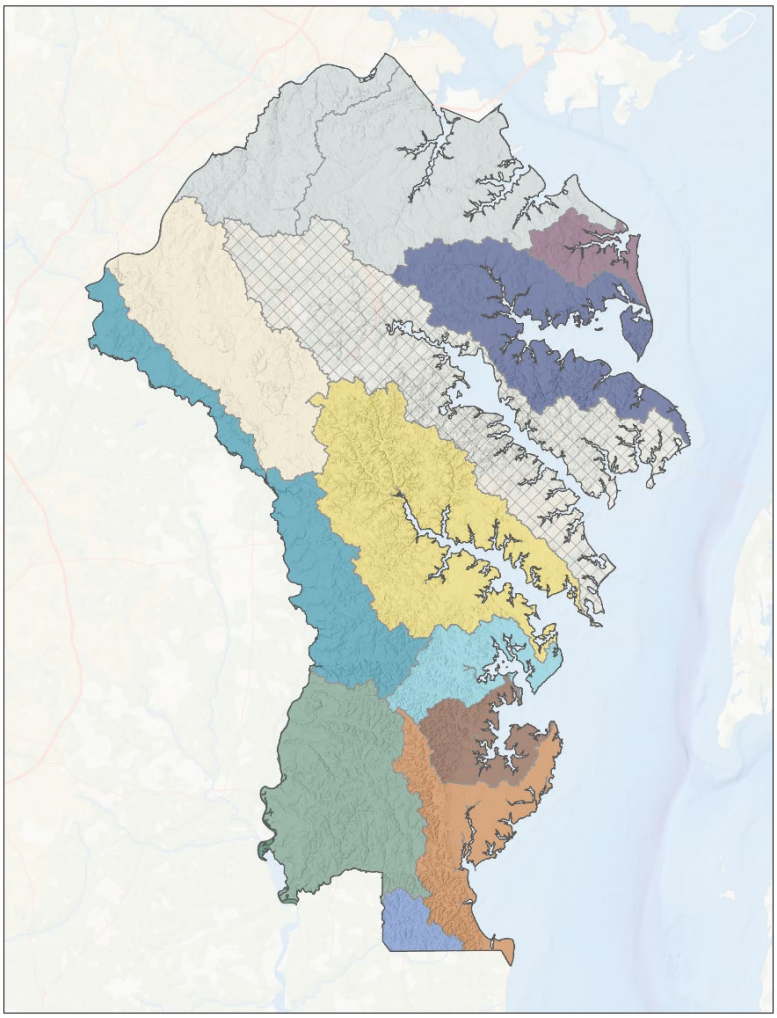
Anne Arundel Countywide TMDL Stormwater Implementation Plan

FY 25 Annual Progress Report - December 2025



Anne Arundel County
Bureau of Watershed
Protection
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FY 25 Annual Progress Report

December 2025

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Bureau of Watershed Protection and Restoration

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Definitions of Key Terms

Anne Arundel County Watershed Stewards Academy	A non-profit organization that builds capacity in Anne Arundel County by training Master Watershed Stewards to help neighbors reduce pollution in our local creeks and rivers.
Backcasting	A method developed by Baltimore County and approved by Maryland Department of Environment to 'translate' historical land cover datasets to a format consistent with Phase 6 Chesapeake Bay Watershed Model land cover classes. This allows the most accurate estimation of land cover and loads at the baseline year for each TMDL and ensures baseline loads are not over or underestimated.
Baseline Load	A Baseline load is a pollutant load estimate for each TMDL watershed at baseline year conditions. Baseline loads are estimated as the sum of land use loads minus any reductions from BMPs that were installed in or before the baseline year.
Baseline Year	The baseline year is the bench mark year from which progress in reducing pollutant loads is assessed.
Bay segment	Bay segments are geographical areas of the Chesapeake Bay as defined within the Phase 5 Chesapeake Bay Model.
BMP	A watershed Best Management Practice that is used to reduce and control stormwater and associated pollution.
Chesapeake Bay Program	A regional partnership that directs and conducts the restoration of the Chesapeake Bay.

Chesapeake Bay Conservancy	A non-profit organization that works to conserve and restore the natural and cultural resources of the Chesapeake Bay watershed. The Conservancy also develops geospatial datasets such as land cover.
CIP	The Capital Improvement Program of Anne Arundel County Government.
EPA	The United States Environmental Protection Agency.
Interim Programmed Reduction	Load reduction, expressed as either lbs, counts, or percent, which are achieved from BMPs that are under a design contract and have reached the 30% design stage.
MDE	The Maryland Department of the Environment.
MDNR	The Maryland Department of Natural Resources.
MS4	MS4, or Municipal Separate Storm Sewer System, is a conveyance or system of conveyances owned by a state, city, town, village, or other public entity that discharges stormwater to Waters of the United States.
National Land Cover Database	Nationwide data on land cover data at a 30m resolution produced by the Multi-Resolution Land Characteristics (MRLC) Consortium.
NPDES	NPDES, or the National Pollutant Discharge Elimination System, is an EPA program that addresses water pollution by regulating point sources that discharge pollutants to Waters of the United States.

Planned Reduction	Load reduction, expressed as either lbs, counts, or percent, which are achieved from BMPs that are either not under a design contract or have not yet reached the 30% design stage.
Progress	Progress, in the context of TMDLs, is the cumulative amount of pollutant reduction, measured in lbs, counts, or percent, which the County has achieved to attain a Stormwater Wasteload Allocation for a given pollutant.
Progress Reduction	Cumulative load reductions, expressed as either lbs, counts, or percent, which are achieved via stormwater BMP implementation through the end of the current fiscal year.
SW-WLA	SW-WLA, or a Stormwater Wasteload Allocation, is the maximum load of pollutants originating from the stormwater sector that is allowed to be discharged to Waters of the United States.
Target Date	The target date when the Stormwater Wasteload Allocation is expected to be met.
TIPP	TIPP, or the TMDL Implementation Progress and Planning tool, is used to estimate baseline loads and reductions from BMPs to meet stormwater waste load allocations. The TIPP tool was created by the Maryland Department of the Environment.
TMDL	A TMDL, or Total Maximum Daily Load, is a calculation of the maximum amount of a pollutant that is allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards and support the waterbodies designated uses.
WIP	WIP, or Watershed Implementation Plan, is a roadmap of how a jurisdiction will achieve its Stormwater Wasteload allocations.

I. Background

Maryland Department of Environment (MDE) issued NPDES Permit No. 20-DP-3316 to Anne Arundel County on November 5, 2021. Part IV.F.3 of this permit requires Anne Arundel County to annually submit a Countywide Stormwater Total Maximum Daily Load (TMDL) Implementation Plan (Countywide Plan) that documents progress toward meeting all TMDLs with Stormwater Wasteload Allocations (SW-WLAs). The Countywide Plan represents Anne Arundel County's roadmap to achieve SW-WLAs for each TMDL and ultimately the progress towards attaining water quality criteria ensuring that each waterbody supports its designated uses. The Countywide Plan must be approved by MDE and must include the following:

- A summary of all completed BMPs, programmatic initiatives, alternative control practices, or other actions implemented for each TMDL stormwater WLA;
- An analysis and table summary of the net pollutant reductions achieved annually and cumulatively for each TMDL stormwater WLA;
- An updated list of proposed BMPs, programmatic initiatives, and alternative control practices, as necessary, to demonstrate adequate progress toward meeting the Department's approved benchmarks and final stormwater WLA implementation dates.

II. Introduction

A. Chesapeake Bay TMDL and Progress Modeling Approach

The Chesapeake Bay TMDL was approved on December 29, 2010 and applies to all of Anne Arundel County. On September 15, 2011 MDE finalized its Phase II Load Allocations and on July 2, 2012 Anne Arundel County submitted its Phase II WIP to MDE. Anne Arundel County's Phase II WIP serves as the implementation/restoration plan for the SW-WLAs for each impairment addressed by the Chesapeake Bay TMDL.[1] At the time of writing this report, the final date for meeting the Chesapeake Bay TMDL SW-WLA is 2040, as set by the U.S. Environmental Protection Agency (EPA).

MDE's TIPP spreadsheet tool was used for all Chesapeake Bay TMDL progress modeling. Land cover data from the National Land Cover Database (NLCD) was used to quantify land cover acreage for the 2009 TMDL baseline year. NLCD data was used because the Chesapeake Conservancy (CC) land cover data, which reflects 2013/2014 conditions, does not reflect the baseline year land use conditions for each TMDL watershed. MS4 regulated land cover increased in many watersheds between the baseline years and 2013/2014, and therefore, relying on 2013/2014 land cover would inflate baseline year loads. The backcasting method developed by Baltimore County, and approved by MDE, resolves this issue. The backcasting method was applied to NLCD data and makes it consistent with the Phase 6 Chesapeake Bay Watershed Model land cover classes.

Backcasting was achieved by comparing 2013/2014 Chesapeake Conservancy (CC) land cover data, that was modified by MDE, to 2013 NLCD land cover data. Before backcasting, several steps were taken to preprocess both the NLCD and CC data. Firstly, MDE's classification of 'Mixed Open/Agriculture' was disaggregated into 'Mixed Open' and 'Agriculture'. This was achieved by reclassifying 'Mixed Open/Agriculture' to 'Agriculture' where the land cover classification intersected with a parcel having an agricultural assessment. All other occurrences of 'Mixed Open/Agriculture' that did not intersect with a parcel having an agricultural assessment were reclassified as 'Mixed Open'.

NLCD land cover data does not have an 'Impervious' land cover category, but is instead classified as different intensities of 'Developed'. To be consistent with Phase 6 Chesapeake Bay Watershed Model land cover classes, all NLDC land cover data were reclassified as 'Impervious' if it intersected with the County's impervious land cover dataset. The 2007 County impervious data were used for the backcasting, as it was the best available impervious dataset closest to the baseline year that provided an accurate representation of impervious surfaces in the County. Finally, NLCD data were

[1] https://mde.maryland.gov/programs/water/TMDL/TMDLImplementation/Pages/WIPPhaseIICountyDocuments.aspx

clipped to the extent of the County MS4-regulated area, removing State, Federal, and any other land that does not fall under the County's jurisdiction.

The backcasting method was conducted for each Bay segment TMDL watershed separately. Each Bay segment TMDL watershed has a unique fingerprint of land cover classes and acreage, therefore the translation of NLCD land cover classes to CC land cover classes is expected to be unique for each watershed. Using both the 2013/2014 NLCD and CC land cover data, for each NLCD land cover category, the percentage of different CC land cover classes within each NLCD land cover class were summarized. This serves as the key with which to 'translate' NLCD data prior to 2014 and make data consistent with the Phase 6 Chesapeake Bay Watershed Model land cover classes.

For each watershed, backcasted 'Aggregate Impervious' and 'Turf' acres were entered into the TIPP Tool to determine the baseline load. Land cover including 'Tree Canopy over Turf' and 'Tree Canopy over Aggregate Impervious' were added to the 'Turf' and 'Aggregate Impervious' baseline acres respectively, and included as land cover conversions. TIPP spreadsheets can be found in Appendix E.

Anne Arundel County recently corrected a computational error that was present in previous iterations of the TIPP modeling datasets. Three land use categories (Tree Canopy Over Impervious Roads, Tree Canopy Over Impervious Surfaces, and Tree Canopy Over Structures) were being incorrectly categorized as Turf instead of Aggregate Impervious. This correction was made to the Baseline Year Land Use and Baseline Year Land Use Conversion values in FY24, with no effect on modeling results. In FY25, this correction was also applied to the drainage areas for Stormwater Management BMPs across all tabs (Baseline Year, Permit Load, Current Progress, and Implementation Scenario). This resulted in a small reduction in Baseline Loads, and a small increase in load reduction progress across all scenarios and watersheds.

B. Local Nutrient and Sediment TMDLs and Progress Modeling Approach

Anne Arundel County has two local nutrient TMDLs and nine local sediment TMDLs. The local nutrient TMDLs, published in "Total Maximum Daily Loads of Nitrogen and Phosphorus for the Baltimore Harbor in Anne Arundel, Baltimore, Carroll and Howard Counties and Baltimore City, Maryland", were approved by EPA in 2007 and revised by MDE in August 2015. The 11 local TMDLs, their approval dates, and current target attainment years can be found in Table 1.

Table 1: Anne Arundel County nutrient and sediment TMDLs

TMDL Watershed	Approval Date of TMDL	Target Year
Baltimore Harbor – Nitrogen and Phosphorus, 8 Digit WS 02130903	December, 17, 2007	2030
Non-Tidal Baltimore Harbor - Sediment, 8 Digit WS 02130903	January, 27, 2022	2030
Little Patuxent River - Sediment, 8 Digit WS 02131105	September 30, 2011	2025
Upper Patuxent River - Sediment, 8 Digit WS 02131104	September 30, 2011	2025
Patapsco River Lower North Branch - Sediment, 8 Digit WS 02130906	September 30, 2011	2025
South River - Sediment, 8 Digit WS 02131003	September 28, 2017	2025
Other West Chesapeake - Sediment, 8 Digit WS 02131005	February 9, 2018	2030
Middle Patuxent River - Sediment, 8 Digit WS 02131102	July 2, 2018	2030
Lower Patuxent River - Sediment, 8 Digit WS 02131101	July 2, 2018	2030
West River - Sediment, 8 Digit WS 02131004	April 24, 2019	2030

As with the Bay segment TMDLs, MDE's TIPP spreadsheet tool was used for all local nutrient and sediment TMDL progress modeling. The backcasting methodology was used for all local TMDLs following the same methodology as the Bay segment TMDLs as noted in Section II.A. Land cover data from the National Land Cover Database (NLCD) was used to quantify land cover acreage for each TMDL baseline year (either 1995, 2005, or 2009).

The backcasting method was conducted for each nutrient and sediment TMDL watershed separately. Following the approach for the Bay segment TMDLs, each watershed's backcasted 'Aggregate Impervious' and 'Turf' acres were entered into the TIPP Tool to determine the baseline load. Land cover including 'Tree Canopy over Turf' and 'Tree Canopy over Aggregate Impervious' were added to the 'Turf' and 'Aggregate Impervious' baseline acres respectively, and included as land cover conversions. TIPP spreadsheets can be found in Appendix E.

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C. Bacteria

Anne Arundel County has 19 individual bacteria TMDLs, approved by EPA between November 2005 and August 2011 (Table 2). Pursuant to MDE guidance, compliance for bacteria TMDLs is assessed programmatically by monitoring activities rather than by modeling. The County does not have a firm target date for achieving the bacteria SW-WLAs, but a variety of programmatic strategies and benchmarks were identified to ensure continual progress is made (see the Bacteria TMDL Progress Matrix in Appendix D).

Table 2: Anne Arundel County bacteria TMDLs

TMDL Watershed	Approval Date
Magothy River Mainstem	February 20, 2006
Magothy River/Forked Creek	February 20, 2006
Magothy River/Tar Cove	February 20, 2006
Patapsco River/Furnace Creek	March 10, 2011
Patapsco River/Marley Creek	March 10, 2011
Patapsco River Lower North Branch, 8 Digit WS 02130906	December 3, 2009
Upper Patuxent River, Subsegment of 8 Digit WS 0213114	August 9, 2011
Rhode River/Bear Neck Creek	February 20, 2006
Rhode River/Cadle Creek	February 20, 2006
Severn River Mainstem, Subsegment of 8 Digit WS 02131002	April 10, 2008
Severn River/Mill Creek	April 10, 2008
Severn River/Whitehall & Meredith Creeks	April 10, 2008
South River/Duvall Creek	November 4, 2005
South River, Subsegment of 8 Digit WS 02131003	November 4, 2005
South River/Ramsey Lake	November 4, 2005
South River/Selby Bay	November 4, 2005
W. Chesapeake Bay/Tracy & Rockhold Creeks	February 20, 2006
West River, Subsegment of 8 Digit WS 02131004	February 20, 2006
West River/Parish Creek	February 20, 2006

D. Polychlorinated Biphenyls (PCBs)

Anne Arundel County has a total of six PCB TMDLs, only two of which have SW-WLAs requiring reductions. These two PCB TMDLs, the Baltimore Harbor, Curtis Creek/Bay and Bear Creek portions of the Patapsco River Mesohaline, and the Patuxent River – Tidal Fresh watersheds are shared with other jurisdictions and were approved by EPA between October 2012 and September 2017 (Table 3). As with Bacteria TMDLs, compliance for PCB TMDLs is assessed programmatically by monitoring activities rather than by modeling, and no target dates are specified.

Table 3: Anne Arundel County PCB TMDLs

TMDL Watershed	Approval Date
Baltimore Harbor, Curtis Creek/Bay, and Bear Creek portions of the Patapsco River Mesohaline Tidal Chesapeake Bay Segment	October 1, 2012
Patuxent River – Tidal Fresh	September 19, 2017

The Draft PCB TMDL implementation plan update for the Baltimore Harbor, Curtis Creek/Bay, and Bear Creek portions of the Patapsco River Mesohaline TMDL can be found in Appendix B. The final Restoration Plan for the Patuxent River – Tidal Fresh TMDL can be found in Appendix A.

III. FY 25 BMP Implementation

In FY25, 2 upland BMPs and 25 alternative BMPs (including 11 septic connections to WWTP within bacterial TMDL watersheds) were implemented, with 570 tons of material collected from annual practices including street sweeping and catch basin cleaning (Table 4).

Table 4: FY 25 BMP implementation in Anne Arundel County

BMP Type	Number/Tons
Upland BMPs	
Wet Extended Detention Pond	1
Extended Detention Shallow Wetland	1
Alternative BMPs	
Outfall Stabilization	3
Conservation Landscaping	4
Step Pool Conveyance System	2
Stream Restoration	3
Impervious Surface Reduction	2
Septic Connections to WWTP*	11
Street Sweeping**	257
Catch Basin Cleaning**	313

* Number of connections excludes those outside of Bacterial TMDL watersheds.

** Annual practice totals for FY25 only. Progress modeling used averages for FY 16-FY 18 and FY 17-FY 18 for street sweeping and catch basin cleaning respectively, to be consistent with MS4 reporting.

A summary of interim programmed restoration and planned restoration via future planned BMPs are presented in Appendix C and Appendix D respectively.

IV. Chesapeake Bay TMDL Progress

The Chesapeake Bay TMDL, established by EPA, sets watershed-wide limits on nitrogen, phosphorus, and sediment pollution. Anne Arundel County is mandated to comply with the stormwater sector's share of the Bay TMDL largely through its NPDES MS4 permit's impervious surface restoration requirement. Anne Arundel County's total nitrogen, total phosphorus, and total suspended sediment target loads (SW-WLAs) for the Chesapeake Bay are 449,641 lbs., 30,147 lbs., and 4,646,000 lbs., respectively. These SW-WLAs equate to required reductions of 31.6%, 46.7%, and 67.3% for the 2009 baseline loads of nitrogen, phosphorus, and sediment. The Chesapeake Bay Program's Executive Council approved a revised Watershed Agreement on December 2nd, 2025, which sets a new TMDL deadline of 2040 with a midpoint check-in of 2033.

In previous NPDES permits, the SW-WLAs and the annual progress the County made in meeting them were reported at the county-level. Within the County's current NPDES permit, county-level SW-WLAs for nitrogen and phosphorus are disaggregated for each Chesapeake Bay Model Phase 5 segment (Bay segment). Using MDE's TIPP tool, the target loads based on the SW-WLAs and FY 25 progress were re-calculated and are presented in Table 5 and Table 6. Sediment SW-WLAs are not presented for each Bay segment as the State of Maryland did not set individual sector targets for sediment within the Chesapeake Bay Phase II Watershed Implementation Plan. Based on experience from the Chesapeake Bay Phase I Watershed Implementation Plan, the State of Maryland expected that reductions in phosphorus would result in concurrent sediment reductions to satisfy the sediment SW-WLA.

Table 5: Nitrogen TMDL progress for each Bay segment within Anne Arundel County

Bay Segment	Target TN Load (lbs/year)	Required TN Reduction (%)	FY 25 TN Reduction (%)	Interim Programmed TN Reduction (%)
Upper Chesapeake Bay Mesohaline	1,768.3	37	0.01	6.93
Middle Chesapeake Bay Mesohaline	39,518.0	36	10.54	10.72
Magothy River Mesohaline	87,445.1	36	6.83	9.82
Patapsco River Mesohaline	101,846.9	35	3.83	8.31
Middle Patuxent River Oligohaline	3,650.0	27	0	10.73
Upper Patuxent River Tidal Fresh	106,779.9	15	1.62	4.32
Rhode River Mesohaline	11,534.9	36	7.82	20.04
Severn River Mesohaline	88,109.6	36	4.51	9.45
South River Mesohaline	63,490.2	36	12.13	15.79
West River Mesohaline	9,499.8	36	1.7	2.13

Table 6: Phosphorus TMDL progress for each Bay segment within Anne Arundel County

Segment	Target TP Load (lbs/year)	Required TP Reduction (%)	FY 24 TP Reduction (%)	Interim Programmed TP Reduction (%)
Upper Chesapeake Bay Mesohaline	128.0	52	0.02	51.5
Middle Chesapeake Bay Mesohaline	5,855.1	51	15.38	15.95
Magothy River Mesohaline	3,777.5	51	19.29	34.23
Patapsco River Mesohaline	5,928.1	49	8.76	20.98
Middle Patuxent River Oligohaline	357.3	45	0	15.21
Upper Patuxent River Tidal Fresh	17,743.1	29	2.83	9.51
Rhode River Mesohaline	1,755.4	52	15.27	46.7
Severn River Mesohaline	6,349.8	51	14.27	30.97
South River Mesohaline	6,217.8	50	35.86	47.62
West River Mesohaline	1,109.2	52	5.71	7.34

Figure 1 and Figure 2 show the baseline loads, load reduction progress, and target loads (in tons) for each bay segment for nitrogen and phosphorus. Load reduction is broken down by FY25 cumulative progress, interim programmed reductions, and planned reduction. These figures help identify where the County needs to expand the current inventory of interim projects to address the SW-WLA in each Bay segment.

As shown in Table 5 and Table 6 and in Figure 1 and Figure 2, load reduction progress at the Bay Segment is variable, with some segments having significantly more BMP implementation than others. Likewise, as Figure 1 and Figure 2 indicate, the interim planned reduction in some Bay segments, defined as projects that are currently under design, will not be enough to meet the required reduction. However, it should be noted that the County has made significant reductions, beyond what is required, in the wastewater sector. For example, the Mayo Water Reclamation Facility in the Rhode River Mesohaline segment was decommissioned in late 2017. Based on average annual discharges from the facility from 2013 to 2016, decommissioning the facility reduced annual inputs of TN and TP to the Rhode River by 23,779 and 1,234 lbs of TN and TP, respectively. To put this in perspective, these reductions equate to 366% of the required TN reduction and 65% of the required TP reduction to meet the Rhode River Mesohaline segment SW-WLAs. Furthermore, the County anticipates that procurement mechanisms such as the annual 'Full Delivery of Turnkey Water Quality Improvements' and the 'Anne Arundel County Watershed Restoration Grant Program' will provide additional load reductions towards meeting the SW-WLAs in each Bay segment. See Appendix C for information on individual projects.

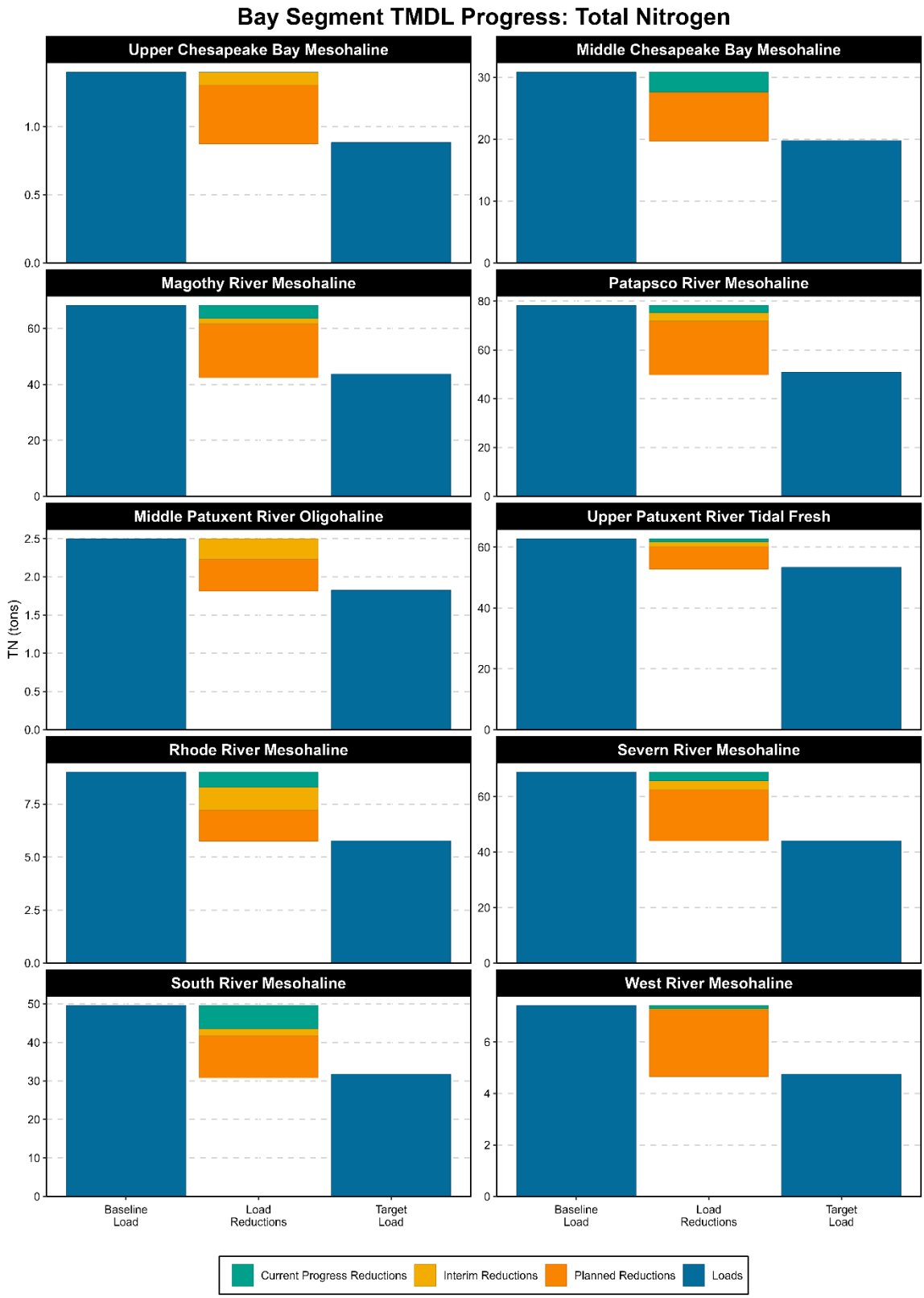

Figure 1: Total Nitrogen baseline load, reductions and target load for each Bay segment

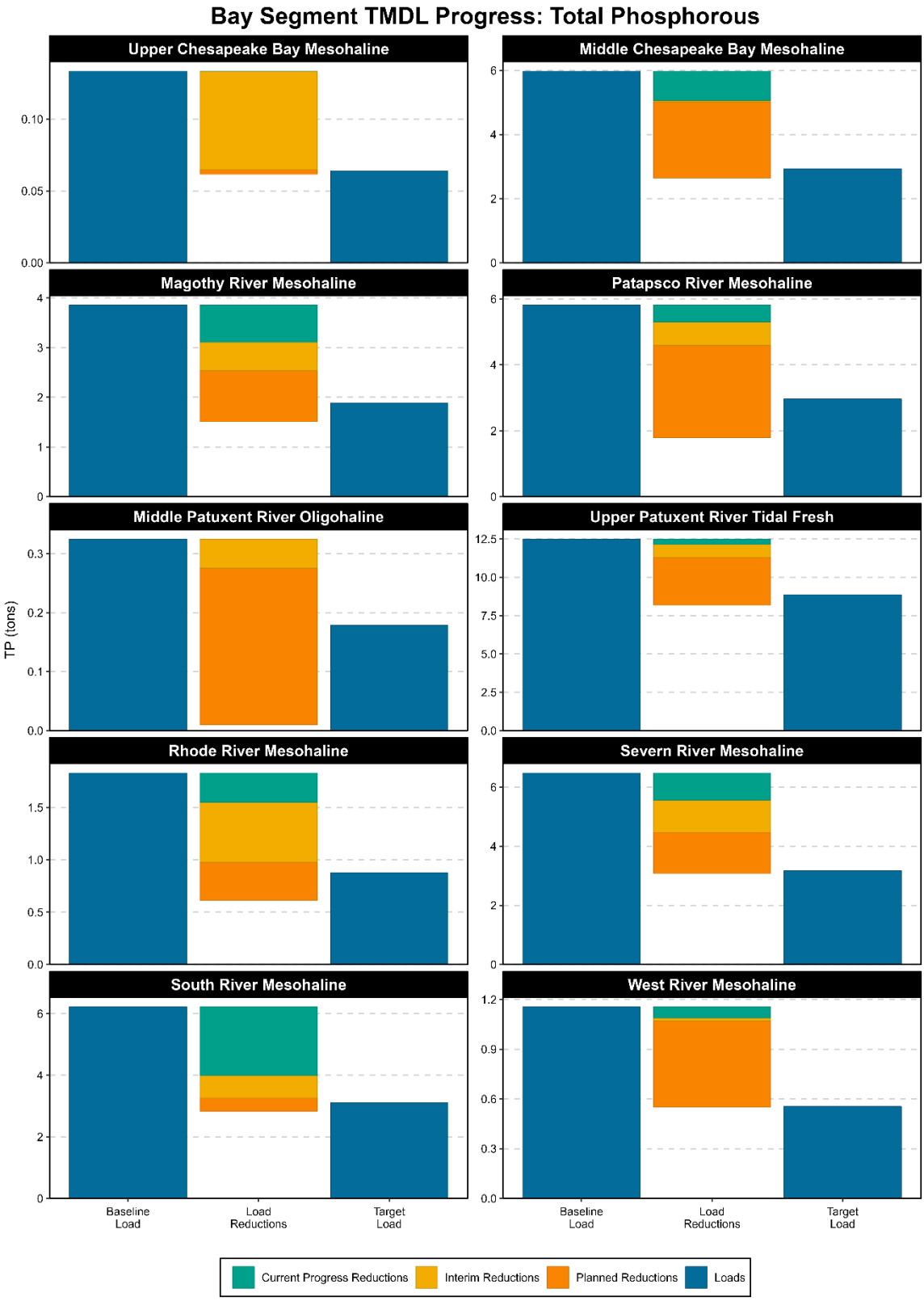

Figure 2: Total Phosphorous baseline load, reductions and target load for each Bay segment

V. Local Sediment and Nutrient TMDL Progress

The location of the eleven local TMDLs within Anne Arundel County are presented in Figure 3 (note: the Baltimore Harbor watershed has nitrogen, phosphorus, and sediment TMDLs). Each TMDL's target load (SW-WLA) is presented in Table 7, along with the target completion year, FY25 cumulative progress, and the expected progress from interim programmed and planned projects. Based on the current interim programmed and planned reductions (Appendix C), the SW-WLAs for each TMDL are expected to be met for all local sediment and nutrient TMDLs.

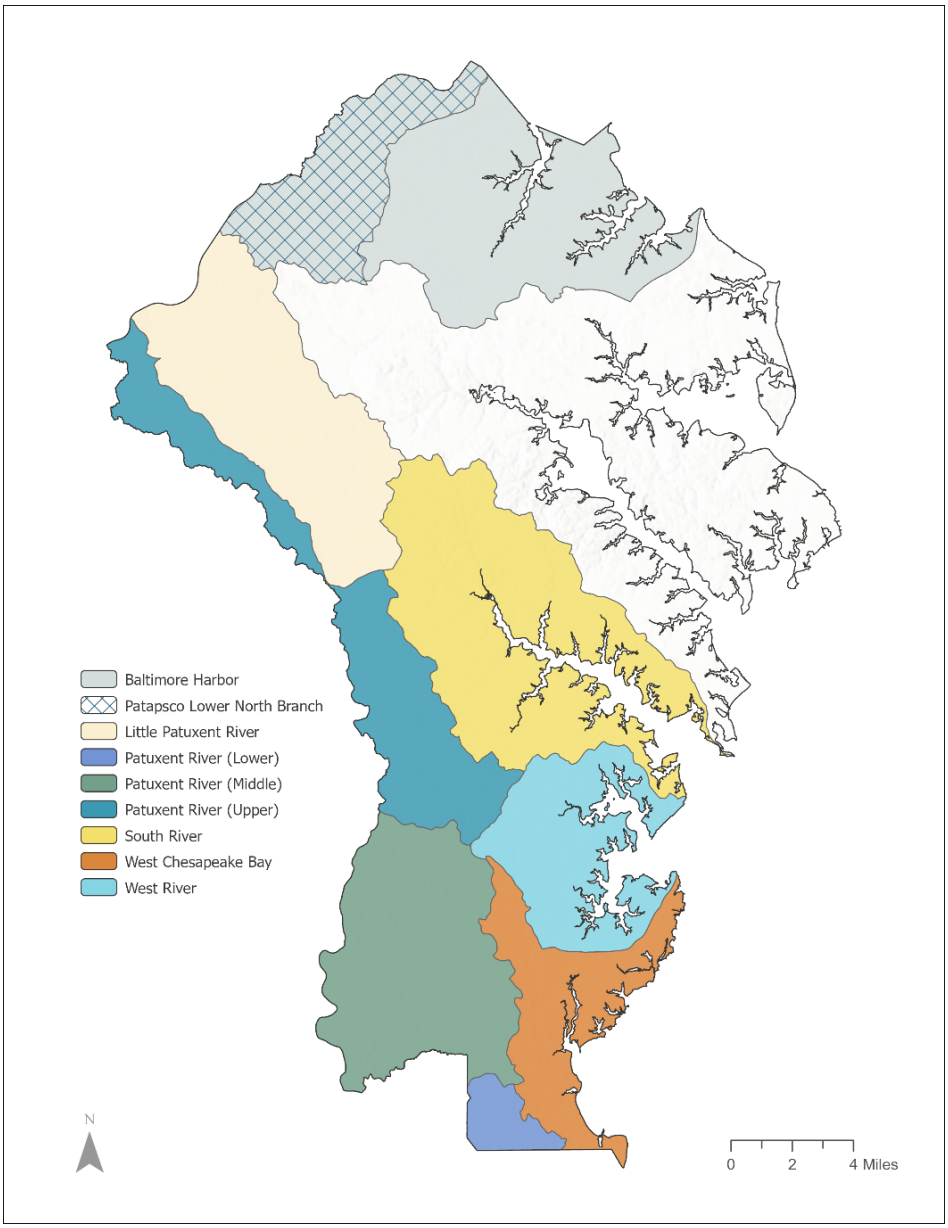

Figure 3: Map of local TSS and nutrient TMDL watersheds

Table 7: Local TSS and Nutrient TMDL progress

Watershed	TMDL	Target Load (lbs)	Required Reduction (%)	Required Completion Year (actual)	FY 25 Cumulative Progress (%)*	Interim Programmed Progress (%)	Planned Implementation Progress (%)
Baltimore Harbor	TN	232,941.4	15%	2030	3.63%	8.38%	15.84%
Baltimore Harbor	TP	18,380.3	15%	2030	7.30%	19.25%	36.15%
Baltimore Harbor	TSS	9,145,526.7	58%	2030	14.28%	48.27%	79.03%
Little Patuxent	TSS	15,047,258.0	20.5%	2025	9.90%	30.46%	30.46%
Lower Patuxent	TSS	767,132.1	61%	2030	0.00%	50.67%	63.52%
Middle Patuxent	TSS	6,982,285.2	56%	2030	0.48%	6.44%	56.47%
Upper Patuxent	TSS	11,314,309.7	11.4%	2025	2.01%	23.50%	23.50%
Patapsco Lower North Branch	TSS	12,960,021.0	22.2%	2025	8.40%	12.64%	25.55%
South River	TSS	13,634,211.2	28%	2025 (2023)	42.16%	52.64%	52.64%
Other West Chesapeake	TSS	7,363,965.3	33%	2030	1.51%	1.51%	33.30%
West River	TSS	7,150,213.7	22%	2030	0.71%	11.42%	22.91%

* Green shading indicates TMDL compliance has been achieved. Yellow shading indicates TMDL compliance is expected to be met or exceeded with interim programmed progress reductions. Orange shading indicates TMDL compliance is expected to be met or exceeded with planned progress reductions.

Figure 4 shows the baseline loads, load reduction progress, and target loads (in tons) for each TMDL watershed. Load reduction is broken down by FY25 cumulative progress, interim programmed reductions, and planned reductions. Figure 4 helps identify where the County needs to expand the current inventory of planned projects to address the SW-WLA in each TMDL watershed.

Figure 5 shows the breakdown of load reductions by BMP type for all implemented, programmed, and planned reductions. As shown in Figure 5, the majority of load reductions come from stormwater management BMPs and stream and wetland restoration projects. Within the more rural TMDL watersheds, stream and wetland restoration projects make up the bulk of TSS reductions due to limited stormwater management BMP retrofit opportunities.

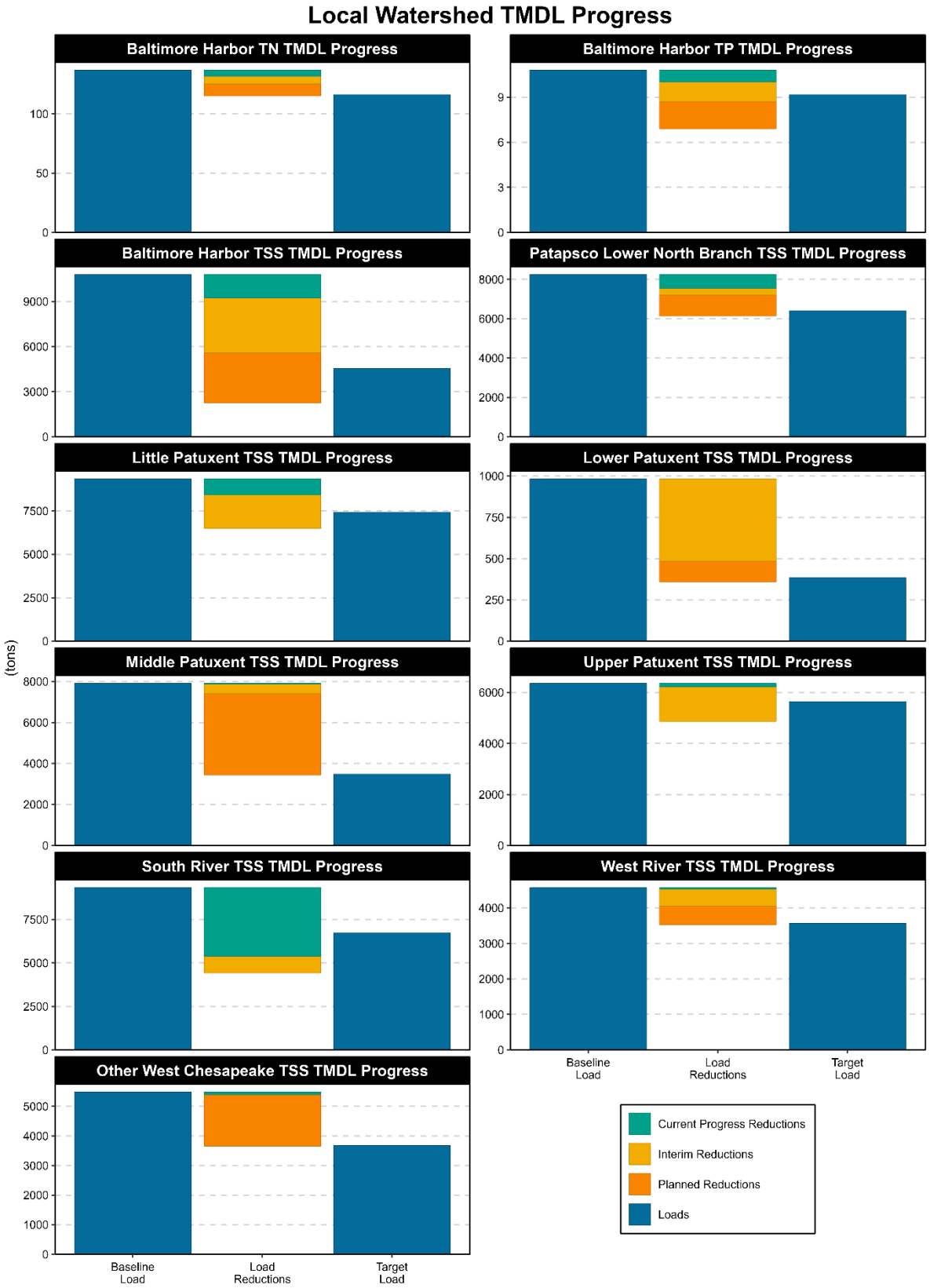

Figure 4: Baseline load, reductions and target load within each TMDL watershed.

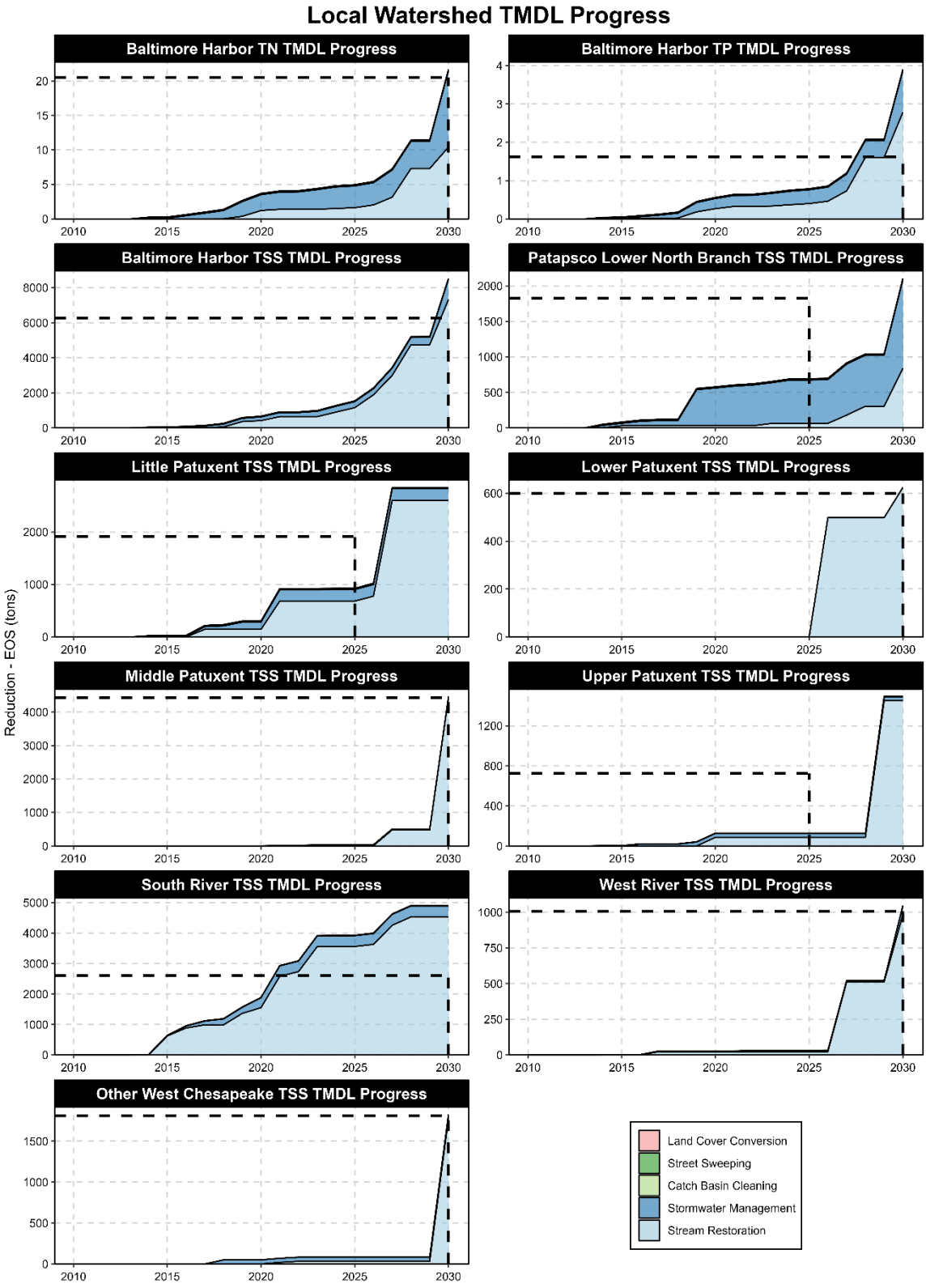

Figure 5: Expected load reductions over time by BMP type within each TMDL watershed. The dashed line indicates the target load reduction and target year for each TMDL watershed.

A. Sediment TMDLs

Required load reductions and progress load reductions for the Sediment TMDL watersheds are presented in Figure 4. Figure 5 shows the breakdown of load reductions by BMP type for FY25 progress load reductions, programmed load reductions, and planned load reductions. Significant sediment load reductions are needed in the Middle Patuxent, Baltimore Harbor, and Other West Chesapeake watersheds beyond what has been achieved thus far.

Note: as demonstrated in Figure 5 above, several of the local sediment TMDLs were due to be attained by 2025 (Little Patuxent, Upper Patuxent, Patapsco Lower North Branch, South River). While the County has achieved the SW-WLA for the South River watershed, attainment has not been achieved by 2025 in the other 3 watersheds. To address this, and to provide new attainment schedules based on current (up through FY24) progress, interim programmed projects, and future planned projects, the County is submitting a draft TMDL implementation plan update that consolidates the 9 local sediment TMDL implementation/restoration plans into one plan (Appendix B). Upon approval of a final plan update from MDE, the County will update the attainment schedules for the local sediment TMDLs in future Countywide TMDL implementation plans as needed. Until then, the original implementation/restoration plans' 2025 and 2030 attainment dates will remain.

1.Baltimore Harbor

The Baltimore Harbor watershed is situated in the northern portion of the County, and shares political boundaries with Baltimore City, Baltimore, Carroll, and Howard Counties (Figure 6). The Anne Arundel County portion of the Baltimore Harbor watershed is approximately 30,357 acres (47.4 square miles) in area and contains approximately 160.4 total miles of streams.

The target sediment load for the Baltimore Harbor is 9,145,527 pounds per year - a 58% reduction from the baseline by 2030. Current FY25 progress shows a reduction of 3,081,940 pounds (14.28%). Total interim programmed and planned restoration will result in a further 13,970,421 pounds of reduction, resulting in a total of 79.03% reduction by the completion year (Table 8).

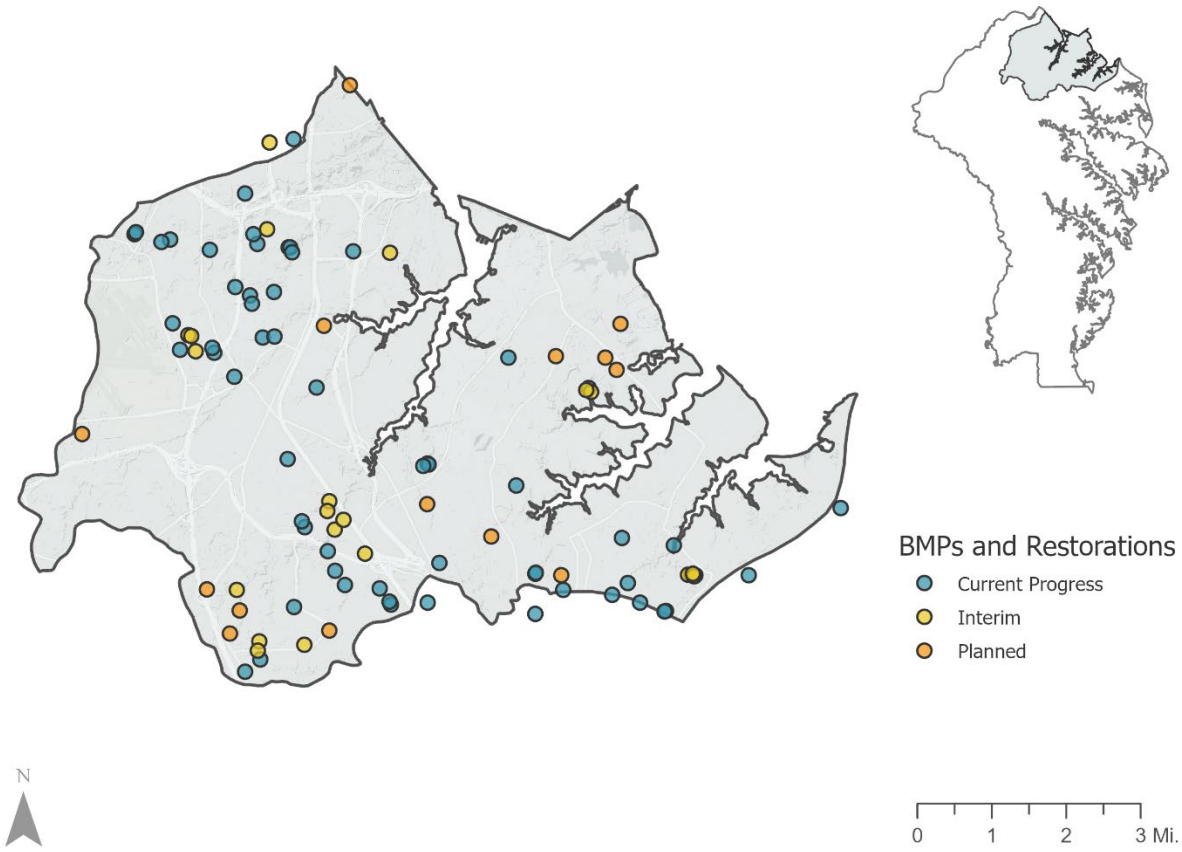

Figure 6: Map of the Baltimore Harbor TSS TMDL watershed

The Baltimore Harbor FY25 progress reduction (14.28%) was achieved via street sweeping (~60.2 lane miles), storm drain cleaning (~126,043 pounds), 45 stormwater management practices, five land cover conversion BMPs (3.86 acres) and ten stream restorations (10,950 linear feet). The interim programmed and planned reduction portfolios consist of 17 stormwater management practices and 20 stream restorations (40,106 linear feet) and will achieve compliance with the TMDL. See Appendix C for information on individual projects. Note that there are several BMP points providing water quality treatment that plot outside the watershed boundary shown in Figure 6. The drainage areas for these BMPs overlap partially with the Baltimore Harbor TMDL watershed, despite their centroids falling outside the boundary used for mapping. These BMP drainage areas are determined from high-resolution QL1 LiDAR and the County's stormwater infrastructure network, and as such are more accurate than the MD 8-digit watershed boundaries. This is the case for all subsequent maps containing BMP points outside the map boundary.

The top three implemented projects that provide the greatest sediment reductions in the Baltimore Harbor are:

- BMP0291, a stream restoration that reduces 610,000 lbs of sediment annually;
- BMP0300, a stream restoration that reduces 493,000 lbs of sediment annually; and
- BMP0281, a stream restoration that reduces 356,069 lbs of sediment annually.

Table 8: TMDL summary for Baltimore Harbor TSS

Results and TMDL WLA	Loads and Percent Reduction
2009 Baseline Load (lbs)	21,577,326
FY25 Progress Load (lbs)	18,495,386
FY25 Percent Reduction	14.28%
Target TMDL WLA Percent Reduction	58.00%
Planned Implementation Load (lbs)	4,524,965
Planned Implementation Percent Reduction	79.03%

2. Patuxent River (Little Patuxent River, Upper Patuxent River, Middle Patuxent River, and Lower Patuxent River)

a. Little Patuxent

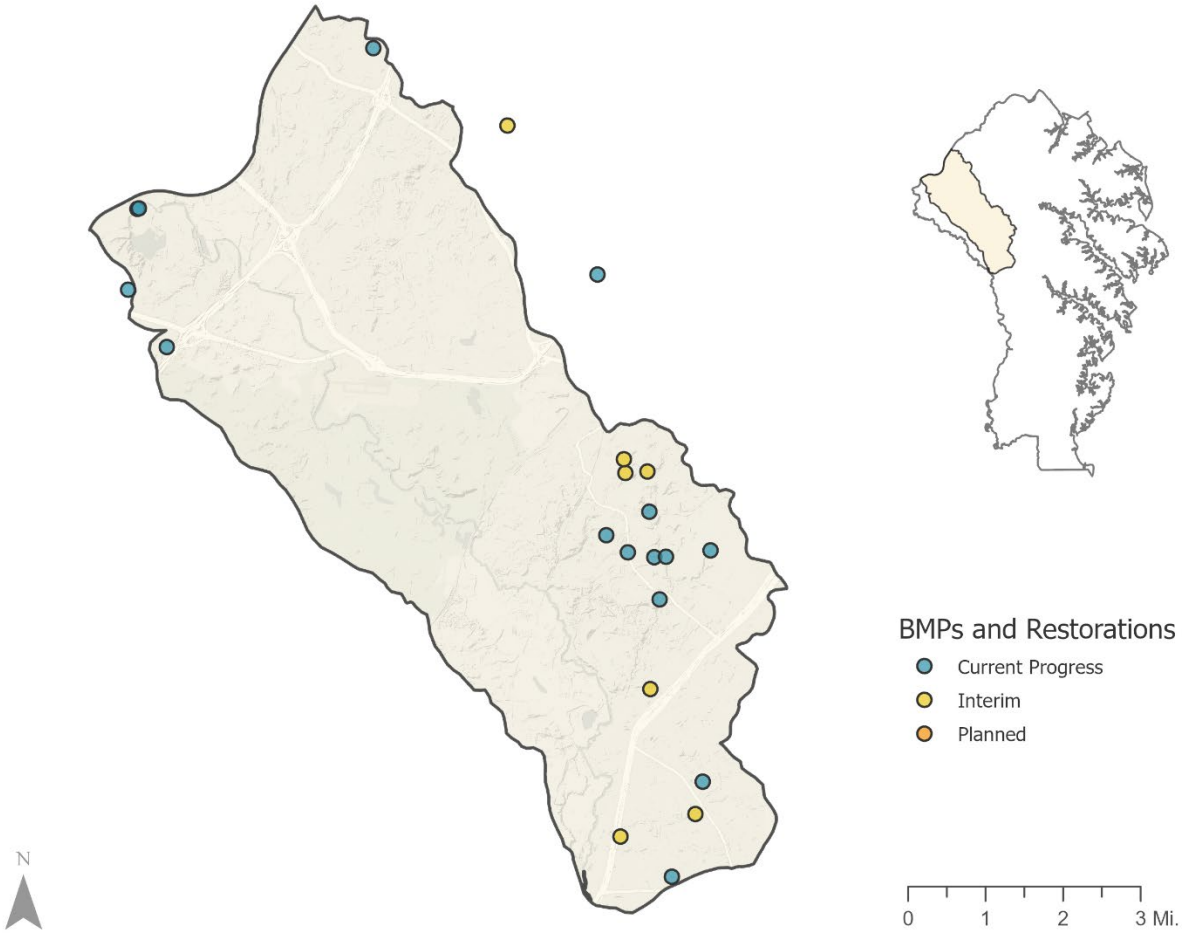

Figure 7: Map of the Little Patuxent River TSS TMDL watershed

The Little Patuxent watershed is situated in the western portion of the County, and shares political boundaries with Howard County (Figure 7). Anne Arundel County's portion of the Little Patuxent watershed is approximately 27,752 acres (43.4 square miles) in area and contains approximately 1,200 total miles of streams.

The target sediment load for the Little Patuxent is 15,047,258 pounds per year - a 20.5% reduction from the baseline by 2025. Current FY25 progress shows a reduction of 1,851,125 pounds (9.90%).

Total interim programmed and planned restoration will result in a further 3,842,901 pounds of reduction, resulting in a total of 30.46% reduction (Table 9).

The Little Patuxent River FY25 progress reduction (9.90%) was achieved via street sweeping (~44.6 lane miles), storm drain cleaning (~16,690 pounds), 11 stormwater management practices, and four stream restorations (4,221 linear feet). The interim programmed and planned reduction consists of one stormwater management practice and six stream restorations (9,076 linear feet) and will achieve compliance with the TMDL. See Appendix C for information on individual projects.

The top three implemented projects that provide the greatest sediment reductions in the Little Patuxent are:

- BMP0324, a stream restoration that reduces 620,053 lbs of sediment annually;
- BMP0712, a stream restoration that reduces 454,000 lbs of sediment annually; and
- BMP0266, a stream restoration that reduces 250,728 lbs of sediment annually.

Table 9: TMDL summary for Little Patuxent TSS

Results and TMDL WLA	Loads and Percent Reduction
2005 Baseline Load (lbs)	18,690,865
FY25 Progress Load (lbs)	16,839,739
FY25 Percent Reduction	9.90%
Target TMDL WLA Percent Reduction	20.50%
Planned Implementation Load (lbs)	12,996,838
Planned Implementation Percent Reduction	30.46%

b. Upper Patuxent

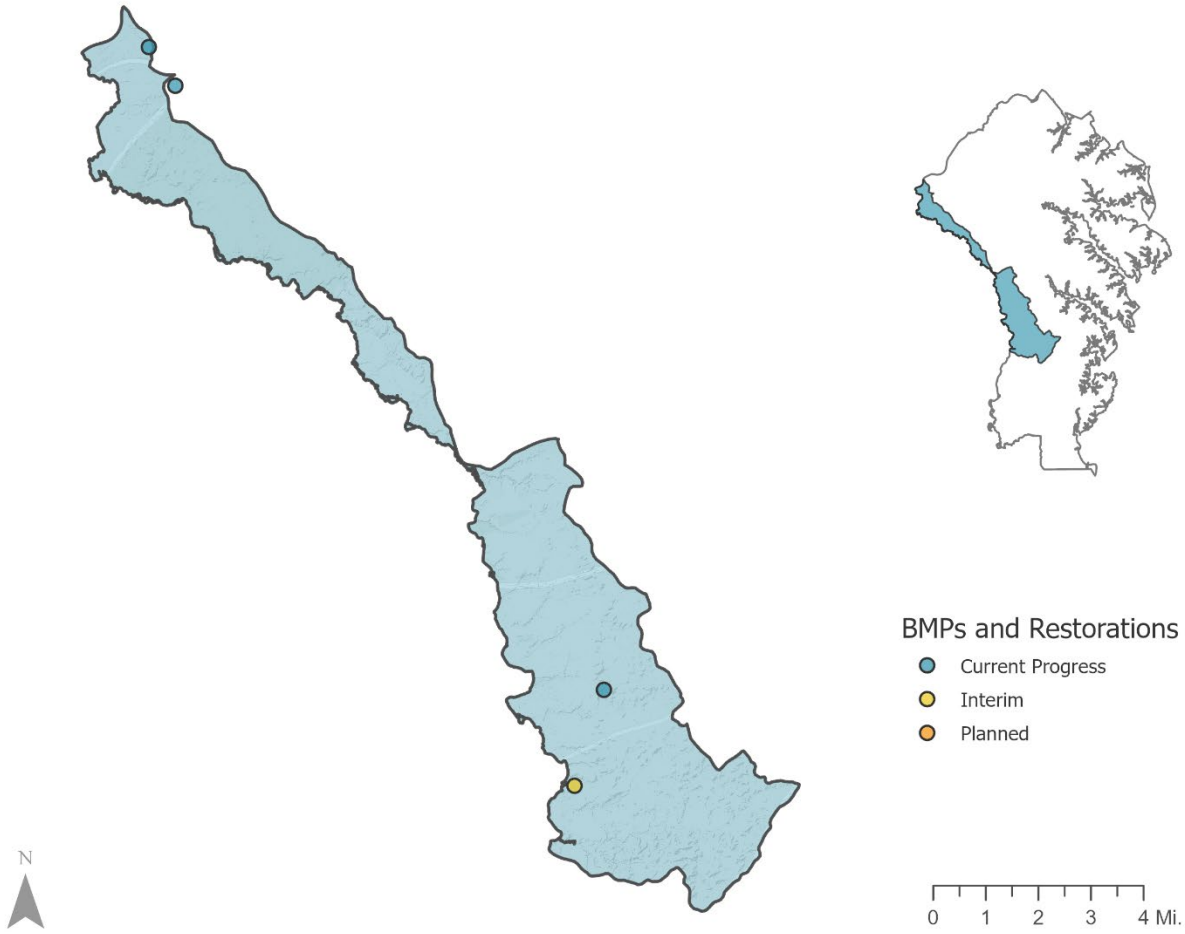

Figure 8: Map of the Upper Patuxent River TSS TMDL watershed

The Upper Patuxent is situated in the western portion of the County, and shares political boundaries with Prince George's County along the Patuxent River and a small portion of Howard County (Figure 8). Anne Arundel County's portion of the Upper Patuxent watershed is approximately 22,420 acres (35.0 square miles) in area and contains approximately 90 miles of streams.

The target sediment load for the Upper Patuxent is 11,314,310 pounds per year - an 11.4% reduction from the baseline by 2025. Current FY25 progress shows a reduction of 255,884 pounds (2.01%). Total interim programmed and planned restoration will result in a further 2,730,472 pounds of reduction, resulting in a total of 23.50% reduction (Table 10).

The Upper Patuxent FY25 progress reduction (2.01%) was achieved via street sweeping (~4.7 lane miles), storm drain cleaning (~1,416 pounds), two stormwater management practices, and one stream restoration (236 linear feet). The interim programmed and planned reduction consists of two stream restorations (2,552 linear feet) and will achieve compliance with the TMDL. See Appendix C for information on individual projects.

The top three implemented projects that provide the greatest sediment reductions in the Upper Patuxent are:

- BMP0289, a stream restoration that reduces 171,500 lbs of sediment annually;
- BMP0197, a stormwater management BMP that reduces 42,437 lbs of sediment annually;
- BMP0068, a stormwater management BMP that reduces 36,517 lbs of sediment annually.

Table 10:TMDL summary for Upper Patuxent TSS

Results and TMDL WLA	Loads and Percent Reduction
2005 Baseline Load (lbs)	12,710,224
FY25 Progress Load (lbs)	12,454,340
FY25 Percent Reduction	2.01%
Target TMDL WLA Percent Reduction	11.40%
Planned Implementation Load (lbs)	9,723,868
Planned Implementation Percent Reduction	23.50%

c. Lower Patuxent

The Lower Patuxent is located in the southernmost portion of the county and shares political boundaries with Calvert County (Figure 9). Only a small portion of the entire Lower Patuxent watershed is located within Anne Arundel County; the rest of the Lower Patuxent watershed extends through Prince George's, Calvert, Charles, and St. Mary's counties until the point of discharge from the Patuxent River into the Chesapeake Bay. The Anne Arundel County portion of the Lower Patuxent watershed is approximately 3,217 acres (5 square miles) and contains approximately 24.7 miles of streams.

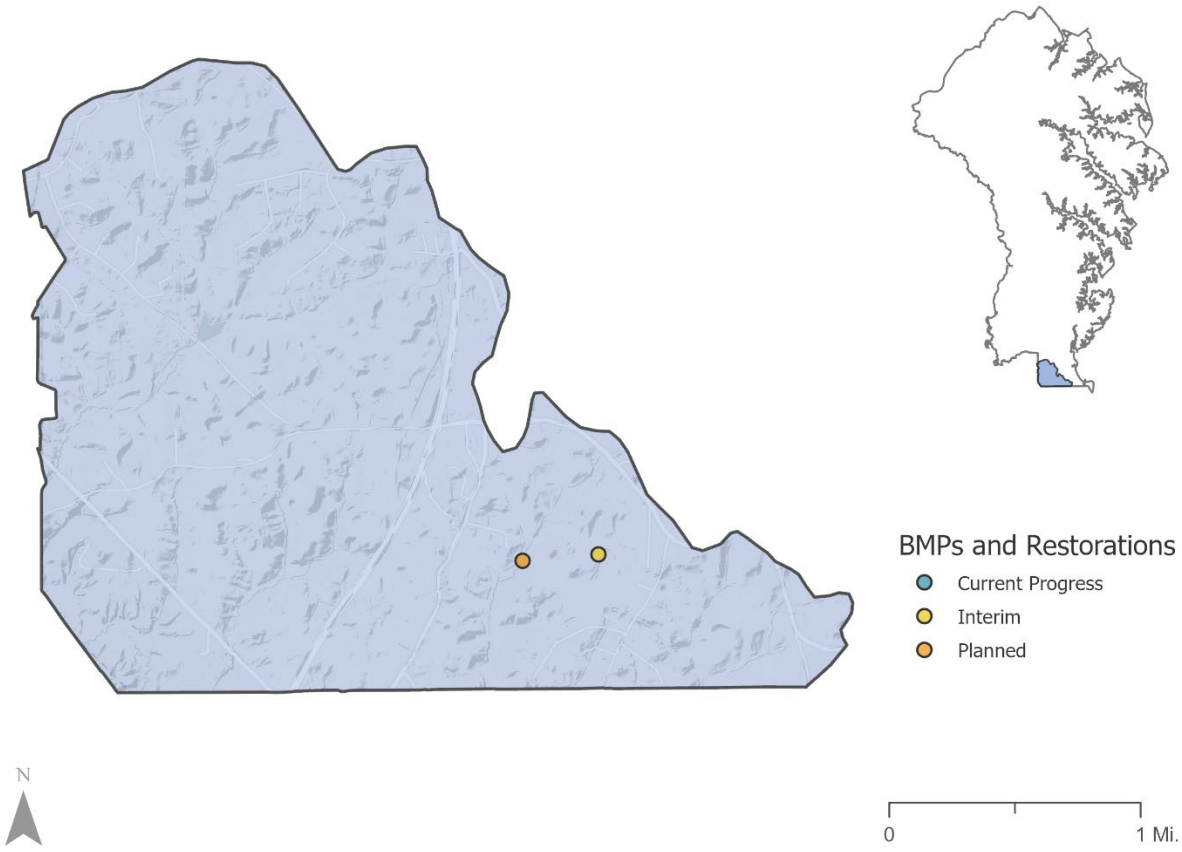

Figure 9: Map of the Lower Patuxent River TSS TMDL watershed

The target sediment load for the Lower Patuxent is 767,132 pounds per year - a 61% reduction from the baseline by 2030. Current FY25 progress shows a reduction of 0 pounds (0%). Total interim programmed and planned restoration will result in a further 1,248,374 pounds of reduction, resulting in a total of 63.52% reduction by the completion year (Table 11). The interim

programmed reduction consists of two stream restorations (4,504 linear feet) and will achieve compliance with the TMDL. See Appendix C for information on individual projects.

Table 11:TMDL summary for Lower Patuxent TSS

Results and TMDL WLA	Loads and Percent Reduction
2009 Baseline Load (lbs)	1,965,190
FY25 Progress Load (lbs)	1,965,190
FY25 Percent Reduction	0.00%
Target TMDL WLA Percent Reduction	61.00%
Planned Implementation Load (lbs)	716,816
Planned Implementation Percent Reduction	63.52%

d. Middle Patuxent

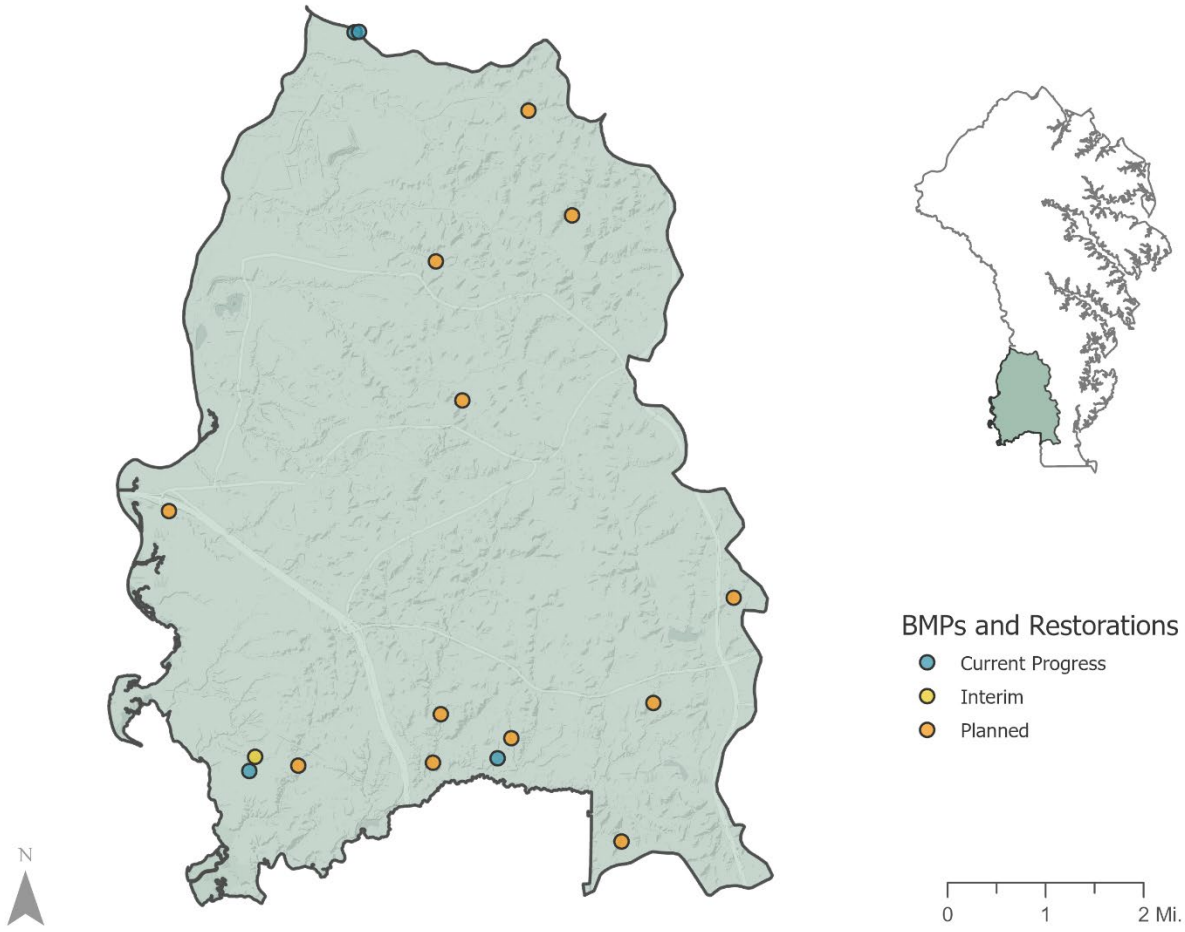

Figure 10: Map of the Middle Patuxent River TSS TMDL watershed

The Middle Patuxent watershed is located in the southwest portion of the county, and shares political boundaries with Prince George's County along the Patuxent River to the west, and with Calvert County along Lyons Creek to the south (Figure 10). The Anne Arundel County portion of the Middle Patuxent watershed is approximately 26,490 acres (41.4 square miles) and contains approximately 228 miles of streams.

The target sediment load for the Middle Patuxent is 6,982,285 pounds per year - a 56% reduction from the baseline by 2030. Current FY25 progress shows a reduction of 76,158 pounds (0.48%). Total interim programmed and planned restoration will result in a further 8,860,108 pounds of reduction, resulting in a total of 56.47% reduction by the completion year (Table 12).

The Middle Patuxent FY25 progress reduction (0.48%) was achieved via street sweeping (~1.1 lane miles), storm drain cleaning (~441 pounds), three land cover conversion BMPs (37.50 acres), and one stream restoration (244 linear feet). The interim programmed and planned reduction consists of 13 stream restorations (35,726 linear feet) and will achieve compliance with the TMDL. See Appendix C for information on individual projects.

The top three implemented projects that provide the greatest sediment reductions in the Middle Patuxent are:

- BMP0821, a land cover conversion that reduces 51,858 lbs of sediment annually;
- BMP0779, an outfall stabilization that reduces 19,785 lbs of sediment annually; and
- BMP0413, a land cover conversion that reduces 1,988 lbs of sediment annually.

Table 12:TMDL summary for Middle Patuxent TSS

Results and TMDL WLA	Loads and Percent Reduction
2009 Baseline Load (lbs)	15,824,622
FY25 Progress Load (lbs)	15,748,463
FY25 Percent Reduction	0.48%
Target TMDL WLA Percent Reduction	56.00%
Planned Implementation Load (lbs)	6,888,356
Planned Implementation Percent Reduction	56.47%

3. Patapsco River Lower North Branch

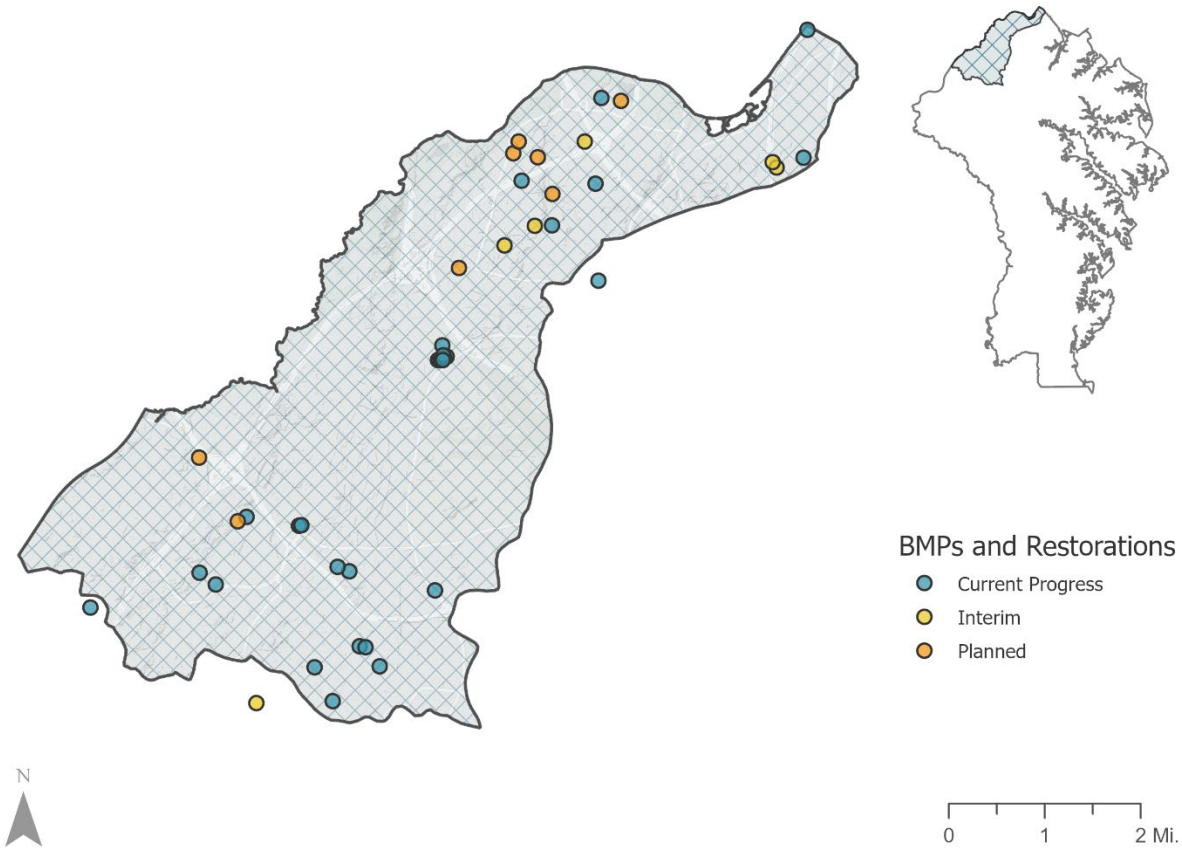

Figure 11: Map of the Patapsco River Lower North Branch TSS TMDL watershed

The Patapsco LNB watershed is situated in the northwestern portion of the County, and shares political boundaries with Howard County along Deep Run and Baltimore County along the mainstem of the Patapsco River (Figure 11). The downstream extent of the watershed borders Baltimore City. Anne Arundel County's portion of the Patapsco LNB watershed is approximately 15,270 acres (23.9 square miles) in area and contains approximately 96 miles of streams.

The target sediment load for the Patapsco LNB is 12,960,021 pounds per year - a 22.2% reduction from the baseline by 2025. Current FY25 progress shows a reduction of 1,383,604 pounds (8.40%). Total interim programmed and planned restoration will result in a further 2,826,320 pounds of reduction, resulting in a total of 25.55% reduction (Table 13).

The Patapsco Lower North Branch FY25 progress reduction (8.40%) was achieved via street sweeping (~33.5 lane miles), storm drain cleaning (~12,221 pounds), 25 stormwater management practices, two land cover conversion BMPs (0.33 acres) and two stream restorations (515 linear feet). The interim programmed and planned reduction consists of 11 stormwater management practices and three stream restorations (14,752 linear feet) and will achieve compliance with the TMDL. See Appendix C for information on individual projects.

The top three implemented projects that provide the greatest sediment reductions in the Patapsco Lower North Branch are:

- BMP0198, a stormwater management BMP that reduces 563,136 lbs of sediment annually;
- BMP0168, a stormwater management BMP that reduces 138,877 lbs of sediment annually; and
- BMP0234, a stormwater management BMP that reduces 117,406 lbs of sediment annually.

Table 13:TMDL summary for Patapsco Lower North Branch TSS

Results and TMDL WLA	Loads and Percent Reduction
2005 Baseline Load (lbs)	16,478,527
FY25 Progress Load (lbs)	15,094,923
FY25 Percent Reduction	8.40%
Target TMDL WLA Percent Reduction	22.20%
Planned Implementation Load (lbs)	12,268,603
Planned Implementation Percent Reduction	25.55%

4. South River

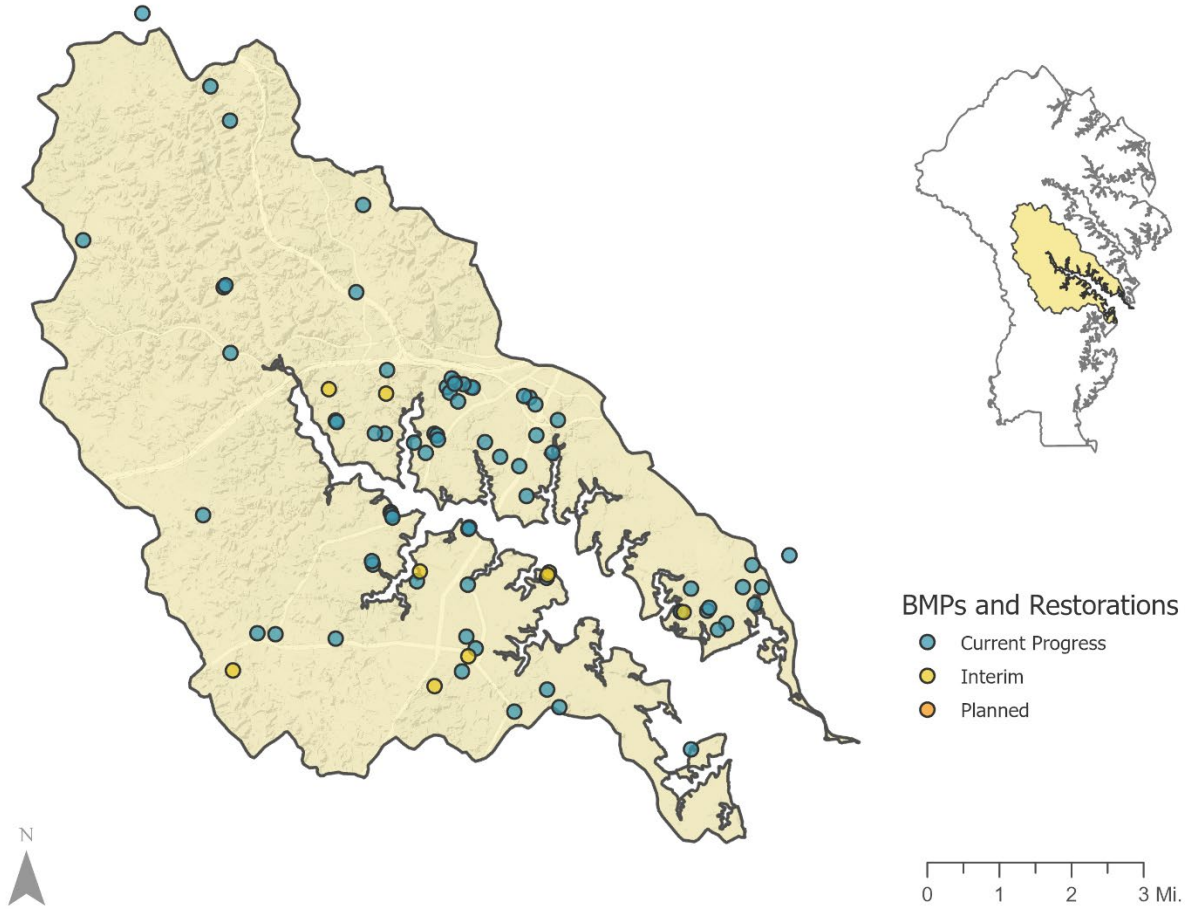

Figure 12: Map of the South River TSS TMDL watershed

The South River watershed is situated in the central portion of the County and drains directly to the Chesapeake Bay (Figure 12). The watershed comprises approximately 36,514 acres and lies entirely within the County.

The target sediment load for the South River is 13,634,211 pounds per year - a 28% reduction from the baseline by 2025. This goal was met in FY23. Current FY25 progress shows a reduction of 7,859,759 pounds (42.16%). Total interim programmed and planned restoration will result in a further 1,953,605 pounds of reduction, resulting in a total of 52.64% reduction (Table 14).

The South River FY25 progress reduction (42.16%) was achieved via street sweeping (~20.3 lane miles), storm drain cleaning (~25,296 pounds), 44 stormwater management practices, 4 land cover conversion BMPs (9.91 acres) and 23 stream restorations (34,355 linear feet). The interim

programmed and planned reduction consists of three stormwater management practices and five stream restorations (12,833 linear feet). See Appendix C for information on individual projects.

The top three implemented projects that provide the greatest sediment reductions in the South River are:

- BMP0286, a stream restoration that reduces 1,327,869 lbs of sediment annually;
- BMP0740, a stream restoration that reduces 991,192 lbs of sediment annually; and
- BMP0283, a stream restoration that reduces 744,000 lbs of sediment annually.

Table 14:TMDL summary for South River TSS

Results and TMDL WLA	Loads and Percent Reduction
2009 Baseline Load (lbs)	18,642,931
FY25 Progress Load (lbs)	10,783,172
FY25 Percent Reduction	42.16%
Target TMDL WLA Percent Reduction	28.00%
Planned Implementation Load (lbs)	8,829,567
Planned Implementation Percent Reduction	52.64%

5. Other West Chesapeake Bay

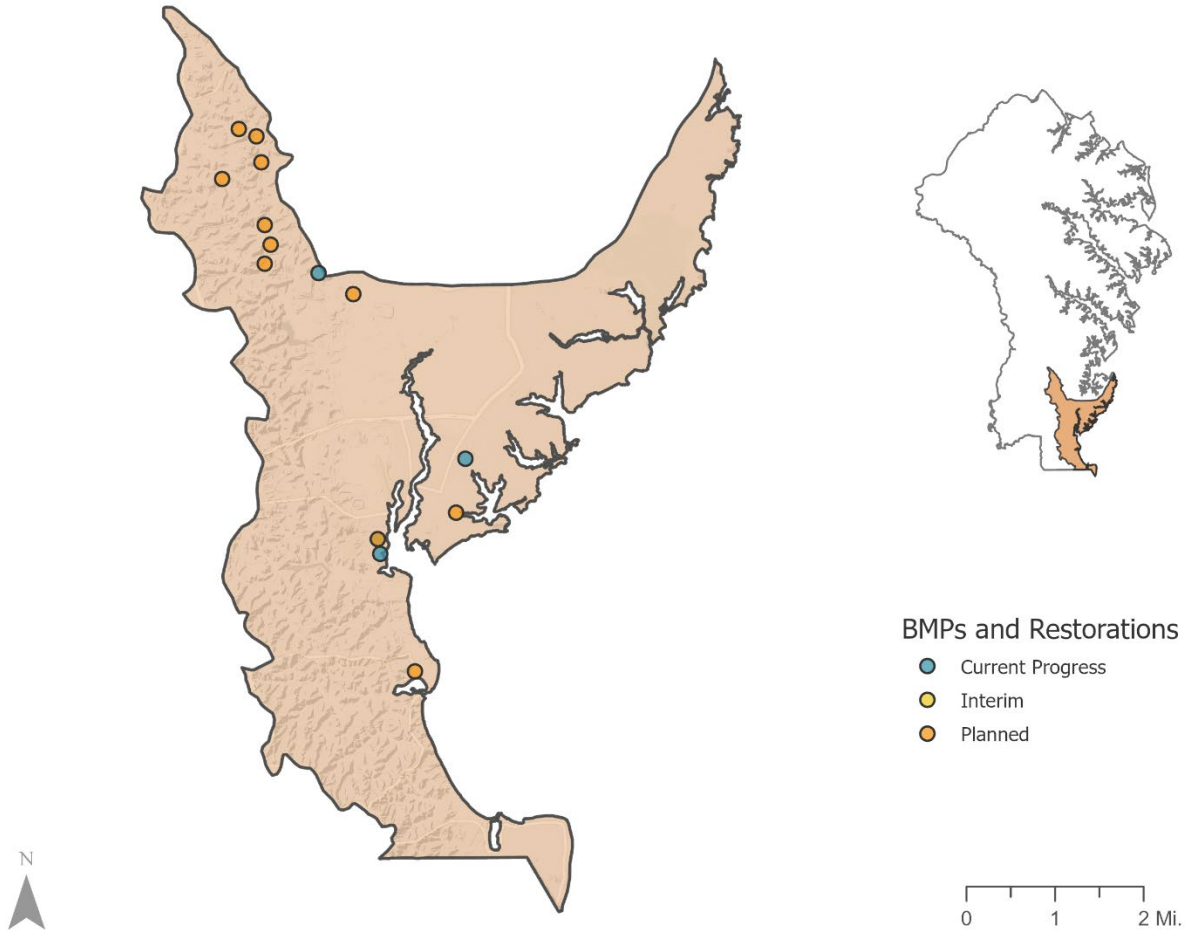

Figure 13: Map of the Other West Chesapeake Bay TSS TMDL watershed

The Other West Chesapeake watershed is situated in the southeastern portion of the County and shares political boundaries with Calvert County (Figure 13). The Anne Arundel County portion of the Other West Chesapeake watershed is approximately 14,662 acres (22.9 square miles) in area and contains approximately 100 total miles of streams.

The target sediment load for the Other West Chesapeake watershed is 7,363,965 pounds per year - a 33% reduction from the baseline by 2030. Current FY25 progress shows a reduction of 166,033 pounds (1.51%). Total interim programmed and planned restoration will result in a further 3,485,615 pounds of reduction, resulting in a total of 33.30% reduction by the completion year (Table 15).

The Other West Chesapeake FY25 progress reduction (1.51%) was achieved via street sweeping (~0.1 lane miles), storm drain cleaning (~1,057 pounds), two stormwater management practices, and two stream restorations (563 linear feet). The interim programmed and planned reduction consists of zero stormwater management practices and 11 stream restorations (14,055 linear feet) and will achieve compliance with the TMDL. See Appendix C for information on individual projects.

The top three implemented projects that provide the greatest sediment reductions in the Other West Chesapeake Bay are:

- BMP0185, a stormwater management BMP that reduces 99,622 lbs of sediment annually;
- BMP0320, a stream restoration that reduces 38,312 lbs of sediment annually; and
- BMP0771, a stream restoration that reduces 27,380 lbs of sediment annually.

Table 15:TMDL summary for Other West Chesapeake Bay TSS

Results and TMDL WLA	Loads and Percent Reduction
2009 Baseline Load (lbs)	10,966,169
FY25 Progress Load (lbs)	10,800,137
FY25 Percent Reduction	1.51%
Target TMDL WLA Percent Reduction	33.00%
Planned Implementation Load (lbs)	7,314,521
Planned Implementation Percent Reduction	33.30%

6. West River

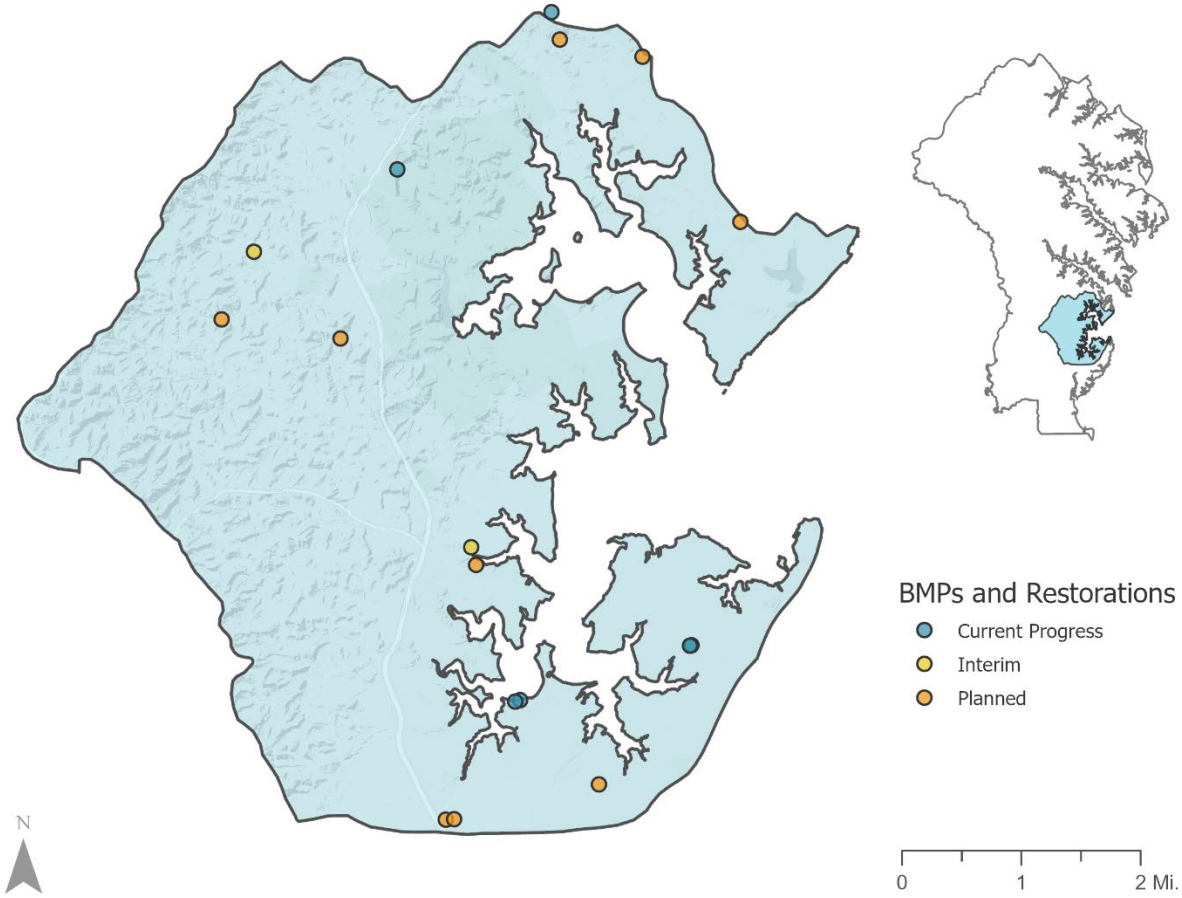

Figure 14: Map of the West River TSS TMDL watershed

The Non-Tidal West River watershed is located in the southeastern part of Anne Arundel County and consists of two major segments - the West River and the Rhode River (Figure 14). The Non-Tidal West River watershed is approximately 15,623 acres (24.4 square miles) and contains approximately 62 miles of streams, 33 miles of which are perennial.

The target sediment load for the West River is 7,150,214 pounds per year - a 22% reduction from the baseline by 2030. Current FY 25 progress shows a reduction of 64,699 pounds (0.71%). Total interim programmed and planned restoration will result in a further 2,030,019 pounds of reduction, resulting in a total of 22.91% reduction by the completion year (Table 16).

The West River FY25 progress reduction (0.71%) was achieved via street sweeping (~0.1 lane miles), storm drain cleaning (~758 pounds), four stormwater management practices, one land cover conversion BMPs (0.08 acres) and one stream restoration (1,400 linear feet). The interim

programmed and planned reduction consists of seven stormwater management practices and three stream restorations (5,380 linear feet) and will achieve compliance with the TMDL. See Appendix C for information on individual projects.

The top three implemented projects that provide the greatest sediment reductions in the West River are:

- BMP0259, a stream restoration that reduces 46,364 lbs of sediment annually;
- BMP0725, a stormwater management BMP that reduces 5,789 lbs of sediment annually; and
- BMP0069, a stormwater management BMP that reduces 4,877 lbs of sediment annually.

Table 16:TMDL summary for West River TSS

Results and TMDL WLA	Loads and Percent Reduction
2009 Baseline Load (lbs)	9,141,604
FY25 Progress Load (lbs)	9,076,905
FY25 Percent Reduction	0.71%
Target TMDL WLA Percent Reduction	22.00%
Planned Implementation Load (lbs)	7,046,886
Planned Implementation Percent Reduction	22.91%

B. Nutrient TMDLs

Required load reductions and progress load reductions for the Baltimore Harbor TN and TP TMDL are presented in Figure 4. Figure 5 shows the breakdown of load reductions by BMP type for FY25 progress load reductions, programmed load reductions, and planned load reductions. As shown in Figure 5, the majority of load reductions come from stormwater management BMPs and stream restorations.

1.Baltimore Harbor

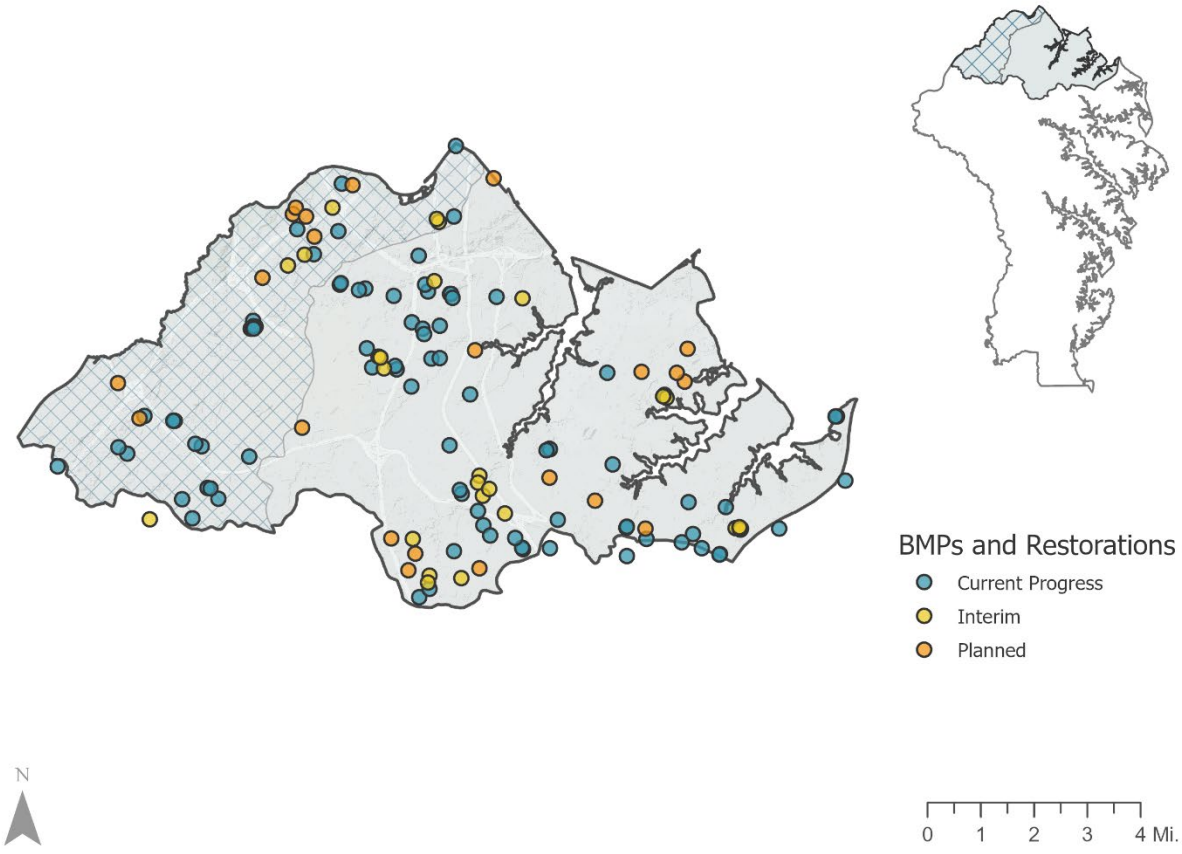

Figure 15: Map of the Baltimore Harbor TN and TP TMDL watershed

The Baltimore Harbor Watershed is situated in the northern portion of the County, and shares political boundaries with Baltimore City, Baltimore, Carroll, and Howard Counties (Figure 15). The

Anne Arundel County portion of the Baltimore Harbor watershed is approximately 45,134 acres (70.5 square miles) in area and contains approximately 202 total miles of streams.

The target Total Nitrogen (TN) load for the Baltimore Harbor is 232,941 pounds per year - a 15% reduction from the baseline by 2030. Current FY 25 progress shows a reduction of 9,929 pounds (3.63%). Total interim programmed and planned restoration will result in a further 33,425 pounds of reduction, resulting in a total of 15.84% reduction by the completion year (Table 17).

The Baltimore Harbor FY25 progress reductions for TN (3.63%) were achieved via street sweeping (~93.7 lane miles), storm drain cleaning (~138,264 pounds), 68 stormwater management practices, 7 land cover conversion BMPs (4.19 acres) and 12 stream restorations (11,465 linear feet). The interim programmed and planned reduction consists of 27 stormwater management practices and 23 stream restorations (54,858 linear feet) and will achieve compliance with the TMDL. See Appendix C for information on individual projects.

The top three implemented projects that provide the greatest TN reductions in the Baltimore Harbor are:

- BMP0268, a stream restoration that reduces 1,683 lbs of TN annually;
- BMP0198, a stormwater management BMP that reduces 1,026 lbs of TN annually; and
- BMP0291, a stream restoration that reduces 696 lbs of TN annually.

The target Total Phosphorus (TP) load for the Baltimore Harbor is 18,380 pounds per year - a 15% reduction from the baseline by 2030. Current FY25 progress shows a reduction of 1,577 pounds (7.30%). Total interim programmed and planned restoration will result in a further 6,229 pounds of reduction, resulting in a total of 36.15% reduction by the completion year (Table 18).

The Baltimore Harbor FY25 progress reductions for TP (7.30%) were achieved via street sweeping (~93.7 lane miles), storm drain cleaning (~138,264 pounds), 68 stormwater management practices, 7 land cover conversion BMPs (4.19 acres) and 12 stream restorations (11,465 linear feet). The interim programmed and planned reduction consists of 27 stormwater management practices and 23 stream restorations (54,858 linear feet) and will achieve compliance with the TMDL. See Appendix C for information on individual projects.

The top three implemented projects that provide the greatest TP reductions in the Baltimore Harbor are:

- BMP0291, a stream restoration that reduces 321 lbs of TP annually;
- BMP0268, a stream restoration that reduces 167 lbs of TP annually; and
- BMP0198, a stormwater management BMP that reduces 125 lbs of TP annually.

Table 17:TMDL summary for Baltimore Harbor TN

Results and TMDL WLA	Loads and Percent Reduction
1995 Baseline Load (lbs)	273,691
FY25 Progress Load (lbs)	263,762
FY25 Percent Reduction	3.63%
Target TMDL WLA Percent Reduction	15.00%
Planned Implementation Load (lbs)	230,337
Planned Implementation Percent Reduction	15.84%

Table 18:TMDL summary for Baltimore Harbor TP

Results and TMDL WLA	Loads and Percent Reduction
1995 Baseline Load (lbs)	21,594
FY25 Progress Load (lbs)	20,018
FY25 Percent Reduction	7.30%
Target TMDL WLA Percent Reduction	15.00%
Planned Implementation Load (lbs)	13,788
Planned Implementation Percent Reduction	36.15%

Anne Arundel County submitted the final restoration plan update for the Baltimore Harbor watershed nutrient TMDL with the FY24 MS4 annual report; MDE approved the update in May 2025.

VI. Bacteria TMDL Progress

The location of the 19 waterways with EPA-approved TMDLs associated with bacteria impairments are presented in Figure 16. Fecal coliforms are identified as the cause of impairment in 15 of the 19 waterways. *E. coli* and Enterococci are identified as the impairments in the remaining four watersheds (Table 19).

Due to the number of bacteria TMDLs, and because the four source categories (pet waste, wildlife, human, and livestock) were represented in all the impaired waterbodies, Anne Arundel County chose to develop a single consolidated implementation plan to address all 19 bacteria TMDLs.[2] The final implementation plan update was submitted with the FY23 MS4 annual report.

A summary of FY25 bacteria TMDL implementation progress can be found in Appendix D.

[2] https://www.aacounty.org/public-works/bwpr/watershed-assessment-planning/chesapeake-bay-tmdl

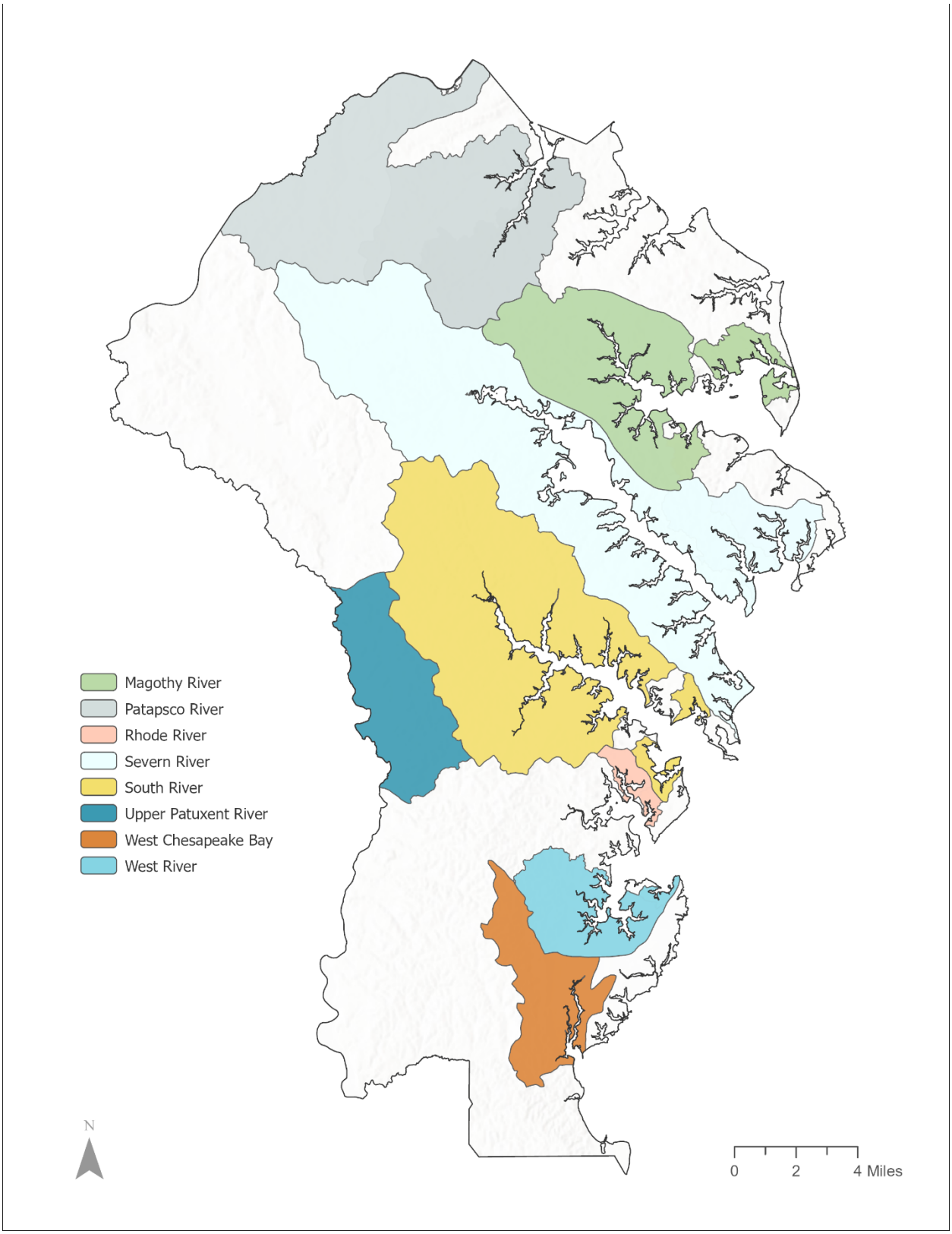

Figure 16: Map of the Bacteria TMDL watersheds in Anne Arundel County

Table 19:List of Bacteria TMDLs in Anne Arundel County

Location	Approval Date	Impairment	% Reduction Required*
Magothy River Mainstem	February 20, 2006	Fecal coliform	12.8
Magothy River/Forked Creek	February 20, 2006	Fecal coliform	26.3
Magothy River/Tar Cove	February 20, 2006	Fecal coliform	0.0
Patapsco River/Furnace Creek	March 10, 2011	Enterococci	77.7
Patapsco River/Marley Creek	March 10, 2011	Enterococci	75.7
Patapsco River Lower North Branch, 8 Digit WS 02130906	December 3, 2009	*E. coli*	20.7
Upper Patuxent River, Subsegment of 8 Digit WS 0213114	August 9, 2011	*E. Coli*	22.3
Rhode River/Bear Neck Creek	February 20, 2006	Fecal coliform	43.3
Rhode River/Cadle Creek	February 20, 2006	Fecal coliform	72.2
Severn River Mainstem, Subsegment of 8 Digit WS 02131002	April 10, 2008	Fecal coliform	19.0
Severn River/Mill Creek	April 10, 2008	Fecal coliform	86.0
Severn River/Whitehall & Meredith Creeks	April 10, 2008	Fecal coliform	90.0
South River/Duvall Creek	November 4, 2005	Fecal coliform	45.6
South River, Subsegment of 8 Digit WS 02131003	November 4, 2005	Fecal coliform	29.5
South River/Ramsey Lake	November 4, 2005	Fecal coliform	59.3
South River/Selby Bay	November 4, 2005	Fecal coliform	0.0
W. Chesapeake Bay/Tracy & Rockhold Creeks	February 20, 2006	Fecal coliform	81.6
West River, Subsegment of 8 Digit WS 02131004	February 20, 2006	Fecal coliform	35.3
West River/Parish Creek	February 20, 2006	Fecal coliform	53.1

*Based on the MDE published TMDL documents for bacteria impaired watersheds in Anne Arundel County and Anne Arundel County's *Total Maximum Daily Load Restoration Plan for Bacteria, February 2017*. Percent reductions required for the Patapsco and Upper Patuxent are for the Anne Arundel County portion only.

A. Restoration Strategies

Two restoration strategies are implemented in Anne Arundel County to achieve bacteria TMDL compliance. The first strategy (Tier A) addresses the human sources of bacteria originating from effluent from poorly maintained septic systems, sanitary sewage overflows (SSOs), and illicit discharges of wastewater into storm drains. The second strategy (Tier B) addresses non-human sources of bacteria originating from as pet, wildlife, and livestock excrement.

1.Tier A Strategies

a. Illicit Detection and Elimination

The County's Illicit Discharge Detection and Elimination (IDDE) program requires that approximately 150 outfalls are evaluated each year. In FY25, the County evaluated a total of 163 outfalls. Two outfalls had a confirmed illicit discharge. Please refer to the *FY25 IDDE Program* Report – found in Appendix C of the *Fiscal Year 2025 NPDES MS4 Annual Report* – for more information regarding the illicit discharges and corrective actions taken.

b. Sanitary Sewer Overflow Abatement

The County has a program to upgrade the sanitary sewer system to improve its reliability. These upgrades aim to abate SSOs and reduce the discharge of human bacteria to surface water. No sewer pumping station (SPS) upgrade projects were completed in watersheds with a bacteria TMDL in FY25. There are currently 10 active SPS upgrade projects in bacteria TMDL watersheds that are scheduled to be completed in future fiscal years. In FY25, 46 SSOs were reported throughout the County, with 25 of those occurring within bacteria TMDL watersheds. The County maintains a live, publicly accessible map viewer of SSOs that can be found here.

c. Septic Retirement

The County aims to retire 20-40 septic systems per year, and replace these systems with connection to the sanitary sewer system. In FY25, the County retired 12 septic systems, 11 of which were located in watersheds with a bacteria TMDL. Between FY2017 and FY2025, the County has connected a total of 223 private septic systems to the public sewer system (181 in bacteria TMDL watersheds). A list of all septic-to-sewer connections can be found in Appendix D.

d. Monitoring

For the current MS4 permit term, the County has opted to fund the pooled monitoring initiative for bacteria research in lieu of conducting bacteria trend monitoring. There are several bacteria monitoring programs in the County to assess impairment in local waterways and to confirm water quality improvements resulting from BMP and programmatic implementation. These efforts include the following programs:

- Anne Arundel County Department of Health's bi-weekly monitoring of public bathing beaches from Memorial Day through Labor Day.
- Monitoring in the Rhode River/Bear Neck Creek to assess water quality impacts associated with the conversion of the Mayo Water Reclamation Facility from water treatment plant to pumping station.
- Bacteria monitoring as part of post-restoration storm and baseflow monitoring at two CIP restoration projects - Furnace Branch and Cowhide Branch - both of which are located in bacteria TMDL watersheds. Monitoring at both of these projects has been completed, with final monitoring reports to be finalized in the future.
- Weekly monitoring conducted by volunteers in conjunction with Anne Arundel Community College ("Operation Clearwater") during the summer swimming season. This sampling and analysis program has been ongoing for 17 years, and the County continues to support these efforts.

Moving forward, the County intends to focus future bacteria reduction efforts in TMDL watersheds where SW-WLAs have not yet been met, to the greatest extent possible. The County understands that current literature suggests that the effectiveness of BMPs to reduce bacteria levels is variable, and largely dependent on site location and BMP type. The County will continue to collaborate with MDE and other jurisdictions to investigate the effect that BMPs have on reducing bacteria concentrations. Where such opportunities exist, the County will continue to employ BMPs with other controls to reduce bacteria loads.

For more information regarding Tier A Strategies please refer to Appendix D.

2. Tier B Strategies

a. Stormwater Retrofits

The County has a program to implement new stormwater management practices and retrofit pre-2002 stormwater management facilities. This program concurrently treats stormwater from impervious surfaces and reduces pollutants such as bacteria. A total of 425 projects (including 172

upland BMPs and 253 septic connections) have been completed in watersheds with a bacteria TMDL between 2012 and 2025. Three upland BMPs were completed in bacteria TMDL watersheds in FY25. The list of completed and planned BMPs can be found in Appendix D.

b. Street Sweeping and Inlet Cleaning

Bureau of Highways maintains an enhanced street sweeping and inlet cleaning program. The program focuses on routes that consist of curbed streets in impaired watersheds, routes that lack engineered stormwater quality controls, and areas considered to be pollutant hotspots; 181.28 lane miles are swept within the County's Bacteria TMDL watersheds.

Table 20:Lane miles of street sweeping within Bacterial TMDL watersheds

Watershed	Lane Miles Swept
Magothy River Mainstem	21.43
Magothy River/Forked Creek	2.19
Magothy River/Tar Cove	1.00
Patapsco River/Furnace Creek	22.16
Patapsco River/Marley Creek	24.89
Patapsco River Lower North Branch, 8 Digit WS 02130906	34.04
Upper Patuxent River, Subsegment of 8 Digit WS 0213114	0.75
Rhode River/Bear Neck Creek	0.11
Rhode River/Cadle Creek	0.00
Severn River Mainstem, Subsegment of 8 Digit WS 02131002	47.92
Severn River/Mill Creek	4.70
Severn River/Whitehall & Meredith Creeks	0.46
South River/Duvall Creek	0.40
South River, Subsegment of 8 Digit WS 02131003	20.96
South River/Ramsey Lake	0.23
South River/Selby Bay	0.00
W. Chesapeake Bay/Tracy & Rockhold Creeks	0.03
West River, Subsegment of 8 Digit WS 02131004	0.00
West River/Parish Creek	0.00

c. Pet Waste Management

Among the Tier B strategies, pet waste management achieves the greatest load reductions for the least cost and continues to be a focus of the County's bacteria management strategy. The County continued to highlight proper pet waste management practices through its social media outlets and at community events and presentations throughout FY25, and continues to make pet waste stations available to interested communities for no cost. Moving forward, primary responsibility

for implementing the pet waste outreach and education campaign will be transferred to the Anne Arundel Watershed Stewards Academy, while the County will still provide materials and support for outreach initiatives. The County will maintain its role in implementation oversight and reporting associated with Bacteria SW-WLA achievement activities. In FY25, nine pet waste stations were provided to interested residential neighborhoods throughout the County, all of which are located in bacteria TMDL watersheds.

a. Canada Goose Management

The County added a new Tier B strategy to its Bacteria TMDL Implementation Plan update in FY23. This Tier B strategy involves management of non-migratory Canada goose populations at sites that contain open water. In FY23 the County initiated a "No Mow" Program on targeted County owned stormwater management ponds to discourage large and long-term congregations of Canada geese at stormwater ponds, particularly during nesting and molting seasons. Goose populations serve as sources of bacteria and nutrient sources to these ponds and other water bodies throughout the County.

For more information on stormwater pond "no mow" buffers study and other Tier B Strategies please refer to Appendix D.

B. Bacteria TMDL Watersheds

A summary of the Bacteria TMDLs by watershed is provided in the following sections.

1. Magothy River (Mainstem, Forked Creek, and Tar Cove)

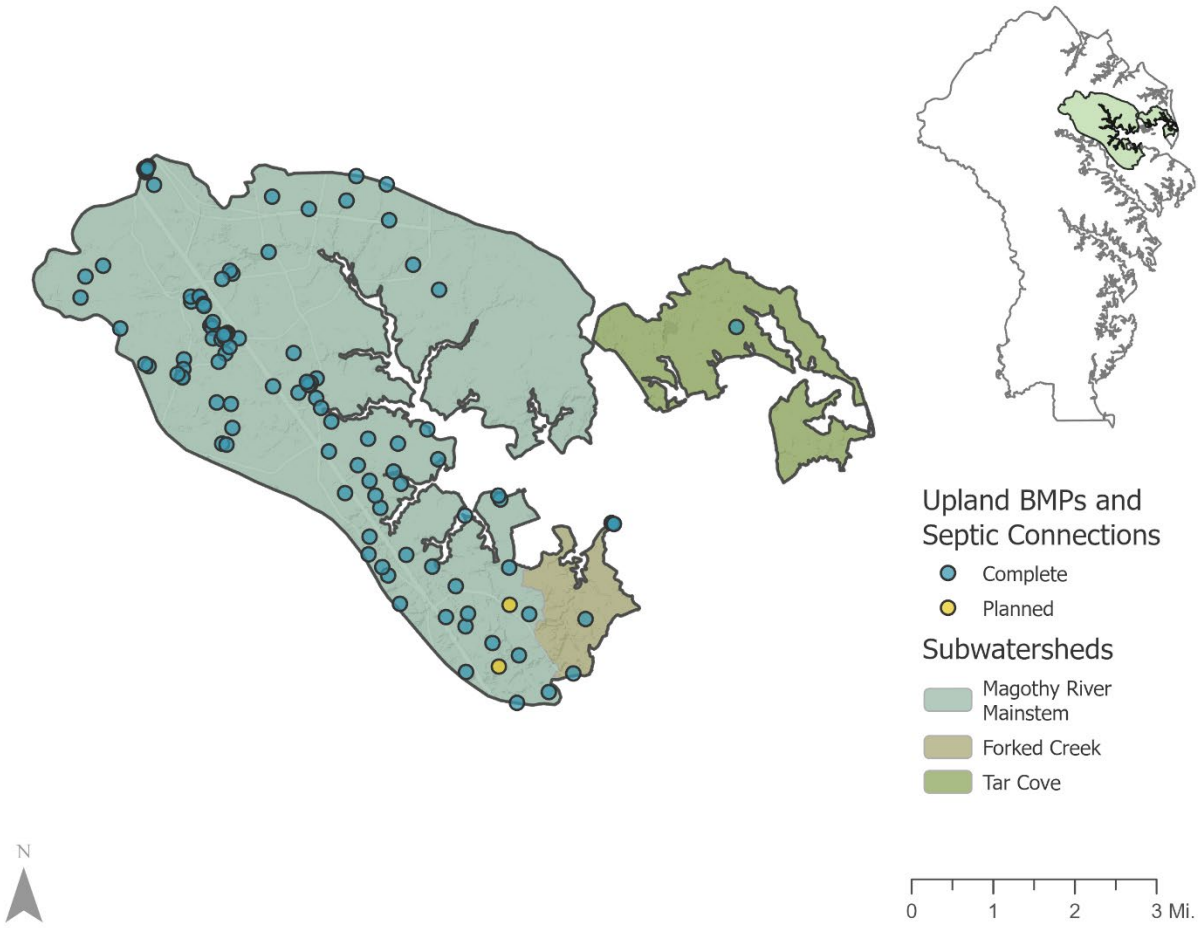

Figure 17: Map of the Magothy River Bacteria TMDL watershed

The Magothy River Watershed is located in the northeastern portion of the County near Pasadena and Severna Park (Figure 17). The Magothy River flows southeast into the Chesapeake Bay near Gibson Island. There are 3 bacteria TMDLs in the Magothy River – the Magothy mainstem, Forked Creek and Tar Cove. Forked Creek is a small tidal creek located along the south shoreline of the river near its mouth and has a mainstem approximately 2.5 miles long. Tar Cove is on the opposite (north) shoreline, adjacent to Sillery Bay. The primary land use category in all three watersheds is residential. All three watersheds are impaired by fecal coliforms.

Upland Restoration BMPs and Septic Connections in the Magothy River:

Magothy Mainstem:	98 complete, 2 planned
Forked Creek:	5 complete
Tar Cove:	1 complete

2. Patapsco River (Patapsco Lower North Branch, Furnace Creek, and Marley Creek)

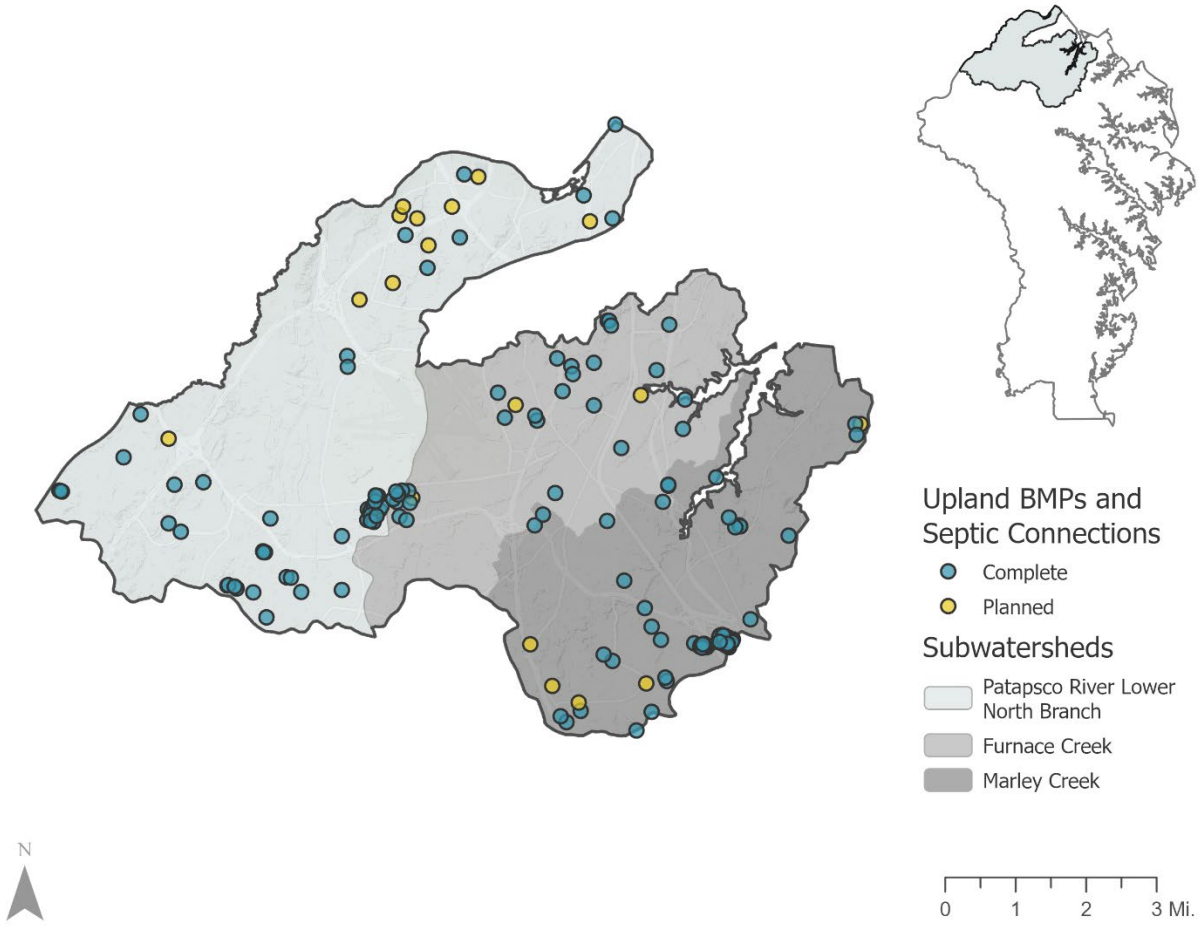

Figure 18: Map of the Patapsco River Bacteria TMDL watershed

Anne Arundel County's portion of the Patapsco Lower North Branch (LNB) watershed is approximately 15,270 acres (23.9 square miles) in area and contains approximately 96 miles of streams (Figure 18). The Patapsco River LNB is generally non-tidal, and is one of two bacteria TMDL watersheds impaired by *E. coli*.

Furnace Creek and Marley Creek are tidal creeks in the northern portion of the County, a few miles east of Baltimore-Washington International airport. These two watersheds are similar in size (8,579 acres for Furnace Creek, 8,737 acres for Marley Creek), and are highly urbanized with much residential development. The Marley Creek and Furnace Creek watersheds are both impaired by Enterococci.

Upland Restoration BMPs and Septic Connections in the Patapsco River:

Lower North Branch:	51 complete, 10 planned
Furnace Creek:	27 complete, 3 planned
Marley Creek:	65 complete, 5 planned

3. Upper Patuxent River

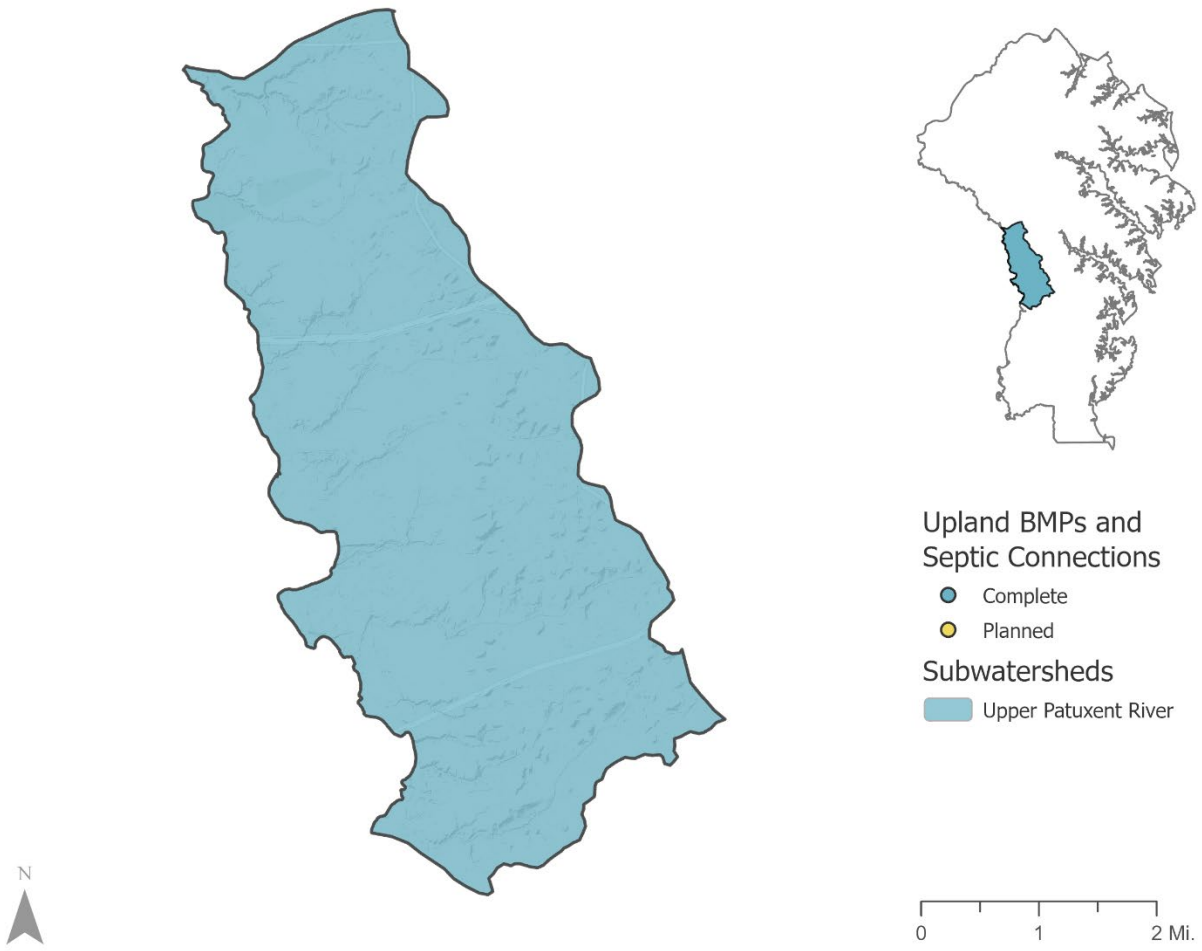

Figure 19: Map of the Upper Patuxent River Bacteria TMDL watershed

The Upper Patuxent is situated in the western portion of the County (Figure 19). Anne Arundel County's portion of the Upper Patuxent watershed is approximately 22,420 acres (35.0 square miles) in area and contains approximately 90 total miles of perennial stream. The Upper Patuxent Watershed is one of two bacteria watersheds that are impaired by *E. coli*. No upland projects have been completed or planned.

4. Rhode River (Bear Neck Creek and Cadle Creek)

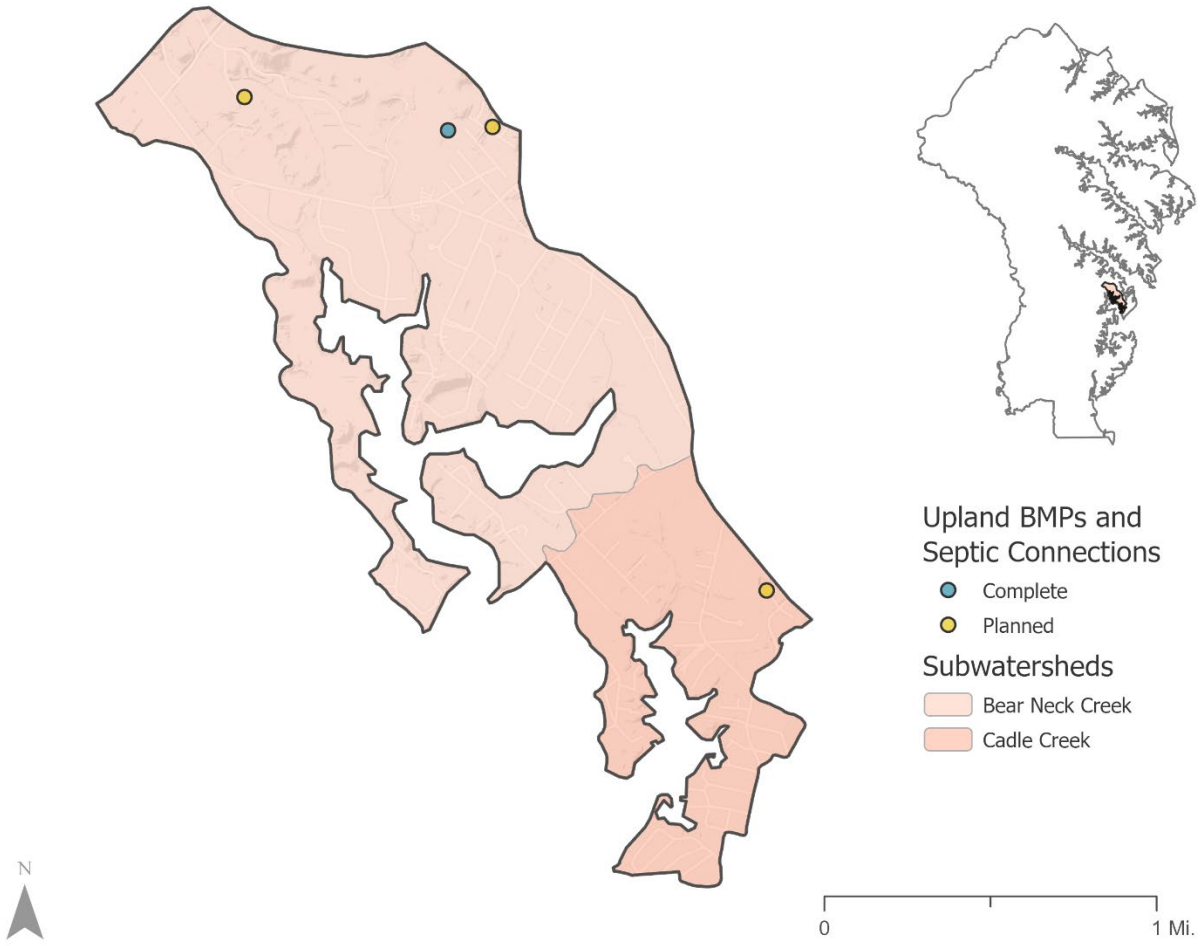

Figure 20: Map of the Rhode River Bacteria TMDL watershed

Bear Neck Creek and Cadle Creek are located in the Rhode River Watershed, in the southeastern part of Anne Arundel County (Figure 20). The Bear Neck Creek Watershed is 880 acres with 50 percent of its land use being residential, mainly consisting of the community of Mayo. The Cadle Creek Watershed is 320 acres, with approximately 70 percent of the land use is residential and 20 percent is impervious.

<u>Upland Restoration BMPs and Septic Connections in the Rhode River:</u>
Bear Neck Creek: 1 complete; 2 planned
Cadle Creek: 1 planned

5. Severn River (Mainstem, Mill Creek, and Whitehall and Meredith Creeks)

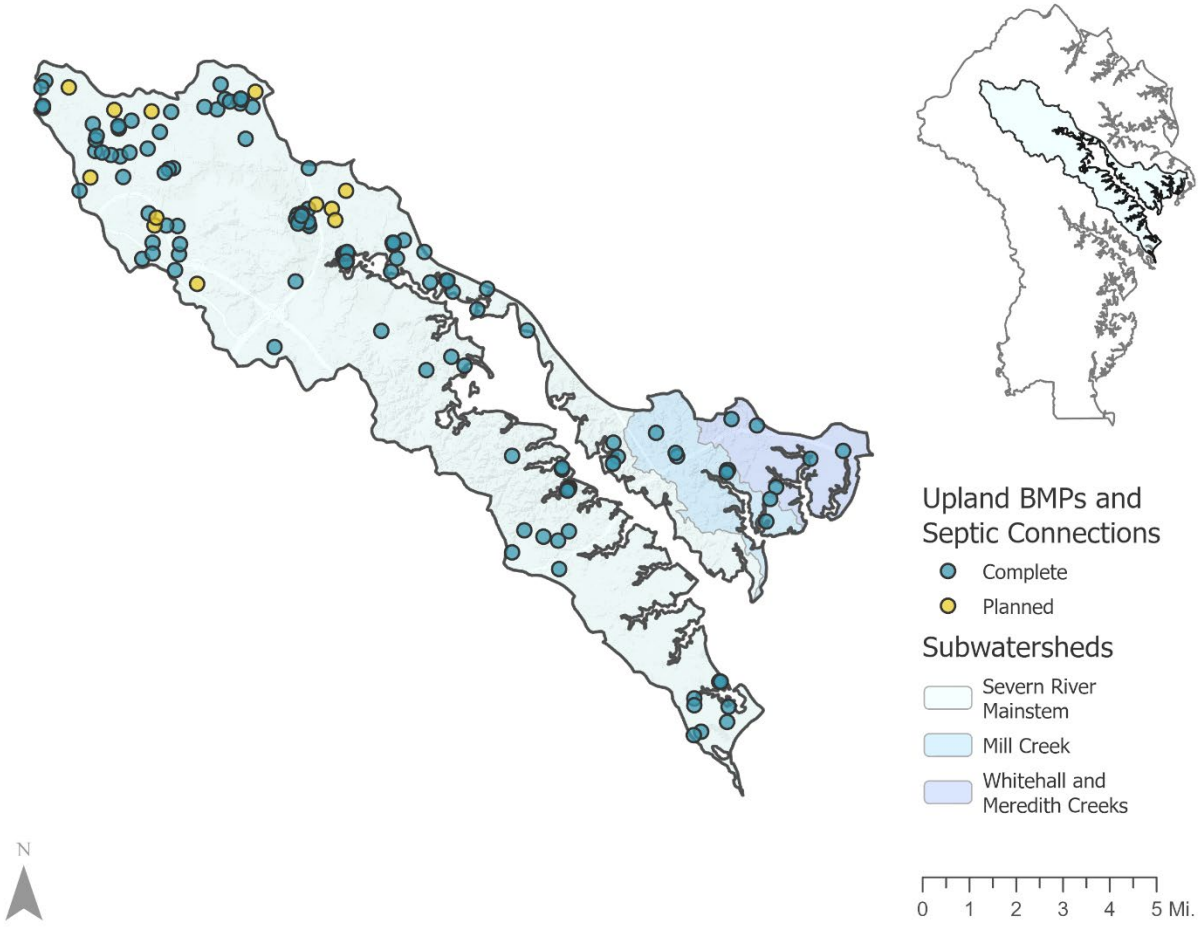

Figure 21: Map of the Severn River Bacteria TMDL watershed

The Severn River Mainstem flows from northwest to southeast across the center of the County, from the community of Severn at the headwaters to the city of Annapolis near the mouth (Figure 21). The total watershed area is 37,011 acres, and the dominant land uses are residential at 44 percent and forested at 35 percent. Mill Creek, Whitehall Creek, and Meredith Creek are all located a few miles northeast of the Severn River's mouth and discharge into the Chesapeake Bay just west of the Bay Bridge.

Upland Restoration BMPs and Septic Connections in the Severn River:

Severn Mainstem:	107 complete, 12 planned
Mill Creek:	8 complete
Whitehall and Meredith:	5 complete

6. South River (Mainstem, Duvall Creek, Ramsey Lake, Selby Bay)

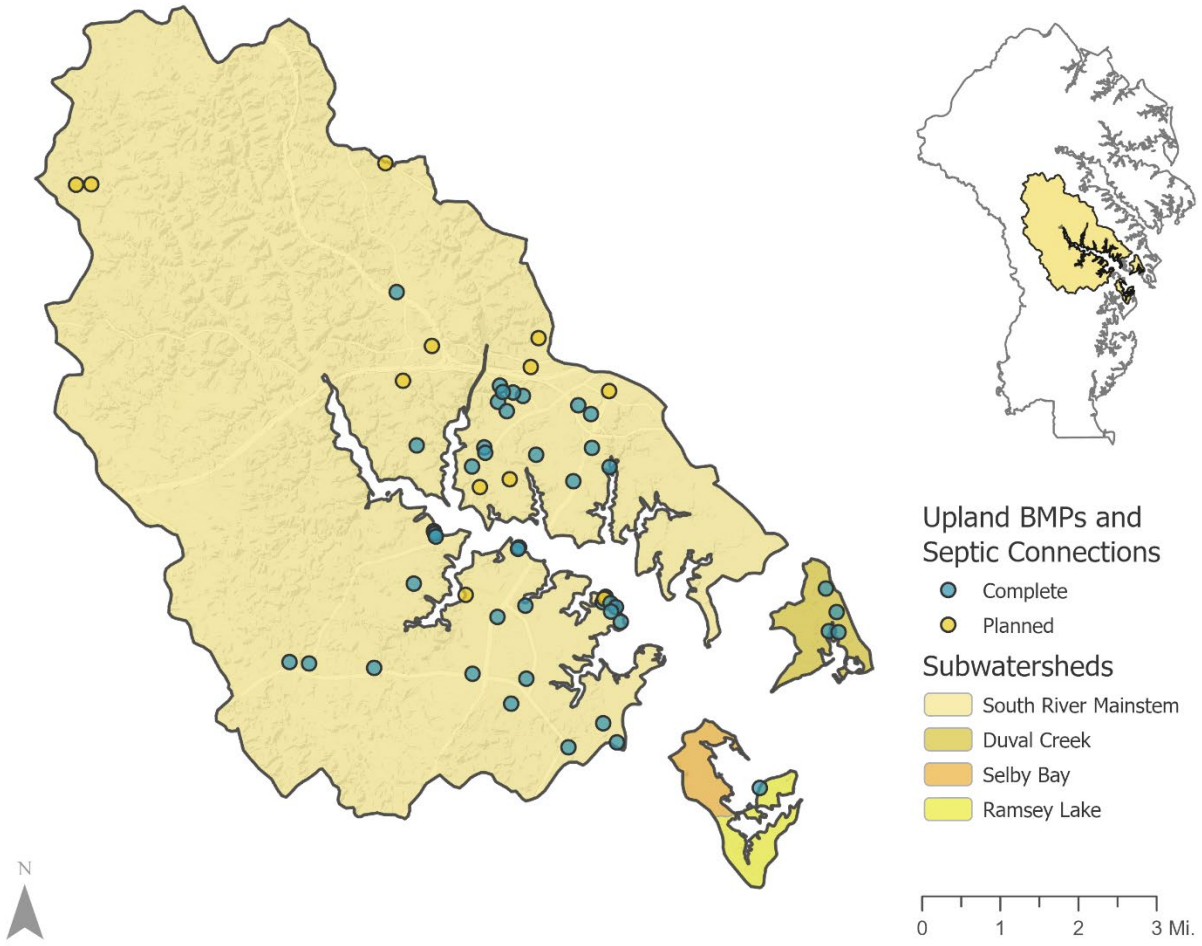

Figure 22: Map of the South River Bacteria TMDL watershed

The South River Watershed has four impaired waterways with approved bacteria TMDLs: the South River Mainstem, Duvall Creek, Ramsey Lake, and Selby Bay (Figure 22). The South River is located immediately south of the Severn River in the central portion of the County. Like the Severn, it flows from northwest to southeast. The headwaters are near the town of Crownsville. The mouth, where it discharges to the Chesapeake Bay, is near Thomas Point Park. Duvall Creek, Ramsey Lake, and Selby Bay are small embayments near the mouth of the South River.

<u>Upland Restoration BMPs and Septic Connections in the South River:</u>

South River:	39 complete, 13 planned
Duval Creek:	4 complete
Ramsey Lake:	1 complete
Selby Bay:	None

7. West Chesapeake Bay (Tracy and Rockhold Creeks)

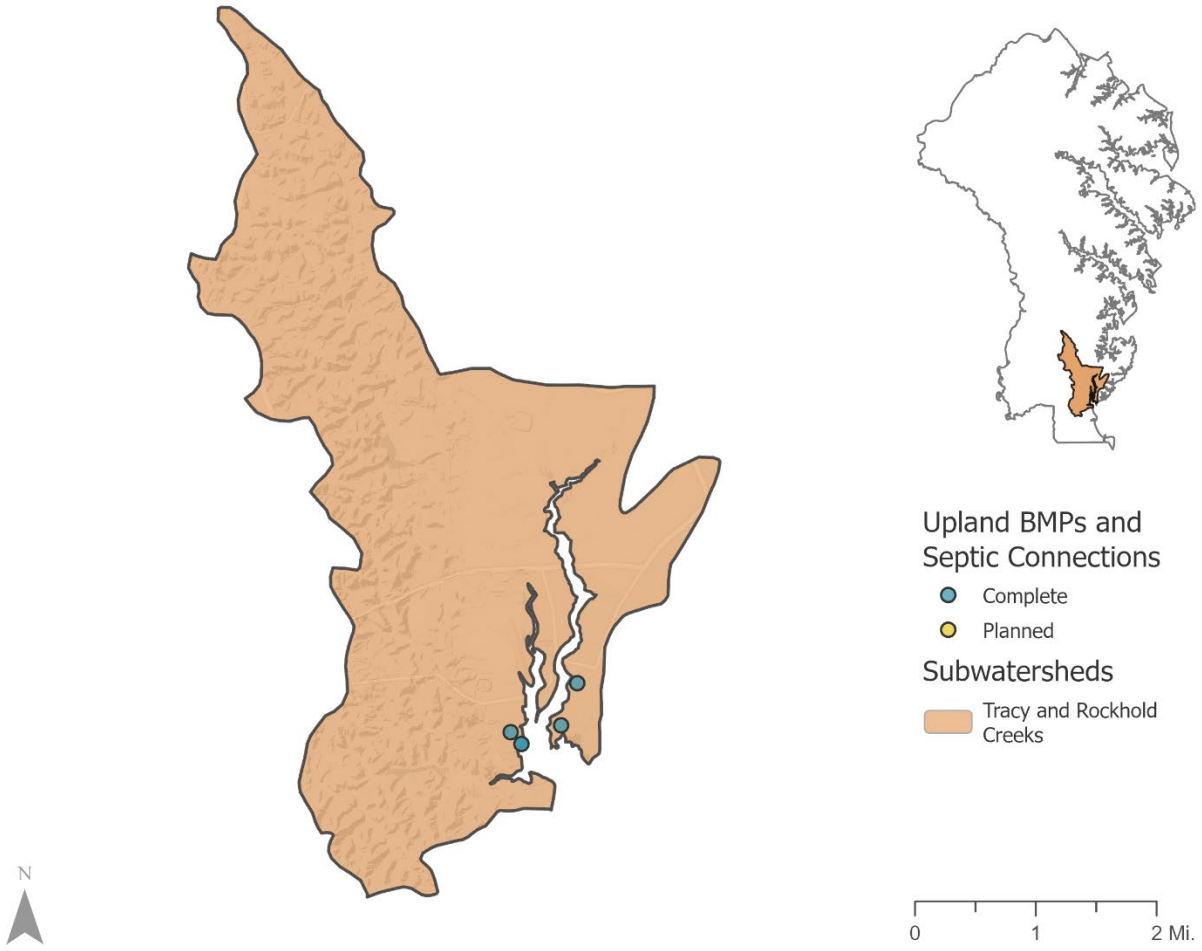

Figure 23: Map of the Other West Chesapeake Bay Bacteria TMDL watershed

Tracy and Rockhold Creeks, situated in the southeastern portion of the County (Figure 23), have a combined watershed area of 7,962 acres, about half of which is forest.

<u>Upland Restoration BMPs and Septic Connections in the West Chesapeake Bay:</u>
Tracy and Rockhold Creeks: 5 complete

8. West River (Mainstem and Parish Creek)

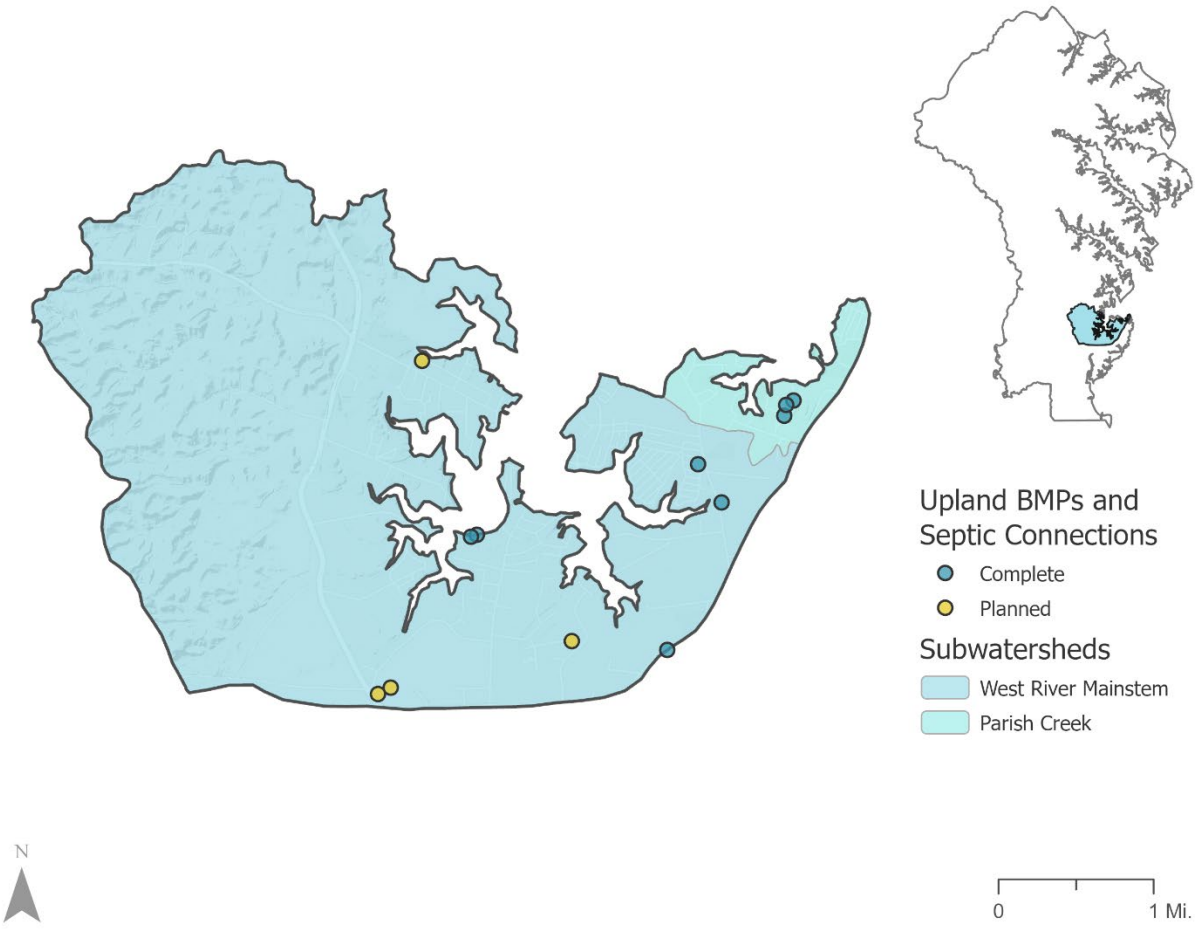

Figure 24: Map of the West River Bacteria TMDL watershed

The West River is a tidal estuary and river system in the southeast portion of the County near the town of Galesville (Figure 24). Parish Creek is a small estuary east of the West River, near the town of Shady Side. Parish Creek drains an area of 324 acres.

<u>Upland Restoration BMPs and Septic Connections in the West River:</u>
West River: 5 complete; 4 planned
Parish Creek: 3 complete

VII. PCB TMDL Progress

The locations of the two PCB TMDLs within Anne Arundel County are presented in Figure 25.

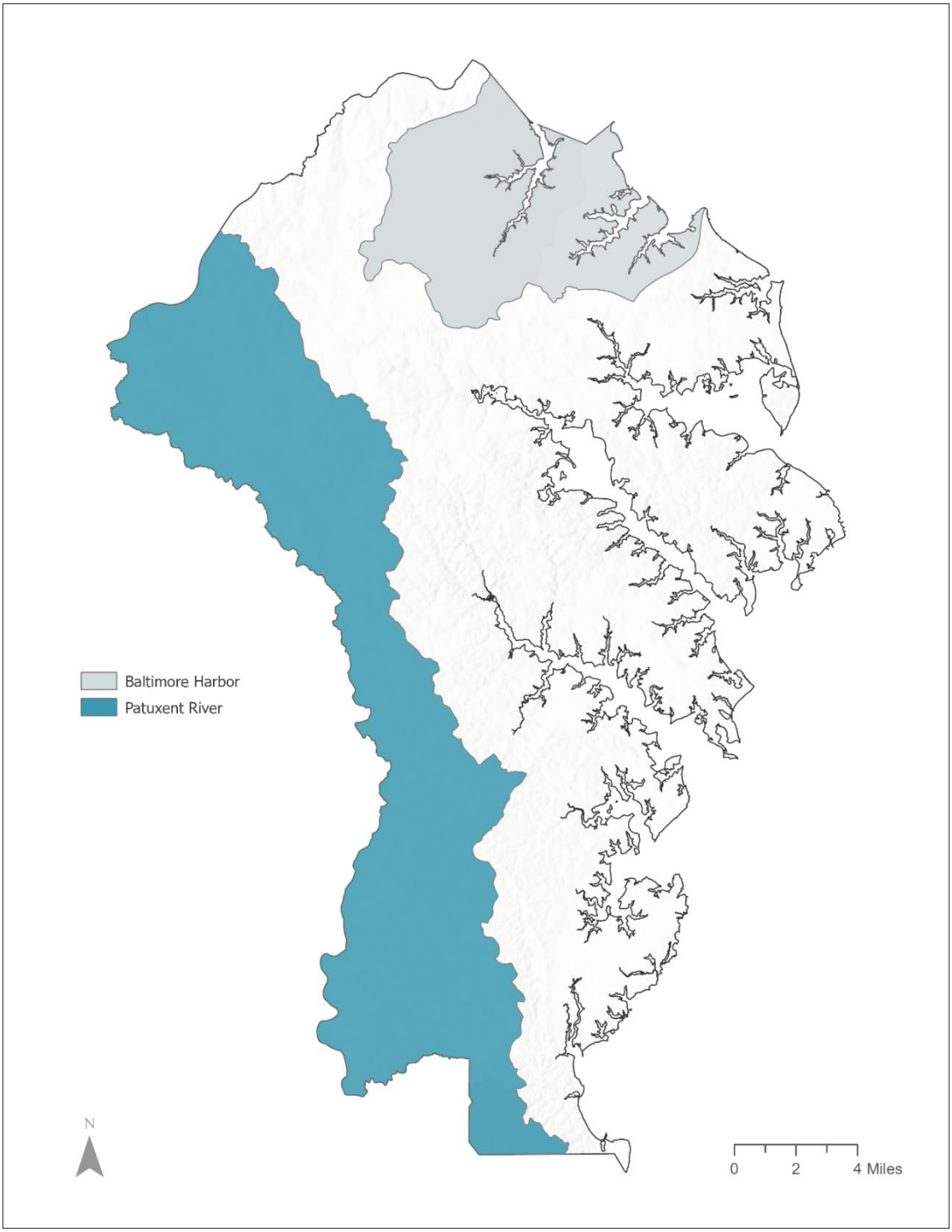

Figure 25: Map of the PCB TMDL watersheds in Anne Arundel County

A. Baltimore Harbor

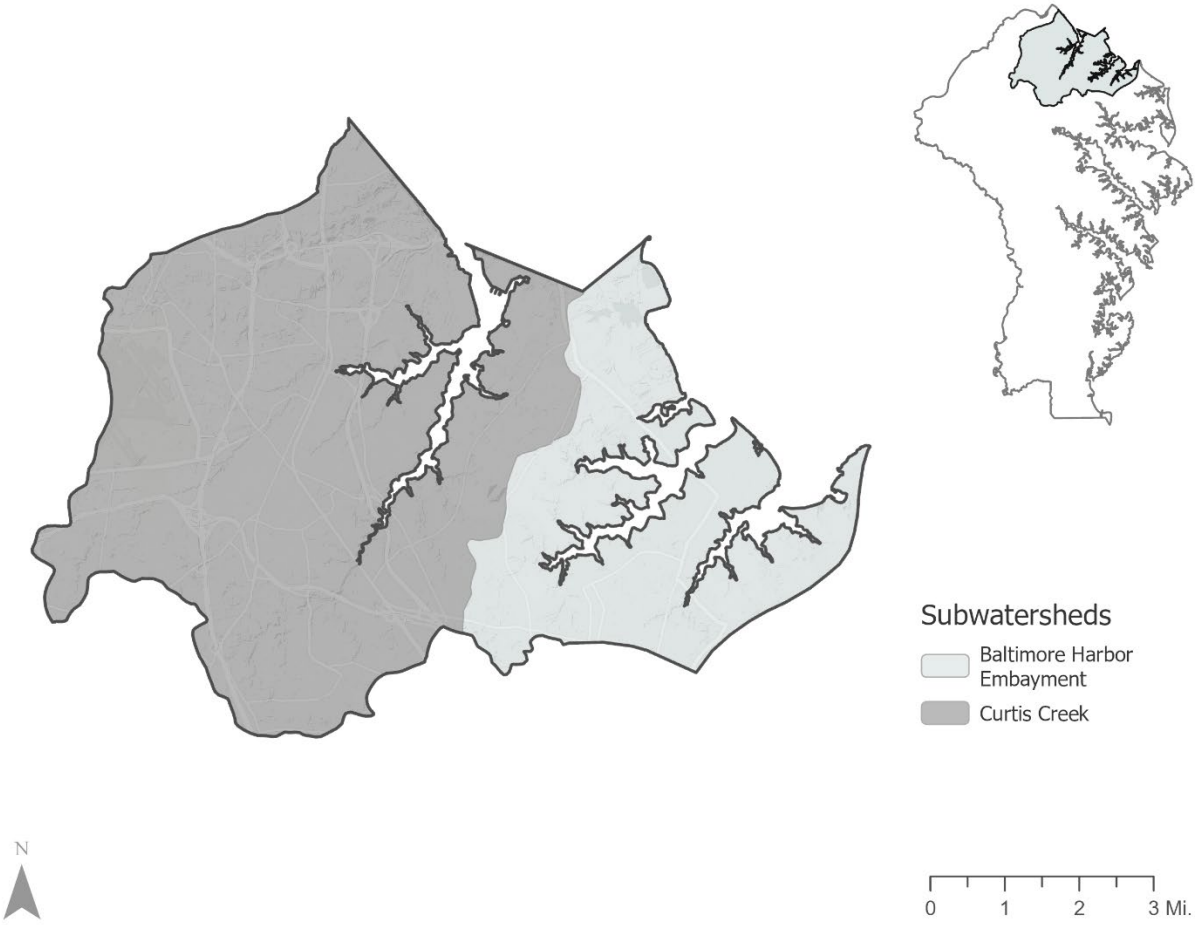

Figure 26: Map of the Baltimore Harbor PCB TMDL watershed

In 2012, EPA approved a TMDL for Polychlorinated Biphenyls (PCBs) for the Baltimore Harbor, Curtis Creek/Bay, and Bear Creek portions of the Patapsco River Mesohaline Tidal Chesapeake Bay Segment (Figure 26). The PCB TMDL addresses PCBs in fish tissue for the Baltimore Harbor Embayment, and PCBs in fish tissue and sediment for Curtis and Bear Creeks. The required percent reduction in PCBs by 2025 is 93.5% for Curtis Creek and 91.1% for Baltimore Harbor. The County's actions towards implementation to date are as follows:

- **2016 -** The County submitted its Baltimore Harbor and Curtis Creek/Bay Polychlorinated Biphenyls (PCB) TMDL Restoration Plan as part of the County's 2016 MS4 Annual Report.
- **2019 –** The County completed the development of a targeted PCB Action Strategy.

- **Spring 2020 -** Following completion of the action strategy, the County engaged in collaboration with MDE's Integrated Water Planning Program and University of Maryland Baltimore County (UMBC) staff to develop a trackback-style monitoring strategy utilizing passive samplers to measure time-integrated freely dissolved PCB water column concentration to further investigate watershed sources of PCB. An agreement was reached in which MDE would provide funding for field personnel, while UMBC would provide training, materials and analysis towards the monitoring effort.
- **Fall 2020 -** Phase 1 of the monitoring effort began in September 2020 with the deployment of passive surface water PCB sampling devices at 17 locations within the Sawmill Creek watershed (a subwatershed of the Baltimore Harbor PCB TMDL watershed), as well as two reference locations outside of the TMDL watershed. In November 2020, sediment grab samples were also collected at each of the 19 sites and in early December 2020, the passive samplers were retrieved. During FY 23 analysis of both surface water and sediment was conducted by UMBC staff. Phase I sampling was successful in identifying two tributaries contributing significant PCB loads. The full results of the Phase I monitoring are presented in the *PCB Source Tracking in Anne Arundel County, January 12, 2022* report included in Appendix F of the 2024 Countywide TMDL Stormwater Implementation Plan.
- **2022 -** Based on the results of the 2020 Sawmill Creek monitoring, a Phase II sampling plan was finalized in May 2022 in an effort to further determine geographic sources of PCBs. Phase II monitoring began in July 2022 and concluded in November 2022. Phase II monitoring utilized combinations of standard water column passive sampling, stream bed sediment sampling, pore water sampling, short time passive sampling and suspended sediment sampling (using sediment traps) at 12 sites in the two tributaries of concern identified in Phase I. Phase II sampling was again a collaborative effort between the County, UMBC, and MDE. Sample analysis and data reporting was conducted by UMBC. Results of the Phase II monitoring are presented in the *PCB Source Tracking Report in Anne Arundel County – Phase II* report included in Appendix F of the 2024 Countywide TMDL Stormwater Implementation Plan.
- **2024 -** The County is collaborating with UMBC on Phase III of a source tracking effort in the Sawmill Creek watershed, as well as Phase I monitoring efforts in the Cabin Branch and Marley Creek subwatersheds. In all three watersheds, samplers were deployed in November 2024 and retrieved in March 2025. Please refer to *Proposal for PCB source tracking in Anne Arundel County- Phase 3 (2024)* in Appendix G of this document for UMBC's work plan for this effort. As of the writing of this report, UMBC is still processing and analyzing samples. Results of these monitoring efforts, as well as the monitoring report(s), will be shared with MDE upon receipt and review by the County.
- **2025 -** The County has updated the Baltimore Harbor and Curtis Creek/Bay PCB TMDL Implementation Plan. The draft plan update can be found in Appendix B of this document.

B. Patuxent River

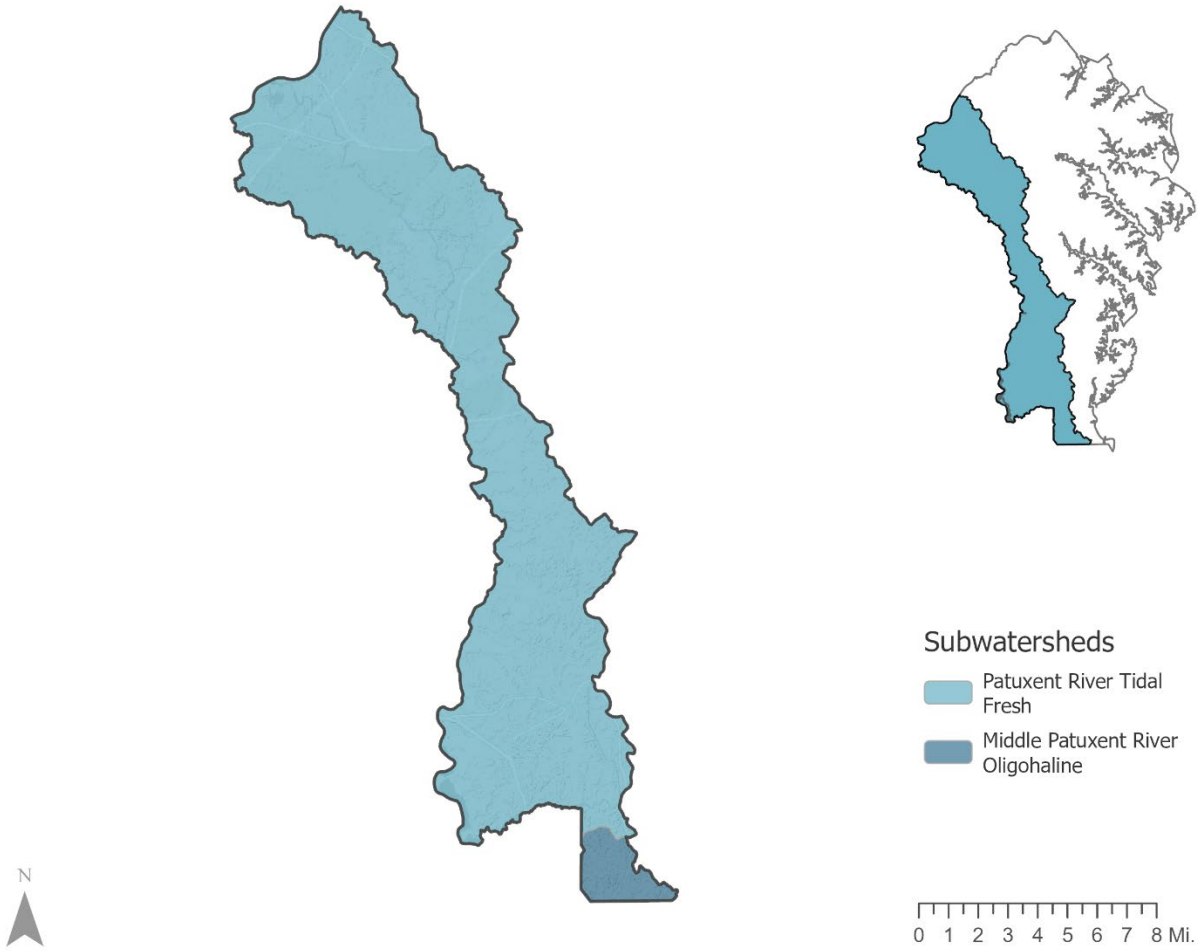

Figure 27: Map of the Patuxent River PCB TMDL watershed

The Total Maximum Daily Load of Polychlorinated Biphenyls in the Patuxent River Mesohaline, Oligohaline and Tidal Fresh Chesapeake Bay Segments was approved by EPA in 2017 and requires a 99.9 % reduction in PCB loads (Figure 27). In 2020, Anne Arundel County submitted a draft restoration plan for the tidal fresh portion of the watershed that lies within the boundary of Anne Arundel County for MDE review. Subsequent comments and responses to those comments occurred from November 2020 through July 2021.

It is anticipated and generally understood that a 99.9% reduction in PCB loading may not be feasible given the current limited understanding of PCB sources, the ubiquitous presence of PCBs in watershed soils, and the limitations of stormwater systems to control PCB loading. Therefore, MDE is looking to local jurisdictions to document annual progress on PCB source tracking and programmatic implementation.

Following MDE's issuance of "*Guidance for Developing Local PCB TMDL Stormwater Wasteload Allocation Watershed Implementation Plans, August 2022"*, the County completed a watershed implementation plan to address PCBs in the Patuxent watershed in September 2024. The plan builds upon the County's 2020 implementation plan, meets MDE's requirement to update previously approved TMDL plans by the end of the current MS4 permit term, and includes a PCB monitoring plan for the County's portion of the TMDL watershed. The draft plan was posted for public comment for the period of December 1, 2024 through December 30, 2024 - no public comments were received. MDE provided written approval of the draft plan in April 2024. The final Implementation Plan can be found in Appendix A of this document. Development of a QAPP and Phase I monitoring are next steps.

VIII. Adaptive Management Strategy

A. Overview

Anne Arundel County's strategy for making progress toward meeting SW-WLAs is achieved through an adaptive management process that involves both quantitative assessment strategies (TIPP modeling and impairment monitoring) and qualitative assessment strategies (programmatic). The adaptive management process includes evaluating multiple aspects of the TMDL implementation process to incorporate new information and to refine benchmarks and milestones and to identify deficiencies. The County evaluates its implementation progress annually to identify and incorporate improvements. Progress is reported annually in the Countywide TMDL Stormwater Implementation Plan as part of the MS4 Annual report submittal.

B. Countywide Management Strategy

The foundation for the County's restoration program was set forth in the County's 2012 Phase II Chesapeake Bay TMDL Watershed Implementation Plan (WIP) following MDE's allocation of stormwater loads for nitrogen, phosphorus and sediment on September 15, 2011. The County's Phase II WIP identified programs, policies and practices, and established a commitment to implementation that ensures achievement of the required nitrogen, phosphorus and sediment load reductions. The County's Phase II WIP set forth a strategy for implementation that identified statutory authority, capital projects, funding mechanisms and timelines for achieving its allocated loads using nitrogen as the keystone pollutant. The County adopted an edge of stream strategy to pursue load reductions associated with the stormwater sector, with most of the nutrient and sediment load reductions anticipated to be achieved through implementation of this strategy and execution of TMDL implementation plans. Further, this strategy is critical to restoring the functional capacity, efficiency, and overall health of the County's headwater streams with the goal of attaining all SW-WLAs and ultimately delisting impaired waterbodies.

1. Quantitative SW-WLA Load Reduction Tools

Anne Arundel County's primary tool for achieving quantifiable SW-WLA reductions is its 6-Year Capital Improvement Program (CIP). Restoration projects are identified and included in the CIP budget each fiscal year. The CIP includes projects budgeted for design and construction for the current fiscal year and projects programmed for the following 5 fiscal years. Projects programmed into the CIP budget were initially identified through comprehensive assessments of all County watersheds. In developing these assessments, the County prioritized all watersheds as high, medium, low and very low for restoration and for preservation. To date, the majority of the restoration projects identified in the County's Phase II WIP have been implemented. These projects

are broadly classified as stream restoration projects, stormwater management retrofits, shoreline restoration and storm drain infrastructure maintenance and repair. In addition to restoration projects implemented through its CIP Program, the County has established a BWPR Restoration Grant Program that provides funding for NGO restoration projects and a public-private partnership "Turnkey" program that funds specific design-build-maintain restoration projects..

2. Qualitative SW-WLA Load Reduction Tools

Anne Arundel County has several programs and strategies in place to assist in making further progress toward achieving SW-WLAs. These programs are considered "qualitative" because their benefits to load reduction are not easily quantifiable.

a. Stormwater Fee Credit Program

The County encourages property owners to install BMPs to manage stormwater. Eligible property owners have the opportunity to reduce their Watershed Protection and Restoration Fee (WPRF) assessments by up to 50% for proactive and sustainable uses of stormwater runoff controls. In addition, the BWPR established a WPRF Stormwater Remediation Fee Credit Agreement to provide credit to single-family property owners that have installed small-scale (e.g., under 5,000 sq. ft. land disturbance) stormwater BMPs on their property.

The Program's goals are to encourage practices that proactively and sustainably manage runoff on private property and support BWPR's goal to minimize the impact of land development on water resources.

b. BMP Preventative Maintenance and Inspection Program

The County conducts preventative maintenance inspections, according to COMAR 26.17.02, of all ESD treatment systems, structural stormwater management facilities, and stormwater conveyances, at least on a triennial basis. Documentation identifying the ESD systems and structural stormwater management facilities inspected, the number of maintenance inspections, follow-up inspections, the enforcement actions used to ensure compliance, the maintenance inspection schedules, and any other relevant information is submitted in the County's MS4 annual report. Preventative maintenance inspection responsibility is split between Department of Public Works (DPW) and Inspections and Permits (I&P) staff, with I&P staff responsible for the vast majority (approximately 95%) of facility inspections. Within DPW, achieving the required triennial inspections involves identifying those facilities due for inspections and implementing a minimum inspection rate per month to ensure all required inspections are achieved. Additional information can be found in the MS4 annual report Section D.1.d (Preventative maintenance inspections).

c. Public Outreach and Education Program

The County maintains an aggressive public outreach and education program using social media platforms and in person events to engage its citizenry in addressing the impacts of stormwater. Additionally, the County founded and supports the Anne Arundel Watershed Stewards Academy to train Master Watershed Stewards to provide community outreach, education and engagement as well as to implement large and small-scale restoration projects and BMPs on private properties throughout the County. The public outreach and education program achievements, and the WSA achievements, are annually documented in the County's NPDES MS4 Annual Report.

d. Effective land use decision implementation

Numerous land use plans drive management decisions in Anne Arundel County related to water quality.

- Plan2040 is the General Development Plan for Anne Arundel County. It sets the policy framework to protect the natural environment, shape development of the built environment, provide public services to promote healthy communities, and support a diverse, resilient economy.
- Region Plans are community-driven land use documents that build on Plan2040 in smaller areas. Region Plans evaluate community assets and needs, present a shared vision for the next 20 years, and make specific recommendations about planned land use, zoning, environmental protection, transportation improvements, public facilities, and community design.
- Green Infrastructure Master Plan guides voluntary actions to conserve a network of connected natural areas and to add trees and green spaces in underserved communities. Conservation of green infrastructure supports public health, recreation, wildlife, and water quality. The Plan includes a goal of conserving 5,000 acres of open space by 2030.
- The Environment Article, Title 9, Subtitle 5 of the Annotated Code of Maryland, requires each county to develop water supply and sewerage systems in accordance with a county master plan that specifies the extent, adequacy, sizing, staging, and other characteristics of such facilities so that they are in compliance with State laws relating to water pollution, environmental protection, and land use. The plan is required to be updated every 3 years. The most recent Water and Sewer Master Plan was adopted and enacted in June 2022.

e. IDDE Program

Through this Program, the County works to identify and eliminate potentially polluting non-stormwater discharges to the storm drain system (Appendix C of the MS4 annual report).

C. Progress Assessment Methods

Anne Arundel County uses impairment specific methods to monitor progress toward achieving SW-WLAs. Modeling is used to determine progress for sediment and nutrient TMDLs while monitoring is used to determine progress for bacteria and PCB TMDLs.

Impairment	Modeling Method	Monitoring Method
Sediment & Nutrient	TMDL Implementation Progress planning (TIPP)	
Bacteria		Trend, Source Tracking
PCB		Track Back

1. Modeling Method

Anne Arundel County uses the TIPP model to assess and track progress toward meeting nutrient and sediment TMDLs. The TIPP model was developed by MDE in 2021 and functions as a calculator to estimate pollutant loads and to evaluate progress and implementation scenarios. As noted in Guidance for Developing Local Nutrient and Sediment TMDL SW-WLA watershed implementation plans, MDE requires jurisdictions to use this tool for consistency among load reduction calculation methodologies and ease of reporting progress. The TIPP model estimates load reduction at various points in the watershed planning process, allowing users to assess current progress and future BMP implementation. Land use specific loading rates are multiplied by an amount, which may be acres or systems depending on the load source, to calculate loads coming off the land. The land use loading rates used in this model are Chesapeake Bay Phase 6 CAST-Watershed Model No Action (No BMP) scenario loading rates aggregated at the 8-digit watershed scale by county and include streambed and bank (STB) loads determined by a variation of the method used to determine STB load in the MDE 2021 MS4 Accounting Guidance document. These loads account for inconsistencies in load distribution between the Phase 5 and 6 model.

The TIPP model estimates load reductions for nitrogen, phosphorus and total suspended solids at two different scales: Edge-of-stream (EOS) and Edge-of-tide EOT). EOS loads are calculated using the methods and BMP efficiencies recommended by the expert panels approved by the Chesapeake Bay Program. The EOS scale is used for local TMDL modeling and the County's implementation plans. The EOT scale incorporates in-stream uptake, processing, and transport that affects nutrient and sediment loads from the upstream source to the receiving water body. EOT loads in the model are calculated using Chesapeake Bay Phase 6 Watershed Model No Action scenario delivery factors at the Maryland 8-digit watershed scale. Land use is a critical factor in models used to assess TMDL compliance. Land cover data from the National Land Cover Database (NLCD) is used to quantify land cover acreage. Because NLCD land cover classifications are inconsistent with the Phase 6 Chesapeake Bay Watershed Model land cover classes, the back-

casting method developed by Baltimore County (*Back-casting Land Cover Approved Methodology, Version 06.04.2021*) is applied to NLCD data used within the TMDL progress modeling.

Modeling methodologies may change in the future because of updated versions of the Bay Model, which could change loading rates, or because of crediting changes directed by MDE or Expert Panels, that would affect load reduction calculations or BMP percent efficiencies. The TIPP model was originally developed by MDE, and if information is updated in the model MDE will release a new version of the model. Revised components of the updated version will then be incorporated into the County's TIPP workbooks. The County will stay up–to-date on decisions impacting local TMDL pollutant modeling and will revise TMDL implementation plans as necessary.

2. Monitoring Methods (Bacteria)

Anne Arundel County currently has 19 individual bacteria TMDL watersheds. Fifteen (15) of those watersheds are listed with fecal coliform as the impairment indicator based on USE II water quality standards. The TMDLs for these 15 watersheds were established using data from MDE monitoring stations in shellfish harvesting areas. The remaining four (4) TMDL waterbodies are designated as recreational USE I, with E. coli listed as the impairment indicator for two watersheds and enterococci listed as the impairment indicator for two watersheds.

On March 1, 2022 the County notified MDE of its intent to modify Pooled Monitoring Program participation beginning in FY23 (July 1, 2022); the County would participate in the Watershed Assessment Monitoring PMP for the bacteria monitoring component. The Watershed Assessment Monitoring MOU Amendment for FY23 through FY26 and a copy of the March 1, 2022 correspondence was provided in Appendix F of the FY23 MS4 Annual Report**.** There are no further amendments to this MOU and the MOU remains in effect through June 30, 2026.

For the duration of FY25, Anne Arundel County participated in the Pooled Monitoring Program in lieu of bacteria monitoring, therefore there is no associated bacteria monitoring methodology.

3. Monitoring Methods (PCB)

Anne Arundel County has developed an iterative approach to assess and track progress toward meeting PCB SW-WLAs using a source tracking strategy. Anne Arundel County currently has stormwater WLAs for three drainages under two individual PCB TMDLs – the Baltimore Harbor, Curtis Creek/Bay, and Bear Creek Portions of Patapsco River Mesohaline Tidal Chesapeake Bay Segment TMDL, and the Patuxent River TMDL. The TMDLs were established using fish tissue and sediment PCB concentration data from MDE's monitoring program. A detailed update on this program can be found in Section G.3. (PCB Source Tracking) of the MS4 annual report.

4. Monitoring Methods (Countywide Biological)

In 2004, a Countywide Biological Stream Survey (CBSS) for Anne Arundel County was developed to assess the biological condition of the County's streams at multiple scales (i.e., site specific, primary sampling unit (PSU), and countywide). The CBSS is based on the Maryland Department of Natural Resources' Maryland Biological Stream Survey, scaled down to a County-level. The program is structured such that all major watersheds of the County are sampled in a 5-year period or Round, using a rotating basin design. In a rotating basin design, a subset of watershed areas is assessed each year, which rotate annually until the entire County is sampled.

The CBSS' goals are applicable at three scales; Countywide, Primary Sampling Unit, and Stream-specific, and include the following components:

- Status: describe the overall stream condition
- Trends: how has the overall stream condition changed over time
- Problem identification/prioritization: identify the impaired and most degraded streams
- Stressor-response relationships: identify anthropogenic stressors and their biological response
- Evaluation of environmental management activities: monitor the success of implemented programs and restoration/retrofit projects

Please review the program design document and other quality assurance documents for additional information that fully documents the Program's design: www.aacounty.org/departments/public-works/wprp/ecological-assessment-and-evaluation/biological-monitoring/.

A focus of the ongoing watershed biological assessment is to obtain additional data to determine watershed conditions for purposes of supporting further listing/de-listing decisions. MDE published the *Delisting Methodology for Biological Assessments in Maryland's Integrated Report* which outlines the monitoring and biocriteria requirements for a waterbody to be de-listed from the 303(d) list. In general, to consider a waterbody for delisting, that waterbody must have at least two sampling events with IBI scores of 3.0 or greater for both fish and benthos. The CBSS will provide data points that can be used to support listing/delisting decisions.

5. Monitoring Methods (Targeted Biological)

To evaluate management activities, the County uses CBSS assessment methods (biological monitoring, water chemistry sampling, physical habitat, geomorphic evaluation) to assess baseline and post-restoration conditions for select stream, wetland and stormwater restoration and retrofit sites. Although this monitoring utilizes the same methods and procedures as the CWBMP, the

sites are not randomly selected. There are two general approaches to site selection in the targeted work. Some sites are on restored reaches that the County tracks to see how the stream benthic community changes over time in response to the restoration. The other group of sites, varying in number from year to year, is established on reaches planned for future restoration work. The intent is to create a baseline of biological conditions to justify project implementation by providing permitting agencies evidence that biological and habitat impairments exist within a reach of interest. The County also samples one site within a minimally disturbed stream reach to use as a reference reach.

D. Tracking Progress and Implementation of Additional Management Measures

The County measures progress by determining whether the targets for load reductions are being met according to the milestone schedules set for the County's TMDL Implementation/Restoration Plans. Anne Arundel County tracks progress through modeling and in situ monitoring, as discussed above; and also manages a comprehensive system for adding and tracking projects and accounting for programmatic (qualitative) initiatives. New BMPs, retrofits and restoration projects constructed through the County's CIP program, and new development and redevelopment projects are entered into the County's BMP database and NPDES MS4 geodatabase as they come on-line. Additional County entities including the Bureau of Highways, Road Operation Division, which is responsible for maintenance efforts including street sweeping and inlet cleaning, report progress on management practices that are also tracked in County geodatabases. The County also captures and tracks projects implemented through the County's Restoration Grant Program by NGOs and the Watershed Stewards Academy. Annual progress is reported by the County via the NPDES MS4 Report and associated MS4 Geodatabase which serves as the overarching reporting mechanism for all stormwater management reporting.

E. Decision Making Timeframe

The Annual MS4 and TMDL progress assessments along with monitoring results contribute to ongoing re-evaluation of implementation/restoration plans, programs and management strategies. The County adapts and responds accordingly as technologies and efficiencies change, programs mature, credit trading is enacted, and regulations are put in place. When changes to the County's management approach for achieving SW-WLAs are determined necessary, those changes are documented through updates to individual TMDL Implementation Plans. Figure 28 below shows the decision-making process that triggers future management actions.

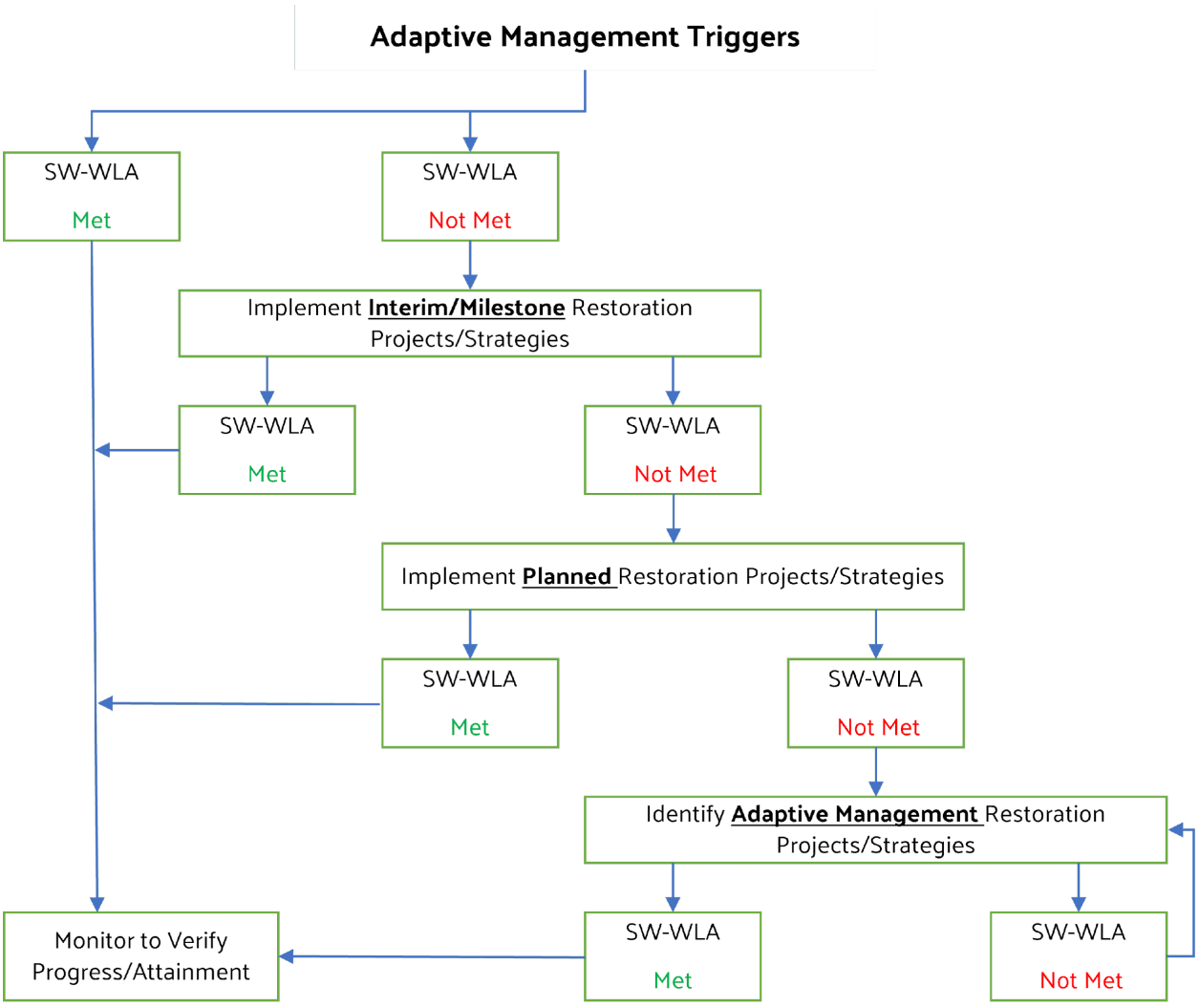

Figure 28: Adaptive Management Decision Diagram

F. Potential Management Options

If it is determined through modeling and in situ monitoring that insufficient progress has been made, the County will identify and pursue additional management strategies. Such management strategies could include, but are not limited to:

- Provide incentives for restoration project implementation in watersheds where monitored or modeled load reductions are lagging behind schedule.
- Implement projects that address multiple impairments.
- Implement projects for which additional funding can be leveraged.
- Continue to refine BMP inspection rate protocols while enhancing staff abilities to more efficiently inspect stormwater management facilities through the development/implementation of an inspection application for field tablets.
- Re-evaluate watershed assessments to identify additional opportunities for restoration or preservation implementation and/or to refocus programmatic initiatives.

IX. Appendices

Appendix A Approved Final Implementation Plans (Patuxent PCB TMDL)
Appendix B Draft Implementation Plan Updates (Baltimore Harbor PCB TMDL, Local Sediment TMDL)
Appendix C Local and Bay TMDL BMP
Appendix D Bacteria TMDL Supporting Documents
Appendix E TIPP Tool Spreadsheets
Appendix F PCB TMDL Supporting Documents
Appendix G Response to MDE Comments: Anne Arundel Countywide TMDL Stormwater Implementation Plan - FY 2024 Progress Report

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