Chesapeake Bay TMDL Action Plan

Permit No. VA0063177

2023-2028

Department of Public Utilities

Richmond, Virginia

August 27, 2026

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List of Abbreviations

Ac	acre(s)
BMP	best management practice
City	City of Richmond
CSS	combined sewer system
DEQ	Virginia Department of Environmental Quality
EOS	edge of stream
GIS	geographic information system
lb	pound(s)
lf	linear foot/feet
MS4	municipal separate storm sewer system
NLCD	National Land Cover Dataset
Plan	Chesapeake Bay TMDL Action Plan
POC	pollutant of concern
RCP	reinforced concrete pipe
TMDL	total maximum daily load
TN	total nitrogen
TP	total phosphorus
TSS	total suspended solids
USGS	United States Geological Survey
VESMP	Virginia Erosion and Stormwater Management Program
VPDES	Virginia Pollutant Discharge Elimination System
yr	year(s)

1. Preface

The City of Richmond (City) has developed this third permit term Chesapeake Bay Total Maximum Daily Load (TMDL) Action Plan (Plan) as required in the City's *Authorization to Discharge under the Virginia Pollutant Discharge Elimination System (VPDES) and the Virginia State Water Control Law* (Integrated Permit) (Permit No. VA0063177). Though the Integrated Permit encompasses requirements for the City wastewater, combined sewer, and municipal separate storm sewer systems (MS4), this Plan addresses discharges from only the MS4. It was developed according to the Virginia Department of Environmental Quality (DEQ) *Guidance Memo No. 20-2003 Chesapeake Bay TMDL Special Condition Guidance* (Guidance Document) dated February 6, 2021. This Plan is the third of three plans to be developed by the City over three permit terms to reduce the total nitrogen (TN) and total phosphorus (TP) loads from urban stormwater runoff. The previous plans included required reductions in total suspended solids (TSS); however, TSS reduction requirements were removed from the City's 2025 permit as outlined on Pages 5 and 6 of the VPDES Permit Fact Sheet.

The City is located within the James River Basin in central Virginia, and has a total land area of 40,011 acres, as shown in Figure 1-1. It is bordered by Chesterfield and Henrico Counties and is bisected by the James River. The City is located entirely within the 2010 US Census Urban Area named Richmond, Virginia.

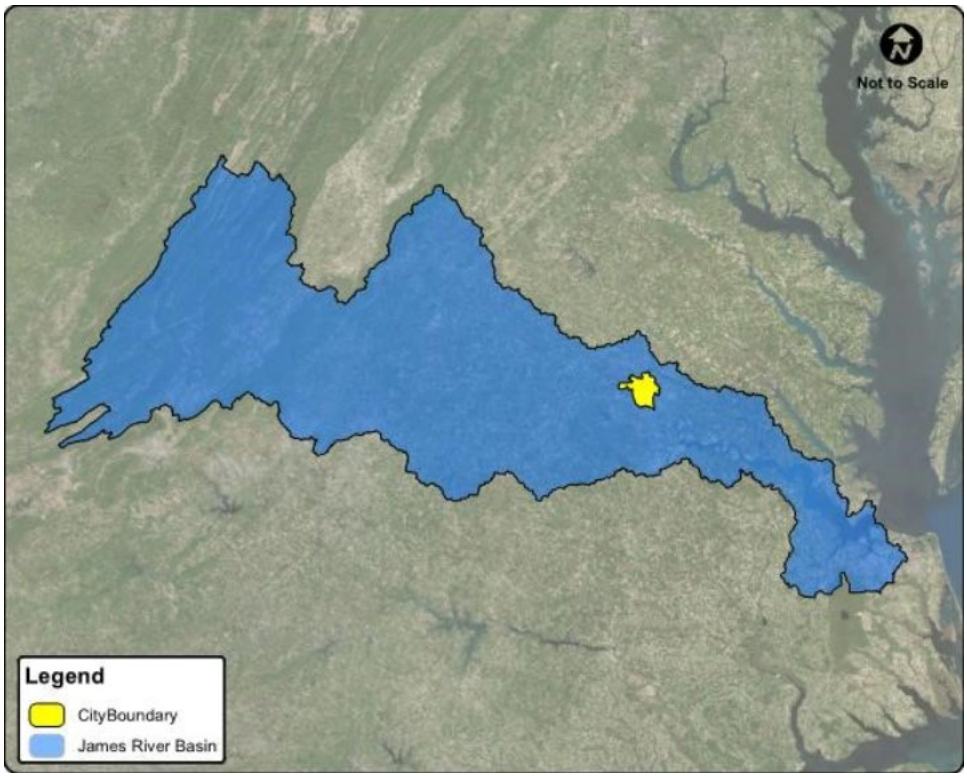

Figure 1-1. Richmond and the James River Basin.

The permit requires the Plan address the following requirements:

1. Documentation of new legal authorities used to meet the requirements of the Plan;
2. The load and cumulative reduction calculations for each river basin;
3. The total reductions achieved as of November 1, 2023, for each pollutant of concern;

4. A list of best management practices (BMPs) implemented prior to November 1, 2023, to achieve the reductions associated with the Chesapeake Bay TMDL;
5. The BMPs planned to be implemented within 60 months of the effective date of the permit to meet the cumulative reductions calculations in Part IV.F.2, F.3, and F.4 of the Integrated Permit; and
6. A summary of public comments received on the action plan and any revisions made to the Plan as a result of the comments.

Table 1-1 provides an overview of the Integrated Permit requirements and the corresponding section where the requirement is addressed.

Table 1-1. Overview of the Chesapeake Bay TMDL Action Plan Requirements Integrated Permit VA0063177 Part IV.F.11

Integrated Permit Part	Description of Requirement	Corresponding Section of this Plan
IV.F.11.a.(1)	New or modified legal authorities	Section 2
IV.F.11.a.(2)	Load & cumulative reduction calculations	Section 3
IV.F.11.a.(3)	Total reductions achieved as of November 1, 2023	Section 4
IV.F.11.a.(4)	BMPs implemented prior to November 1, 2023	Section 5
IV.F.11.a.(5)	BMPs to be implemented in the third permit term	Section 6
IV.F.11.a.(6)	Summary of public comments	Section 7

2. Part IV.F.11.a.(1): New or Modified Legal Authorities

Permit Language:

- ***Any new or modified legal authorities, such as ordinances, permits, policy, specific contract language, orders, and interjurisdictional agreements, implemented or needing to be implemented to meet the requirements of Part IV.F.2, F.3, and F.4.***

The Integrated Permit requires that the Plan document new or modified legal authorities, including ordinances, permits, policy, specific contract language, orders, and inter-jurisdictional agreements.

The City obtained an integrated permit from the Virginia Department of Environmental Quality, consolidating the VPDES regulatory requirements for the MS4, combined sewer system, wastewater system, and wastewater treatment plant. The effective date of the Integrated Permit is September 1, 2025, and it will expire on August 31, 2030. The combined permit simplifies reporting, including progress toward the Chesapeake Bay TMDL, and incorporates other elements from the Phase II MS4 permit previously held by the City.

No new legal authority is required to implement this Plan or meet the requirements described in the Integrated Permit.

3. Part IV.F.11.a.(2): Load & Cumulative Reduction Calculations

Permit Language:

- ***The load and cumulative reduction calculations for each river basin calculated in accordance with Part IV.F.2, F.3, and F.4.***

In accordance with the Integrated Permit and Guidance Document dated February 6, 2021, pollutant of concern (POC) loads and second permit required reductions were calculated from the City's MS4 service area and land cover as of June 30, 2009.

For the first permit term plan, titled *Chesapeake Bay TMDL Action Plan Permit No. VAR040005 2013-2018*, the MS4 service area was delineated from the City boundary and 2000 US Census Urban Area, excluding the combined sewer system (CSS) service area, other MS4 and VPDES permittees, forested areas, open water bodies, and areas of surface runoff away from the MS4. The City also evaluated areas of surface runoff into the MS4 and included these areas in its service area. For the second permit term, the MS4 service area was modified to remove areas outside the City that may flow into the MS4. This is due to their inclusion in the MS4 service areas of the neighboring counties, which led to double counting of loads and required reductions from these possible inflow areas to the City. There have been no changes in the service area for the third permit term.

After the MS4 service area was modified, the land cover characteristics as of June 30, 2009, were estimated, and POC loads and reduction requirements were modified to remove the inflow areas based upon the James River Basin rates provided in the Integrated Permit. Finally, additional loads from new sources were evaluated and the cumulative first, second, and third permit term required reductions were calculated. Each of these steps is described further in the following subsections.

3.1. Modification of the MS4 Service Area

As previously outlined, the MS4 service area was originally delineated using the 2000 US Census Urban Areas and the City boundary in the first permit term Plan. For the second permit term, the MS4 service area was required to be delineated with the 2010 US Census Urban Area boundary; however, because the City is entirely contained by both the 2000 and 2010 US Census Area, there were no associated changes to the extent of the MS4 service area as per to Guidance Document dated February 6, 2021.

As delineated for the City's first permit term Plan, the MS4 service area included inflow areas from Henrico and Chesterfield Counties. After further review during the second permit term Plan, it was determined that these areas were addressed in Chesapeake Bay TMDL Action Plans of those jurisdictions. Therefore, the inflow areas were removed from the City's MS4 service area to avoid double counting of nutrient load reduction responsibilities.

For the second permit term Plan, the MS4 service area calculations were modified from the first permit term Plan to remove the inflow areas, as shown in Table 3-1. The development of the exclusion areas is documented in the first permit term Plan.

There have been no changes in the service area for the third permit term. The final MS4 service area used in the POC load and required reduction calculations for the third permit term Plan is 21,380 acres.

Table 3-1. Areas of Inclusion and Exclusion from the MS4 Service Area	
Area Category	Area (Ac)
City of Richmond Boundary	40,011
Exclusion Areas (inside City boundary)	18,631
Inclusion Area (outside City boundary)	0
Total MS4 Service Area	**21,380**

3.2. Part IV.F.2: Existing Developed Lands

Permit Language:

- ***The permittee shall implement measures to reduce the load of total nitrogen and total phosphorus from existing developed lands served by the MS4 as of June 30, 2009, within the 2010 Census Urbanized Area by at least 100% of the Level 2 (L2) Scoping Run Reductions.***

3.2.1. Existing Source Loads

The baseline (2009) annual POC loading rates, as documented in the City first permit term Plan, were estimated by the Chesapeake Bay Program using the Phase 5.3.2 version of the Chesapeake Bay Watershed Model. The 2009 pervious and impervious land cover within the service area were previously estimated using the City's 2014 impervious land cover provided by the City GIS and the 2006 and 2011 United States Geological Survey (USGS) National Land Cover Dataset (NLCD) land cover GIS files in the first permit term Plan. The annual POC loads for the City were then calculated using the 2009 pervious and impervious lands cover conditions within the MS4 service area. No modifications have been made to this land cover methodology from the first permit term Plan.

2009 Pervious and Impervious Land Cover

The 2009 land cover characteristics were estimated from the 2014 impervious area land cover GIS file in the City and an estimate of the annual average change in land cover, which itself was derived from the 2006 and 2011 USGS NLCD GIS files. The impervious cover files were clipped to the MS4 service area, and the pervious cover was calculated as the remaining area, as shown in Figure 3-1 and Table 3-2.

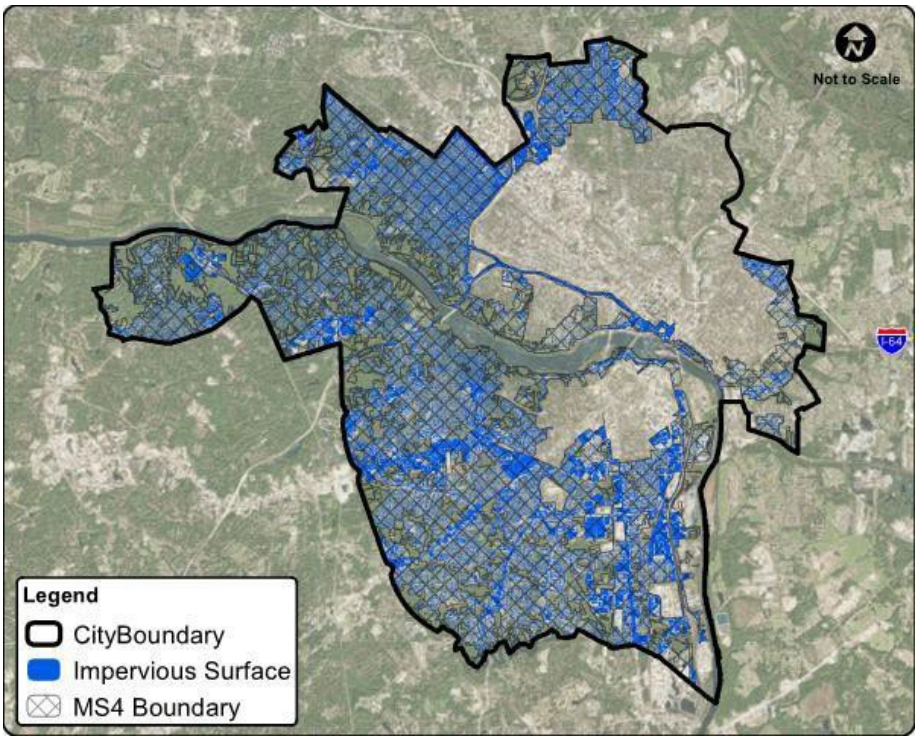

Figure 3-1. Impervious areas within the MS4 service area.

Table 3-2. MS4 Service Area Land Cover In 2009 and 2014

Land Cover	2014 MS4 Land Cover (ac)[a]	2006 NLCD Land Cover (ac)[b]	2011 NLCD Land Cover (ac)[b]	2006-2011 USGS Average Annual Change	Estimated 2009 MS4 Land Cover (ac)[c]
Impervious	7,378	5,799	5,953	0.144%	7,224
Pervious	14,002	15,544	15,390	-0.144%	14,156
Total Area	21,380	21,343	21,343		21,380

a. Impervious land cover from the City's GIS basemap dataset. Impervious land cover was digitized from aerial imagery.
b. Pervious and Impervious land covers calculated from USGS land cover raster imagery. Data resolution is a 30-meter grid.
c. Dataset is an estimate of the historical land cover. GIS datasets from 2009 were not available.

Annual POC Load Calculations – Existing Sources as of 2009

The MS4 service area defined in Section 3.1, and the land cover estimates described in Section 3.2.1, were used to calculate the annual pollutant loads under 2009 conditions. The annual pollutant loading rates are prescribed in the Integrated Permit by drainage basin. Pollutant loading rates have been defined for pervious and impervious urban lands for TN and TP at the edge of stream (EOS).

Table 3-3 presents the existing source loads for the City, within the James River Basin, as calculated from loading rates in Table 3 of the Integrated Permit. The existing source loads are 166,784 pounds per year (lb/yr) of TN and 19,792 lb/yr of TP.

Table 3-3: Existing (2009) Source Loads for the James River Basin					
Subsource	Pollutant	Total Existing Acres Served by MS4 (06/30/09)	2009 EOS Loading Rate (lb/Ac/yr)	Estimated Total POC Load Based on 2009 Progress Run (lb/yr)	Estimated Total POC Load (lb/yr)
Regulated Urban impervious	Total Nitrogen	7,224	9.39	67,833	166,784
Regulated Urban Pervious		14,156	6.99	98,951	
Regulated Urban impervious	Total Phosphorus	7,224	1.76	12,714	19,792
Regulated Urban Pervious		14,156	0.50	7,078	

Numbers may not sum due to rounding

3.2.2. Required Pollutant Reductions

The required reductions of POCs from existing (2009) sources in the Integrated Permit are consistent with the Chesapeake Bay TMDL and the Virginia Phase I, II, and III Watershed Implementation Plans, and are based on the Chesapeake Bay Watershed Model Phase 5.3.2 L2 scoping run for existing developed lands. The total required reductions from the annual pollutant loading rates vary for each pollutant and land cover. As specified in the Virginia Phase III Watershed Improvement Plan, the required third permit term pollutant reductions are an additional 60 percent of the total required reductions specified in the L2 scoping run. By October 31, 2028, a total of 100 percent of the total required reductions will be achieved. The City has identified projects to achieve the required pollution reductions for the third permit term as detailed in Sections 4, 5, and 6 of this Plan. The total required reductions per acre across all three permit terms for the James River Basin are identified in Table 3-4.

Table 3-4. Required POC Reduction Rates from Existing (2009) Sources for the James River Basin				
Subsource	Pollutant	2009 EOS Loading Rate (lb/ac/yr)[a]	Total Percent Required Reduction[b]	Total Required Reduction (lb/ac/yr)
Regulated Urban impervious	Total Nitrogen	9.39	9%	0.8451
Regulated Urban Pervious		6.99	6%	0.4194
Regulated Urban impervious	Total Phosphorus	1.76	16%	0.2816
Regulated Urban Pervious		0.5	7.25%	0.03625

a. Edge of stream loading rate based on the Chesapeake Bay Watershed Model Progress Run 5.3.2 as outlined in Table 3 of Part IV.F.2 of the Integrated Permit.

b. Percentage of MS4 required Chesapeake Bay total L2 loading reduction per Table 3 of Part IV.F.2 of the Integrated Permit.

Table 3-5 presents the City's required reductions from existing sources, as calculated from reduction rates in Table 3 of the City Integrated Permit. The total reductions required by the end of the third permit term for existing sources within the City are 12,042 lb/yr of TN and 2,547 lb/yr of TP.

Table 3-5. Third Permit Term Required Reductions from Existing (2009) Sources for the James River Basin

Subsource	Pollutant	Total Existing Acres Served by MS4 (06/30/09)	Total Required Reduction (lb/ac/yr)	Total Reduction Required Third Permit Term (lb/yr)	Total Reduction Required Third Permit Term (lb/yr)
Regulated Urban impervious	Total Nitrogen	7,224	0.8451	6,105	12,042
Regulated Urban Pervious		14,156	0.4194	5,937	
Regulated Urban impervious	Total Phosphorus	7,224	0.2816	2,034	2,547
Regulated Urban Pervious		14,156	0.03625	513	

Numbers may not sum due to rounding

3.3. Part IV.F.3: New Sources

Permit Language:

- ***No later than the expiration date of this permit, the permittee shall offset 100% of the increased loads from new sources initiating construction between July 1, 2009, and expiration date of this permit, and designed in accordance with 9VAC25-870 Part II C (9VAC25-870-93 et seq.) if the following conditions apply:***
    - ***a. The activity disturbed one acre or greater; and***
    - ***b. The resulting total phosphorous load was greater than 0.45 lb/acre/year, which is equivalent to an average land cover condition of 16% impervious cover.***

The City is required to provide additional POC load reductions for any project that meets the Part IV.F.3 criteria. Within the City, projects constructed between July 1, 2009, and July 1, 2014, may qualify as a new source. After July 1, 2014, projects were required to meet or exceed the Part IV.F.3 criteria through the City ordinance, regulations and requirements; therefore, construction projects during this period would not require additional pollutant load reductions under this Special Condition. For those projects initiating construction between July 1, 2009, and July 1, 2014, the aggregate accounting method was selected in the 2015 *Chesapeake Bay TMDL Action Plan* to determine the additional treatment requirements from new sources, as outlined in the Guidance Document dated February 6, 2021.

The additional POC reductions required by Part IV.F.3 were calculated using the steps described in the first permit term Plan. Tables 3-6 and 3-7 estimate the post-development POC loads and the estimated changes in loads from June 30, 2009, to July 1, 2014, for the updated MS4 service area modified in the second permit term Plan.

Table 3-6. Post-Development Conditions July 1, 2014				
Subsource	Pollutant	Total Existing Acres Served by the MS4 (07/01/14)	2009 EOS Loading Rate (lb/Ac)	Estimated Total POC Load as of 07/01/14
Regulated Urban Impervious	Total Nitrogen	7,378	9.39	69,279
Regulated Urban Pervious		14,002	6.99	97,874
Regulated Urban Impervious	Total Phosphorus	7,378	1.76	12,985
Regulated Urban Pervious		14,002	0.50	7,001

Table 3-7. Total Load Changes from New Sources between June 30, 2009, and July 1, 2014					
Subsource	Pollutant	Estimated Total POC Load as of 07/01/14 (lb/yr)	Estimated Total POC Load as of 06/30/09 (lb/yr)	Load Change (lb/yr)	Total Load Change (lb/yr)
Regulated Urban Impervious	Total Nitrogen	69,279	67,833	1,446	370
Regulated Urban Pervious		97,874	98,951	(1,077)	
Regulated Urban Impervious	Total Phosphorus	12,985	12,714	271	194
Regulated Urban Pervious		7,001	7,078	(77)	

Numbers may not sum due to rounding

Next, the best management practices (BMPs) that were implemented between June 30, 2009, and July 1, 2014, were evaluated to determine the total treatment provided. Per the 2015 *Chesapeake Bay TMDL Action Plan*, the total POC reduction from BMPs is 59.90 lb for TN and 15.40 lb for TP. The POC reduction from BMPs was subtracted from the total change in loads, as shown in Table 3-8. The associated list of BMPs was provided in Appendix D of the first permit term plan, titled *Chesapeake Bay TMDL Action Plan Permit No. VAR040005 2013-2018.*

Table 3-8. Net Load Change (Total Load Change Minus Reductions from Implemented BMPs)			
Pollutant	Total Load Change (lb/yr)	Reductions from On-site BMPs (lb/yr)	Net Load Change (lb/yr)
Total Nitrogen	370	60	310
Total Phosphorus	194	15	179

Numbers may not sum due to rounding

The City is required to treat the entire net load change to the maximum extent practicable during the three permit terms in 5 percent, 35 percent, and 60 percent increments. In the current (third) permit term, the City is required to offset a cumulative 100 percent of the net load change to the maximum extent practicable (Table 3-9) associated with new sources. The method utilized by the City to achieve the required reductions is discussed in Section 4.

Table 3-9. Additional Reductions Required During Third Permit Term

Pollutant	Net Load Change (lb/yr)	Required Reduction during Third Permit Term
Total Nitrogen	310	100%
Total Phosphorus	179	100%

3.4. Part IV.F.4: Grandfathered Projects

Permit Language:

- ***No later than the expiration date of this permit, the permittee shall offset the increased loads from projects grandfathered in accordance with 9VAC25-870-48 that began construction after July 1, 2014, if the following conditions apply:***
    - ***a. The activity disturbs one acre or greater; and***
    - ***b. The resulting total phosphorous load was greater than 0.45 lb/acre/year, which is equivalent to an average land cover condition of 16% impervious cover.***

The City is required to provide additional pollutant load reductions for any project that meets the Part IV.F.4 requirements prior to the project construction completion. The reduction requirement is calculated as the difference between (1) the post-development loading rate; and (2) the loading rate associated with sixteen percent impervious cover.

The City revised its Virginia Erosion and Stormwater Management Program (VESMP) requirements to meet the 16 percent impervious land cover requirements for the design of post-development stormwater management facilities in 2009. Since the requirements were revised in 2009, the City does not anticipate that any construction projects would require any additional permit loads reductions under Part IV.F.4.

3.5. Cumulative First, Second, and Third Permit Term Required Reductions

The total required reductions by the end of the third permit term are the combined total POC loads from existing developments and new sources for the first, second, and third permit terms. The cumulative required reductions through the third permit term are 12,352 lb of TN and 2,726 lb of TP, as shown in Table 3-10.

Table 3-10. Total Reductions Required Through Third Permit Term

Pollutant	Baseline Required Reductions (lb/yr)	Required Reductions from New Sources (lb/yr)	Required Reductions from Grandfathered Projects (lb/yr)	Total Third Permit Term Required Reductions (lb/yr)
Total Nitrogen	12,042	310	0	12,352
Total Phosphorus	2,547	179	0	2,726

4. Part IV.F.11.a.(3): Total Reductions Achieved as of November 1, 2023

Permit Language:

- ***The total reductions achieved as of November 1, 2023, for each pollutant of concern in each river basin.***

The following five projects and programs were completed prior to November 1, 2023:

- Maury Cemetery stream restoration;
- Cherokee Lake wet pond enhancement;
- Forest Hill Park wet pond retrofit;
- Little Westham Creek stream restoration; and
- Pocosham Creek stream restoration.

The nutrient annual load reductions from these projects are summarized and shown in Table 4-1. Project locations are identified in Appendix A.

Table 4-1. Reductions for Projects Completed Before November 1, 2023

Project	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)
Cherokee Lake wet pond enhancement	872	198
Forest Hill Park wet pond retrofit	1,354	299
Maury Cemetery stream restoration	894	176
Little Westham Creek stream restoration	4,073	1,590
Pocosham Creek stream restoration	4,395	880
Total Pollutant Removal (lb /yr)	**11,588**	**3,143**

Numbers may not sum due to rounding

5. Part IV.F.11.a.(4): BMPs Implemented Prior to November 1, 2023

Permit Language:

- ***A list of BMPs implemented prior to November 1, 2023, to achieve reductions associated with the Chesapeake Bay TMDL, including:***
    - ***a. The date of implementation; and***
    - ***b. The reductions achieved.***

5.1. Maury Cemetery Stream Restoration

The Maury Cemetery Stream Restoration project, located in the City's Maury Cemetery, restored approximately 1,950 lf of stream channel. The project is bounded to the north by Maury Street, to the south by North Hopkins Road, to the east by an existing CSX railroad, and to the west by Maury Cemetery. The restoration, completed in May 2018, improved the overall function of the Maury Cemetery Stream by preventing erosion, restoring habitat, and improving the water quality in the stream. The approximate project location is shown in Figure 5-1.

Figure 5-1. Approximate location of the Maury Cemetery Creek stream restoration.

Following the development of the 2015 *Chesapeake Bay TMDL Action Plan*, the City re-calculated the pollutant removal using the four Stream Restoration Protocols approved by the Chesapeake Bay Program. The 2014 Protocols are described in the report *Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects* dated September 8, 2014, which was the most recent version of the Stream Restoration Protocols at the time of evaluation and reported to DEQ:

- Credit for prevented sediment during storm flow (Protocol 1)

- Credit for in-stream and riparian nutrient processing within the hyporheic zone during base flow (Protocol 2)
- Credit for floodplain reconnection volume (Protocol 3)

Using the approved methods to determine the credit for each protocol, it is estimated that the restored stream will remove 894 lb/yr of TN and 176 lb/yr of TP as shown in Table 5-1.

Table 5-1. Pollutant Removal Calculations for Maury Cemetery Stream Restoration

Pollutant	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)
Protocol 1	382	176
Protocol 2	510	0
Protocol 3	2.08	0.22
Total Pollutant Removal (lb/yr)	**894**	**176**

Numbers may not sum due to rounding

5.2. Cherokee Lake Wet Pond Enhancement

Cherokee Lake is a large detention reservoir in the northwest portion of the City. It collects runoff from 351 acres, which is composed primarily of managed turf (292 acres) and some impervious area (59 acres), and discharges to the James River. The approximate project location is included in Figure 5-2.

Figure 5-2. Cherokee Lake wet pond enhancement project location

The existing pond was built before 2006 and was not constructed to the current DEQ BMP Clearinghouse specifications. However, the pond was considered to provide some water quality

treatment. It was retrofitted to a Level 2 Wet Pond in 2013 and 2016 with the addition of forebays to provide extended detention.

To calculate the amount of nutrient removal prior to the enhancements, the unimproved reservoir was treated as a wet pond. However, due to the absence of a riser/low-flow orifice and a forebay, the treatment efficiencies for the existing pond were reduced by 20 percent. The nutrient removal credit claimed by the City is the difference between the pollutant reductions of the enhanced Level 2 Wet Pond minus the existing pollutant removal (Brown and Caldwell, 2018). The calculations are summarized in Table 5-2.

Table 5-2. Pollutant Removal Calculations for Cherokee Lake Wet Pond Enhancement

Pollutant	Removal Efficiency of Existing BMP	Downward Modification	Actual Removal Efficiency of Existing BMP	Untreated Load (lb/yr)	Load Removed by Existing Practice (lb/yr)	Load Removed by Level 2 Wet Pond (lb/yr)	Load Removed by Retrofit (lb/yr)
Total Nitrogen	20%	20%	16%	3,635	582	1,454	872
Total Phosphorus	45%	20%	36%	508	183	381	198

Numbers may not sum due to rounding

5.3. Forest Hill Park Wet Pond Retrofit

Forest Hill Park Lake collects stormwater runoff from 2,688 acres and discharges to the James River. The lake is located north of Forest Hill Avenue and south of the James River. The approximate project location is included in Figure 5-3.

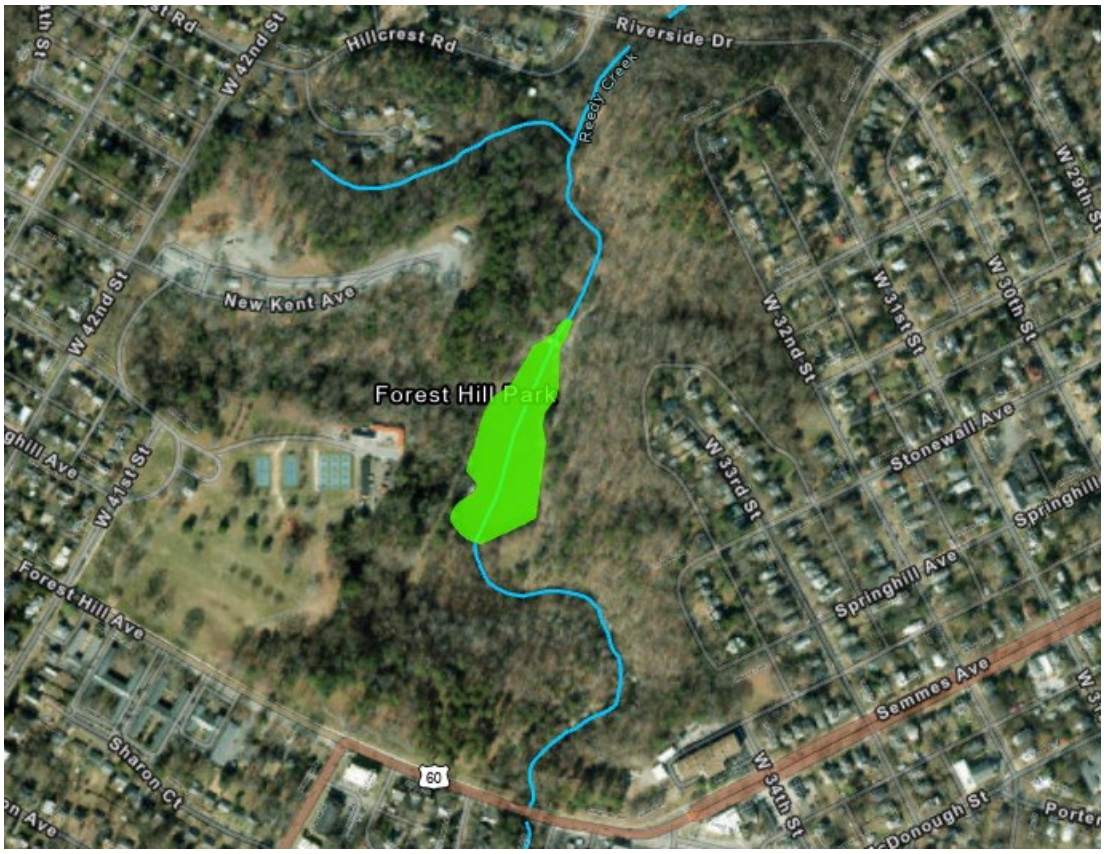

Figure 5-3. Forest Hill wet pond retrofit project location

The lake, which was built in 2009, was completely silted when the site was selected to be retrofit. Therefore, the pre-retrofit pollutant reduction was considered to be zero. In 2010, the lake was dredged, and construction of forebays and an adjacent wetland area was completed in the fall of 2010. Based on the volumetric capacity of the new wet pond and wetlands, the combined system can treat 430 acres. The pollutant removal efficiency of the pond is based on that of a Level 1 Wet Pond. Therefore, the retrofitted system can remove 1,354 lb/yr TN and 299 lb/yr TP, (Brown and Caldwell, 2018), as shown in Table 5-3.

Table 5-3. Pollutant Removal Calculations for Forest Hill Park Wet Pond Retrofit

Pollutant	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)
Pollutant Removal (lb/yr)	**1,354**	**299**

5.4. Little Westham Creek Stream Restoration

Little Westham Creek is located on the campus of the University of Richmond, as shown in Figure 5-4. The project site is bounded by River Road to the south, the Country Club of Virginia-Westhampton to the east, Westhampton Way to the north, and the University of Intramural Fields on UR Drive to the west. The drainage area for this stream is regulated urban and forested land and lies within the city's regulated area. The stream restoration is part of a larger restoration project called the Gambles Mill Eco-Corridor, which includes several initiatives implemented by or in partnership with the University of Richmond. The Eco-Corridor also includes a walking trail and educational signage, a meadow with native plant species, and a stormwater demonstration area with a bioswale, rain garden, and level spreaders. The site also functions as a working classroom for students. Pre- restoration conditions of the stream, including an outfall (left) and an old, exposed wastewater pipe (right) are depicted in Figure 5-5.

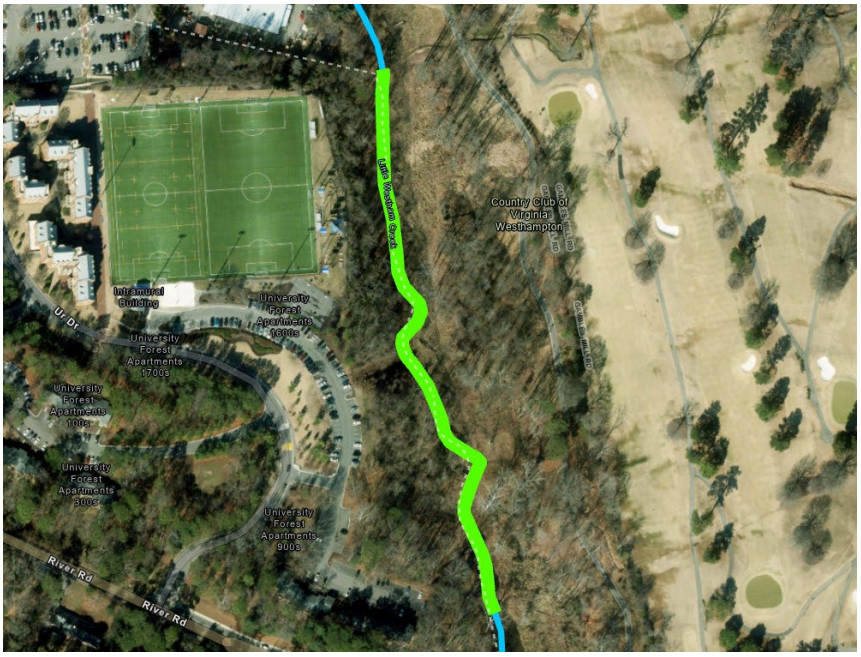

Figure 5-4. Approximate location of the Little Westham Creek stream restoration project

Figure 5-5. Pre-restoration images of Little Westham Creek.

The stream restoration was completed in 2019. The project restored 2,100 lf of stream, with a total approximate drainage area of 3.5 square miles. The credit for the project was calculated using the 2014 Stream Restoration Protocols, the 2019 *Recommended Methods to Verify Stream Restoration Practices Built for Pollutant Crediting in the Chesapeake Bay Watershed*, and the 2020 *Consensus Recommendations for Improving the Application of the Prevented Sediment Protocol for Urban Stream Restoration Projects Built for Pollutant Removal Credit*. The pollutant removal achieved through each Protocol is summarized in Table 5-4 below.

Table 5-4. Pollutant Removal Calculations for Little Westham Creek Stream Restoration

Pollutant	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)
Protocol 1	3,452	1,590
Protocol 2/3	621	N/A
Total Load Reductions (lb/yr)	**4,073**	**1,590**

Annual inspections of post-restoration conditions for Little Westham Creek are monitored through site photography, BEHI assessments, and post-construction surveys.

5.5. Pocosham Creek Stream Restoration

The Pocosham Creek stream restoration project is located on a tributary of Pocoshock Creek that flows into Falling Creek, which flows to the James River. The unnamed tributary, near Pocosham Drive, drains approximately 3,606 acres of mostly suburban and forest lands in the southwestern part of the City, west of the James River. Approximately half of the watershed is located within the City

limits, and the other half is in Chesterfield County[1]. The restoration project restored 5,474 lf of stream channel. The project location is shown in Figure 5-6.

Figure 5-6. Approximate location of the Pocosham Creek stream restoration.

The project included repairs to eroding sections of the creek and the addition of a bankfull floodplain bench to reduce velocities and erosion. The pre-restoration conditions of the channel are depicted in Figure 5-7. In-stream structures, such as cross vanes, j-hook vanes, and vanes were implemented to improve stability and create and enhance habitat within the creek corridor. The project also incorporates walking trails to improve access and amenities in Pocosham Park. Construction was completed in early 2019.

[1] Virginia Department of Environmental Quality, Division of Water Permitting, 2021. Guidance Memo No. 20-2003 – Chesapeake Bay TMDL Special Condition Guidance, Part III.2.b *"Permittees may receive full credit (100%) for the proportion of regulated land (i.e. permittees' MS4, other MS4s and/or Industrial Stormwater permitted land) that drains to a stream restoration project…"* available at https://townhall.virginia.gov/L/ViewGDoc.cfm?gdid=6960

Figure 5-7. Images of pre-restoration condition of Pocosham Creek stream channel.

Using the 2014 Stream Restoration Protocols, the pollutant reductions from the restored stream are 4,395 lb/yr TN and 880 lb/yr TP, as shown in Table 5-5.

Table 5-5. Pollutant Removal Calculations for Pocosham Creek Stream Restoration

Pollutant	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)
Protocol 1	1,946	876
Protocol 2	2,409	0
Protocol 3	40	3.56
Pollutant Removal (lb/yr)	**4,395**	**880**

Credits amounts adjusted per final design and as-builts. Numbers may not sum due to rounding

6. Part IV.F.11.a.(5): BMPs to be Implemented in the Third Permit Term

Permit Language:

- ***The BMPs to be implemented by the permittee within 60 months of the effective date of this permit to meet the cumulative reductions calculated in Part IV.F.2, F.3, and F.4, including as applicable:***
  - ***(a) Type of BMP;***
  - ***(b) Project name;***
  - ***(c) Location;***
  - ***(d) Percent removal efficiency for each pollutant of concern; and***
  - ***(e) Calculation of the reduction expected to be achieved by the BMP calculated and reported in accordance with the methodologies established in Part IV.F.9 for each pollutant of concern.***

The City has identified two projects to achieve the remaining required reductions by October 31, 2028:

- Pine Camp Creek stream restoration
- Broad Rock Creek stream restoration

The Pine Camp Creek stream restoration was completed after November 1, 2023 (the effective date of the third permit term), while the Broad Rock Creek stream restoration is anticipated to be completed by October 31, 2028. Each project location is identified in Appendix A. As stream restoration projects generally do not have defined percent removal efficiencies, reductions are quantified in lbs/yr in accordance with the methodologies established in Part IV.F.8[2] of the City's integrated permit for each pollutant of concern. Alternative projects may be substituted during the current permit term at the City's discretion to achieve the required POC reductions.

6.1. Pine Camp Creek Stream Restoration

Pine Camp Creek references an unnamed tributary located behind the Pine Camp Arts and Community Center on the northern side of Richmond. The project stabilized and restored 1,694 lf of stream between Old Brook Road and the confluence with Horse Creek, which flows to the Chickahominy River. The forested land around the creek is visited by frequently students from a nearby middle and high school, as well as residents from the surrounding neighborhoods for education and recreation. The restoration site receives drainage from approximately 198 acres of forested, turf, and impervious lands. All developed land that drains to the site is part of the City's MS4 service area.

[2] As Part IV.F.9 does not establish methodologies for calculating and reporting loading and reduction values, the City calculates and reports reductions consistent with Part IV.F.8: *"Loading and reduction values greater than or equal to 10 pounds calculated in accordance with Part IV.F.2, F.3, and F.4 shall be calculated and reported to the nearest pound without regard to mathematical rules of precision. Loading and reduction values of less than 10 pounds reported in accordance with Part IV.F.2, F.3, and F.4 shall be calculated and reported to two significant digits."*

Prior to the restoration, the condition of the stream showed signs of bank erosion. Improvements focused on addressing these issues, as well as water quality improvement. Restoration for the stream channel also addressed pipe separation and failure of a 60" RCP stormwater pipe located on Old Brook Road. The approximate project drainage area and location are shown in Figures 6-1 and 6-2.

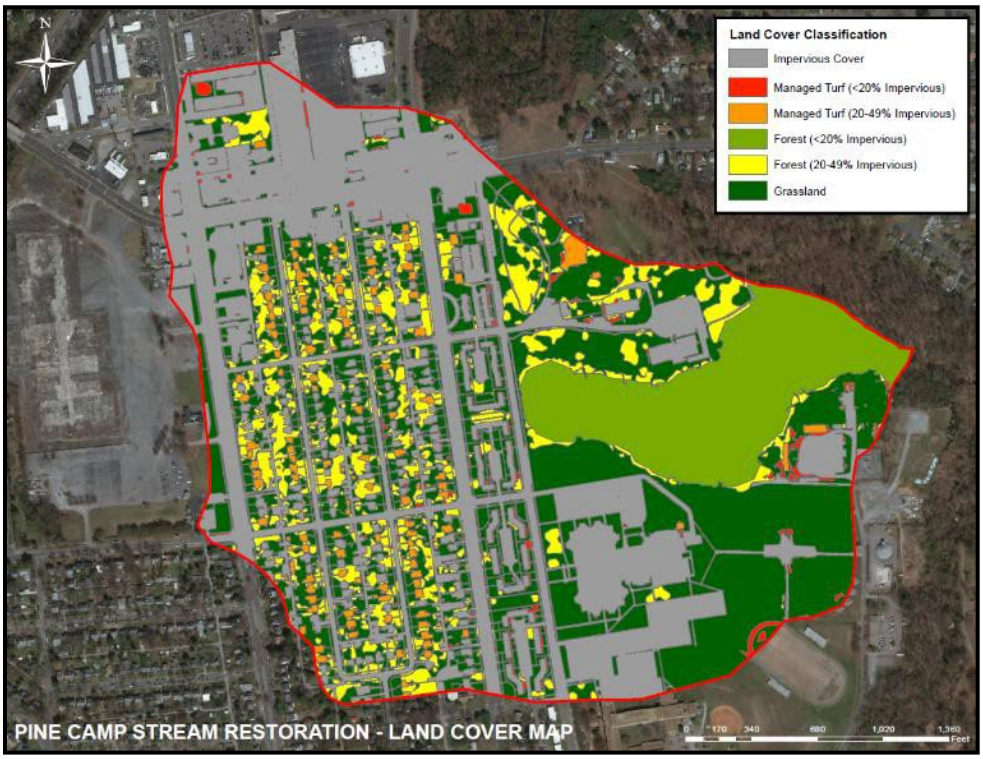

Figure 6-1. Drainage area and land coverage contributing to Pine Camp Creek stream.

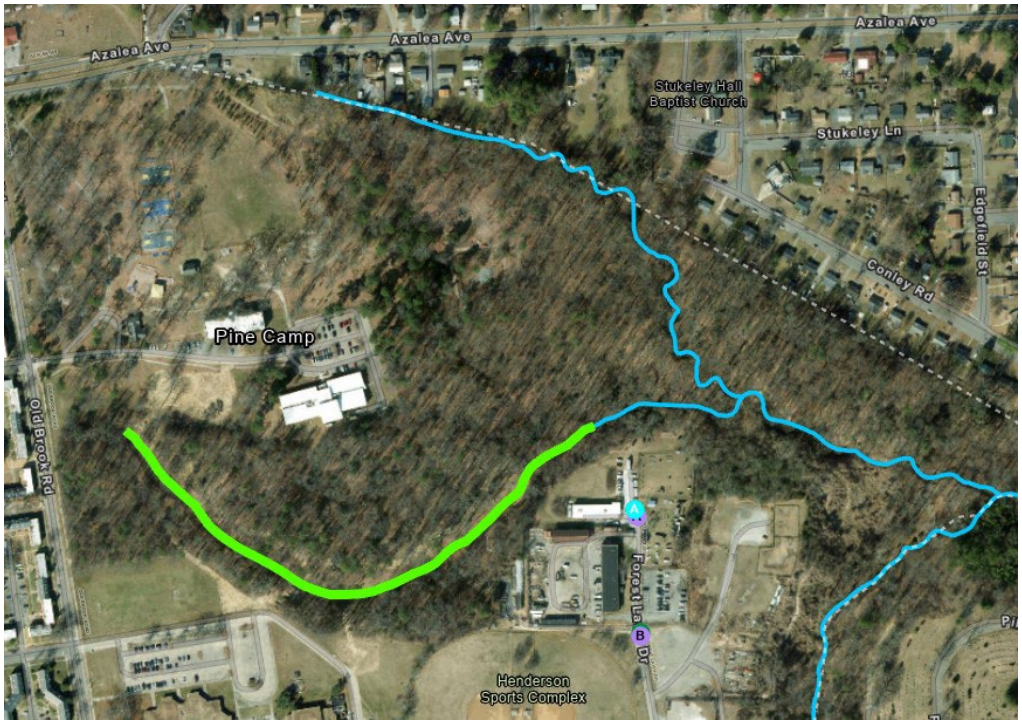

Figure 6-2. Approximate location of the Pine Camp Creek stream restoration.

The project employed natural channel design practices to emphasize contribution to stream functional improvements while reducing stormwater pollutants. Images in Figure 6-3 display the pre-existing conditions of the unnamed tributary, including debris build-up and bank erosion.

Figure 6-3. Pre-restoration condition of Pine Camp Creek stream channel.

The stream restoration efforts involved step-pools/plunge pools for energy dissipation at pipe outfalls into the creek, a series of step-pools in a steep section of the creek, wetland areas on a floodplain bench downstream, and increased sinuosity and vegetative cover throughout the stream reach. These natural channel design techniques were intended to provide pollutant abatement; improve water quality and diversity of aquatic habitat area; and reduce bank erosion.

Using the 2014 Stream Restoration Protocols and the *Recommendations for Crediting Outfall and Gully Stabilization Projects in the Chesapeake Bay Watershed* expert panel report dated October 15, 2019, the pollutant reductions from the restored stream are 598 lb/yr of TN and 279 lb/yr of TP, as shown in Table 6-1.

Table 6-1. Pollutant Removal Calculations for Pine Camp Creek Stream Restoration

Pollutant	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)
Protocol 1	592	277
Protocol 5	5.09	2.50
Pollutant Removal (lb/yr)	**598**	**279**

Credit amounts adjusted per final design and as-builts. Numbers may not sum due to rounding

The project design was completed in November 2020 and construction was completed in November 2025.

6.2. Broad Rock Creek Stream Restoration

The Broad Rock Creek Stream Restoration project is located along a portion of both Broad Rock Creek and Goode Creek, with the latter tributary flowing into the James River. The drainage basin for the project is approximately 2,456 acres of mostly urban developed land cover. The project intends to restore a combined 2,100 linear feet of Broad Rock Creek and Goode Creek. The stream restoration project is part of a park revitalization project that includes better stream connectivity for park goers. The project location is shown in Figure 6-4.

Figure 6-4. Approximate Location of the Broad Rock Creek stream restoration

The project includes repairs to eroding sections of the creek and the addition of a bankfull floodplain bench to reduce velocities and erosion. The pre-restoration conditions of the channel are depicted in Figure 6-5. The existing streams exhibit signs of scour and sections of steep embankment slopes. Sporadic outcroppings of bedrock are also present. A significant area immediately surrounding the streams and the confluence contains bamboo that is being systematically removed to best preserve the existing stream embankments and support new riparian restoration.

In-stream grade-control structures may be implemented to improve stability and enhance habitat within the creek corridor, though the design intends to use the existing bedrock and boulder features as much as possible. A concurrent adjacent park restoration project also incorporates walking trails to improve access and amenities in Broad Rock Creek Park.

Figure 6-5. Downstream View of Broad Rock Creek

Using the 2021 *Unified Guide for Crediting Stream and Floodplain Restoration Projects in the Chesapeake Bay Watershed*, the pollutant reductions from the restored stream are forecasted to be 812 lbs/yr TN and 204 lbs/yr TP, as shown in Table 6-2.

Table 6-2. Pollutant Removal Calculations for Broad Rock Creek Stream Restoration

Pollutant	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)
Protocol 1	693	204
Protocol 2	119	-
Protocol 3	TBD	TBD
Pollutant Removal (lb/yr)	**812**	**204**

The Broad Rock Creek stream restoration is anticipated to be completed by October 31, 2028.

6.3. Cumulative Pollutant Load Reductions

POC load reductions from the projects completed prior to November 1, 2023, and the two projects completed or anticipated to be complete by October 31, 2028, are summarized in Table 6-3, along with the total pollutant load reductions from all projects completed or planned to date.

Table 6-3. Pollutant Reduction Credits for Projects Completed Through The Third Permit Term		
Project	Total Nitrogen (lb/yr)	Total Phosphorus (lb /yr)
Projects Completed Before November 1, 2023	11,588	3,143
Pine Camp Creek stream restoration	598	279
Broad Rock Creek stream restoration	812	204
Total	**12,998**	**3,626**

Numbers may not sum due to rounding

Completed projects meet the required nutrient reductions for the first and second permit terms, and the projects the City plans to complete before the end of the third permit term will meet the requirements of the third permit term. Table 6-4 shows credits achieved for each permit term. Cherokee Lake, Forest Hill Park, and Maury Cemetery were completed prior to July 1, 2018, and meet the 5% nutrient reduction requirement for the Phase 1 action plan. Little Westham Creek and Pocosham Creek were completed prior to November 1, 2023, and provide additional nutrient reductions to meet the 40% nutrient reduction requirements for the Phase 2 action plan. Pine Camp Creek stream restoration is complete, and the City plans to complete Broad Rock Creek stream restoration by October 31, 2028. The completion of these two projects will meet the 100% nutrient reduction requirements for the Phase 3 action plan.

Table 6-4. First, Second, and Third Permit Term Pollutant Reduction Requirements and Credits		
Project	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)
Reductions Required Prior to July 1, 2018 (5%)*	618	136
Reductions Achieved Prior to July 1, 2018	3,120	673
Reductions Required Prior to November 1, 2023 (40%)	4,941	1,090
Reductions Achieved Prior to November 1, 2023	11,588	3,143
Reductions Required Prior to November 1, 2028 (100%)	12,352	2,726
Reductions to be Achieved Prior to November 1, 2028	12,998	3,626

Numbers may not sum due to rounding

* The original Phase 1 action plan estimated slightly higher required reductions because it included inflow from outside of the City. This inflow was removed from the calculations in the Phase 2 action plan, as described in Section 3.1 above.

In addition to the projects described in this Plan, the City may complete one or two additional projects by October 31, 2028, in order to exceed the minimum required Chesapeake Bay pollution reductions. Any reductions in excess of the 100% cumulative Chesapeake Bay Special Condition requirement, whether identified in this TMDL Action Plan or reported to DEQ in future Integrated CSS and MS4 Annual Reports, will be applied to any reductions required by future TMDL, implementation plan, or MS4 permit condition.

7. Part IV.F.11.a.(6): Public Comments

Permit Language:

- ***A summary of any comments received as a result of public participation required in Part IV F 13[3], the permittee's response, identification of any public meetings to address public concerns, and any revisions made to Chesapeake Bay TMDL action plan as a result of public participation.***

The City made its draft third term Chesapeake Bay TMDL Action Plan available for public comment on the MS4 website from August 6th, 2026, until August 22nd, 2026. The City also hosted a public hearing on the Action Plan on August 19th, 2026. The City announced the public comment period and public hearing on the City's MS4 website and in the Richmond Times-Dispatch. Publication is confirmed by the publisher's advertising affidavit, newspaper reference number 0001571211. No comments were received during the comment period.

[3] The City's integrated permit does not include a Part IV.F.13. The public comment period was conducted consistent with Part IV.F.12: *"Prior to submittal of the action plan required in Part IV.F.11.a, the permittee shall provide an opportunity for public comment for no fewer than 15 days on the additional BMPs proposed in the third phase Chesapeake Bay TMDL action plan."*

References

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RES. Little Westham Creek – Year 5 Verification Report. August 12, 2024

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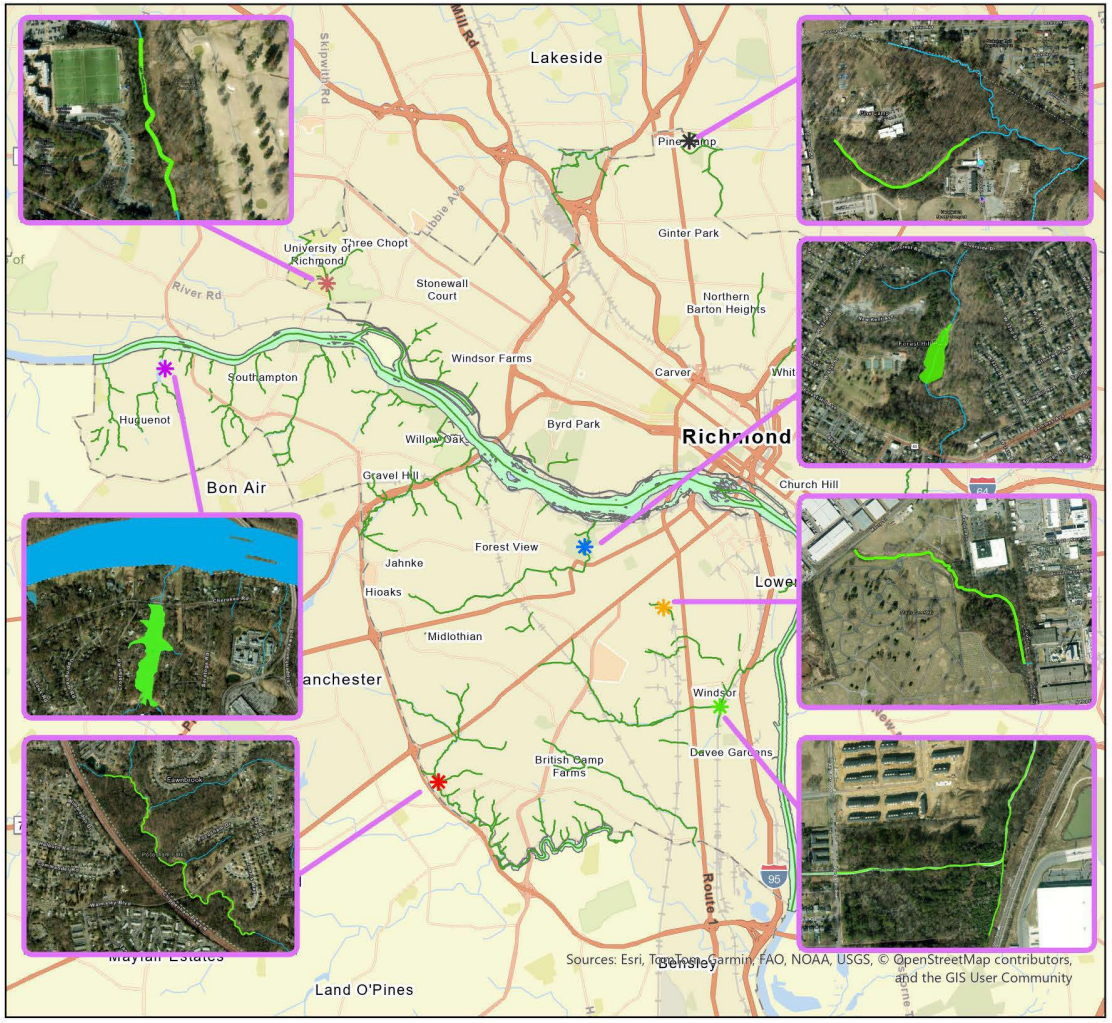
Wood, David, et al. A Unified Guide for Crediting Stream and Floodplain Restoration Projects in the Chesapeake Bay Watershed, Chesapeake Bay Program, August 18, 2021

Appendix A: Project Map



City of Richmond

Projects Completed Through Third Permit Phase

N
W E
S

Legend

Projects

Name

- Pocosham Creek
- Broad Rock Creek
- Cherokee Lake
- Forest Hill Park
- Little Westham Creek
- Maury Cemetery Creek
- Pine Camp Creek
- Stream
- Water Features