

**Phase III Chesapeake Bay
Total Maximum Daily Load (TMDL)
Action Plan
Permit Cycle: 2023-2028**

Permit No.: VAR040073

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Background

The University of Virginia (UVA) is comprised of approximately 1,200 acres and is located within the borders of both the City of Charlottesville and Albemarle County. The University is also situated in the headwaters of the Meadow Creek and Moores Creek watersheds which drain to the Rivanna River on the eastern boundary of the City of Charlottesville. The Rivanna River flows to the James River, and ultimately discharges to the lower Chesapeake Bay.

As a predominately urbanized state entity, the University is classified as a Small Municipal Separate Storm Sewer System (MS4) and is mandated to follow the regulations of the Environmental Protection Agency as outlined in the Clean Water Act, the Virginia Stormwater Act and the MS4 General Permit issued by the Virginia Department of Environmental Quality (DEQ). In compliance with Part II A of the General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (Permit No.: VAR040073), the University of Virginia, an MS4 Operator, has updated its Chesapeake Bay Total Maximum Daily Load (TMDL) Action Plan.

The TMDL for the Chesapeake Bay sets limits on the amount of pollutants of concern (POCs), including Total Nitrogen (TN), and Total Phosphorous (TP), that can be discharged to the Bay without detrimentally impacting water quality. The MS4 Permit Special Condition for the Chesapeake Bay TMDL requires all MS4 operators to reduce existing levels of these POCs to a level that will be protective of Bay water quality. This process typically requires that the MS4 operator install best management practices (BMPs) that will, through various means, lower the contaminant levels in or erosive velocities of stormwater discharged to local streams and water bodies.

The Virginia Chesapeake Bay TMDL Watershed Implementation Plans (WIPs) dictated compliance under the TMDL using a phased approach, affording permittees up to three full five-year permit cycles to implement necessary reductions. MS4 permittees were required to meet 5.0% of the Level 2 (L2) scoping run for existing developed lands by the end of the first permit cycle (2013-2018), an additional 35% during the second permit cycle (2018-2023), and the final 60% of the L2 scoping run reductions in the third permit cycle (2023-2028).

This TMDL Action Plan has been prepared in accordance with the 11/1/2023 MS4 General Permit and the DEQ's TMDL Guidance Memo GM20-2003 dated February 6, 2021.

1. Current Program and Legal Authority

The University of Virginia owns, operates and maintains its own small MS4. The entirety of UVA's MS4 is located on UVA owned property. Environmental Resources and the Facilities Management Department at the University have developed a comprehensive stormwater program and are responsible for enforcement and compliance with the standards of the Clean

Water Act under the General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems. The requirements stipulated in the University's Standards & Specifications (S&S) for Stormwater Management and Erosion and Sediment Control (SWM/E&SC) along with the MS4 program plan provide the authority to enforce the Chesapeake Bay TMDL special condition. In addition, Facilities Management applies a stormwater utility fee to all supported departments, the medical center, and auxiliary entities to establish a renewable funding source to maintain the stormwater program.

The MS4 permit requires the University to implement pollution control measures addressing the following six program areas in order to minimize the amount of pollution entering state waterways:

1. Public Education and Outreach
2. Public Involvement/Participation
3. Illicit Discharge Detection and Elimination
4. Construction Site Stormwater Runoff Control
5. Post-Construction Stormwater Management
6. Pollution Prevention/Good Housekeeping

Refer to <https://pollutionprevention.virginia.edu/stormwater-mgmt/MS4-permit/> for the current MS4 Program Plan.

UVA's S&S for SWM/E&SC have been developed to ensure that all land-disturbing activities undertaken by UVA will proceed in accordance with all applicable laws and regulations as related to municipal separate storm sewer systems and construction activities in the Commonwealth of Virginia. UVA's S&S for SWM/E&SC are approved by DEQ and are composed of general specifications. The general specifications that apply to the land-disturbing activities include the following:

1. Virginia Erosion and Stormwater Management Act (§62.1-44.15:24-50, as amended)
2. Virginia Erosion and Stormwater Management Regulation (9VAC25-875, as amended)
3. General VPDES Permit for Discharges of Stormwater from Construction Activities (9VAC25-880, as amended)
4. General VPDES Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (9VAC25-890, as amended)
5. Virginia Stormwater BMP Clearinghouse and Virginia Stormwater Management Handbook (<https://www.deq.virginia.gov/our-programs/water/stormwater/stormwater-construction/bmp-clearinghouse>)

No new or modified legal authorities have been implemented to meet the conditions of the MS4 permit. Although no official contracts have been drafted, the University may coordinate with the City of Charlottesville and/or Albemarle County to develop a memorandum of understanding to meet the Special Condition as planning and requirements evolve.

2. Means and Methods to Address Discharges from New Sources

All projects at the University involving land-disturbing activity subject to Virginia Erosion and Stormwater Management Laws and Regulations shall be bound by the DEQ-approved UVA S&S for SWM/E&SC. The University ensures that projects are located, designed, and constructed to protect the water quality and living resources of local streams, rivers and the Chesapeake Bay. The University is in a unique position in that it oversees all development on its property and can regulate projects accordingly.

Site-specific SWM plans shall be prepared for all projects involving a regulated land-disturbing activity that:

1. Requires a Virginia Erosion and Stormwater Management Program (VESMP) General Permit for Discharges of Stormwater from Construction Activities;
2. Includes land-disturbing activity within a watershed of a regional SWM facility;
3. Incorporates the use of a constructed BMP; or
4. Includes land-disturbing activity exceeding 6,000 square feet within the City of Charlottesville's portion of campus or 10,000 square feet for Albemarle County to the maximum extent practical.

Projects are encouraged to oversize BMPs to help address the TMDL requirements or to build up a "bank" of credits to be used on future projects. Continued long-term maintenance on all installed BMPs is performed by the Facilities Management Department. Specific procedures for maintaining these stormwater management facilities have been developed as part of the MS4 program noted in Section 1.

3. Estimated Existing Source Loads and Calculated Total Pollutant of Concern Required Reductions

In order to calculate the total POC loads and required reductions from existing sources, the University first determined the extent of its regulated service area based on the 2010 census urbanized area as of the baseline date of 6/30/09. Then this area was delineated as impervious or pervious areas. Appendix A shows the regulated University lands and their designations as pervious and impervious. These areas were determined using UVA Geographic Information System data. Regulated impervious and pervious areas were determined in the following manner:

1. A 2009 UVA parcel data was generated by creating a layer with the 6/30/09 parcels within the 2010 Urbanized area layers.
 - a. 2009 Parcel data based on City of Charlottesville and Albemarle County Tax Parcel GIS Data.
 - b. 2010 urbanized area boundary source: U.S. Census website (<http://www.census.gov/geo/reference/ua/urban-rural-2000.html>).

2. A layer for exemptions from the regulated urban land cover data set was created. This layer has two categories: Industrial & Forested.
 - a. The UVA Parking & Transportation facility parcel is exempt. This site is covered by industrial stormwater permit VAR051372.
 - b. The forested areas marked as exempt were created from aerial imagery. Areas identified as forested are no less than 900 m² contiguous and are undeveloped. Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, 1:4,623.
3. A layer was created for impervious data using impervious layers from a 2009 GIS dataset that identifies UVA buildings, parking areas, roads, sidewalks and other hardscape features.
4. The 2009 MS4 area was created by clipping the exemptions layer (step 2) from the 2009 parcels layer (step 1).
5. UVA's regulated urban impervious and pervious areas were derived by overlaying the impervious layer (step 3) and the 2009 MS4 layer (step 4).
6. The University shares jurisdictional boundaries with three other MS4 permittees; the County of Albemarle (County), the City of Charlottesville (City) and the Virginia Department of Transportation (VDOT). To address slight differences between digital maps, the County, University, and the City have agreed to use the City's jurisdictional boundary as a common delineation between the permittees' regulated areas. Each permittee has agreed to take responsibility for the POC loads generated within their regulated area boundary regardless of sheet flow draining to or from another jurisdiction. POC reduction credit for BMPs installed on any lands with inter-jurisdictional sheet flow will be received by the permittee that installs and maintains the BMP. The University agreed to include within its regulated area, all lands solely owned and operated by the University that lie within the jurisdictional extent of the County and the City. Correspondingly, the County and the City have agreed to include within their respective regulated areas, lands which they solely own and operate; as such, these lands were excluded from the University's regulated area. GIS files were shared between the County, the City, and UVA to ensure all lands were included in the TMDL process.

Table 1 below provides a summary of the University land that is subject to the MS4 permit and the determination of Chesapeake Bay TMDL loading and reduction requirements. The University's MS4 service area is entirely within the James River watershed; therefore, Table 3a in the 11/1/2023 MS4 Permit was used in these calculations.

Table 1

Calculation Sheet for Estimating Existing Source Loads and Reduction Requirements for the James River Basin (Based on MS4 General Permit 2023-2028-Table 3a) *Edge of Stream Loading Rate based on the Chesapeake Bay Watershed Model Progress Run 5.3.2								
		A	B	C	D	E	F	G
Pollutant	Subsource	Loading Rate (lbs/ac/yr)	Existing Developed Lands as of 06/30/09 served by the MS4 within the 2010 CUA (acres)	Load (lbs/yr)	Percentage of MS4 Required Chesapeake Bay Total L2 Loading	Percentage of L2 Required Reduction by 2028	100% Cumulative Reduction Required by 2028 (lbs/yr)	Sum of 100% Cumulative Reduction (lbs/yr)
Nitrogen	Regulated Urban Impervious	9.39	327	3,071	9%	100%	276	458
	Regulated Urban Pervious	6.99	432	3,020	6%	100%	181	
Phosphorus	Regulated Urban Impervious	1.76	327	576	16%	100%	92	108
	Regulated Urban Pervious	0.50	432	216	7.25%	100%	16	

The University has never used an average land cover condition of greater than 16% impervious cover for the design of post-development stormwater management facilities. Additionally, there are no grandfathered projects. As a result, there are no increased loads to offset.

4. Means and Methods to Meet the Required Reductions as of 11/1/23

The University met the POC reduction requirements for the first and second permit cycle outlined in the Chesapeake Bay TMDL special condition. These reductions were achieved as a result of implementing structural BMPs since 2009, completing stream restoration projects since 2006, and accounting for “historical” BMPs installed and maintained on projects since 2006 and before July 1, 2009. See Table 2 below.

Reductions achieved as of 11/1/23 have been verified using the calculation methods defined in the DEQ Guidance Memo or relevant expert panels and the established efficiencies therein. Appendices B & C provide a listing of these BMPs, the date of implementation, reductions achieved and supporting calculations. The following subsections discuss the methodologies used to calculate load reductions.

Historical BMPs

Appendix VI of the Guidance Memo allows full reduction credit to be provided for BMPs installed on or after January 1, 2006, and prior to July 1, 2009, and that were constructed to address water quality. All of the BMPs that qualified for historical designation included in this Action Plan were provided to DEQ in the “Historical Data Clean-Up” submittal (2015). The reductions that were calculated for these BMPs followed the James River Edge of Stream loading rates and the Chesapeake Bay Program Retrofit Curves/Equations, or the Chesapeake Bay Program Established Efficiencies (Guidance Memo Example V.B.1 and V.C.1 respectively).

Structural BMPs Installed Since 2009

POC reductions for BMPs that have been installed on sites less than one acre since 2009 were calculated using the DEQ Guidance Memo (Appendix V.B, V.C) and utilize the Virginia Stormwater Clearinghouse, the Chesapeake Bay Program Retrofit Curves/Equations, the Chesapeake Bay Program Established Efficiencies or the 1999 Virginia Stormwater Management Handbook. Similarly, any BMPs that were installed beyond the VSMP requirements or on a project that reduced the pollutants on site used the same calculation methodologies.

Appendix V.E in the DEQ Guidance Memo was used to calculate reductions for any oversized BMPs installed since 2009 on a site that disturbed greater than one acre. Per correspondence with the DEQ, for redevelopment projects completed prior to January 1, 2014, permittees need to reduce the post-redevelopment pollutant load to the pre-redevelopment pollutant load level prior to taking credit for any additional reductions produced by a BMP.

Stream Restorations

The University has completed several stream restoration projects in the Meadow Creek watershed on regulated urban area since 2006. Following Appendix V.J of the Guidance Memo, Appendix C details these stream restoration projects and the associated POC reductions. The efficiencies calculated follow the revised default rates for non-coastal plain streams in Table 3 of the *Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects*, dated September 8, 2014. All of the stream restoration projects listed in Appendix C were submitted to the Army Corps of Engineers and found to meet the criteria as described in the Corps Nationwide Permit Number 27.

Cumulative Reductions Achieved As of 11/1/23

Table 2 summarizes the total load reductions achieved as of 11/1/23 for each POC. The University has exceeded the reductions required for Total Phosphorous for the final permit cycle. Pollutant reductions achieved in the first and second permit cycle that exceeded the cumulative 40% requirement of the second permit cycle will be applied to requirements for the third permit. The University’s MS4 service area only discharges to the James River Basin.

Table 2

Total Reductions Achieved as of November 1, 2023 (James River Basin)							
Pollutant of Concern	BMPs installed between 1/1/06 and 7/1/09 (Historical BMPs) (lbs/yr)	BMPs on Projects That Reduced Impervious, Installed Capacity Beyond VSMP Requirements or Retrofits (lbs/yr)	BMPs on Projects with Stricter Requirements (lbs/yr)	Oversized BMPs (lbs/yr)	Stream Restoration Projects Implemented (lbs/yr)	Total Reductions Achieved as of November 1, 2023	Percentage of Final Permit Cycle (2028) Reductions Achieved (%)
Nitrogen	121	73	8.8	33	82	317	69%
Phosphorus	21	12	1.7	5.2	74	113	104%

Regional Facilities

Long before the mandates of the most recent Permit, the University of Virginia had made an aggressive effort to reduce POCs within the watershed. In order to protect the local watersheds, and ultimately the Chesapeake Bay, the University constructed three oversized regional stormwater management facilities (two constructed wetlands and one retention pond). These BMPs were partly constructed in an effort to create a “bank” of POC credits for projected future development. Projects completed within the jurisdiction of the University that could not implement BMP methods due to physical or other constraints could use these “bank” credits to satisfy water quality regulations. The DEQ has confirmed, verbally and via email, that any unclaimed excess capacity (calculated using the Guidance Memo) could be utilized to account for POC reductions required through 2028 or as available. No credits from the regional facilities have been included with this submission or are reflected in Table 2 above. Should the University’s POC reduction requirements change during future permit cycles, UVA may wish to permanently retire some banked capacity to meet TMDL requirements. In that event, UVA will provide supporting calculations of the remaining bank capacity.

5. Means and Methods to Meet the Required Reductions During the 2023-2028 MS4 Permit Cycle

As shown in Table 2 above, the University needs to implement additional measures by 10/31/28 (i.e., 60 months after the effective date of the current MS4 Permit) to reduce the total nitrogen load from existing developed lands served by the MS4 as of 6/30/09, within the 2010 Census urbanized areas by at least 100% of the L2 Scoping Run Reductions. The following subsections discuss the projects anticipated to be implemented during the permit cycle to achieve the remaining POC load reductions.

Gilmer Basin Conversion

Gilmer Basin was converted from a dry extended detention basin designed prior to the BMP Clearinghouse specifications to a Level 2 extended detention basin in 2024. Appendix V.D in

the DEQ Guidance Memo was used to calculate the reductions from BMP conversions. This oversized BMP was originally installed as a regional facility; its pollutant reductions associated with redevelopment projects have been accounted for in accordance with the procedures in Appendix V.E in the DEQ Guidance Memo.

Septic Disconnection

The University will implement two septic system disconnection projects during the current permit cycle. Both projects will occur on state land within Albemarle County. The University confirmed with the County that they did not wish to claim the associated reductions. Nitrogen load reductions are estimated using the loading rate, removal efficiency and actual building occupancy data as described in Appendix V.O from the 20-2003 Guidance Memo. The septic disconnection projects are expected to be completed during 2024.

Anticipated Cumulative Reductions (2028)

Table 3 summarizes the load reductions expected to be achieved during the 11/1/23 MS4 permit cycle for each POC. Please see Appendix D for detailed calculations of all proposed BMPs and the associated reductions and removal efficiencies.

Table 3

Total POC Reductions Proposed During Permit Cycle - 2023-2028 (James River Basin)			
Pollutant of Concern	Proposed BMP Conversion (lbs/yr)	Proposed Septic Disconnections (lbs/yr)	Total Reductions from Proposed BMPs (lbs/yr)
Nitrogen	51	116	167
Phosphorus	9.5	0	9.5

With the water quality benefits that could be realized as a result of the proposed BMPs, the University will achieve and exceed the reduction requirements for all the POCs by 10/31/28 (see Table 4).

Table 4

Total POC Reductions Achieved and Proposed (James River Basin)					
Pollutant of Concern	Total Reductions Achieved as of 11/1/23 (lbs/yr)	Total Reductions from Proposed BMPs During Third Permit Cycle (lbs/yr)	Total Reductions Expected by End of Third Permit Cycle (lbs/yr)	Total Reduction Required for Final Permit Cycle (2028), 100% (lbs/yr)	Percentage of Final Permit Cycle (2028) Reductions Achieved (%)
Nitrogen	317	167	484	458	106%
Phosphorus	113	9.5	122	108	113%

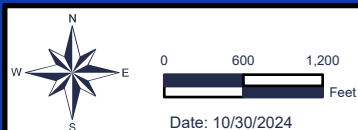
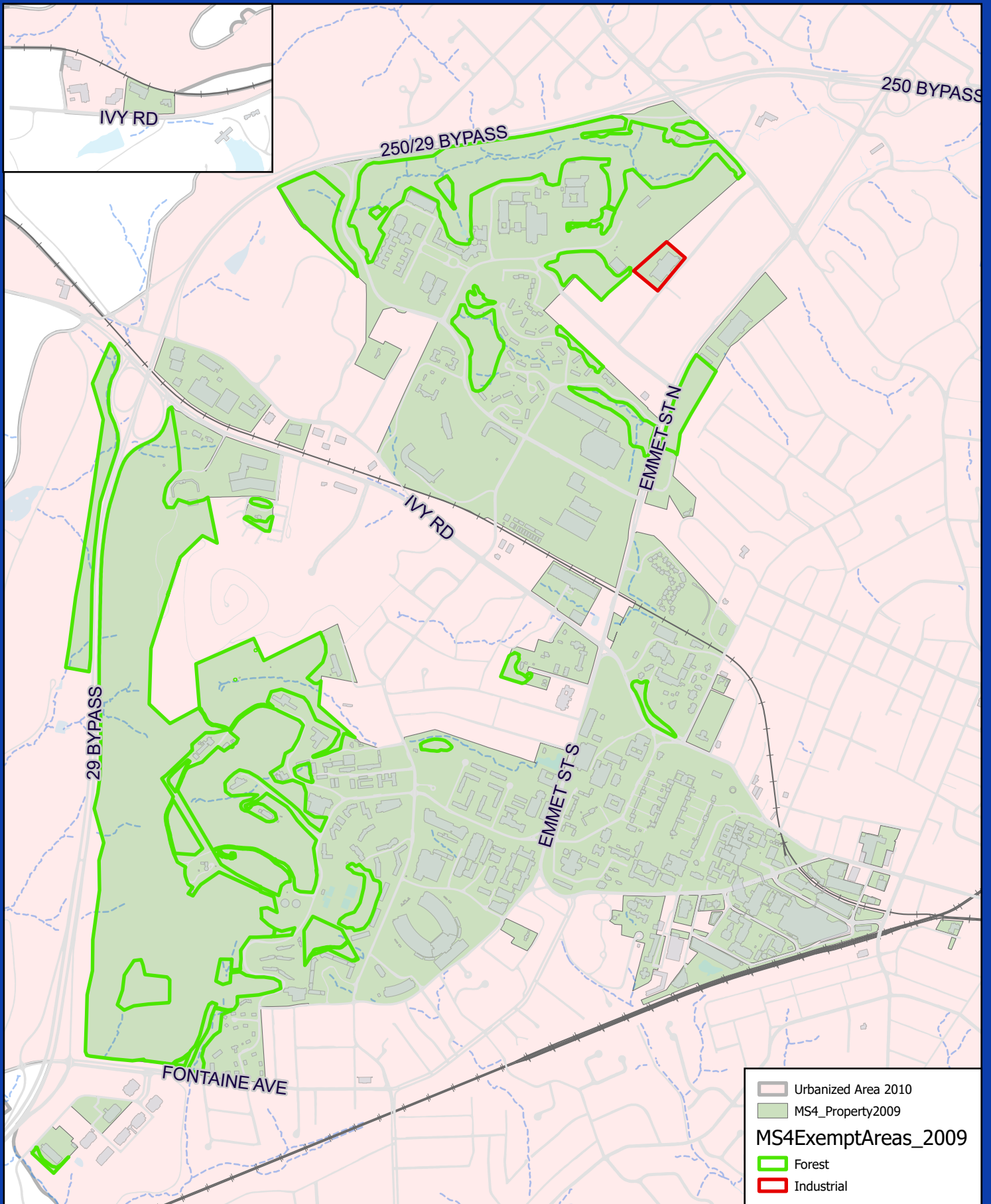
If planning efforts at the University should change and affect this Action Plan, updates or modifications will be submitted to the DEQ in accordance with the permit conditions found in the 2023 MS4 Permit to ensure that the University has continued to comply with the MS4 General Permit.

6.Public Comments on Action Plan

This Action Plan is posted on the TMDL section of the [UVA Environmental Resources website](#). Prior to finalizing the documents in accordance with the 2023 MS4 Permit, this Action plan was posted on the website for 15 days to provide the opportunity for public comment and suggested revisions. No comments were received.

Appendix A

MS4 Pervious/ Impervious Areas Map



**6/30/2009 Property Boundary With
2010 Census Urbanized Area**

Appendix B

List of BMPs Implemented and Reductions Achieved Prior to 11.01.23

BMPs Implemented Prior to November 1, 2023

Site Name	Year Installed	BMP Type	Maximum Reductions (lbs/yr)	
			Phosphorous	Nitrogen
Historical BMPs				
JPJ Arena	2006	Bioretention	1.2	7.9
JPJ Arena	2006	Water Quality Swale	0.73	6.9
Reactor Building Basin	2007	Dry Extended Detention	3.7	27
11th Street Garage	2008	Hydrodynamic Structure	0.32	0.57
Campbell Hall	2008	Bioretention	0.67	3.7
Hereford College Basin	2008	Dry Extended Detention	6.7	43
Observatory Hill Stone Storage System	2008	Dry Extended Detention	7.0	31
Robertson Hall	2008	Vegetated Roof	0.20	0.99
Subtotal			21	121
BMPs on Projects That Reduced Impervious, Installed Capacity Beyond VSMP Requirements or Retrofits				
MR-6	2009	Vegetated Roof	0.47	3.6
	2010	Bioretention	0.58	3.6
	2010	Bioretention	1.5	10
	2010	Bioretention	1.5	11
	2010	Bioretention	0.73	4.6
South Lawn				
Bavaro Hall	2010	Hydrodynamic Structure	0.027	0.093
Amphitheater	2010	Permeable Pavement	0.12	0.56
	2013	Bioretention	0.15	1.0
	2013	Bioretention	0.13	0.93
New Cabell				
Thrust Theatre	2013	Vegetated Roof	0.040	0.20
Ridley Hall	2014	Bioretention	0.78	4.2
Hospital	2014	Vegetated Roof	0.79	3.9
	2016	Vegetated Roof	0.053	0.26
	2016	Bioretention	0.049	0.43
	2016	Permeable Concrete	0.31	1.7
Leake II (Skipwith)				
Hereford Rain Garden	2017	Bioretention	0.087	0.70
Clark Hall (Nook)	2017	Bioretention	0.036	0.36
MSE Bioretention	2017	Bioretention	0.079	0.39
Clinical Wing	2017	Green Roof	0.15	0.72
Thornton Hall Entry	2016	Permeable Pavement	0.057	0.30
Remembrance Garden	2017	Permeable Pavement	0.043	0.23
Bond House	2019	Bioretention	3.2	20
	2019	Porous Asphalt	0.19	1.0
	2019	Pervious Concrete	0.35	1.9
FM Yard Redevelopment Pavement				
Lambeth Commons Permeable Pavers	2022	Permeable Pavers	0.21	1.1
Subtotal			12	73
BMPs on Projects with Stricter Requirements				
PCC Annex	2010	Filterra®	0.083	0.41
Newcomb Hall	2010	Vegetated Roof	0.066	0.33
Arlington Blvd	2011	Dry Detention	0.17	0.59
Garrett Hall	2011	Vegetated Roof	0.31	2.1
North Grounds Mechanical Plant	2015	Filtering Practice	0.18	0.64
Education Resource Center	2017	Infiltration	0.88	4.8
Subtotal			1.7	8.8
Oversized BMPs				
Sieg Warehouse	2009	Bioretention	1.1	8.1
	2009	Bioretention (Rain Garden)		
PSC Addition, ITC Basin	2009	Dry Extended Detention	1.5	4.5
Alderman Building 6 (Gibbons)	2015	Infiltration Chamber	0.49	3.1
Rugby Administration Building (O'Neil)	2015	Bioretention	0.18	0.99
	2020	Bioretention	1.9	16
	2020	Bioretention		
	2020	Bioretention		
	2020	Bioretention		
Brandon Avenue				
Subtotal			5.2	33
Stream Restorations				
JPJ Arena - 1	2006	Stream Restoration	12	13
JPJ Arena - 2	2006	Stream Restoration	31	35
Lambeth – Phase 1	2011	Stream Restoration	8.8	9.8
Lambeth – Phase 2	2012	Stream Restoration	5.7	6.3
Carr’s Hill Field Park	2013	Stream Restoration	16	18
Subtotal			74	82
		Grand Total (lbs/yr)	113	317

Appendix C

Reduction Calculations for BMPs Implemented Prior to 11.01.23

Historical BMPs

Historical BMPs

Site Name	JPJ Arena	JPJ Arena	Reactor Building Basin		11th Street Garage	Campbell Hall	Hereford College Basin	
Date BMP Installed	2006	2006	2007		2008	2008	2008	
Conversion or Enhancement	Enhancement	Enhancement	Conversion		Enhancement	Enhancement	Conversion	
Site Area (Ac)	1.35	1.33	24.20	24.20	1.20	0.60	38.46	38.46
BMP Type (UVA Description)	Bioretention	Water Quality Swale	Dry Detention	Dry Extended Detention	BaySeparator™	Bioretention	Dry Detention	Dry Extended Detention
SWMF ID#	ME10-5574-03	ME10-5574-04	ME01-0334-01	ME01-0334-01	MO6B-1149-01	ME06-0438-01	MO1A-6463-01	MO1A-6463-01
WQV (CF)	1,362.8	441.3	3,770.3	7,540.7	300.0	849.4	11,113.2	22,226.5
PERFORMANCE BASED CRITERIA								
Drainage Area to BMP-Impervious (Ac)	0.75	0.24	2.08	2.08	1.20	0.47	6.12	6.12
Drainage Area to BMP-Pervious (Ac)	0.60	1.09	22.12	22.12	0.00	0.13	32.34	32.34
JAMES RIVER POC RATES								
Phosphorus (P) Loads (lbs/yr)	1.62	0.97	14.72	14.72	2.12	0.89	26.94	26.94
Nitrogen (N) Loads (lbs/yr)	11.24	9.89	174.14	174.14	11.31	5.32	283.53	283.53
Total Suspended Solids (TSS) Loads (lbs/yr)	568.85	274.55	3642.39	3642.39	815.50	330.15	7413.53	7413.53
VA STORMWATER MANAGEMENT HANDBOOK (1999)								
BMP Type	Bioretention I	Water Quality Swale		Extended Detention	BaySeparator™	Bioretention I		Extended Detention
P Removal Efficiency	50%	35%		35%	15%	50%		35%
P Reduction per VA Stormwater Management Handbook (lbs/yr)	0.81	0.34		5.15	0.32	0.44		9.43
VA STORMWATER BMP CLEARINGHOUSE								
BMP Type								
P Removal Efficiency								
N Removal Efficiency								
P Reduction per Clearinghouse (lbs/yr)								
N Reduction per Clearinghouse (lbs/yr)								
BAY PROGRAM RETROFIT PERFORMANCE CURVES								
Type (ST or RR)	RR	RR			ST	RR		
Runoff Depth Treated (Inches)	0.50	0.50			0.07	0.50		
P Removal Efficiency	52.3%	52.3%			7.9%	52.3%		
N Removal Efficiency	44.8%	44.8%			5.0%	44.8%		
TSS Removal Efficiency	56.0%	56.0%			10.0%	56.0%		
P Reduction per Retrofit Curves (lbs/yr)	0.85	0.51			0.17	0.47		
N Reduction per Retrofit Curves (lbs/yr)	5.04	4.43			0.57	2.38		
TSS Reduction per Retrofit Curves (lbs/yr)	318.56	153.75			81.86	184.89		
BAY PROGRAM BMP EFFICIENCY								
CBP BMP Type	Bioretention	Bioswale	Dry Detention	Extended Detention	Hydrodynamic Structure	Bioretention	Dry Detention	Extended Detention
P Removal Efficiency	75%	75%	10%	20%	10%	75%	10%	20%
N Removal Efficiency	70%	70%	5%	20%	5%	70%	5%	20%
TSS Removal Efficiency	80%	80%	10%	60%	10%	80%	10%	60%
P Reduction per CBP Efficiency Table (lbs/yr)	1.22	0.73	1.47	2.94	0.21	0.67	2.69	5.39
N Reduction per CBP Efficiency Table (lbs/yr)	7.87	6.92	8.71	34.83	0.57	3.72	14.18	56.71
TSS Reduction per CBP Efficiency Table (lbs/yr)	455.08	219.64	364.24	2185.43	81.55	264.12	741.35	4448.12
Maximum Phosphorus Credit per Site (lbs/yr)	1.22	0.73	1.47	5.15	0.32	0.67	2.69	9.43
Maximum Nitrogen Credit per Site (lbs/yr)	7.87	6.92	8.71	34.83	0.57	3.72	14.18	56.71
Maximum Suspended Solids Credit per Site (lbs/yr)	456	220	365	2186	82	265	742	4449
TP Additional Reduction (lbs/yr)	1.2	0.73	3.7		0.32	0.67	6.7	
TN Additional Reduction (lbs/yr)	7.9	6.9	27		0.57	3.7	43	
TSS Additional Reduction (lbs/yr)	456	220	1,821		82	265	3,707	

Historical BMPs

Site Name Date BMP Installed Conversion or Enhancement Site Area (Ac) BMP Type (UVA Description) SWMF ID# WQV (CF)	Observatory Hill Stone Storage System	Robertson Hall	
	2008	2008	
	Enhancement	Enhancement	
	18.77	0.15	
	Dry Extended Detention	Green Roof	
	MO3A-0201-01	MO6A-0057-01	
	30,564.6	517.3	
PERFORMANCE BASED CRITERIA			
Drainage Area to BMP-Impervious (Ac)	8.42	0.15	
Drainage Area to BMP-Pervious (Ac)	10.35	0.00	
JAMES RIVER POC RATES			
Phosphorus (P) Loads (lbs/yr)	19.99	0.26	
Nitrogen (N) Loads (lbs/yr)	151.41	1.41	
Total Suspended Solids (TSS) Loads (lbs/yr)	6746.01	101.54	
VA STORMWATER MANAGEMENT HANDBOOK (1999)			
BMP Type	Extended Detention		
P Removal Efficiency	35%		
P Reduction per VA Stormwater Management Handbook (lbs/yr)	7.00		
VA STORMWATER BMP CLEARINGHOUSE			
BMP Type			
P Removal Efficiency			
N Removal Efficiency			
P Reduction per Clearinghouse (lbs/yr)			
N Reduction per Clearinghouse (lbs/yr)			
BAY PROGRAM RETROFIT PERFORMANCE CURVES			
Type (ST or RR)		RR	
Runoff Depth Treated (Inches)		0.95	
P Removal Efficiency		68.9%	
N Removal Efficiency		58.9%	
TSS Removal Efficiency		73.8%	
P Reduction per Retrofit Curves (lbs/yr)		0.18	
N Reduction per Retrofit Curves (lbs/yr)		0.83	
TSS Reduction per Retrofit Curves (lbs/yr)		74.96	
BAY PROGRAM BMP EFFICIENCY			
CBP BMP Type	Extended Detention	Bioretention	
P Removal Efficiency	20%	75%	
N Removal Efficiency	20%	70%	
TSS Removal Efficiency	60%	80%	
P Reduction per CBP Efficiency Table (lbs/yr)	4.00	0.20	
N Reduction per CBP Efficiency Table (lbs/yr)	30.28	0.99	
TSS Reduction per CBP Efficiency Table (lbs/yr)	4047.61	81.23	
Maximum Phosphorus Credit per Site (lbs/yr)	7.00	0.20	
Maximum Nitrogen Credit per Site (lbs/yr)	31	0.99	
Maximum Suspended Solids Credit per Site (lbs/yr)	4048	82	Reduction Totals
TP Additional Reduction (lbs/yr)	7.0	0.20	21
TN Additional Reduction (lbs/yr)	31	0.99	121
TSS Additional Reduction (lbs/yr)	4,048	82	10,681

**BMPs on Projects That Reduced Impervious, Installed Capacity Beyond VSMP
Requirements or Retrofits**

BMPs on Projects That Reduced Impervious, Installed Capacity Beyond VSMP Requirements or Retrofits

Site Name Date BMP Installed Reduced Impervious/ In Addition to VSMP Req's/ Retrofit Site Area (Ac) BMP Type (UVA Description) SWMF ID# WQV (CF)	MR-6	South Lawn				Bavaro Hall	Amphitheater	New Cabell	
	2009 In Addition 0.65	2010 Reduced Impervious 11.26				2010 In Addition 0.10	May 2010 Reduced Impervious 0.25	2013 Reduced Impervious 2.1	
	Green Roof	Biofilter 1	Biofilter 2	Biofilter 3	Biofilter 4	Vortsentry	Porous Pavers	West Biofilter	East Biofilter
	MO6A-1161-01 827.6	MO5B-0070-01 1,587.6	MO5B-0070-02 2,080.7	MO5B-0070-03 2,164.5	MO5B-0070-04 1,780.4	ME03-0264-02 50.4	MO5B-0062-02 363.0	MO5B-0060-01 549.0	MO5B-0060-02 549.0
PERFORMANCE BASED CRITERIA									
Drainage Area to BMP-Impervious (Ac)	0.24	0.38	0.89	0.93	0.46	0.10	0.10	0.08	0.06
Drainage Area to BMP-Pervious (Ac)	0.41	0.22	0.84	0.84	0.32	0.00	0.00	0.10	0.11
JAMES RIVER POC RATES									
Phosphorus (P) Loads (lbs/yr)	0.63	0.78	1.99	2.06	0.97	0.18	0.18	0.19	0.16
Nitrogen (N) Loads (lbs/yr)	5.12	5.11	14.23	14.60	6.56	0.94	0.94	1.45	1.33
Total Suspended Solids (TSS) Loads (lbs/yr)	203.91	279.47	687.38	714.46	343.74	67.69	67.69	64.26	51.74
VA STORMWATER BMP CLEARINGHOUSE									
BMP Type									
P Removal Efficiency									
N Removal Efficiency									
P Reduction per Clearinghouse (lbs/yr)									
N Reduction per Clearinghouse (lbs/yr)									
BAY PROGRAM RETROFIT PERFORMANCE CURVES									
Type (ST or RR)	RR	RR	ST	ST	ST	ST	RR	RR	RR
Runoff Depth Treated (Inches)	0.95	1.15	0.64	0.64	1.07	0.14	1.00	1.89	2.52
P Removal Efficiency	68.9%	72.4%	46.8%	46.7%	55.9%	15.5%	69.9%	77.9%	78.8%
N Removal Efficiency	58.9%	61.9%	29.8%	29.7%	35.5%	9.9%	59.8%	66.7%	66.7%
TSS Removal Efficiency	73.8%	77.6%	59.5%	59.4%	71.1%	19.8%	74.9%	83.6%	84.9%
P Reduction per Retrofit Curves (lbs/yr)	0.43	0.56	0.93	0.96	0.54	0.03	0.12	0.15	0.13
N Reduction per Retrofit Curves (lbs/yr)	3.01	3.16	4.23	4.34	2.33	0.09	0.56	0.97	0.89
TSS Reduction per Retrofit Curves (lbs/yr)	150.52	216.86	409.04	424.27	244.37	13.39	50.71	53.76	43.92
BAY PROGRAM BMP EFFICIENCY									
CBP BMP Type	Bioretention	Bioretention	Bioretention	Bioretention	Bioretention	Hydrodynamic Structure	Permeable Pavement - no sand	Bioretention	Bioretention
P Removal Efficiency	75%	75%	75%	75%	75%	10%	50%	75%	75%
N Removal Efficiency	70%	70%	70%	70%	70%	5%	45%	70%	70%
TSS Removal Efficiency	80%	80%	80%	80%	80%	10%	70%	80%	80%
P Reduction per CBP Efficiency Table (lbs/yr)	0.47	0.58	1.49	1.54	0.73	0.02	0.09	0.14	0.12
N Reduction per CBP Efficiency Table (lbs/yr)	3.58	3.57	9.96	10.22	4.59	0.05	0.42	1.02	0.93
TSS Reduction per CBP Efficiency Table (lbs/yr)	163.13	223.58	549.91	571.57	274.99	6.77	47.39	51.41	41.39
Maximum Phosphorus Reduction per Site (lbs/yr)	0.47	0.58	1.5	1.5	0.73	0.027	0.12	0.15	0.13
Maximum Nitrogen Reduction per Site (lbs/yr)	3.6	3.6	10	11	4.6	0.093	0.56	1.0	0.93
Maximum Suspended Solids Reduction per Site (lbs/yr)	164	224	550	572	275	14	51	54	44

Notes:

1. Drainage area to South Lawn Biofilter 4 changed due to the Brandon UCH project.

BMPs on Projects That Reduced Impervious, Installed Capacity Beyond VSMP Requirements or Retrofits

Site Name Date BMP Installed Reduced Impervious/ In Addition to VSMP Req's/ Retrofit Site Area (Ac) BMP Type (UVA Description) SWMF ID# WQV (CF)	Thrust Theatre	Ridley Hall	Hospital	Leake II (Skipwith)		
	2013 In Addition 0.03	2014 Retrofit 0.67	October 2014 In Addition 0.60	2016 Reduced Impervious 1.23		
	Green Roof	Biofilter	Green Roof	Green Roof	Biofilter	Permeable Pavement
	ME06-0449-02 87.1	ME03-0260-01 1,219.7	MO6A-1150-02 2,710.0	ME01-0234-01 130.7	ME01-0234-02 87.1	ME01-0234-03 653.4
PERFORMANCE BASED CRITERIA						
Drainage Area to BMP-Impervious (Ac)	0.03	0.56	0.60	0.04	0.02	0.217
Drainage Area to BMP-Pervious (Ac)	0.00	0.11	0.00	0.00	0.06	0
JAMES RIVER POC RATES						
Phosphorus (P) Loads (lbs/yr)	0.05	1.04	1.06	0.07	0.07	0.38
Nitrogen (N) Loads (lbs/yr)	0.28	6.03	5.63	0.38	0.61	2.04
Total Suspended Solids (TSS) Loads (lbs/yr)	20.31	390.21	406.16	27.08	19.60	146.90
VA STORMWATER BMP CLEARINGHOUSE						
BMP Type				Vegetated Roof #1	Bioretention #1	Permeable Pavement #2
P Removal Efficiency				45%	55%	81%
N Removal Efficiency				45%	64%	81%
P Reduction per Clearinghouse (lbs/yr)				0.03	0.04	0.31
N Reduction per Clearinghouse (lbs/yr)				0.17	0.39	1.65
BAY PROGRAM RETROFIT PERFORMANCE CURVES						
Type (ST or RR)	RR	RR	RR	RR	RR	RR
Runoff Depth Treated (Inches)	0.80	0.60	1.24	0.90	1.20	0.83
P Removal Efficiency	65.1%	57.5%	73.6%	67.8%	73.1%	65.9%
N Removal Efficiency	55.7%	49.3%	62.9%	57.9%	62.4%	56.4%
TSS Removal Efficiency	69.7%	61.7%	78.9%	72.6%	78.3%	70.7%
P Reduction per Retrofit Curves (lbs/yr)	0.03	0.60	0.78	0.05	0.05	0.25
N Reduction per Retrofit Curves (lbs/yr)	0.16	2.97	3.55	0.22	0.38	1.15
TSS Reduction per Retrofit Curves (lbs/yr)	14.16	240.57	320.46	19.66	15.35	103.78
BAY PROGRAM BMP EFFICIENCY						
CBP BMP Type	Bioretention	Bioretention	Bioretention	Bioretention	Bioretention	
P Removal Efficiency	75%	75%	75%	75%	75%	
N Removal Efficiency	70%	70%	70%	70%	70%	
TSS Removal Efficiency	80%	80%	80%	80%	80%	
P Reduction per CBP Efficiency Table (lbs/yr)	0.04	0.78	0.79	0.05	0.05	
N Reduction per CBP Efficiency Table (lbs/yr)	0.20	4.2	3.9	0.26	0.43	
TSS Reduction per CBP Efficiency Table (lbs/yr)	16.25	313	325	22	16	
Maximum Phosphorus Reduction per Site (lbs/yr)	0.040	0.78	0.79	0.053	0.049	0.31
Maximum Nitrogen Reduction per Site (lbs/yr)	0.20	4.2	3.9	0.26	0.43	1.7
Maximum Suspended Solids Reduction per Site (lbs/yr)	17	313	325	22	16	104

Notes:
1. Drainage area to South Lawn Biofilter 4 changed due to the Brandon UCH project.

BMPs on Projects That Reduced Impervious, Installed Capacity Beyond VSMP Requirements or Retrofits

Site Name	Hereford Rain Garden	Clark Hall (Nook)	MSE Bioretention	Clinical Wing	Thornton Hall Entry
Date BMP Installed	Apr-15	Dec-16	Dec-16	October 2016	Aug-16
Reduced Impervious/ In Addition to VSMP Req's/ Retrofit	Retrofit	Retrofit	Retrofit	In Addition	Reduced Impervious
Site Area (Ac)	0.13	0.07	0.11	0.11	0.16
BMP Type (UVA Description)	Biofilter	Biofilter	Biofilter	Green Roof	Permeable Pavers
SWMF ID#	MO1A-2392-01	MO5A-0068-01	MO5A-0270-01	MO6A-1176-01	MO5A-0204-01
WQV (CF)	72.6	18.2	108.9	379.3	72.6
PERFORMANCE BASED CRITERIA					
Drainage Area to BMP-Impervious (Ac)	0.04	0.01	0.06	0.11	0.04
Drainage Area to BMP-Pervious (Ac)	0.09	0.06	0.00	0.00	0
JAMES RIVER POC RATES					
Phosphorus (P) Loads (lbs/yr)	0.12	0.05	0.11	0.19	0.07
Nitrogen (N) Loads (lbs/yr)	1.00	0.51	0.56	1.03	0.38
Total Suspended Solids (TSS) Loads (lbs/yr)	36.17	12.83	40.62	74.46	27.08
VA STORMWATER BMP CLEARINGHOUSE					
BMP Type		Bioretention #1	Bioretention #1		Permeable Pavement #2
P Removal Efficiency		55%	55%		81%
N Removal Efficiency		64%	64%		81%
P Reduction per Clearinghouse (lbs/yr)		0.03	0.06		0.06
N Reduction per Clearinghouse (lbs/yr)		0.33	0.36		0.30
BAY PROGRAM RETROFIT PERFORMANCE CURVES					
Type (ST or RR)	RR	RR	RR	RR	RR
Runoff Depth Treated (Inches)	0.50	0.50	0.50	0.95	0.50
P Removal Efficiency	52.3%	52.3%	52.3%	68.9%	52.3%
N Removal Efficiency	44.8%	44.8%	44.8%	58.9%	44.8%
TSS Removal Efficiency	56.0%	56.0%	56.0%	73.8%	56.0%
P Reduction per Retrofit Curves (lbs/yr)	0.06	0.02	0.06	0.13	0.04
N Reduction per Retrofit Curves (lbs/yr)	0.45	0.23	0.25	0.61	0.17
TSS Reduction per Retrofit Curves (lbs/yr)	20.26	7.19	22.75	54.97	15.16
BAY PROGRAM BMP EFFICIENCY					
CBP BMP Type	Bioretention	Bioretention	Bioretention	Bioretention	
P Removal Efficiency	75%	75%	75%	75%	
N Removal Efficiency	70%	70%	70%	70%	
TSS Removal Efficiency	80%	80%	80%	80%	
P Reduction per CBP Efficiency Table (lbs/yr)	0.09	0.04	0.08	0.15	
N Reduction per CBP Efficiency Table (lbs/yr)	0.70	0.36	0.39	0.72	
TSS Reduction per CBP Efficiency Table (lbs/yr)	28.94	10.27	32.49	59.57	
Maximum Phosphorus Reduction per Site (lbs/yr)	0.087	0.036	0.079	0.15	0.06
Maximum Nitrogen Reduction per Site (lbs/yr)	0.70	0.36	0.39	0.72	0.30
Maximum Suspended Solids Reduction per Site (lbs/yr)	29	11	33	60	16

Notes:
1. Drainage area to South Lawn Biofilter 4 changed due to the Brandon UCH project.

BMPs on Projects That Reduced Impervious, Installed Capacity Beyond VSMP Requirements or Retrofits

Site Name Date BMP Installed Reduced Impervious/ In Addition to VSMP Req's/ Retrofit Site Area (Ac) BMP Type (UVA Description) SWMF ID# WQV (CF)	Remembrance Garden	Bond House	FM Yard Redevelopment Pavement		Lambeth Commons Pavers	
	Nov-17 In Addition 0.12	Dec-19 Reduced Impervious 3.05	Jul-19 Reduced Impervious 1.97		2022 In Addition 0.20	
	Permeable Pavers	Biofilter	FM Yard Porous Asphalt	FM Yard Pervious Concrete	Permeable Pavers	
	ME06-0121-02	MOSB-2150-01	ME01-0228-01	ME01-0228-02	ME13-2464-01	
	54.5	3,738.9	327.6	619.0	361.2	
PERFORMANCE BASED CRITERIA						
Drainage Area to BMP-Impervious (Ac)	0.03	2.06	0.18	0.34	0.20	
Drainage Area to BMP-Pervious (Ac)	0	1.32	0.00	0.00	0.00	
JAMES RIVER POC RATES						
Phosphorus (P) Loads (lbs/yr)	0.05	4.29	0.32	0.60	0.35	
Nitrogen (N) Loads (lbs/yr)	0.28	28.57	1.69	3.20	1.87	
Total Suspended Solids (TSS) Loads (lbs/yr)	20.31	1527.92	122.19	230.87	134.71	
VA STORMWATER BMP CLEARINGHOUSE						
BMP Type	Permeable Pavement #2	Bioretention #1	Permeable Pavement #1	Permeable Pavement #1	Permeable Pavement #1	
P Removal Efficiency	81%	55%	59%	59%	59%	
N Removal Efficiency	81%	64%	59%	59%	59%	
P Reduction per Clearinghouse (lbs/yr)	0.04	2.36	0.19	0.35	0.21	
N Reduction per Clearinghouse (lbs/yr)	0.23	18.28	1.00	1.89	1.10	
BAY PROGRAM RETROFIT PERFORMANCE CURVES						
Type (ST or RR)	RR	RR	RR	RR	RR	
Runoff Depth Treated (Inches)	0.50	0.50	0.50	0.50	0.50	
P Removal Efficiency	52.3%	52.3%	52.3%	52.3%	52.3%	
N Removal Efficiency	44.8%	44.8%	44.8%	44.8%	44.8%	
TSS Removal Efficiency	56.0%	56.0%	56.0%	56.0%	56.0%	
P Reduction per Retrofit Curves (lbs/yr)	0.03	2.24	0.17	0.31	0.18	
N Reduction per Retrofit Curves (lbs/yr)	0.13	12.81	0.76	1.44	0.84	
TSS Reduction per Retrofit Curves (lbs/yr)	11.37	855.65	68.43	129.29	75.44	
BAY PROGRAM BMP EFFICIENCY						
CBP BMP Type		Bioretention				
P Removal Efficiency		75%				
N Removal Efficiency		70%				
TSS Removal Efficiency		80%				
P Reduction per CBP Efficiency Table (lbs/yr)		3.21				
N Reduction per CBP Efficiency Table (lbs/yr)		20.00				
TSS Reduction per CBP Efficiency Table (lbs/yr)		1222.34				
						Reduction Totals
Maximum Phosphorus Reduction per Site (lbs/yr)	0.04	3.2	0.19	0.35	0.21	12
Maximum Nitrogen Reduction per Site (lbs/yr)	0.23	20	1.0	1.9	1.1	73
Maximum Suspended Solids Reduction per Site (lbs/yr)	12	1223	69	130	76	4,404

Notes:

1. Drainage area to South Lawn Biofilter 4 changed due to the Brandon UCH project.

BMPs on Projects with Stricter Requirements

Projects with Stricter Requirements

Site Name	PCC Annex	Newcomb Hall	Arlington Blvd	Garrett Hall	North Grounds Mechanical Plant	Education Resource Center	
Date BMP Installed	March 2010	July 2010	2011	2011	2015	March 2017	
Site Area (Ac)	0.228	0.593	0.85	0.69	0.71	0.88	
BMP Type (UVA Description)	Filtterra® (6x4)	Green Roof	Detention	Green Roof	Water Quality Filters	Infiltration	
SWMF ID#	MO6A-1164-01	ME06-0122-02	ME12-BLVD-01	MO5B-0055-02	ME11-7533-02	MO6A-1146-02	
WQV (CF)	35.0	172.4	1,051.1	620.7	308.6	2,050.0	
PERFORMANCE BASED CRITERIA							
Drainage Area to BMP-Impervious (Ac)	0.06	0.05	0.77	0.18	0.17	0.53	
Drainage Area to BMP-Pervious (Ac)	0.00	0.00	0.64	0.18	0	0.03	
JAMES RIVER POC RATES							
Phosphorus (P) Loads (lbs/yr)	0.11	0.09	1.68	0.41	0.30	0.95	
Nitrogen (N) Loads (lbs/yr)	0.59	0.47	11.70	2.95	1.60	5.19	
Total Suspended Solids (TSS) Loads (lbs/yr)	42.65	33.85	585.94	140.04	115.08	361.81	
VA STORMWATER BMP CLEARINGHOUSE							
BMP Type						Infiltration #2	
P Removal Efficiency						93%	
N Removal Efficiency						92%	
P Reduction per Clearinghouse (lbs/yr)						0.88	
N Reduction per Clearinghouse (lbs/yr)						4.77	
BAY PROGRAM RETROFIT PERFORMANCE CURVES							
Type (ST or RR)	ST	RR		RR	ST	RR	
Runoff Depth Treated (Inches)	0.15	0.95		0.95	0.50	1.07	
P Removal Efficiency	17.0%	68.9%		68.9%	41.1%	71.1%	
N Removal Efficiency	10.8%	58.9%		58.9%	26.1%	60.8%	
TSS Removal Efficiency	21.6%	73.8%		73.8%	52.3%	76.2%	
P Reduction per Retrofit Curves (lbs/yr)	0.02	0.06		0.28	0.12	0.67	
N Reduction per Retrofit Curves (lbs/yr)	0.06	0.28		1.74	0.42	3.15	
TSS Reduction per Retrofit Curves (lbs/yr)	9.21	24.99		103.38	60.15	275.62	
BAY PROGRAM BMP EFFICIENCY							
CBP BMP Type	Bioretention	Bioretention	Dry Detention	Bioretention	Urban Filtering Practices	Urban Infil -with sand/veg no underdrain	
P Removal Efficiency	75%	75%	10%	75%	60%	85%	
N Removal Efficiency	70%	70%	5%	70%	40%	85%	
TSS Removal Efficiency	80%	80%	10%	80%	80%	95%	
P Reduction per CBP Efficiency Table (lbs/yr)	0.08	0.07	0.17	0.31	0.18	0.81	
N Reduction per CBP Efficiency Table (lbs/yr)	0.41	0.33	0.59	2.06	0.64	4.41	
TSS Reduction per CBP Efficiency Table (lbs/yr)	34.12	27.08	58.59	112.03	92.06	343.72	
							Reduction Totals
Maximum Phosphorus Reduction per Site (lbs/yr)	0.083	0.066	0.17	0.31	0.18	0.88	1.7
Maximum Nitrogen Reduction per Site (lbs/yr)	0.41	0.33	0.59	2.1	0.64	4.8	8.8
Maximum Suspended Solids Reduction per Site (lbs/yr)	35	28	59	113	93	344	672

Oversized BMPs

Oversized BMPs (IIC)

Site Name Date BMP Installed Site Area (Ac) BMP TYPE (UVA Description) SWMF ID# WQV (CF)	Sieg Warehouse		PSC Addition, ITC Basin	Alderman Building 6 (Gibbons)	Rugby Administration Building (O'Neil)	
	October 2009		2009	August 2015	August 2015	
	2.4		9.04	1.97	1.17	
	Biofilter 1 MO-1693-01	Biofilter 2 (Rain Garden) MO-1693-02	Dry Extended Detention MO7-0598-01	Infiltration Chamber MO3A-2375-01	Bioretention ME13-2422-01	
	1,287.0	750.0	13,068.0	2,400.0	654.0	
PERFORMANCE BASED CRITERIA						
Total Site						
A Applicable Area (acres)	2.4		9.04	1.97	1.17	
Post-development Impervious Area (acres)	1.57		4.17	1.08	0.44	
I _{POST} Percent Impervious Cover (percent expressed in whole numbers)	65		46	55	38	
Pre-development Impervious Area (acres)	1.25		3.52	0.84	0.41	
I _{PRE} Percent Impervious Cover (percent expressed in whole numbers)	52		39	43	35	
I _{watershed} (percent expressed in whole numbers)	16		16	16	16	
TP _{ex} (L _{PRE})Relative Total Phosphorous Site Load (lbs/yr)	2.84		8.26	1.95	0.97	
TP _{watershed} (L _{pre(watershed)}) (lbs/yr)	1.06		4.00	0.87	0.52	
TP _{post} (L _{POST})Relative Total Phosphorous Site Load (lbs/yr)	3.50		9.59	2.44	1.04	
RR _{p(pre)} Total Phosphorous Reduction Required (lbs/yr)	0.94		2.15	0.69	0.16	
RR _{p(watershed)} Total Phosphorous Reduction Required (lbs/yr)	2.43		5.59	1.57	0.52	
RR _{p(VSMP)} Total Phosphorous Reduction Required (lbs/yr)	0.94		2.15	0.69	0.16	
RR _{p(TMDL)} Total Phosphorous Reduction Required (lbs/yr)	0.66		1.33	0.49	0.06	
BMP SPECIFIC TO DRAINAGE AREA						
DA _{BMP} Total Drainage Area to BMP (acres)	0.49	2.38	6.23	1.32	0.2	
IA _{BMP} Impervious Area to BMP (acres)	0.46	1.11	3.60	0.66	0.17	
I _{BMP} Percent Impervious Cover (expressed in whole numbers)	93	47	58	50	84	
TP _{DA} (L _{BMP})Relative Total Phosphorous Load (lbs/yr)	0.99	2.55	8.09	1.50	0.37	
TP _{DA} Removal Efficiency per 1999 VA SWM Handbook	50%	50%	35%	65%	65%	
TP _{DA} Reduction from BMP (Total Load x Efficiency) (lbs/yr)	0.50	1.27	2.83	0.98	0.24	
TP _{DA} Combined Reductions from BMP(s) (lbs/yr)		1.77	2.83	0.98	0.24	
Proportion of Reduction [(L _{removed} - RR _{p(TMDL)})/L _{removed}]		0.63	0.53	0.50	0.74	
CBP BMP Type	Bioretention	Bioretention	Extended Detention	Urban Infil - no sand\ underdrain	Bioretention	
TN _{DA} Relative Total Nitrogen Load (lbs/yr)	5.16	13.26	42.08	7.82	1.91	
TN _{DA} Removal Efficiency	70%	70%	20%	80%	70%	
TN _{DA} Reduction from BMP (Total Load x Efficiency) (lbs/yr)	3.61	9.28	8.42	6.26	1.34	
TN _{DA} Combined Reductions from BMP(s) (lbs/yr)		12.89	8.42	6.26	1.34	
TSS _{DA} Relative Total Suspended Solids Load (lbs/yr)	417.94	1072.89	3406.43	633.37	154.70	
TSS _{DA} Removal Efficiency	80%	80%	60%	95%	80%	
TSS _{DA} Reduction of BMP (Total Load x Efficiency) (lbs/yr)	334.35	858.31	2043.86	601.70	123.76	
TSS _{DA} Combined Reductions from BMP(s) (lbs/yr)		1192.66	2043.86	601.70	123.76	
Reduction Totals						
Phosphorus Reduction per Site (lbs/yr)	1.1		1.5	0.49	0.18	3.3
Nitrogen Reduction per Site (lbs/yr)	8.1		4.5	3.1	1.0	17
Suspended Solids Reduction per Site (lbs/yr)	751		1,086	299	92	2,228

Notes:
1. Lannigan track BMPs are in series. Palmer Field (Softball) used 0.25 lbs of TP from Lannigan Track (see calcs).

Oversized BMPs (IIB)

Site Name Date BMP Installed Site Area (Ac) BMP TYPE (UVA Description) SWMF ID# WQV (CF)	Brandon Avenue			
	April 2020			
	10.32			
	Bioretention A	Bioretention B	Bioretention C	Bioretention D
	MO5B-2150-03	MO5B-2150-04	MO5B-2150-05	MO5B-2150-06
	5,552	3,555	2,638	2,592
<u>VIRGINIA RUNOFF REDUCTION METHOD WORKSHEET</u>				
<u>Total Site</u>				
A Applicable Area (acres)	10.32			
Post-development Impervious Area (acres)	7.25			
Pre-development Impervious Area (acres)	7.45			
TP Load Final Post-Redevelopment (lbs/yr)	17.13			
TP Load Post-Redevelopment (lbs/yr)	17.13			
TP Load Post-Redevelopment (new impervious) (lbs/yr)	0.00			
RR _{P(VSMP)} Total Phosphorous Reduction Required (lbs/yr)	3.08			
<u>VA STORMWATER BMP CLEARINGHOUSE</u>				
BMP Type	Bioretention #1	Bioretention #1	Bioretention #1	Bioretention #1
DA _{BMP} Total Drainage Area to BMP (acres)	1.73	1.17	1.13	0.93
Managed Turf Credit Area	0.00	0.09	0.41	0.18
Impervious Cover Credit Area	1.61	1.01	0.67	0.71
TP Load to Practice (lb/yr)	3.48	2.23	1.66	1.63
P Removal Efficiency	55%	55%	55%	55%
TP Removed (lb/yr)	1.92	1.23	0.91	0.89
Combined TP Removed (lb/yr)	4.95			
Proportion of Reduction	38%			
N Removal Efficiency	64%	64%	64%	64%
TN Removed (lb/yr)	15.95	10.21	7.58	7.45
Combined TN Removed (lb/yr)	41.19			
<u>CBP BMP CALCULATIONS</u>				
CBP BMP Type	Bioretention	Bioretention	Bioretention	Bioretention
TSS _{DA} Relative Total Suspended Solids Load (lbs/yr)	1464.73	938.61	698.69	686.07
TSS _{DA} Removal Efficiency	80%	80%	80%	80%
TSS _{DA} Reduction of BMP (Total Load x Efficiency) (lbs/yr)	1171.79	750.89	558.96	548.85
TSS _{DA} Combined Reductions from BMP(s) (lbs/yr)	3030.48			
Reduction Totals				
Phosphorus Reduction per Site (lbs/yr)	1.9			
Nitrogen Reduction per Site (lbs/yr)	16			
Suspended Solids Reduction per Site (lbs/yr)	1,145			

Stream Restorations

Stream Restorations

Reductions for Stream Restoration Projects						
Project Name	Year Built	Length (LF)	Location	POC Reductions		
				TN @ 0.075 lbs/ft/yr	TP @ 0.068 lbs/ft/yr	TSS @ 44.88 lbs/ft/yr
JPJ Arena - 1	2006	165	Meadow Creek	13	12	7,406
JPJ Arena - 2	2006	455	Distillery Branch	35	31	20,421
Lambeth – Phase 1	2011	130	Meadow Creek	9.8	8.8	5,835
Lambeth – Phase 2	2012	84.5	Meadow Creek	6.3	5.7	3,793
Carr’s Hill Field Park	2013	230	Tributary to Meadow Creek	18	16	10,323
Totals (lbs/yr)				82	74	47,778
Percent of Final Permit Cycle (2028) Reductions Achieved				18%	68%	99%

Appendix D

BMPs To Be Implemented During the Current Permit Cycle and Proposed Reductions

Proposed Conversion BMPs

Conversion BMPs

Site Name		Gilmer Basin	
Date BMP Installed		2024	
Conversion or Enhancement		Pre Conversion	Post Conversion
Site Area (Ac)		6.80	27.95
		Extended Detention	Extended Detention
BMP Type (UVA Description)			
SWMF ID#		MO3A-0201-01	MO3A-0201-01
WQV (CF)		14,996	62,048
PERFORMANCE BASED CRITERIA			
Drainage Area to BMP-Impervious (Ac)		3.96	16.40
Drainage Area to BMP-Pervious (Ac)		2.84	11.55
JAMES RIVER POC RATES			
Phosphorus (P) Loads (lbs/yr)		8.39	34.64
Nitrogen (N) Loads (lbs/yr)		57.04	234.73
Total Suspended Solids (TSS) Loads (lbs/yr)		2967.75	12269.29
VA STORMWATER MANAGEMENT HANDBOOK (1999)			
BMP Type			
P Removal Efficiency			
P Reduction per 1994 VA SWM Handbook (lbs/yr)			
VA STORMWATER BMP CLEARINGHOUSE			
BMP Type		Extended Detention #1	Extended Detention #2
P Removal Efficiency		15%	31%
N Removal Efficiency		10%	24%
P Reduction per Clearinghouse (lbs/yr)		1.26	10.74
N Reduction per Clearinghouse (lbs/yr)		5.70	56.34
Proportion of Required Reduction		n/a	94%
BAY PROGRAM BMP EFFICIENCY			
CBP BMP Type		Extended Detention	Extended Detention
TSS Removal Efficiency		60%	60%
TSS Reduction per CBP Efficiency Table (lbs/yr)		1780.65	7361.57
Phosphorus Credit per Site (lbs/yr)		1.26	10.15
Nitrogen Credit per Site (lbs/yr)		5.70	53.23
Suspended Solids Credit per Site (lbs/yr)		1780.65	6955.66
		Reduction Totals	
TP Additional Reduction (lbs/yr)		9.48	9.5
TN Additional Reduction (lbs/yr)		51	51
TSS Additional Reduction (lbs/yr)		5,176	5,176

VRRM calcs have Gilmer Hall Renovation TP required reduction = 0.59 lb/yr, TP removed by pratice = 10.70 lbs/yr.

Proposed Septic Disconnections

Septic Disconnections

Site Name	Montesano	KCRC	
Date of Disconnection	Aug-24	Oct-24	
Building GSF	4,800	10,225.90	
Employees	17	16	
BMP TYPE (UVA Description)	Septic Disconnection	Septic Disconnection	
SWMF ID#	NA	NA	
Guidance Memo No. 20-2003 Method			
TN Reductions (lbs/TN/person/yr)	3.5	3.5	Reduction Totals
Maximum Phosphorus Reduction per Site (lbs/yr)	0.00	0.00	0.00
Maximum Nitrogen Reduction per Site (lbs/yr)	60	56	116
Maximum Suspended Solids Reduction per Site (lbs/yr)	0.00	0.00	0.00

Notes

1. Percent removal efficiency: TN=100%, TP & TSS = 0%.