Albemarle County

Chesapeake Bay
TMDL Action Plan Update

submitted as partial fulfillment
in meeting
Special Condition (Section IIA) of the
2018-2023
VPDES General Permit for
Small Municipal Separate Storm Sewer Systems
VAR040074

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List of Abbreviations

ac	acres
ac-ft	acre-feet
BMP	best management practice
CIP	capital improvement project
County	Albemarle County, VA
DEQ	Virginia Department of Environmental Quality
EOS	edge of stream
GIS	geographic information system
Guidance Document	*Virginia DEQ Chesapeake Bay TMDL Action Plan Guidance Document*
HUC8	hydrologic unit code 8
lb	pound
lf	linear feet
MS4	Municipal Separate Storm Sewer System
NED	National Elevation Dataset
NFWF	National Fish and Wildlife Foundation
Phase II MS4 Permit	General Permit for Discharges of Stormwater from Small MS4s
Plan	Chesapeake Bay TMDL Action Plan
POC	pollutant of concern
ROW	right-of-way
SLAF	Stormwater Local Assistance Fund
TMDL	total maximum daily load
TN	total nitrogen
TP	total phosphorus
TSS	total suspended solids
UA	U.S. Census Bureau designated urban area
USGS	U.S. Geological Survey
VAR05	General VPDES Permit for Stormwater Associated with an Industrial Activity
VDOT	Virginia Department of Transportation
VSMP	Virginia Stormwater Management Program
VPDES	Virginia Pollutant Discharge Elimination System
WIP	Watershed Implementation Plan
yr	year

Executive Summary

Albemarle County, Virginia has developed this Chesapeake Bay Total Maximum Daily Load (TMDL) Action Plan update as required by the 2018-2023 General VPDES Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (Phase II General Permit No. VAR040074) and in accordance with the Virginia Department of Environmental Quality (DEQ) *Chesapeake Bay TMDL Action Plan Guidance* dated May 18, 2015.

This Action Plan includes a summary of the current TMDL requirements as they apply to the County's MS4 regulated area and demonstrates the County's compliance with the required reductions of the pollutants of concern (POC) – phosphorus, nitrogen, and sediment. The POC reductions are driven by three categories of sources within the regulated area:

- loads from existing sources as of June 30, 2009
- increased loads from new sources constructed between July 1, 2009 and June 30, 2014
- increased loads from grandfathered sources constructed after July 1, 2014.

As part of its first phase Chesapeake Bay Action Plan, the County delineated the regulated area using the 2010 Census-designated urbanized area, excluding other MS4 jurisdictions, VDOT roads, VPDES permit holders, forested areas, and water bodies. The regulated area – which includes 1,963 acres of impervious surface and 5,206 acres of pervious surface – is used as the basis for calculating nutrient loads and required reductions. Using General Permit Table 3a, the required POC reductions from existing sources for the second permit cycle – 40% of the total long-term goal – were calculated. All computations are summarized in Table ES1.

Prior to locally administering the Virginia Stormwater Management Program beginning on July 1, 2014, Albemarle County imposed stormwater management design standards that were different than – and, in ways, less stringent than – the Virginia standards. To address the possible pollutant removal shortcomings for stormwater facilities associated with new and grandfathered sources designed under the old standards, the County assessed land development projects and facilities constructed beginning July 1, 2009 on a site-by-site basis. Despite having a slightly less stringent criterion, many facilities were, nonetheless, over-designed – resulting in a net *credit* towards POC reduction requirements (see Table ES1).

Since Jan 1, 2006, the County has implemented eight capital improvement projects eligible toward pollutant reduction requirements; the credits are summarized in Table ES1. While the general permit only requires this Action Plan update to list BMPs that have been implemented prior to July 1, 2018, the County has also provided accounting and information on BMPs that have been implemented through July 1, 2019, as they currently contribute toward the County's 40% reduction requirements during the 2018-2023 permit cycle. The County also will receive credit for nutrient management plans (NMPs) that were implemented on County-owned properties and for disconnected septic systems.

Further, the County has provided DEQ with a database of all BMPs installed between 1985 and the present – as part of DEQ's 2015 Historical Data Clean-Up RFA – in order to better represent County pollutant loads in the Phase 6 Chesapeake Bay Watershed Model. As part of this Action Plan, the County

is claiming full POC removal credit for BMPs installed within the regulated area on or after January 1, 2006 and before July 1, 2009. The comprehensive list was submitted by September 1, 2015, and the additional credit is incorporated into the County pollutant reduction tally.

All estimated values for the County's POC reduction requirements and achievements are summarized in the following table:

Table ES1: Summary of Total POC Reduction Requirements and Credits

	Type	Phosphorus (lbs/yr)	Nitrogen (lbs/yr)	Total Suspended Solids (lbs/yr)
Reduction Requirements (1st cycle – 5 %)		30.0	182.6	15,383.9
(2nd cycle – 40 %)		296.6	1,527.5	109,133.9
(3rd cycle – 100%)		757.9	3,845.5	311,791.6
Reduction Credits	New and Grandfathered Sources	121.1	471.9	55,702.3
	Structural BMPs	70.4	268.7	33,558
	Stream Restorations	246.3	244.4	354,349.9
	BMPs installed between January 1, 2006 and July 1, 2009	253.3	2,601.4	228,654
	Connection of septic systems to sanitary sewer	0	373.5	0
	Nutrient Management Plans	0.1	0.9	0
	Total Reduction Credits	691.2	3,960.7	672,264.4
Total Reductions Remaining		66.7	0	0
Total % Reductions Achieved		91.2%	103.0%	215.6%

Based on the results of the calculations provided in this Action Plan, Albemarle County has exceeded all second permit cycle reduction goals and anticipates counting any credit beyond the 40% toward reduction requirements for subsequent permit cycles and any reductions necessary to offset future grandfathered projects.

The following table provides a summary of specific permit requirements and the section within this Action Plan in which the requirement is addressed.

Table ES2 Overview of Chesapeake Bay TMDL Action Plan Update Requirements		
General Permit Section	Description of Requirement	Corresponding Section/Appendix of this TMDL Action Plan
2.A.11.a	Any new or modified legal ordinances, policies, or interjurisdictional agreements	Section 2, Appendix C
2.A.11.b	Load and cumulative load reduction calculations	Section 4.1
2.A.11.c	Total reductions achieved for each POC in each river basin	Section 5.6
2.A.11.d	A list of BMPs implemented	Table 5.1, Appendix B
2.A.11.e	BMPs to be implemented by the permittee	Section 5.7
2.A.11.f	A summary of any comments received as a result of public participation	Section 6

1. Introduction

Albemarle County is located in Piedmont Virginia, within the James River Watershed and has a total land area of 464,623 acres (ac). It surrounds the City of Charlottesville (the City) and contains portions of the University of Virginia (UVA), Piedmont Virginia Community College (PVCC), and some properties owned by the City. Approximately five percent of the County is designated as urban area, or development area, in the Comprehensive Plan. The remaining 95% of the County consists of forest, agriculture, and suburban development.

Albemarle County is responsible for contributing to the restoration of the Chesapeake Bay through the planning and implementation of activities to reduce the discharge of POCs to local waters. The extent of required local efforts is dictated by the Special Condition for the Chesapeake Bay TMDL in General Permit No. VAR040074, the VPDES General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4s). Local requirements are further elucidated by the Chesapeake Bay TMDL Action Plan Guidance Document No. 15-2005, issued by the Department of Environmental Quality on May 18, 2015 (henceforth referred to as "Guidance Document").

Virginia's Phase I, Phase II, and Phase III Watershed Implementation Plans (WIPs) require that operators of MS4s achieve the following pollutant reductions over a period of three five-year permit cycles:

Table 1.1 Virginia Phase I and II WIPs Required Reductions

pollutant	reduction from *impervious* regulated areas	reduction from *pervious* regulated areas
nitrogen	9%	6%
phosphorus	16%	7.25%
sediment	20%	8.75%

MS4s are permitted to achieve these reductions incrementally over time, per the following schedule:

Table 1.2 MS4 Permittees Incremental Reductions

permit cycle (years)	% implementation required
1st (2013 – 2018)	5%
2nd (2018 – 2023)	35%
3rd (2023 – 2028)	60%
total	100%

This Total Maximum Daily Load (TMDL) Action Plan update includes a summary of the Special Condition and DEQ guidance as they pertain to Albemarle County, summaries of the computations and results quantifying the POC reduction requirements, descriptions of the analytical methods used, and an examination of the projects and practices that will contribute towards providing compliance with the POC reductions required during the second permit cycle.

2. Review of Current MS4 Permit Authority and Capabilities

This section reviews the current program, existing legal authorities, new legal authorities and the potential funding mechanism used to meet the Special Condition in accordance with General Permit Section 2.A. Albemarle County has determined that the existing legal authorities as stated in this section, supplemented by collaborations with neighboring MS4 permittees and funding initiatives, are sufficient to ensure compliance with the Special Condition.

2.1 Existing and New Legal Authorities

Based on Albemarle County's MS4 Program Plan, MS4 Program Authority is implemented under the following:

- Virginia Stormwater Management Act
- Virginia Erosion and Sediment Control Law
- Chesapeake Bay Preservation Act (CBPA)
- Albemarle County Code, including:
    - Subdivision Ordinance (Chapter 14)
    - Water Protection Ordinance (Chapter 17)
    - Zoning Ordinance (Chapter 18)
- Albemarle County Design Standards Manual (outlines administrative policies and procedures related to land development regulations)

Chapter 17 of the Albemarle County Code – known as the Water Protection Ordinance (WPO) – is the primary legal mechanism through which the County regulates land disturbing activities, land development, illicit discharges, and impacts to riparian areas and other natural resources. The WPO was revised in 2014 to incorporate the new Virginia Stormwater Management Program (VSMP) requirements pertaining to erosion and sediment control and stormwater management. It continues certain preexisting programs of the County that exceed the minimum State standards, specifically the County's stream buffer protection program. The various rules of the WPO were reorganized to better facilitate their administration.

Below is a brief summary of the key elements in the WPO:

- Article I, General (Sections 17-100 to 17-108): Identifies the authority for the ordinance, states its purpose, describes its applicability, including its applicability to the Town of Scottsville.
- Article II, Administration (Sections 17-200 to 17-211): Designates the County as the program authority and the County engineer as the program administrator, defines terms, and establishes fees.
- Article III, Applicability of the VESCP and the VSMP to a Land Disturbing Activity or a Site Condition (Sections 17-300 to 17-306): Describes the types of land disturbing activities subject to and exempt from the County's erosion and sediment control program (VESCP) and stormwater management program (VSMP).

- Article IV, Procedure for Submitting, Reviewing and Acting on Applications; Post-Approval Rights and Obligations (Sections 17-400 to 17-424): Establishes the form and content for all required plans, including two new types of plans (pollution prevention plans and stormwater pollution prevention plans) previously administered by the State; establishes the procedure for submitting, reviewing and acting on plans; establishes the rights and obligations of an owner after the County has approved an application, including the obligation to maintain permanent stormwater management facilities; and establishes the procedures for amending plans after approval.
- Article V, Technical Criteria (Sections 17-500 to 17-502): Establishes the technical criteria for controlling erosion and sediment, managing stormwater quantity, and managing stormwater quality to satisfy State standards.
- Article VI, Stream Buffers (Sections 17-600 to 17-604): Continues and updates the County's stream buffer protection regulations and amends some of the regulations to simplify their administration.
- Article VII, Illicit Discharges, Illicit Connections, and Prohibited Dumping (Sections 17-700 to 17-703): Continues and updates the County's regulations prohibiting illicit discharges and connections, and prohibiting dumping, as part of the County's MS4 program.
- Article VIII, Compliance (Sections 17-800 to 17-814): Establishes a wide range of duties on owners holding approved permits to engage in land disturbing activity, including the duty to comply with all applicable requirements, to maintain all structures, systems and facilities, to maintain certain required permits and plans onsite, to provide information pertaining to certain discharges, to report certain discharges, and to provide records; also establishes the authority of the administrator to obtain information from owners, to conduct inspections of sites, and to conduct monitoring and sampling; the new State regulations impose an obligation on the County for ensuring compliance.
- Article IX, Enforcement (Sections 17-900 to 17-905): Continues, clarifies and enhances the County's enforcement authority under its VESCP, VSMP and MS4 programs, ranging from issuing notices to comply and stop work orders to seeking civil penalties and other judicial remedies.
- Article X, Groundwater Assessments (Sections 17-1000 to 17-1005): Continues the County's program to collect groundwater information in conjunction with its review of certain developments; this article is not part of the County's erosion and sediment control or stormwater management programs.

No further modifications or new legal authorities are needed to comply with the Special Condition.

2.2 Coordination with Adjacent MS4 Permittees

Albemarle County shares complex jurisdictional boundaries with the four adjacent MS4 permittees: the City of Charlottesville (the City), the University of Virginia (UVA), Piedmont Valley Community College (PVCC), and the Virginia Department of Transportation (VDOT). PVCC lies solely within the County, and UVA lies within both the County and City. To address slight differences between digital maps, the County, UVA, and the City have agreed to use the City's jurisdictional boundary as a common delineation

between the two localities. UVA has provided their MS4 jurisdictional map – based on the properties held by the university – to the County and City.

The County, City, and UVA have agreed to take responsibility for the POC loads within their regulated area boundary regardless of sheetflow draining to or from another jurisdiction. Furthermore, POC reduction credit for installed BMPs draining lands from multiple jurisdictions will be received by the permittee that installs the BMP. The County agreed to consider as part of its regulated area all lands solely owned and operated by the County (parcels and rights-of-way) that lie within the boundaries of the City. Correspondingly, the City has agreed to include within its regulated area lands which it solely owns and operates; as such, these lands were excluded from the County's regulated area. However, the County reserves the right to enter into agreements in which TMDL credit is shared with adjacent permittees for any projects which treat drainage from multiple permittees' lands. In fact, the County and the City have entered into such an agreement for the RiverRun stream restoration in March of 2018. The stream restoration is discussed in detail in Appendix B, and the agreement between the City and the County is presented in Appendix C.

2.3 Funding

Albemarle County supports its TMDL program through a combination of Board appropriations from the General Fund, grants such as the Stormwater Local Assistance Fund (SLAF), and partnerships with other regulated MS4s.The County has been awarded three SLAF grants totaling $451,613 since 2015.

3. MS4 Regulated Area

Chesapeake Bay pollutant reductions have been assigned to Albemarle County through its MS4 permit and apply to the MS4 regulated area as of June 30, 2009[1]. The determination of the size and extent of the regulated area is a critical step in the action planning process. Regulated area (or regulated *land*) – as it pertains to Phase II MS4s – is defined as "the conveyances and drainage area [served by the MS4] that falls within a Census designated urbanized area"[2].

Albemarle County's regulated area was defined in a manner consistent with the Guidance Document finalized May 18, 2015.

3.1 US Census-Designated Urban Areas

The MS4 regulated area is primarily based on the boundaries of Urban Areas (UAs) as defined by the U.S. Census. The general permit indicates that the 2000 UA shall be used to determine the POC loading rates and reductions required during the first and second permit cycle[3]. For the third permit cycle, the 2010 UA must be used to calculate POC loading rates and removal requirements[4]. The intent of this directive is to give MS4s sufficient time to adapt to the increase in pollutant reduction requirements associated with a *presumed* expansion of the extent of the UA.

[1] Guidance Document, page 5

[2] Guidance Document, page 1

[3] 9VAC25-890-40 (General Permit) Section I.C.3

[4] Guidance Document, page 3

However, while the Albemarle County UA expands from 2000 to 2010 in some areas, it contracts in other areas and has actually decreased in total area over this period. Because Albemarle will not be required to adapt to a significant UA expansion and in order to simplify the action planning process over time, the County will use the 2010 UA for this and subsequent permit cycles. DEQ has indicated that Albemarle County may base its MS4 regulated area on the 2010 UA boundary without consideration of the 2000 UA boundary[5].

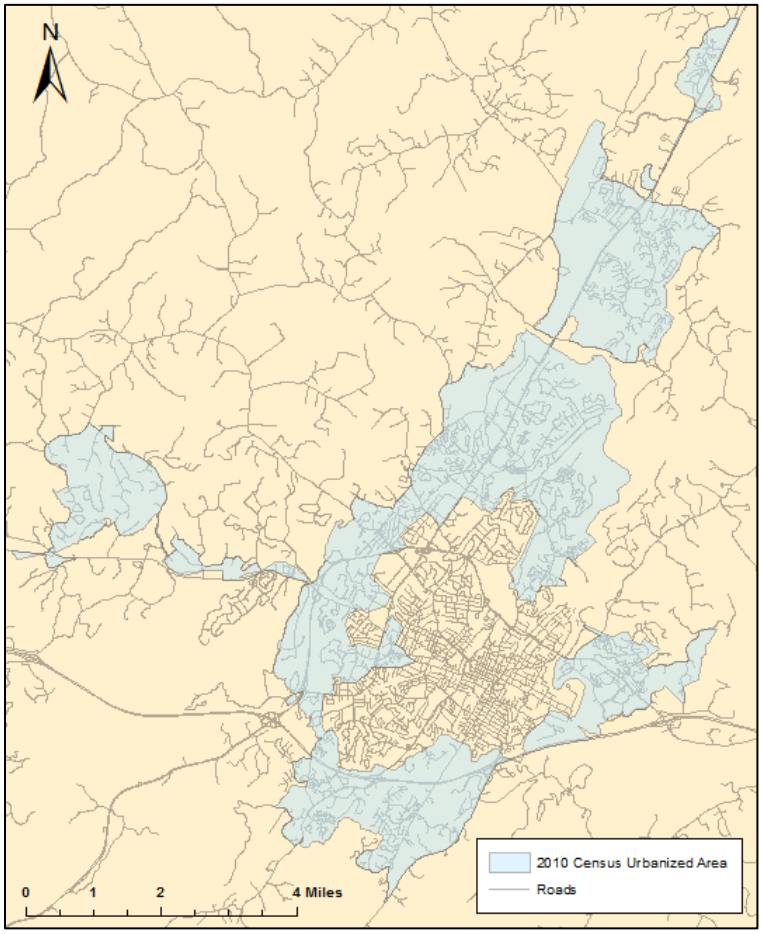


Figure 3.1 Albemarle County 2010 Census Designated Urbanized Area

3.2 Areas Served by the MS4

An MS4 is a conveyance or system of conveyances 1) owned or operated by a county or other public body and 2) designed or used for collecting or conveying stormwater[6]. Based on this definition of regulated area and the Guidance Document, areas not draining into the operator's MS4 may be excluded from its regulated area.

Albemarle County has not historically borne responsibility for maintaining conveyance infrastructure outside of County-owned properties. However, the County recently reconsidered this issue and

[5] conveyed via telephone conversation with Jaime Bauer on February 2, 2015, 9:00AM

[6] 9VAC25-870-10 (Definitions)

concluded that it will, as a matter of policy, begin assuming responsibility for the operation of conveyance infrastructure on private properties if the infrastructure lies within a public easement. The County does not presently know the full extent and location of this public conveyance infrastructure, so it is not possible at this time to determine whether lands within the 2010 UA are served by the County's MS4. Consequently, the County will suppose – for the second-cycle Action Plan – that *all* private lands within the 2010 UA could potentially be served by the MS4. Nonetheless, the County reserves the right – as part of future action planning – to refine the MS4 regulated area based on information collected in the course of mapping the storm sewer system.

3.3 Areas Not Included in Albemarle MS4

Permittees should not include the conveyances and drainage areas that are regulated by a separate MS4 permit and may exclude the following from the regulated urban impervious and pervious cover calculations:

1. Land regulated under any General VPDES permit that addresses industrial stormwater, including VAR05, VAG11, and VAR84;
2. Land regulated under an individual VPDES permit for industrial stormwater discharges;
3. Forested Lands;
4. Agricultural Lands;
5. Wetlands; and,
6. Open Waters.[7]

Regulated under a separate MS4 permit or VPDES permit

Lands on which stormwater management is the responsibility of other parties are removed from Albemarle County's MS4 regulated area[8]. These lands include:

1) Other MS4 Jurisdictions
   a) The University of Virginia (UVA)
   b) Virginia Dept. of Transportation (VDOT)
   c) City of Charlottesville-owned properties in the County
   d) Piedmont Valley Community College (PVCC)
2) General VPDES-Permitted Sites:
   a) Republic Services of Charlottesville (VAR050974)
   b) Moores Creek Regional STP (VAR051387)
   c) Charlottesville-Albemarle Regional Airport (VAR050503)
   d) Northrop Grumman Systems Corporation (VAR050876)

In addition, County-owned properties within the City of Charlottesville – for example, the downtown County Office Building and several schools – are *added* to the Albemarle County MS4 regulated area.

[7] Guidance Document, page 5

[8] Guidance Document, page 5

UVA, City of Charlottesville-owned properties in the County, PVCC, and the General VPDES permit areas are removed from the 2010 regulated area boundary shapefile. VDOT is removed from the 2009 Land Use shapefile.

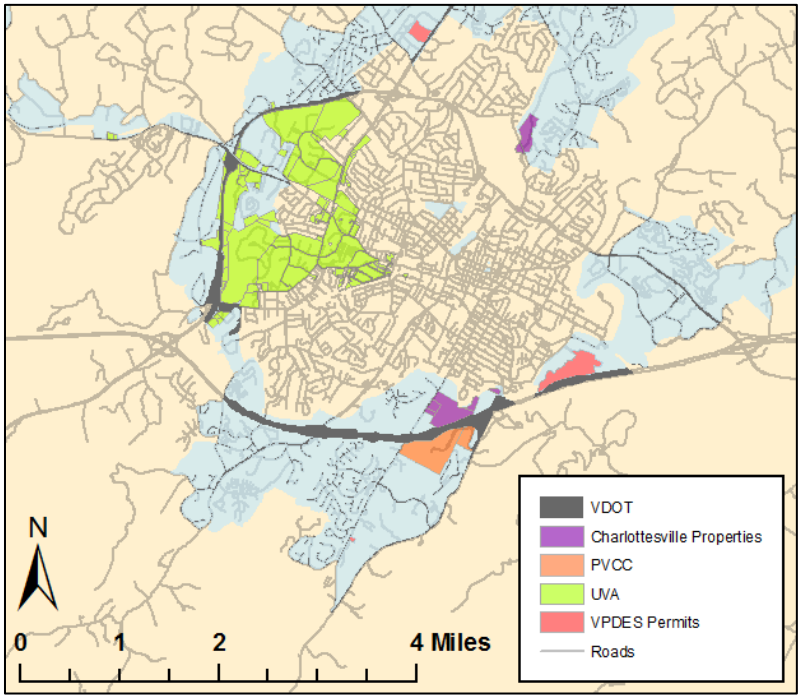


Figure 3.2 Other MS4 Jurisdictions removed from the County MS4 area and the County owned properties within the City added to the County MS4 area.

Forested Lands

Forested lands are removed from the MS4 regulated area because they are not assigned a loading in the Chesapeake Bay Model[9]. Any forested lands excluded from the MS4 regulated area were also excluded from the load reduction calculations for individual BMPs as part of considering new and grandfathered sources.

The identification of forested lands within Albemarle County's regulated area was based on a local land cover map developed in 2009 in partnership with the Rivanna River Basin Commission, The Nature Conservancy, and the Thomas Jefferson Soil and Water Conservation District. This map includes land cover classifications for deciduous forest, evergreen forest, open space, impervious area, and water. The land cover map has a fine resolution (1-foot) so it was necessary to differentiate between an actual urban forest and small clusters of trees which would not act as a true forested area – such as a cluster of trees within a commercial parking lot or residential area. This was accomplished by setting a minimum

[9] Guidance Document, page 5

25-foot pervious buffer around all impervious surfaces – buildings, roadways, driveways, and parking lots – and then establishing a minimum contiguous area threshold of 0.5-acres[10] for land cover identified as forested to qualify as "forested lands" in the context of the MS4. The County established a 0.5-acre threshold as a conservative estimate of forest coverage, instead of using the 900m^2 recommended in the final guidance document, given the lack of forest density data.

Figure 3.3 Example of excluded forested areas

Wetlands and Open Waters

Lastly, Albemarle County has decided to remove bodies of water from the MS4 regulated area[11]. Identification of water bodies within the County was based on a local land cover map developed in 2009. Any areas classified as water (baseclass 3) in this land cover map were not included in POC load calculations.

[10] Guidance Document, page 5

[11] Guidance Document, page 5

Figure 3.4 Example of excluded water bodies

3.4 Summary of Regulated Area Calculations

Based on the descriptions above, the County used ArcGIS to designate the MS4 regulated area and classify and quantify the land uses, as summarized in the following table.

Table 3.1 Albemarle County MS4 Regulated Area Exclusion and Inclusion Areas	Area (ac)
2010 Census Urbanized Area	15,763
Exclusion Areas:	
Other MS4 Permittees (excluding VDOT)	1,133
VPDES Permittees	453
VDOT Roads	1,013
Forest	5,935
Water	242
Inclusion Areas:	
County Properties in the City	40
Total Regulated Acres	**7,169**
regulated pervious	5,206
regulated impervious	1,963

All other MS4 and VPDES permittees are excluded from the Albemarle County MS4 Boundary Shapefile. The regulated pervious and impervious acreages are used to determine load reduction requirements based on Tables 3a.

The regulated acres described above is the County's best estimate based on current data. As stated, the County reserves the right – as part of future action planning – to refine the MS4 regulated area based on additional information collected.

4. Required Pollutant Reductions

The County must reduce POCs discharged from the following categories of sources within the MS4 regulated area:

1. existing – generally based on land cover as of June 30, 2009
2. new – generally based on changes to land cover between July 1, 2009 and June 30, 2014
3. grandfathered – generally based on changes to land cover occurring after July 1, 2014 but permitted under old stormwater management requirements

Although MS4s are responsible for addressing only forty percent of the total required pollutant reductions for new sources during the 2nd permit cycle, the calculations presented in the following sections are for the long-term total (100%) required load reductions, unless otherwise noted.

All required pollutant reduction calculations for existing and new sources can be found in the Appendix A spreadsheet.

4.1 Existing Sources

Existing sources are characterized as urban pervious and impervious areas within the MS4 regulated area as of June 30, 2009. As previously described, contiguous forested areas outside of the 25-ft impervious surface buffer and over 0.5-acres in size are classified as forested and are not assigned a loading rate.

The estimated POC loads from existing sources are simply a function of the amounts of regulated pervious and impervious areas and loading rates specified in Table 3 of the General Permit (Special Condition 3).

Table 4.1 General Permit Table 3a estimating existing source loads for the James River Basin				
Subsource	**Pollutant**	**Total Existing Area Served by MS4 (ac)**	**2009 EOS Loading Rate (lbs/ac-yr)**	**Estimated Total POC Load (lbs/yr)**
Regulated Urban Impervious	Nitrogen	1,963	9.39	18,433
Regulated Urban Pervious		5,206	6.99	36,390
Regulated Urban Impervious	Phosphorus	1,963	1.76	3,455
Regulated Urban Pervious		5,206	0.5	2,603
Regulated Urban Impervious	Total Suspended Solids	1,963	676.94	1,328,833
Regulated Urban Pervious		5,206	101.08	526,222

Required pollutant reductions for existing developed lands are intended to meet the Level 2 (L2) scoping run of the Chesapeake Bay Model. The total POC reductions – in pounds/acre-year – are derived by multiplying the percent reductions by the loading rates, as follows. These total reductions are then translated into the incremental reductions for each permit cycle.

Table 4.2 Total required pollutant reductions intended to meet the Level 2 (L2) scoping run translated into the incremental reductions for each permit cycle.								
				Required Reductions (lbs/ac-yr)				
Subsource	**POC**	**VA WIP reduc-tions**	**2009 EOS Loading Rate (lbs/ac-yr)**	**Total (2013 – 2028) 100%**		**1st-cycle (2013 – 2018) 5%**	**2nd-cycle (2018 – 2023) 35%**	**3rd-cycle (2023 – 2028) 60%**
Regulated Urban Impervious	N	9%	9.39	0.85		0.04	0.30	0.51
Regulated Urban Pervious		6%	6.99	0.42		0.02	0.15	0.25
Regulated Urban Impervious	P	16%	1.76	0.28		0.01	0.10	0.17
Regulated Urban Pervious		7.25%	0.5	0.04		0.002	0.01	0.02
Regulated Urban Impervious	TSS	20%	676.94	135.39		6.77	47.39	81.23
Regulated Urban Pervious		8.75%	101.08	8.84		0.44	3.10	5.31

The required pollutant reductions are calculated in pounds per year by multiplying by the load reductions from the above table (in pounds per acre -year) by the corresponding amounts of regulated

pervious and impervious areas. The table below summarizes Albemarle County's total required reductions from existing sources for the POCs for the second permit cycle.

Table 4.3 General Permit Table 3a determining total POC reductions required during this permit cycle for the James River Basin

Subsource	Pollutant	Total Existing Area Served by MS4 (ac)	Second Permit Required Reduction in Loading Rate (lbs/ac-yr)	Total Reduction Required 2nd Cycle (lbs/yr)	
Regulated Urban Impervious	Nitrogen	1,963	0.30	581	1,527
Regulated Urban Pervious		5,206	0.15	764	
Regulated Urban Impervious	Phosphorus	1,963	0.10	193	290
Regulated Urban Pervious		5,206	0.01	66	
Regulated Urban Impervious	Total Suspended Solids	1,963	47.39	93,018	124,518
Regulated Urban Pervious		5,206	3.10	16,116	

The table below summarizes Albemarle County's total POC required reductions from existing sources through the third permit cycle (100%).

Table 4.4 Total Required POC reductions extrapolated over 3 permit cycles based on Table 3a of the General Permit

Subsource	Pollutant	Total Existing Area Served by MS4 (ac)	Total Required Reduction in Loading Rate (lbs/ac-yr)	Total Reduction Required 1st – 3rd Cycle (lbs/yr)	
Regulated Urban Impervious	Nitrogen	1,963	0.85	1,659	3,845
Regulated Urban Pervious		5,206	0.42	2,187	
Regulated Urban Impervious	Phosphorus	1,963	0.28	550	758
Regulated Urban Pervious		5,206	0.04	208	
Regulated Urban Impervious	Total Suspended Solids	1,963	135.39	265,771	311,792
Regulated Urban Pervious		5,206	8.84	46,021	

Calculations for the above tables are provided in Appendix A, tab "Existing Source Load Reductions".

4.2 New Sources

Albemarle County is required to consider new sources of pollutants under Special Condition 4 because – prior to the adoption and local implementation of the VSMP on July 1, 2014 – the County used an average land cover condition of 20% impervious cover for the design of post-development stormwater management facilities for land development within the regulated area[12]. Special condition 4 applies to development initiating construction between July 1, 2009 and June 30, 2014 that disturbs one acre or greater.

The County identified new sources using two methods:

1. Comparison of County GIS planimetric data approximating July 1, 2014 land cover to the county-wide 2009 land cover map.
2. Analysis of County database files for approved site plans, subdivisions, and other land disturbing activities.

These two data sources were reconciled to develop a single listing of new sources, which was included in the submission of the County's first phase Action Plan. This list of new sources is also included for reference in Appendix A.

Factors Affecting Pollutant Reduction Calculations

Per Albemarle County requirements between July 1, 2009 and June 30, 2014, BMPs constructed as part of the new developments were designed to reduce phosphorus loads to that of a 20% impervious average land cover condition. While this is less stringent than the State's 16% land cover condition, the County had certain requirements which were *more* stringent than State requirements. First, Albemarle County approved site plans typically using a flow-weighted mean pollutant concentration of 0.7 mg/L for development areas, 0.35 mg/L for drinking water watersheds, and 0.4 mg/L for agricultural areas,[13] whereas the Virginia Stormwater Management Handbook required the use of a flow-weighted mean pollutant concentration of only 0.26 mg/L regardless of land use. Second, Albemarle County required stormwater management on development sites that disturbed 10,000 square feet or greater; compared to the State's 1-acre disturbed area threshold. Third, Albemarle County required stormwater management for *any* redevelopment project that increased impervious surface, regardless of pre-development conditions or size of the disturbed area. In contrast, the State required stormwater management for redevelopment based on the existing land cover condition and post-development land cover condition being greater than or less than 16% impervious.[14]

In addition, the County found that most BMPs were over-designed relative to the local requirements, primarily because the selected BMP pollutant reduction efficiencies usually exceeded those necessary to

[12] 9VAC25-890-40 (General Permit) Section II.A.4

[13] Community Development spreadsheet

[14] 9VAC25-870-96 (Water Quality)

exactly meet the requirement. For example, if a developed site required a 57% phosphorus reduction to comply with the County's 20% impervious average land cover condition, the designers may have selected a Wet Pond providing a 65% phosphorus reduction, thus resulting in a phosphorus reduction which was 8% beyond the County's requirements for that site. In most cases, this over-design of BMPs, in addition to the stricter requirements for flow-weighted mean pollutant concentration, more than compensates for the difference in the County and State average land cover conditions. Further, some of the BMPs were sized to treat existing offsite development. The County is accounting for these pollutant reductions toward its reduction requirements.

Due to these factors, the County has no further reduction requirements to meet Special Condition 7, and the accounting for these facilities has resulted in a net credit counted towards Special Condition 4, described in section 5.2 below.

Special Situations

Through the process of determining the required nutrient reductions from new sources of pollution, Albemarle County found additional development scenarios beyond those described in Situations 1-4 in the guidance document[15]. Appendix A describes each of the additional situations, the pollutant reduction accounting, and the pollutant load computation description. Column BE in Appendix A, tab "New Source Load Red," lists any relevant special situations for each new development.

The most common scenario is Special Scenario #1 in Appendix A, "Land in Transition". Since development occurs over time, the commencement and completion of developments considered to be new sources do not fall neatly within the July 1, 2009 to June 30, 2014 time frame. Based on DEQ guidance, developments having the majority of construction taking place during the new sources time frame, but either commencing construction prior to July 1, 2009 or completing construction after June 30, 2014, are considered "in transition" and are included in the new source load calculations. Any development that occurred prior to July 1, 2009 is not included in the existing source load calculations[16].

scenarios for lands in transition	construction commencement	construction completion	how these were addressed
1	before July 1, 2009	July 1, 2009 – June 30, 2014	included as new source; pre-construction land use used for computing existing sources
2	July 1, 2009 – June 30, 2014	after June 30, 2014	included as new source; full development build out estimated
3	before July 1, 2009	after June 30, 2014	pre-construction land use used for computing existing sources and full development build out estimated

[15] Guidance Document, page 26-35

[16] Guidance Document, Footnote page 6

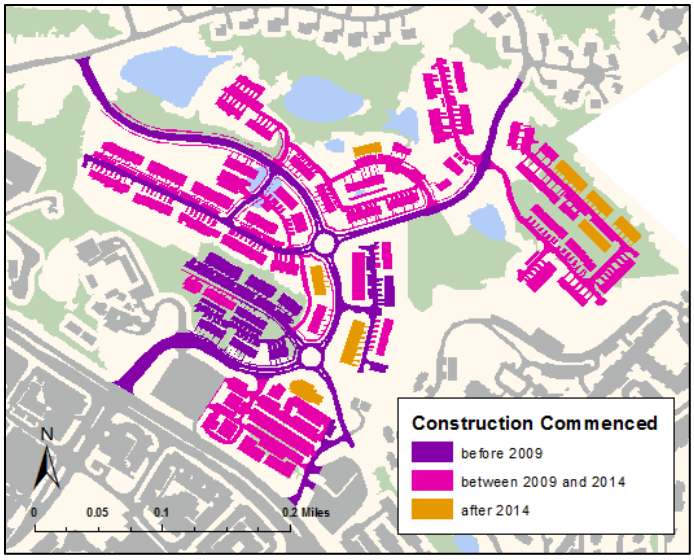


Figure 4.1 Example of a new source site with portions considered "in transition"

4.3 Grandfathered Sources

Albemarle County is required to consider grandfathered sources of pollutants under Special Condition 5 because – prior to the adoption and local implementation of the VSMP on July 1, 2014 – the County used an average land cover condition of 20% impervious cover for the design of post-development stormwater management facilities for land development within the regulated area[17]. Special condition 8 applies to development initiating construction after July 1, 2014 grandfathered in accordance with 9VAC25-870-48 and disturbs one acre or greater.

Table 4.5 presents a list of possible grandfathered projects; highlighted in orange are those grandfathered projects that have initiated construction and are therefore included in the accounting in Appendix A, tab "New and GF Source Loads".

[17] 9VAC25-890-40 (General Permit) Section II.A.5

Table 4.5 A list of future projects and associated acreages that may qualify as grandfathered in accordance with 9VAC25-870-48				
Project Name	Permit Number	Permit Date	Disturbed Acres	Development Acres
5th Street Station	VAR10E976	9/26/2014	62.0	86.9
Agnor Hurt Elementary School Renovations and Additions	VAR10F111	8/22/2014	5.4	19.5
Albemarle Health and Rehabilitation Center	VAR10D888	10/24/2014	6.26	8.41
Albemarle Place (Stonefield)	VAR100061	10/15/2014	26.3	65.8
Albrecht Place	VAR10F182	9/19/2014	3.0	3.4
Belvedere Phase II	VAR10C817	1/26/2015	20.59	31.52
Briarwood (Phase 5 and 6, gas station and parking)	VAR107199	10/24/2014	47.0	47.0
Cascadia	VAR10G099	10/14/2014	60.77	60.77
Chick fil A	VAR10F774	10/3/2014	2.79	2.79
Church of Our Saviour	VAR10G284	10/15/2014	1.8	6.16
CMA Colonial Auto Center	VAR10C895	7/25/2014	9.0	14.37
Goodwill Mill Creek Dr	VAR10E125	9/5/2014	0.8	0.8
Hollymead 230kV	VAR100076	7/25/2014	90.3	151.5
Hollymead Town Center Area C Blocks 4 and 9	VAR10G100	10/10/14	19.57	19.57
Jim Price Chevrolet	VAR10F231	9/19/2014	1.2	10.0
Land Between Dickerson Road Across from CHO Airport and Town Center Drive Near Hollymead Town Center	VAR107193		7.1	24.84
Northside Library	VAR10D711	9/5/2014	3.11	3.11
Oakleigh	VAR107174	9/5/2014	9.39	9.39
Pantops Corner	VAR10E170	9/12/2014	7.01	7.01
Rolkin Road Retail Center	VAR10G008	10/10/2014	1.3	1.7
The Lofts at Meadowcreek	VAR10E747	9/5/2014	2.6	2.8
Wetsel Property Surplus Soil Disposal Area	VAR107249	11/21/2014	3.06	3.06
Willow Glen Subdivision	VAR107191	9/5/2014	23.5	23.68

The projects highlighted above have – thus far – resulted in a net credit toward pollutant reduction requirements. The County intends to count this credit towards Special Condition 5, described in section 5.2 below.

Since any increase in loads must be entirely offset prior to completion of the project, future projects will be accounted for on a site-by-site basis – as construction is initiated – using the same methodology as new source loads. If specific projects do require offsets, Albemarle County will utilize the excess POC credits currently available.

4.4 Summary of Required Pollutant Reductions

The table below summarizes the long-term (100%) POC load reduction requirements to meet special conditions 3, 4, and 5 described in this section.

Table 4.6 OVERVIEW OF TOTAL POC REDUCTION REQUIREMENTS		**Phosphorus (lbs/yr)**	**Nitrogen (lbs/yr)**	**TSS (lbs/yr)**
TMDL Required Reductions	Existing Sources	758	3,846	311,792
	New Sources	0	0	0
	Grandfathered Sources Total Prior to Completion	0	0	0
	Total Required Reductions	**758**	**3,846**	**311,792**

As indicated, existing land cover within the County's regulated area is driving significant pollutant reduction requirements. The means and methods to offset these reduction requirement are described in section 5 below. BMPs constructed in conjunction with new and grandfathered sources have resulted in credits towards these pollution reduction requirements, therefore no further reductions are needed to meet special condition 3 or 4.

5. Means and Methods of Achieving Pollution Reductions

This section highlights the means and methods that Albemarle County will use to achieve the required pollution reductions under MS4 permit VAR040074 calculated in Section 4.

The means and methods used to meet the required existing source reductions from Table 3a for the second permit cycle consist of taking credit for:

1. Capital improvement projects (structural BMPs and stream restoration)
2. BMPS installed to meet development or redevelopment requirements
3. Urban nutrient management plans
4. Septic conversion to sanitary sewer
5. BMPs installed between January 1, 2006 and June 30, 2009

The current section offers a summary of pollutant removal generated by each of these means and methods. A spreadsheet summarizing nutrient removal calculations is provided in Appendix A.

5.1 Summary of Completed Capital Improvement Projects (CIPs)

Albemarle County is claiming POC removal credit for eight capital projects which have been completed prior to the submission of this Action Plan. A list of BMPs implemented to achieve reductions associated with the Chesapeake Bay TMDL, including date of implementation and reductions achieved, is included in Table 5.1. For each BMP, POC removal calculations are consistent with methodologies dictated in the Guidance Document. While the general permit only requires reporting of reductions through July 1, 2018[18], the County has also elected to also report projects which have been completed through to July 1, 2019, as they will contribute toward the County's 40% reduction totals.

Within the regulated drainage area, Albemarle County receives full POC reduction credit for all treatment provided by structural BMPs. For structural BMPs on unregulated land and stream restoration projects which receive drainage from unregulated lands, Albemarle County receives the full POC reduction credit minus the required baseline reduction. POC removal calculations for implemented BMPs are provided in detail in Appendix A (Load Reduction Calculations).

The locations of the two new capital projects which have been installed since the submission of the County's first phase Action Plan in 2015 are depicted in the Figure 5.1 and described in detail in Appendix B.

[18] 9VAC25-890-40 (General Permit) Section II.A.11.d

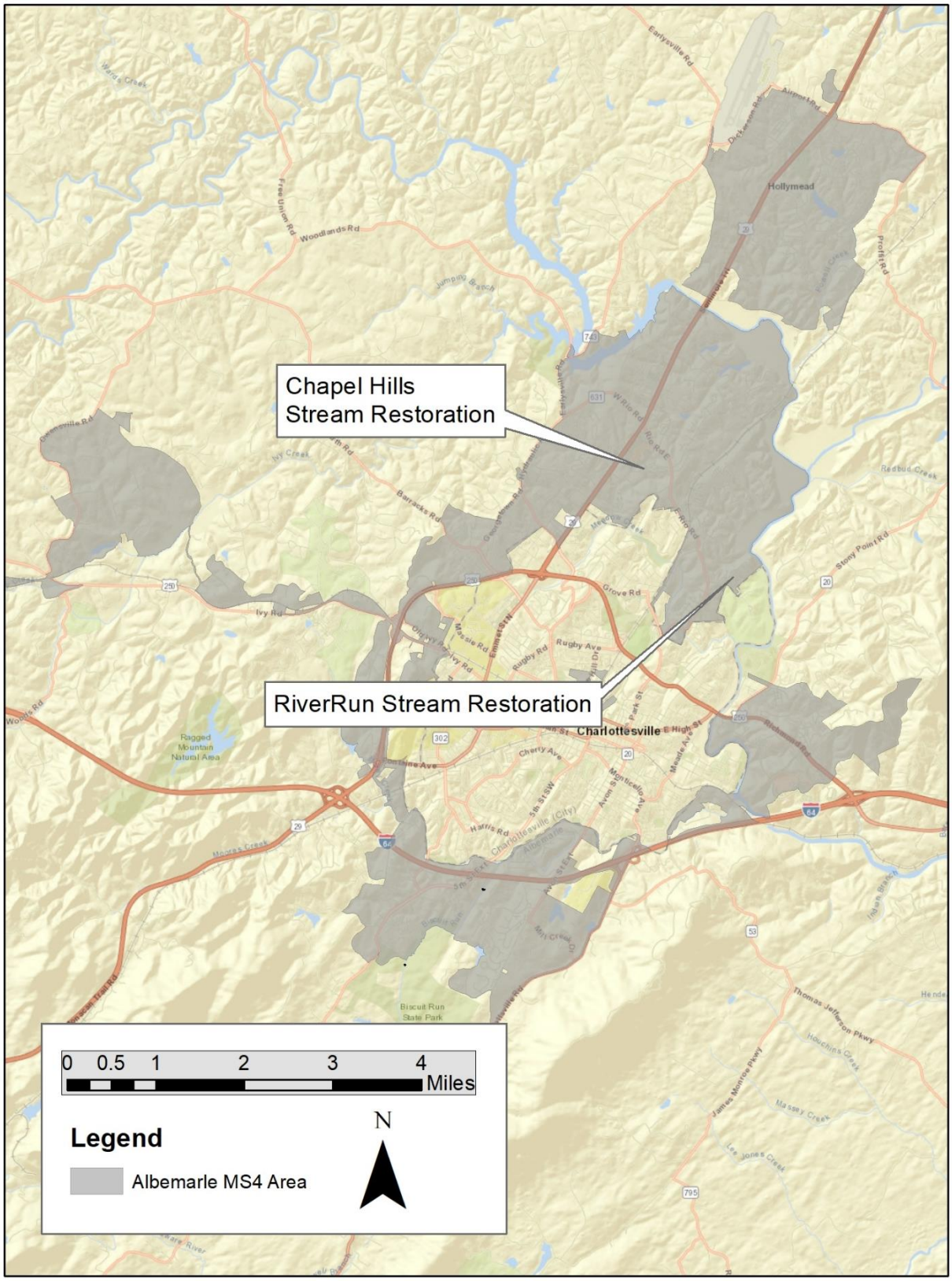


Figure 5.1 Newly Implemented Capital Project Locations

Table 5.1. BMP Installation dates and POC removal totals					
Site Name	**BMP Type**	**Date Installed**	**TP (lb/yr)**	**TN (lb/yr)**	**TSS (lb/yr)**
RiverRun	Stream Restoration	4/19/2019	106.2	0*	202,360.0
Chapel Hills	Stream Restoration	4/16/2019	86.9	95.9	57,356.6
COB-McIntire	Bioretention Basin	10/1/2011	1.82	0.37	695.1
Church Road	Constructed Wetlands	4/22/2015	29.59	171.58	14,954.9
Western Albemarle High School	Bioretention Basin	9/30/2014	0.07	145.34	27.0
Woodbrook Lagoon	Constructed Wetlands & Sand Filter	5/1/2012	38.9	27.1	17,881.1
Four Seasons Channel	Stream Restoration	3/9/2015	49.0	0.37	92,000.0
Crozet Wetlands Channel	Stream Restoration	9/30/2012	4.1	3.2	2,633.2

*The City of Charlottesville received all TN credit, pursuant to the Memorandum of Understanding presented in Appendix C, as the project treated regulated land in both the County of Albemarle and the City of Charlottesville.

5.2 BMPs installed to meet development or redevelopment requirements

Permittees can receive credit towards special condition 4 reduction requirements from BMPs installed after July 1, 2009 that were implemented to meet the minimum VSMP technical criteria phosphorus removal requirements for new development under the following circumstances:

- Redevelopment: the County is taking full credit for any POC reductions that result from redevelopment projects
- Stricter Development Requirements: the County is taking full credit for any POC reductions due to stricter development requirements – such as sites less than 1 acre
- Oversized BMPs: the County is taking credit for the difference between the BMPs' reductions and the reductions required under the VSMP regulations[19]

As mentioned in Section 4.2 above, while the County used a more lenient average land cover condition for development in the urban areas, other intricacies in the local rules sometimes resulted in more stringent overall local standards. Therefore, the County is counting the reductions beyond VSMP requirements towards special condition 4 reduction requirements.

Using the simple method, the Albemarle County site-by-site spreadsheet computations follow the methodology specified in appendix V.E. of the Guidance Document and account for:

- the *increase* in pollutant loads which must be mitigated due to new development – typically a conversion of regulated pervious area to impervious areas

[19] Guidance Document, Page 11

- the pollutant *reductions* provided by the onsite stormwater management constructed as part of the new development
- the *proportion* of the implemented BMP's total reduction that is available for credit towards the TMDL.

The increased phosphorus load due to new sources is computed by comparing the actual post-development phosphorus load to the *allowable limit*, defined as 1) the pre-development phosphorus load for redevelopment projects and 2) the phosphorus load based on a 16% impervious average land cover condition for new development projects. The difference between the actual post-development load rate and the allowable limit is considered to be the *pollutant load to mitigate,* calculated only for TP.

Subsequently, the phosphorus load reductions from onsite BMPs were calculated based on the post-development loading rate and phosphorus reduction efficiencies from the Virginia Stormwater BMP Clearinghouse, the Chesapeake Bay Program (CBP) established efficiencies, the Bay Program Retrofit Curves (henceforth referred to as "retrofit curves"), or the 1999 Virginia Stormwater Management Handbook [20]. In accordance with DEQ guidance, phosphorus removal efficiency from manufactured treatment devices (MTDs) is based on the efficiency from the approved site plan, when that information is available. When not available, the phosphorus removal efficiency from the Virginia Stormwater BMP Clearinghouse is utilized to account for MTDs[21]. This Action Plan utilizes the greatest of the phosphorus removal efficiencies described above to account for the phosphorus load reduction from each BMP. If the 1999 Virginia Stormwater Management Handbook or Virginia Stormwater BMP Clearinghouse efficiency was utilized to determine phosphorus reductions, then the reductions of nitrogen utilized the greater of the CBP established efficiencies or the retrofit curves and applied the same method to sediment. If phosphorus reductions were determined using either the CBP established efficiencies or retrofit curves, the same method was applied to both nitrogen and sediment. Efficiency details are summarized in Appendix A, tab "Efficiency Table Overview".

To determine the proportion of the load reduction that can be counted as credit towards TMDL requirements, the *allowable limit* was subtracted from the *maximum BMP reduction* for phosphorus to calculate a *net credit*. The net credit was divided by the maximum BMP reduction to calculate the *percent available for credit.* This percentage is then applied to nitrogen and sediment to calculate the net credit for each.

[20] An email from Kelsey Brooks (DEQ) on September 25, 2015 confirmed that it is permissible to use the 1999 Stormwater Management Handbook efficiencies to account for facilities which were designed under those standards.

[21] Conveyed via email from Kelsey Brooks on June 24, 2015

If a project included multiple BMPs, the reductions from each BMP were added to get a *total load reduction* from the site. BMPs in series were addressed by considering the effect of pollutant reductions due to upstream BMPs.

The calculations for each new development site can be found in Appendix A, tab "New and GF Source Loads". Some headings contain embedded comments with a description of the column. A summary of the POC credit provided by these BMPs is provided in Table 5.2 below. These credits include oversized BMPs from new sources and grandfathered sources that have initiated construction (highlighted in orange in Table 4.5).

Table 5.2 Summary of POC credit provided by BMPs Installed to meet development or redevelopment requirements

# of Facilities	Impervious Area Treated (Ac)	P (lb/yr)	N (lb/yr)	TSS (lb/yr)
184	379.13	121.1	471.9	55,702.3

5.3 Credits for urban nutrient management plans

Albemarle County is claiming POC reduction credit for Nutrient Management Plans (NMPs) on county owned lands pursuant to Appendix V.K in the Action Plan Guidance Document. The County is required under the "general permit (section I.E.6.i) to develop NMPs on "all lands owned or operated by the permittee where nutrients are applied to a contiguous area greater than one acre." Because these NMPs are already assumed POC reductions in the WIP, Albemarle County may only claim POC reduction credit for NMPs on lands owned/operated by the County where nutrients are applied to a contiguous area *less than or equal* to one-acre. The James River EOS rates were used to determine loads from pervious areas, and the blended risk level and associated TN and TP reduction rates were used to determine load reductions associated with these NMPs. For NMPs on unregulated lands, a baseline reduction of 48% was applied to the estimated load removal. Based on these criteria, Albemarle County is claiming 0.13 lb TP/yr and 0.89 lb TN/yr from NMPs on County-owned property. These NMPs collectively help provide POC reduction on a total 4.04-ac of County-owned property. Detailed calculations are provided in Appendix A ("NMP" tab).

5.4 Credits for connection of septic systems to sanitary sewers

Albemarle County is claiming POC reduction credit for any properties that were converted from a septic system to a sanitary sewer connection. In accordance with the guidance emailed from Jaime Bauer on July 24, 2015, permittees may take nitrogen credit based on a septic tank TN loading at edge of stream of 3.6 lb TN/year/person, the average number of people per household for 2009-2013 in Albemarle County (2.47 people/household[22]), and the number of households converted. According to the Albemarle County Service Authority, 42 properties were disconnected from a septic system and connected to the sanitary sewer. As a result, the County is claiming 373.5 lb TN/year of TMDL credit from septic disconnections.

[22] http://quickfacts.census.gov/qfd/states/51/51003.html, retrieved August 2015.

5.5 Credits for 2006-2009 historical stormwater BMPs

Albemarle County, with the assistance of the Thomas Jefferson Planning District Commission, applied for and received the 2015 Historical Data Cleanup grant from DEQ. The County has populated and submitted the BMP reporting spreadsheet provided by DEQ for all BMPs installed between 1985 and the present in order to better represent County pollutant loads in the Phase 6 Chesapeake Bay Watershed Model. Per Part IV, 2 of the Chesapeake Bay TMDL Special Condition Guidance Document, the County is affirming that the complete list, to the maximum extent practicable, of historical BMPs was submitted to DEQ by September 1, 2015.

As part of this Action Plan, the County is claiming full POC removal credit toward required reductions for BMPs installed on regulated lands on or after January 1, 2006 and before July 1, 2009. In general, bond release dates were used as installation dates for historical BMPs, as this is the most accurate record maintained by the County for BMP installation dates. Because BMP installation occurs over a period of time – sometime spanning years – all BMPs which have an estimated construction date of January 1, 2006 or later and which were installed as part of development completed prior to the "new sources" identified in this Action Plan were included as "historical" per DEQ guidance[23]. Drainage areas for these historical BMPs were delineated using best professional judgement based on site plans, topography, aerial photography, parcel boundaries, and available storm infrastructure data. POC loads generated over the drainage areas of these historical BMPs were calculated by multiplying the James River EOS Loading Rates by the forested, impervious, and pervious land cover in the historical BMP drainage areas. Detailed POC load and load removal calculations are provided in Appendix A ("Historical BMP Accounting" Tab).

The load reductions from historical BMPs were calculated based on the post-development loading rate and phosphorus reduction efficiencies from the Virginia Stormwater BMP Clearinghouse, the Chesapeake Bay Program (CBP) established efficiencies, the retrofit curves, or the 1999 Virginia Stormwater Management Handbook [24]. In accordance with DEQ guidance, phosphorus removal efficiency from manufactured treatment devices (MTDs) is based on the efficiency from the approved site plan, when that information is available. When not available, the phosphorus removal efficiency from the Virginia Stormwater BMP Clearinghouse is used to account for MTDs[25]. This Action Plan utilizes the greatest of the phosphorus removal efficiencies described above to account for the phosphorus load reduction from each historical BMP. If the 1999 Virginia Stormwater Management Handbook or Virginia Stormwater BMP Clearinghouse efficiency was utilized to determine phosphorus reductions, then the reductions of nitrogen utilized the greater of the CBP established efficiencies or the retrofit curves and applied the same method to sediment. If phosphorus reductions were determined using either the CBP established efficiencies or retrofit curve, the same method was applied to both nitrogen and sediment. Efficiency details are summarized in Appendix A, tab "Efficiency Table Overview".

[23] Conveyed via email from Kelsey Brooks on September 25, 2015

[24] An email from Kelsey Brooks on September 25, 2015 confirmed that it is permissible to use the 1999 Stormwater Management Handbook efficiencies to account for facilities which were designed under those standards.

[25] Conveyed via email from Kelsey Brooks on June 24, 2015

A summary of the POC removal provided by these historical BMPs is provided below in Table 5.3.

Table 5.3 Summary of POC Removal Provided by Historical BMPs				
# of Facilities	**Impervious Area Treated (Ac)**	**P (lb/yr)**	**N (lb/yr)**	**TSS (lb/yr)**
148	180.91	253.3	2,601.4	228,654.0

5.6 Summary of total POC reductions to date

Table 5.4 provides the total reductions achieved as of July 1, 2018, for each pollutant of concern in the James River Basin, as required by the MS4 general permit[26]. Because the County has achieved additional pollution reductions after July 1, 2018 that will contribute to the goals of this Action Plan, cumulative totals through Oct 31, 2019 are provided in Table 5.5.

Table 5.4: Summary of Total POC Reduction Requirements and Credits achieved <u>through July 1, 2018</u>				
	Type	Phosphorus (lbs/yr)	Nitrogen (lbs/yr)	Total Suspended Solids (lbs/yr)
Reduction Requirements (1st cycle – 5 %)		30.0	182.6	15,383.9
(2nd cycle – 40 %)		296.6	1,527.5	109,133.9
(3rd cycle – 100%)		757.9	3,845.5	311,791.6
Reduction Credits	New and Grandfathered Sources	119.3	464.9	55,639.9
	Structural BMPs	70.4	268.7	33,558
	Stream Restorations	81.7	172.4	114,892
	BMPs installed between January 1, 2006 and July 1, 2009	253.3	2,601.4	228,654
	Connection of septic systems to sanitary sewer	0	373.5	0
	Nutrient Management Plans	0.1	0.9	0
	Total Reduction Credits	524.8	3,866.3	432,744
Total Reductions Remaining		233.1	0	0
Total % Reductions Achieved		69.2%	101.1%	138.8%

[26] 9VAC25-890-40 (General Permit) Section II.A.11.c

Table 5.5: Summary of Total POC Reduction Requirements and Credits achieved through October 31, 2019				
	Type	Phosphorus (lbs/yr)	Nitrogen (lbs/yr)	Total Suspended Solids (lbs/yr)
Reduction Requirements (1st cycle – 5 %)		30.0	182.6	15,383.9
(2nd cycle – 40 %)		296.6	1,527.5	109,133.9
(3rd cycle – 100%)		757.9	3,845.5	311,791.6
Reduction Credits	New and Grandfathered Sources	121.1	471.9	55,702.3
	Structural BMPs	70.4	268.7	33,558
	Stream Restorations	246.3	244.4	354,349.9
	BMPs installed between January 1, 2006 and July 1, 2009	253.3	2,601.4	228,654
	Connection of septic systems to sanitary sewer	0	373.5	0
	Nutrient Management Plans	0.1	0.9	0
	Total Reduction Credits	691.2	3,960.7	672,264.4
Total Reductions Remaining		66.7	0	0
Total % Reductions Achieved		91.2%	103.0%	215.6%

In summary, Albemarle County has exceeded its second cycle pollutant reduction requirements per the special condition for the Chesapeake Bay TMDL through credit for the implementation of capital improvement projects, oversized BMPs and redevelopment projects related to new and grandfathered sources, urban nutrient management plans, connection of septic systems to sanitary sewer, and accounting for historical BMPs installed on or after January 1, 2006 and before July 1, 2009. As shown in Table 5.3, all second permit cycle reduction goals have been exceeded for phosphorus, nitrogen, and total suspended solids. Therefore, the County intends to count the excess credit (401.6 lbs/yr TP, 2,433.2 lbs/yr TN, and 563,130.5 lbs/yr TSS) toward any subsequent permit cycle reduction requirements.

5.7 Additional means and methods to meet the required reductions

The County is currently considering implementing a variety of BMPs to contribute toward POC reduction requirements. These projects may include stream restorations, retrofits of existing BMPs on public and private lands, the installation of new BMPs on public and private lands, land use change, urban nutrient management plans, and/or street sweeping. Additionally, the County is considering the purchase of POC removal credits as permitted by § 62.1-44.19:21.A of the Code of Virginia. Table 5.6 shows some of the capital projects currently being considered by the County for implementation during the second permit

cycle, including each projects' estimated POC removal. The County reserves the right to modify the practices and projects described in this section in addition to adding, removing, and/or substituting practices and projects for the ones described.

Table 5.6 - Overview of Potential BMPs

Site Name	Type	Pollution Removal – Expected percent removal efficiency and total removal			Location
		TP	TN	TSS	
Berkmar	Stream Restoration	14.3 lbs	15.8 lbs	9454.0 lbs	38°04'56.1"N 78°28'38.6"W
Berkmar	Constructed Wetlands Retrofit	16.8 lbs / 36%*	48.5 lbs / 15.5%*	8452 lbs / 51%*	38°04'49.4"N 78°28'38.8"W
Biscuit Run**	Stream Restoration	36.8 lbs	70.4 lbs	42,131.1 lbs	37°59'58.1"N 78°30'55.3"W
Dunlora Farm	Stream Restoration	27.6 lbs	25.0 lbs	16,515.8 lbs	38°04'15.2"N 78°27'06.2"W
Mill Creek	Stream Restoration	54.4 lbs	49.3 lbs	32,538 lbs	37°59'57.7"N 78°30'17.8"W
Pen Park***	Stream Restoration	19.0 lbs	0	0	38°03'21.5"N 78°27'05.2"W
Rio Hill	Constructed Wetlands	45% / 29.2 lbs	20% / 89.3 lbs	60% / 14,168 lbs	78°28'30.1"W 38°5'16.8"N

*Percent removal efficiencies are *after* discounting existing dry detention pond efficiency per Guidance Document appendix V.D.

**Percent removal totals are not applicable for stream restoration projects.

***City of Charlottesville and Albemarle County intend to share both costs and credits for Pen Park stream restoration project as shown in Table 5.6.

6. Public Comment Process

On October 15, 2019 a draft of the County's Action Plan update was uploaded to the County's Water Resources Management website. The County has received no comments as of the time of this writing.

References

9 Va. Admin. Code 25-870, Virginia Stormwater Management Program (VSMP) Regulation (amended and renumbered, October 23, 2013)

9 Va. Admin. Code 25-890, Virginia Department of Environmental Quality Water Division, General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (effective date; July 1, 2018) (Albemarle County General Permit No. VAR040074)

Albemarle County Department of Water Resources, Albemarle County MS4 Program Plan 2013-2018, October 2014

Guidance Memo No. 15-2005, Virginia Department of Environmental Quality Water Division, Revised May 18, 2015

Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects, Chesapeake Bay Program, September 8, 2014

Virginia Stormwater BMP Clearinghouse, 2013 (http://www.vwrrc.vt.edu/swc/StandardsSpecs.html)

Virginia Stormwater Management Handbook Volume II, First Edition 1999

Appendix A: Nutrient Load Accounting

(see Appendix A spreadsheet)

Tabs:

1. Existing Source Load Red. – calculates the POC reduction requirements for existing sources based on Tables 2 and 3
2. 2009 Land Use – describes the regulated and unregulated land area totals and provides details on lands not included in the regulated area
3. New and GF Source Loads – calculates the POC reduction requirements for new and grandfathered sources
4. Special Situations- Describes the special situations referred to in column AZ of the New and GF Source Loads tab
5. Structural BMP Accounting – calculates the POC reductions from Structural BMP capital projects used to meet the required load reductions
6. Stream Restoration Accounting – calculates the POC reductions from Stream Restoration capital projects used to meet the required load reductions
7. Historical BMP Accounting- calculates the POC reductions from historical BMPs not previously reported to DEQ on or after January 1, 2006 and before July 1, 2009
8. NMP – summarizes the credit taken for urban nutrient management plans placed on County owned property of one contiguous acre or less
9. Nutrient Accounting Overview – summarizes the POC reduction requirements and BMP credits accounted to date
10. Efficiency Lookup – used as a lookup table for BMPs in the “New and GF Source Loads” worksheet
11. Efficiency Table Overview – summarizes the efficiencies used to determine the new source onsite BMP reductions using the Virginia Stormwater Management Handbook 1999; also summarizes the Chesapeake Bay Program established efficiencies and the Clearinghouse/VA SWM Handbook 2013 nutrient efficiencies

Appendix B: Capital Improvement Project Descriptions

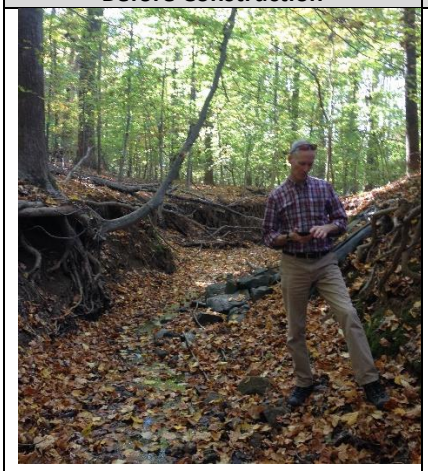
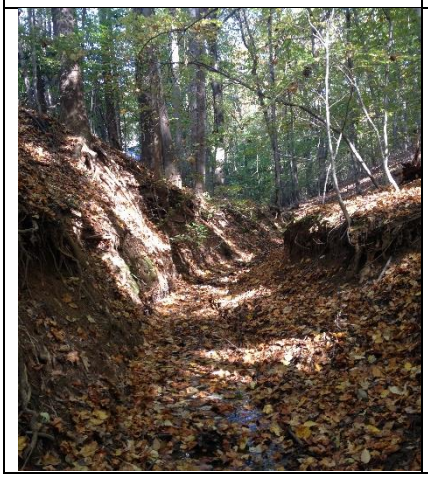
Albemarle County completed construction of two natural channel design stream restoration projects since the submission of the first phase Chesapeake Bay TMDL Action Plan; the RiverRun stream restoration, which involved a partnership with the City of Charlottesville, and the Chapel Hills stream restoration project. Previously installed projects are documented in detail in the County's first phase Chesapeake Bay TMDL Action Plan.

Chapel Hills Stream Restoration

In April of 2019, Albemarle County completed the construction of a stream restoration project – using natural channel design – along a 1,278-ft reach of a degraded and actively-incising channel. The project is located within the County's MS4 area on three privately-owned parcels. The channel has a total drainage area of 73 acres, of which 16 acres are impervious.

As the channel is located at the bottom of a steep hill on both sides, it was not feasible to create a new floodplain around the incised channel. As a result, significant volumes of fill were placed into the incised channel so that the restored channel could access the existing floodplain located, on average, approximately five feet above the incised channel. Fill depth decreased toward the downstream end of the restoration to enable connection with the existing downstream channel without abrupt change in channel invert elevation. Other restoration activities involved installation of riffle and pool sequences to improve aquatic habitat; installation rock sills/vanes, wood sills/vanes, root wad structures, and toe wood structures to ensure channel stability; and planting of native vegetation.

Credit calculations are summarized in Appendix A and were calculated using the default rate found in the Guidance Document.

Chapel Hills Stream Restoration Before and After Photos		
Before Construction	**During Construction**	**After Construction**
		
		

RiverRun Sream Restoration

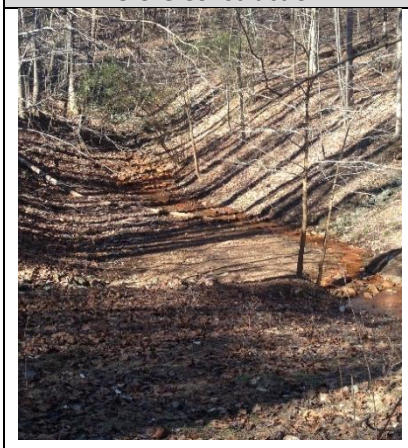
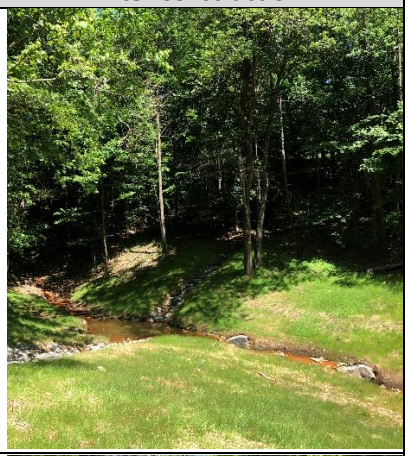
In April of 2019, Albemarle County completed a stream restoration project – using natural channel design – along a 650-foot reach of a degraded and actively-incising channel. The project's upstream limits are within the MS4 area of Albemarle County and the project terminates downstream within the City of Charlottesville MS4 area. The channel has a total drainage area of 26.6 acres of which approximately eight acres are impervious.

This stream restoration opportunity was initially revealed during an initiative to identify and prioritize retrofits of stormwater detention basins located on private property. A breached detention basin existed at the upstream end of the restored channel within the RiverRun neighborhood. The project team quickly recognized that decommissioning the detention basin and restoring the degraded channel would result in significantly greater ecological uplift than a traditional stormwater retrofit. As a significant length of impaired channel existed within the City of Charlottesville, Albemarle and Charlottesville partnered to share both the costs of the project and the resulting pollution reduction credits. Albemarle County is claiming full credit for phosphorus and sediment reductions while the City of Charlottesville is claiming full credit for all nitrogen reductions. The agreement between Albemarle County and Charlottesville is included in appendix C and POC removal totals and calculations are provided in appendix A.

Restoration activities involved channel grading to reconnect the channel to the floodplain; installation of riffle and pool sequences to improve aquatic habitat; installation rock sills/vanes, wood sills/vanes, and toe wood structures to ensure channel stability; and planting of native vegetation.

Credit is claimed for this project based on protocols 1 and 2 from the Recommended Protocols for Defining Pollutant Reductions Achieved by Individual Stream Restoration Projects[27]. Credits calculations are summarized in the following memo and in Appendix A.

[27] Berg et al. Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects. Prepared by Tom Schueler (Chesapeake Stormwater Network) and Bill Stack (Center for Watershed Protection). Page 32-38. September 8, 2014.

RiverRun Stream Restoration Before and After Photos		
Before Construction	**During Construction**	**After Construction**
		
		

POLLUTANT REDUCTION MEMO: RIVER RUN

1739A Allied St.
Charlottesville, VA 22903
540.239.1428
www.ecosystemservices.us
info@ecosystemservices.us

September 25, 2019

TO: Stavros Calos
Albemarle County Water Resource Program
401 McIntire Road
Charlottesville, VA 22902
434-296-5816 80 |scalos@albemarle.org

SUBJECT: As-Built Pollution Reduction Report – River Run

Summary:
The pollutant reductions reported in table 1 associated with Protocol 1 below are 2.3% higher than those reported in the memo dated December 19th, 2017 to reflect new erosion rate curves released with the Phase 6 Chesapeake Bay Model. Otherwise, the methodology is identical to that reported on December 19th, 2017. Edge of stream loading and reduction rates have been removed since the Phase 6 model now calculates delivery loads based on the project's location. Protocol 2, nitrogen reductions due to floodplain connection, have been added. Protocol 3 was assessed, but due to limited riparian area and volume under 1' of depth, removal efficiencies were less than 1% and would yield less than 1 lb TP/yr.

Table 1: As-built pollutant reduction achievements

Method	TSS (tons/yr)	TP (lbs/yr)	TN (lbs/yr)
Protocol 1	101.18	106.24	230.70
Protocol 2	0	0	64.63
Total	**101.18**	**106.24**	**295.33**

1.1. Methodology: Protocol 1

1. Perform a geomorphic survey of the project reach
2. Conduct Bank Erosion Hazard Index (BEHI) and Near Bank Stress (NBS) assessments in accordance with standards set forth by the Chesapeake Bay Field Office (USFWS A, 2004) & (USFWS B, 2004)
3. Estimate bankfull height based on field identified bankfull indicators and hydraulic geometry
4. Conduct bulk density testing
5. Estimate erosion rates using the Bank Assessment for Non-point-source Consequences of Sediment (BANCS) model with the erosion rate curves provided by the Chesapeake Bay Program in the documentation for the Chesapeake Assessment Scenario Tool
6. Calculate edge of field sediment loading rates by multiplying the volumetric erosion rate by the field-measured bulk density
7. Calculate edge of field nitrogen and phosphorous loading rates by multiplying the sediment

loading rate by nitrogen and phosphorous concentrations supplied by the Expert Panel.

8. Calculate the edge of field pollutant reduction rate by applying a restoration efficiency to the edge of field loading rates supplied by the Expert Panel.
9. **Validate:** Conduct post-construction BEHI on representative cross-section to ensure that BEHI is rated as moderate or less to receive credit.

1.2. Methodology: Protocol 2

Section 5 of the Expert Panel Guidance outlines the methodology for calculating nitrogen reductions from increased hyporheic exchange between the stream channel and the floodplain rooting zone. Since the floodplain rooting zone depth is limited, credit is only available for reaches in which the bank height ratio (low bank height to bankfull depth) is less than 1.0. In this case, 570.53 linear feet of the restored stream has a bank height ratio of less than 1 foot. The downstream section of the restored reach drops in elevation to tie to the existing stream, and as such, has a slightly higher BHR. The reduction rates achievable along these stretches are largely based on in-situ denitrification studies conducted on restored streams in the Baltimore metropolitan area by Kaushal et al., 2008 and Striz and Mayer, 2008.

For credit calculations, the hyporheic zone is modeled as a rectangular tunnel with a width that stretches 5 feet on either side of the median base flow width, a depth of 5 feet, and a length equal to the qualified stream length (the entire reach in this case). It is within this volume of soil that denitrification occurs at a rate of 1.06×10^{-4} pounds/day/ton of soil (Kaushal et al., 2008). The accounting process for Protocol 2 credit calculations are as follows:

1. Estimate the median base flow width
2. Calculate the volume of hyporheic exchange tunnel and weight of soil contained therein using bulk densities from Protocol 1
3. Apply the denitrification rate to yield the nitrogen reductions due to hyporheic exchange

The median baseflow width was estimated using measured base flow during asbuilt conditions.

1.3. Nutrient & Sediment Loading Estimate

Sediment loading was calculated by performing a BANCS assessment to estimate erosion rates. Then the associated nutrient loading was calculated based on nutrient concentrations determined by Walter et al. (2007), consistent with the Expert Panel Guidance and shown in table 3. Inputs of the BANCS model include: bank erosion hazard index (BEHI) parameters, near bank stress (NBS) parameters, bank length, bank height, bulk density, and bankfull depth. Changes in BEHI parameters were geolocated using a survey grade GPS along the left and right bank and were combined with reconnaissance level 1 near bank stress (NBS) ratings to calculate erosion rates in feet per year. The area of bank subject to erosion was taken to be the area between the top and toe of the banks which were geolocated using a total station

during the geomorphic survey conducted in October 2017. Bank height was calculated for sections between each change in NBS or BEHI parameter which follows the assumption that variations in bank height will correspond to a break in at least 1 BANCS parameter. Bankfull height was estimated using bankfull indicators and regional hydraulic geometry curves. Bulk density testing of stream bank sediments was performed using a modified USDA-NRCS methodology, the results of which are shown in table 2. With these inputs, a volumetric erosion rate could be calculated and multiplied by the bulk density to determine the edge of field (EoF) sediment loading rate shown in table 4. EoF nutrient loading rates were calculated by multiplying the EoF sediment loading rate by the nutrient concentrations shown in table 3.

Table 2: Bulk density results

Bank Length (ft)	Bulk Density (lbs/cf)
574.88	73.20
379.07	76.30

Table 3: Nutrient concentrations

Associated Pollutant	lbs/ton of soil
TP	1.05
TN	2.28

Table 4: Pre-restoration pollutant loading rates

Loading Region	TSS (tons/yr)	TP (lbs/yr)	TN (lbs/yr)
Edge of Field	202.36	212.483	461.392

Watershed loading rates using TMDL Action Plan guidance can be found in Table 5 below. The methodology for Protocol 2 requires that reductions cannot exceed the loading produced by the watershed. The reductions achieved by Protocol 2 are verified as less than the loading produced by the watershed.

Table 5: Watershed Pollutant Loading

TP=	21.10	lb/yr
TN=	322.64	lb/yr
TSS=	13432.17	lb/yr

1.4. Restoration Efficiency

The Expert Panel conservatively assumed a 50% restoration efficiency for calculating pollutant reductions for Protocol 1. The Panel also decided that if monitoring proves an efficiency greater than 50%, a revised efficiency may be applied to all previous and subsequent credit releases. This efficiency is applied to the EoF pollutant loads from table 4 to determine the EoF reductions found in table 1 at the top of this document.

Ecosystem Services, LLC
By:

Manager – Principal Engineer

Kip Mumaw, PE
kip@ecosystemservices.us

Attachments:

1. Erosion Rate Map
2. BANCS Parameters
3. Asbuilt BEHI & Cross Sections
4. Protocol 2 Calculations

Appendix C: Agreement between Albemarle County and City of Charlottesville for RiverRun stream restoration cost and credit sharing

Scanned 3/26/18

City of Charlottesville
Contract Circulation Form

Today's Date: March 23, 2018

CONTRACT FOR: RiverRun Stream Restoration, Joint project with Albemarle County

DATE OF CONTRACT: N/A

NAME OF CONTRACTOR: Albemarle County

AMOUNT OF CONTRACT: $125,000
- $37,500.00 due before County bids project
- $87,500.00 due at construction completion

CONTRACT ACCOUNT CODE: 6431001000 530670

Please circulate the attached MEMORANDUM OF UNDERSTANDING, and any attachments referenced and return to the person/department indicated below:

		Date Received	Date Forwarded
Finance	[signature]	3/23/18	3/23/18
City Atty.	[signature]	3/23/18	3/23/18
City Mgr.	[signature]	3.23.18	3.23.18

RETURN TO: Melissa Orndorff Stephens
Stormwater Utility Administrator, Utilities **Tel. Extension: x3876**

Please contact me if you have any questions. Thank you!

Amt - S Carlos
2/1/18

MEMORANDUM OF UNDERSTANDING

THIS MEMORANDUM OF UNDERSTANDING is entered into this 19th day of ~~January~~ July, 2018, by and between the **COUNTY OF ALBEMARLE, VIRGINIA**, a political subdivision of the Commonwealth of Virginia (hereinafter "the County") and the **CITY OF CHARLOTTESVILLE, VIRGINIA**, a municipal corporation and political subdivision of the Commonwealth of Virginia (hereinafter "the City").

PURPOSE: The purpose of the Memorandum of Understanding is to detail the agreement between the City and the County to share the costs and credits for a collaborative stream restoration project.

PROJECT LOCATION: The City and County desire to restore approximately five hundred and sixty (560) linear feet of a degraded urban stream (hereinafter "the Project"). Portions of the urban stream lie within the boundaries of both the City and the County. A portion of the Project is located on Albemarle County Tax Map Parcel Number 062D1-02-00-00100. The other portion of the Project is located on City of Charlottesville Tax Map Parcel Number 48B001000.

COUNTY RESPONSIBILITIES: The County shall perform the following tasks in furtherance of this Memorandum of Understanding:

1. The County shall manage the design and construction of the Project.

2. Pursuant to the authority granted by the County and the City by Virginia Code §§ 62.1-44.15:27 and 62.1-44.15:55, the County shall have the right and authority on behalf of the City to undertake any action or duty assigned to the City's Program Administrator for purposes of the Project.

3. The County shall pay all costs for design and construction of the Project.

4. The County shall maintain the Project for ten years following completion of the Project's construction. Maintenance shall be in general accord with the River Run Stream Restoration Monitoring & Maintenance Plan prepared by Ecosystem Services. During this ten year period, the County shall pay all costs associated with maintenance of the Project.

5. Ten years after completion of the Project's construction, the County shall only maintain that portion of the Project located within the jurisdictional boundary of the County.

CITY RESPONSIBILITIES: The City shall perform the following tasks in furtherance of this Memorandum of Understanding:

1. The City shall pay the County one hundred and twenty-five thousand dollars ($125,000.00) to pay for a portion of the Project's costs. The City's payment shall occur in two installments. The City shall pay the County thirty-seven thousand five hundred dollars ($37,500.00) prior to the County's advertising the Project for prospective bids. The City shall

pay the County eighty-seven thousand five hundred dollars ($87,500.00) after the Project is fully constructed.

2. The City shall provide the County all construction and access easements necessary to construct and maintain the Project.

3. Ten years after completion of the Project's construction, the City shall maintain that portion of the Project located within the jurisdictional boundary of the City.

CITY REVIEW OPPORTUNITIES/INFORMATION REQUESTS: While the County shall maintain full responsibility for design and construction of the Project, the County will provide any request for information about the Project within one (1) business day of the City's request. The County will also provide the City opportunities for non-binding plan and construction review at ninety percent of plan completion as well as at completion of construction of the Project.

NUTRIENT CREDITS: Pursuant to 9VAC25-820-10, upon completion of the Project, the City will claim all nitrogen reduction credits associated with the Project and the County will claim all credit for sediment and phosphorus reduction.

IN WITNESS WHEREOF, the City and County do hereby execute this Memorandum of Understanding:

COUNTY OF ALBEMARLE, Virginia

By: _____
Director of Facilities and Environmental Services

Date: 19 June 2018

Approved at to Form:

By: _____
County Attorney

FUNDS ARE AVAILABLE

BY _____
Director of Finance/Designee

CITY OF CHARLOTTESVILLE, Virginia

By: _____
Director of Finance

Date: 3.23.2018

Approved as to Form:

By: _____
City Attorney

Appendix D: GIS Processes

2010 US Census MS4 Jurisdiction Boundary

- Clipped the 2010 US Census Urban Areas to Albemarle County
- Erase Charlottesville, UVA, PVCC, and Charlottesville properties within the county
- Add in the County Owned properties within Charlottesville (CountyParcels_inCville.shp)

Worked with Charlottesville to come to agreement on County owned parcels in the City and City owned Parcels in the County, as well as, the MS4 boundary to create a cohesive file.

VDOT

- For route #'s below 600 (not 300's), let's select sde parcel ROW that intersect these roads and that yields MS4_MAJOR_RDS.
- For route #'s 600 and above – copy out the rcl to another fc (using stateplane us feet as the output coordinate system). For records in rcl copy that have blank/NULL/0 values for VDOT_PAVEMENT_WIDTH_MSR field, plug in 15. Add a buffer field and calc it to be ½ the VDOT_PAVEMENT_WIDTH_MSR. Buffer this fc (use FLAT parameter) using that new field. à VDOT_MINOR_RDS_BUFFER.
- Take VDOT_MINOR_RDS and buffer (use ROUND parameter) by an amount that's larger than the pavement width and cul-de-sac areas (200 FT) to make VDOT_MINOR_RDS_BUFFER_200. Then clip VDOT_MINOR_RDS_BUFFER_200 by the roads_poly to yield VDOT_MINOR_RDS_CLIPPED.
- Take rcls PVT and buffer (use FLAT parameter) by a an amount that's not too big and not too small b/c we're just trying to the buffer to be just a little outside the the roads_poly layer (30 FT) to make PVT_RDS_BUFFER_30. Then clip PVT_RDS_BUFFER_30 by the roads_poly to yield PVT_RDS_CLIPPED.
- Erase PVT_RDS_CLIPPED by VDOT_MINOR_RDS_BUFFER to yield PVT_RDS_CLIPPED_ERASED
- Erase VDOT_MINOR_RDS_CLIPPED by PVT_RDS_CLIPPED_ERASED to yield VDOT_MINOR_RDS_CLIPPED_ERASED.
- Explode VDOT_MINOR_RDS_CLIPPED_ERASED to VDOT_MINOR_RDS_CLIPPED_ERASED_EXPLODED and copy out the features that intersect VDOT_MINOR_RDS to yield VDOT_MINOR_RDS_CLIPPED_ERASED_EXPLODED_INTERSECT.
- Copy VDOT_MINOR_RDS_CLIPPED_ERASED_EXPLODED_INTERSECT to fc called MS4_VDOT_UNDISSOLVED.
- Merge VDOT_MINOR_RDS_BUFFER into MS4_VDOT_UNDISSOLVED. This allows for some medians and some other girthiness to be accounted for.
- Merge MS4_MAJOR_RDS into MS4_VDOT_UNDISSOLVED.
- Dissolve MS4_VDOT_UNDISSOLVED into MS4_VDOT_UNCLIPPED.
- Clip MS4_VDOT_UNCLIPPED by MS4 boundary to yield **MS4_VDOT_FINAL**.

A python script was created and run so the process can be replicated when VDOT takes ownership of newer infrastructure. There are 3 parcels that mess up the file and have to be manually edited out after the script is run, this will be reconciled in the future.

2009 Land Cover

- Clip 2009 Land Cover to the 2010 MS4 Jurisdictional Area -> 2009_LandUse_MS4Boundary.shp
- Extract out each of the land uses:
    - Impervious Cover = Baseclass 4
    - Water = Baseclass 3
    - Pervious Cover = Baseclass 2
    - Forest = Baseclass 0/1
- Impervious Cover: Use 2014 Impervious cover and remove new sources file to create the 2009 impervious cover file. Add in the 2009 impervious cover removed for new sources to get full picture of 2009 land use.
    - 2014 impervious surface erase new source file
    - Erase IC in transition (2009_IC_InTransition.shp section 4) from 2014_IC_erase_ New_tomake_2009IC.shp -> 2009_IC_erase_InTransition.shp **(**some manual edits needed)
    - Append 2009_IC_removed.shp
    - Dissolve
    - Create a 25ft buffer around all impervious surfaces and dissolve
    - Erase and add buffer to pervious surface.
- Pervious Cover: dissolve impervious and pervious land cover into one file. Make baseclass = 2 and then erase the created impervious cover file from 2014 data.
    - Extract pervious and impervious cover (baseclass 2 and 4) from the land use file.
    - Dissolve to create a cohesive open space shapefile
    - Erase the 2009 Impervious cover
    - Erase and then append
    - Clip to MS4 boundary and dissolve
- Forest:
    - Dissolve Forest layer
    - Erase
    - Explode file to create distinct features
    - Recalculate area and select features under 0.5 acres -> export and remove features from forest layer and add them the 2009_impervious_BUFF25 shapefile
    - Erase 2009_Impervious_BUFF25andlessthan0.5acres.shp from the forest layer.
- All land cover:
    - Append all 2009 Land Uses into one file
    - Calculated geometry for Area (acres)
    - Erase MS4_VDOT_FINAL.shp

2014 Land Cover

- Impervious
    - 2014 Impervious layers merged and clipped to Combo MS4 Jurisdictional Area -> 2014_IC_merge.shp
        - Roads_Poly
        - Buildings
        - Driveways
        - Road_Bridges
        - Railroads- buffered by 10 ft and dissolve
    - Add in the impervious surface for the County owned parcels within the City of Charlottesville.
    - Clip to Alb. Co. MS4 Jurisdiction final -> 2014_IC_Merge_clipto_MS4boundary.shp
    - Erase new sources built between 2009 and 2014 ->2014_IC_merge_eraseNew.shp
    - Erase Existing IC removed (2009_IC_removed -do not use Existing_IC_Removedfor_newdevelopment) for New Development -> 2014_IC_merge_eraseNewRemoved.shp
    - Append the **new sources** file to collect all of the manual edits done to the new source shapefile and the "**in transition"** impervious cover file-> 2014_IC_merge_eraseNewRemoved_append.shp
    - Dissolve -> **2014_IC_Total.shp**

New Source Pollutant Loads

- New impervious surfaces on the ground between July 1, 2009 and June 30, 2014.
    - Erase 2009 impervious cover from 2014 Impervious cover
    - Manual edits to eliminate all small slivers created by a difference in GIS mapping from 2009 to 2014.
    - Manual edits to identify and combined all parts of each development.
- Impervious cover not completed as of July 1, 2014 but part of a project initiated prior to July 1, 2014 so counted as new sources (to be built).
    - Created a shapefile and outlined future build out of the new development projects based on site plans.
- Impervious surface in transition, areas associated with new development that were in transition or under construction as of July 1, 2009, counted as new sources and not included in existing sources.
    - Created a shapefile of impervious cover captured in the 2009 impervious cover file, but included in new sources because "in transition"
- Development Boundaries – disturbed area for each new development used to calculate imperviousness associated with the project for nutrient load calculations.
    - Created a shapefile based on the parcel shapefile for each new development that represents the disturbed area used to calculate the post-development nutrient loads.

- Existing impervious that is within the new development boundaries and/or removed for new development:
    - If there was any existing IC on the ground prior to the new development it was collected in this shapefile to determine redevelopment verses new development project for each of the new sources of pollution.
- Stormwater management for each new development:
    - **2010_RA_NewSource_SMFs.shp** – All of the stormwater management facilities associated with the new development projects.
    - **2010_RA_NewSource_SMF_Watersheds.shp** -> All of the watersheds associated with the SMF based on the engineered site plans when available.
    - **Existing_IC_treatedby_newSMFs.shp** -> includes all of the impervious surface counted as existing sources of pollution that is treated by a new stormwater management facility.