Albemarle County

Combined Local TMDL Action Plan:

Benthic TMDL for the Rivanna River
and
Bacteria TMDL for the Rivanna River Mainstem, North Fork Rivanna River, Preddy Creek and Tributaries, Meadow Creek, Mechums River, and Beaver Creek Watersheds

For Special Condition (Part II.B) of the
2018-2023
VPDES General Permit for
Small Municipal Separate Storm Sewer Systems
VAR040074

prepared by:
Albemarle County
Environmental Services Division
401 McIntire Road
Charlottesville, Virginia 22902
(434) 296-5816
www.albemarle.org/water

April 30, 2020

Table of Contents

List of Acronyms

BMP – Best Management Practice

DEQ – Virginia Department of Environmental Quality

GIS – Geographic Information Systems

MS4 – Municipal Separate Storm Sewer System

POC – Pollutant of Concern

RCA – Rivanna Conservation Alliance

RSEP – Rivanna Stormwater Education Partnership

TMDL – Total Maximum Daily Load

WLA – Waste Load Allocation

Introduction

Albemarle County has prepared and updated this Local Total Maximum Daily Load (TMDL) Action Plan to address the "Local TMDL Special Condition" portion of its MS4 General Permit (Part II.B). The specific contents included in this updated Action Plan, as required by the MS4 Permit Part II.B.3, are listed below and addressed in respective sections of this Action Plan:

a. The TMDL project name;
b. The EPA approval date of the TMDL;
c. The wasteload allocated to the permittee (individually or in aggregate), and the corresponding percent reduction, if applicable;
d. Identification of the significant sources of the pollutants of concern discharging to the permittee's MS4 and that are not covered under a separate VPDES permit. For the purposes of this requirement, a significant source of pollutants means a discharge where the expected pollutant loading is greater than the average pollutant loading for the land use identified in the TMDL;
e. The BMPs designed to reduce the pollutants of concern in accordance with Parts II B 4, B 5, and B 6;
f. Any calculations required in accordance with Part II B 4, B 5, or B 6;
g. For action plans developed in accordance with Part II B 4 and B 5, an outreach strategy to enhance the public's education (including employees) on methods to eliminate and reduce discharges of the pollutants; and
h. A schedule of anticipated actions planned for implementation during this permit term.

Albemarle County collaborated with the University of Virginia and the City of Charlottesville in preparation of this Action Plan. However, each entity has produced its own Action Plan.

The County intends to implement this Action Plan through multiple permit cycles using an adaptive, iterative approach as progress is demonstrated toward achieving reductions necessary to meet the WLAs. While this Action Plan presents current and future practices intended to mitigate sediment and bacteria impairments described in this report, the County reserves the right to substitute/modify other projects and practices for the ones described in this report.

Depending on the economic trajectory of County and Commonwealth funding availability over the permit cycle, the County is prepared to adjust to economic reality by shifting resources as necessary from capital projects to lower-cost community engagement and water resource protection initiatives.

1. TMDL Project Name and EPA Approval Dates (*Parts II.B.3.a,b*)

The report titled *Benthic TMDL Development for the Rivanna River Watershed* (published March 2008) establishes the sediment TMDL for Albemarle County. This report was published in March of 2008 and was approved by the EPA on June 11, 2008. This report is henceforth referred to as the "Benthic TMDL Report." The report titled *Bacteria TMDL Development for the Rivanna River Mainstem, North Fork Rivanna River, Preddy Creek and Tributaries, Meadow Creek, Mechums River, and Beaver Creek Watersheds* establishes an aggregate bacteria TMDL for E. Coli. This report was published in March of 2008 and approved by the EPA on January 5, 2009. This report is henceforth referred to as "Bacteria TMDL Report."

2. Pollutants Causing the Impairments

2.1 Benthic TMDL Pollutant

In 1996 and subsequently 2006, two adjacent segments of the Rivanna River were added to Virginia's 303(d) List of Impaired Waters for exceedance of water quality standards necessary to support aquatic life. The Rivanna River Benthic TMDL Report identified sedimentation caused by urban runoff as the most probable stressor in the Rivanna River benthic impaired segments. Embeddedness, or the degree to which sediment occupies spaces between cobbles and rocks in the streambed, and sediment deposition observed at monitoring stations were found to be in the suboptimal range for the support of aquatic life, as "buildup of sediment in the stream bed can drastically change the composition and availability of macroinvertebrate habitats and therefore can be a stressor for the benthic community." To address these impairments, a sediment TMDL is presented in the Benthic TMDL Report.

The impaired reaches included on Virginia's 303(d) list and applicable to this TMDL report are VAV-H28R-01 and VAV-H29R-01. These reaches and the corresponding watershed are shown in Figure 2.1.1.

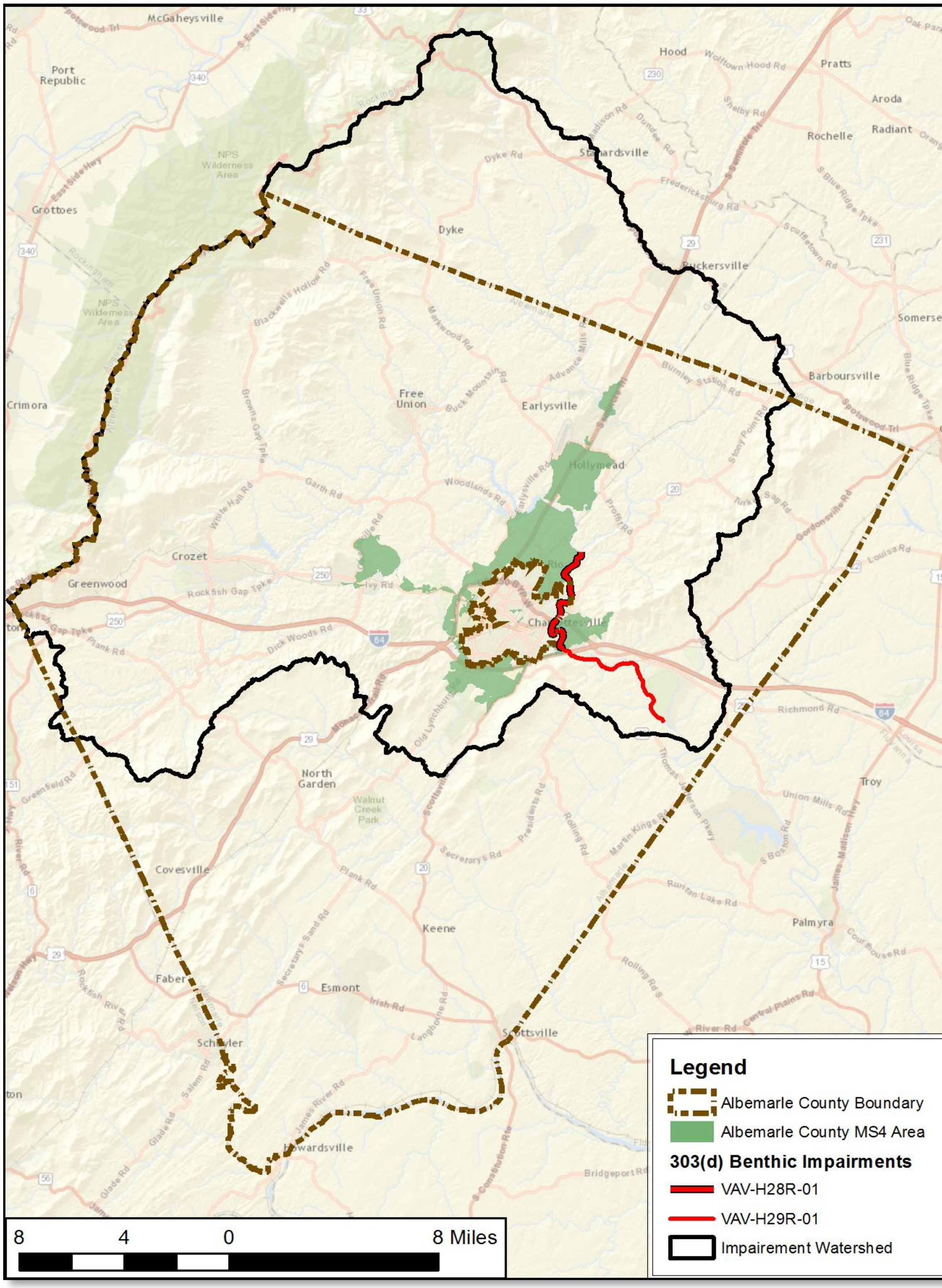


Figure 2.1.1. Benthic Impairment Reaches and Watershed

2.2 Bacteria TMDL Pollutant

As stated in the Bacteria TMDL Report, bacteria TMDLs are established for the Rivanna River mainstem (VAV-H28R-RVN01A00), the North Fork Rivanna River (VAV-H27R-RRN01A00), Preddy Creek and tributaries (VAV-H27R-PRD01A00), Meadow Creek (VAV-H28R-MWC01A00), Mechums River (VAV-H23R-MCM01A00), and Beaver Creek (VAV-H23R-BVR02A04). These waterbodies were added to Virginia's 303(d) List of Impaired waters between 1998 and 2006 for exceedance of the state's water quality standards for E. coli and for fecal coliform bacteria. When these waterbodies were first listed as impaired, the water quality standard was expressed in units of fecal coliform bacteria. The bacteria water quality standard is now expressed in units of E. coli because "there is a stronger correlation between the concentration of E. coli and the incidence of gastrointestinal illness than with fecal coliform" (Bacteria TMDL Report, page 1-7). The bacteria impaired reaches included on Virginia's 303(d) list and their corresponding watersheds are shown on Figure 2.2.1.

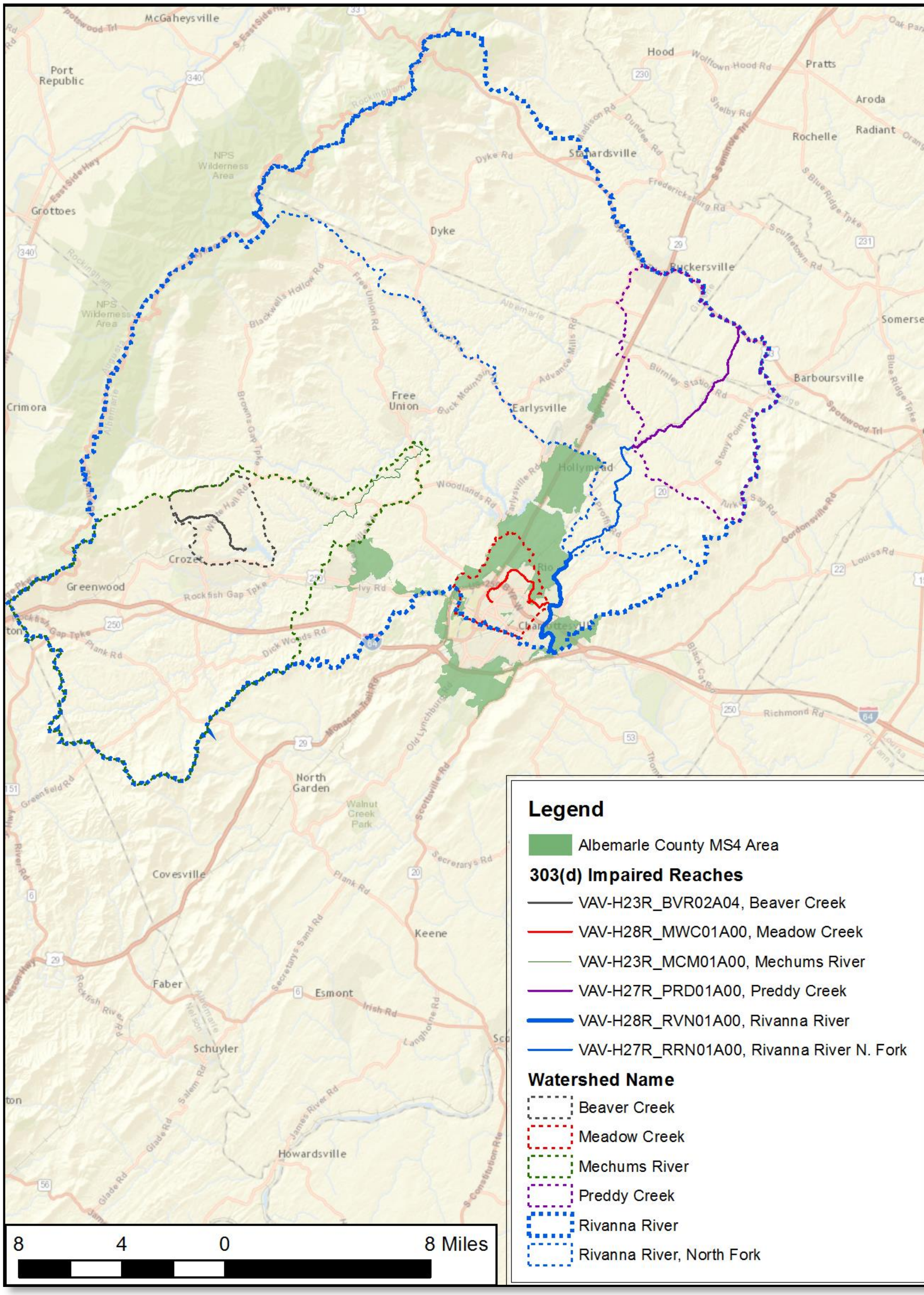


Figure 2.2.1. Bacteria Impairment Reaches and Watershed

3. Wasteload Allocations and Corresponding Percent Reductions (*Part II.B.3.c*)

Albemarle County has been assigned an individual wasteload allocation (WLA) for sediment and an aggregate WLA for bacteria.

3.1 Sediment WLA

The Benthic TMDL Report estimates existing sediment loads and provides a WLA for the Albemarle County MS4 (Benthic TMDL Report, Table 7-2). Sediment allocations included in the Benthic TMDL Report include "loads from general stormwater permits issued to industrial facilities, domestic sewage facilities, mines/quarries, concrete facilities, car wash facilities, and construction sites within the MS4 area" in addition to instream erosion (Benthic TMDL Report, page 7-3). The existing and allocated loads assigned by the Benthic TMDL Report for the Albemarle County MS4 are summarized below in Table 3.1.1.

It is worth noting that the Benthic TMDL Report estimated Albemarle County's MS4 area as a total of 20,984 acres (Table 2-9), whereas the County's subsequent mapping of its MS4 area revealed that the MS4 area contains a total regulated area of 7,169 acres. The County's MS4 mapping procedures are outlined in its 2nd Phase Chesapeake Bay TMDL Action Plan.

Table 3.1.1. Sediment WLA for Albemarle County MS4

Permit Number	MS4 Permit Holder	Land-based loads (lbs/day)	Instream Erosion (lbs/day)	Existing Total Load (lbs/day)	Allocated Load (lbs/day)	Percent Reduction*
VAR040074	Albemarle County	1,606	4,729	6,335	2,576	59.3

(*) The percent load reduction specified for MS4s accounts for loads from all land sources including forested areas.

3.2 Bacteria WLA

The Bacteria TMDL Report includes an aggregate WLA which addresses point sources in the City of Charlottesville, VDOT, the University of Virginia, Piedmont Virginia Community College, and the Albemarle County MS4 Area. The WLAs provided in the Bacteria TMDL Report do not distinguish between loads aggregated to MS4s and VPDES permitted facilities. The report also does not document precisely which land area was considered to be a part of the Albemarle County MS4. Notwithstanding, these WLAs are summarized in Table 3.2.1. Please note that the report indicates that MS4 areas contribute zero load to Preddy Creek and Mechums River. In addition, no land included within the County's MS4 drains to the impaired reach of Beaver Creek (as shown in Figure 2.2.1).

Table 3.2.1. Aggregate E. coli WLAs for MS4s			
Impaired Waterbody	**WLA for MS4s (cfu/yr)**	**Percent Reduction (%)**	**WLA Reference Table (Bacteria TMDL Report)**
Rivanna River	**3.27 E+12**	**95%**	**Table 5-4**
North Fork Rivanna River	**5.10 E+11**	**95%**	**Table 5-9**
Preddy Creek	0.00 E+00	0%	Table 5-14
Meadow Creek	**3.83 E+12**	**95%**	**Table 5-18**
Mechums River	0.00 E+00	0%	Table 5-22
Beaver Creek	2.20 E+10*	95%	Table 5-27

*Although the Bacteria TMDL Report lists MS4 areas as contributors to Beaver Creek, Beaver Creek does not currently receive drainage from any MS4 areas, as shown in Figure 2.2.1.

4. Significant Sources of Pollutants of Concern Discharging to the MS4 (*Part II.B.3.d*)

The General Permit (Part II.B.3.d) requires this Action Plan to include:

> *Identification of the significant sources of the pollutants of concern (POCs) discharging to the permittee's MS4 and that are not covered under a separate VPDES permit. For the purposes of this requirement, a significant source of pollutants means a discharge where the expected pollutant loading is greater than the average pollutant loading for the land use identified in the TMDL.*

This section of the Action Plan identifies features and land uses within the MS4 area that are considered significant sources of sediment and bacteria.

4.1 Significant Sources of Sediment

While the Benthic TMDL Report identifies that instream erosion contributes approximately 75% of sediment loads to the benthic-impaired reach of the Rivanna, certain areas of severe stream and channel erosion contribute pollutant loadings expected to be greater than the average pollutant loading for the instream erosion rate identified in the TMDL. Through a program to assess and improve drainage infrastructure, Albemarle County is working toward identifying and prioritizing individual stream and channel reaches where instream erosion contributes loads that are significantly greater than average.

Additionally, construction sites remain a significant contributor to sediment loads. The Benthic TMDL Report indicated that 5 construction permits existed at the time of Report development, all with existing and allocated loads of 1,874 lbs/day (Benthic TMDL Report Table 7-4). However, the number of active construction sites is constantly changing within Albemarle County, so sediment contributions from this general source will therefore occasionally be greater than the allocated load based on five construction sites included in the Benthic TMDL Report. While erosion and sediment control measures are highly effective for controlling smaller storm events, the increasing frequency of more extreme precipitation events are believed to be causing increased frequency of significant sources of sediment discharges from construction sites beyond the loading rate identified in the TMDL.

Because much of the County's urban area was developed prior to stringent stormwater quality and quantity control requirements, runoff from many developed areas in the County receives no stormwater treatment. Concentrated impervious and turf areas that are not treated by BMPs are expected to contribute greater than average sediment loading rates. These untreated areas contribute sediment in two primary ways; areas with runoff that is not collected by water *quality* BMPs will fail to reduce land-based sediment loads, and any runoff that is not detained by water *quantity* BMPs (such as traditional detention basins) is expected to contribute greater peak stormflow volume and therefore contribute to greater instream erosion.

4.2 Significant Sources of Bacteria

Because both wildlife and pets are recognized as sources of bacteria into bacterially impaired waters (Bacteria TMDL Report Pages 3-28 and 3-30), County staff anticipate that the rate of bacteria loading from County parks may be greater than the average bacteria loading for similar land uses identified in the TMDL. There are two County parks that intersect the MS4 area, and both allow pets, provide wildlife habitat, and contain MS4 outfalls. These properties are depicted relative to local TMDL watersheds and County MS4 Boundaries in Figure 4.2.1. However, it is currently unknown which, if any, of these properties have a pollutant loading greater than the average pollutant loading for the land use identified in the TMDL. Additional possibly significant sources of bacteria are summarized in Table 4.2.1.

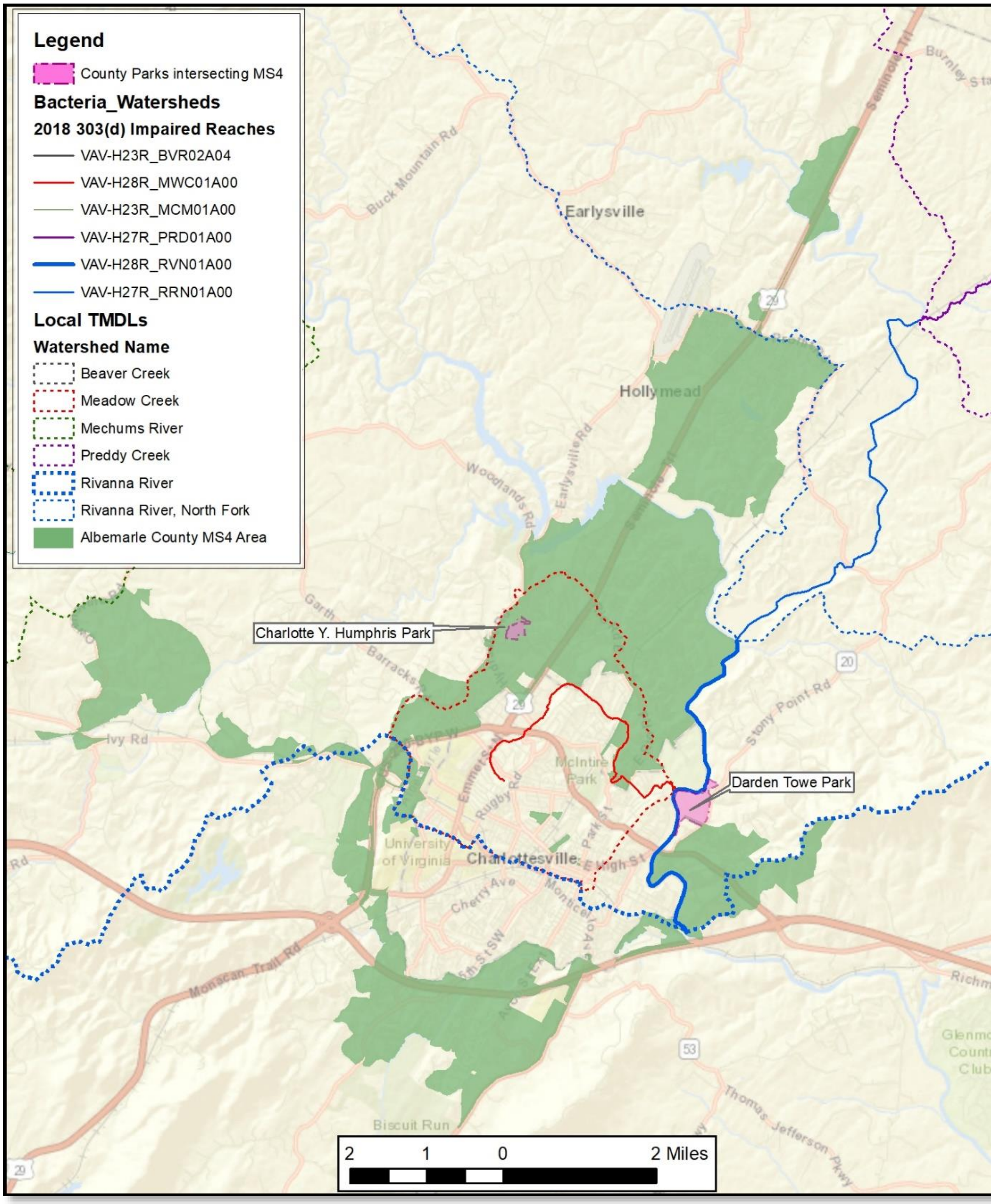


Figure 4.2.1. Potentially significant sources of bacteria

Table 4.2.1. Potentially significant sources of bacteria from facilities of concern	
Source	**Bacteria Contribution Description**
Domestic Pets:	
County Parks & Dog Parks	Parks, especially those with designated dog parks, tend to be places that receive a higher load of fecal matter from dogs. The County's MS4 area contains one park that is located within the MS4 area and also drains to the impaired reach of the Rivanna River– Charlotte Humphris Park.
Vet clinics or dog boarding programs	Any programs or institutions which provide sufficient time outside for pets (typically dogs) may contribute significant loads of bacteria via pet waste, if waste is not properly collected and disposed.
Urban Wildlife/Birds:	
Ponds/lakes/ streams which attract wildlife	Any ponds and streams that attract wildlife (typically geese) and subsequently drain into the MS4 may provide significant sources of bacteria.
Unsecured food waste and trash	Any unsecured food waste or trash may attract wildlife and promote greater contributions of bacteria contamination.
Illicit connections or illicit discharges:	
Leaking sanitary sewer lines	Any leaking sewer lines may contribute human waste and bacteria loads to the MS4 area, especially if there is a cross connection with storm sewer pipes.
Failing septic systems, and outhouses	Although not expected to be numerous, these sources may individually contribute human waste and bacteria loads to the MS4 area.
Other Sources:	
Urban areas with no water quality treatment	Urban areas which do not drain to water quality BMPs likely contribute higher loading of bacteria from pet and animal waste than other areas which first drain to water quality BMPs[1].

5. BMPs Designed to Reduce Pollutants of Concern *(Part II.B.3.e - h)*

This section of the Action Plan describes County BMPs to reduce sediment and bacteria pollution in line with General Permit Part II.B.3.e, part II.B.4 (Bacteria TMDL) and Part II.B.5 (Local Sediment, phosphorus, and nitrogen TMDLs). This section also provides sediment reduction calculations, outreach strategies, and a schedule of anticipated milestones, as respectively required by General Permit Part II.B.3.f through h.

5.1 BMPs Designed to Reduce Sediment *(Parts II.B.5)*

Albemarle County has utilized and intends to utilize BMPs approved by the Chesapeake Bay Program in addition to other measures to reduce sediment loads into the benthic-impaired reach of the Rivanna River (General Permit Part II.B.5.a). This section summarizes installed and planned BMPs to reduce

[1] Hathaway et al., 2009. Indicator Bacteria Removal in Storm-Water Best Management Practices in Charlotte, North Carolina. Journal of Environmental Engineering Vol. 135, Issue 12.

sediment loads, presents calculations for sediment load removal (General Permit Part II.B.5.c), and presents a schedule of anticipated actions planned (General Permit Part II.B.3.h).

Lower Land Disturbance Thresholds *(Part II.B.5.a.3)*

In addition to structural BMPs, Albemarle County reduces sediment loads by utilizing a lower land disturbance threshold than required under Virginia Stormwater Management and Erosion and Sediment Control Regulations. Chapter 17 of the 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. Among many measures designed to reduce erosion and sediment pollution, the WPO includes a disturbance threshold for small construction activities of 10,000 square feet, as opposed to 1 acre required by Virginia's regulatory requirements. In fact, in summer 2020, the Albemarle County Board of Supervisors is scheduled to consider lowering the threshold even further to 2,500 square feet.

Completed and Proposed Structural BMPs and Stream Restorations *(Part II.B.5.a.2)*

Since 2011 Albemarle County has constructed three stormwater retrofits and three stream restoration projects within the drainage area of the benthic-impaired reach of the Rivanna River. The location of these BMPs is depicted in Figure 5.1.1. They are described in greater detail in the County's Phase II Chesapeake Bay TMDL Action Plan, but additional detail and load removal calculations are also provided in Section 5.2 of this Action Plan. In addition to already-completed BMPs, Albemarle County intends to construct additional Chesapeake Bay Program approved stormwater retrofits and stream restorations during the current permit cycle in order to reduce sediment loads into the Rivanna River and the Chesapeake Bay.

The County has received a DEQ Stormwater Local Assistance Fund (SLAF) Grant for the Rio Hill project, and the County has applied for a SLAF Grant for the Biscuit Run Project described in this report. Please note that, while the County anticipates funding to be available based on current appropriations, the County cannot guarantee the availability of funding to construct these projects per the anticipated schedule provided below in Table 5.2.2. In addition, the County reserves the right to modify the projects proposed in Table 5.2.2 or substitute them for other projects and/or practices.

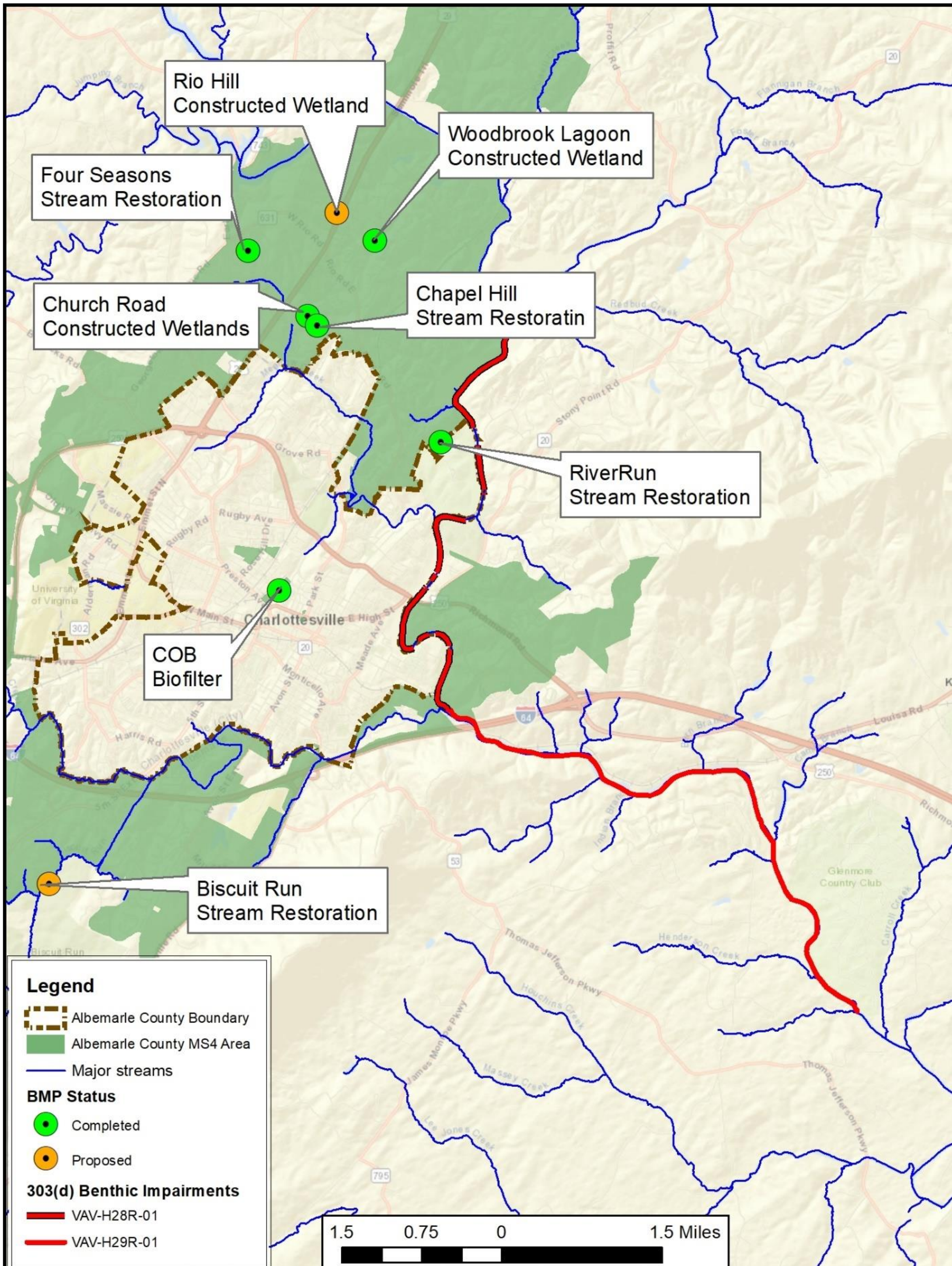


Figure 5.1.1. Completed and Proposed Structural BMPs for Sediment Removal

5.2 Sediment Load Reduction Calculations *(Part II.B.3.f)* and Schedule of Anticipated Actions *(Part II.B.3.h)*

The County has calculated sediment load reductions achieved through stream restoration projects and structural BMPs prior to this report in addition to reductions anticipated during the current permit cycle. Load reductions were calculated utilizing the Chesapeake Bay TMDL Action Plan Guidance Document published by DEQ (Guidance Memo No. 15-2005), with the exception of the land-based sediment loading rates. DEQ staff have indicated that it is not appropriate to use the edge of stream sediment loading rates provided in the Chesapeake Bay TMDL Action Plan Guidance Document Table 2a, as these loading rates reflect average sediment delivery into the Chesapeake Bay (not the Rivanna River) as a function of land use type.

As a result, DEQ staff instructed Albemarle County staff that we may use a generalized loading rate of 0.3lbs/day/acre to model land-based sediment loads and subsequent load reductions toward achieving the WLA[2]. The loading rate of 0.3 lbs/day/acre is the average loading rate per acre for Albemarle County, the City of Charlottesville, and UVA MS4 areas presented in the Benthic TMDL Report. Calculations for sediment load reductions from the structural BMPs and the stream restoration projects described in section 5.1 are presented below in Tables 5.2.1 and 5.2.2.

Table 5.2.1. Sediment load reduction calculations for completed and proposed Stream Restorations

Project Name	Year Installed / anticipated	Lat	Long	Acres Treated	Length (LF)	Sediment removed (lb/yr)
RiverRun Stream Restoration	2019	38.056	-78.454	26.6	650	202,360[1]
Chapel Hills Stream Restoration	2019	38.072	-78.475	73.0	1,278	57,357[2]
Four Seasons Stream Restoration	2015	38.082	-78.487	12.6	360	92,000[1]
Biscuit Run Stream Restoration (*Proposed*)	Phased Project - Design Commencing: FY 2021	37.9954	-78.5221	7,680	1,000	44,880[2]

[1]Stream restoration sediment removal calculations provided in Appendix.
[2]Stream restoration sediment removal calculations utilize Interim Removal Rate Per Linear Foot of 44.88 lbs/day[3]

Calculations for the removal of sediment from structural BMPs are presented below in Table 5.2.2. Sediment load reduction was modeled pursuant to the Chesapeake Bay TMDL Action Plan Guidance Document, with the exception that a uniform loading rate of 0.3 lb/acre/day was used to calculate

---

[2] Email from Tara Seiber, DEQ Valley Region TMDL Coordinator, December 9, 2015

[3] Berg et al., 2014. Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects. Tom Schueler and Bill Stack, Chesapeake Stormwater Network.

sediment loads entering these facilities. Removal rates for Woodbrook Lagoon and the County Office Building Biofilter were calculated using the stormwater treatment / runoff reduction curves presented in the Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Retrofit Projects[4]. Removal rates for the Church Road Constructed Wetlands were calculated using Chesapeake Bay Program Established Efficiencies[5]. Additional details regarding the sediment removal efficiencies of these BMPs are provided in Albemarle County's Chesapeake Bay TMDL Action Plan, which was submitted on October of 2019.

Table 5.2.2. Sediment load reduction calculations for completed and proposed sediment-reduction BMPs

Project Name	Year Installed / anticipated	Lat	Long	Acres Treated	Total Sediment Load (lb/day)	Sediment Removal Rate (%)	Sediment Removal (lbs/day)	Sediment Removal (lbs/yr)
Church Road Constructed Wetlands	2015	38.073	-78.477	68.4	20.52	51.0%	10.46	3,821.86
Woodbrook Lagoon Constructed Wetlands	2013	38.036	-78.482	254	73.71	14.8%	10.94	3,996.62
County Office Building (COB) Biofilter	2011	38.083	-78.465	2.11	0.63	73.0%	0.46	168.75
Rio Hill Constructed Wetlands *(Proposed)*	Construction Complete: FY 2021	38.087	-78.472	71.97	21.59	54%	11.66	4,258.82

5.3 Sediment Load Reduction Monitoring

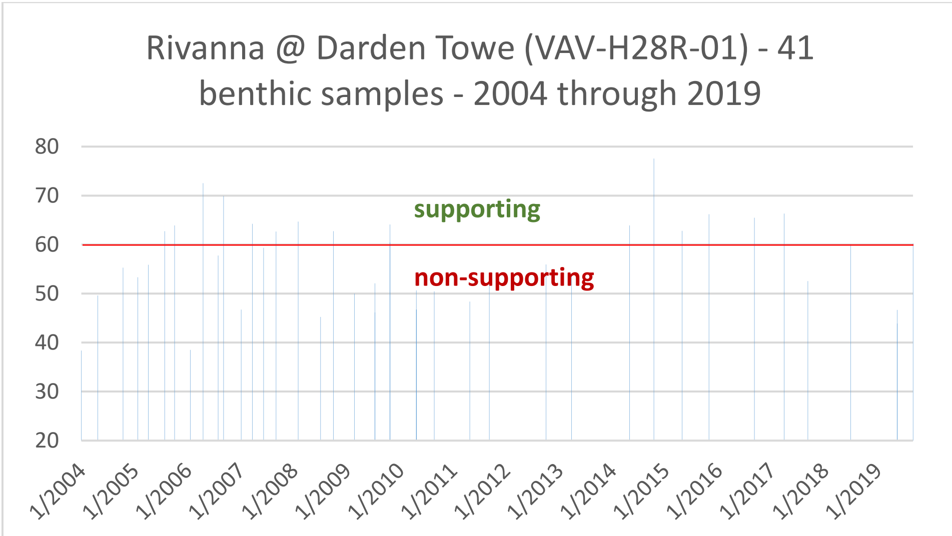
In addition to calculating sediment reductions, Albemarle County continues to track the condition of the impaired reaches and the condition of major tributaries flowing into the reaches through ongoing support of the StreamWatch monitoring program, now a program of the Rivanna Conservation Alliance (RCA). With financial support from Albemarle County, StreamWatch has collected Level III benthic data at sites in and near the impaired reaches for over a decade. The quality of Level III data is on par with DEQ's own data and is accepted by DEQ for listing and de-listing purposes. The StreamWatch dataset helped prompt the listing of VAV-H29R-01.

StreamWatch data collected in the impaired reaches over a 15-year period demonstrate relatively persistent benthic impairment. Figure 5.3.1 displays multimetric benthic index scores from all samples at two representative sites on the Rivanna River, collected as far back as 2004. Scores lower than 60 (red line in figures) indicate impairment. To be de-listed, scores need to exceed 60 for five years with minimal

[4] Bahr et al., 2012. Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Retrofit Projects. Prepared by Tom Schueler and Cecilia Lane, Chesapeake Stormwater Network.

[5] Chesapeake Bay TMDL Action Plan Guidance Document published by DEQ (Guidance Memo No. 15-2005), Appendix V.C.

exceptions. As shown, benthic scores from individual samples sometime meet the standard, but the overall pattern does not.



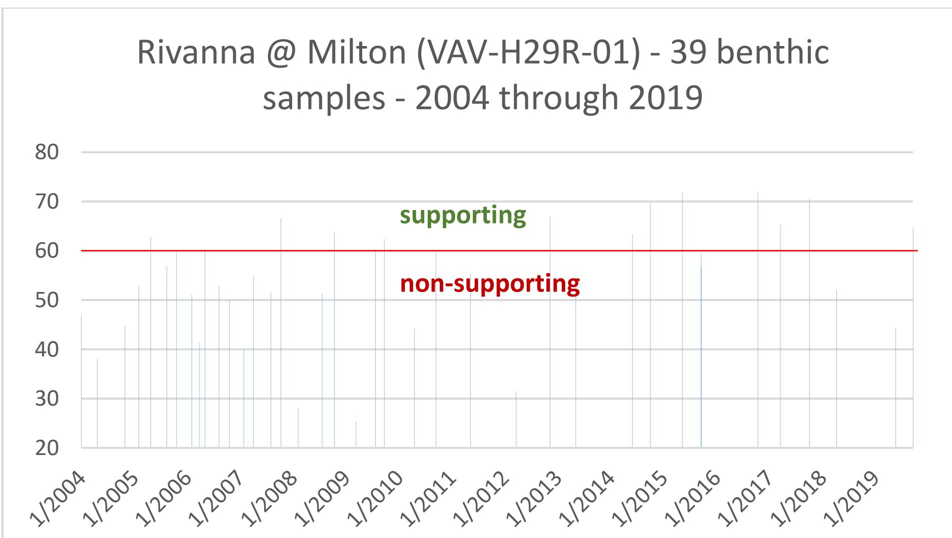


Figure 5.3.1. Multimetric benthic index scores at impaired reaches

It is also worth noting the condition of waters flowing into the impaired reaches. VAV-H28R-01 is formed at the confluence of the North and South Forks of the Rivanna River. As shown in Table 5.3.1, average benthic scores for these two streams suggest marginal and sub-standard conditions. The North Fork Rivanna River might support the aquatic life standard; the larger South Fork definitely does not. Downstream of the confluence, urbanization increases. The effects of urban land use are reflected in average scores indicative of severe impairment in Meadow Creek and Moores Creek. These streams contribute polluted water and flashy flows to the subject reaches of the Rivanna. They also indicate an intensity of urban land use that directly impacts the Rivanna and that cannot easily be mitigated.

Table 5.3.1 - Benthic conditions in major tributaries of impaired reaches of the Rivanna River			
Site / Stream	# of samples	Average benthic score	Condition
North Fork @ Forks of Rivanna	26	60.9	Good to Fair (Borderline supporting)
South Fork @ Forks of Rivanna	37	47.3	Fair (Non-supporting)
Meadow Creek @ Locust Lane Court	29	28.7	Poor (Non-supporting)
Moores Creek @ Woolen Mills	24	27.7	Poor (Non-supporting)

5.4 Management Strategies for Bacteria Reduction *(Part II.B.4)*

This section of the Action Plan addresses MS4 permit Part II.B.4, which requires that, as an approved VSMP authority, the County select and implement at least three of the strategies listed in Table 5 of the permit document. Table 5.4.1 below lists strategies that the County is currently implementing (or will implement in the future) to help reduce or mitigate significant sources of bacteria in the MS4 area. These strategies correspond to the types of bacteria sources described earlier in this Action Plan. Other strategies will also be implemented as additional opportunities and needs become evident. Unless otherwise noted in the table, all of these activities are on-going.

Table 5.4.1. Strategies for Bacteria Reduction	
Strategy	**Strategy Description**
Domestic Pets:	
Leash ordinance	A new County ordinance (Sec. 4-225) requires that dogs be on a leash when not on the owner's property. This will increase the likelihood that an owner will notice when his/her dog defecates and thus increase the likelihood that she/he will pick up and dispose of the pet waste.
Pet waste receptacles at parks	The County's parks have receptacles into which dog owners are asked to dispose of their pet's waste. Pet waste bags are also provided at designated dog parks.
Urban Wildlife/Birds:	
Signage against feeding wildlife	County-owned stormwater wet ponds in the MS4 area are posted with signs prohibiting the feeding of wildlife. This is to reduce the potential numbers of birds and other animals that would otherwise be attracted to those ponds.
Trash removal from stormwater ponds	At one of its stormwater wet ponds that receives a high volume of trash from an adjacent shopping center, the County has installed a floating boom to collect floatables. The trash is removed regularly throughout the year, reducing the trash load downstream – a potential attractant of wildlife to streams.
Carcass removal	Virginia Department of Transportation removes animal carcasses from roadways – a potential bacteria source and wildlife attractant to impervious road surfaces.
Illicit connections or illicit discharges:	
Detection and elimination of leaking sanitary sewers and cross-connections	Albemarle County's MS4 staff is currently conducting video assessment of the County's storm sewer systems, which will help identify cross-connections with the sanitary sewer system. MS4 staff will also start using enhanced illicit discharge detection and outfall screening methodologies to identify sewage leaks, starting in FY2021.
Septic system maintenance	The Thomas Jefferson Soil and Water Conservation District provides cost-share funding for septic system maintenance and replacement. While current funding is available in the Tye River and Hardware River watersheds (outside of the MS4 area), funding will likely be available to septic system owners within the County's MS4 area at some point in the future.
Other Sources:	
Stormwater management in areas with limited water quality treatment	The County intends to construct stormwater management retrofits in areas of the MS4 that currently receive little to no water quality treatment, including those effective at removing bacteria. Some of these retrofits will be new structures while others will be water quality enhancements of existing stormwater flow control practices. See Table 5.2.2 for a list of completed and anticipated retrofits and anticipated schedules. These practices can reduce bacteria in addition to sediment.
Septage treatment for recreational vehicles	Rivanna Water and Sewer Authority accepts septage from RVs, motorhomes, campers, and charter buses at its wastewater treatment facility at no cost. This reduces the likelihood of raw septage being improperly disposed of in waterways or on land.
Enhanced maintenance of stormwater facilities	Many of the County's stormwater management facilities are maintained in such a way as to provide a functional ecosystem that can process bacteria from wildlife and stormwater sources. This includes strategies to maintain plant diversity, reduce invasive species, and provide for floodplain and wetland functionality.

5.5 Methods to Assess Bacteria Reductions

Instead of modeling bacteria reductions, Albemarle County plans to track progress of bacteria reductions in partnership with the Rivanna Conservation Alliance's StreamWatch program. In 2012, StreamWatch staff and volunteers began monitoring *e. coli* levels once per month (in general) using the Level II Coliscan© Easygel method. In 2018, RCA then started collecting bacteria data using the Level III Colilert™ process – a much more precise method.

Figure 5.5.1 shows locations of ongoing bacteria sampling stations relative to impaired reaches and the Albemarle County MS4 boundary. All these stations are operated by RCA. Bacteria monitoring sites MWC13, RVN09, and RVN11 fall within the area of interest to the bacteria portion of this TMDL Action Plan. *E. coli* data from these three locations especially will be used to assess the effectiveness of this Action Plan in reducing the discharge of bacteria from the MS4 area.

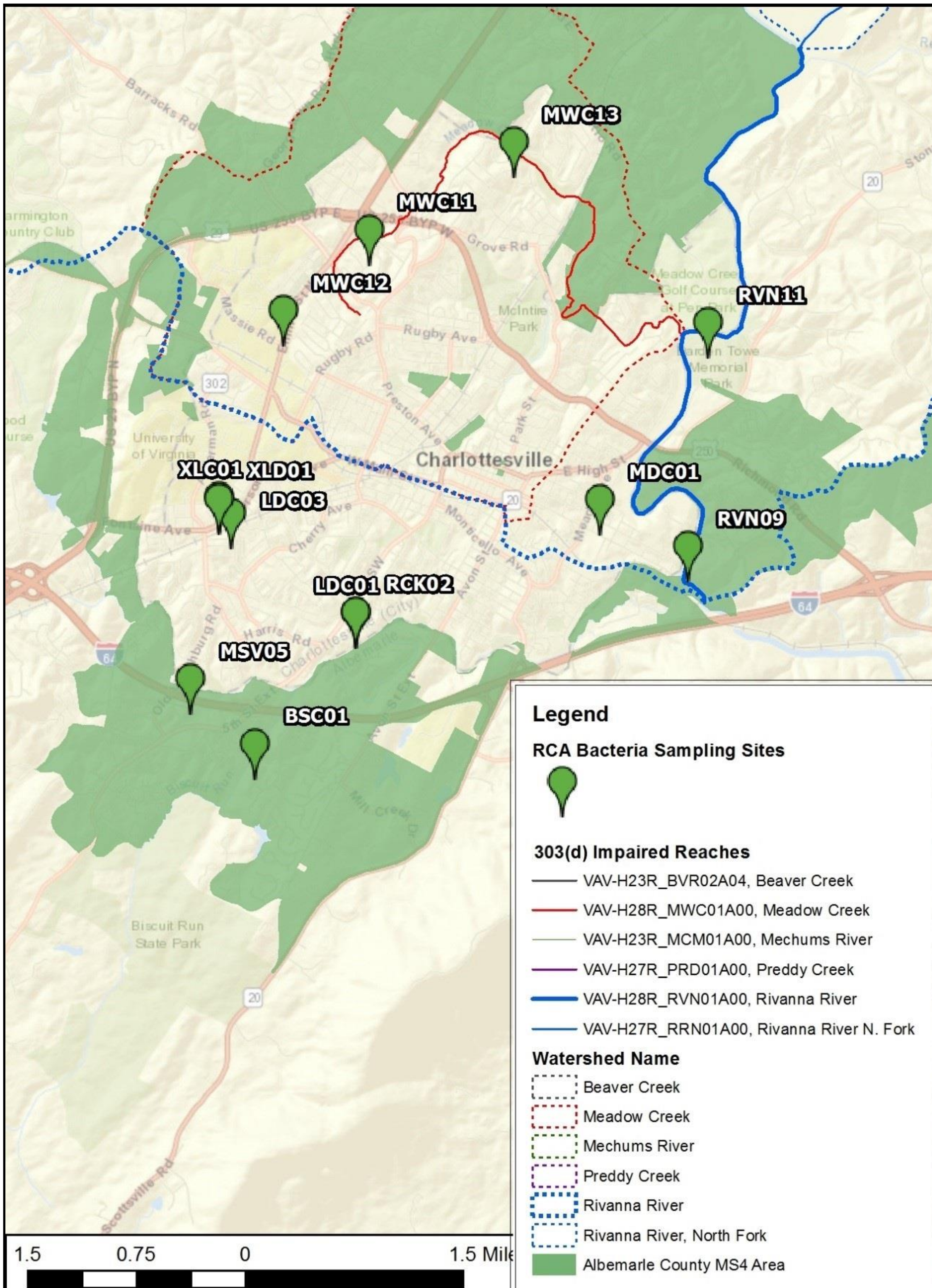


Figure 5.5.1. Rivanna Conservation Alliance (formerly StreamWatch) Bacteria Sampling Locations

5.6 Outreach Strategy *(Part II.B.3.g)*

This section of the Action Plan addresses strategies to enhance outreach and education for the public and County employees on methods to eliminate and reduce discharges of sediment and bacteria. Albemarle County is a sponsor and active participant of the Rivanna Stormwater Education Partnership (www.rivanna-stormwater.org, RSEP), which is a collaboration between local MS4 permittees to promote education and outreach regarding local stormwater issues, including sediment and bacteria impaired waterbodies. As a group, RSEP developed an education and outreach plan for the 2018-2023 MS4 permit cycle. Table 5.6.1. lists all the activities in that plan that are relevant to sediment and/or bacteria pollution, along with the anticipated frequency of each.

Table 5.6.1. Outreach & Education Strategies for the Public

Strategy *Examples*	Time Frame *Anticipated Frequency*	Anticipated Relevant Message(s)	Relevant POC(s)
Written Materials *Utility Bill Inserts*	Spring *Two or Three times during permit cycle*	Pick up After Your Pets: Animal waste that is washed off of lawns and sidewalks sends harmful bacteria into the storm drain system and into streams and rivers, creating problems for swimmers and fish	Bacteria
Media Materials *Charlottesville Public Access Station PSAs*	Winter *Once during permit cycle*	We all prefer healthy streams and lakes…but most of our local waters are somewhat polluted. When it rains, pollution is carried directly into streams by runoff from parking lots, streets, and lawns. Here's what YOU can do to reduce pollution: (one) pick up after your pet, (two) don't over-fertilize your lawn, and (three) capture the water from your rooftop in a rain barrel...or in a rain garden. Do your part to keep our streams clean and healthy. Visit Rivanna-stormwater.org.	Bacteria Sediment
Media Materials *Cville Weekly Ads*	Fall or Spring *Annually*	While being good to your pet, don't be bad to the river. Every time it rains, runoff from your lawn carries bacteria and other organisms from your pet's waste into local streams. Dispose of your pet's waste properly by bagging it and throwing it away.	Bacteria
Media Materials *Radio Ads*	Summer *Once during permit cycle*	Pet waste commonly contains bacteria and parasites harmful to humans and other pets. Waste left on trails, sidewalks and grassy areas can wash into creeks and lakes, harming aquatic life and making the water unsafe for swimming and wading. By picking up after dogs and cats, you can improve local water quality and keep your community safer! Remember: Always scoop pet waste and dispose of it properly by throwing it in the trash, flushing it down the toilet or composting it with a pet waste composter.	Bacteria
Alternative Materials *Magnets*	Spring *Once during permit cycle*	Hand out magnets regarding cigarette butt litter, picking up pet waste, and proper car washing at Earth Week or other tabling events	Bacteria
Alternative Materials *Stickers*	Spring *Once during permit cycle*	Hand out stickers with stormwater focused messaging at Earth Week or other tabling events	Bacteria Sediment

Media Materials *Social Media Promotion*	Twice Yearly *Annually*	Provide stormwater focused social media content to existing local Facebook pages or other social media outlets. Share stormwater video online.	Bacteria Sediment

Applicable County employees undergo periodic training – either internally or externally – related to various MS4 functions. Many of the training topics relate to sediment and bacteria reduction. Table 5.6.2 below largely reflects the employee training plan from the County's 2018 – 2023 MS4 Program Plan, with the addition of stream restoration maintenance which is related to sediment reduction. The frequency of these trainings is also included in the table.

Table 5.6.2. Outreach for County Employees

Department Receiving Training	**Targeted Staff**	**Good Housekeeping / Pollution Prevention**	**Enhanced Training (for applicable staff)**		
			Stream Restoration Maintenance	**Spill Response**	**VA ESC**
Frequency:	*biennial*	*To maintain certification*	*As needed*	*To maintain certification*	*To maintain certification*
Public Schools Building Services	• building maintenance • grounds management • custodians • mechanics • bus drivers • other field staff	x		x	
Community Development	• E&S control inspectors • building inspectors • zoning inspectors	x			x
Community Emergency Response Team	• all staff	x		x	
Emergency Communications Center	• all staff	x			
Fire & Rescue	• all staff	x		x	
Facilities and Environmental Services	• building maintenance • grounds management • custodians • project managers	x	x	x	
Parks and Recreation	• all staff	x		x	
Police	• all staff	x			
Purchasing	• all staff	x			
Social Services	• field staff	x			

6. Public Comment

On April 15, 2020, Albemarle County made a draft of this Action Plan available on its website for public review and comment, as required by Part II.B.7 in the General Permit. As of the submission of this Action Plan, the County has not received any public comments.

7. Appendix: Supporting Documents

7.1 Four Seasons Stream Restoration Sediment Load Reduction Accounting

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

1001 Boulders Parkway
Suite 300
Richmond, VA 23225

P 804.200.6500
F 804.560.1016
www.timmons.com

April 15, 2014

Greg Harper
County of Albemarle
Water Resources Manager
401 McIntire Road, Room 224
Charlottesville, Virginia 22902-4596

VIA EMAIL: gharper@albemarle.org

Re: Defining Pollutant Reductions by Four Season Drive Channel Improvements Albemarle County, Virginia

Dear Mr. Harper:

Timmons Group was contracted to analyze the applicability of three of the four (Protocols 1-3) *Recommended Protocols for Defining Pollutant Reductions Achieved by Individual Stream Restoration Projects*[1]. The following is a summary of our analysis.

Protocol 1: Credit for Prevented Sediment during Storm Flow

"This protocol provides an annual mass nutrient and sediment reduction credit for qualifying stream restoration practices that prevent channel or bank erosion that would otherwise be delivered downstream from an actively enlarging or incising urban stream," (Schueler and Stack 2013). Timmons Group followed the outlined three step process to compute a mass reduction credit for prevented sediment, as follows:

Step 1. The stream sediment erosion rates and annual sediment loadings were estimated utilizing the Bank and Nonpoint Source Consequences of Sediment (BANCS) Method developed by Rosgen (2001). On January 17, 2014, Timmons Group assessed the existing channel by performing a series of field data collection exercises including the Bank Erosion Hazard Index (BEHI) and Near Bank Stress (NBS) assessments for each stream bank within the restoration reach. This assessment summary can be found on the enclosed Worksheet 3-13. Summary form of annual stream bank erosion estimates for various study reaches. Sample reaches were then assigned one of four (4) corresponding erosion rate categories ranging from "Low" to "Extreme," as illustrated on the enclosed BANCS Assessment Map. Based on this analysis, the existing channel can be classified as having an extremely high erosion rate (calculated unit erosion rate = 0.17 tons/yr/ft). Extrapolated along the existing restoration length, the overall sediment load is predicted to be 92 ton/yr.

Step 2. The erosion rates calculated using the BANCS method were converted to nitrogen and phosphorus loadings. Based on the published values presented in the guidance document for both phosphorus and nitrogen concentrations in stream bank sediments (1.05 pounds P/ton of sediment and 2.28 pounds N/ton of sediment), the predicted nutrient load resulting from erosion of the stream banks within the project limits is 97 lb/yr of phosphorus and 210 lb/yr of nitrogen.

[1] Provided as Section 5 in *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. The Water Quality Goal Implementation Team issued their final approval of this document on May 13, 2013.

CIVIL ENGINEERING | ENVIRONMENTAL | SURVEYING | GIS | LANDSCAPE ARCHITECTURE | CONSTRUCTION SERVICES

Step 3. The protocol calls for a 50% effective reduction in the nutrient loading unless there is a representative "natural" condition from which the low BEHI and NBS scores can be estimated from, however the 50% effective reduction was used in this analysis. The following sediment and nutrient credits were determined for Protocol 1:

Sediment = 46 ton/yr
Total Phosphorus = 49 lb/yr
Total Nitrogen = 105 lb/yr

Protocol 2: Credit for In-stream and Riparian Nutrient Processing during Base Flow

"This protocol provides an annual mass nitrogen reduction credit for qualifying projects that include design features to promote denitrification during base flow," (Schueler and Stack 2013). To qualify for credit under Protocol 2, the bank height ratio is required to be 1.0 or less in order to promote hyporheic exchange between the stream channel and the floodplain rooting zone. The hyporheic box is calculated as the width of the channel plus five feet on either side of the stream bank, extending to a maximum depth of five feet, excluding areas of bedrock outcropping or confining clay layers. The box extends the length of the restored channel.

As a result of the project 360 linear feet of stream will be reconnected to the hyporheic zone. The area of the proposed hyporheic box is 98 ft^2, resulting in an estimated 2,205 tons of soil nutrient processing.

Protocol 2 limits the amount of reduction based on 40% of the contributing watersheds nitrogen load. The project will provide 64 lb/yr of nitrogen reduction.

Protocol 3: Credit for Floodplain Reconnection Volume

"This protocol provides an annual mass sediment and nutrient reduction credit for qualifying projects that reconnect stream channels to their floodplain over a wide range of storm events… A wetland-like treatment is used to compute the load reduction attributable to floodplain deposition, plant uptake, denitrification and other biological and physical processes," (Schueler and Stack 2013).

It appears the intent of Protocol 3 is to provide increased sediment and nutrient credit for restoration projects that include the design of wetlands within the project floodplain that are actively engaged during smaller storm events, specifically those less than the 1.5 year storm event. The result is a reduction in sediment and nutrient concentrations of the stormwater runoff from the contributing watershed by means of hydraulic detention and nutrient processing occurring in the floodplain wetlands. Therefore, the project should result in a minimum watershed to floodplain ratio of one percent to ensure adequate hydraulic detention time for flows in the floodplain. Further, the floodplains should be specifically designed to act as wetlands, and designers are afforded more credit for designs that engage the floodplain during smaller storm events (e.g., 0.25 or 0.5 inches).

The goal of this stream restoration project was to reduce erosion of the existing stream banks utilizing natural stream channel techniques. The proposed design primarily utilizes a Priority 3 restoration approach - widening the floodplain at the existing bankfull elevation. This is accomplished by creating a floodplain bench on one or both sides of the existing stream channel at the elevation of the existing bankfull stage (1- to 2-year storm event). A minimal floodplain bench is proposed, corresponding to 0.2 acres of the 13-acre project watershed, or only 0.83%. As this project does not meet the minimum floodplain to watershed ratio, nor include specifically designed wetland areas to be engaged in small storm events, Protocol 3 is not applicable.

Summary

Sediment and nutrient credits were computed for the Hoehns Lake Stream Restoration project, as follows:

Protocol	Phosphorous Credit (lbs/yr)	Nitrogen Credit (lbs/yr)	Sediment Removal Credit (ton/yr)
1	49	105	46
2	N/A	64	N/A
3	N/A	N/A	N/A
Total	49	169	46

Timmons Group thanks you for the opportunity to work on this project and assess the potential sediment and nutrient reduction credits associated with compliance with the Chesapeake Bay TMDL. We would be happy to meet with you to review our findings and to discuss our assumptions, the guidance documents, and the Protocols in-depth, as related to this and future projects for Albemarle County. Please contact us at your convenience to discuss the subject further.

Sincerely,

Timmons Group

R. Napier

Rebecca Napier, PE
Environmental Project Manager

Enclosures:

- Worksheet 3-13. Summary form of annual streambank erosion estimates for various study reaches.
- BANCS Assessment Map

7.2 RiverRun Stream Restoration Sediment Load Reduction Accounting

POLLUTANT REDUCTION MEMO: RIVER RUN

ECOSYSTEM SERVICES
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.