	68.5	2635.0	75.00%	75.00%	55.00%	6.59	51.39	1,808.77
22	EN00000005163	4,132	4,741	9.6	71.9	3276.1	75.00%	75.00%	55.00%	7.23	53.95	1,801.83
23	EN00000005164	1,458	1,623	3.4	25.0	1149.3	50.00%	50.00%	55.00%	1.89	12.50	632.12
24	EN00000005165	0,484	0,404	1.1	7.4	368.6	75.00%	75.00%	55.00%	0.79	5.53	202.71
25	EN00000005167	0,906	1,047	2.1	15.8	719.1	75.00%	75.00%	55.00%	1.59	11.87	395.49
26	EN00000005182	1,409	1,484	3.2	23.6	1104.1	50.00%	50.00%	55.00%	1.61	11.80	607.23
27	EN00000005808	20,249	3,603	37.4	215.3	14071.6	50.00%	50.00%	55.00%	18.72	107.66	7,739.40
28	EN00000005819	8,743	10,249	20.5	163.7	6854.6	50.00%	50.00%	55.00%	10.26	76.87	3,825.04
29	EN00000005820	8,463	14,027	21.9	177.5	7146.7	50.00%	50.00%	55.00%	10.95	88.76	3,930.70
30	EN00000005829	0,402	1,211	1.3	12.2	394.4	50.00%	50.00%	55.00%	0.66	6.12	216.89
31	EN00000005830	0,223	0,118	0.5	2.9	163.0	75.00%	75.00%	55.00%	0.34	2.19	89.66
32	EN00000005831	2,725	4,197	6.9	54.9	2269.0	50.00%	50.00%	55.00%	3.45	27.46	1,247.96
33	EN00000005834	0,278	0,044	0.5	2.9	192.6	50.00%	50.00%	55.00%	0.26	1.46	105.90
34	EN00000005838	23,154	35,595	58.5	466.2	19271.8	50.00%	50.00%	55.00%	21.30	235.11	10,599.46
35	EN00000005875	5,650	4,645	12.3	85.5	4294.5	50.00%	50.00%	55.00%	6.13	42.76	2,381.97
36	EN00000005951	11,320	15,688	27.9	217.2	9266.9	50.00%	50.00%	55.00%	13.93	106.61	5,096.81
37	EN00000005951	9,741	5,339	19.8	128.8	7134.0	50.00%	50.00%	55.00%	9.91	64.40	3,923.73
38	EN00000005948	2,878	0,429	5.3	30.0	1991.4	50.00%	50.00%	55.00%	2.64	15.01	1,095.27
39	EN00000005943	0,450	0,385	1.0	6.9	343.9	50.00%	50.00%	55.00%	0.49	3.46	189.14
40	EN00000005947	27,213	25,155	61.0	438.4	21065.2	50.00%	50.00%	55.00%	30.49	215.19	11,585.85
41	EN00000005922	6,014	5,315	13.2	93.6	4603.5	50.00%	50.00%	55.00%	6.62	46.81	2,534.67
42	EN00000001006	0,546	1,272	1.6	14.0	498.2	50.00%	50.00%	55.00%	0.80	7.01	274.03
43	EN00000001007	0,710	0,818	1.7	12.4	563.3	50.00%	50.00%	55.00%	0.83	6.19	309.82
44	EN00000001161	1,015	1,373	2.5	19.1	825.6	50.00%	50.00%	55.00%	1.24	9.56	454.10
45	EN00000001204	1,547	1,603	3.5	25.7	1269.4	50.00%	50.00%	55.00%	1.76	12.87	685.15
46	EN00000001205	0,509	1,274	1.5	13.7	473.1	50.00%	50.00%	55.00%	0.77	6.84	280.23
47										254.72	1,979.07	94,691.94
48												
49												

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ATTACHMENT 8
SEPTIC-TO-SEWER CONNECTIONS

SECTION 1. OVERVIEW

In 2015, DEQ received a request to review the appropriateness of allowing credit under the Chesapeake Bay TMDL for the connection of septic systems to sanitary sewer. DEQ determined this to be an acceptable practice for crediting toward the required pollutant reduction requirement for total nitrogen (TN).

SECTION 2. POLLUTANT LOAD REDUCTION

The TN load reduction is calculated as follows:

The assumed average load of total nitrogen at the edge of the septic drainfield is 9 lbs/year/person with an average attenuation factor of 60% from the edge of the drainfield to the edge of the stream resulting in a TN load of 3.6 lbs/year/person at the edge of the stream.

To calculate the TN load reduction achieved for each household that is connected to sanitary sewer that was previously served by a drainfield, the 3.6 lbs/year/person is multiplied by the average number of people per household based on the latest Census data. The total TN reduction is then calculated by multiplying this by the number of households connected.

County records of septic-to-sewer connections:

From / To	Number of Households Connected to Sanitary that were Previously Served by a Drainfield
2006 / 2007	33
2007 / 2009	92
2010 / 2011	29
2011 / 2012	12
2012 / 2013	15
2013 / 2014	13
2014 / 2015	12

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2015 / 2016	29
TOTAL	235

The latest Census data indicates an average of 2.49 persons reside in each household in Henrico County.

Therefore,

TN Reduction = 3.6 lbs/year/person × 2.49 persons/household × 235 households

TN Reduction = 2,106.54 lbs/year

ATTACHMENT 9 SKIPWITH ELEMENTARY STREAM RESTORATION

SECTION 1. OVERVIEW

The Skipwith Elementary Stream Restoration project involved restoration of 1,750 linear feet of an urban stream located in a predominantly residential watershed in the western portion of the County. Natural channel design concepts were applied in the design of the project.

In accordance with the Chesapeake Bay TMDL Guidance document distributed by DEQ on May 18, 2015:

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.

As explained in this analysis, the Skipwith Elementary Stream Restoration project generates excess pollutant reductions that are applicable to the TMDL.

SECTION 2. LOCATION

The Skipwith Elementary Stream Restoration project is located at 37.6186 / -77.5350 (latitude / longitude) in the western portion of the County.

SECTION 3. STATUS

Construction of the Skipwith Elementary Stream Restoration project was completed in May of 2012.

SECTION 4. POLLUTANT LOAD REDUCTIONS

As noted, the project was completed in May of 2012. In accordance with the Guidance document,

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...urban stream restoration projects that have been installed on or after January 1, 2006 and those that cannot conform to any of the four protocols for stream restoration, permittees should use the interim approved removal rates developed by the Bay Program to calculate credits.

Therefore the pollutant load reductions achieved by the project are as follows:

Pollutant	Removal Rates (lbs/ft)	Length	% of Drainage Area that is regulated	Pollutant Removal (lbs)
N	0.075	1,750	100	131.25
P	0.068			119.00
Sediment	44.88			78,540.00

SECTION 5. COST

The total cost (design and construction) of the Skipwith Elementary Stream restoration project was \$628,710.00.

Funding for the project came from the Environmental Fund.

SECTION 6. POLLUTANT LOAD REDUCTIONS APPLICABLE TO THE TMDL

As stated above, the funding used for this project came from the Environmental Fund, a product of development projects' compliance with the Stream Assessment / Watershed Management Program administered by the County from August 2001 through June 2014. The Environmental Fund is used to fund watershed projects such as stream restoration, outfall retrofits, and educational programs as one aspect of stormwater compliance for development in the County. Therefore, a portion of the pollutant load reductions achieved by the Skipwith Elementary Stream Restoration project is obligated for development project compliance and is not applicable to the pollutant load reductions associated with the TMDL.

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Since development projects' contributions to the Environmental Fund were based on a rate of \$8,000.00 per pound of phosphorus, the phosphorus load reduction achieved by the Skipwith Elementary Stream Restoration project that is applicable to the pollutant load reductions associated with the TMDL must be reduced by 78.59 lbs/year ($\$628,710.00 \div \$8,000.00$ per pound). Discounting the load reductions for both nitrogen and sediment by a similar percentage results in the following pollutant load reductions that are applicable to the pollutant load reduction requirements of the TMDL:

Pollutant	Total Reduction (lbs/year)	Environmental Fund Obligation (lbs/year)	Applicable to the TMDL (lbs/year)
Total Nitrogen	131.25	86.68	44.57
Total Phosphorus	119.00	78.59	40.41
Total Suspended Solids	78,540.00	51,868.58	26,671.43