Maryland 319 Nonpoint Source Program
Annual Report
State Fiscal Year 2018

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Preface

Nonpoint source (NPS) pollution is defined as polluted stormwater runoff associated with rainfall, snowmelt or irrigation water moving over and through the ground. As this water moves, it picks up and carries pollutants with it, such as sediments, nutrients, toxics, and pathogens. These pollutants eventually reach lakes, rivers, wetlands, coastal waters, ground waters and, most of the time in Maryland, the Chesapeake Bay.

NPS pollution is associated with a variety of activities on the land including farming, logging, mining, urban/construction runoff, onsite sewage systems, streambank degradation, shore erosion and others. For example, stormwater flowing off the land carries the nutrients nitrogen and phosphorus into local streams and eventually into the Chesapeake Bay. Under natural conditions, this is beneficial up to a point. However, if excessive nutrients enter a lake or the Chesapeake Bay, and cause nuisance algae blooms, then these nutrients are considered to be pollutants.

The pollution contributed by nonpoint sources is the main reason why many of Maryland's waters are listed as impaired because Water Quality Standards are not being met for designated uses including fishing, swimming, drinking water, shellfish harvesting among others.

Progress in managing NPS pollution in Maryland is presented in this report. It was produced by the Maryland Department of the Environment (MDE) to meet 319(h) Grant conditions and to demonstrate consistency with three essential elements:

1. EPA Strategic Plan Goal 2 Protecting America's Waters
2. EPA Strategic Plan Objective 2.2 Protect and Restore Watersheds and Aquatic Ecosystems
3. Work plan commitments plus time frame (overall progress is reported in this document).

Abbreviations Used	
319	Clean Water Act, Section 319(h)
AMD	Acid Mine Drainage
ARA	Air and Radiation Administration, MDE
BAT	Best Available Technology
BMP	Best Management Practice
COMAR	Code of Maryland Regulations
DNR	Maryland Department of Natural Resources
EPA	Environmental Protection Agency, United States of America
FFY	Federal Fiscal Year (October 1 thru September 30)
IWPP	Integrated Water Planning Program, WSA, MDE
LMA, MDE LMA	Land and Materials Administration, MDE
MDA	Maryland Department of Agriculture
MDE	Maryland Department of the Environment
MDP	Maryland Department of Planning
MEP	Maximum Extent Practicable
NGO	Non-Government Organization
NPS	Nonpoint Source
NRCS	National Resources Conservation Services
RFP	Request for Proposals
SCD	Soil Conservation District
SRA	Sassafras River Association
SRF	State Revolving Fund
SFY	State Fiscal Year (in Maryland, July 1 thru June 30)
SWAP	Small Watershed Area Plan (another name for a watershed-based plan)
SW Conversion	Converting an existing stormwater facility to provide water quality benefits
SW Retrofit	Adding stormwater management to existing development that had none
TMDL	Total Maximum Daily Load
Trust Fund	Maryland Chesapeake and Atlantic Coastal Bays Trust Fund
USDA	United States Department of Agriculture
WIP	Watershed Implementation Plan for the Chesapeake Bay TMDL
WQA	Water Quality Analysis
WRAS	Watershed Restoration Action Strategy (aka watershed-based plan)
WRE	Water Resources Elements (components of a local comprehensive plan)
WSA	Water and Science Administration, MDE
WWTP	Waste Water Treatment Plant (sewage treatment)

I. Mission and Goals of the NPS Program

Maryland's 2015-2019 Nonpoint Source Management Plan (State NPS Plan), generated by the Maryland Department of the Environment (MDE) and partner agencies, was approved by the US Environmental Protection Agency (EPA) in January 2015. The document's vision, mission, goals are shown on the right. The completed document, including posted updates is available on the Internet at http://mde.maryland.gov/programs/Water/319NonPointSource/Pages/index.aspx

Maryland's 2015-2019 NPS Management Plan

1.A Vision
Ensuring a clean environment and excellent quality of life for Marylanders.

Maryland's vision is to implement dynamic and effective nonpoint source pollution control programs. These programs are designed to achieve and maintain beneficial use of water; improve and protect habitat for living resources; and protect health through a mixture of water quality and/or technology based programs; regulatory and/or non-regulatory programs; and financial, technical, and educational assistance programs. (*Maryland Nonpoint Source Management Plan*, December 1999)

1.B Mission
Maryland's Nonpoint Source Management Program (Program) mission is to protect and restore the quality of Maryland's air, water, and land resources, while fostering smart growth, a thriving and sustainable economy and healthy communities.

1.C Goals
The Program has the following seven broad goals to advance its mission and vision:

1. Improving and protecting Maryland's water quality.
2. Promoting land redevelopment and community revitalization.
3. Ensuring safe and adequate drinking water.
4. Reducing Maryland citizen's exposure to hazards.
5. Ensuring the safety of fish and shellfish harvested in Maryland.
6. Ensuring the air is safe to breathe.
7. Providing excellent customer services to achieve environmental protection.

The State NPS Plan is designed to meet requirements of the Federal Clean Water Act Section 319 and to be consistent with Maryland commitments and responsibilities in the Chesapeake Bay Agreement, the Chesapeake TMDL, and Maryland's Chesapeake Bay Watershed Implementation Plan (WIP).

To realize the visions in these documents, the State's NPS programs are designed to: achieve and maintain beneficial uses of water; protect public health, and; improve and protect habitat for living resources. The State programs use a mixture of water quality and/or technology based approaches including regulatory and non-regulatory programs, and programs that provide financial, technical, and educational assistance.

Through program management and financial/technical support, Maryland's Section §319(h) NPS Program plays a role in helping to protect and improve of Maryland's water quality. The NPS Program promotes and funds State and local watershed planning/implementation efforts, water quality monitoring to evaluate progress, governmental partnership/cooperation and education/outreach. Program partners include State agencies, local government (counties, municipalities, Soil Conservation Districts), private landowners and watershed associations.

Consistent with these priorities, selection of NPS implementation projects for 319(h) Grant funding incorporates the following goals:

GOAL 1 To support meeting Total Maximum Daily Load (TMDL) nonpoint source reduction targets.

GOAL 2 To significantly contribute to reducing one or more nonpoint source water quality impairments in a water body identified in Maryland's 303(d) list of impaired water bodies leading toward full or partial restoration.

GOAL 3 To implement projects from EPA-accepted watershed-based plans that will produce measurable nonpoint source pollutant load reduction consistent with Goals 1 and 2.

II. Executive Summary

In accordance with the Federal Clean Water Act Section 319, this report documents the activities and accomplishments by the State of Maryland 319 NPS Program. MDE is the lead agency for administering Section 319, including the 319(h) Grant. MDE is also the lead 319 NPS management agency responsible for coordination of policies, funds, and cooperative agreements with state agencies and local governments. Several other state agencies have key responsibilities, including the Maryland Department of Natural Resources (DNR) and the Maryland Department of Agriculture (MDA). The 319 NPS Program is housed within MDE's Water and Science Administration (WSA) Integrated Water Planning Program.

During the past 29 years, Maryland received about $61.27 million through the 319(h) Grant to support the Maryland's NPS management program including on-the-ground implementation of best management practices (BMPs).

In 319 priority watersheds, overall reported SFY18 reductions of nitrogen, phosphorus, and sediment are significantly greater than goals in *Maryland's 2015-2019 Nonpoint Source Management Plan* (State Plan). In these watersheds, the majority of this success arises from the State's integrated reporting of BMP implementation for the EPA Chesapeake Bay Program. In the numbers below, cover crops account for the difference between "all reported BMPs" and multi-year BMPs:

Nitrogen SFY18 Reduction (lb/yr):
Goal: 200,000. All reported BMPs: 1,364,096. Multi-Year BMPs only: 996,342.
Phosphorus SFY18 Reduction (lb/yr):
Goal: 4,000. All reported BMPs: 96,551. Multi-Year BMPs only: 95,004.
Sediment SFY18 Reduction (tons/yr):
Goal: 800. All reported BMPs: 10,345. Multi-Year BMPs only: 9,117.

Overall reported funding of NPS implementation in priority watersheds reached $10.5M from the Federal 319(h) Grant and $28M from State funding thru the end of SFY18 (excluding match for the 319 Grant).

One 319-funded project was completed during SFY18 that reported implementing best management practices. These projects' estimated pollutant load reductions totaled: nitrogen 313.7 lbs/yr, phosphorus 284.4 lbs/year and sediment 93.9 tons/year.

Three Maryland State agencies reported expending over $72.95 million for nonpoint source programs and implementation during SFY18. (Departments of Agriculture, Environment and Natural Resources only)

III. Overview

Maryland surface waters flow into three major drainage areas:

- The Chesapeake Bay watershed receives runoff from of Maryland's mid section and encompasses more than 90% of the State. Most 319-funded implementation projects are in this watershed. These projects are mostly designed to reduce nitrogen, phosphorus and sediment pollutant loads.
- Maryland's Coastal Bays receives runoff from Maryland's eastern-most coastal plain in Worcester County.
- Maryland's Appalachian area runoff drains thru the Youghiogheny River and Casselman River watersheds toward the Ohio and Mississippi Rivers. In the Casselman River watershed, the 319(h) Grant continues to help fund acid mine drainage remediation.

Overall, Maryland has over 9,940 miles of non-tidal streams and rivers. These waters and the Chesapeake Bay have provided a rich bounty that been the foundation for much of Maryland's rich heritage and prosperity. The State's water resources continue to provide food and water for its residents, jobs for the economy and a place where people may relax and enjoy the natural environment. Our quality of life, including drinking water, recreation/tourism, commercial and recreational fishing and wildlife habitats depend on healthy waters supported by healthy watersheds.

However, Maryland's water resources are under stress from a variety of causes -- with nonpoint source pollution being the greatest single factor. The sources of excessive nitrogen and phosphorus in Maryland arise in large part from major land uses as shown in Figures 1 and 2 (Chesapeake Bay Model 2017 progress run Phase 6). The state's waters are increasingly impacted by and remain impaired due largely to nonpoint sources of pollution and related habitat degradation, which are most commonly due to altered land uses. The lands that are altered from natural conditions contribute various forms of nonpoint point source pollution such as excessive levels of the nutrients nitrogen and phosphorus.

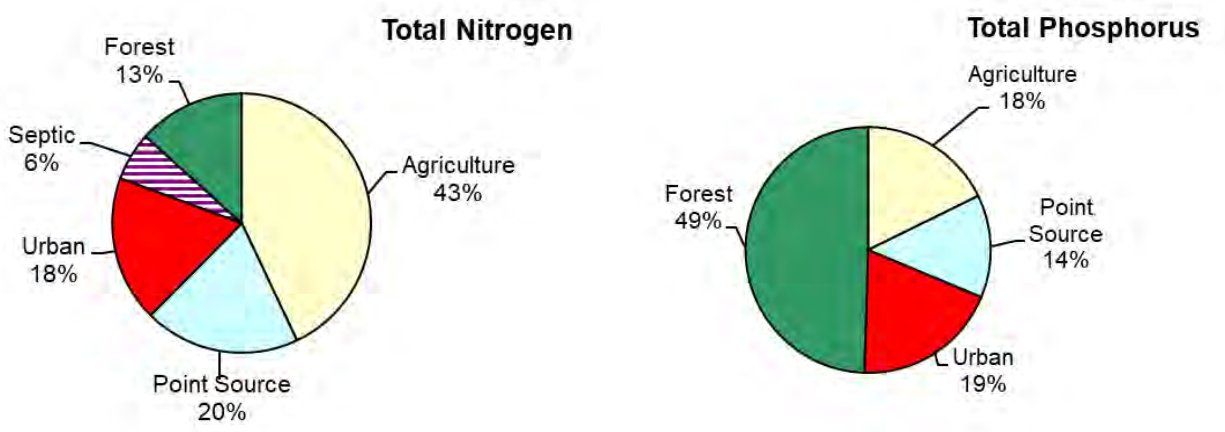


Figure 1: Total Nitrogen (TN) and Total Phosphorus (TP) Sources in Maryland in SFY18.

The best methods for controlling NPS pollution are commonly called conservation practices or Best Management Practices (BMPs). These BMPs are designed to meet specific needs, like increasing tree cover to capture stormwater, grassed buffers to control sediment and phosphorus that could leave farm fields, or wet stormwater ponds to capture sediment and nutrients in urban runoff. Every year,

Maryland reports the cumulative total number of BMPs implemented in the State. The most recent statewide aggregate reporting is summarized in **Section IV - Table 2**.

Maryland's NPS management program has responsibilities set forth in the Federal Clean Water Act Section 319. To help meet these responsibilities, the State program has received Federal grant support each year since 1990 and is required to maintain at least a minimum annual level of nonfederal expenditure. A summary that covers the period 1990 thru SFY18 for Maryland is in **Appendix A – Financial Information**.

Chapter IV of the Annual Report provides brief summaries of grant-funded NPS Program activities during SFY18 in 319 priority watersheds. Additional details are available in **Appendices B - J**.

Demonstrating improvements in water quality resulting from nonpoint source program implementation and successes in achieving nonpoint source management goals and objectives are important for the program. Each year, at least one success story is submitted to EPA. Maryland's SFY18 success story is based on MDE analysis of monitoring data from Tarkiln Run in Garrett County. The in-stream data documented that pH levels have significantly improved following implementation of acid mine drainage remediation projects that were partially funded by the 319(h) Grant (see **Appendix M– Success Story**).

Figure 2. MDE's Abandoned Mines Division hosted staff from EPA Region 3 at various acid mine remediation projects in the Casselman River watershed October 2018. The photo shows one of the sand-dumps funded in part by 319(h) Grant funds (photo by MDE).

IV. Major Accomplishments, Successes and Progress

A. Statewide NPS Management Program Progress

1. Introduction and Overview

This annual report is based in part on the milestones from *Maryland's 2015-2019 Nonpoint Source Management Plan* that was approved by EPA in January 2015. It also provides a summary of implementation progress reporting in 319 priority watersheds (see Figure 3). In addition to local input in 319 priority watershed progress, MDE also uses data reported by Maryland for use in the Chesapeake Bay Model. To gauge progress toward meeting state and local goals, Maryland tracks implementation progress for selected categories of BMPs that have been recognized by the EPA Chesapeake Bay Program and the Chesapeake Bay States.

Maryland's 2015-2019 Nonpoint Source Management Plan includes specific categories of objectives designed to focus effort on reducing and preventing NPS pollution: 1- Regional Coverage, 2- Multiple Scales, 3- Pollutants and Stressors, 4- Pollutant Sources, 5- Types of Waterbodies, 6- Protection and Restoration, 7- Priority Setting, and 8- Program Management and Evaluation. Under these categories are specific objectives with milestones to gage progress. The table below summarizes SFY18 progress for selected milestones.

Table 1. Milestones Progress

Obj. #	Objective Name (abbreviated)	Goal SFY18	Report SFY18
3	Annual nitrogen NPS Loads to Bay (2)	Report Progress	42,917,233
	Nitrogen: overall reduction in 319 priority watersheds (lb/yr)	200,000	1,364,096
	Annual phosphorus NPS Loads to Bay (2)	Report Progress	3,152,847
	Phosphorus: overall reduction in 319 priority watersheds (lb/yr)	4,000	96,551
	Sediment: 319-funded projects annual reductions (tons/yr)	20	4,860
	Sediment: overall reduction in 319 priority watersheds (tons/yr)	800	10,345
4	Cover crop acreage	418,000	558,797
	Nutrient Management Plan acreage (report includes all 3 Tiers)	713,516	353,904
	Soil Conservation and Water Quality Plan acreage	1,041,000	923,895
	Septic system upgrades to remove nitrogren (count)	1,200	1,751
	Stormwater retrofits (nitrogen reduction lb/yr) (1)	22,000	14,638
	Local stormwater WLA implementation plans reviewed		
5	319 priority watersheds: implement watershed plans	Report Progress	See section IV.B
(1) Underestimate of actual due to complexity of calculating estimate.			
(2) Due to complexities in reporting, bay load reductions are reported using the Phase 6 watershed model. All other load reductions are calculated using the Phase 5 model.			
See Appendix Milestones for a complete listing of milestones and progress for this state fiscal year.			

Additionally, Maryland also tracks statewide progress by other metrics:

- Many forms of best management practices (BMPs) as listed in the table on next page.
- 319(h) Grant investment in Maryland is summarized in Appendix A, including
    - Total annual 319(h) Grant awards to Maryland
    - State of Maryland expenditures for NPS programs (maintenance of effort)
    - Distribution of 319(h) Grant implementation funding by County
    - Distribution of 319(h) Grant funds for monitoring (water quality, biological)

Table 2. BMP Implementation Statewide Progress In Maryland State Fiscal Year 2018

Type of Practice	Statewide Total	Nitrogen Reduction (lb/yr)	Phosphorus Reduction (lb/yr)
Animal Composters on Ag Lands	35	318	8
Animal Waste Management Systems-Livestock	902	1,085,856	122,952
Animal Waste Management Systems-Poultry	730	164,016	18,572
Cover Crops	543,359	980,366	44,802
Dry Detention Ponds and Hydro Structures	52,810	19,283	2,387
Dry Extended Detention Ponds	30,280	44,226	2,737
Filtering Practices	6,203	18,120	1,682
Forest Conservation	118,809	1,627	21
Forest Harvesting Practices	17,103	11,707	183
Grassed Buffers	52,997	407,324	46,657
Infiltration Practices	15,638	91,360	6,007
Nutrient Management Plan Implementation	792,464	1,443,296	211,843
Retirement Of Highly Erodible Lands	28,928	136,759	1,436
Riparian Forest Buffers on Ag Lands	23,290	256,149	20,504
Riparian Forest Buffers on Urban Lands	944	1,114	322
Runoff Control	1,464	2,138	132
Septic Connections to Sewers	2,352	17,176	0
Septic Denitrification	12,101	55,665	0
Soil Conservation Water Quality Plans	898,717	1,023,007	180,185
Stream Protection w/Fencing	737	10,067	985
Stream Protection w/o Fencing	64,021	72,875	11,409
Stream Restoration	336,460	5,745	510
Tree Planting on Agricultural Lands	28,928	335,872	41,243
Water Control Structures	3,155	23,703	0
Wet Ponds	65,044	95,000	13,228
Wetland Restoration on Ag Lands	14,083	53,703	10,096

Table footnotes:

1. Data for each BMP represents cumulative totals through June 2018 using CBP Model Phase 6.
2. Nutrient load reductions are estimates for each type of practice representing the effect of each BMP acting independently. The nutrient reduction estimates do not account for the potential aggregate effect of multiple BMPs interacting together. For example, an agricultural field may have both cover crops and grassed buffers.
3. These tables' values do not include all BMPs implemented. Some BMP reductions are not easily calculated.
4. 2017 Progress incorporated changes in BMP implementation which included decreases in some BMPs from past years.

2. Priority Watersheds for 319(h) Grant Implementation Funding

During SFY18, ten priority watersheds in Maryland are eligible for 319(h) Grant implementation funding. Additionally one watershed plan received conditional approval. There are four other watershed plans that are currently being drafted in an effort to seek eligibility. The table below summarizes watershed planning status in each area. The locations of the priority watersheds are mapped on the next page.

Table 3. Priority Watersheds for 319(h) Grant Implementation Funding

Watershed		Plan Name	Plan Date, Status	Plan Lead
Chesapeake Bay	Back River	*Tidal Back River Small Watershed Action Plan*	2010 Implementing	Baltimore County Department of Environmental Protection and Sustainability
		Upper Back River Small Watershed Action Plan	2008 Implementing	
	Middle Gwynns Falls	*Middle Gwynns Falls Small Watershed Action Plan*	2014 Implementing	
	Lower Jones Falls	*Lower Jones Falls Watershed Small Watershed Action Plan*	2008 Implementing	
	Spring Branch	*Spring Branch Subwatershed – Small Watershed Action Plan*	2008 Completed	
	Antietam Creek	*Antietam Creek Watershed Restoration Plan*	2012 Implementing	Washington County Soil Conservation District
	Corsica River	*Corsica River Watershed Restoration Action Strategy, Corsica River Targeted Initiative Progress Report: 2005-2011*	2004, 2012 Implementing	Town of Centreville, Queen Anne's County
	Jennings Run (Evitts Creek)	*Upper Jennings Run Watershed Implementation Plan*	2019 (Conditional) Implementing and Updating	MDE Land & Materials Admin., Abandoned Mine Land Div. & Integrated Water Planning Program
	Lower Monocacy River	*Lower Monocacy River Watershed Restoration Action Strategy (WRAS) Supplement: EPA A-I Requirements, Frederick County Maryland*	2008 Implementing	Frederick County Dept. Of Public Works, Community Development Division
	Sassafras River	*Sassafras Watershed Action Plan*	2009 Implementing	ShoreRivers (formerly Sassafras River Association)
	Upper Choptank River	*Upper Choptank River Watershed Based Plan*	2010 Implementing	Caroline County Dept. of Planning & Codes
Casselman River (Ohio River Basin)		*Casselman River Watershed Plan for pH Remediation*	2011 Implementing	MDE Land & Materials Admin., Abandoned Mine Land Div.
Coastal Bays (Atlantic Ocean)		TBD	2019 Drafting Plan	Worcester County
Hunting Creek		TBD	2019 Drafting Plan	MDE Integrated Water Planning Program & Caroline County Dept. of Planning & Codes
Cambridge Creek		TBD	2019 Drafting Plan	ShoreRivers
Williston Lake		TBD	2019 Drafting Plan	Shore Rivers

Table footnotes: Copies of the watershed plans are available on MDE's web page: http://mde.maryland.gov/programs/Water/319NonPointSource/Pages/factsheet.aspx

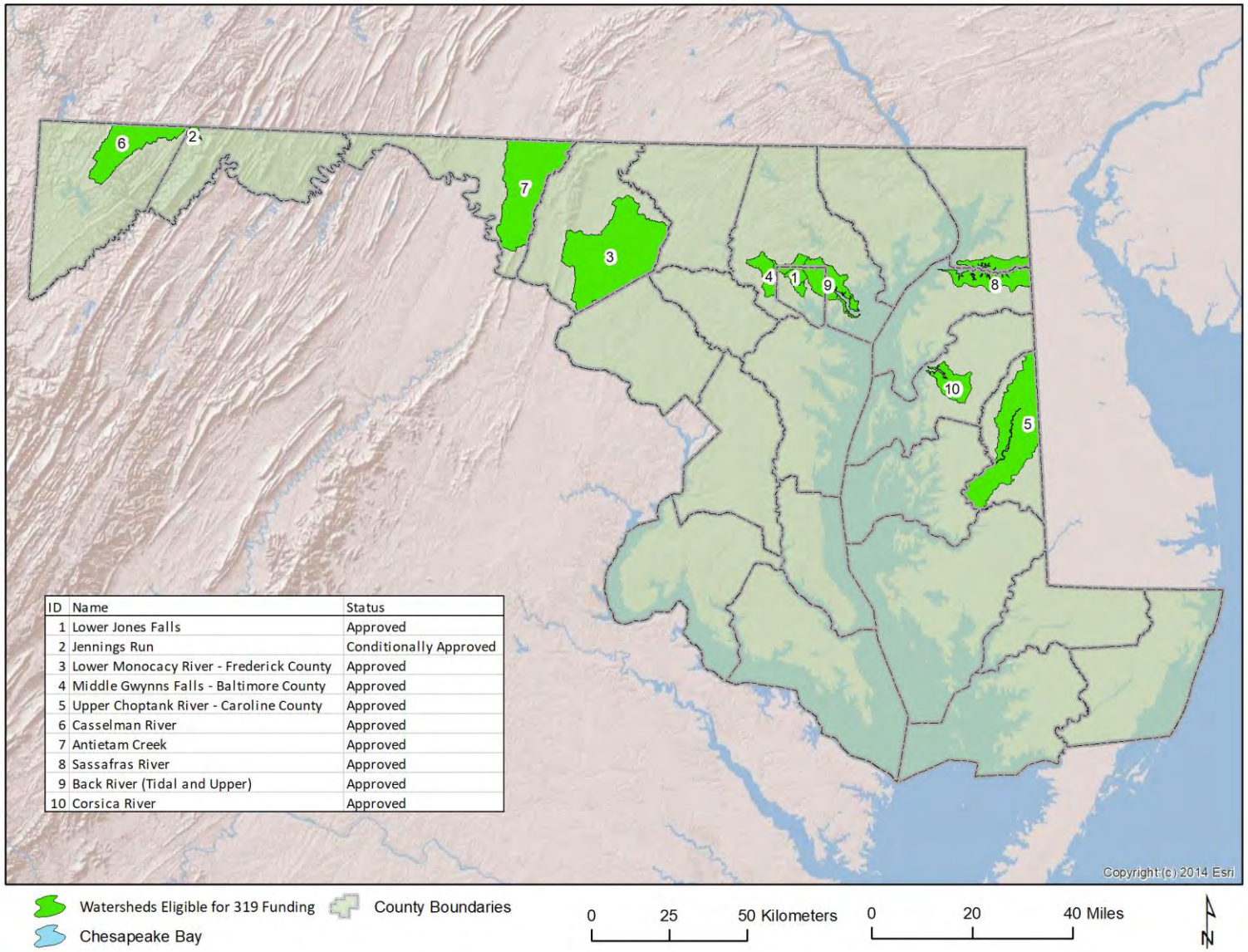


Figure 3. 319 Priority Watershed in Maryland Currently Eligible for 319(h) Grant Implementation Funding

Table 3 on the previous page lists the ten 319 priority watersheds that are currently eligible to seek funding to implement a watershed plan that EPA has reviewed and accepted (plus one conditionally approved plan). In all ten watersheds, Total Maximum Daily Load (TMDL) load allocations that limit NPS loads are reiterated in the watershed plan explicit goals. For each of these watersheds, plan implementation progress tracking includes BMP implementation and load reduction estimates. Progress is reported by MDE to EPA every year in the *Maryland 319 Nonpoint Source Program Annual Report*.

To date, implementation of the 319 priority watershed plans has not generated information that might suggest that revision of a TMDL should be considered. However, in the Casselman River watershed which has pH TMDLs, watershed plan implementation has resulted in meeting several TMDLs at the stream segment scale and State water quality pH standards are being met in these stream segments following acid mine drainage remediation (implementation and ongoing operation and maintenance of BMPs).

In all ten watersheds, funding for NPS implementation from three grant sources is summarized in Table 3:

- Federal 319(h) Grant funds
- State Revolving Fund
- State Chesapeake and Atlantic Coastal Bays Trust Fund

In one case, Antietam Creek watershed, the 319(h) Grant funding was initially used beginning in 1994 to help implement previous watershed priorities/plans that pre-dated the current the 319 Priority Watershed Plans (See Appendix B for details).

Table 4. 1994-SFY2018 NPS Implementation Funding in 319 Priority Watershed Plans

319 Priority Watershed	Projects Completed (count)	Federal 319(h) Grant ($) (1)	State Revolving Fund ($)	State Trust Fund ($) (2)	Other State NPS ($)	State Funds Total ($) (2, 3)	Total Funds Reported ($)
Antietam Creek	38	3,176,276.14	424,600	696,771.99	0	1,121,371.99	4,297,648.13
Back River (Tidal)	41	556,443.00	3,102,100	6,407,987.74	0	9,738,986.74	11,297,845.55
Back River (Upper)		1,002,415.81	0		228,899		
Casselman River	2	782,734.00	0	6,440.19	0	6,440.19	789,174.19
Corsica River	44	1,919,132.11	200,000	1,208,801.00	70,000	1,478,801.00	3,397,933.11
Lower Jones Falls	32	139,000.00	100,664	3,404,103.00	0	3,504,767.00	3,643,767.00
Lower Monocacy River	40	1,387,102.99	6,346,142	400,961.97	0	6,747,103.97	8,134,206.96
Middle Gwynns Falls	7	320,004.00	0	1,932,058.00	0	1,932,058.00	2,252,062.00
Sassafras River	27	64,000.00	0	3,588,185.47	0	3,588,185.47	3,652,185.47
Upper Choptank River	34	1,174,095.43	0	333,658.00	0	333,658.00	1,507,753.43
TOTAL	265	10,521,203.48	10,173,506	17,978,967.36	298,899	28,451,372.36	38,972,575.84

1) Federal includes all 319(h) Grant NPS implementation projects only (Planning and water quality monitoring costs excluded.)

2) State Funds includes all reported State-funded implementation projects before and after watershed plan completion including State Revolving Fund and Chesapeake and Atlantic Coastal Bays Trust Fund, and "other" reported State funding (319 table).

3) State Funds exclude match for the 319(h) Grant NPS implementation projects because in Maryland it generally is not associated with a project in the local watershed.

During SFY18 in the 319 priority watersheds, one 319(h) Grant-funded project was completed and 8 319(h) Grant-funded implementation projects actively working as shown in Table 5. Additional information on all of these projects is provided in this report and in **Appendices B-J**.

Table 5. SFY2018 319(h) Grant-Funded Implementation Projects Status

319 Priority Watershed	Status			Environmental Results (4)		
	Completed (1)	Working (2)	Proposed (3)	Nitrogen lbs/yr	Phosphorus lbs/yr	Sediment ton/yr
Antietam Creek	0	1	2	0.0	0.0	0.00
Back River - Tidal	0	0	0	0	0	0
Back River - Upper	1	0	0	314	284	94
Casselman River	0	1	0	0	0	0
Corsica River	0	0	0	0	0	0
Lower Jones Falls	0	0	0	0	0	0
Lower Monocacy River	0	1	0	0	0	0
Middle Gwynns Falls	0	1	1	0	0	0
Sassafras River	0	2	0	0	0	0
Upper Choptank River	0	2	0	0	0	0
TOTAL	1	8	3	313.7	284.4	93.90

(1) Project ended during SFY2018 (7/1/17 thru 6/30/18). (2) Project continued during/beyond SFY2018.
(3) In MDE's application for the FFY2018 319(h) Grant (awarded 9/17/18). (4) Completed projects only.

Also, in 319 priority watersheds, implementation progress was accomplished using funding from sources other than the 319(h) Grant. Table 6 (next page) summarizes the aggregate pollutant load reduction by all NPS projects reported in this document regardless of funding source including annual practices like cover crops.

Additional information for each 319 priority watershed is presented in the following sections of this chapter and in **Appendices B - J**.

Table 6. SFY18 Pollutant Load Reductions in Priority Watersheds

319 Priority Watershed	Sub Watershed	Agriculture Multi-Year BMPs			Urban BMPs (Multi-Year)			All Multi-Year BMPs		
		Nitrogen lbs/yr	Phosphorus lbs/yr	Sediment ton/yr	Nitrogen lbs/yr	Phosphorus lbs/yr	Sediment ton/yr	Nitrogen lbs/yr	Phosphorus lbs/yr	Sediment ton/yr
Antietam Creek	All in Maryland	263,386.0	30,562.0	7,498.00	635.0	20.00	17.00	264,021.0	30,582.0	7,515.00
Back River	Tidal (entire County subwatershed)	0	0	0	104.0	3.0	0.30	104.0	3.0	0.30
	Upper (Baltimore City and County)	0	0	0	357	289.0	519.00	357.0	289.0	519.00
Corsica River	All	1,567.0	40.0	15.00	70.0	0	0	1,637.0	40.0	15.00
Lower Jones Falls	All (Baltimore City and County)	0	0	0	88.0	7.0	1.00	88.0	7.0	1.00
Lower Monocacy River	All incl. Lake Linganore, Frederick Co.	718,100.0	63,120.0	753.00	377.0	16	17	718,477.0	63,136.0	770.00
Middle Gwynns Falls	All in Baltimore County only	0	0	0	766.0	171.0	160.00	766.0	171.0	160.00
Sassafras River	All in Maryland only	2,560.0	194.0	98.00	106.0	2	0	2,666.0	196.0	98.00
Upper Choptank River	All in Caroline County only	8,090.0	580.0	39.00	136.0	0	0	8,226.0	580.0	39.00
TOTAL		993,703.0	94,496.0	8,403.00	2,639.0	508.0	714.30	996,342.0	95,004.0	9,117.30
MDE used MAST to estimate pollutant load reductions for BMPs that were reported by MDE to the EPA Bay Program. Urban Baltimore County watersheds are shaded.										

319 Priority Watershed	Sub Watershed	Cover Crops SFY18			TOTAL All BMPs SFY18		
		Nitrogen lbs/yr	Phosphorus lbs/yr	Sediment ton/yr	Nitrogen lbs/yr	Phosphorus lbs/yr	Sediment ton/yr
Antietam Creek	All in Maryland	46,887.0	340.0	267.00	310,908.0	30,922.0	7,782.00
Back River	Tidal (entire County subwatershed)	0	0	0	104.0	3.0	0.30
	Upper (Baltimore City and County)	0	0	0	357.0	289.0	519.00
Corsica River	All	20,611.0	61.0	17.00	22,248.0	101.0	32.00
Lower Jones Falls	All (Baltimore City and County)	0	0	0	88.0	7.0	1.00
Lower Monocacy River	All incl. Lake Linganore, Frederick Co.	144,149.0	879.0	753.00	862,626.0	64,015.0	1,523.00
Middle Gwynns Falls	All in Baltimore County only	0	0	0	766.0	171.0	160.00
Sassafras River	All in Maryland only	50,886.0	267.0	141.00	53,552.0	463.0	239.00
Upper Choptank River	All in Caroline County only	105,221.0	0.0	50.00	113,447.0	580.0	89.00
TOTAL		367,754.0	1,547.0	1,228.00	1,364,096.0	96,551.0	10,345.30

3. Success Stories

During SFY18, MDE reported a success story on improvements in Tarklin Run, which is a tributary to the Casselman River in Garrett County, Maryland. MDE planned and implemented the work necessary to eliminate the low pH impairment to the stream caused by acid mine drainage. MDE also conducted the before and after water quality monitoring and analysis that was necessary to document the in-stream improvements (see Appendix – Success Story).

4. National Water Quality Initiative

The National Water Quality Initiative (NWQI) focuses on priority watersheds with impaired streams to help farmers and forest landowners voluntarily improve water quality and aquatic habitat. Beginning in 2012, Maryland's NWQI area has been the Catoctin Creek watershed.
It encompasses the southwestern portion of Frederick County and is framed by Catoctin Mountain on the east and South Mountain on the west. The watershed drains 120 square miles, including forested mountain slopes, agricultural valleys, and small towns. Surface waters here are impaired by sediments, nutrients, impacts to biological communities, and fecal coliform. The land use distribution in the watershed is approximately 43% agricultural, 42% forest/herbaceous and 15% urban, with agricultural land mostly planted in row crops and pasture.

In 2012, Maryland was among the first States to create a cooperative monitoring agreement to support the NWQI effort. Since that time, MDE has collaborated with the United States Department of Agriculture/National Resources Conservation Services (USDA/NRCS) to conduct in-stream monitoring in the Catoctin Creek watershed. During SFY18 this included a combination of nutrient synoptic surveys and surface water bi-weekly monitoring.

During SFY18, the following NWQI activities were conducted in the Catoctin Creek watershed:

1) MDE continued monitoring under the 2016 3-year interagency agreement with Maryland NRCS to fund water quality sampling and sample analysis.
2) Sampling during this period was conducted at the same small-watershed sites originally designated for this project.
3) During SFY18, MDE in cooperation with the Frederick Soil Conservation District identified two farmers willing to allow water quality monitoring by MDE to determine if an in-stream water quality change can be detected. Downstream of this farmer's land, MDE already has an existing monitoring station. In SFY18 during BMP installation, MDE began water quality sampling within and above the farm. MDE sampling ended December 2018, and the Department is still waiting on the results of the analysis.

Over the period from 2013 thru 2015, Maryland DNR reported that Catoctin Creek nitrogen levels decreased when changes in river flow are accounted for. One station in Catoctin Creek showed a significant decrease in sediment levels. [1] Analysis has not been conducted to determine if these changes can be linked to NWQI implementation.

[1]Maryland Department of Natural Resources. *Water Quality Summary 2013-2015*. Report received via personal communication 11/6/17 from Renee Karrh.

B. Antietam Creek Watershed

Location

The Antietam Creek watershed encompasses 290 mi^2 in total. It drains part of Washington County, Maryland (118,400 acres, 185 mi^2) with its headwaters in Pennsylvania. The 54 mile-long Creek flows into to the Potomac River and the Chesapeake Bay. Watershed land use in Maryland is 42% agricultural, 31% forest and 27% developed.

Goals, Milestones and Progress

The State NPS Management Plan Objective 5 lists two milestones for Antietam Creek:

1) Annual implementation progress reporting for goals in the 2012 watershed plan by the Washington County SCD (see next page and Appendix B), and
2) A 2018 assessment of progress and potential watershed plan update.

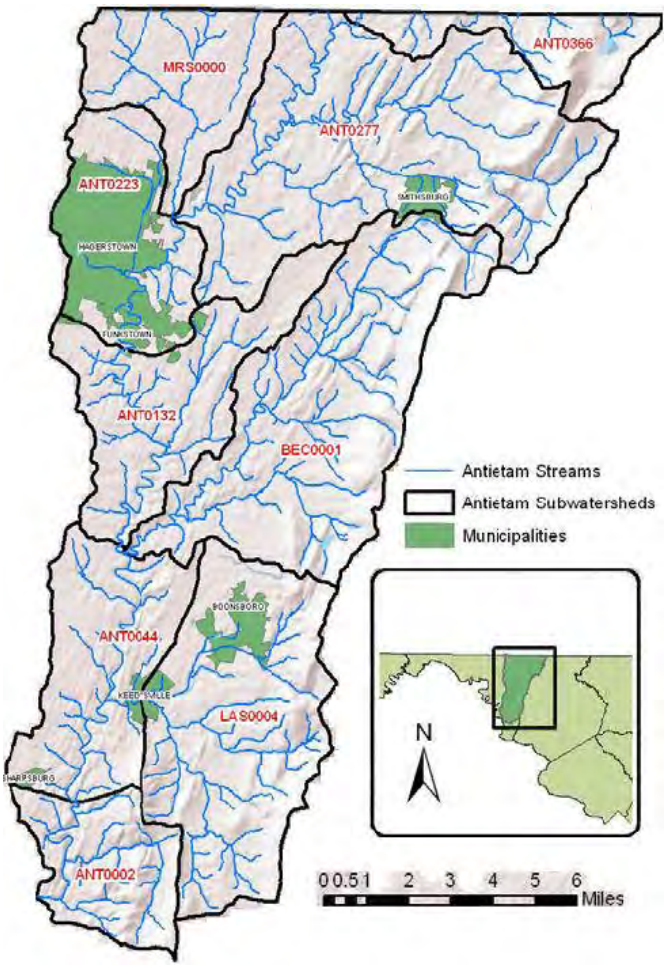


Figure 4. Antietam Creek Watershed.

Figure 5. In November 2014 during EPA's annual review of Maryland's NPS program, EPA staff joined the Washington County Soil Conservation District Manager and MDE staff in an on-site review of the proposed stream restoration on part of Little Antietam Creek. The steep eroding creek banks in the photo were typical along this part of the creek. The proposed stream restoration site assessment and design was partially funded by the 319(h) Grant in FFY2011 project #13 (MDE photo). The same vicinity after the restoration in 2017 is depicted on the next page.

Implementation Status -- Antietam Creek Watershed Plan

Between 2012 and June 2018, over $2.49 million has been invested by State and Federal grants/loans in completed projects to help implement the Antietam Creek Watershed Plan as summarized in the table below. This investment, along with the leveraged nonfederal funds, has yielded significant pollutant load reduction.

Table 7: Grant Expenditures Summary 2012 to June 2018
Antietam Creek Watershed Plan Implementation

Grant Project Expenditures					Pollutant Load Reduction			
Grant Name	**Federal Grants $**	**State Grants $**	**Non Federal Match $**	**Total $ Expenditures**	**Nitrogen lb/yr**	**Phosphorus lb/yr**	**Sediment tons/yr**	**E. Coli billion/yr**
319(h) Grant	1,407,509.60		938,340.07	2,345,849.67	642.8	216.5	1,136.41	166
State Revolving Fund		424,600.00		424,600.00	202.0	10.7	0.0	0.0
Chesapeake & Atlantic Coastal Bays Trust Fund		696,771.99		696,771.99	426.9	51.3	15.08	0
TOTAL	1,407,509.60	1,121,371.99	938,340.07	3,467,221.66	1,271.6	278.5	1,151.49	166

$2,528,881.59 =TOTAL for State and Federal grants/loans expended

Table 8: Pollution Load Reduction Progress Reported

Antietam Creek Watershed	Nitrogen lb/yr	Phosphorus lb/yr	Sediment tons/yr	E. Coli billion/yr
2012 thru SFY17	46,575.2	3,116.1	2,370.74	
SFY18 Cover Crops	46,887.4	340.1	267.4	
SFY18 Multi-Year BMPs	264,021.4	30,583.2	7,516.5	0
All Trust Fund thru SFY18	426.9	51.3	15.08	0
Total	357,910.8	34,090.7	10,169.8	0.0
Watershed Plan Goals (1)			12,923.00	5,411,472
Percent of Goal Achieved			78.7%	0%
All funding sources. Annual BMPs are included in SFY18 only. See Appendix B.				

Since the adoption of the watershed plan in 2012, reported pollution load reductions from all implementation has also made significant progress (table left). Washington County, in cooperation with MDE, is currently working to update their watershed plan, per the State's Nonpoint Source Management Plan milestone goal. An updated plan is expected to be completed by the end of SFY19.


Figure 6. Stream restoration construction long Little Antietam Creek took place in 2016 (above left). Construction was completed late in 2016 (above right). The restoration was funded in part by two the 319(h) Grant in FFY2015 project #7) (photos by Washington County SCD).

C. Back River Watersheds

Location

The Back River watershed is located in Baltimore County and Baltimore City. It has two Small Area Watershed Plans (SWAPs) as shown in the map and table below. EPA accepted the Tidal Back River SWAP in 2010 and the Upper Back River SWAP in 2008.

Implementation

Projects that are implementing watershed plans goals, funded thru three Federal and State grant/loan sources, are summarized on the next page. The pollutant removal goals in both the Tidal Back River and the Upper Back River watershed plans are drawn from the same nutrient TMDL. Both plans have urban BMP implementation goals. Agriculture is nearly absent in both areas. No agricultural BMP implementation was reported during SFY14-18 in either area.

Figure 7. Back River Watersheds.

The following tables were provided by Baltimore County (below and next page). They include implementation from all funding sources, such as 319(h) Grant, State Revolving Fund, the Chesapeake and Atlantic Coastal Bay Trust Fund, and others. Also see Appendix C.

Table 9. Tidal Back River Watershed Plan Goal and Implementation Progress

Management Practice	SWAP Goal	Units	2010-FY14 Progress	FY15 Activity	FY16 Activity	FY17 Activity	FY18 Activity	2010-FY18 Progress
6. Convert Dry Ponds	2	projects	0	2	0	0	0	2
10. Stormwater Retrofits	16	projects	0	1	9	0	0	10
11. Impervious Cover Removal	0.5	acres	0.1	0.3	1.0	0.1	0	1.5
12. Downspout Disconnection	12.0	rooftop acres	0.6	0.1	0.2	0	0	0.9
16. Riparian Buffer Trees	156	acres	0	0	0.4	0	0.2	0.6
17. Shoreline Buffer Trees	181	acres	0.4	0	0	0	0	0.4
18. & 19. Upland Trees	36.75	acres	2.7	0.1	5.4	2.1	14.5	24.8
20. Institutional Trees*	2.1	acres	0.7	0	3.4	0.1	0	4.2
33. Shoreline Management	2	projects	1	0	0	0	0	1
36. Stream Restoration	3,442	ft	3,926	0	0	0	0	3,926

*These trees are double counted from 16.-19. for SWAP progress in this category but not for nutrient reductions.

Table 10. Upper Back River SWAP (Baltimore County Portion) Goal and Implementation Progress

Management Practice	SWAP Goal	Units	2008-FY14 Progress	FY15 Activity	FY16 Activity	FY17 Activity	FY18 Activity	Total Progress
Convert Dry Ponds	17	projects	0	5	7	0	2	12
Stormwater Retrofits	50	projects	5	2	1	1	3	12
Downspout Disconnection	180	rooftop acres	3.2	0.5	0.3	0	0	4.0
Riparian Buffer Trees	200	acres	2.2	1.2	0.0	0.04	0.3	3.8
Reforestation	50	acres	16.4	2.1	7.0	2.2	2.8	30.5
Street Trees	4,000	trees	290	80	93	0	0	463
Stream Restoration	66,000	ft	2,000	0	0	0	4,183	6,183

* Baltimore County and Baltimore City are responsible for meeting these goals collectively

Table 11. Pollution Load Reduction Progress Tidal and Upper Back River SWAPs

Tidal Back River Watershed	Nitrogen lbs/yr	Phosphorus lbs/yr	Sediment lbs/yr
SWAP Implementation			
2010-FY14	1,012.6	663.0	2,608,925.5
FY15	280.6	2.6	719.5
FY16	90.7	7.8	2,825.3
FY17	59.8	0.6	141.2
FY18	104.6	3.6	786.5
2011 Fertilizer Act	1,081.7	239.4	0.0
FY18 Street Sweeping	518.1	207.2	62,168.4
FY18 Inlet Cleaning	12.4	4.9	1,482.8
Total Estimated Pollutant Reductions 2010-FY18	3,160.5	1,129.1	2,677,049.2
Watershed Plan Goals	6,498	679	
Percent of Goal Achieved	48.6%	166.3%	

Pollution Reduction Progress (Baltimore County Portion)			
Upper Back River Watershed	Nitrogen lbs/yr	Phosphorus lbs/yr	Sediment lbs/yr
Completed Measures Prior To SWAP			
	9,661.0	1,340.6	unk
SWAP Implementation			
2008-FY14	481.4	172.1	510,894.1
FY15	250.1	10.5	1,424.7
FY16	158.3	16.8	5,534.6
FY17	40.1	6.5	2,470.5
FY18	357.3	289.2	1,038,971.9
2011 Fertilizer Act	6,472.5	1,432.4	0.0
FY18 Street Sweeping	602.0	240.8	72,237.0
FY18 Inlet Cleaning	65.2	26.1	7,823.5
Total Estimated Pollutant Reductions 2010-FY18	8,426.9	2,194.4	1,639,356.3
Grand Total Pollutant Reductions	18,087.9	3,535.0	1,639,356.3
Watershed Plan Goals*	48,189.6	6,055.8	
Percent of Goal Achieved	37.5%	58.4%	

*Baltimore County and Baltimore City are responsible for meeting these goals collectively

D. Casselman River Watershed

Location

In Maryland, the Casselman River flows about 20 miles from Savage River State Forest into Pennsylvania. The watershed area is 66 square miles and is part of the Mississippi River drainage. Land use in the watershed can be aggregated into three broad categories: forest (89%), agriculture (9%), and developed land (2%).

Goal

MDE's watershed plan goal is to meet the pH water quality standard of no less than 6.5 pH and no greater than 8.5 pH by increasing alkalinity (mg $CaCO_3$/l). This goal is derived from the Western Maryland pH TMDLs approved in 2008 based on in-stream water quality data collected in 2005 or earlier.

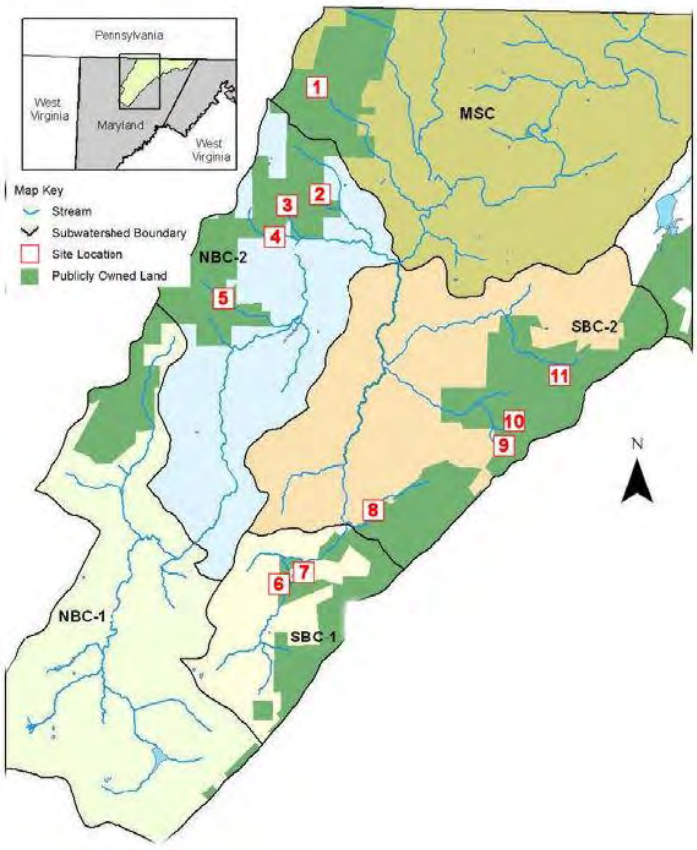


Figure 8. Casselman River watershed and Phase 1 sites.

Implementation

All construction is by MDE using 319(h) FFY13 Grant funds. Phase 1 is on public land and Phase 2 is on private land, which ended in SFY17, to install BMPs to mitigate acid mine drainage. (see Appendix D)

Figure 9. The photo shows a FFY13 319(h) Grant-funded site on private land where delivery trucks deposited limestone crushed to sand-sized grains (grey in photo center right). The limestone particles at this site will be gradually washed downstream and distributed along the stream bed. The limestone neutralizes excess acidity and provides pH buffering capacity (photo by MDE Land Management Administration, Abandoned Mine Land Division.).

E. Corsica River Watershed

Location

The Corsica River, which is 6.5 miles in length, is located in Queen Anne's County. The watershed area is 40 square miles and is part of the larger Chester River Watershed. Land use in the watershed aggregates into three broad categories:
- 66% agriculture,
- 26% woodland,
- 8% developed lands.

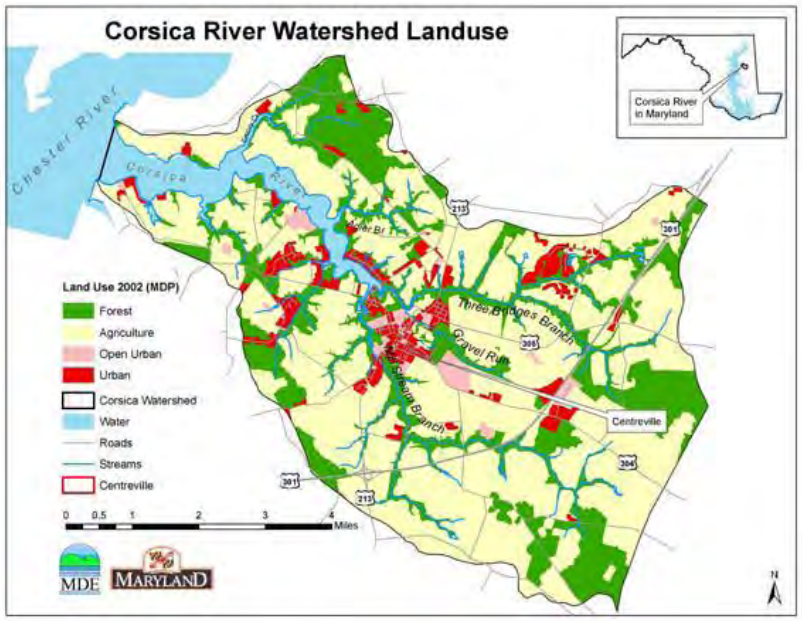


Figure 10. Corsica River Watershed Goals

Table 12: Pollution Load Reduction Progress

Corsica River Watershed	Nitrogen lb/yr	Phosphorus lb/yr	Sediment tons/yr
2005 thru SFY17	51,033.0	6,252.3	1,096.39
SFY18 Cover Crops	20,611.4	61.4	17.5
SFY18 Multi-Year BMPs	1,638.2	40.6	15.7
All Trust Fund thru SFY18	1,360.8	130.9	20.3
Total 2005 thru SFY18	74,643.4	6,485.2	1,149.92
Watershed Plan Goals (1)	NA	NA	NA
Percent of Goal Achieved	NA	NA	NA
All funding sources. Annual BMPs in SFY18 only. See Appendix E.			

Centreville developed the Corsica River watershed plan in 2005 with input from Queen Anne's County, Queen Anne's Soil Conservation District and others. The goal of the watershed plan is to continue meeting the nutrient TMDL. Since the plan was completed, significant pollutant reduction has been accomplished (table on left) primarily thru investment of several million dollars of public funding (table below). In addition, a progress report covering 2005-2011 summarized watershed plan implementation status and updated BMP implementation goals (See Appendix E).

Table 13: Grant Expenditures Summary - Corsica River Watershed Plan Implementation

Grant Project Expenditures					Pollutant Load Reduction		
Grant Name	Federal Grants $	State Grants $	Non Federal Match $	Total $ Expenditures	Nitrogen lb/yr	Phosphorus lb/yr	Sediment tons/yr
319(h) Grant	1,919,132.11	270,000.00	1,279,421.41	3,233,553.56	215,912.4	13,790.9	1,957.18
State Revolving Fund	0	200,000.00	0	250,000.00	864.0	173.0	0.00
Chesapeake & Atlantic Coastal Bays Trust Fund		1,208,801.10		1,208,801.10	1,360.8	130.9	20.28
TOTAL	1,919,132.11	1,678,801.10	1,279,421.41	4,692,354.67	218,137.2	14,094.7	1,977.45

F. Lower Jones Falls

The Lower Jones Falls watershed encompasses 16,550 acres (25.9 mi^2) in Baltimore County (30.09%) and Baltimore City (69.91%). About 54 miles of streams in the watershed flow into the tidal Patapsco River and the Chesapeake Bay. Land use in the watershed is 55.9% residential (11.1% low density, 23.7% mid density and 21.1% high density). Various developed land uses cover 21.7% of the watershed (6.9% commercial, 2.4% industrial, 10.5% institutional and 1.9% highway). Open land uses account for the remaining 22.2% of the watershed area (6.1% open urban, 13.6% forest, 1.3% agriculture, 0.6% bare ground, 0.6% extractive and 0.3% water). Overall impervious cover is 31.8%.

Implementation Status

In the tables, Baltimore County and City are both responsible for the goals. However, information regarding implementation efforts towards the goals of the watershed plan is not available for the City.

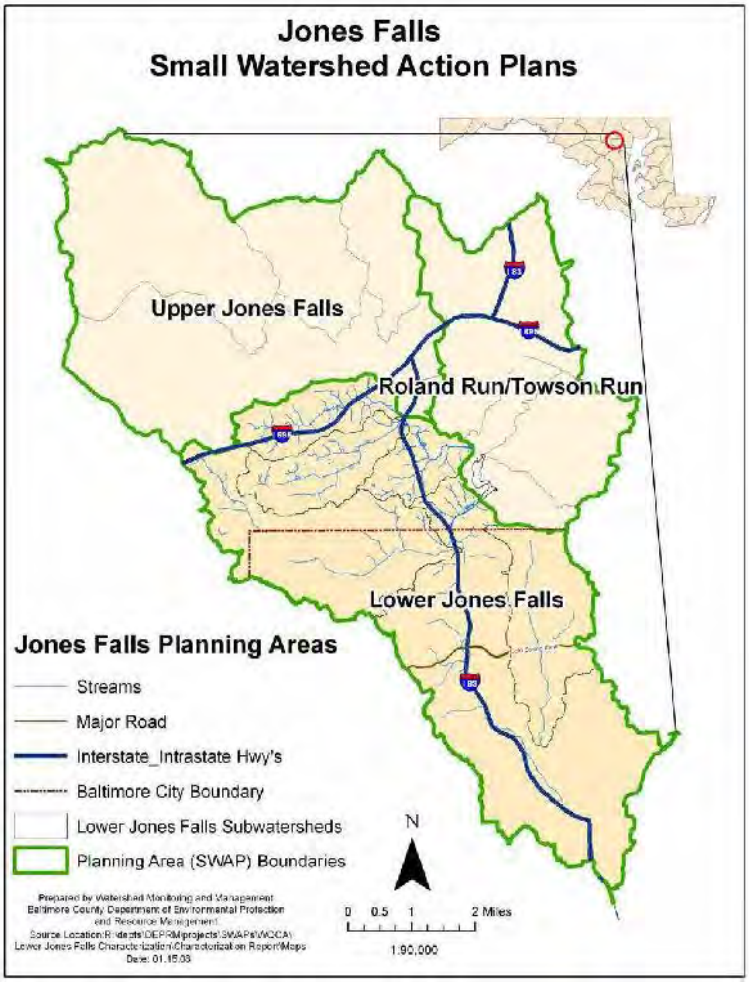


Figure 11. Jones Falls Watershed

Table 14: Lower Jones Falls SWAP Pollution Reduction Progress (Baltimore County Portion)

Lower Jones Falls Watershed	Nitrogen lbs/yr	Phosphorus lbs/yr	Sediment lbs/yr
Completed Measures Prior To SWAP			
	7,751	1,166	418,556
SWAP Implementation			
FY09-FY14	71.0	6.4	4,112.7
FY15	55.7	0.0	6.5
FY16	6.2	0.2	95.2
FY17	63.6	39.3	139,582.1
FY18	88.6	7.6	2,069.8
2011 Fertilizer Act	7,016.7	920.5	0.0
FY18 Street Sweeping	127.8	51.1	15332.5
FY18 Inlet Cleaning	7.0	2.8	841.7
Total Estimated Pollutant Reductions FY09-FY18	7,436.6	1,027.9	162,040.5
Grand Total Pollutant Reductions	15,187.6	2,193.9	580,596.5
Watershed Plan Goals*	23,146	3,887	409,800
Percent of Goal Achieved*	65.6%	56.4%	141.7%

*Baltimore County and Baltimore City are responsible for meeting these goals collectively
Also see Appendix F. No implementation data has been reported for the City.

G. Lower Monocacy River Watershed

Location

The Lower Monocacy River watershed encompasses 194,700 acres (304 mi^2) that drains portions of Frederick County (87%), Montgomery County (10%) and Carroll County (3%). The mainstem of the Monocacy River is 58 miles long. The Monocacy River drains into the tidal Potomac River and then the Chesapeake Bay. Overall impervious cover is 4% but it is concentrated in two subwatersheds: Carroll Creek (18.6%) and Ballenger Creek (13.4%). Land use in the watershed is:

- 47% Agricultural
- 30% Forest
- 22% Developed land uses

Figure 12. Monocacy River Watershed.

Goals and Implementation

Frederick County's 2004 Lower Monocacy River Watershed Restoration Action Plan addresses 168,960 acres (264 mi^2) within the County. The County's 2008 plan supplement incorporated goals from the Lake Linganore sediment TMDL, which is based on data collected in 2002 and earlier.

Table 15: Pollution Reduction Progress Reported

Lower Monocacy River Watershed	Nitrogen lb/yr	Phosphorus lb/yr	Sediment tons/yr
Prior Years	46,556.5	4,115.8	1,941.58
SFY18 Cover Crops	144,149.8	879.4	753.6
SFY18 Multi-Year BMPs	718,477.8	63,136.1	17,064.5
All Trust Fund thru SFY18	1,622.3	100.3	22.3
Total Estimated Pollutant Reduction 2008 thru 2014	910,806.4	68,231.6	19,782.0
Watershed Plan Goals (1)	649,998	68,952	10,345
Percent of Goal Achieved	140.1%	99.0%	191.2%
Prior Years data is from 2013 and Maryland Chesapeake Bay WIP reporting SFY14-SFY16. See Appendix G.			

Table 15 shows that significant estimated pollutant load reductions was achieved during state fiscal year. However, much of the estimated pollution reduction is associated with annual cover crops. Therefore, a continuation of annual cover crop planting is necessary in the future.

Implementation Status – Lower Monocacy River Watershed Plan

Table 16: Grant Expenditures Summary - Lower Monocacy River Watershed Plan Implementation

Grant Expenditures Summary					Pollutant Load Reduction		
Grant Name	**Federal Grants $**	**State Grants $**	**Non Federal Match $**	**Total $ Expenditures**	**Nitrogen lb/yr**	**Phosphorus lb/yr**	**Sediment tons/yr**
319(h) Grant	1,387,102.99		8,549,963.33	16,119,456.60	3,154.3	418.3	32.28
State Revolving Fund		6,346,142	7,800,000.00	14,146,142	Unknown	Unknown	Unknown
Chesapeake & Atlantic Coastal Bays Trust Fund		400,961.97		400,961.97	1,622.3	100.3	22.31
TOTAL	1,387,102.99	6,747,103.97	16,349,963.33	30,666,560.57	4,776.6	518.6	54.59

The summary table above indicates that significant estimated pollutant load reductions have been reported as a result of over $1.38M in Federal 319(h) Grant funds that leveraged about three quarters of a million dollars in local match in the Lower Monocacy River watershed (see Appendix G).

H. Middle Gwynns Falls Watershed

The Middle Gwynns Falls watershed encompasses 14,881 acres (23.25 mi^2) in Baltimore County (Baltimore City portion of watershed not addressed in the watershed plan). About 77.9 miles of streams in the watershed flow into the tidal Patapsco River and then the Chesapeake Bay. The tables below show watershed plan implementation activity.

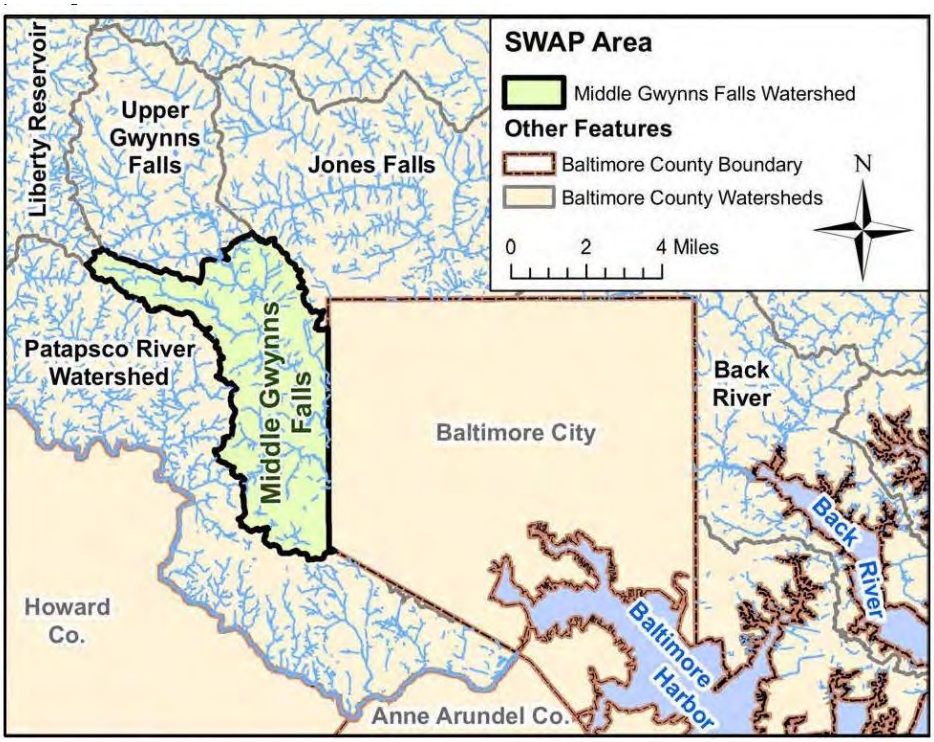


Figure 13. Gwynns Falls watershed in Baltimore County Implementation Status

Table 17: Middle Gwynns Falls SWAP Pollution Reduction Progress

Middle Gwynns Falls Watershed	Nitrogen lbs/yr	Phosphorus lbs/yr	Sediment lbs/yr	Bacteria
Completed Measures Prior To SWAP				
Through August 2013	1,559.9	235.2	1,072,689.4	
SWAP Implementation				
September 2013-FY14	643.9	160.0	304,678.2	
FY15	128.0	8.7	12,989.5	
FY16	277.1	22.2	20,191.6	
FY17	53.4	1.6	1,940.9	
FY18	766.5	171.0	321,132.3	46.6% reduction
2011 Fertilizer Act	4,928.0	640.0	0.0	
FY18 Street Sweeping	458.5	183.4	55,025.8	
FY18 Inlet Cleaning	37.87	15.15	4,544.4	
FY18 Septic Pumpouts	6.8	na	na	
Total Estimated Pollutant Reductions Post-SWAP	7,300.1	1,202.1	720,502.7	
Grand Total	8,860.0	1,437.3	1,793,192.1	
Watershed Plan Goals	50,442*	4,086*	NA	99.99%
Percent of Goal Achieved	17.6%	35.2%	NA	46.6%
*Bay TMDL: 29.0% N Reduction, 45.1% P Reduction (no BMP scenario reductions)				

For more information see Appendix H.

Table 18: Grant Expenditures Summary - Middle Gwynns Falls Watershed Plan Implementation

Grant Project Expenditures					Pollutant Load Reduction			
Grant Name	**Federal Grants $**	**State Grants $**	**Non Federal Match $**	**Total $ Expenditures**	**Nitrogen lb/yr**	**Phosphorus lb/yr**	**Sediment tons/yr**	**Bacteria MPN/yr**
319(h) Grant	320,004.00		213,336.00	533,340.00	415.2	136.4	306.2	0
State Revolving Fund		0		0	0	0	0	0
Chesapeake & Atlantic Coastal Bays Trust Fund		1,932,057.56		1,932,057.56	1,021.5	320.9	478.0	0
TOTAL	320,004.00	1,932,057.56	213,336.00	2,465,397.56	1,436.7	457.3	784.2	0

Figure 14. The two photos show existing conditions in the Scotts Level Branch drainage area in the vicinity of Marriottsville Road within the Middle Gwynns Falls watershed. A FFY2016 319(h) Grant for over $0.6M is currently in construction to eliminate the eroding vertical stream banks and to restore the stream area. Total project cost is projected to be well over $1.0M. Project completion is projected for end of June 2020 (photo by Baltimore County Dept. of Environmental Protection and Sustainability, Capital Program and Operations Section).

I. Sassafras River Watershed Plan

The Sassafras River watershed encompasses 62,000 acres (96.9 mi^2) that drains portions Kent County, MD (57%), Cecil County, MD (28%) and New Castle County, DE (8%). The 20.6 mile-long Sassafras River mainstem flows into the Chesapeake Bay. Impervious area covers 2.2% of the watershed. Land use in the watershed is 57% agricultural, 24% forest, 4% developed, 14% water, and 1% wetland.

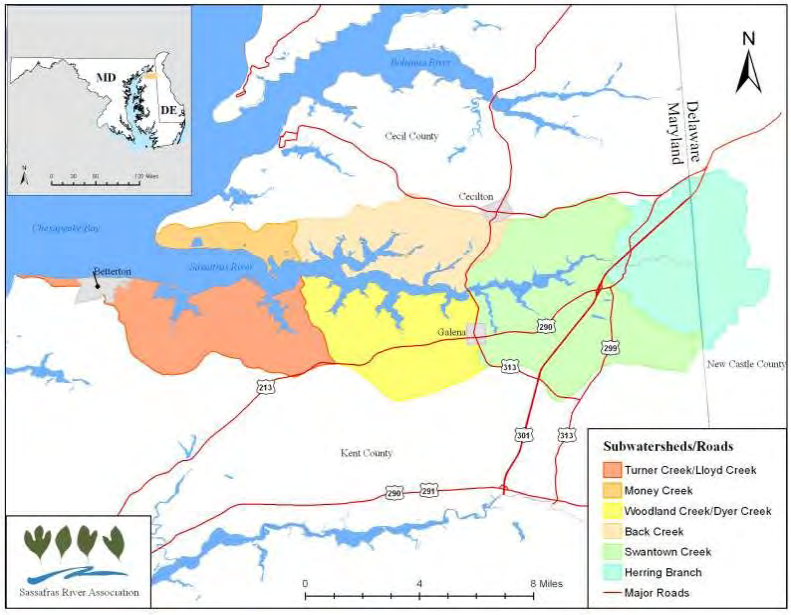


Figure 15. Sassafras River watershed map

Plan Implementation Progress

The 2009 Sassafras River Watershed Action Plan (SWAP) was developed by the Sassafras River Association (SRA). On November 15, 2017 the SRA, which is the lead Sassafras plan implementer announced that it is merging with two other NGOs. The new NGO, called ShoreRivers, is anticipated to continue as the lead implementer of the Sassafras Plan. Implementation tracking progress is summarized on the next page.

Figure 16. The photo above shows a newly constructed BMP on a Kent County farm as seen 9/26/17 when EPA and MDE representatives visited. The farm's steep slope and large drainage area required that grade stabilization be provided by rock. In between the rock, several bioretention/treatment wetland areas are ready for planting. Representatives in photo: Kent Soil Conservation District Board member, Sassafras River Association agricultural project leader (photo by MDE, Integrated Water Planning Program).

Implementation Status – Sassafras River Watershed Plan

Table 19: Grant Expenditures Summary - Sassafras River Watershed Plan Implementation

Grant Project Expenditures					Pollutant Load Reduction		
Grant Name	**Federal Grants $**	**State Grants $**	**Non Federal Match $**	**Total $ Expenditures**	**Nitrogen lb/yr**	**Phosphorus lb/yr**	**Sediment tons/yr**
319(h) Grant	64,000.00		42,666.67	108,333.33	100.7	20.2	2.6
State Revolving Fund	0	0	0	0	0	0	0
Chesapeake & Atlantic Coastal Bays Trust Fund		3,588,185.47		3,588,185.47	18,115.1	9,301.5	2,629.2
TOTAL	64,000.00	3,588,185.47	42,666.67	3,696,518.80	18,215.8	9,321.7	2,631.9

The table above shows that, among three State administered funding sources, Maryland's Chesapeake and Atlantic Coastal Bays has had the most significant impact in the Sassafras River watershed. During SFY2018, there were two active projects funded on three farms with 319(h) Grant funding:

- Harbor View and Colchester Farms Project involves constructing a mixture of a cascading wetland system, bioretention, and enhanced treatment infiltration, and
- Starkey Project involves constructing multi-celled treatment wetlands, wetland creation/restoration, and stabilization of an eroded gully.

During SFY2018, no additional projects were proposed for this watershed.

Table 20: Pollution Reduction Progress

Sassafras River Watershed	Nitrogen lb/yr	Phosphorus lb/yr	Sediment tons/yr
Previous Years	13,354.1	1,082.9	594.26
SFY18 Cover Crops	50,886.7	267.7	141.9
SFY18 Multi-Year BMPs	2,667.1	196.4	98.6
All Trust Fund thru SFY18	18,115.1	9,301.5	2,629.2
Total Pollutant Reduction	85,023.0	10,848.5	3,464.0
Watershed Plan Goals (1)	46,475	6,458	721.9
Percent of Goal Achieved	182.9%	168.0%	479.8%
All funding sources. Annual BMPs in SFY18 only. See Appendix I.			

The table shows that pollutant reductions reported during SFY2018 made significant progress to watershed plan goals.

However for nitrogen load reduction, annual cover crops account for more than two thirds of the achievement. Consequently, land owner efforts and the funding sources that support their efforts much be maintained indefinitely to continue nitrogen load reduction progress into the future.

Phosphorus and sediment pollutant load reduction continue to be more associated with multi-year BMPs. This suggests that annual implementation may account for a smaller percentage of future BMP implementation needs.

J. Upper Choptank River

Location

The Upper Choptank River watershed encompasses 163,458 acres (255 mi^2) and drains parts of three Maryland counties (Caroline, Talbot and Queen Anne's) and parts of Delaware. It flows into the Chesapeake Bay. Impervious area covers 2.2% of the watershed. Land use in the watershed is: 58% agricultural; 31% forest; 8% developed and; 3% water.

Goal

Caroline County's Upper Choptank River watershed plan remains unchanged since 2010. It is based on Tributary Strategy NPS goals and EPA's Chesapeake Bay Program 2002 pollutant load estimates for the Upper Choptank River watershed. The Plan's NPS pollutant load reduction goals are:

- Total nitrogen reduction: 704,000 lbs/year
- Total phosphorus reduction: 34,500 lbs/year.
-

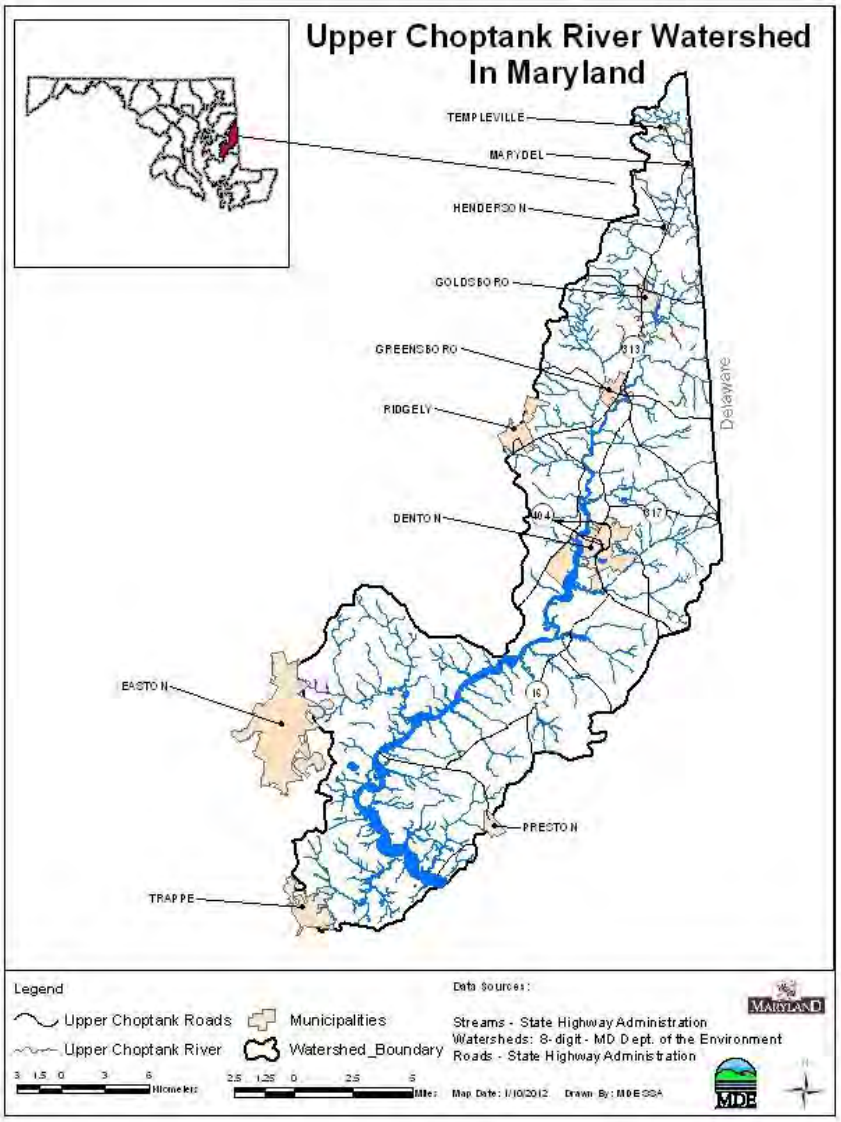


Figure 17. Upper Choptank River Watershed.

Table 21: Grant Expenditures Summary - Upper Choptank River Watershed Plan Implementation

Grant Project Expenditures					Pollutant Load Reduction		
Grant Name	**Federal Grants $**	**State Grants $**	**Non Federal Match $**	**Total $ Expenditures**	**Nitrogen lb/yr**	**Phosphorus lb/yr**	**Sediment tons/yr**
319(h) Grant	1,174,095.43		782,730.29	1,956,825.72	145,137.3	11,988.1	666.91
State Revolving Fund		0		0	0	0	0
Chesapeake & Atlantic Coastal Bays Trust Fund		333,657.78		333,657.78	3,940.4	164.1	853.6
TOTAL	1,174,095.43	333,657.78	782,730.29	2,290,483.50	149,077.7	12,152.2	1,520.56

Implementation Status – Upper Choptank River Water Plan

Table 22: Pollution Load Reduction Progress

Upper Choptank River Watershed	Nitrogen lb/yr	Phosphorus lb/yr	Sediment tons/yr
2002 thru SFY17	208,550.3	18,946.9	1,070.04
SFY2018 Cover Crops	105,221.4	0.1	50.5
SFY18 Multi-Year BMPs	8,227.6	580.0	39.7
All Trust Fund thru SFY18	3,940.4	164.1	853.6
Total Estimated Pollutant Reduction	321,999.3	19,527.0	1,160.20
Watershed Plan Goals (1)	704,000	34,500	
Percent of Goal Achieved	45.7%	56.6%	
All funding sources. Annual BMPs in SFY18 only. See Appendix J.			

The pollutant load reduction progress table above summarizes overall watershed plan implementation progress based on available reporting. Annual cover crops for SFY2018 comprise ~30% of the total estimated nitrogen pollutant load reduction for implementing the watershed plan. This suggests that cover crop planting will continue to be an important annual practice for future years of watershed plan implementation.

V. Areas of Concern/Recommendations/Future Actions

Key challenges addressed by the 319 NPS Program, in collaboration with other state efforts, include increasing NPS pollution in some areas, resource constraints versus measureable environmental results, and reporting NPS Implementation Progress. These issues were presented in the 2013 and 2014 Annual Reports, which are available on MDE's web page at http://www.mde.state.md.us/programs/Water/319NonPointSource/Pages/Programs/WaterPrograms/319NPS/index.aspx Several additional issues relating to timeframe, estimating pollutant load reduction and limitations of the 319(h) Grant are noted below.

A. Completeness, Accuracy and Consistency of BMP implementation and tracking data

Significant effort has been invested by State agencies to improve the completeness and accuracy of BMP implementation data. Some of this work has been funded by an EPA grant under the Chesapeake Bay Regulatory and Accountability Program (CBRAP). The first grant "CBRAP1" ran from 7/1/10 thru 6/30/17. The second grant "CBRAP2" started 7/1/16 and continued thru SFY18. The third grant "CBRAP3" started 7/1/18 and continues through SFY22. These grants have been and will continue to be used by Maryland to help address issues involving both point sources and nonpoint sources. Several of the work areas called Objectives that address nonpoint source issues are:

- Agriculture NPS
    - Technical assistance for farmers drafting and updating nutrient management plans to meet State requirements. (funded from 7/1/10 thru 6/30/18 under Objective 10 CBRAP1 and CBRAP2). This work will continue to be funded in CBRAP3; however, MDE and MDA now receive two separate pots of money from EPA for the CBRAP grant.
    - Agricultural Watershed Implementation Plan coordination to meet the Chesapeake Bay TMDL. (funded from 7/1/10 thru 6/30/18 under Objective 11 CBRAP1 and CBRAP2). See note in first bullet in regards to CBRAP3.
    - Poultry manure management assessments and compliance (funded from 7/1/10 thru 6/30/13 under Objective 12 CBRAP1 only). See note in first bullet in regards to CBRAP3.
    - Nutrient management review and compliance (funded 7/1/14 thru 6/30/17 under Objective 23 CBRAP1 only). See note in first bullet in regards to CBRAP3.
    - Best management practice verification (funded 3/15/15 thru 6/30/17 under Objective 29 CBRAP1 and CBRAP2). See note in first bullet in regards to CBRAP3.
- Urban NPS
    - Accountability framework development and implementation at the State and local levels such as establishing watershed implementation plans, monitoring progress of NPS implementation by setting two-milestones and tracking efforts to meet plan goals and milestones (funded 7/1/2012 thru 6/30/22 under Objective 16 CBRAP1, CBRAP2, and CBRAP3)
    - Coordination of among State programs and with local agencies to expedite NPS implementation (funded 7/1/10 thru 6/30/18 under Obj. 9 CBRAP1 and CBRAP2, funded 7/1/11 thru 6/30/13 under Obj. 13 CBRAP1 only, funded 7/1/12 thru 6/30/18 under Obj. 15 CBRAP1 and CBRAP2, and funded 7/1/18 thru 6/30/22 under Obj. 15 in CBRAP3).
    - Development, deployment, updating and training for a tool for tracking and envisioning NPS implementation scenarios. The Maryland Automated Scenario Tool (MAST). (Funded 7/1/10 thru 11/21/11 under Obj. 3 CBRAP1 only, funded 3/1/12 thru 12/31/12

under Obj. 18 CBRAP1 only and funded 7/1/16 thru 6/30/17 under Obj. 36 CBRAP2 only – not funded in CBRAP3).

- Data Management
    - Enhancing statewide data management integration and efficiency. (funded 1/1/15 thru 6/30/17 under Obj. 26 CBRAP1 only).
    - Development and deployment of the new data management system using FFY16, FFY17, and FFY18 319(h) Grant funds.

B. Differences in 319 Priority Watershed Plan Implementation and Tracking

Prior to the SFY15 Annual Report, reporting and tracking for NPS implementation in each 319 priority watershed was limited to local capabilities using diverse methods. Reporting was inconsistent and there was no basis for comparison among the watersheds. Beginning with the SFY15 Annual Report, MDE used data collected for the EPA Chesapeake Bay Program to create a consistent reporting method that allows consistent reporting and comparability statewide.

There are significant differences in participation among local jurisdictions. Some participate fully, several participate only indirectly (public newsletters) or not at all. Among these, Baltimore County is fully engaged but is dissatisfied with the tracking methods used for statewide reporting and prefers to supply their own estimates of progress that were used in the watershed-specific reporting in this report. For all 319 priority watersheds except for Baltimore County, MDE a combination of the Phase 5 and Phase 6 Chesapeake Bay watershed models (based on the available information) to estimate BMP pollutant load reductions for nitrogen, phosphorus and sediment It is anticipated that next year, Maryland will fully transition to using the Phase 6 watershed model for annual reporting purposes.

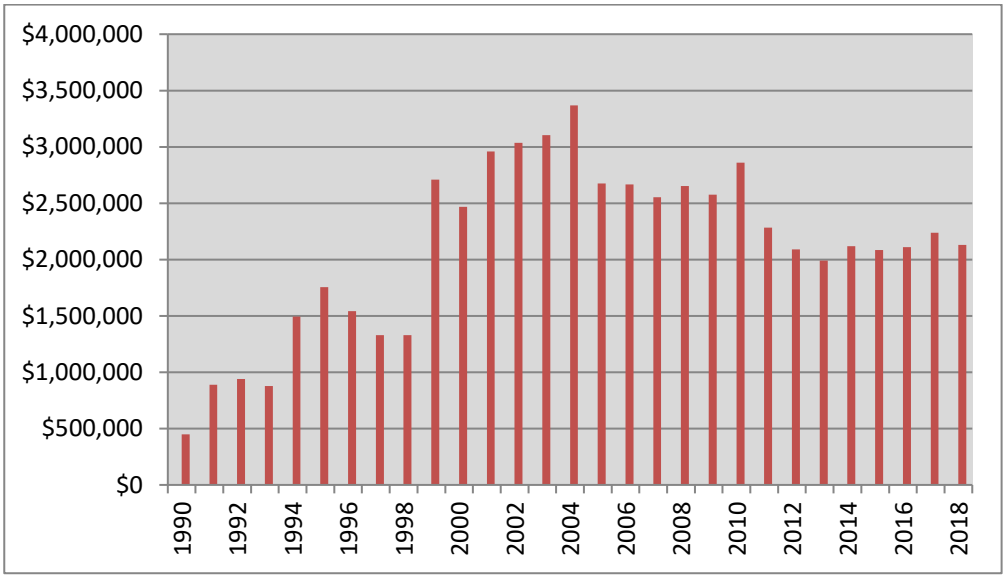
C. Limitation to Using 319(h) Grant Funds for NPS Implementation

As first reported in the 2014 Annual Report, local interest in funding NPS implement use the 319(h) Grant has tended to very limited. Therefore, for 2014 thru SFY17 few 319-funded BMPs have been completed and total pollutant load reduction reported is small compared to other reported funding sources.

Beginning in SFY17, consistent with EPA guidance, Maryland began reporting 319(h) Grant matching funds AND pollutant load reductions associated with the matching funds.

Appendix A Financial Information

Federal 319(h) Grant Funds Awarded To Maryland
By Federal Fiscal Year Appropriated 1990 thru SFY 2018



Grant funding from the Federal Clean Water Act Section 319(h) was first awarded to the State of Maryland in 1990. The graph above shows the Federal funds in each grant award. As the graph shows, grant awards received by Maryland from FFY2014 thru FFY2017 have been similar funding levels. The allocation to Maryland is based on a national formula for distribution of 319 (h) Grant funds among the States, which has remained unchanged since the early 1990s.

The table on the next page lists the award amounts and the amount of nonfederal match for each award. The year shown for each grant award is the Federal Fiscal Year (FFY) that the federal funds were appropriated. Upon award, each grant has a maximum life of five years.

Award Amounts for Federal 319(h) Grant Funds Awarded To Maryland

Since 1990, about $59 million in Federal 319(h) Grant funds have been awarded to Maryland as shown in the table below.

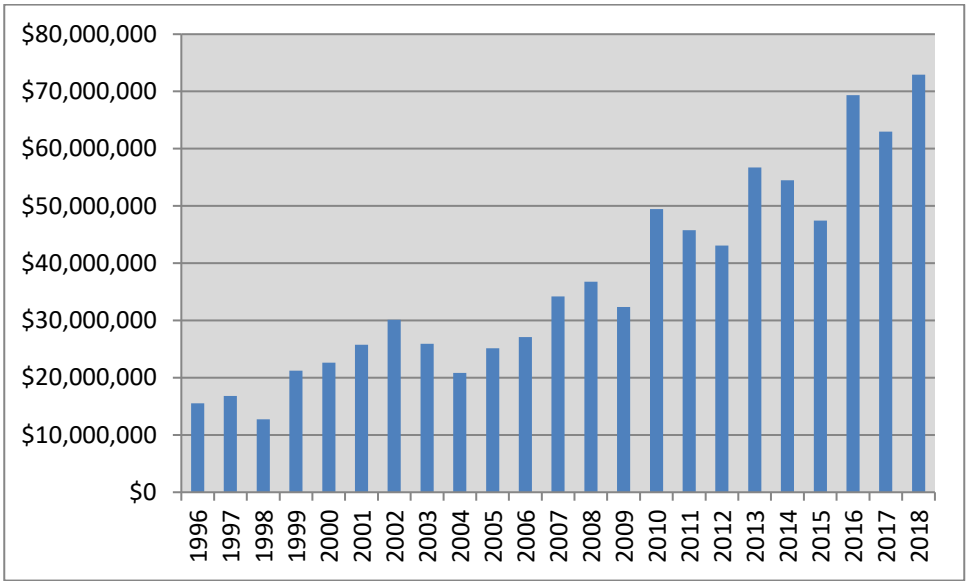
Federal 319(h) Grant Funds Awarded To Maryland By Federal Fiscal Year Appropriated

Federal Fiscal Year (1)	National Budget 319(h) Grant (millions)	319(h) Grant Allocated to Maryland (2)	Non-Federal Match By Maryland (3)	Total Grant + Match In Maryland
1990	$38.0	$447,771	$298,514	$746,285
1991	$51.0	$890,039	$593,359	$1,483,398
1992	$52.5	$939,298	$626,199	$1,565,497
1993	$50.0	$877,070	$584,713	$1,461,783
1994	$80.0	$1,494,413	$996,275	$2,490,688
1995	$100.0	$1,755,964	$1,170,643	$2,926,607
1996	$100.0	$1,541,980	$1,027,987	$2,569,967
1997	$100.0	$1,327,699	$885,133	$2,212,832
1998	$105.0	$1,327,699	$885,133	$2,212,832
1999	$200.0	$2,708,298	$1,805,532	$4,513,830
2000	$200.0	$2,467,576	$1,645,051	$4,112,627
2001	$237.5	$2,958,486	$1,972,324	$4,930,810
2002	$237.5	$3,035,576	$2,023,717	$5,059,293
2003	$238.5	$3,104,500	$2,069,667	$5,174,167
2004	$237.0	$3,369,190	$2,246,127	$5,615,317
2005	$207.3	$2,675,598	$1,783,732	$4,459,330
2006	$204.3	$2,666,655	$1,777,770	$4,444,425
2007	$199.3	$2,551,736	$1,701,157	$4,252,893
2008	$200.9	$2,653,500	$1,769,000	$4,422,500
2009	$200.9	$2,575,782	$1,717,188	$4,292,970
2010	$200.9	$2,860,785	$1,907,190	$4,767,975
2011	$175.5	$2,283,639	$1,522,426	$3,806,065
2012	$164.5	$2,091,000	$1,394,000	$3,485,000
2013	$155.9	$1,990,999	$1,327,333	$3,318,332
2014	$159.3	$2,119,118	$1,412,745	$3,531,863
2015	$158	$2,084,277	$1,389,518	$3,473,795
2016	$163.40	$2,109,728	$1,406,485	$3,516,213
2017	$167.90	$2,236,500	$1,491,000	$3,727,500
2018		$2,129,000	$1,419,333	$3,548,333
Total	$4,385.3	$61,273,876	$40,849,251	$102,123,127

1) Federal Fiscal Year is the year of appropriation. Shaded rows are grant years that have closed in Maryland. Other years shown are active grant years in Maryland.
2) Federal grant amount awarded to Maryland by Federal Fiscal Year. Includes EPA in-kind.
3) Matching funds required for each grant award (40%) from nonfederal sources.

Expenditures Reported By The State Of Maryland
For NPS Programs and Projects Excluding 319(h) Grant & Match

Summary State Fiscal Year 1996 thru 2018



The Federal Clean Water Act's 1987 Amendments include provisions to ensure that the States do not use Section 319(h) Grants to replace State expenditures that already were occurring. This Maintenance Of Effort (MOE) requirement ensures that each State's NPS expenditures are at least equal to or greater than the baseline level set in the 1990s. Maryland's minimum Maintenance Of Effort is $8,447,270 annually.

As a prerequisite for receiving the next 319(h) Grant award, each State is required to document that their nonfederal expenditures for NPS programs and projects in the previous year, not counting match, meet their MOE. MOE expenditures reported by Maryland are cumulative expenditures in a single State fiscal year (July 1 through June 30) by three State agencies: Maryland Department of Agriculture (MDA); Maryland Department of the Environment, and Maryland Department of Natural Resources (DNR).

The graph above shows that Maryland consistently surpasses its MOE. Beginning in 2013, NPS expenditures by DNR's Chesapeake and Atlantic Coastal Bays Trust Fund were included in the MOE. Expenditures for nonpoint programs and projects by other State agencies, local governments, private organizations or other entities have not been included in Maryland's MOE reporting to EPA. Therefore, it is likely that the total annual expenditure for nonpoint source programs and projects in Maryland is significantly greater than the dollar amount reported to meet MOE requirements.

319(h) Grant Implementation Funding Distribution 2002 thru SFY2017

The following table summarizes 319(h) Grant budget allocations of Federal funds for implementation by watershed, county and region of Maryland. This view is an indicator of efforts by State grant managers, with the essential cooperation of local implementers, to direct Federal 319(h) Grant funds to watersheds that are eligible for the funds. The table does not address actual expenditures of either Federal or nonfederal funds associated with the projects.
Additional context for table and the following analysis includes:

- Implementation Funding in the table includes expenditures for entire completed implementation projects, which may include design, construction, staff (project management) and related supplies, travel, etc.
- Expenditures for 319 implementation funding included:
    - Watersheds currently eligible for 319 implementation funding.
- Expenditures implementation funding not included:
    - Watershed plan areas where implementation is complete and no longer eligible.
    - Watersheds that received 319 implementation funding in 2002 or later but are not currently eligible.
- State Targeting Priorities (see below)
- Local Priorities for Seeking 319(h) Grant Funds (see below)

State Targeting Priorities

- Agricultural Technical Assistance. MDE and the Maryland Dept. of Agriculture (MDA) cooperated in the 1990s and early 2000s to prioritize watersheds for 319 funding to support technical staff in Soil Conservation District Offices who facilitated implementation of BMPs. This targeting included Antietam Creek and Upper Choptank River.
- Success Story Targeting. In approximately 2009, MDE assessed types of impairment and geographic areas to find combinations that were most likely to be correctable in the near term. Based on the assessment, MDE determined that acid mine drainage (AMD) tended to be a discrete impairment that could be mitigated within several years of monitoring and implementation so that success could be demonstrated. Then considering additional AMD prioritization assessments by technical experts in MDE and the existing ability for MDE to carry out watershed planning and impairment mitigation, two areas in Garrett County were selected for implementation: Aaron Run and Casselman River watersheds.
- Local Cooperation. With the exception of AMD mitigation (above), MDE relies on local jurisdiction willingness and interest to: 1) conduct watershed planning that leads to eligibility for 319(h) Grant implementation funding and 2) assume responsibility to implement the watershed plan and compete for 319 implementation project funding. MDE encourages local jurisdictions in this regard by offering technical assistance and 319 grant funding opportunities (within the limits of available resources). Baltimore County had the greatest interest in achieving watershed plan eligibility of any jurisdiction in Maryland. Additionally, several jurisdictions have competed for implementation funding most frequently and successfully: Baltimore County, Caroline County, Centreville/Queen Anne's County, and Washington County Soil Conservation District.

Watershed Planning Efforts to Seek Eligibility for 319(h) Grant Implementation Funding

Beginning in 2005, fifteen watershed planning efforts focused on meeting eligibility requirements for Federal 319(h) Grant implementation funding. The list below summarizes the current status of those

efforts. Numerous watershed planning efforts by jurisdictions and agencies during the same time period that did not involve seeking 319-eligibility are not listed.

List of Watershed Planning Efforts Focused On Eligibility for 319(h) Grant Implementation Funding 2005 thru State Fiscal Year 2018			
Watershed Plan Responsible Entity	**# of Plans**	**Significant Contributor**	**Status June 2016**
Baltimore County	1	na	implemented
	4	na	eligible
Calvert County	1	na	not eligible
Caroline County	1	MDE	eligible
Centreville / Queen Anne's County	1	DNR	eligible
Frederick County	1	na	eligible
MDE	1	MDE	eligible
	1	MDE	conditional eligibility
Prince George's County	1	na	not eligible
Sassafras River Association	1	na	eligible
Washington County Soil Conservation District	1	MDE	eligible
Worcester County	1	MDE	not eligible
	1	na	drafting

The table on the next page summarizes the total Federal 319(f) grant funds expended in each of these watersheds. The expenditures shown includes all 319 funding both before and after EPA accepted the watershed plan. For example, the expenditures listed for the Lower Jones Falls watershed were invested years prior to the completion of the watershed plan.

319(h) Grant Implementation Budget Funding Distribution 2002 thru SFY2018

Based on Completed Implementation Projects Total Expenditures*

Expenditures within a Local Jurisdiction				Chesapeake Bay		Coastal Bays		Ohio River Basin	
Name	# of Eligible Watershed Plans	Federal Grant Budget $	%	Eligible Watershed	Federal Grant $	Eligible Watershed	Federal Grant $	Eligible Watershed	Federal Grant $
Allegany	0	0							
Anne Arundel	0	0							
Baltimore City	2	139,000	1%	Back River - Upper	0				
				Jones Falls - Lower	139,000				
Baltimore County	4	2,017,862	17%	Back River - Tidal	556,443				
				Back River - Upper	1,002,415				
				Gwynns Falls - Middle	320,004				
				Jone Falls - Lower	139,000				
Calvert	0	0							
Caroline	1	1,174,095	10%	Choptank River - Upper	1,174,095				
Carroll	0	0							
Cecil	1	0		Sassafras River	0				
Charles	0	0							
Dorcester	0	0							
Frederick	1	1,387,103	12%	Monocacy River - Lower	1,387,103				
Garrett	1	1,718,734	15%	Aaron Run	936,000			Casselman River	782,734
Harford	0	0							
Howard	0	0							
Kent	1	64,000	1%	Sassafras River	64,000				
Montgomery	0	0							
Prince George's	0	0							
Queen Anne's	1	1,919,132	17%	Corsica River	1,919,132				
Somerset	0	0							
St Mary's	0	0							
Talbot	0	0							
Washington	1	3,176,276	27%	Antietam Creek	3,176,276				
Wicomico	0	0							
Worcester	0	0				Coastal Bays	0		
	Overall TOTAL	11,596,202	100%	Drainage Area Total $	10,813,468		0		782,734
				Percent of Total $	93%		0%		7%

Region	Count	Total $	%
Central Md	4	2,156,862	19%
Eastern Shore	3	3,157,227	27%
Southern Md	0	0	0%
Western Md	3	6,282,113	54%
Maryland TOTAL	10	11,596,202	100%

* Note: Table includes only watersheds that are currently eligible for Federal Clean Water Act Section 319(h). Other watersheds that previously received 319 implementation funds (Deer Creek, St. Clements Bay, etc.) are not included.)

Summary of 319 Priority Watershed Monitoring (Water Quality and Biological) Funded by the 319(h) Grant								
Watershed	**Sub Watershed**	**Anti-Degradation**	**Before / After**	**Benthic**	**Long Term**	**OSDS**	**Success Story**	**Synoptic Survey**
Antietam Creek		2015: 2 sites		MDE BA 2013-2015 2018				MDE TW 2009 2011-2015
Back River								
Casselman River		2018: 1 site	MDE TW 2010-2018	MDE BA 2011-2016 2018			2015 Big Laurel Run 2016 Little Laurel Run 2017 Spiker Run 2018: Tarkiln Run	
Catoctin Creek				MDE BA 2018				MDE TW 2012-2018
Corsica River		2016: 1 site 2014: 2 sites	MDE TW 2007-2012	MDE TW 2005-2007	MDE TW 2005-2018	MDE TW 2007-2015		MDE TW 2008-2013 2015-2018
Lower Jones Falls								
Lower Monocacy River	Bens Branch, Linganore Cr		MDE TW 2005-2015	MDE TW 2005-2007			2008 Bens Branch	MDE TW 2005-2007
Middle Gwynns F.								
Sassafras River (1)								MDE TW 2006-2007
Upper Choptank River		2016: 2 sites 2015: 1 site 2014: 1 site 2018: 5 sites						

Anti-Degradation = MDE BA sampling benthic macroinvertebrates and/or fish communities usually on a single day in Spring.
Before/After = Sampling before and after implementing NPS BMPs to gauge in-stream water quality affects.
Bens Branch = 2008 success story, site is also called Hunting Lotte Farm.
Benthic = MDE BA sampling benthic macroinvertebrates and/or fish communities before and after NPS BMP implementation.
Long Term = Weekly grab (whole & filtered) and flow weighted composite samples for total and dissolved nutrients
MDE BA = MDE Biological Assessment for Water Quality Protection and TMDL Implementation
MDE TW = MDE Targeted Watershed Monitoring of NPS Implementation Progress
OSDS = Monitoring pre and post land use change re OSDS implementation: TDN, NH4, NO23, NO2, PO4, CL.
NSS = Nutrient Synoptic Survey: whole & filtered samples for total & dissolved nutrients. Sometimes: chlorides, sulfates, bacteria, other.
Success Story = Year that MDE submitted and EPA accepted the success story. Success stories listed were supported by the before/after monitoring and/or the benthic monitoring listed for the table.

(1) Final Report for 319(h) Grant FFY2006 project #8.

Appendix B: Antietam Creek in Washington County, Maryland Watershed Eligible for 319(h) Grant Implementation Funding

B.1 Introduction

The *Antietam Creek Watershed Restoration Plan* was completed by the Washington County Soil Conservation District, with technical assistance by MDE, in September 2012. EPA accepted the plan in September 2012. The watershed covered by the Antietam Creek watershed plan is the drainage in Maryland only. In Maryland, the Antietam Creek watershed is entirely within Washington County. Pennsylvania is not addressed in the watershed plan.

Sediment reduction goal is 12,923 tons (Antietam Creek watershed plan Table 8, page 27).

Bacteria reduction goal is 5,411,472 billion E. Coli bacteria MPN/year (Antietam Creek watershed plan Table 10, page 34) (MPN is most probable number).

Base Year for watershed plan implementation is 2012. The watershed plan accounts for pollutant reductions and BMP implementation prior to that year in setting the watershed plan goals. Pollutant load reductions and BMP implementation reported beginning 2012 can be counted toward meeting watershed plan goals.

B.2. Milestones

Maryland's 2015-2019 NPS Management Plan Objective 5 includes two milestones for this watershed:

- Annually: Report progress in the 319 Annual Report, and
- 2018: Assess implementation progress toward sediment and bacteria reduction watershed plan milestones and update the plan if needed (this reiterates a pre-existing milestone in the watershed plan).

B.3. Water Quality Monitoring Activity, Overall Condition, Trends

Index of Biological Integrity [2]

Beginning in 2014, MDE's 319(h) Grant-funded biological monitoring project has been sampling benthic macroinvertebrates and fish in selected streams within the Antietam Creek watershed. These two measures are used to gauge existing stream health on a scale of 1 to 5:

good (4.0-5.0), fair (3.0-3.9), poor (2.0-2.9), very poor (1.0-1.9)
BIBI = benthic index of biological integrity
FIBI = fish index of biological integrity

The following biological information was extracted from the MDE Biological Assessment FFY-17 GRTS#5 July 2018 progress report, Project #1 Implementation of the Antietam Creek Watershed Restoration Plan. [3]

Project 1's objective involves collecting benthic data for a fifth year from selected stream sites in the Antietam watershed, which is currently listed on the 303(d) list of impaired waters, and has an approved TMDL for nutrients and sediments. Within areas where localized implementation projects have been approved, six benthic macroinvertebrate stations were established for long-term monitoring of sediment control projects Table 1. This effort is designed to demonstrate long-term improvement in the BIBI if sediment control projects are successful.

In 2018, six stations were sampled for benthics (see Table 2). Currently all six stations are pending results for 2018. Five years of completed data (2013, 2014, 2015, 2016 and 2017) are not sufficient to interpret trends at this time.

Table B1 Antietam Creek Implementation Study Stations

Station	Stream Name	Location	Latitude	Longitude
LAC-001-T	Little Antietam Creek	Anderson Property/Soccer Field	39.68165	-77.60550
LAC-002-T	Little Antietam Creek	Shank Property/farm	39.68527	-77.60973
BEAV-001-T	Beaver Run	Cavetown Church Property	39.64585	-77.58418
BEAV-002-T	Beaver Run	Albert Powell Hatchery	39.58767	-77.64026
LGC-001-T	Little Grove Creek	Smithburg STP	39.66398	-77.58364
LGC-002-T	Little Grove Creek	mouth	39.68196	-77.60606

Table B2 Antietam Creek Stations Pre-Implementation Results

Station	2013 BIBI	2014 BIBI	2015 BIBI	2016 BIBI	2017 BIBI	2018 BIBI
LAC-001-T	2.500	3.250	2.500	2.500	2.500	pending
LAC-002-T	3.000	3.000	2.000	2.000	2.250	pending
BEAV-001-T	3.750	2.000	2.500	2.750	2.000	pending
BEAV-002-T	2.500	2.250	1.750	2.250	1.750	pending
LGC-001-T	1.250	1.000	1.500	1.250	1.750	Pending
LGC-002-T	not sampled	2.750	1.750	1.750	2.000	pending

[2] Maryland Department of the Environment. MDE Biological Assessment for Water Quality Protection and TMDL Implementation. 319(h) Grant FFY2017 Project 5 Objective 2.
[3] Maryland Department of the Environment. *Final Report MDE Biological Assessment FFY-17 GRTS#5*. Charles Poukish and Chris Luckett. July, 2018.

Water Quality Monitoring Before/After Plan Implementation [4]

MDE conducted nontidal water quality monitoring in the Antietam Creek watershed from mid 2011 thru late 2014 to gather three years of in-stream water quality data at 58 synoptic survey monitoring stations before significant watershed plan implementation occurred. The SFY16 Annual Report provides some summary information on this program.

From 2015 thru SFY18, no additional monitoring was conducted at the 58 synoptic survey monitoring stations. During this time period, it seemed unlikely that watershed plan implementation had progressed to a level that changes in water quality might be detected.

B.4 Grant-Funded Implementation Projects

319(h) Grant: synopsis of multi-phase projects fully completed during SFY18
No 319(h) grant funded projects in the Antietam Creek watershed were completed during SFY18. However, there are several on-going projects in the watershed:

Beaver Creek (Antietam Creek tributary, Use III trout stream) stream restoration project (325 linear feet) on private farmland (Barr property) by Washington County Soil Conservation District.

- Total 319(h) Grant expenditure for overall project: $255,494.63
- Phase 1: 319 FFY13 #10 $148,930.00 expended for site survey, design and permitting, partial construction of stream restoration design.
    - Subgrant agreement executed 12/17/2013
    - Project completed 12/31/15
- Phase 2: 319 FFY15 #6 $106,564.63 expended to complete construction the stream restoration per Phase 1 designs.
    - Subgrant agreement executed 11/2/15
    - Project completed 12/31/16

Little Grove Creek stream restoration (950 linear feet) project at the Smithsburg wastewater treatment plant (WWTP) by Washington County.

- 319 FFY18 #8 $221,178: cattle water supply, septic upgrade to remove nitrogen, survey and design for stream restoration.
    - Subgrant agreement executed 12/10/18
    - Project ongoing

Installation of a BAT septic system and agricultural BMPs on private farmland (Winders property) affecting Little Grove Creek by Washington County Soil Conservation District.

- Total 319(h) Grant expenditure for overall project: $92,065
- Phase 1: not 319-funded, completed 2016: stream fencing, cattle water supply and buffer establishment
- Phase 2: 319 FFY16 #8 $39,480: septic upgrade to remove nitrogen, survey and design Phase III Ag BMPs.
    - Subgrant agreement executed:3/10/17
    - Project ongoing
- Phase 3: 319 FFY18 #9 $52,585: construct agricultural BMPS to address manure management, storage and runoff issues at the farm.
    - Subgrant agreement executed: 12/10/18
    - Project ongoing

[4] Maryland Department of the Environment. MDE Targeted Watershed Project. 319(h) Grant FFY2016 Project 4 Objective 2.

Antietam Creek Watershed
1994-SFY18 Completed NPS Implementation Projects - 319(h) Grant

Project Summary			Project Expenditures					Reported Pollutant Load Reduction			
Area/Lead	Name/Dsescription	End Date	Grant Funding Source	Grant Funds		Non Federal $ Match	Total $	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)	Bacteria (billion/yr)
				Federal $	State $						
Md Dept of Agriculture (MDA) with Washington County Soil Conservation District (SCD)	Antietam Creek Watershed Project		319 FFY1994 #6								
		1996	319 FFY1995 #13	112,821.00		Federal grant budget for project is presented. Expenditure data is unavailable.		Projects and pollutant load reduction from projects reported prior to 2012 (shaded grey in table) were accounted for in the watershed plan. Therefore, these reductions are not counted toward implementing the watershed plan. However, available pollutant load reduction data is presented.			
		1998	319 FFY1996 #15	52,774.00							
		1998	319 FFY1997 #16	91,531.00							
		1999	319 FFY1998 #17	105,337.00							
		2000	319 FFY1999 #12	120,360.00							
		2001	319 FFY2000 #8	99,733.00							
		2002	319 FFY2001 #9	125,859.00							
		2003	319 FFY2002 #6	134,423.00							
		2004	319 FFY2003 #7	124,859.00							
		2005	319 FFY2004 #11	106,189.90		70,793.27	176,983.17				
		2007	319 FFY2004 #27	129,225.23		86,150.15	215,375.38	77,692	5,686	0	0
		2006	319 FFY2005 #5	119,446.79		79,631.19	199,077.98	4,718	720	0	0
		2008	319 FFY2007 #5	139,258.68		92,839.12	232,097.80	65,216	5,862	81.2	0
		2010	319 FFY2008 #6	155,838.12		103,892.08	259,730.20	71,239	5,553	0	0
	MDA Antietam Creek Watershed Proj	2010	319 FFY2009 #3	151,110.82		100,740.55	251,851.37	64,590	5,067	0	0
Washington Co. SCD	Antietam Creek Watershed Plan	2012	319 FFY2008 #20	29,264.39		19,509.59	48,773.98	0	0	0	0
	Barr Property Stream Restoration Ph1	SFY16	319 FFY13 #10	148,930.00		99,287.00	248,217.00	23.75	4.95	2.76	0
	Barr Property Stream Restoration Ph2	SFY17	319 FFY15 #6	$106,564.63		$71,043.09	$177,607.72				
	Kiwanis Park Stream Stabilization Ph1	SFY15	319 FFY2014 #7	124,340.97		82,893.98	207,234.95	34.2	10.3	16.75	0
	Kiwanis Park Stream Stabilization Ph2	SFY16	319 FFY12 #13	39,147.90		26,098.60	65,246.50	17.1	5.15	4.15	0
	Shank/Anderson Project Phase 2 of 3	SFY16	319 FFY11 #13	64,253.43		42,835.62	107,089.05	157.7	56.7	795.0	0
	Shank/Anderson Project Phase 3 of 3	SFY17	319 FFY15 #7	448,365.00		298,910.00	747,275.00				
Washington County	Greensburg Rd Little Antietam Creek Restoration	2014	319 FFY2012 #11	229,555.73		153,037.15	382,592.88	110	37.4	85.25	0
	Devils Backbone Park Stream Restoration	SFY16	319 FFY11 #15	95,051.72		63,367.81	361,812.58	300.0	102.0	232.50	0
		SFY16	319 FFY14 #8	122,035.83		81,357.22					
TOTAL overall				3,176,276.14	0.00	1,472,386.43	3,680,965.57	284,097.8	23,104.5	1,217.61	0
TOTALS for projects counted toward watershed plan implementation.				1,407,509.60	0.00	938,340.07	2,345,849.67	642.8	216.5	1,136.41	166
For sediment and bacteria pollutant loads, BMPs installed 2012 and later can be counted toward watershed plan implementation.								498.6	168.8	1,034.41	0.0

SFY18 NPS Implementation Projects In Progress - 319(h) Grant - Antietam Creek Watershed

Project Summary			Project Funding					Future Pollutant Load Reduction			
Area/Lead	Name/Description	End Date	Grant Funding Source	Grant Budgeted		Non Federal $ Match	Total $ Budgeted	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)	Bacteria (MPN/yr)
				Federal $	State $						
Hagerstown	no projects working during SFY18										
Washington County	Little Grove Creek Stream Restoration	2020	319 FFY18 #8	221,178		147,452	368,630	71.25	64.6	42750	0
Washington County SCD	Winder Property Phase 1 of 3	2019	319 FFY16 #8	39,480		26,320	65,800	126.4	17.15	1,662.5	271.4 billion
	Winder Property Phase 2 of 3	2020	319 FFY18 #9	52,585		35,057	87,642	123.3	17.15	1,662.5	105.4 Billion
			TOTALS	313,243	0	208,829	522,072	321.0	98.9	46,075.0	271.4 billion

Antietam Creek Watershed
2011-SFY18 Completed State Revolving Fund NPS Implementation Projects

Project Summary			Project Expenditures					Pollutant Load Reduction			
Area/Lead	Name/Description	End Date	Grant Funding Source	Grant Funds		Match $	Total $	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)	Bacteria (MPN)
				Federal $	State $						
Washington County	Lehmans Mill Road Stream Bank Stabilization	2012	SRF Grant	0.00	191,700.00	0.00	191,700.00	101	5.35	0	0
	Burnside Bridge Rd Stream Bank Stabilization	2012	SRF Grant	0.00	232,900.00	0.00	232,900.00	101	5.35	0	0
TOTAL for completed projects				$0.00	$424,600	$0.00	$424,600.00	202	11	0	0

Summary of State Revolving Fund Projects Activity in SFY18 - Antietam Creek Watershed

Project Summary			Project Funding					Projected Pollutant Load Reduction			
Area/Lead	Name/Description	End Date	Grant Funding Source	Grant Funds		Match $	Total $	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)	Bacteria (MPN)
				Federal $	State $						
	no SRF-funded projects now working										

	Antietam Creek Watershed										
	Chesapeake and Atlantic Coastal Bays Trust Fund										
	SFY 2018 NPS Implementation Project Status (1)										
Year Funded	PartnerCD	ProjectTitle	ProjectType	County	Trust Fund Dollars	Status	BMP Units	BMPs Reported	Annual LbsN	Annual LbsP	Annual TonsTSS
SFY13	Chesapeake Bay Foundation	Maryland Watershed Restoration Project: Hidden Hollow Farm	Tree Planting Projects	Washington	1,485.00	Complete	acres	3	111.8	10.7	4.65
SFY13	Town of Boonsboro	Boonsboro Community Tree Planting In The Park Project	Tree Planting Projects	Washington	15,000.00	Complete	acres	3.6	80.4	5.4	0.95
SFY14	Chesapeake Bay Trust	Hagertown's Tree Planting and Memorial Blvd Greening	Tree Planting Projects	Washington	65,850.00	Complete					
SFY14	Chesapeake Bay Trust	Hagertown's Tree Planting and Memorial Blvd Greening	Tree Planting Projects	Washington	104,150.00	Complete			11.8	0.5	0.04
SFY14	City of Hagerstown	Bioretention Facility near Clean Water Circle (site A)	Stormwater Management	Washington	455,000.00	Complete			100.5	20.9	5.80
SFY14	City of Hagerstown	Wet Swales near Hagerstown Light Dept. (Site B)	Stormwater Management	Washington	45,000.00	Complete			36.9	9.3	2.70
SFY14	Washington County	Fountaindale Elementary (Washington County Board of Education Riparian Buffers)	Tree Planting Projects	Washington	625.50	Complete	acres	0.2	5.9	0.2	0.05
SFY14	Washington County	Northern Middle School (Washington County Board of Education Riparian Buffers)	Tree Planting Projects	Washington	780.62	Complete	acres	1.2	35.4	1.5	0.27
SFY14	Washington County	Smithsburg Middle/High School Complex (Washington County Board of Education Riparian Buffers)	Tree Planting Projects	Washington	2,341.87	Complete	acres	1.5	44.3	1.8	0.34
SFY15	Md Forestry Board Foundation	Klein Reforestation	Tree Planting Projects	Washington	6,539.00	Complete	acres	2	0.0	1.0	0.29
	(1) Maryland DNR provided this data 2/21/19 and indicated it is the full extent available.			TOTALS	696,771.99				426.88	51.31	15.08
SFY18	Md Forestry Board Foundation	Klein Reforestation	Tree Planting Projects	Washington	4,711.83	Design/Planning			7.4	0.52	0.25
	(1) Maryland DNR provided this data 2/21/19 and indicated it is the full extent available.			TOTALS	4,711.83				7.40	0.52	0.25
					701,483.82						

B.5 BMPs Reported for Agricultural and Urban Practices for State Fiscal Year 2017

Antietam Creek Watershed
In Washington County, Maryland
SFY18 Agricultural BMP Implementation

Agricultural Best Management Practices (1)	Unit	BMPs Reported	Estimated Pollutant Load Reduction: Nitrogen Total (lbs)	Phosphorus Total (lbs)	Sediment Total (tons)	E. coli billion/yr
Annual Practices						
Cover Crops	acres	4,133	46,887.4	340.1	267.4	
Multi-Year Practices						
Alternative Crops	acres					
Amendments for the Treatment of Ag Was	AU					
Animal Mortality Facility	count					
Conservation Cover*	acres	64	1,438.7	16.0	77.2	
Conservation Plans/SCWQP	acres	2,315	3,560.1	335.9	266.5	
Critical Area Planting	acres					
Dead Bird Composting Facility	count					
Fencing	feet	2,358	256,786.2	30,084.8	7,148.6	
Field Border	acres					
Filter Strip	acres					
Grassed Waterway	acres	0.06	1.8	0.1	0.0	
Horse Pasture Management	acres					
Loafing Lot Management System	acres	0.34	41.4	10.0	0.5	
Pasture & Hay Planting	acres					
Prescribed Grazing	acres	21.4	28.6	8.6	2.8	
P-sorbing Materials	acres					
Riparian Forest Buffer	acres					
Riparian Herbaceous Cover	acres	3.0	94.1	0.8	0.5	
Roof Runoff Structure	count	2	247.8	49.8	2.4	
Stream Restoration Ag	feet					
Tree/Shrub Establishment	acres					
Waste Storage Facility*	count	3	1181.04	49.77	0.00	
Wastewater Treatment Strip	acres					
Water Control Structure	count					
Watering Facility	count	9	6.6	6.7	0.4	
Wetland Creation	acres					
Wetland Restoration	acres					
Windbreak/Shelterbelt Establishment	feet					
Total Annual Practices (2)			46,887.4	340.1	267.4	0.0
Total Multi-year Practices			263,386.3	30,562.3	7,498.9	0.0
Total Pollutant Load Reduction			310,273.7	30,902.4	7,766.3	0.0

(1) "SFY18 Total" column is MDA data.
(2) Annual Practices: cover crops, nutrient mgmt, manure transport, conservation tillage & high residue tillage.

Antietam Creek Watershed Plan
Agricultural BMP Implementation Goals

Management Practice	Sediment Goal Table 14	Bacteria Goal Table 18	Units	Progress: SFY18	Progress: 2012 thru SFY18
Cover Crops	4,000		acres/yr	4,133	
			acres	64	
Soil Conservation WQ Plans	3,050	15,460	acres	2,315	19,612
Stream Protection Fenced	780 ac	780 ac	feet	2,358	39,132
Grass Buffers	295	35	acres	0	3
			acres	0	0.8
			acres	0	2.38
Riparian Forest Buffers		260	acres	0	90.3
			acres	3	13.2
Runoff Control Systems		12	count	2	33
			feet	0	7,626
Animal Waste Mgmt Systems		26	count	3	20
			count	9	44
Conservation Tillage	6,200		acres		
Erodible Land Retirement	130		acres		0
Livestock Stream Crossing		17	count		0
No-Till	4,800		acres		0
Stream protection no fence	1,300	1,300	acres		40

Prior Years Progress Toward Watershed Plan Goals

Data reported by locals: 2013 Annual Report	Extracted from State Data reported by MDE to EPA Bay Program: SFY14	SFY15	SFY16	SFY17	Units
3,956.9	2,887.0	3,015.0	3,441.0	3,997.0	acres
	8,905.0	6,160.0	21,691.0	18.0	feet
2.5	0	0	0.0	0.0	acres
0	0.1	0.0	0.7	0.0	acres
0	1.0	0.0	0.6	0.7	acres
56.8	2.5	0.0	11.2	19.8	acres
0	7.3	0.0	0.59	2.3	acres
4	2	3	13.0	9.0	count
0	0	0	325.0	7,301.0	feet
2	4	4	7	0	count
0	5	8	5	17.0	count
0	0	0			acres
0	0	0			count
0	0	0			acres
40.0	0	0			acres

Antietam Creek Watershed
In Washington County, Maryland
SFY2018 Urban BMP Implementation

Urban Best Management Practice	Unit	BMPs Reported	Estimated Pollutant Load Reduction			
			Nitrogen lb/yr	Phosphorus lb/yr	Sediment tons/yr	Bacteria billion/yr
Bioretention	acres	0				
Bioswale	acres	0				
Disconnection of Rofftop Runoff	acres	0				
Dry Detention Ponds & Hydro Structures	acres	0				
Dry Extended Detention Ponds	acres	0				
Dry Well	acres	0				
Filtering Practices	acres	0				
Forest Conservation	acres	0				
Forest Harvesting Practices	acres	0				
Infiltration Practices	acres	0				
Permeable Pavement	acres	0				
Rain Garden	acres	0				
Reduction of Impervious Surface	acres					
Riparian Forest Buffers on Urban Lands	acres					
Septics Connections to Sewers	count					
Septics Denitrification Critical Area	count					
Septic Denitrification outside of 1000 ft	count	6	19.8			
Septic Denitrification within 1000 ft	count	9	49.5			
New Stormwater Treatment	acres	29	100.4	15.6	12.8	
Stream Restoration Urban	feet					
Street Sweeping	acres					
Tree Planting	acres	47	465.3	5.36	4.79	
Urban Forest Buffer	acres	0				
Wet Extended Detention	acres	0				
Wet Ponds & Wetlands	acres	0				
TOTAL Pollutant Load Reduction			635.03	20.92	17.63	0.00

(1) "BMPs Reported" column is MDE data. Bacteria load reduction was not reported.
(2) Load reductions are edge of stream estimates calculated by MDE using MAST.

Antietam Creek Watershed Plan
Urban BMP Implementation Goals

Urban Best Management Practice	Sediment Goal Table 14	Bacteria Goal Table 18	Units	Progress	
				SFY18	2012-SFY17
Forest Harvest Practices	250		acres	0.00	798.0
			acres		19.69
Septic System Upgrades		645	count	15	152

Prior Years Progress Toward Watershed Plan Goals					
Data reported by locals	Extracted from State Data reported by MDE to EPA Bay Program				
2012-2013	SFY14	SFY15	SFY16	SFY17	Units
722.0	0.0	76.0	0.0	0	acres
				19.69	acres
26	10	30	14	15	count
	17	4	21	0	
				18.8	acres

Appendix C: Tidal Back River in Baltimore County, Maryland And Upper Back River in Baltimore County and Baltimore City, Maryland Watersheds Eligible for 319(h) Grant Implementation Funding

C.1. Back River Small Area Watershed Plans Summary

Upper Back River Watershed	Tidal Back River Watershed
Lead NPS Implementers: Baltimore County, Baltimore City Other NPS implementers report progress thru the Lead. Pollutant Load Reduction Goals - Total nitrogen: 48,190 pounds - Total phosphorus: 6,056 pounds Total drainage area: 27,716.7 acres (43.3 mi^2) - Total open tidal water: NA - Baltimore Co.: 55.5%; Baltimore City: 44.5%. - Impervious cover: 30.7 % Land Use - Agriculture: --- - Commercial: 9.9% - Forest: 11.5% - Industrial: 6.5% - Institutional: 8.0% - Residential low density: 8.5% - Residential mid density: 26.5% - Residential high density: 20.4% - Urban open: 6.2% - Water/Wetlands: ---	Lead NPS Implementer: Baltimore County Other NPS implementers report progress thru the Lead. Pollutant Load Reduction Goals - Total nitrogen: 6,498 pounds - Total phosphorus: 679 pounds Total Drainage area: 7,720 acres (12 mi^2) - Total open tidal water: 3,947 acres (6.2 mi^2) - Baltimore County: 100% - Impervious cover: 18.4% Land Use - Agriculture: 4.4% - Commercial: 7.2% - Forest: 32.1% - Industrial: 3.5% - Institutional: 4.4% - Residential low density: 2.4% - Residential mid density: 23.0% - Residential high density: 8.6% - Urban other: 11.4% - Water/Wetlands: 3.0%

C.2. Tidal Back River SWAP Overview

The *Tidal Back River Small Watershed Action Plan* (SWAP) was completed by Baltimore County in February 2010 and was accept by EPA in August 2010. The watershed is entirely within Baltimore County, Maryland. The watershed plan can be found at: https://mde.maryland.gov/programs/Water/319NonPointSource/Documents/Watershed%20Plans/A-I_EPA_Accepted_Plans/Tidal_Back_River.pdf.

Base Year for watershed plan implementation is 1998. Pollutant load reductions reported beginning that year can be counted toward meeting watershed plan goals. Section 1.3 pages 3 and 4 of the watershed plan indicate that the plan's nutrient goals are from the TMDL for nitrogen and phosphorus (EPA approved 2005). The TMDL is based on water quality data collected 1992-1997 (See TMDL Section 4.1 page 18, and also Section 2.6 pages 6-17).

Tidal Back River SWAP pollutant reduction goals (Table 3-2 on page 23) are:

- Nitrogen reduction goal is 6,498 pounds per year.
- Phosphorus reduction goal is 679 pounds per year.

Tidal Back River SWAP implementation goals (Appendix A, Table A-1) are for urban BMPs. Of these, the measurable goals are numbered: 6, 10, 12, 16, 17, 18, 19, 20, and 36. Some goals have milestone dates for reporting or progress achievement, which were reiterated in *Maryland's 2015-2019 NPS Management Plan* under Objective 5:

- Annually: Report progress in the 319 Annual Report
- Assess progress for several action items
  - 2016: #37 hot spots
  - 2018: #10 stormwater retrofits
  - 2019: #31 wetland plantings.

C.3. Upper Back River SWAP Overview

The Upper Back River Small Watershed Action Plan was completed by Baltimore County in November 2008 and was accept by EPA in January 2009. The watershed covered is in Baltimore City and Baltimore County, Maryland. The watershed plan can be found at: https://mde.maryland.gov/programs/Water/319NonPointSource/Documents/Watershed%20Plans/A-I_EPA_Accepted_Plans/Upper_Back_river.pdf.

Pollutant reduction goals are presented in Table 3-2 on page 3-8 of the watershed plan:

- Nitrogen reduction goal is 48,190 pounds per year.
- Phosphorus reduction goal is 6,056 pounds per year.
- Fecal bacteria reduction is a general goal in the watershed plan but there are no quantitative measures or milestones in the plan for water quality or BMP implementation. The plan notes that a consent decree is governing improvements to the sewerage system that will lead to reduced bacteria in surface waters in plan Section 1.4.1 (page 1-4), Section 2.3 (page 2-2), Section 2.9 (page 2-4), Section 3.2.7 (page 3-4) and Appendix A Table A-2 in several places.

BMP implementation goals in the Upper Back River watershed plan are in two different places:

- Table 3-4 and Table 3-5 on pages 3-11 and 3-12.
- Appendix A Table A-2.

Base Year for watershed plan implementation is 1998. Pollutant load reductions reported beginning that year can be counted toward meeting watershed plan goals. Section 1.3 pages 3 and 4 of the watershed plan indicate that the plan's nutrient goals are from the TMDL for nitrogen and phosphorus. The TMDL is based on water quality data collected 1992-1997 (See TMDL Section 4.1 page 18, and also Section 2.6 pages 6-17.).

Maryland's 2015-2019 NPS Management Plan Objective 3 milestones for this watershed:

- Annually: Report progress in the 319 Annual Report,
- Assess progress for several action items in future years:
  - 2018: plan implementation progress particularly for open space tree planting, and impervious area removal on institutional land.
  - 2019: hotspot investigation and follow-up.

C.4. Grant-Funded Implementation Projects

The following three pages present tables summarizing the status of grant-funded NPS BMP implementation from the follow grant sources:

- Tidal Back River watershed: 319(h) Grant and State Revolving Fund
- Upper Back River watershed: 319(h) Grant and State Revolving Fund
- Back River watershed overall: Chesapeake and Atlantic Coastal Bays Trust Fund

2012-SFY18 Completed NPS Implementation Projects -- Back River Tidal Watershed
319(h) Grant and State Revolving Loan Fund (SRF)

Project Summary			Project Expenditures					Reported Pollutant Load Reduction		
Lead	Name/Description	End Date	Grant Funding Source	Grant Funds		Match $	Total $	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)
				Federal $	State $					
Baltimore County	Pleasure Island Beach Shoreline (1)	2012	SRF Grant	$0	$2,717,100	$0	$4,285,123	1,010	53.5	0
	Bread & Cheese Creek stream restoration & stormwater control	2013	319 FFY2010 #11	556,443	0	370,962	1,000,000	280.07	94.19	214
	Tidal Back River Greening (2)		SRF Grant	0	385,000	0	1,500,000	441	113	24
TOTAL reported for completed projects				556,443	3,102,100	370,962	6,785,123	1,731	260.7	238

SFY 2018 319(h) Grant Activity for NPS Implementation Projects - Back River Tidal Watershed

Project Summary			Project Funding					Future Pollutant Load Reduction		
Lead	Name/Description	End Date	Grant Funding Source	Grant Funds		Match	Total	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)
				Federal	State					
Baltimore County	No 319 projects were working during SFY18									

Footnotes:

(1) SRF records indicate this project is “a shoreline erosion control project utilizing dredged material; included maintenance dredging of the 5,000 ft long channel adjacent to the island to create the beach and to stabilize 3,100 linear feet of shoreline using a combination of stone structures and beach fill with wetland vegetation.”

(2) The project involved 7 schools, 1 park & ride, 1 community center. SRF records also indicate "consists of stormwater improvements, including impervious surface removal, bioretention BMPs, reforestation, and shoreline enhancement w/wetland buffer". Total overall project cost was recalculated during design according to SRF records.

2012-SFY18 Completed NPS Implementation Projects -- Back River Upper Watershed
319(h) Grant and State Revolving Loan Fund (SRF)

Project Summary			Project Expenditures					Pollutant Load Reduction		
Lead	Name/Description	End Date	Grant Funding Source	Grant Funds		Non Federal Match	Total	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)
				Federal	State					
Baltimore County	Redhouse Run/Overlea stream restoration & stormwater control	2001	319 FFY2000 #16	$130,000.00		$86,667	$530,000.00	52	9.46	2.67
			Other		$228,899.00					
	Redhouse Run/St. Patricks stream restoration	2011	319 FFY2007 #18	$418,500.00		$279,000	$883,016.00	609	32.1	5.37
	Upper Back River Stormwater conversions	2012	319 FFY2008 #21	$95,883.81		$63,923	$159,806.35	51.7	11.5	2.06
	Herring Run/Overlook Park stream restoration & buffer planting	2018	319 FFY2014 #9	$358,032		$238,688	$596,720.00	313.7	284.4	93.9
	No completed SRF projects are iedentified									
TOTAL reported for completed projects				$1,002,415.81	$228,899.00	$668,277.21	$2,169,542.35	1,026.4	337.5	104.0

For nitrogen and phosphorus pollutant loads, BMPs installed 1998 or later can be counted toward watershed plan implementation.

SFY17 319(h) Grant Project Activity - Back River Upper Watershed

Project Summary			Project Funding					Projected Pollutant Load Reduction		
Lead	Name/Description	End Date	Grant Funding Source	Grant Funds		Non Federal Match	Total	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)
				Federal	State					
Baltimore City	No 319 projects were working during SFY17									

Back River Watershed (Tidal and Upper combined)

Chesapeake and Atlantic Coastal Bays Trust Fund

SFY 2018 NPS Implementation Project Status (1)

Year Funded	PartnerCD	ProjectTitle	ProjectType	County	Trust Fund Dollars	Status	BMP Units	BMPs Reported	Annual LbsN	Annual LbsP	Annual TonsTSS
FY10	Baltimore County DEPS	Red House Run Stream Restoration	Stream Restoration	Baltimore	186,121.00	Complete			606	32	0.0025
FY12	Baltimore County	Herring Run at Overlook Park Stream Restoration ar	Stream Restoration	Baltimore	385,735.55	Complete			65	11	3.92
		Bread and Cheese Creek Water Quality Enhancemer	Stream Restoration		193,557.00	Complete			200	30	6.7515
		Monitoring Water Quality Improvements at Bread a	Monitoring		5,400.00	Complete			0	0	0
		Upland Tree Plantings - BWB	Tree Planting Projects		35,000.00	Complete			11.9	2.3	0.1485
		Tree Planting - BRRC	Tree Planting Projects		10,000.00	Complete			5.8	1.1	0.072
FY13	Alliance for the Chesapeake Bay	Trees and Environmental Education: Chinquapin Ru	Tree Planting Projects	Baltimore City	8,065.31	Complete			8.6	0.59	0.09
		Trees and Environmental Education: Northwood &	Tree Planting Projects		8,065.32	Complete			8	0.55	0.9
	Parks and People Foundation	Students Restoring Urban Stream: Herring Run Park	Tree Planting Projects		16,305.00	Complete			6.6	0.44	0.07
		Green Space Creation at Moravia Park Elementary (I	Stormwater Management		370,000.00	Complete			8.87	1.09	0.435
	Baltimore County	Bread & Cheese Creek Stream Restoration	Stream Restoration	Baltimore	802,801.00	Complete			346.2	115.7	263.5
		Upper Back River Stormwater pond implementation	Stormwater Management		95,883.81	Complete			371.5	56.4	10.61
		Tidal Back River Greening Project	Stormwater Management		787,388.00	Complete			441	133.2	24.13
FY14	Chesapeake Bay Trust	Greening Watershed Neighborhoods	Tree Planting Projects	Baltimore	114,342.00	Complete			42.39	1.71	0.14
	Baltimore City Recreation and Parks	Chinquapin Run Park @ Kitmore		Baltimore City	6,739.07	Complete			3.438	0.234	0.0378
		Armistead Gardens ES/MS		Baltimore City	2,994.02	Complete			1.1775	0.05	0.0085
		Baltimore IT Academy		Baltimore City	2,994.02	Complete			1.1304	0.048	0.0082
		Moravia Park ES		Baltimore City	16,847.67	Complete			7.065	0.3	0.051
		NACA Freedom and Democracy Academy		Baltimore City	8,423.84	Complete			4.239	0.18	0.0306
		Patterson HS		Baltimore City	1,682.77	Complete			0.77	0.03	0.005
		Vanguard Collegiate/Maritime Academy		Baltimore City	5,615.89	Complete			2.355	0.1	0.017
		Hazelwood EMS		Baltimore City	8,985.42	Complete			3.77	0.16	0.027
		Herring Run Park @ Armistead Gardens		Baltimore City	7,300.66	Complete			3.72	0.25	0.041
		Herring Run Park @ Shannon & Lyndale		Baltimore City	8,199.20	Complete			4.18	0.28	0.046
	Alliance for the Chesapeake Bay	Gallery Church Baltimore		Baltimore	1,890.58	Complete			1.3188	0.0532	0.0043
		St. Matthew's Catholic		Baltimore City	2,014.63	Complete			0.8949	0.0361	0.0029
		Faith Presbyterian, Baltimore		Baltimore City	2,975.52	Complete			1.41	0.06	0.0046
	Baltimore County	Victory Villa ES		Baltimore	4,482.11	Complete			4.58	0.31	0.05
		Villa Cresta ES		Baltimore	2,465.16	Complete			2.52	0.17	0.03
		Herring Run at Overlook Park Stream Restoration ar	Stream Restoration	Baltimore	2,471,368.00	Complete			313.7	284.4	93.86
FY15	Blue Water Baltimore	Baltimore International Academy	Stormwater Management	Baltimore City	290,000.00	Complete			5.95	1.43	0.426
		Natural History Society of Maryland		Baltimore	270,000.00	Complete			1.53	0.38	0.112
		St. Anthony of Padua		Baltimore City	143,160.90	Complete			2.15	0.42	0.124
		St. Pius X		Baltimore	131,184.29	Complete			3.56	0.54	0.16
	(1) Maryland DNR provided this data 11/30/17 and indicated it is the full extent available.			TOTALS	6,407,987.74				2,491.3	675.5	405.82

C.5. Monitoring

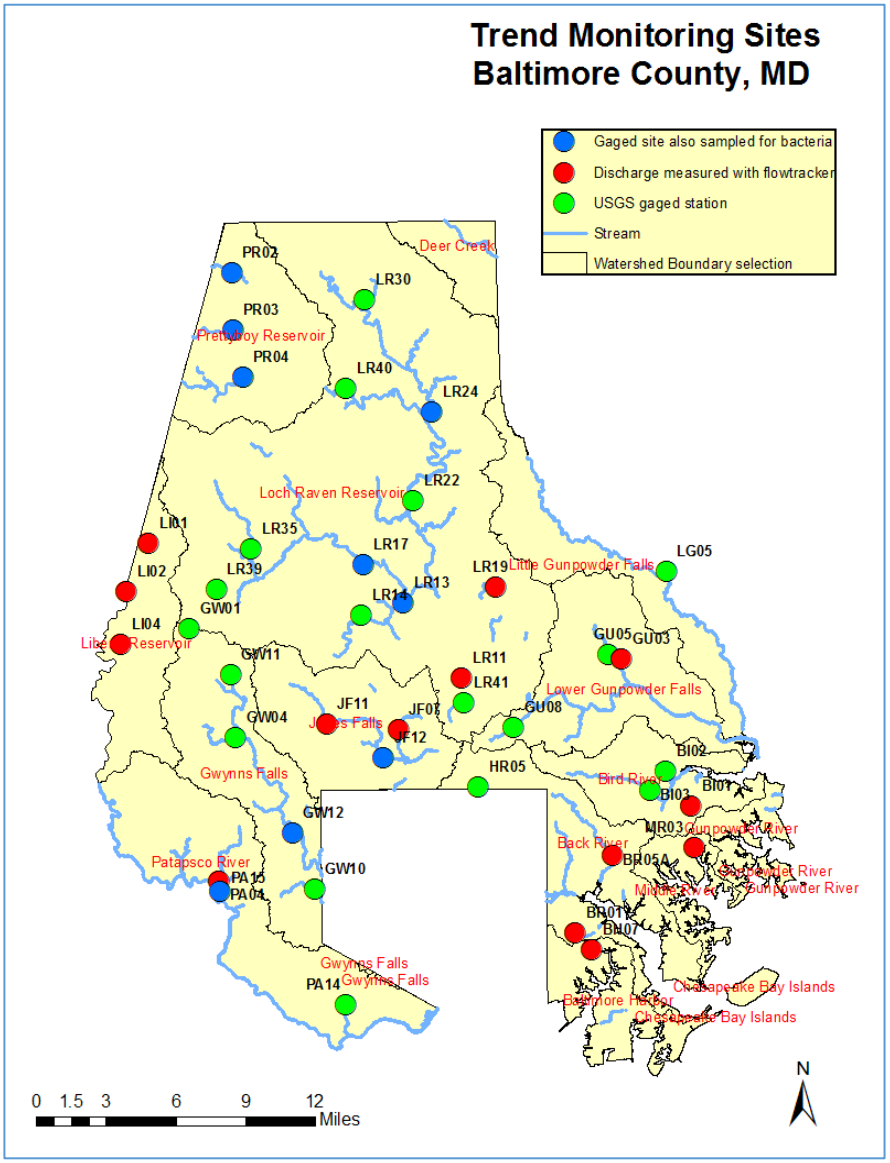
C.5.a. Nontidal Water Quality – State Agencies

MDE nontidal monitoring projects funded by the 319(h) Grant have not been operating in the Back River watershed. [5, 6] Maryland Department of Natural Resources is not known to be monitoring Back River nontidal streams.

C.5.b. Nontidal – Water Quality Baltimore Countywide

Baltimore County reports annually to MDE on its progress toward meeting its MS4 permit requirements. [7] In their report, findings from county conducted monitoring efforts are summarized. The distribution of countywide water quality trend monitoring stations in Baltimore County is shown in the adjacent map.

According to the County, their Back River water quality monitoring stations are showing the following trends for pollutant concentrations (2018 County MS4 report Table 9-20 page 9-52):
-- Nitrogen improving trendline slope = -4.1913
-- Phosphorus improving trendline slope = -0.0925
-- Sediment improving trendline slope = -14.379



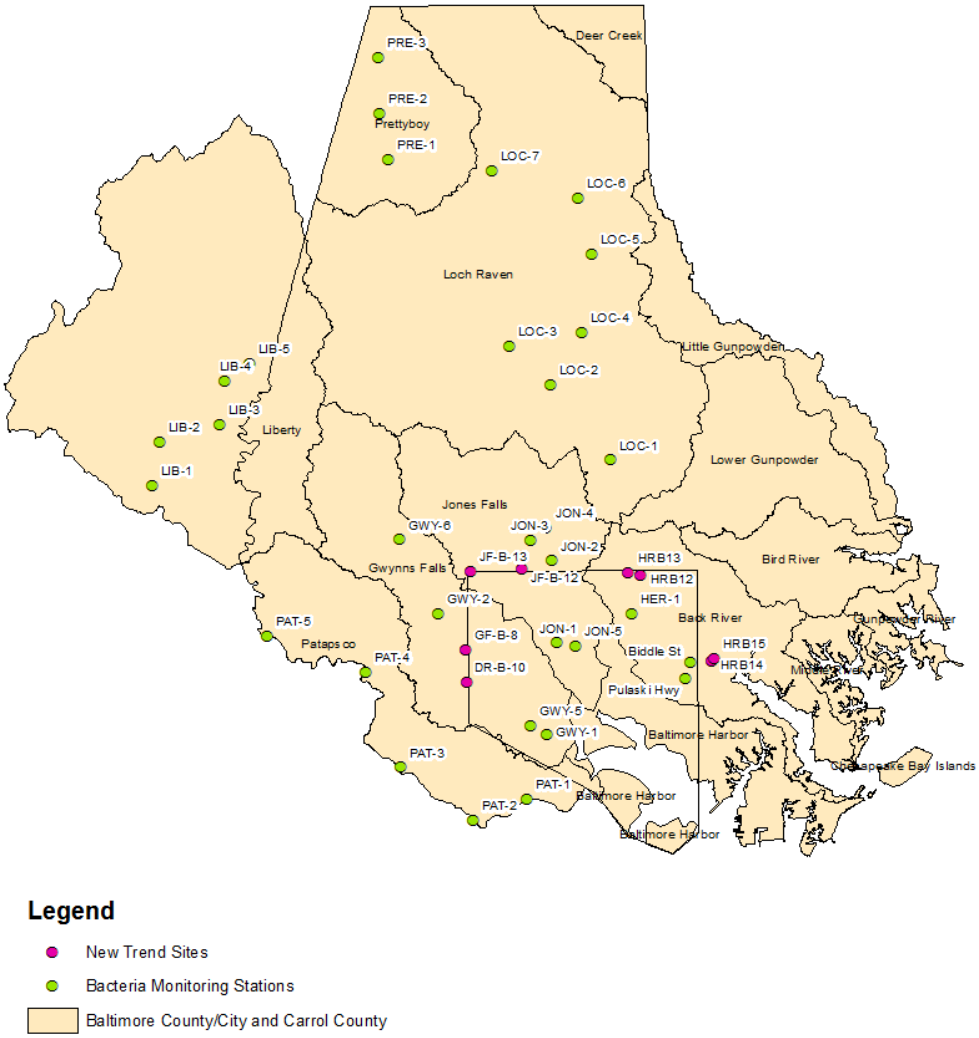
Baltimore County trend monitoring sites. (County report Figure 9-21 page 9-46)

[5] Maryland Department of the Environment. MDE Targeted Watershed Project. 319(h) Grant FFY2017 Project 4.
[6] Maryland Department of the Environment. MDE Biological Assessment for Water Quality Protection and TMDL Implementation. 319(h) Grant FFY2017 Project 5.
[7] Baltimore County. NPDES Municipal Stormwater Discharge Permit 2018 Annual Report. December 21, 2018.

Back River Pollutant Load Analysis, Standardized by Drainage Area Acreage, 2017							
Site	Drainage Area (ac)	TSS	Nitrate / Nitrite	Total Nitrogen	Total Phosphorus	Chloride	Sodium
BR01	403.15	8.81	4.50	5.73	0.36	277.13	162.32
BR05A	3,566.61	8.06	0.79	1.48	0.10	241.34	119.31
HR05	1,356.27	31.60	4.76	6.58	0.22	320.01	232.72

As shown in the table above, the County also estimated pollutant loads at their three Back Rivers stations. (2018 County MS4 report, Table 9-19 page 9-46).

Baltimore County also conducts bacteria monitoring at the stations shown in the map below. There are seven bacteria trend monitoring sites in the Herring Run watershed. Four additional sites were added in 2015 for a total of seven. Of these additional sites, two sites are in the headwaters of Herring Run and are intended to look at the concentration of bacteria at the city/county line for the two headwater branches. The other two additional sites are located in Redhouse Run, which was included in the Herring Run Bacteria TMDL, but for which there was no bacteria monitoring data. The table on the next page presents the number of samples and the geometric mean for high (wet) flow and low (dry) flow by year. It also presents the geometric mean of all samples by year regardless of condition. The table is stratified by annual data (includes all data collected for the year) and seasonal data (includes only those samples collected between May 1st and September 30th each year). The next table provides the frequency of exceedance of single samples to the water quality standard (126 MPN). The zero percent exceedances are highlighted in green. These results are displayed graphically below the tables.



Legend

- New Trend Sites
- Bacteria Monitoring Stations
- Baltimore County/City and Carrol County

For the stations in the Herring Run tributary to Back River, the County graphed E. coli geometric mean concentrations for both annual and seasonal flow periods stratified by flow condition as shown on the following pages (2018 County MS4 report Figures 9-39 thru 9-63, pages 9-90 thru 9-95). The County noted that samples taken in 2017 were almost completely during low flows.

Map: Baltimore County bacteria monitoring sites. (2018 County MS4 report Figure 9-27 page 9-56)

Herring Run E. coli Results on an Annual and Seasonal Basis (2018 County MS4 Report Table 9-39 page 9-90-9-91)

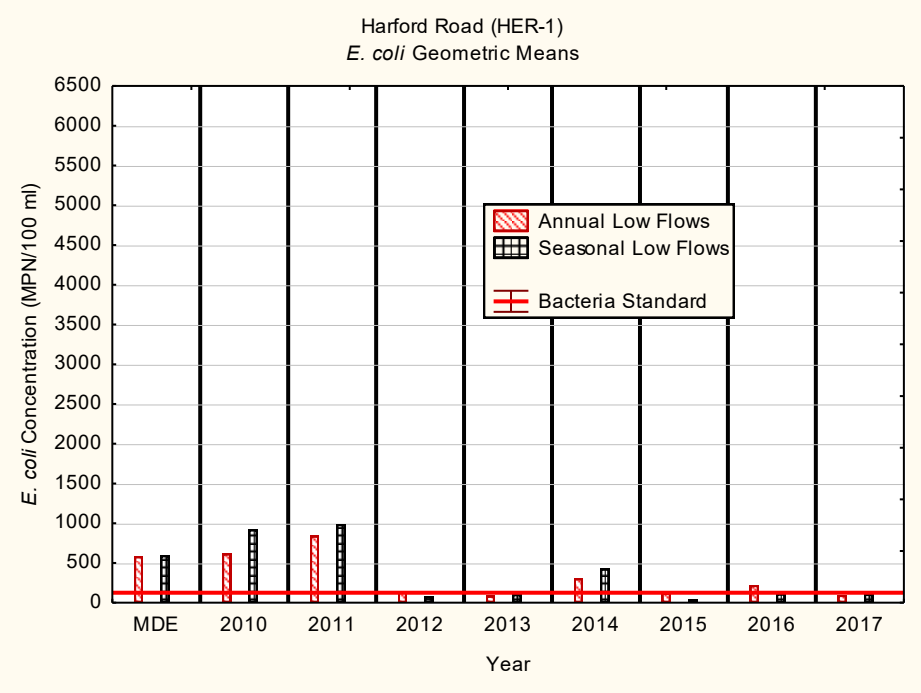
Annual Data (number of samples and geometric mean MPN)													
Site	**Flow Type**	**2012**		**2013**		**2014**		**2015**		**2016**		**2017**	
		N	**MPN**	**N**	**MPN**	**N**	**MPN**	**N**	**MPN**	**N**	**MPN**	**N**	**MPN**
HER-1	High	2	448	2	1253	3	2023	2	2420	1	2420	1	727
	Low	7	136	9	***85***	8	304	8	***122***	7	221	5	***96***
	All	9	177	11	139	11	510	10	165	8	298	6	135
Biddle	High	3	388	2	618	2	1591	2	1184	1	2420	1	1300
	Low	8	196	8	***103***	7	251	8	419	7	601	5	134
	All	11	236	10	147	9	378	10	506	8	734	6	195
Pulaski Hwy	High	3	763	2	1849	3	1621	2	1289	1	2420	1	770
	Low	8	***123***	4	402	8	461	8	350	7	755	4	168
	All	11	202	10	146	11	650	10	444	8	874	5	228
HR-B-12	High							5	5823	0	--	0	--
	Low							12	682	17	382	14	146
	All							17	1333	17	382	14	146
HR-B-13	High							5	3026	0	--	0	--
	Low							12	717	17	358	14	373
	All							17	1124	17	358	14	373
HR-B-14	High							5	1012	0	--	0	--
	Low							12	***120***	17	***93***	14	***80***
	All							17	226	17	***93***	14	***80***
HR-B-15	High							5	8227	0		0	--
	Low							12	2246	17	2018	14	704
	All							17	3370	17	2018	14	704

Seasonal Data (May 1st to September 30th)													
Site	**Flow Type**	**2012**		**2013**		**2014**		**2015**		**2016**		**2017**	
		N	**MPN**	**N**	**MPN**	**N**	**MPN**	**N**	**MPN**	**N**	**MPN**	**N**	**MPN**
HER-1	High	0		1	649	1	2420	1	2420	0	--	0	--
	Low	4	***74***	3	***106***	3	426	3	***41***	4	***113***	3	***108***
	All	4	***74***	4	166	4	658	4	***113***	4	***113***	3	***108***
Biddle	High	1	167	1	158	1	2420	1	2420	0	--	0	--
	Low	4	356	3	192	2	461	3	356	4	1117	3	165
	All	5	306	4	183	3	801	4	575	4	1117	3	165
Pulaski Hwy	High	1	333	1	2420	1	2420	1	2420	0	--	0	--
	Low	4	189	3	649	3	580	3	231	4	1471	3	182
	All	5	211	4	170	4	829	4	415	4	1471	3	182
HR-B-12	High							3	14430	0	--	0	--
	Low							7	870	10	345	8	***107***
	All							10	2020	10	345	8	***107***
HR-B-13	High							3	3512	0	--	0	--
	Low							7	1353	10	591	8	775
	All							10	1801	10	591	8	775
HR-B-14	High							3	2057	0	--	0	--
	Low							7	372	10	247	8	235
	All							10	658	10	247	8	235
HR-B-15	High							3	18601	0	--	0	--
	Low							7	2599	10	1225	8	1127
	All							10	4690	10	1225	8	1127

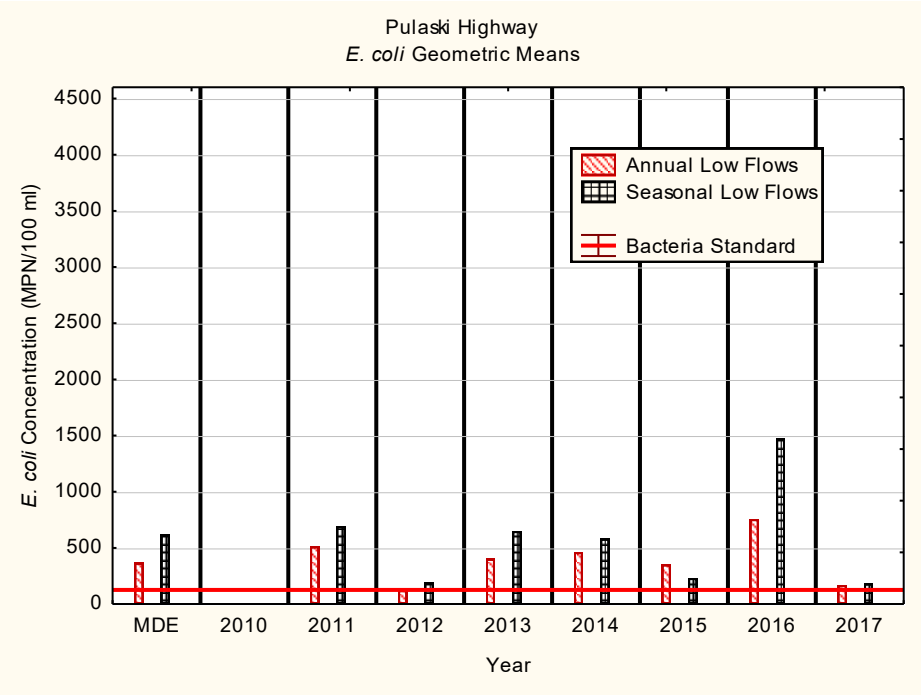
Frequency of Exceedance of Single Sample Water Quality Standards (2018 County MS4 Report Table 9-40 page 9-96

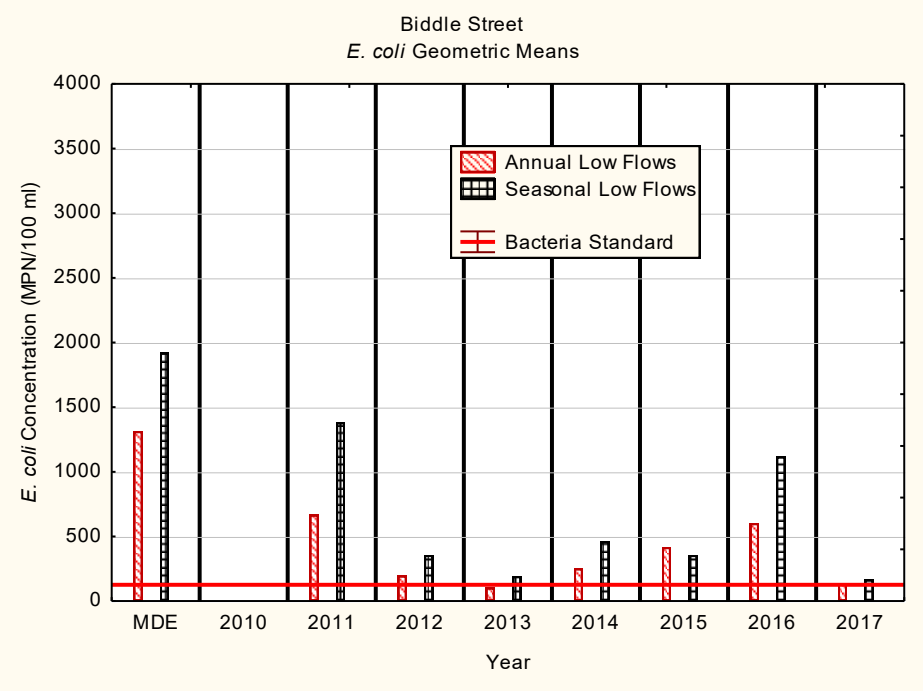
Site	Year	N		Percent Single Sample Exceedance (MPN)							
		Flow Type		576		410		298		235	
		High	Low	High	Low	High	Low	High	Low	High	Low
HER-1	2013	1	3	100%	0%	100%	0%	100%	0%	100%	33%
	2014	1	3	100%	33%	100%	67%	100%	67%	100%	67%
	2015	1	3	100%	33%	100%	33%	100%	33%	100%	33%
	2016	0	4		0%		0%		0%		0%
	2017	0	3		0%		0%		0%		0%
Biddle	2013	1	3	0%	33%	0%	33%	0%	33%	0%	67%
	2014	1	2	100%	50%	100%	50%	100%	50%	100%	100%
	2015	1	3	100%	33%	100%	67%	100%	67%	100%	67%
	2016	0	4		75%		75%		100%		100%
	2017	0	3		0%		0%		33%		67%
Pulaski	2013	1	3	0%	0%	0%	0%	0%	0%	0%	25%
	2014	1	3	100%	33%	100%	67%	100%	100%	100%	100%
	2015	1	3	100%	33%	100%	33%	100%	67%	100%	67%
	2016	0	4		50%		50%		50%		75%
	2017	0	3		33%		33%		33%		33%
HR-B-12	2013										
	2014										
	2015	3	7	100%	57%	100%	86%	100%	86%	100%	86%
	2016	0	10		30%		30%		30%		40%
	2017	0	8		13%		13%		13%		13%
HR-B-13	2013										
	2014										
	2015	3	7	100%	86%	100%	86%	100%	86%	100%	100%
	2016	0	10		50%		60%		80%		90%
	2017	0	8		75%		75%		88%		88%
HR-B-14	2013										
	2014										
	2015	3	7	100%	43%	100%	43%	100%	43%	100%	57%
	2016	0	10		20%		30%		40%		40%
	2017	0	8		25%		25%		25%		25%
HR-B-15	2013										
	2014										
	2015	3	7	100%	100%	100%	100%	100%	100%	100%	100%
	2016	0	10		80%		80%		90%		100%
	2017	0	8		75%		88%		100%		100%

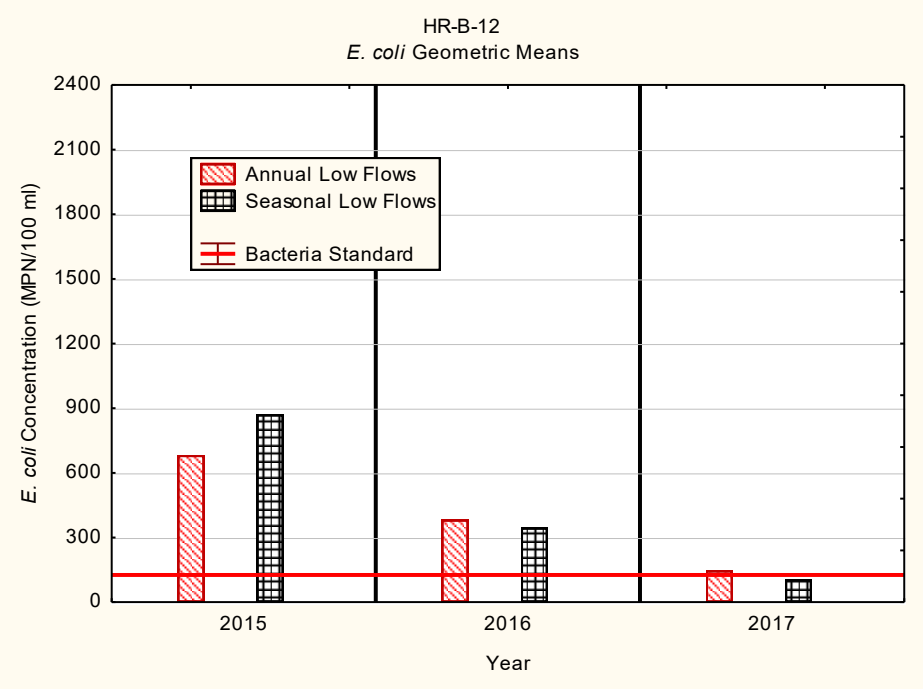
The data presented above also indicate a generally improving trend over time in the bacteria concentrations, particularly during low flow (dry weather) conditions, but since 2014 has become more variable. Site HER-1 has generally decreased, but the other sites have been more variable. The sites added in 2015 show a generally decreasing trend in exceedances, except site HR-B-15.



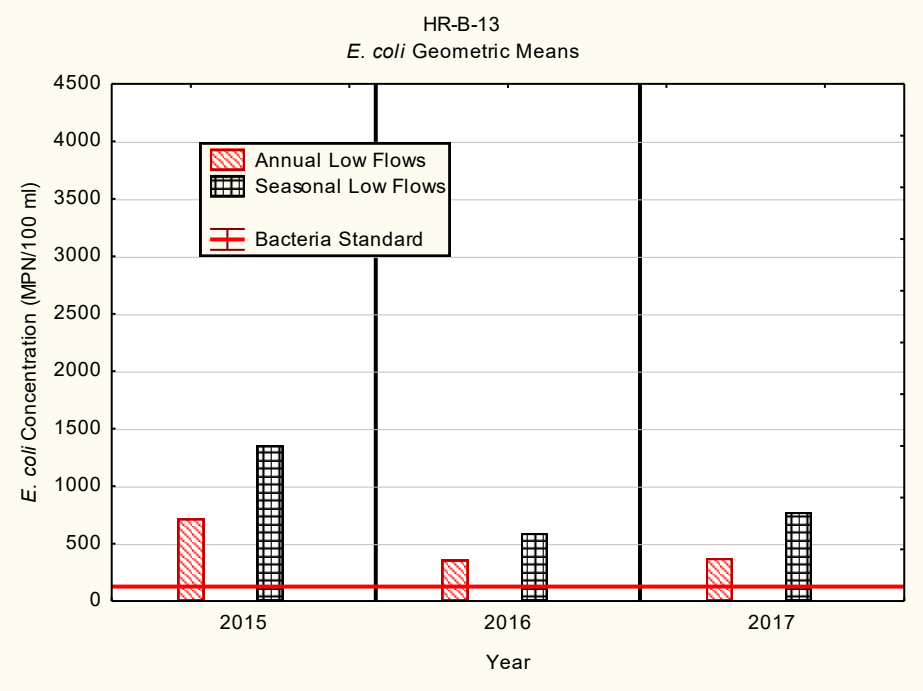
The County report states "For the third year in a row, site HER-1 met the bacterial standard for seasonal low flows, and met for standard for annual low flows as well in 2017."

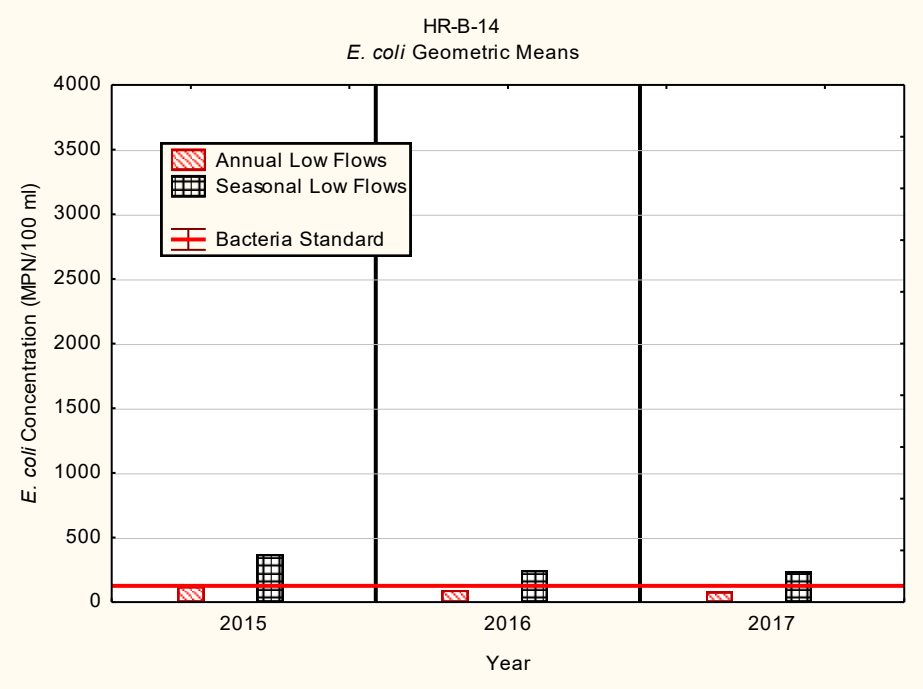




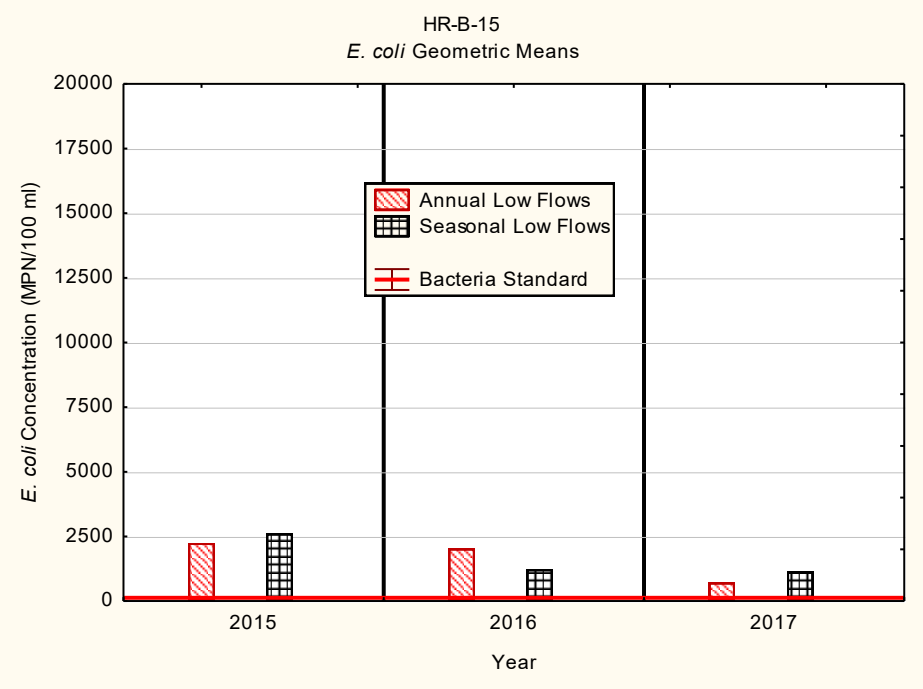


According to the County report "Site HR-B-12 also met the standard for the seasonal period in 2017."





According to the County report "Site HR-B-14 also met the standard for annual low flows for the third year in a row."



C.5.c. Tidal Water Quality – State Agencies

The most recent assessment available from the Maryland Department of Natural Resources is presented below: [8]

"Water quality in the tidal waters of the Back River is poor because nitrogen and sediment levels are too high. However, nitrogen and phosphorus levels have improved. Habitat quality is poor for underwater grasses due to high algal densities and poor water clarity. Summer dissolved oxygen levels in Back River are good but indicate poor habitat quality due to excessive algal densities…

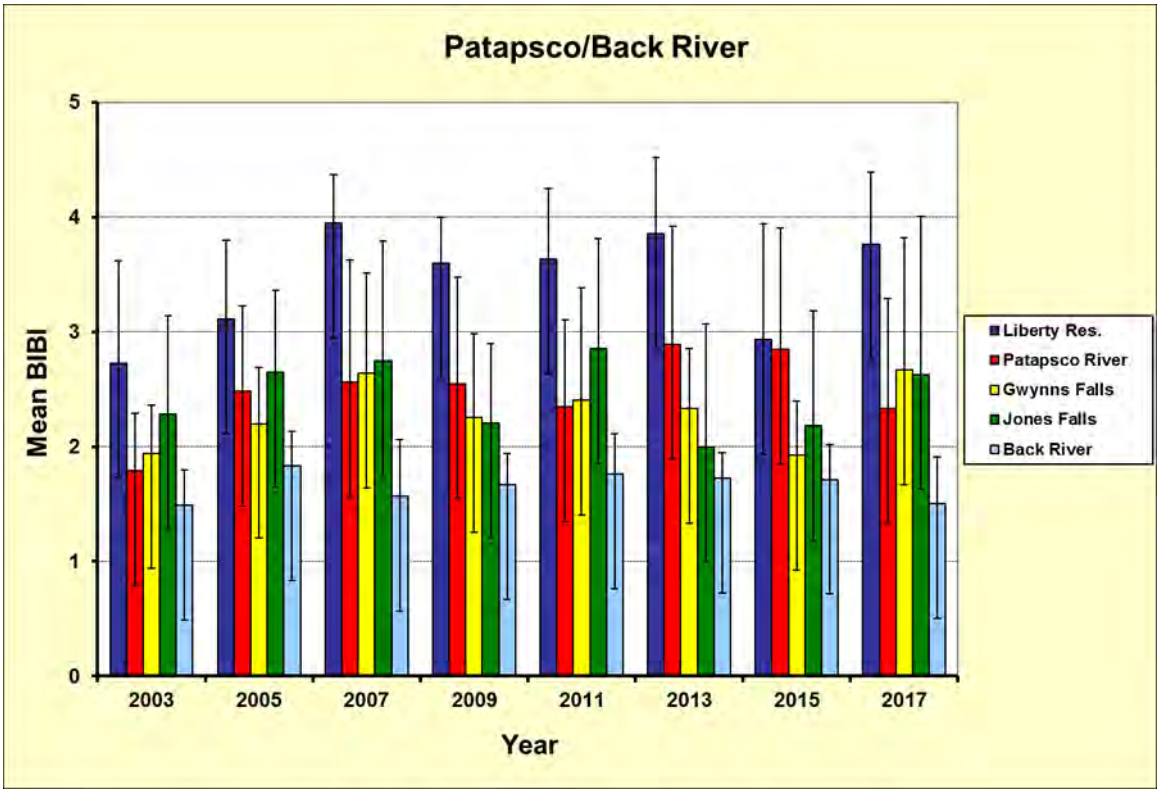
In many ways, Back River water and habitat quality is the worst of all Maryland rivers. Percent developed land use in the Back River watershed is the highest (and percent agriculture is the lowest) of all Maryland rivers. Nitrogen and phosphorus levels in the water and algal densities are also the highest, and water clarity is among the worst. Sediment levels are also among the highest of the high developed watershed rivers. Even though summer bottom dissolved oxygen levels are the highest of all Maryland rivers, this is an indication of poor habitat quality due to high nutrient levels and algal densities."

C.5.d. Nontidal Biology – Baltimore County

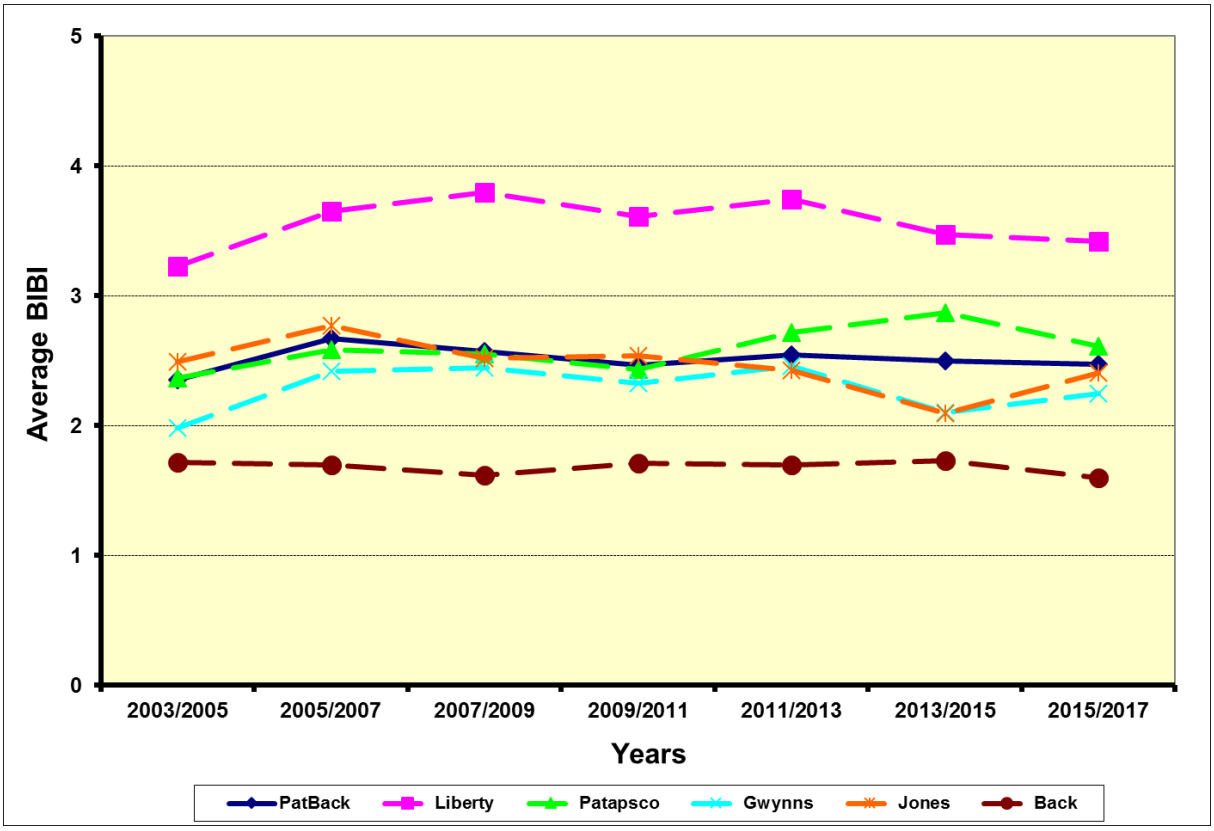
One the five biological monitoring programs conducted by Baltimore County is to assess ecological health of stream using a probabilistic monitoring approach in freshwater and tidal waters using the Maryland Biological Stream Survey protocol. County-wide fifty randomly selected sites are monitored annually. Baltimore County visits its 319 priority watersheds every other year. The MBSS

[8] DNR. *Water Quality Summary 2013-2015*. Preliminary report received via personal communication from Renee Karrh 11/6/17.

system is used to rank the conditions observed as summarized in the two graphs below (Very Poor = 1.00 thru 1.99, Poor = 2.00 thru 2.99, Fair = 3.00 thru 3.99, Good = 4.00 thru 4.99):



Means and one standard deviation of BIBI scores between 2003 and 2017
(2018 County MS4 report page 9-102)

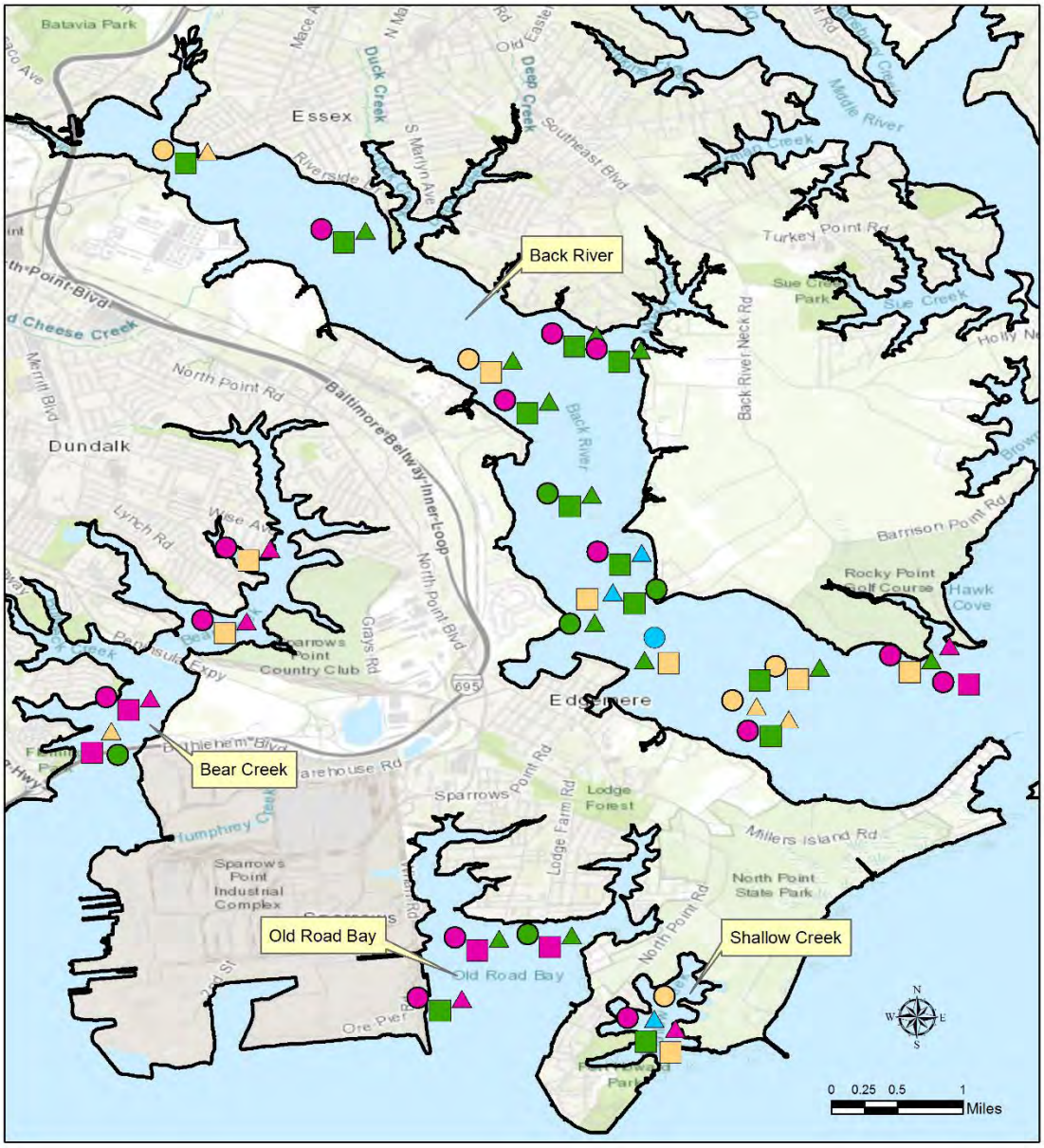


BIBI rolling averages for probabilistic monitoring sites between 2003 and 2017.. (County 2018 MS4 Report Figure 9-67, page 9-105).

C.5.e. Tidal Biology – Baltimore County

Baltimore County began Tidal Benthic Random Sampling in 2013 on a biennial basis. Results are summarized below (County 2018 MS4 Report, Figure 9-80 page 9-119).

Baltimore County BIBI Sample Results
For 2013, 2105, and 2017



Appendix D: Casselman River Watershed in Garrett County, Maryland
Watershed Eligible for 319(h) Grant Implementation Funding

D.1 Introduction

The *Casselman River Watershed Based Plan for pH Remediation* was completed by MDE in January 2011. MDE revised the plan in March 2011, and EPA accepted the plan in March 2011. The part of the watershed encompassed by the watershed plan is in Garrett County, Maryland. The watershed plan can be found here: https://mde.maryland.gov/programs/Water/319NonPointSource/Documents/Watershed%20Plans/A-I_EPA_Accepted_Plans/Casselman_pH.pdf.

- Pollution reduction goals for pH can be found in Chapter 3, Section 3.2 on page 11 of the watershed plan.
- BMP implementation goals for pH can be found in Chapter 5, Table 9 on page 35 of the watershed plan.
- The plan does not address nutrients or sediment. Also, the downstream portion of the Casselman River watershed in Pennsylvania is not addressed in the MDE plan.

Base Year for watershed plan implementation is 2006. Pollutant load reductions that year and thereafter can be counted toward meeting watershed plan goals. Section 3.1, sub-section 10 indicates that the plan's goal is taken from the pH TMDL and the TMDL model run, which used data thru 2005 (see TMDL Table 2-4 page 15 and Section 2.2.1 page 25).

Responsibility to implement the plan rests with MDE's Abandoned Mine Land Division (AMLD). To help meet this responsibility, they have worked with the Maryland Department of Natural Resources, the Garrett Soil Conservation District, and private property owners.

Maryland's 2015-2019 NPS Management Plan Objective 5 includes several milestones for this watershed:

- Report Annually: Report progress in the 319 Annual Report including number/percentage of pH impaired stream segments, NPS Program Success Stories, and implementation progress.
- 2015 Goal is 50% for percentage of impaired stream segments in watershed that are remediated and meet the State water quality standard for pH.
  - Status SFY18
    - Delistings: Three segments in the Casselman have been identified in the draft 2018 Integrated Report.
- Report 303(d) stream segments that achieve pH criteria via Maryland's Integrated Report.

D.2 Implementation, Operations and Maintenance

During SFY18 July 2017 thru June 30, 2018:

- MDE's Abandoned Mine Land Division (AMLD) completed bidding, and construction of four additional Phase II limestone sand application sites in the fall of 2016. The last constructed four sites became operational with the addition of limestone sands in February 2017. With construction of the four new sites, this brings the total of completed projects (Phase I and II) to eighteen that are adding alkalinity to the mainstem and several tributaries of the Casselman.

Limestone sand was dumped at the 18 operational sites at the end of December 2017. For this reason, the first 2018 load of sand was dumped in February 2018 at a cost of $9,491 for 78.1 tons @$48.90/ton). Another load was dumped in March 2018 ($2980.46 for a total of 60.95 tons @48.90). (Note: The amount of sand and even the time between dumping of sand varies for each site and the amount of previous precipitation, i.e., sand left from last dump, size and flow of the stream, etc.)

D.3 Monitoring

D.3.a Index of Biological Integrity [9]

Beginning in 2014, MDE's 319(h) Grant-funded biological monitoring project has been sampling benthic macroinvertebrates in selected streams within the Casselman River watershed. This measure are used to gauge existing stream health on a scale of 1 to 5:

good (4.0-5.0), fair (3.0-3.9), poor (2.0-2.9), very poor (1.0-1.9)
BIBI = benthic index of biological integrity

The following biological information was extracted from the January 2018 progress report, Project #2 Implementation of the *Casselman River Watershed Based Plan for pH Remediation*. [10]

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Project 2's objective is to collect benthic data within the Casselman River watershed prior to and after installation of acid mine drainage AMD treatment systems in order to determine treatment efficiency and document improvement. All benthic samples are analyzed in the MDE Field Services benthic laboratory.

This effort assessed four Phase I implementation stations from 2011 thru 2016 (Table 1). Three out of four Phase 1 sites demonstrate significant improvements in the benthic community coinciding with improvements in pH (Table 2). The fourth station CASS 008 T did not improve for unknown reasons. Three of the four sites now meet or surpass the healthy BIBI threshold of 3.0. The pH impairments for these three stations were removed from the Maryland 303(d) list. Phase one benthic monitoring has been discontinued.

[9] Maryland Department of the Environment. MDE Biological Assessment for Water Quality Protection and TMDL Implementation. 319(h) Grant FFY2017 Project 5 Objective 2.
[10] Maryland Department of the Environment. *Q2Report MDE Biological Assessment FFY-17 GRTS#5 thru 12-31-2017*. Charles Poukish. January, 2018.

Table D1 BIBI Sampling Stations in Casselman River Watershed					
Watershed Plan Phase	Stream Name	Location	Station Code	Latitude	Longitude
Phase 1 Implementation on public land	**Big Laurel Run near West Shale Road**	**West Shale Road, 0.8 miles South of Germany Road**	**CASS 017A T**	**39.64881**	**79.13779**
	Spiker Run	**Amish Road-Bittinger Property**	**CASS 001 T**	**39.69692**	**79.18695**
	Kameris Creek	**off Amish Road**	**CASS 006 T**	**39.67326**	**79.20672**
	Unnamed tributary 2 to NB Casselman R	**State Land- Amish Road**	**CASS 008 T**	**39.65878**	**79.22273**
Phase 2 Implementation on private land	**Little Shade Run**	**Posey Row Road**	**LSR0013**	**39.70851**	**79.17987**
	Unnamed tributary to Little Laurel Run	**Off West Shale Road**	**LLR0021**	**39.63430**	**79.15047**
	Unnamed tributary to North Branch Casselman River	**Leger Road at Foxtown Road**	**UNA0018**	**39.63229**	**79.24320**

Beginning in 2016, sampling at five Phase II stations was initiated to assess conditions before AMD treatment begins. Two of those sites (UTSCA43A and SCA0067) were dropped in 2016 because the results indicated they were biologically healthy (BIBI 4.0 and 3.75 respectively). In 2018 one additional post-implementation station was added in the Phase II Casselman watershed to assess additional AMD mitigation that was recently placed along the stream. Table 1 lists the three sampling sites that continue into 2018.

Table D2 Phase 1 BIBI Findings Before and After Installation of pH Mitigation Casselman River Watershed										
Station	BIBI Before		Average Before		2013 pH mitigation installed	BIBI After			Average After	
	2011	2012	BIBI	pH		2014	2015	2016	BIBI	pH
CASS 017B T	1.750	2.750	2.250	5.0		3.250	2.750	3.000	3.000	6.9
CASS 001 T	2.500	3.250	2.875	6.6		4.250	4.250	4.750	4.417	7.0
CASS 006 T	2.250	2.250	2.250	5.6		3.000	3.000	3.500	3.167	7.1
CASS 008 T	2.500	2.500	2.500	4.6		2.750	2.250	2.500	2.500	6.9

Monitoring results for Phase I sites and continuing monitoring at Phase II sites are designed to help demonstrate localized/sustained water quality improvements that are in compliance with state pH standards, and either meet or surpass the biological 303 (d) listing threshold for healthy benthic communities (IBI of 3 or greater). This monitoring plan accomplishes the "demonstrate improvement" requirement in the a-i criteria and should successfully fulfill all the requirements of a true TMDL implementation project. The design focuses on the actual stream segments impaired by acid mine discharge, which in turn, supports delisting of the 303 (d) stream segments impaired by AMD.

Table D3 Phase II Casselman Acid Mine Remediation Benthic Results					
Pre-Implementation Results		**Post Implementation Results**			
Station	**2016 BIBI**	**2017 BIBI**	**2018 BIBI**	**2019 BIBI**	**Average Post-BIBI**
LSR_0013_T	2.000	2.750	pending		pending
LLR_0021_T	2.250	2.250	pending		pending
UNA_0018_T	2.000	2.000	pending		pending
UNA_0011-T	not sampled	not sampled	pending		
WILL_201_T	not sampled	not sampled	pending		
GEOR_101_T	not sampled	not sampled	pending		

D.3.b Water Quality Monitoring [11]

MDE has been conducting nontidal water quality monitoring in the Casselman River watershed from 2010 thru 2018. All available information for SFY2018 is presented in the table below. Monitoring at completed Phase 2 implementation sites is continuing.

Nontidal Water Quality Monitoring in the Casselman River Watershed [12]				
Activity	**2017 Jul-Sept**	**2017 Oct-Dec**	**2018 Jan-Mar**	**2018 Apr-June**
Phase I Site Samples	Sampling ended 2016			
Phase II Site Samples	42	42	No winter samples	28

According to the most recent final report (FFY17) for MDE's Targeted Watershed project:

"Figure D1 [below] shows Phase I of the AMD BMP implementation to address pH impairments (sand dump platforms and leach beds). This part of the study has been completed.
[Figures D2 and D3 (below)] show Phase II of the AMD BMP implementation. This part of the study is currently underway. Pre implementation monitoring has been accomplished. BMPs were installed in the Fall of 2016, and Post implementation efforts will follow. [Figure 2] shows the stations that were sampled in 2016. There were a total of 18 stations. [Figure D3] shows the current stations that are being monitored in 2017. The total number of Casselman monitoring sites, at the current Phase II location is 14."

[11] Maryland Department of the Environment. MDE Targeted Watershed Project. 319(h) Grant FFY2017 Project 4 Objective 2.
[12] Maryland Department of the Environment. Targeted Watershed project quarterly status reports.

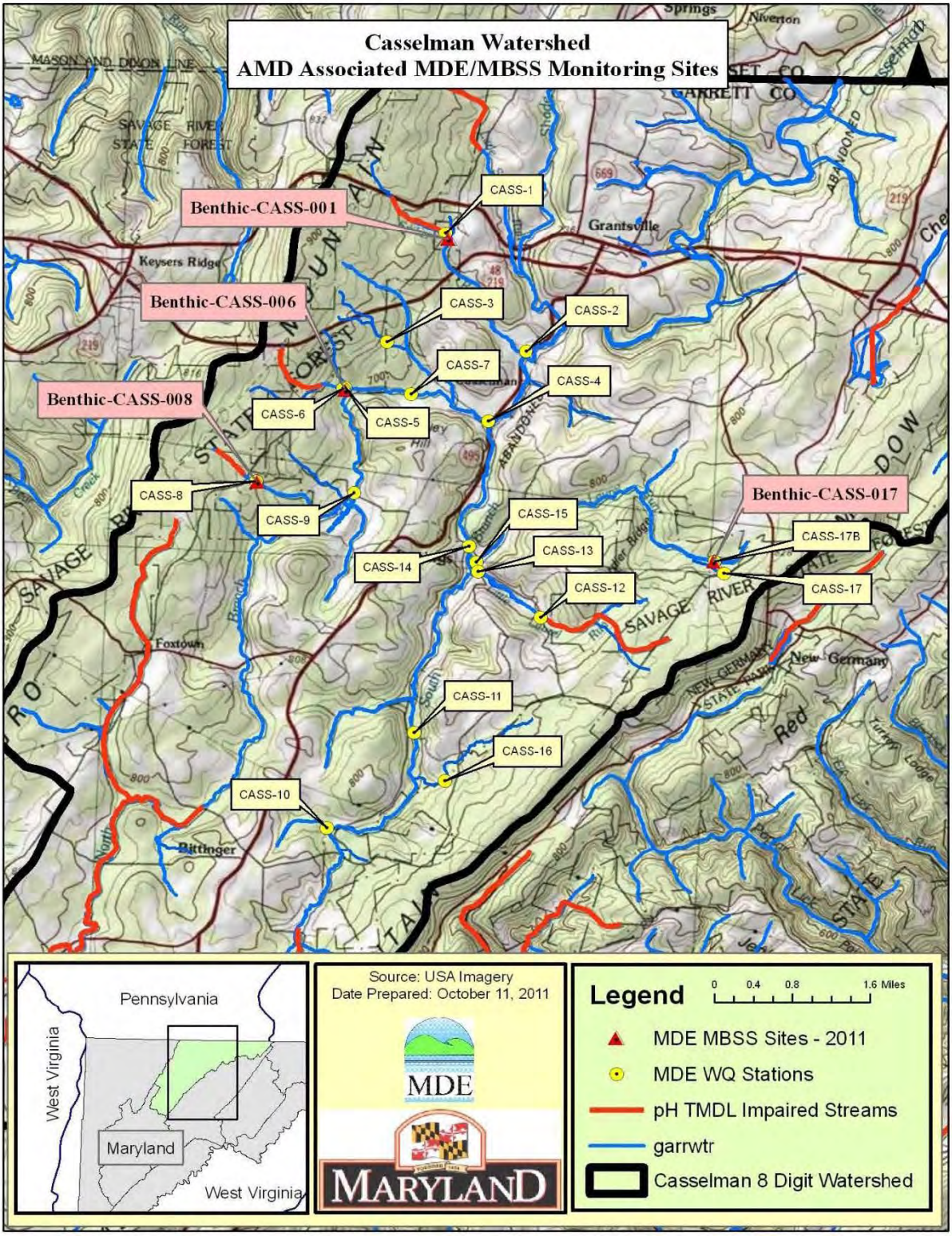


Figure D1. Map of Monitoring Stations for Phase I Implementation.

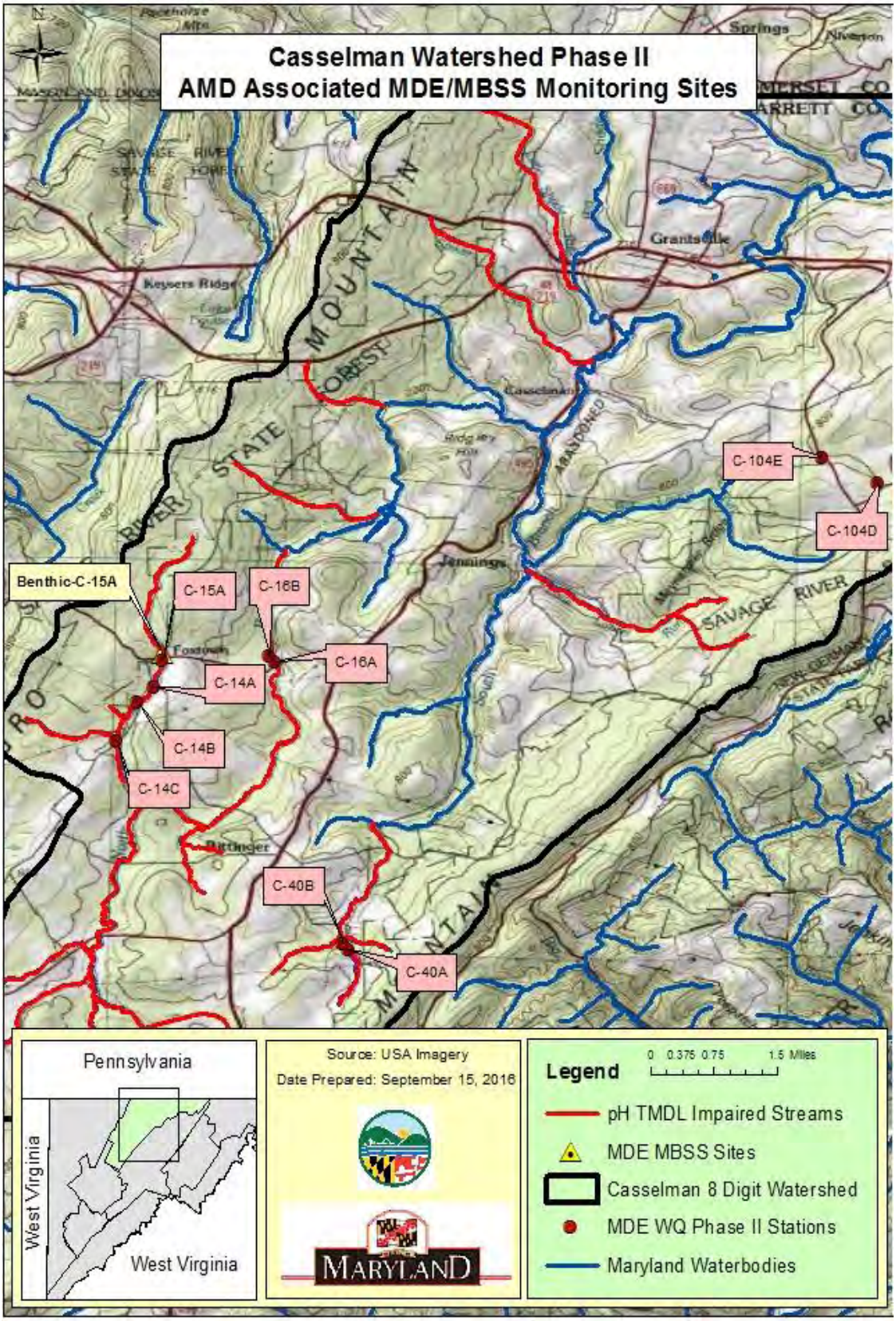


Figure D2. Map of Monitoring Stations for Phase II Implementation (2016).

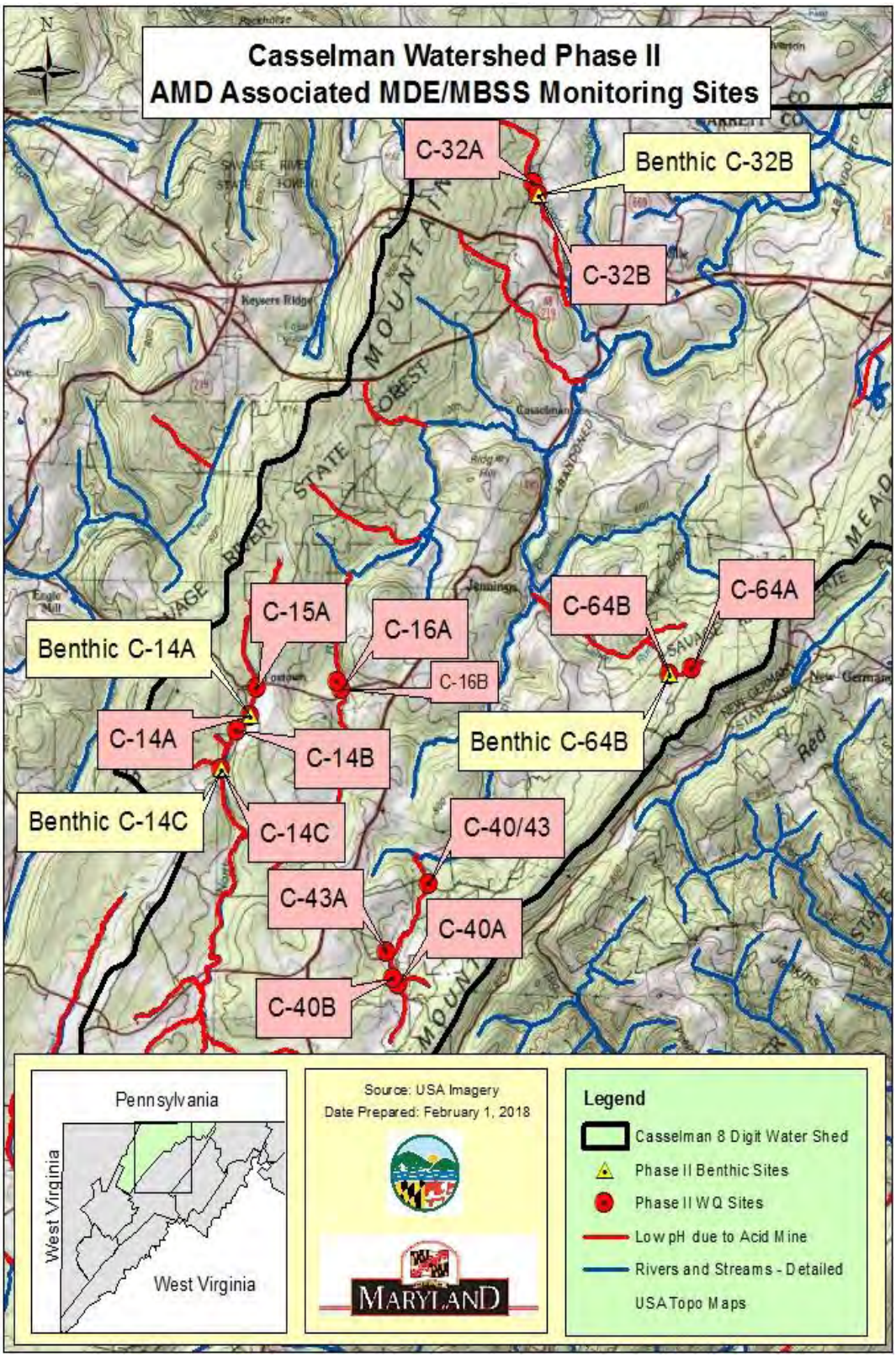


Figure D3: Map of Monitoring Stations for Phase II Implementation (2017).

D.4 Grant-Funded Implementation Projects

D.4.a 319(h) Grant

Funding for Phase 1 implementation is completed and Phase 2 continued thru SFY18 as summarized below based on quarterly project progress reports. The status of 319 grants in this watershed and the status of implementation site construction is summarized below:

- Phase 2 implementation of the Casselman River watershed plan focused on implementing limestone sand application sites on private property. Phase 2 implementation is completed, and the project is merely waiting on EPA approval to close. During Phase II, the construction of seven limestone sand application sites was completed after AMLD selected suitable sites on private land, acquired landowner permission, and completed in-house designs for approximately seven more limestone sand projects in other impaired locations in the watershed. These projects were bid out individually from 2014-2016 through MDE Small Procurement using the eMaryland[1] website for a total cost of **$80,591.00**. A PVC liner and intake improvements to the Spiker Leach Bed **($31,345)** were completed under Phase II in 2017..
- The table below indicates the amount of limestone sand used at the dump sites as well as total estimated costs. The amount of limestone sand and time between limestone sand dumping varied for each site and the amount of previous precipitation, i.e., sand left from last dump, size and flow of the stream, etc.

Year	Limestone Sand Tonnage	Limestone Sand Cost per Year
2013 (partial)	160	$5,450.25
2014	330	$12,890.32
2015	553	$26,505.50
2016	387	$18,461.12
2017	531	$22,856.76
2018 (partial)	238	$11,659.73
Total	2199	$97,823.68

D.4.b Maryland's Chesapeake and Atlantic Coastal Bays Trust Fund Grant: This grant had very little activity in this watershed that did not contribute to implementation the Casselman River plan.

D.4.c State Revolving Fund: There is no record of any project in the Casselman River watershed.

Casselman River Watershed 2006-SFY18 Completed 319(h) Grant NPS Implementation Projects							
Project Summary			**Project Expenditures**				
Area/Lead	**Name/Description**	**End Date**	**Grant Funding Source**	**Grant Funds**		**Non Federal Match**	**Total**
				Federal	**State**		
MDE	Casselman Watershed pH Plan	2011	FFY2008	$55,000.00		$36,666.67	$91,666.67
	AMD pH Remediation Phase 1	2014	319 FFY09 #6	$644,115		$429,410	$1,073,525
	AMD pH Remediation GIS Tool	SFY16	319 FFY11#14	$83,619		$55,746	$139,365
			TOTALS	$782,734.00	$0.00	$521,822.67	$1,304,556.67
SFY18 319(h) Grant NPS Implementation Project Activity - Casselman River Watershed							
Project Summary			**Project Funding**				
Area/Lead	**Name/Description**	**End Date**	**Grant Funding Source**	**Grant Funds**		**Non Federal Match**	**Total**
				Federal	**State**		
MDE	AMD pH Remediation Phase 2	6/30/2018	319 FFY13 #5	$401,307		$267,538	$668,845
Notes: 1) Phase II finished all construction activity during SFY18. Now project is just waiting on final EPA approval.							

Current Casselman pH Impairment List and Mitigation Status

Plan Shed (2)	Maryland Integrated Report			Status	Priority (Canaan)	TMDL Monitoring		MDE Implementation Monitoring			BMP Status SFY17					
	Name	8-Digit Segment	Impairmt			Site	Name		Location	Success Story	Project #	Site Name	Type	Phase	Comlpete	BMP cost
NBC-1	North Branch Casselman River	MD-050202040030	4a - pH	In Operation	3	UNA0015	UT to NB Casselman		Trib 11 to NB Casselman		C14	Bowser Foxtown Road	Limestone sand	2	2014	$11,810
						UNA0015	UT to NB Casselman		Trib 11 to NB Casselman		C15	Bowser Dung Hill Road	Limestone sand	2	2016	$11,256
NBC-2	North Branch Casselman River	MD-050202040032	4a - pH	In Operation	4	NBC0072	NB Casselman R	CASS-3	Trib to NB Casselman	not TMDL stream	C28	Amish Rd North	Leach bed and Sand	1	2013	$69,119
						TAR0003	NB Casselman R	CASS-5	Trib to NB Casselman	5 or 6 ready re tmdl	C27	Amish Rd South	Limestone sand	1	2013	$18,460
						na			NBC Casselman Mainstem		C16a	Synder - Dung Hill Rd	Limestone sand	2	2014	$12,630
	Alexander Run	MD-050202040032	4a - pH	In Operation	8	ALE0011	Alexander Run	CASS-8	Alexander Run	Submitting to EPA for FFY19	C22	Amish Rd - Alexander Run	Limestone sand	1	2013	$9,605
	Tarkiln Run	MD-050202040032	4a - pH	In Operation	4	TAR0003	Tarkiln Run	CASS-6	Tarkiln Run	submitted to EPA for FFY18	C25	Tarkiln Run	Limestone sand	1	2013	$8,868
MSC	Spiker Run	MD-050202040034	4a - pH	In Operation	5	SPI0018	Spiker Run	CASS-1	Spiker Run	EPA approved for FFY17	C30	Spiker Run	Leach bed & sand	1	2013	$71,850
	Little Shade Run	MD-050202040034	4a - pH	In Operation	6	LSR0015	Little Shade Run	none	Little Shade Run		C32	Yoder Posey Row Road	Limestone Sand	2	2016	$11,071
SBC-1	South Branch Casselman River	MD-050202040031	4a - pH	In Operation	9	na		CASS-10	Trib 12 to SB Casselman	not TMDL stream	C53	Bear Hill Road	Leach bed	1	2013	$78,274
						na		CASS-10	Trib 12 to SB Casselman		C52	Maynardier Ridge Rd W of Bear Hill	Limestone sand	1	2013	$8,506
						SCA0067	SB Casselman R	CASS-11	SBC mainstem		C40	Koch - Frank Brenneman Rd	Limestone sand	2	2014	$8,800
						SCA0067	SB Casselman R		UT to SBC mainstem		C43	Windy Ridge	Limestone sand	2	2016	$10,400
SBC-2	Little Laurel Run	MD-050202040033	4a - pH	In Operation	7	na		CASS-16	Trib 8A & 10 to SB Casselman	not TMDL stream	C56	Maynardier Ridge Rd	Limestone sand	1	2013	$9,765
					1	LLR0009	Little Laurel Run	CASS-12	UN Trib 6 (to Little Laurel Run)	EPA approved for FFY16	C65	West Shale Rd South	Limestone sand	1	2013	$8,526
						LLR0024	Little Laurel Run	CASS-12	UN Trib 5 (to Little Laurel Run)		C64	West Shale Rd North	Limestone sand	1	2013	$10,294
						LLR0024	Little Laurel Run	CASS-12	UN Trib 4 (to Little Laurel Run)		C64a	Savage State Forest -West Shale Rd	Limestone sand	2	2016	$11,410
	Big Laurel Run	MD-050202040033	not listed	In Operation	2	na		CASS-17B	UN Trib (to Big Laurel Run)	EPA approved	C72A	Big Laurel Run West Shale Road (add)	Limestone sand	1	2013	$11,124
						na		CASS-17B	UN Trib (to Big Laurel Run)		C72	Big Laurel Run West Shale Road Siphon	Leach bed and sand	1	2013	$111,019
CEP	Meadow Run	MD-050202040035	4a - pH	planning		MDW008	Meadow Run	none	Meadow Run @ Rt 40							

(1) Draft 2016 Integrated Report 4a - impaired, TMDL completed. 2012 Integrated Report did not list Casselman pH impairments separately.

(2) Watershed Plan subwatershed designations:

NBC-1 North Branch Casselman River headwaters

NBC-2 North Branch Casselman River lower reaches

SBC-1 South Branch Casselman River headwaters

SBC-2 South Branch Casselman River lower reaches

MSC Mainstem Casselman River

CEP Casselman River eastern portion

Appendix E: Corsica River Watershed in Centreville and Queen Anne's County, Maryland Watershed Eligible for 319(h) Grant Implementation Funding

E.1 Introduction

Centreville developed the *Corsica River Watershed Restoration Action Strategy* in 2005 with input from Queen Anne's County, Queen Anne's Soil Conservation District and others. The watershed plan (action strategy) encompasses the entire Corsica River watershed including the Town of Centreville in Queen Anne's County.

The watershed plan's pollutant reduction goals refer to the TMDL for nitrogen and phosphorus approved 5/9/2000. The TMDL document indicates that the Corsica River watershed ambient NPS nutrient loads already met the TMDL load allocation as summarized below. Therefore, the nitrogen and phosphorus TMDLs are benchmarks to prevent water quality degradation.

268,211 lb/yr = Total NPS nitrogen load, TMDL page 4
268,211 lb/yr = nitrogen TMDL load allocation, TMDL page 22
0 lb/yr = NPS nitrogen reduction goal based on TMDL

19,380 lb/yr = Total NPS phosphorus load, TMDL page 4
19,380 lb/yr = phosphorus TMDL load allocation, TMDL page 22
0 lb/yr = NPS phosphorus reduction goal based on TMDL

Current BMP implementation goals are in the *Corsica River Targeted Initiative Progress Report*: 2005-2011 on pages 16-17. On these pages, the table "Comprehensive Implementation Strategies for the Corsica River: 2012 to 2016" sets BMPs implementation goals that replace the goals in the 2005 watershed plan. The progress report also summarizes watershed plan implementation status thru 2011. The report is available: http://www.townofcentreville.org/departments/environment.asp

Base Year for watershed plan implementation is 2005. All stakeholders agreed that the baseline year is 2005. Also, the Corsica nutrient TMDL approved in 2000 was based on 1997 water quality data (See TMDL Section 2.2 pages 5-9, and the 2005 watershed plan pages 23-24.)

E.2 Milestones

Maryland's 2015-2019 NPS Management Plan Objective 5 includes two milestones for this watershed:

- Annually: Report progress in the 319 Annual Report, and
- In 2016 assess plan implementation progress and in 2017 update plan if needed. As of the end of SFY2017, the Corsica River watershed plan implementers elected to retain the existing watershed plan, as revised in 2011, with no additional updates or revisions.

E.3 Monitoring

E.3.a Nontidal – Water Quality Monitoring Before/After Implementation [13]

[13] Maryland Department of the Environment. MDE Targeted Watershed Project. 319(h) Grant FFY2017 Project 4 Objective 2.

MDE has been conducting nontidal water quality monitoring in the Corsica River watershed from 2005 thru the date of this report. All available information for SFY2018 is presented in the table below.

Nontidal Water Quality Monitoring in the Corsica River Watershed [14]				
Activity	**2017 Jul-Sept**	**2017 Oct-Dec**	**2018 Jan-Mar**	**2018 Apr-June**
Composite Samples	27	22	11	37
Weekly Grab Samples	44	52	46	52
Synoptic Survey	0	78	78	36

E.3.b Nontidal – Index of Biological Integrity [15]

MDE's 319(h) Grant-funded biological monitoring project samples benthic macroinvertebrates and fish in healthy nontidal streams as part of Maryland's Tier II Antidegradation Program. These two measures serve as a gauge of existing stream health using a scale of 1 to 5:

good (4.0-5.0), fair (3.0-3.9), poor (2.0-2.9), very poor (1.0-1.9)
BIBI = benthic index of biological integrity
FIBI = fish index of biological integrity

In previously identified healthy waters within the Corsica River watershed several sites have been sampled to determine if healthy conditions are continuing. A score of 4.000 or above means Tier II healthy water criteria are continuing to be met. A lower score indicates that conditions have degraded below Maryland's Tier II healthy water criteria: [16,5]

- Gravel Run 1, CORS-109-A-2017 BIBI pending on 7/13/18
  - FIBI 2.667 in 2017
- Gravel Run 124, CORS-214-A-2014
  - BIBI 4.143 on 3/13/14
  - FIBI 4.33 in 2014
- Gravel Run 125, CORS-214-A-2015 (no longer meets Tier II criteria)
  - BIBI 1.86 on 3/21/14
  - FIBI 3.67 in 2014
- Mill Stream Branch, CORS-216-A-2016
  - BIBI 4.143 on 11/30/17
  - FIBI 4.667 on 6/30/16

[14] Maryland Department of the Environment. Targeted Watershed project quarterly status reports.
[15] Maryland Department of the Environment. MDE Biological Assessment for Water Quality Protection and TMDL Implementation. 319(h) Grant FFY2017 Project 5 Objective 2.
[16] Maryland Department of the Environment. *Q3Report MDE Biological Assessment FFY-16 GRTS#5 thru 3-30-2017*. Charles Poukish. May 8, 2017. 47 pages.

All fish data analysis results for SFY2018 are presented in the table below. [17]

Fish Monitoring for Index of Biological Integrity Assessment in the Corsica River Watershed						
Gravel Run, Station MDE-CORS-109-A-2017 FIBI = 2.667 July 6, 2017						
Common Name	Tolerance	Native or Introduced	Trophic Status	Lithophilic Spawner	Composition	# sampled @ Station
Least Brook Lamprey	NOTYPE	N	FF	N	B	6
American eel	NOTYPE	N	GE	N		17
Blacknose dace	T	N	OM	N		1
Eastern mudminnow	T	N	IV	N		13
Green sunfish	T	IC	GE	N		1
Pumpkinseed	T	IY	IV	N		1
Redbreast sunfish	NOTYPE	IY	GE	N		3
Tessellated darter	T	N	IV	N	B	98

E.3.c Tidal

The Maryland Department of Natural Resources (DNR) conducted tidal water quality monitoring in the Corsica River from 2005 thru 2016. In 2017, a monitoring hiatus was initiated. According to a recent water quality summary by Maryland DNR, Corsica River "water quality is poor because phosphorus and sediment levels are too high. Habitat quality for underwater grasses is poor because algal densities are high and water clarity is low. Summer bottom dissolved oxygen levels are good." [18]

[17] Maryland Department of the Environment. *Q4Report MDE Biological Assessment FFY-17 GRTS#5 thru 11-30-2017*. Charles Poukish. December 13, 2017. 54 pages.
[18] DNR. *Water Quality Summary 2013-2015*. Preliminary report received via personal communication from Renee Karrh 11/6/17.

Corsica River Watershed
2005-SFY18 Completed 319(h) and State Revolving Fund Grant NPS Implementation Projects

Project Summary			Project Expenditures					Overall Pollutant Load Reduction		
Area/Lead	Name/Description	End Date	Grant Funding Source	Grant Funds		Non Federal Match	Total	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)
				Federal	State					
Centreville	Watershed Restoration	2006	319 FFY05 #2	$232,666.15		$155,110.77	$387,776.92	0	0	0
	Watershed Restoration	2009	319 FFY06 #3	$241,974.82		$161,316.55	$403,291.37	62	6	0
	Watershed Restoration	2012	319 FFY09 #1	$270,427.25		$180,284.83	$520,712.08	5.33	1.05	0.29
	Stormwater Retrofit near WWTP		General Funds		$60,000.00					
	Banjo Lane Coastal Plain Outfall		General Funds		$10,000.00					
	Watershed Restoration	SFY16	319 FFY11 #8	278,237.30		185,491.53	463,728.83	57.93	5.29	1.11
	Watershed Restoration	SFY16	319 FFY12 #7	81,674.57		54,449.71	136,124.28	7.2	0.5	0.09
MDA / Queen Anne's Soil Conservation District	Agricultural Technical Assistance	2006	319 FFY04 #18	$32,379.50		$21,586.33	$53,965.83	4,847	114	0
		2008	319 FFY05 #12	$145,554.24		$97,036.16	$242,590.40	767	79	463
		2008	319 FFY06 #9	$14,272.71		$9,515.14	$23,787.85	2,413	233	0
		2008	319 FFY07 #6	$22,187.16		$14,791.44	$36,978.60	286	10	755
		2009	319 FFY08 #7	$50,780.00		$33,853.33	$84,633.33	46	3	62
		2010	319 FFY09 #4	$58,539.00		$39,026.00	$97,565.00	19,740	6,664	33
		2011	319 FFY10 #10	$61,590.00		$41,060.00	$102,650.00	53,259	802	0
		2012	319 FFY11 #10	$66,700.59		$44,467.06	$111,167.65	45,703	642	492
		2013	319 FFY12 #9	$50,999.97		$33,999.98	$50,000.00	55,822	828	108.6
		2014	319 FFY13 #9	$47,810.49		$31,873.66	$79,684.15	32,831	4,394	38.28
Queen Anne's County	Corsica and Beyond	2008	319 FFY06 #13	$124,281.44		$82,854.29	$207,135.73	0	0.34	0
	Bioretention Swale	2011	319 FFY08 #19	$50,000.00		$33,333.33	$83,333.33	0.22	0.35	0.739
	Board of Education Bioretention	2013	319 FFY11 #11	$22,431.94		$14,954.63	$37,386.57	5.16	0.36	0.066
	Board of Ed. Phase 2: Kramer Center	2014	319 FFY12 #10	$66,624.98		$44,416.65	$111,041.63	60.7	7.6	3.03
	Bloomfield Park N. Bldg. Permeable Paving	2012	State Revolving Fund		$200,000.00		$250,000.00	864	173	0
			319 Projects Total Completed	$1,919,132.11		$1,279,421.41	$3,233,553.56	215,912.4	13,790.9	1,957.18
			SRF Projects Total Completed		$200,000.00		$250,000.00	864	173	0
			TOTAL 319 & SRF Projects Completed	$1,919,132.11	$270,000.00	$1,279,421.41	$3,483,553.56	216,776.4	13,963.9	1,957.18

SFY18 NPS Implementation Projects In Progress - 319(h) Grant and State Revolving Fund - Corsica River Watershed

Project Summary			Project Funding					Projected Pollutant Load Reduction		
Area/Lead	Name/Description	End Date	Grant Funding Source	Grant Funds		Non Federal Match	Total	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)
				Federal	State					
All Local Government	No 319 project working during SFY17									
	No SRF project working during SFY17									

	Corsica River Watershed										
	Chesapeake and Atlantic Coastal Bays Trust Fund										
	SFY18 NPS Implementation Project Status (1)										
Year Funded	PartnerCD	ProjectTitle	ProjectType	County	TrustFund Dollars	Status	BMP Units	BMPs Reported	Annual LbsN	Annual LbsP	Annual TonsTSS
FY11	Corsica River Conservancy	Education & Outreach	Education & Outreach	Queen Anne's	15,710	Complete			0.00	0.00	0.00
		Symphony Village Bioswale	Stormwater Management	Queen Anne's	17,000	Complete			0.37	0.03	0.00
		Residential Soil Tests: 64 sites	Education & Outreach	Queen Anne's	481	Complete			0.00	0.00	0.00
		Volunteer Water-Quality Program	Education & Outreach	Queen Anne's	1,213	Complete			0.00	0.00	0.00
		Corsica Watershed Rain Garden Initiative: 73 sites	Stormwater Management	Queen Anne's	144,027	Complete			0.02	0.00	0.00
	Queen Annes County	Bloomfied Park Permable Paving	Stormwater Management	Queen Anne's	50,000	Complete			4.00	0.66	0.00
		QAC Office Building Stormwater Management	Stormwater Management	Queen Anne's	200,000	Complete			12.00	2.00	0.00
		Centreville WWTP Outfall Design and Permitting	Stormwater Management	Queen Anne's	30,000	Complete			0.00	0.00	0.00
		Banjo Lane Coastal Plain Outfall	Stormwater Management	Queen Anne's	30,000	Complete			0.00	0.00	0.00
		Rain Barrel Giveaway Program: 118 barrels	Stormwater Management	Queen Anne's	5,782	Complete			0.00	0.00	0.00
		Mill Stream Park Buffer - Phase II	Tree Planting Projects	Queen Anne's	52,471	Complete	acres	7.3	209.66	14.16	2.56
		Providence Area Planting	Tree Planting Projects	Queen Anne's	23,001	Complete	acres	3.2	91.90	6.21	1.12
		Conquest Beach Planting	Tree Planting Projects	Queen Anne's	4,528	Complete	acres	0.63	18.09	1.22	0.22
		Mill Stream Park Buffer Plantings (Phase I)	Tree Planting Projects	Queen Anne's	20,000	Complete	acres	0.7	57.44	3.88	0.70
FY12	Corsica River Conservancy	Corsica River Rain Gardens	Stormwater Management	Queen Anne's	10,000	Complete			215.40	14.60	2.60
	Town of Centreville	Outfall Rehabilitation	Stream Restoration	Queen Anne's	250,000	Complete			10.00	2.00	0.64
FY13	Queen Annes County	Centreville Elementary School Bioretention	Stormwater Management	Queen Anne's	50,000	Complete			0.00	0.00	0.00
		Board of Education Bioretention	Stormwater Management	Queen Anne's	62,132	Complete			0.00	0.00	0.00
	Town of Centreville	Pennsylvania Ave Bioswale	Stormwater Management	Queen Anne's	50,000	Complete			12.42	0.99	0.00
FY14	Queen Annes County	Kennard School Planting	Tree Planting Projects	Queen Anne's	4,800	Complete	acres	5	29.87	2.00	0.35
FY15	Delmarva RC & D Council	Centreville High School Stormwater Wetland	Stormwater Management	Queen Anne's	44,468	Complete			501.00	35.40	9.53
FY16	Delmarva RC & D Council	Conquest Wetland Restoration	Wetland Restoration	Queen Anne's	112,515	Complete			55.50	32.65	1.06
FY17	Delmarva RC & D Council	Conquest and Middle School Wetlands	Wetland Restoration	Queen Anne's	27,220	Complete			137.35	14.80	1.45
FY18	Maryland Forestry Board Foundat	Sanford	Tree Planting Projects	Queen Anne's	3,454	Complete			5.82	0.29	0.05
	(1) Maryland DNR provided this data 2/21/19 and indicated it is the full extent available.			TOTALS	1,208,801				1,360.84	130.89	20.28
FY18	Chester River Association	Gunston School - Ravine #1	Stormwater Management	Queen Anne's	150,228	Design/Planning			190.02	25.43	0.35
FY18	Chester River Association	Gunston School - Ravine #2	Stormwater Management	Queen Anne's	150,228	Design/Planning			19.97	1.55	0.42
FY18	Chester River Association	Gunston School - Ravine #3	Stormwater Management	Anne Arundel	150,228	Design/Planning			6.00	5.44	0.61
	(1) Maryland DNR provided this data 2/21/19 and indicated it is the full extent available.			TOTALS	450,684				0.00	0.00	0.00

SFY2018 Agricultural BMP Implementation						Corsica River Watershed Plan					Prior Years Progress Toward Watershed Plan Goals					
Corsica River Watershed			Estimated Pollutant Load Reduction			**2011 Progress Report Table 1**			**Progress**		2005-2013 2013 Annual Report	Extracted from State Data reported by MDE to EPA Bay Program				
BMP Type	**Unit**	SFY18 Total	Nitrogen Total (lbs)	Phosphorus Total (lbs)	Sediment Total (tons)	**Management Measure**	**Goal**	**Units**	**SFY14-SFY18**	**Units**		SFY14	SFY15	SFY16	SFY17	**Units**
Annual Practices																
Cover Crops	acres	5,504	20,611.4	61.4	17.51	2. Agricultural Cover Crops	5500 acre/yr	acres								
Multi-Year Practices																
Alternative Crops	acres								0	acres		0	0	0	0	acres
Amendments for the Treatment of Ag V	AU								0	AU		0	0	0	0	AU
Animal Mortality Facility	count								1	count		0	0	0	1	count
Conservation Cover	acres	99.9	1,247.8	9.0	10.29				105.6	acres		1.2	0	0	4.5	acres
Conservation Plans/SCWQP	acres	416	233.1	22.0	5.45				7,141	acres		1,773	1,998	1422	1532	acres
Critical Area Planting	acres								0	acres		0	0	0	0	acres
Dead Bird Composting Facility	count								0	count		0	0	0	0	count
Fencing	feet								0	feet		0	0	0	0	feet
Field Border	acres								0	acres		0	0	0	0	acres
Filter Strip	acres								0	acres		0	0	0	0	acres
Grassed Waterway	acres	0.2	9.2	1.9	0.00				1.6	acres		0.1	0	0	1.3	acres
Horse Pasture Management	acres								0	acres		0	0	0	0	acres
Loafing Lot Management System*	acres	0.3	6.4	0.5	0.01				0.3	acres		0	0	0	0	acres
Pasture & Hay Planting	acres								0	acres		0	0	0	0	acres
Prescribed Grazing*	acres	4.67	4.2	1.6	0.00				9.34	acres		0	0	0	4.67	acres
P-sorbing Materials	acres								0	acres		0	0	0	0	acres
Riparian Forest Buffer	acres					1. Agricultural Buffers	150	acres	8.78	acres	94.3	0	0	4.39	4.39	acres
Riparian Herbaceous Cover	acres								5.3	acres		0.4	0	0	4.9	acres
Roof Runoff Structure†	count	1	0.0	0.0	0.00				1	count		0	0	0	0	count
Stream Restoration Ag	feet								0	feet		0	0	0	0	feet
Tree/Shrub Establishment	acres								0	acres		0	0	0	0	acres
Waste Storage Facility*	count	1	66.8	5.5	0.00				1	count		0	0	0	0	count
Wastewater Treatment Strip	acres								0	acres		0	0	0	0	acres
Water Control Structure	count								1	count		0	1	0	0	count
Watering Facility	count								0	count		0	0	0	0	count
Wetland Creation	acres								0	acres		0	0	0	0	acres
Wetland Restoration	acres					6. Wetland Creation (all types)	20	acres	0	acres	88.3	0	0	0	0	acres
Windbreak/Shelterbelt Establishment	feet								0	feet		0	0	0	0	feet
						3. Nutrient Mgmt Horse Farms	5	projects								
						4. Agricultural BMPs (all types)	50	count			11					count
						5. Catalog all BMPs on farms	125	parcels								
						10. Easements, Land Acquisitio	200	acres								
Total Annual Practices (2)			20,611.4	61.4	17.51											
Total Multi-year Practices			1,567.4	40.6	15.7											
Total Pollutant Load Reduction			22,178.8	102.0	33.3											

(1) "SFY17 Total" column is MDA data. MDE used MAST to estimate pollution load reductions.

(2) The Maryland Departmant of Agriculture (MDA) defines annual practices as cover crops, nutrient mgmt, manure transport, conservation tillage & high residue tillage.

†Reductions could not be calculated with units reported

*Reductions for this practice were calculated using Phase 6 Chesapeake Assessment Scenario Tool output

SFY2018 Urban BMP Implementation
Corsica River Watershed

Urban Management Practice	Unit	BMPs Reported	Estimated Pollutant Load Reduction		
			Nitrogen lb/yr	Phosphorus lb/yr	Sediment tons/yr
Bioretention (13)	acres				
Bioswale (13)	acres				
Cisterns & Rain Barrels	acres				
Disconnection of Rooftop Runoff (13)	acres				
Dry Detention Ponds & Hydro Structures (13)	acres				
Dry Extended Detention Ponds (13)	acres				
Dry Swale (13)	acres				
Filtering Practices (13)	acres				
Forest Conservation	acres				
Forest Harvesting Practices	acres				
Infiltration Practices (13)	acres				
Permeable Pavement (13)	acres				
Rain Garden	acres				
Reduction of Impervious Surface (13)	acres				
Riparian Forest Buffers on Urban Lands (13)	acres				
Septics Connections to Sewers	count				
Septic Denitrification Critical Area	count	6	70.80		
Septic Denitrification outside of 1000 feet	count				
Septic Denitrification within 1000 feet	count				
Septic Tank Pumpout	count				
Stream Restoration Urban	feet				
Street Sweeping	acres				
Tree Planting	acres				
Urban Forest Buffer (13)	acres				
Wet Extended Detention	acres				
Wet Ponds & Wetlands (13)	acres				
TOTAL Urban BMPs Pollutant Load Reduction			70.80	0.00	0.00

(1) "BMPs Reported" column data is MDE data. MDE uses MAST to estimate pollutant load reductions.
(2) Pollutant load reduction is estimated by MDE using MAST.

Corsica River Watershed Plan

2011 Progress Report Table 1			Progress		
Urban Management Practice	Goal	Units		SFY14-SFY18	Units
				3.8	acres
				0.0	acres
9. LID Projects -- rain barrels	40	count		0.0	acres
				0.0	acres
				0.0	acres
				0.0	acres
				1.4	acres
				0.0	acres
				0.0	acres
				0.0	acres
				0.0	acres
9. LID Projects -- rain gardens	100	count		0.0	acres
				0.0	acres
				0.0	acres
				0.0	count
7. Retrofit Septic Systems	14	count		19.0	count
				1.0	count
				11.0	count
				0.0	count
15. Stream Restoration	0.5	miles		300.0	feet
Street Sweeping (no goal number)	50	acres		0.0	acres
				0.0	acres
				0.0	acres
				0.0	acres
				0.0	acres
13. Stormwater Retrofits *	187.46	acres	0.0	0.0	acres

Watershed Plan Goal #13 "Stormwater Retrofits" aggregates urban BMPs footnoted (13).
Units of measure shaded red differ from State reporting units.

Prior Years Progress Toward Watershed Plan Goals (Progress Report 2005-2011)

Data Reported by Locals		Extracted from State Data reported by MDE to the EPA Bay Program				
2012 (count)	2013 (count)	SFY14	SFY15	SFY16	SFY17	Units
4	0	0	0	3.8	0	acres
		0	0	0	0	acres
65	0	0	0	0	0	acres
		0	0	0	0	acres
		0	0	0	0	acres
		0	0	0	0	acres
		0	0	1.35	0	acres
		0	0	0	0	acres
		0	0	0	0	acres
		0	0	0	0	acres
		0	0	0	0	acres
		0	0	0	0	acres
		0	0	0	0	acres
		0	0	0	0	acres
		0	0	0	0	acres
		0	0	0	0	count
		0	1	1	11	count
		0	1	0	0	count
		8	1	2	0	count
		0	0	0	0	count
		0	300	0	0	feet
		0	0	0	0	acres
		0	0	0	0	acres
		0	0	0	0	acres
		0	0	0	0	acres
		0	0	0	0	acres

Appendix F: Lower Jones Falls in Baltimore City and Baltimore County, Maryland Watershed Eligible for 319(h) Grant Implementation Funding

F.1. Lower Jones Falls SWAP Overview

Baltimore County completed the *Lower Jones Falls Small Watershed Action Plan* (SWAP) was in October 2008 and EPA accepted it in January 2009. The upstream portion of the watershed is in Baltimore County and the downstream portion of the watershed is in Baltimore City. The watershed plan can be found here: https://mde.maryland.gov/programs/Water/319NonPointSource/Documents/Watershed%20Plans/A-I_EPA_Accepted_Plans/Lower_Jonesfalls.pdf.

Pollutant reduction goals from the watershed plan in two locations: in the Executive Summary Table E-4 on page 9, which is essentially duplicated in Table 5.4 on page 85:

- Nitrogen: 6,498 pounds per year.
- Phosphorus: 679 pounds per year.
- Total Suspended Solids: 204.9 tons per year.
- Fecal Coliform Bacteria: 4,679,348 billion per year.

Watershed plan BMP implementation goals are in Chapter 5, in Tables 5.1 and 5-3. There are two different base years for tracking watershed plan implementation:

- 2008 for nitrogen, phosphorus and sediment. Pollutant load reductions reported that year and thereafter can be counted toward meeting watershed plan goals. The watershed plan Section 5.2 page 83 indicates that the reduction goals are based on anticipated results of the management strategy presented in the plan. Monitoring for these pollutants is not referenced as a basis for the plan and TMDLs for these pollutants were not available when the plan was written.
- 2005 for bacteria. Pollutant load reductions reported that year and thereafter can be counted toward meeting watershed plan goals. The watershed plan Section 5.2 page 83 indicates that the bacteria reduction goal is based on the TMDL. The Fecal Bacteria TMDL Section 2.2 pages 11-12 indicate that the TMDL is based on monitoring conducted 2003 and earlier.

Maryland's 2015-2019 NPS Management Plan Objective 5 lists one milestone for this watershed: annually report progress in the 319 Annual Report.

F.2. Grant-Funded Implementation Projects

The following two pages present tables summarizing the status of grant-funded NPS BMP implementation from the following grant sources:

- 319(h) Grant and State Revolving Fund
- Chesapeake and Atlantic Coastal Bays Trust Fund

Lower Jones Falls Watershed

2006-SFY18 Completed NPS Implementation Projects - 319(h) Grant and State Revolving Fund

Project Summary			Project Expenditures					Pollutant Load Reduction			
Area/Lead	Name/Description	End Date	Grant Funding Source	Grant Funds		Match	Total	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)	Bacteria (MPN)
				Federal	State						
Baltimore City	Stony Run Stream Restoration Northern Parkway to Wyndhurst Av	2006	319 FFY03 #17	$139,000.00	$0	$92,667	$231,666.67	0	299	360	0
Baltimore County	no 319 or SRF funded projects recorded										
TOTAL for completed projects				$139,000.00	$0	$92,666.67	$231,666.67	0	299	360	0

For nitrogen, phosphorus and sediment pollutant loads, BMPs installed 2008 and later can be counted toward watershed plan implementation.

For bacteria pollutant loads, BMPs installed 2005 and later can be counted toward watershed plan implementation.

SFY2018 NPS Implementation Projects In Progress - 319(h) Grant and State Revolving Fund - Lower Jones Falls Watershed

Project Summary			Project Funding					Projected Pollutant Load Reduction			
Area/Lead	Name/Description	End Date	Grant Funding Source	Grant Funds		Match	Total	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)	Bacteria (MPN)
				Federal	State						
Baltimore City	No 319 or SRF projects working during SFY18										
Baltimore County	No 319 or SRF projects working during SFY18										

Lower Jones Falls Watershed
Chesapeake and Atlantic Coastal Bays Trust Fund
SFY 2018 NPS Implementation Project Status (1)

Year Funded	PartnerCD	ProjectTitle	ProjectType	County	TrustFund Dollars	Status	BMP Units	BMPs Reported	Annual LbsN	Annual LbsP	Annual TonsTSS
FY13	Md Forestry Board Foundation	Irvine Nature Center Tree Planting	Tree Planting Projects	Baltimore	31,000	Complete			177	9	1.44
	Parks and People Foundation	Druid Hill Park Bio-Filter Installation (	Stormwater Management	Baltimore City	113,000	Complete			29.58	2.41	0.98
		Phase I: Samuel Coleridge-Taylor 507	Tree Planting Projects	Baltimore City	50,000	Complete			0	0	0
		Howard Dog Park	Stormwater Management	Baltimore City	51,000	Complete			0.99	0.16	0.061
	Baltimore County	Towson Run at Cloisters Stream Rest	Stream Restoration	Baltimore	997,014	Complete			816.9	265.4	607.68
FY14	Chesapeake Bay Trust	Mount Vernon-Belvedere Tree Pit Cı	Tree Planting Projects	Baltimore City	10,000	Complete			188	0.08	12.4
		Improving Tree Health and Canopy in	Tree Planting Projects	Baltimore City	184,535	Complete			28	1.9	0.3
		Reservoir Hill Tree Canopy Project	Tree Planting Projects	Baltimore City	58,010	Complete			74.7	9.2	2.6
		Improving Tree Health and Canopy in	Tree Planting Projects	Baltimore City	40,000	Complete			0	0	0
	Parks and People Foundation	Phase II: 507 W Preston St, Samuel C	Stormwater Management	Baltimore City	431,301	Complete			1.83	0.13	0.145
	Baltimore City Recreation and Parks	Baltimore Polytechnic Institute	Tree Planting Projects	Baltimore City	2,036	Complete			0.99	0.042	0.007
		Northwestern HS	Tree Planting Projects	Baltimore City	4,043	Complete			1.7	0.07	0.012
	Alliance for the Chesapeake Bay	Saints Philip and James Parish	Tree Planting Projects	Baltimore City	810	Complete			0.57	0.03	0.001
		Union Baptist Church	Tree Planting Projects	Baltimore City	338	Complete			0.23	0.01	0.0007
		Baltimore Hebrew Congregation	Tree Planting Projects	Baltimore City	540	Complete			0.376	0.015	0.001
		Chizuk Amuno	Tree Planting Projects	Baltimore	1,688	Complete			1.1775	0.0475	0.0039
		Woodbrook Baptist Church	Tree Planting Projects	Baltimore	878	Complete			0.6123	0.0247	0.002
		Benedictine Sisters of Baltimore Emn	Tree Planting Projects	Baltimore	1,688	Complete			1.42	0.1	0.016
		Bnos Yisroel	Tree Planting Projects	Baltimore City	4,051	Complete			2.826	0.114	0.0093
		Grace United Methodist Church	Tree Planting Projects	Baltimore City	2,976	Complete			0.75	0.038	0.0031
FY15	Parks and People Foundation	Newington Avenue Park	Stormwater Management	Baltimore City	58,460	Complete			0.49	0.05	0.058
		Sarah's Hope Phase II	Stormwater Management	Baltimore City	8,005	Complete			0.27	0.28	0.05
	Blue Water Baltimore	Guilford Elementary Middle School	Stormwater Management	Baltimore City	65,000	Complete			0.24	0.06	0.12
		Chizuk Amuno Synagogue	Stormwater Management	Baltimore	280,000	Complete			6.85	0.76	1.42
		Jones Falls Stream Restoration (Supp	Stream Restoration	Baltimore	24,892	Complete			0	0	0
		Baltimore Hebrew Congregation	Stormwater Management	Baltimore City	159,040	Complete			1.11	0.13	0.24
		Shrine of the Sacred Heart	Stormwater Management	Baltimore City	46,299	Complete			0.36	0.03	0.058
		Govan Presbyterian Stormwater Man	Stormwater Management	Baltimore City	162,500	Complete			6.17	0.79	0.22
		Old Goucher 23rd Street Greening	Stormwater Management	Baltimore City	15,000	Complete			0.46	0.09	0.1
FY16	Blue Water Baltimore	Jones Falls Stream Restoration at Fall	Stream Restoration	Baltimore	600,000	Complete			124.54	38.96	15.33
	(1) Maryland DNR provided this data 11/30/17 and indicated it is the full extent available.			TOTALS	3,404,103				1,468.1	329.9	643.26
FY15	Md Assoc. of Soil Conservation	Irvine Nature Center Site	Stream Restoration	Baltimore	1,951,000	Construction			3363	2625	850
FY14	Druid Heights CDC	Gateway Park in Druid Heights	Stormwater Management	Baltimore City	200,000	Design/Planning			0.26	0.01	0.01
FY19	Park School	Moores Branch Stream Restoration	Stream Restoration	Baltimore	975,206	Select Project Status -			538.11	338.16	207.8
FY19	Baltimore Tree Trust	Jones Falls Watershed	Tree Planting Projects	Baltimore	105,263	Construction			33.3	4.2	1.39
	(1) Maryland DNR provided this data 11/30/17 and indicated it is the full extent available.			TOTALS	9,794,675				6,663.4	3,615.6	2,343.24

F.3. Monitoring

F.3.a. Water Quality – State Agencies

The Maryland Department of Natural Resources (DNR) monitoring is focused entirely on the Jones Falls' receiving waters in the Patapsco River / Inner Harbor as summarized below. The most recent information for Patapsco River tidal waters was summarized for the 2013-2015 time period by DNR. However the following summary information is excerpted from a preliminary report prior to its public availability:

- Water quality in the tidal waters of the Patapsco River is fair because nitrogen levels are too high. Phosphorus and sediment levels have improved. Habitat quality for underwater grasses is poor due to high algal densities and poor water clarity. Severe algal blooms are common in the Patapsco in the summer. Habitat quality for bottom dwelling animals is poor and has gotten worse. Patapsco River nitrogen, phosphorus and sediment levels and algal densities are low to moderate compared to other rivers, and water clarity is better than in other high developed rivers basins. However, summer bottom dissolved oxygen levels in the Patapsco River are the lowest of all rivers in Maryland and greatly degraded. [19]

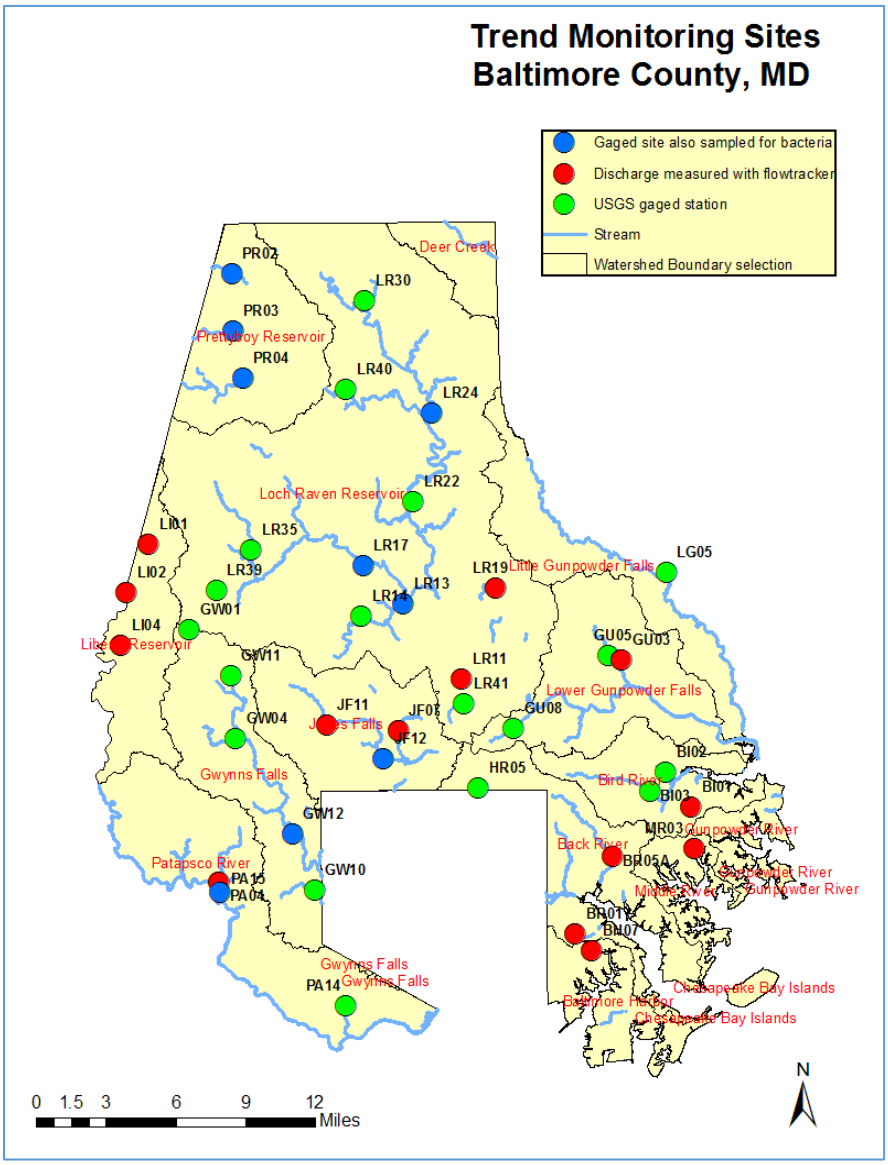
Neither DNR nor MDE are conducting nontidal monitoring water quality monitoring in the Jones Falls watershed. The monitoring projects funded by the 319(h) Grant are not active in this watershed. [20, 21]

[19] DNR. *Water Quality Summary 2013-2015*. Preliminary report received via personal communication 11/6/17.
[20] Maryland Department of the Environment. MDE Targeted Watershed Project. 319(h) Grant FFY2017 Project 4.
[21] Maryland Department of the Environment. MDE Biological Assessment for Water Quality Protection and TMDL Implementation. 319(h) Grant FFY2017 Project 5.

F.3.b. Nontidal – Water Quality Baltimore County

Each year Baltimore County MS4 reports to meet their MS4 permit requirements. [22] In their report, findings from monitoring are summarized. The distribution of countywide water quality monitoring stations in Baltimore County is shown in the adjacent map.

According to the County, their Jones Falls water quality monitoring stations are showing the following trends for pollutant concentrations (2018 County MS4 report Table 9-20 page 9-52):
-- Nitrogen slope = -0.9444
-- Phosphorus slope = -0.0885
-- Sediment slope = -7.6183
(A negative slope indicates reduced pollutant load and improving water quality).



Baltimore County trend monitoring sites. (2018 County MS4 report Figure 9-21 page 9-45)

Jones Falls Pollutant Load Analysis, Standardized by Drainage Area Acreage, 2017

Site	Drainage Area (ac)	TSS	Nitrate / Nitrite	Total Nitrogen	Total Phosphorus	Chloride	Sodium
JF07	3,111.86	8.15	4.46	5.28	0.26	318.03	131.99
JF11	7,986.54	7.84	4.00	4.42	0.24	109.85	37.55
JF12	16,181.91	17.29	3.54	4.25	0.24	179.18	71.21

As shown in the table above, the County also estimated pollutant loads at their three Jones Falls stations. (2018 County MS4 report, Table 9-19 page 9-46).

[22] Baltimore County. NPDES Municipal Stormwater Discharge Permit 2018 Annual Report. December 21, 2018.

F.3.c. Nontidal Bacteria -- Baltimore County

Baltimore County also conducts bacteria monitoring at the stations shown in the map below. There are six bacteria trend monitoring sites in the Jones Falls. Three of the monitoring sites are in the city and three are in the county. The table on the next page presents the number of samples and the geometric mean for high (wet) flow and low (dry) flow by year. It also presents the geometric mean of all samples by year regardless of condition. The table is stratified by annual data (includes all data collected for the year) and seasonal data (includes only those samples collected between May 1st and September 30th each year). The next table provides the frequency of exceedance of single samples to the water quality standard (126 MPN). The zero percent exceedances are highlighted in green. These results are displayed graphically below the tables.

The County graphed E. coli geometric mean concentrations for both annual and seasonal flow periods stratified by flow condition as shown on the following pages (2018 County MS4 report Figures 9-50 thru 9-64, pages 9-83 thru 9-86). The County noted that samples taken in 2016 were almost completely during low flows.

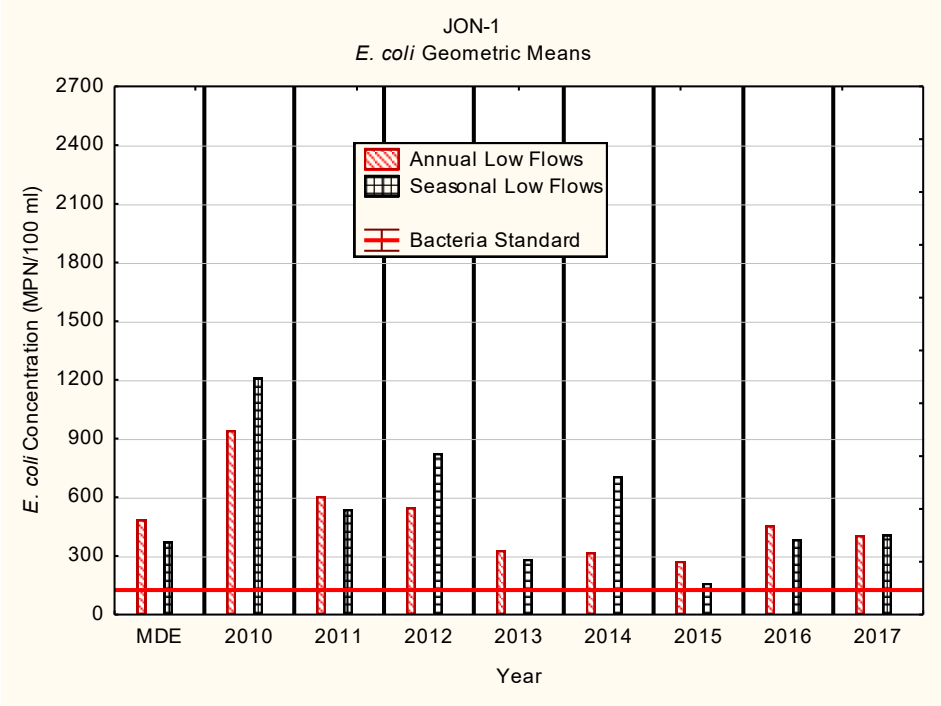
Map: Baltimore County bacteria monitoring sites. (2018 County MS4 report Figure 9-27 page 9-54)

Jones Falls E. coli Results on an Annual and Seasonal Basis (2018 County MS4 Report Table 9-36 page 9-82, 9-83)

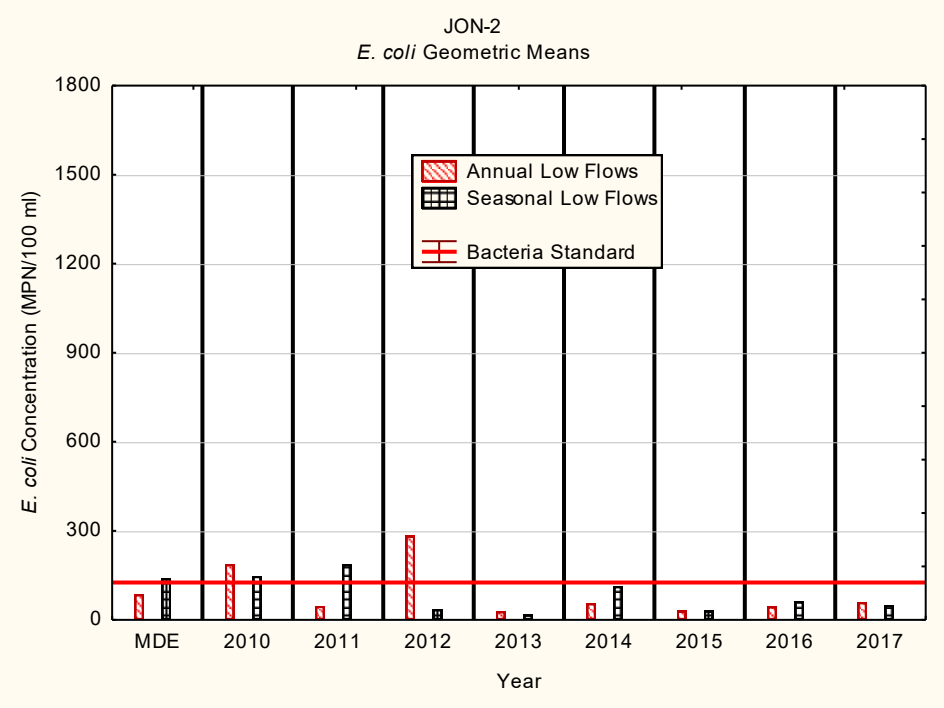
Annual (MPN/100 ml)													
Site	**Flow Type**	**2012**		**2013**		**2014**		**2015**		**2016**		**2017**	
		N	**MPN**	**N**	**MPN**	**N**	**MPN**	**N**	**MPN**	**N**	**MPN**	**N**	**MPN**
JON-1 City	High	3	***98***	2	2,420	3	1684	3	930	1	2420	0	
	Low	8	547	8	328	8	317	8	273	7	455	6	405
	All	11	342	10	489	11	500	11	341	8	561	6	405
JON-2	High	3	***32***	2	***24***	4	442	3	840	1	980	0	
	Low	9	283	10	***28***	7	***55***	8	***30***	7	***45***	6	***59***
	All	12	***55***	12	***27***	11	***117***	11	***80***	8	***66***	6	***59***
JON-3	High	3	240	2	748	4	751	3	300	1	517	0	
	Low	9	***94***	10	***82***	8	***104***	8	***95***	8	205	6	175
	All	12	***119***	12	***118***	12	201	11	145	9	230	6	175
JON-4	High	3	449	2	2,420	4	688	3	508	1	727	0	
	Low	9	***64***	10	***60***	8	186	8	***125***	8	249	6	265
	All	12	***105***	12	***110***	12	288	11	191	9	285	6	265
JON-5 City	High	3	200	2	2,420	4	1151	3	721	2	1414	0	
	Low	9	182	9	200	8	230	8	167	7	155	6	158
	All	12	186	11	315	12	394	11	249	9	204	6	158
JF-B-12	High							4	528	2	2192	2	2420
	Low							13	284	14	275	15	***71***
	All							17	329	16	357	17	***108***
JF-B-13	High							4	697	2	1043	2	2420
	Low							12	237	14	480	15	212
	All							16	310	16	529	17	282
Seasonal (May 1st to September 30th) (MPN/100 ml)													
Site	**Flow Type**	**2012**		**2013**		**2014**		**2015**		**2016**			
		N	**MPN**	**N**	**MPN**	**N**	**MPN**	**N**	**MPN**	**N**	**MPN**	**N**	**MPN**
JON-1 City	High	1	**	1	2,420	2	2420	1	1046	0		0	
	Low	4	824	4	283	3	706	3	161	4	384	4	408
	All	5	215	5	434	5	1155	4	257	4	384	4	408
JON-2	High	1	***75***	1	***63***	2	1087	1	1553	0		0	
	Low	4	***35***	4	***17***	2	***113***	3	***30***	4	***61***	3	***49***
	All	5	***40***	5	***49***	4	351	4	***81***	4	***61***	3	***49***
JON-3	High	1	387	1	770	2	1053	1	866	0		0	
	Low	4	254	4	266	3	549	3	188	4	265	3	448
	All	5	277	5	329	5	712	4	276	4	265	3	448
JON-4	High	1	210	1	2,420	2	1365	1	2420	0		0	
	Low	4	251	4	152	3	305	3	295	4	354	3	713
	All	5	242	5	684	5	555	4	500	4	354	3	713
JON-5 City	High	1	166	1	2,420	2	1773	1	1414	0		0	
	Low	4	***93***	4	479	3	372	3	376	4	205	3	173
	All	5	***105***	5	662	5	695	4	524	4	205	3	173
JF-B-12	High							2	1000	0		1	2420
	Low							8	337	10	359	9	***115***
	All							10	419	10	359	10	156
JF-B-13	High							2	687	0		1	2420
	Low							8	295	10	532	9	282
	All							10	350	10	532	10	349

Frequency of Exceedance of Single Sample Water Quality Standards (County 2018 MS4 Report Table 9-37 page 9-89)

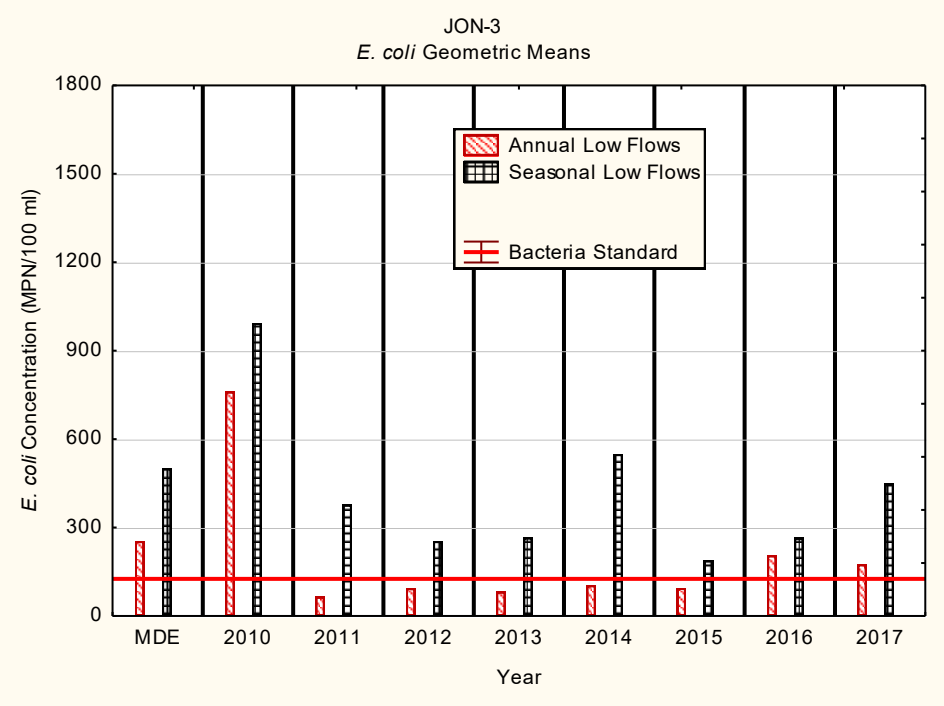
Site	Year	N		Percent Single Sample Exceedance (MPN)							
		Flow Type		576		410		298		235	
		High	Low	High	Low	High	Low	High	Low	High	Low
JON-1	2013	1	4	100%	25%	100%	25%	100%	50%	100%	75%
	2014	2	3	100%	100%	100%	100%	100%	100%	100%	100%
	2015	1	3	100%	0%	100%	0%	100%	0%	100%	0%
	2016	0	4		25%		25%		50%		75%
	2017	0	4		25%		50%		75%		75%
JON-2	2013	1	4	0%	0%	0%	0%	0%	0%	0%	0%
	2014	2	2	50%	0%	100%	0%	100%	0%	100%	0%
	2015	1	3	100%	0%	100%	0%	100%	0%	100%	0%
	2016	0	4		0%		0%		0%		0%
	2017	0	3		0%		0%		33%		33%
JON-3	2013	1	4	100%	50%	100%	50%	100%	50%	100%	50%
	2014	2	3	100%	67%	100%	67%	100%	67%	100%	100%
	2015	1	3	100%	0%	100%	0%	100%	67%	100%	67%
	2016	0	4		0%		50%		50%		75%
	2017	0	3		33%		33%		33%		67%
JON-4	2013	1	4	100%	25%	100%	25%	100%	25%	100%	25%
	2014	2	3	100%	0%	100%	33%	100%	67%	100%	67%
	2015	1	3	100%	0%	100%	33%	100%	33%	100%	67%
	2016	0	4		50%		50%		75%		75%
	2017	0	3		33%		67%		100%		100%
JON-5	2013	1	4	100%	25%	100%	25%	100%	25%	100%	75%
	2014	2	3	100%	0%	100%	33%	100%	67%	100%	100%
	2015	1	3	100%	67%	100%	67%	100%	100%	100%	100%
	2016	0	4		0%		0%		25%		25%
	2017	0	3		0%		33%		33%		33%
JF-B-12	2015	2	8	100%	25%	100%	25%	100%	63%	100%	63%
	2016	0	10		40%		50%		50%		60%
	2017	1	9	100%	11%	100%	33%	100%	33%	100%	33%
JF-B-13	2015	2	8	100%	13%	100%	13%	100%	38%	100%	63%
	2016	0	10		30%		40%		80%		90%
	2017	1	9	100%	22%	100%	33%	100%	44%	100%	44%



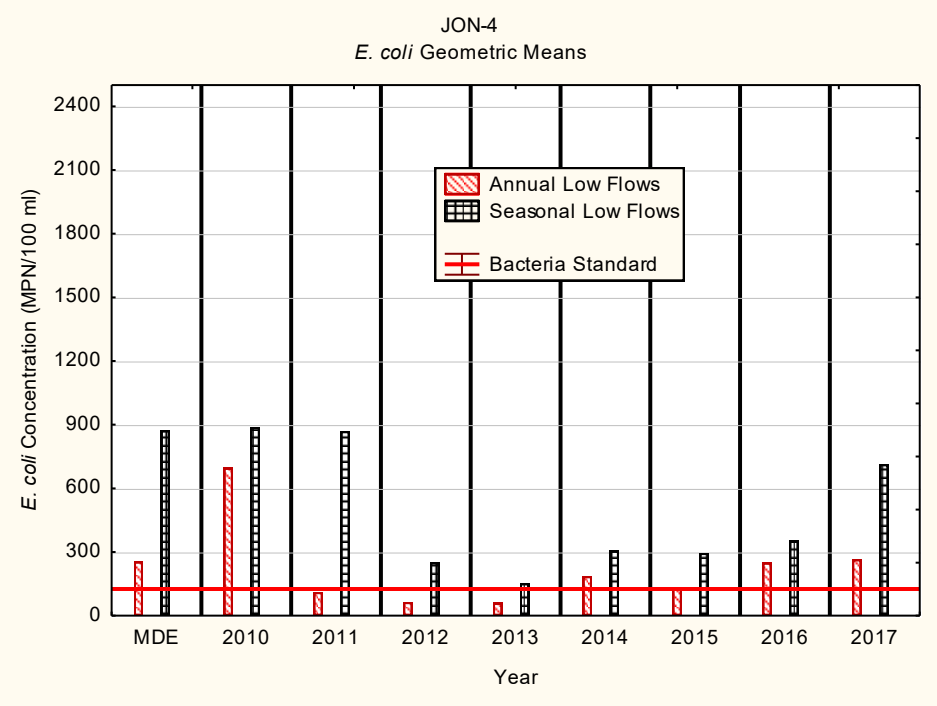
JON-1: County analysis indicates conditions are worsening at this station based on comparing MDE sampling in 2002-2003 and later county sampling.



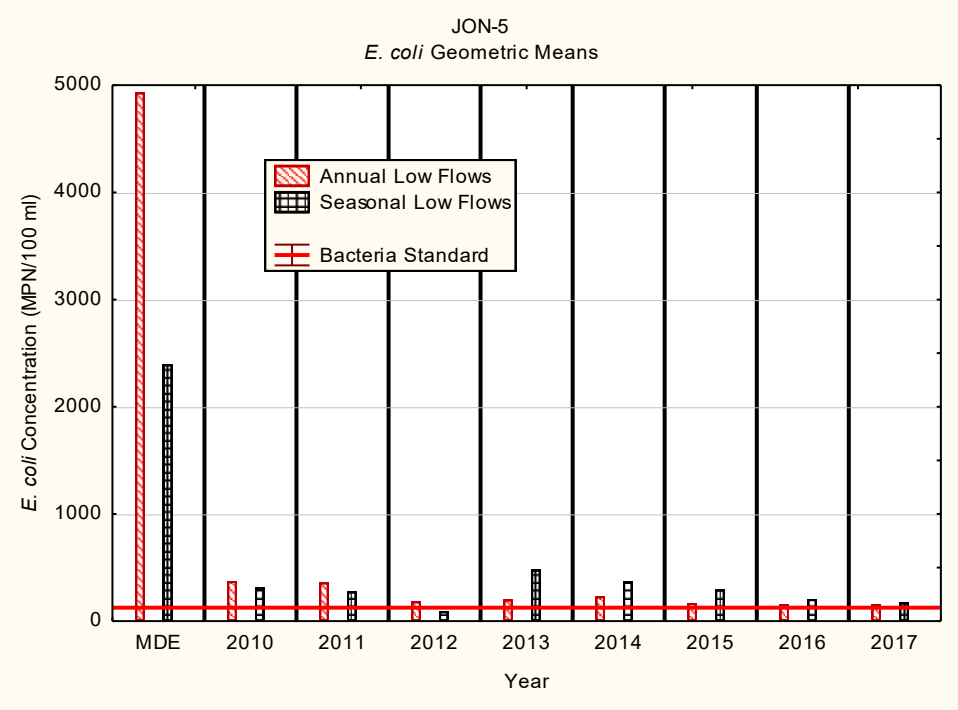
JON-2: County analysis indicates an improvement at this station based on comparing MDE sampling in 2002-2003 and later county sampling.



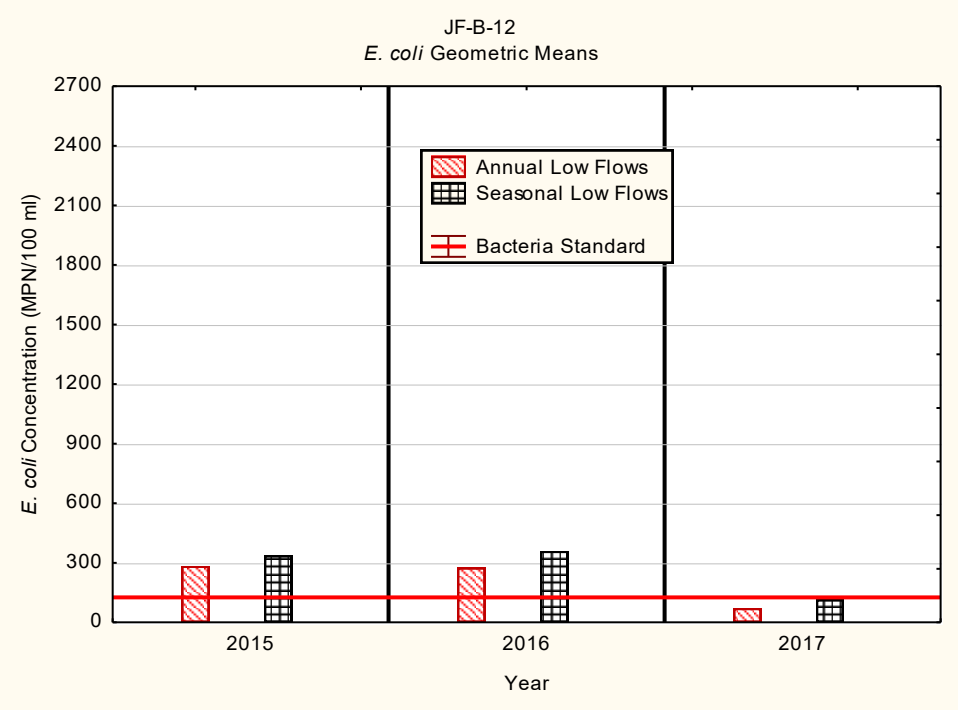
JON-3: County analysis indicates an improvement at this station based on comparing MDE sampling in 2002-2003 and later county sampling.



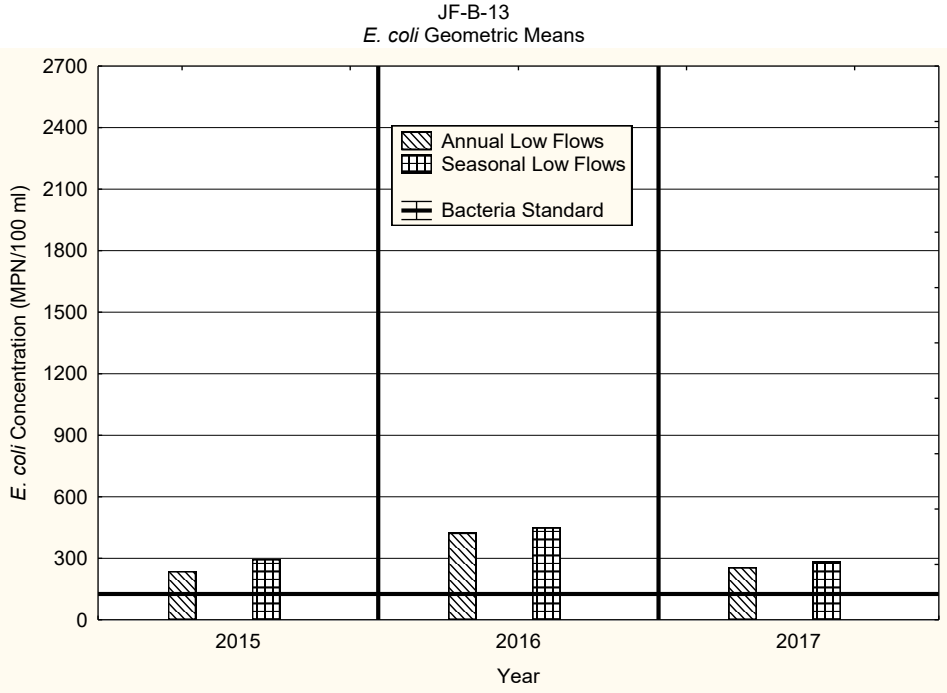
JON-4: County analysis indicates an improvement at this station based on comparing MDE sampling in 2002-2003 and later county sampling.



JON-5: County analysis indicates significant improvement at this station based on comparing MDE sampling in 2002-2003 and later county sampling.



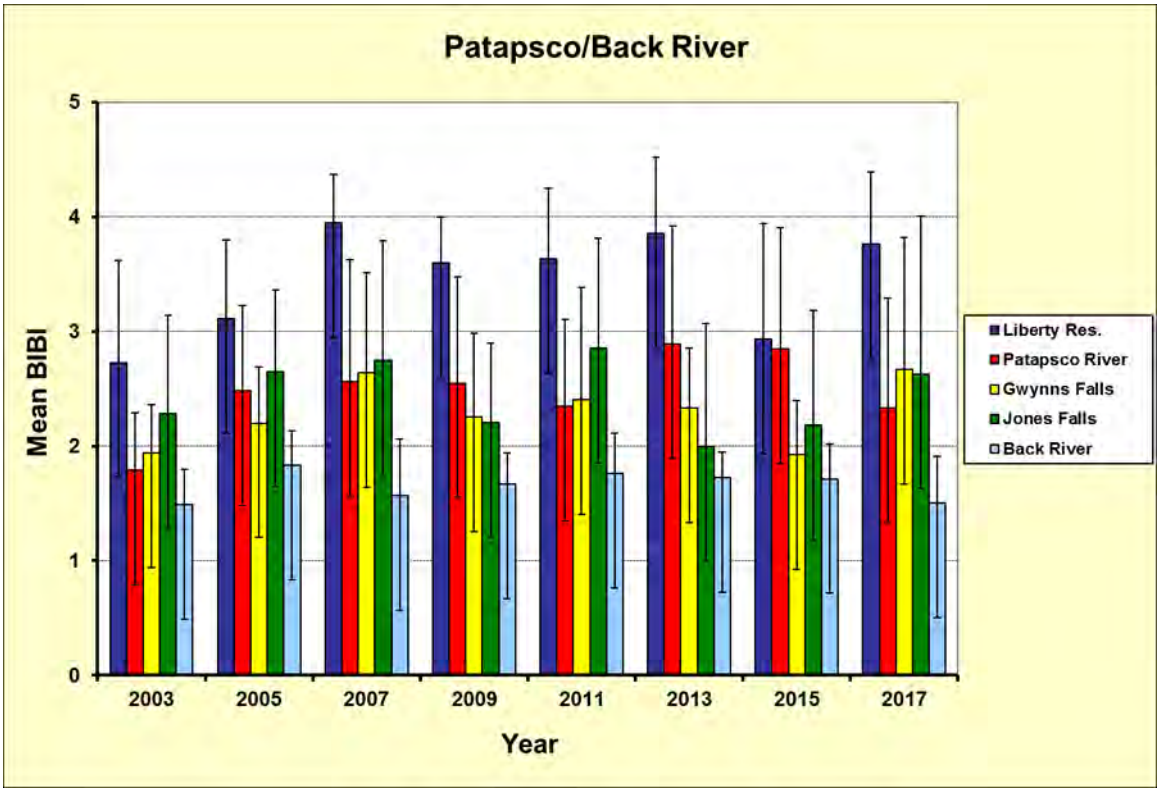
JF-B-12: County analysis over the three years of sampling, low flows have shown a decreasing trend, with both annual and seasonal low flows below the water quality standard for the first time in 2017.



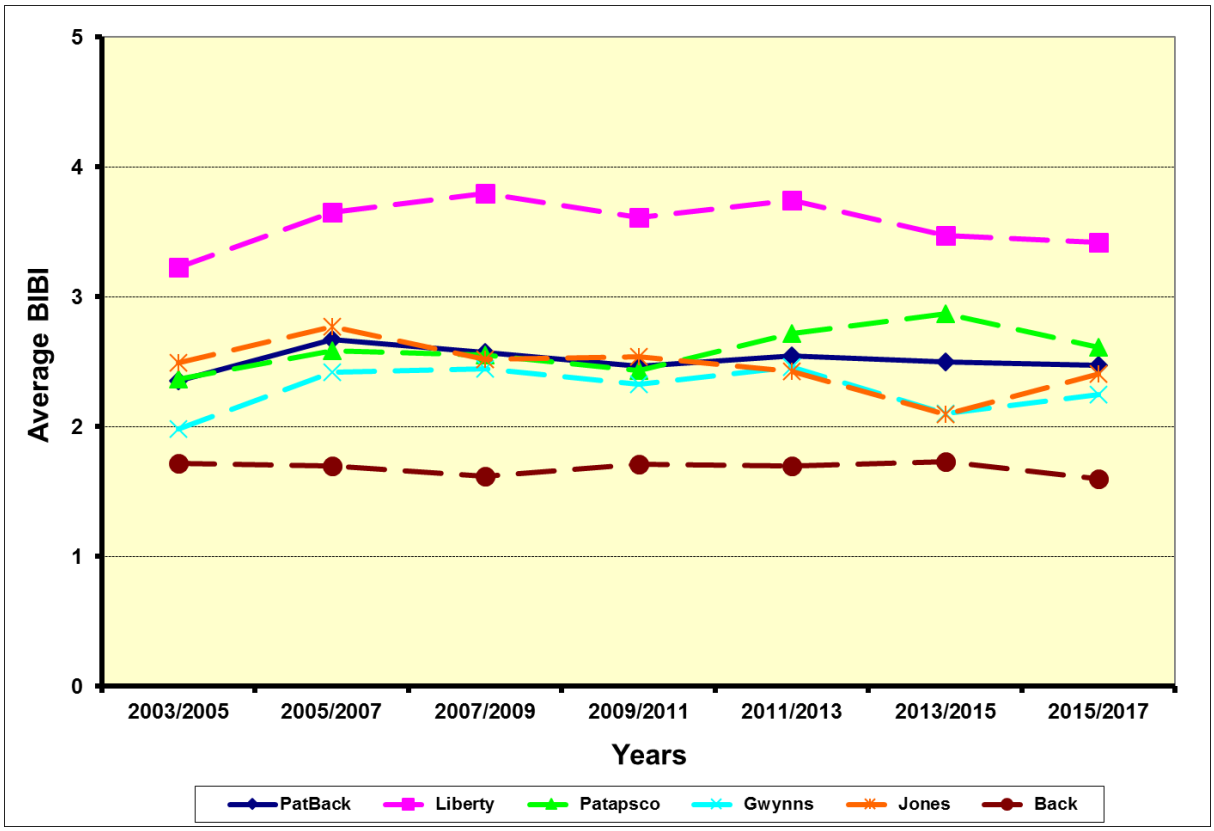
JF-B-13: A third year of monitoring resulted in observed geometric means close to those observed during the first year of monitoring, resulting in essentially flat trends over the three years of monitoring. However, the aggregate geometric mean for seasonal low flows decreased from 409 MPN/100ml in 2016 to 362 MPN/100ml in 2017. Additional monitoring should reveal more definite trends in this branch of Western Run.

F.3.d. Nontidal Biology – Baltimore County

One the five biological monitoring programs conducted by Baltimore County is to assess ecological health of stream using a probabilistic monitoring approach in freshwater and tidal waters using the Maryland Biological Stream Survey protocol. County-wide fifty randomly selected sites are monitored annually. Baltimore County visits its 319 priority watersheds every other year. The MBSS system is used to rank the conditions observed as summarized in the two graphs below (Very Poor = 1.00 thru 1.99, Poor = 2.00 thru 2.99, Fair = 3.00 thru 3.99, Good = 4.00 thru 4.99):



Means and one standard deviation of BIBI scores between 2003 and 2017
(2018 County MS4 report page 9-102)



BIBI rolling averages for probabilistic monitoring sites between 2003 and 2017.
(2018 County MS4 report Figure 9-67, page 9-105)

F.3.e. Tidal Biology – Baltimore County

Since 2013 Baltimore County has conducted random tidal benthic sampling using the Chesapeake Bay Benthic Index of Biological Integrity. County reporting did not indicate that the tidal receiving waters of the Jones Falls was part of this program (2018 County MS4 report page 9-119).

Appendix G: Lower Monocacy River Watershed in Frederick County, Maryland
Watershed Eligible for 319(h) Grant Implementation Funding

G.1 Introduction

The *Lower Monocacy River Watershed Restoration Action Strategy Supplement* was completed by Frederick County in July 2008 and EPA accepted the plan 7/30/2008. The watershed plan can be viewed here: https://mde.maryland.gov/programs/Water/319NonPointSource/Documents/Watershed%20Plans/A-I_EPA_Accepted_Plans/Lower_Monocacy.pdf.The part of the watershed encompassed by the watershed plan is the Frederick County portion of the watershed. (Small upstream portions of the watershed are in Carroll and Montgomery Counties, Maryland.)

Total pollutant reduction goals over 25 years are presented in the watershed plan page 11:

- Nitrogen 649,998 pounds,
- Phosphorus 68,952 pounds,
- Sediment/total suspended solids 10,345 U.S. short tons.

Additional specific goals are:

- Pollutant load reduction for agricultural BMPs (Table J of the watershed plan) and urban BMPs (Table K of the watershed plan)
- Agricultural BMP implementation goals: Table R on page 22.
- Urban BMP implementation goals: Table T on page 25.

Base Year for watershed plan implementation is 2003. Pollutant load reductions that year and thereafter can be counted toward meeting watershed plan goals. The Lake Linganore phosphorus and sediment TMDL described in Section 2.2 page 5 of the watershed plan indicates that monitoring data used for the TMDL was collected in 2002. The 2008 Lower Monocacy watershed plan goals for nitrogen, phosphorus and sediment reduction are based on Tributary Strategy goals and County calculations. The 2008 plan does not address more recent TMDLs.

G.2 Milestones

Maryland's 2015-2019 NPS Management Plan Obj. 5 has two milestones for this watershed:

- Annually: Report progress in the 319 Annual Report, and
- In 2018 assess plan implementation progress and in 2019 update plan if needed. During SFY19, MDE will be consulting with Frederick County in regards to whether a watershed plan update is needed.

G.3 Water Quality

G.3.a State Agency Information

According to Maryland DNR[23], measured nitrogen levels decreased in the Monocacy River and Seneca Creek. Catoctin Creek nitrogen levels decreased when changes in river flow are accounted for. Measured phosphorus levels decreased at most of the stations in the Middle Potomac, but the trends were not significant when the effect of changes in river flow is accounted for. Only one station in Catoctin Creek has a significant decrease in sediment levels.

[23] DNR. *Water Quality Summary 2013-2015*. Preliminary report received via personal communication 11/6/17.

MDE nontidal monitoring projects funded by the 319(h) Grant have not been active in the Lower Monocacy River watershed. [24, 25]

G.3.b Frederick County MS4 Permit Reporting

To meet requirements of its municipal separate sewer system (MS4) permit, Frederick County is monitoring Peter Pan Run, which is tributary to Bush Creek and the Lower Monocacy River. According to the most recent report [26]:

- Monitoring in Peter Pan Run is designed to build a long-term database of water quality and biological conditions and to assess the cumulative effects of restoration projects in the watershed. The program was initiated in 1999 to monitor and assess the effects of stormwater runoff from development in the watershed.
- May 1999 monitoring established the baseline pre-construction conditions within the Peter Pan Run watershed. That year construction began on a planned unit development (PUD), which is now a 3,500 residential unit, mixed-use development that also includes substantial commercial and office space. Construction on the PUD is continuing to add 200 to 300 residential units annually.
- The long term monitoring program involves monitoring flow volumes and water quality from both in-stream and SWM pond outfall stations. It includes monitoring physical and biological conditions at four permanent stations.
- Frederick County's SWM database for this watershed lists:
  - 21 extended detention dry ponds and 10 extended detention wet ponds
  - 5 combination sand filter and extended detention ponds
  - 3 sand filters, 2 infiltration trenches and 1 wet pond
  - 2 constructed swallow marshes and 1 reforestation of urban land on 0.25 acres

The following pages show water quality trend information extracted from the report.

According to the report, a statistical analysis was performed on the individual storm EMC data from 1999 to the present to the in-stream station (Kendall's Tau correlation):

- TKN: statistically significant trend upward ($T_b = 0.156$, $p = 0.002$)
- Nitrate and nitrite: statistically significant trend downward ($T = -0.299$, $p =< 0.0001$) (see below Figure G1)
- TSS: A plot of TSS estimated mean concentrations (EMCs) by storm event did not show a discernible trend (see below Figure G2).

[24] Maryland Department of the Environment. MDE Targeted Watershed Project. 319(h) Grant FFY2017 Project 4.
[25] Maryland Department of the Environment. MDE Biological Assessment for Water Quality Protection and TMDL Implementation. 319(h) Grant FFY2017 Project 5.
[26] Frederick County 2018 MS4 Annual Report, Appendix T: Assessment of Controls Peter Pan Run Monitoring July 2016 – June 2018 Report. Prepared for the Frederick County Office of Sustainability and Environmental Resources. December 5, 2017

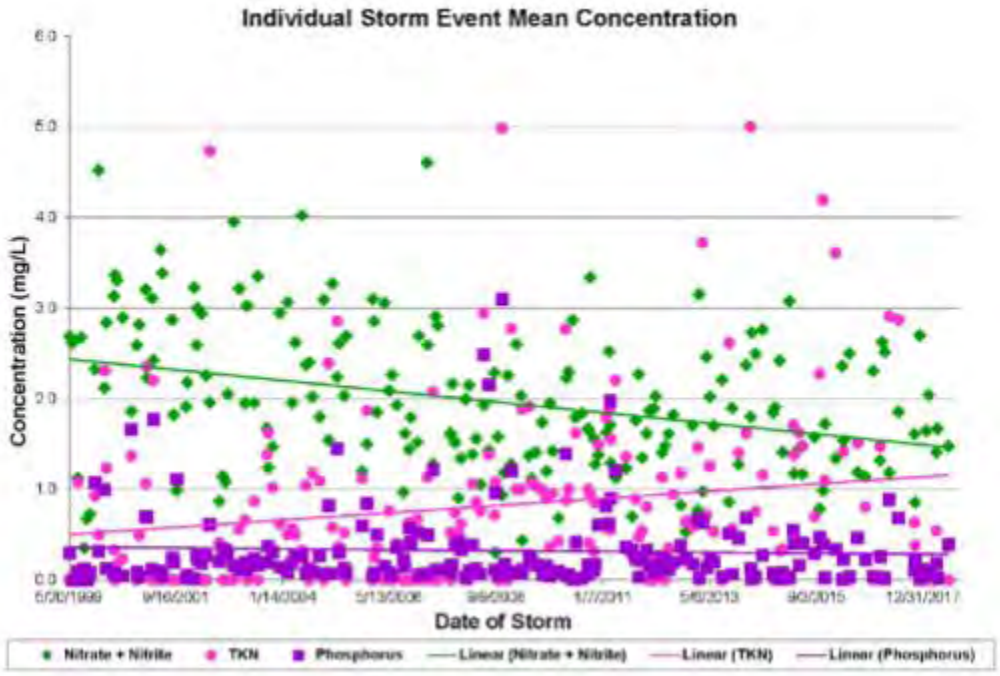


Figure G1: In-stream TKN + NO2/3 EMCs, 1999-2018

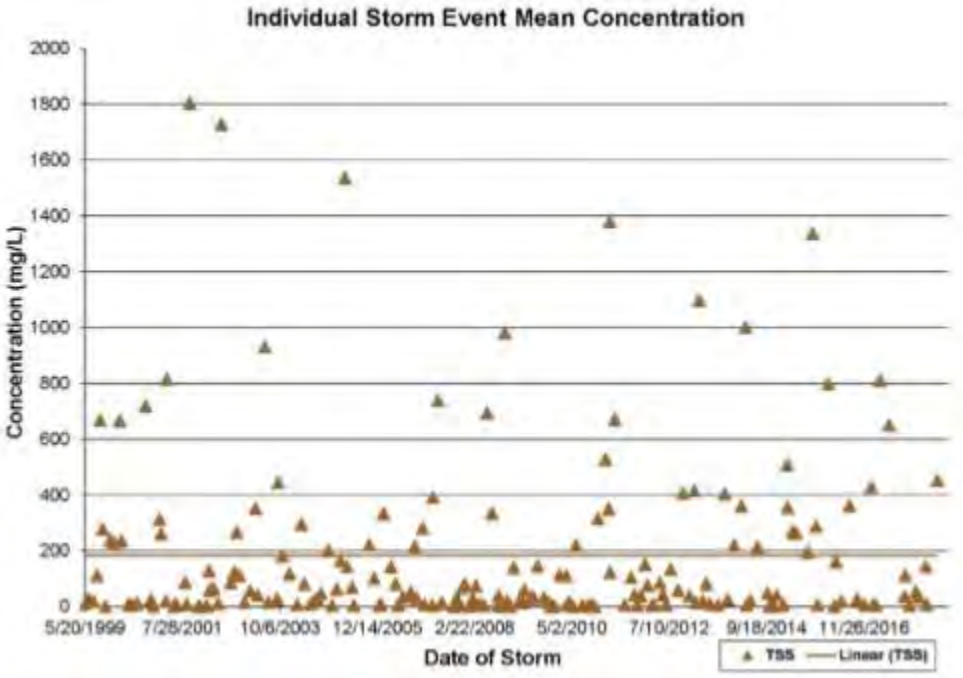


Figure G2: In-stream TSS EMCs, 1999-2018

Lower Monocacy River Watershed
1992-SFY18 Completed NPS Implementation Projects - 319(h) Grant and State Revolving Fund

Project Summary			Project Expenditures					Pollutant Load Reduction		
Area/Lead	Name/Description	End Date	Grant Funding Source	Grant Funds		Non Federal Match	Total	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)
				Federal	State					
MDA with Frederick SCD	Monocacy Agri Enforcement		319 FFY1992 #4	$55,530	Grant budget amount is shown. Expenditure data is not available.			Completed projects shaded grey predate the baseline year for the watershed plan and are not counted toward implementation progress reporting. Blank spaces indicate that information was not available.		
	Moncacy Eng Tech / SCS		319 FFY1992 #5	$52,000						
	Monocacy Demo Monitor/Model		319 FFY1992 #9	$71,438						
	Engineering Support - Monocacy	1994	319 FFY1993 #6							
	Monocacy Watershed Initiative		319 FFY1994 #2							
	Monocacy Watershed	1996	319 FFY1995 #14	$83,190						
	Agricultural Implementation	2006	319 FFY04 #23	$74,767.61		$49,845.07	$124,612.68	1,296.3	171.6	4.7
	Agricultural Implementation	2008	319 FFY04 #39	$35,000.00		$23,333.33	$58,333.33	609.64	118.36	10
Frederick County	Watershed Restoration	2008	319 FFY05 #17	$216,237.00		$144,158.00	$360,395.00	615.9	43.9	8.2
	Urban Wetlands, Bennett Creek Pilot	2011	319 FFY07 #4	$196,732.92		$131,155.28	$327,888.20	101.3	18.5	1.6
		2012	319 FFY08 #4	$228,361.26		$152,240.84	$380,602.10	149.9	31.4	2.782
	Green Infrastructure	2013	319 FFY10 #9	$284,739.42		$189,826.28	$572,971.98	350.94	34.13	4.07
	Neighborhood Green Infrastructure	SFY16	319 FFY13 #7	$89,106.78		$59,404.52	$148,511.30	30.3	0.43	0.93
NGO (1)	Villages of Lake Linganore Stormwater Project	SFY17	SRF		$6,346,142	$7,800,000	$14,146,142	Unknown	Unknown	Unknown
			TOTAL for completed projects	$1,387,102.99	$6,346,142.00	$8,549,963.33	$16,119,456.60	3,154.3	418.3	32.28

For nitrogen, phosphorus and sediment, BMPs installed 2003 and later can be counted toward watershed plan implementation.

Lower Monocacy River Watershed
SFY 2018 NPS Implementation Project In Progress - 319(h) Grant and State Revolving Fund

Project Summary			Project Funding					Projected Pollutant Load Reduction		
Area/Lead	Name/Dsescription	End Date	Grant Funding Source	Grant Funds		Non Federal Match	Total	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)
				Federal	State					
All	No SRF Projects in SFY18									
City of Frederick	Rock Creek Stream Restoration	2019	319 FFY17 #9	$270,000		$180,000	$450,000	94	85	28

Lower Monocacy River Falls Watershed
Chesapeake and Atlantic Coastal Bays Trust Fund
SFY 2018 NPS Implementation Project Status (1)

Year Funded	PartnerCD	ProjectTitle	ProjectType	County	TrustFund Dollars	Status	BMP Units	BMPs Reported	Annual LbsN	Annual LbsP	Annual TonsTSS
SFY14	Center for Watershed Protection	Hood College, Whitaker Parking lot / Rosenstock Hall	Stormwater Management	Frederick	36,923.00	Complete			3.5	0.4	0.2545
		Hood College, North of Coffman Chapel	Stormwater Management	Frederick	56,550.00	Complete			26.4	1.9	0.8665
	City of Frederick	Walnut Ridge (City Stream Restoration and Educational Projects)	Tree Planting Projects	Frederick	19,484.40	Complete	acres	4	114.9	7.7	1.36
		Waterford Park (City Stream Restoration and Educational Projects)	Tree Planting Projects	Frederick	52,607.88	Complete	acres	10.8	310.2	20.7	3.6700001
		Carroll Creek/Baker Park (I) (City Stream Restoration and Educational Projects)	Tree Planting Projects	Frederick	12,664.86	Complete	acres	2.6	74.7	5.0	0.88
		Carroll Creek/Baker Park (II)	Tree Planting Projects	Frederick	10,716.42	Complete	acres	2.2	63.2	4.2	0.75
		Carroll Creek/Baker Park (III) (City Stream Restoration and Educational Projects)	Tree Planting Projects	Frederick	34,097.70	Complete	acres	7	201.0	13.4	2.3800001
		Old Camp Park (City Stream Restoration and Educational Projects)	Tree Planting Projects	Frederick	1,948.44	Complete	acres	0.4	11.5	0.8	0.14
		Rivermist, City Parkland (City Stream Restoration and Educational Projects)	Tree Planting Projects	Frederick	2,435.55	Complete	acres	0.5	14.4	1.0	0.17
		Career & Technology Center (City Stream Restoration and Educational Projects)	Education & Outreach	Frederick	19,877.00	Complete	acres	0.9	0.0	0.0	0
		Fredericktowne Village Park (City Stream Restoration and Educational Projects)	Tree Planting Projects	Frederick	23,868.39	Complete	acres	4.9	104.7	9.4	1.67
	Frederick County	Crestwood Middle School (County Riparian Buffers Streams - Student & Community Collaborative Service)	Tree Planting Projects	Frederick	6,168.65	Complete	acres	2	11.5	0.8	0.126
	Frederick County	Mountain Village HOA (County Riparian Buffers Streams - Student & Community Collaborative Service)	Tree Planting Projects	Frederick	9,107.80	Complete	acres	2.5	14.3	1.0	0.1575
	Land and Cultural Preservation Fund	Dearbought Park	Tree Planting Projects	Frederick	2,721.65	Complete	acres	0.33	9.7	0.4	0.07
	Potomac Conservancy	Schipper - Buffer	Agricultural Practices	Frederick	11,215.00	Complete			289.0	12.0	2.22
		Glick - fencing & grassed waterway	Agricultural Practices	Frederick	11,298.23	Complete			11.7	0.0	3.04
		Wetzel	Agricultural Practices	Frederick	2,018.00	Complete			118.0	4.2	0.92
		Trimmer	Agricultural Practices	Frederick	12,300.00	Complete			177.0	7.3	1.359
SFY15	Delmarva RC & D Council	Cassis	Wetland Restoration	Frederick	2,460.00	Complete			2.2	0.2	0.01
	Maryland Forestry Board Foundation	Reid Reforestation	Tree Planting Projects	Frederick	5,231.00	Complete	acres	1.6	0.0	1.0	0.23
		Friends Meeting School Reforestation	Tree Planting Projects	Frederick	9,808.00	Complete	acres	3	1.0	1.0	0.43
		Stoneking Reforestation	Tree Planting Projects	Frederick	6,539.00	Complete	acres	2	0.0	1.0	0.28
		Danny White	Tree Planting Projects	Frederick	3,000.00	Complete			7.7	0.2	0.05
FY18	Maryland Forestry Board Foundation	McKnight	Tree Planting Projects	Frederick	15,314.00	Complete			18.62	0.92	0.17
		Lake Linganore HOA	Tree Planting Projects	Frederick	8,302.00	Complete			8.55	1.35	0.25
		Day	Tree Planting Projects	Frederick	24,305.00	Complete			28.5	4.5	0.85
	(1) Maryland DNR provided this data 2/21/17 and indicated it is the full extent available.			TOTALS	400,961.97				1,622.3	100.3	22.31
FY19	Maryland Forestry Board F	Thomas Bunk	Tree Planting Projects	Frederick	26044	Design/Planning			29.09	1.43	0.27
FY19	Maryland Forestry Board F	Tess McGaw	Tree Planting Projects	Frederick	7813	Design/Planning			8.73	0.43	0.08
FY19	Maryland Forestry Board F	David Waszkiewicz	Tree Planting Projects	Frederick	10417	Design/Planning			33.2	2.07	1.88
FY19	Maryland Forestry Board F	Jim Werner	Tree Planting Projects	Frederick	7813	Design/Planning			8.73	0.43	0.08
FY19	Maryland Forestry Board F	Brandon Jaworski	Tree Planting Projects	Frederick	5209	Design/Planning			16.61	1.04	0.94
FY19	Frederick County	Transit Pond B	Stormwater Management	Frederick	48275	Permit			16.97	2.58	0.98
FY19	Frederick County	Dudrow Pond	Stormwater Management	Frederick	306570	Permit			420.87	64.18	24.47
FY19	Frederick County	Extension Services BMPs	Stormwater Management	Frederick	40000	Permit			6.24	0.41	0.11
	(1) Maryland DNR provided this data 2/21/17 and indicated it is the full extent available.			TOTALS	452,141.00				540.4	72.6	28.8

SFY2018 Agricultural BMP Implementation
Lower Monocacy River Watershed
In Frederick County, Maryland

Agricultural Best Management Practice	Unit	SFY18 Total	Estimated Pollutant Load Reduction: Nitrogen Total (lbs)	Phosphorus Total (lbs)	Sediment Total (tons)
Annual Practices					
Cover Crops	acres	11,200	144,149.8	879.4	753.6
Multi-Year Practices					
Alternative Crops	acres				
Amendments re: Treatment of Ag Was	AU				
Animal Mortality Facility	count				
Conservation Cover	acres				
Conservation Plans/SCWQP	acres	2,476	4,392.3	399.1	298.4
Critical Area Planting	acres				
Dead Bird Composting Facility	count				
Fencing	feet	5841	712,714.3	62,622.3	16,736.3
Field Border	acres				
Filter Strip	acres				
Grassed Waterway	acres	2.5	117.3	3.6	1.9
Horse Pasture Management	acres				
Loafing Lot Management System	acres	0.63	37.8	5.7	0.5
Pasture & Hay Planting*	acres	12.8	0	2	0
Prescribed Grazing*	acres	125.8	211	20.1	0.29
P-sorbing Materials	acres				
Riparian Forest Buffer	acres				
Riparian Herbaceous Cover	acres				
Roof Runoff Structure	count	4	243.9	40.0	3.0
Stream Restoration Ag	feet	60			2.7
Tree/Shrub Establishment	acres				
Waste Storage Facility	count	3	383.1	4.9	
Wastewater Treatment Strip	acres				
Water Control Structure†	count	7	0.0	0.0	0.00
Watering Facility	count	16		22.5	4.35
Wetland Creation	acres				
Wetland Restoration	acres				
Windbreak/Shelterbelt Establishment	feet				
Total Annual Practices			144,149.8	879.4	753.57
Total Multi-year Practices			718,100.1	63,120.0	17,047.36
Total Pollutant Load Reduction			862,249.9	63,999.4	17,800.94

"SFY18 Total" column is MDA data. MDE estimated reductions w/ MAST.

The Maryland Department of Agriculture (MDA) defines annual practices as cover crops, nutrient mgmt, manure transport, conservation tillage & high residue tillage.

†Reductions could not be calculated with units reported

*Reductions for this practice were calculated using Phase 6 Chesapeake Assessment Scenario Tool output

Lower Monocacy River Watershed Plan
Agricultural BMP Implementation Goals

Management Practice Plan Table R	Goal	Unit	Progress: SFY17 Progress	SFY14 thru SFY17
Cover Crops	25,111	acres/yr	11,200	
				0
				0
				0
				26.3
Soil Conservation & Water Quality Pla	58,292	acres	2,476	13,065
				14.3
				0
				40884
Buffers Grass - Agriculture	789	acres	0	0
				0
				13.48
				0
				3.26
				58.9
				339.6
				0
Buffers Forested - Agriculture	2,233	acres	0	37.84
				2
				24
				60
Tree Planting - Agriculture	444	acres	0	14.3
Animal Waste Mgmt - Livestock	165	count	3	24
Animal Waste Mgmt - Poultry	3			
				0
				8
				74
Wetland - Agriculture	376	acres	0	0
				0
				0
Conservation Tillage	24,032	acres/yr		
Nutrient Management	47,897	acres		
Retirement of Highly Erodible Land	2,185	acres		
Stream Protection with Fencing	1,471	acres		
Stream Protection without Fencing	207	acres		

Prior Years Progress Toward Watershed Plan Goals

Extracted from State Data reported by MDE to EPA Bay Program

	SFY14	SFY15	SFY16	SFY17	Units
	0	0	0	0	acres
	0	0	0	0	AU
	0	0	0	0	count
	19	7.1	0	0	acres
	2,048	2467	3718	2356	acres
	9.6	4.6	0	0.1	acres
	0	0	0	0	count
	1147	31286	2591	19	feet
	0	0	0	0	acres
	0	0	0	0	acres
	0.41	4.87	2.1	3.6	acres
	0	0	0	0	acres
	0.56	0.54	0.1	1.43	acres
	0	9	37.1	0	acres
	3.8	164.2	45.8	0	acres
	0	0	0	0	acres
	0	13.8	0	24.04	acres
	0	2	0	0	acres
	3	1	5	11	count
	0	0	0	0	feet
	0.3	0	0	14	acres
	3	4	2	12	count
	0	0	0	0	acres
	1	0	0	0	count
	3	10	11	34	count
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	feet

SFY2018 Urban BMP Implementation

Lower Monocacy River Watershed In Frederick County, Maryland

Urban Management Practice	Unit	BMPs Reported	Estimated Pollutant Load Reduction		
			Nitrogen lb/yr	Phosphorus lb/yr	Sediment tons/yr
Bioretention (A)	acres				
Bioswale (A)	acres				
Cisterns & Rain Barrels (A)	acres				
Disconnection of Rooftop Runoff (A)	acres				
Dry Detention Ponds & Hydro Structures (A)*	acres	0.27	0.21	0.02	0.016
Dry Extended Detention Ponds (A)	acres				
Dry Well (A)	acres				
Filtering Practices (A)	acres				
Forest Conservation	acres				
Forest Harvesting Practices	acres				
Infiltration Practices (A)	acres				
Permeable Pavement (A)	acres				
Rain Garden (A)	acres				
Reduction of Impervious Surface (A)*	acres	2	1.33	0.00	0.115
Riparian Forest Buffers on Urban Lands (B)	acres				
Septics Connections to Sewers	count				
Septic Denitrification Critical Area	count				
Septic Denitrification outside of 1000 feet	count	1	3.6		
Septic Denitrification within 1000 feet	count	10	60.0		
Septic Tank Pumpout	count				
Stream Restoration Urban	feet				
New Stormwater Treatment	acres	15	94.23	5.95	7.022
New Runoff Reduction	acres	21	218.35	10.13	9.991
Street Sweeping (A)	acres				
Tree Planting	acres				
Urban Forest Buffer (B)	acres				
Wet Extended Detention (A)	acres				
Wet Ponds and Wetlands (A)	acres				
Urban TOTAL Pollutant Load Reduction			377.7	16.1	17.14

"BMPs Reported" column is MDE data. MDE used MAST to estimated pollution reduction.

Pollution load reduction is estimated by MDE using MAST.

*Reductions for this practice were calculated using Phase 6 Chesapeake Assessment Scenario Tool output

Lower Monocacy River Watershed Plan

Urban BMP Implementation Goals

Plan Page 25	Urban Management Practice	Goal	Unit	Progress	
				SFY17	SFY14-SFY17
					7.92
					0
					0.78
					0
					0
					5.32
					0
					0
					0
					0
					4.74
					0.59
					0.23
					2
					46.51
Table T	Septic Denitrification (upgrade & connection to sewer)	17,784	count	11	251
					0
Table T	Stream Restoration, Urban	956	feet	0	0
					0
Table T	Tree Planting (urban)	20	acres	0	0
					8.15
					0
					0
Table T	Nutrient Management mixed	18,461	acres		0
Table T	Nutrient Management urban	17,427	acres		0
Table T	Sediment & Erosion Control	1,460	acres		0
Table T	Buffers Forested, Urban (B)	73	acres	0	54.66
Table T	Stormwater Management (A)	6,780	acres	2	21.49

(A) Watershed plan goal "Stormwater Management" progress aggregates reporting for BMPs footnoted (A).

(B) Watershed plan goal "Buffers Forested, Urban" aggregates reporting for BMPs footnoted (B).

Prior Years Progress Toward Watershed Plan Goals

Prior to SFY14	Extracted from State Data reported by MDE to the EPA Bay Program				
	SFY14	SFY15	SFY16	SFY17	Units
Data by locals in annual reports is not compatible with this reporting methodology.	0.32	7.60	0	0	acres
	0	0	0	0	acres
	0	0.78	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	5.32	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	4.74	0	0	acres
	0	0.59	0	0	acres
	0	0.23	0	0	acres
	0	0	0	0	acres
	44.91	1.60	0	0	acres
	0	0	0	0	count
	0	0	0	0	count
	11	65	43	25	count
	16	10	35	35	count
	0	0	0	0	count
	0	0	0	0	feet
					acres
					acres
	0	0	0	0	acres
	0	0	0	0	acres
	7.15	1.00	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres

Appendix H: Middle Gwynns Falls in Baltimore City and Baltimore County, Maryland Watershed Eligible for 319(h) Grant Implementation Funding

H.1. Middle Gwynns Falls SWAP Overview

The *Middle Gywnns Falls Small Watershed Action Plan* (SWAP) was completed by Baltimore County in September 2013, an addendum was completed in April 2014, and the overall plan was accepted by EPA in April 2014. The part of the watershed encompassed by the watershed plan is the Baltimore County portion of the watershed. Downstream Baltimore City watershed areas are not addressed in this watershed plan. Land use in Baltimore County's Middle Gwynns Falls watershed is 60.9% residential (0.6% low density, 42.5% mid density and 15.2% high density). Various other developed land uses cover 21.1% of the watershed (8.3% commercial, 3.5% industrial, 6.4% institutional and 2.9 transportation). Open land uses account for the remaining 17.9% of the watershed area (5.2% open urban, 12.5% forest and 0.2% agriculture). Overall, impervious surfaces cover 28.9% of the watershed. The watershed plan can be found here: https://mde.maryland.gov/programs/Water/319NonPointSource/Documents/Watershed%20Plans/A-I_EPA_Accepted_Plans/Gwynns-Falls-Middle_SWAP_V1_FINAL_and_Addendum-A.pdf.

Pollutant reduction goals by 2025 (and location within the watershed plan):

- Nitrogen: 50,442 pounds per year (Table 3-3 on page 23).
- Phosphorus: 4,086 pounds per year (Table 3-3 on page 23).
- Sediment: 4,357,308 pounds per year, i.e. 2,179 tons per year (Addendum A Table A-5).
- Fecal Bacteria: varies by monitoring station (Addendum A Table A-12).
- Chloride: The plan has a general goal to reduce in-stream chloride levels.

BMP implementation goals:

- Nitrogen and phosphorus: Appendix A Table A-2.
- Sediment: Addendum A Table A-6.
- Bacteria: Addendum A Section A.3.2

There are three different base years for tracking watershed plan implementation:

- Nitrogen and phosphorus base year is 2011. Pollutant load reductions reported that year and thereafter can be counted toward meeting watershed plan goals. The watershed plan Section 2.2 pages 12-15 indicates that the goal is to help meet the "bay-wide Chesapeake Bay TMDL" completed in 2010. Watershed plan Section 3.4.1.1 page 22 indicates that the baseline NPS load estimates in the plan were derived from 2010 land use data.
- Sediment base year is 2008. Pollutant load reductions reported that year and thereafter can be counted toward meeting watershed plan goals. The watershed plan Addendum A.2.1 indicates that the sediment reduction goal is based land use data from 2007 aerial imagery. The Bay TMDL is based on Chesapeake Bay Program P5 model land uses (pages 5-7) and the edge-of-field target erosion rated (pages 8-12).
- Bacteria base year is 2004. Pollutant load reductions reported that year and thereafter can be counted toward meeting watershed plan goals. The watershed plan Addendum A Section A.3 indicates that the bacteria reduction goal is based on the Gwynns Falls Bacteria TMDL approved by EPA in 2007. The Bacteria TMDL Section 2.2 pages 10-12 indicate that the TMDL is based on monitoring conducted 2003 and earlier.

Maryland's 2015-2019 NPS Management Plan Objective 5 lists one milestone for this watershed: annually report progress in the 319 Annual Report.

H.2. Grant-Funded Implementation Projects

The following three pages present tables summarizing the status of grant-funded NPS BMP implementation from the follow grant sources:

- 319(h) Grant and State Revolving Fund
- Chesapeake and Atlantic Coastal Bays Trust Fund

Middle Gwynns Falls (In Baltimore County only)
2011-SFY18 Completed NPS Implementation Projects - 319(h) Grant and State Revolving Fund

Project Summary			Project Expenditures					Pollutant Load Reduction			
Area/Lead	Name/Description	End Date	Grant Funding Source	Grant Funds		Match $	Total $ (1)	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)	Bacteria (MPN)
				Federal $	State $						
Baltimore County	Scotts Level McDonogh Road Watershed Restoration Project	2014	319 FFY12 #5	$320,004		$213,336	$533,340	415.20	136.4	306.2	0
	no SRF funded projects										
TOTAL for completed projects				$320,004.00	$0	$213,336.00	$533,340.00	415	136	306	0

For nitrogen and phosphorus pollutant loads, BMPs installed 2011 and later can be counted toward watershed plan implementation.
For sediment pollutant loads, BMPs installed 2011 and later can be counted toward watershed plan implementation.

SFY18 NPS Implementation Projects In Progress - 319(h) Grant and State Revolving Fund - Middle Gwynns Falls Watershed

Project Summary			Project Funding					Projected Pollutant Load Reduction			
Area/Lead	Name/Description	End Date	Grant Funding Source	Grant Funds		Match $	Total $	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)	Bacteria (MPN)
				Federal $	State $						
Baltimore County	Scotts Level at Marriottsville Road Stream Restoration	2020	319 FFY16 #10	$613,940		$409,293	$1,023,233	1,580	728	693	0
	Scotts Level at Upper Scotts Level Park	TBD	319 FFY18 #7	$450,000		$300,000	$750,000	3,788	826	885	0
	No SRF projects working during SFY18										

H.3. Monitoring Gwynns Falls Watershed

H.3.a. Water Quality – State Agencies Monitoring

The Maryland Department of Natural Resource provided the following information [27]

- Gwynns Falls nontidal area (Middle Gwynns Falls is a subwatershed herein)
  - Measured phosphorus levels in the water have decreased at all of the non-tidal monitoring locations in the Patapsco River watershed, and sediment levels have decreased at two monitoring locations. Phosphorus levels at the Gwynns Falls station had still decreased when changes in river flow are accounted for.
- Patapsco River tidal (receives flows from Gwynns Falls, Jones Falls, etc.)
  - Water quality in the tidal waters of the Patapsco River is fair in part because nitrogen levels are too high. Phosphorus and sediment levels have improved. Habitat quality for underwater grasses is poor due to high algal densities and poor water clarity. Severe algal blooms are common in the Patapsco in the summer. Habitat quality for bottom dwelling animals is poor and has gotten worse.

MDE nontidal monitoring projects funded by the 319(h) Grant have not been active anywhere in the Gwynns Falls watershed. [28, 29]

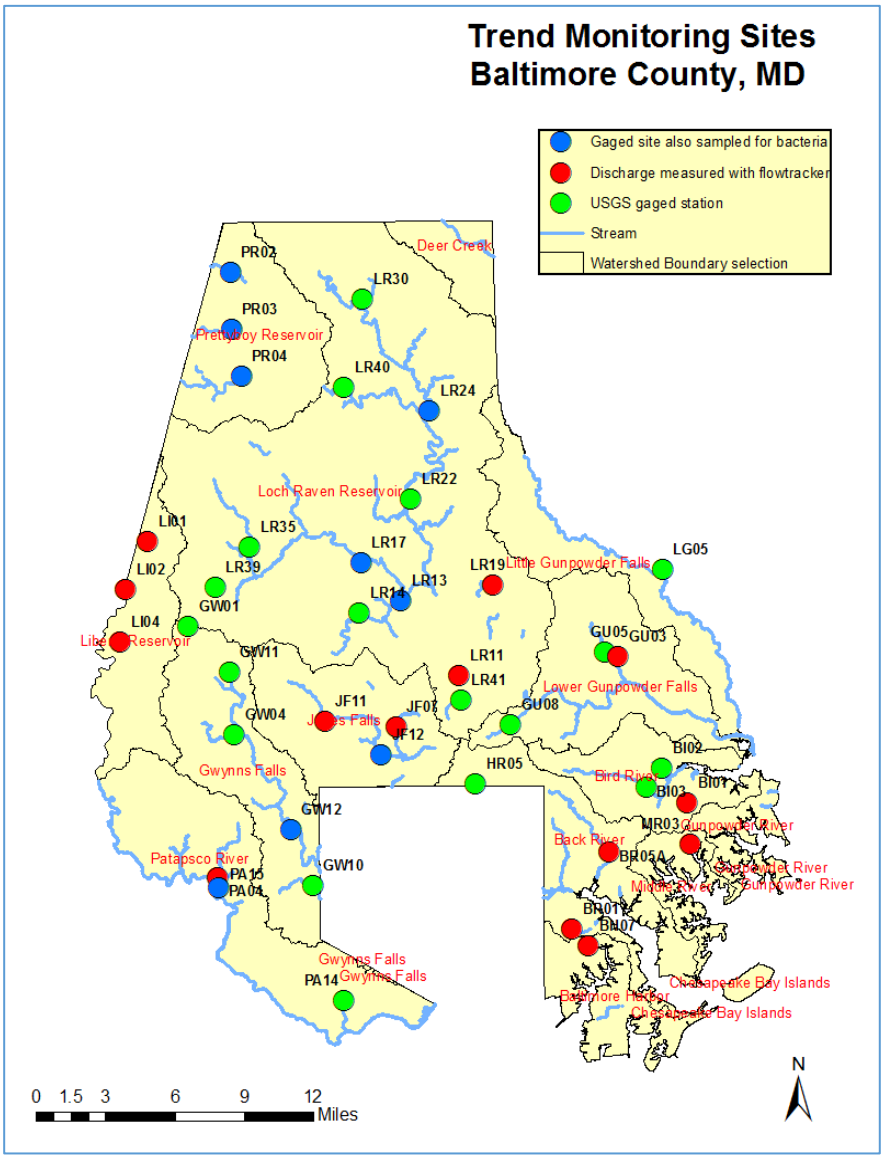
	Middle Gwynns Falls Watershed										
	Chesapeake and Atlantic Coastal Bays Trust Fund										
	SFY 2018 NPS Implementation Project Status (1)										
Year Funded	**Partner**	**ProjectTitle**	**ProjectType**	**County**	**TrustFund Dollars**	**Status**	**BMP Units**	**BMPs Reported**	**Annual LbsN**	**Annual LbsP**	**Annual TonsTSS**
FY13	Baltimore County	Scotts Level Branch at McDonough Retrofit, Stream Restoration, and Buffer	Stream Restoration	Baltimore	680,000	Complete			415.20	136.40	306.20
FY14	Alliance for the Chesapeake Bay	Temple Emanuel of Baltimore	Tree Planting Projects	Baltimore	4,862	Complete	acres	0.8	3.77	0.15	0.01
		Christ the King Church	Tree Planting Projects	Baltimore	2,976	Complete	acres	0.5	2.31	0.09	0.01
	Baltimore County	Woodlawn HS	Tree Planting Projects	Baltimore	12,528	Complete	acres	2.16	10.89	0.83	0.74
		Powhatan ES	Tree Planting Projects	Baltimore	6,380	Complete	acres	1.1	6.30	0.43	0.07
		Dead Run at Westview Park Stream Restorat	Stream Restoration	Baltimore	1,225,312	Complete			583.00	183.00	171.00
	(1) Maryland DNR provided this data 2/21/19 and indicated it is the full extent available.			TOTALS	1,932,058				1,021.47	320.91	478.03
FY19	Baltimore County DEPS	Scotts Level Branch Stream Restoration	Stream Restoration	Baltimore	586,000	Design/Planning			1,913.00	624.00	594.00
FY19	Baltimore Tree Trust	Gwynns Falls Watershed	Tree Planting Projects	Baltimore	105,263	Permit			33.33	4.20	1.39
	(1) Maryland DNR provided this data 2/21/19 and indicated it is the full extent available.			TOTALS	691,263				1,946.33	628.20	595.39

[27] DNR. *Water Quality Summary 2013-2015*. Preliminary report received via personal communication 11/6/17.
[28] Maryland Department of the Environment. MDE Targeted Watershed Project. 319(h) Grant FFY2017 Project 4.
[29] Maryland Department of the Environment. MDE Biological Assessment for Water Quality Protection and TMDL Implementation. 319(h) Grant FFY2017 Project 5.

H.3.b. Nontidal Water Quality - Baltimore County Monitoring

Each year Baltimore County reports progress to meet their MS4 permit requirements. [30] In their report, findings from monitoring are summarized. The distribution of countywide water quality monitoring stations in Baltimore County is shown in the adjacent map.

According to the County, their Gwynns Falls water quality monitoring stations are showing the following trends for pollutant concentrations. (2018 County MS4 report Table 9-20 page 9-52):
-- Nitrogen slope = -1.895
-- Phosphorus slope = -0.018
-- Sediment slope = -12.841
(A negative slope indicates reduced pollutant load and improving water quality)



Baltimore County trend monitoring sites. (2018 County MS4 report Figure 9-21 page 9-45)

Gwynns Falls Pollutant Load Analysis, Standardized by Drainage Area Acreage, 2017

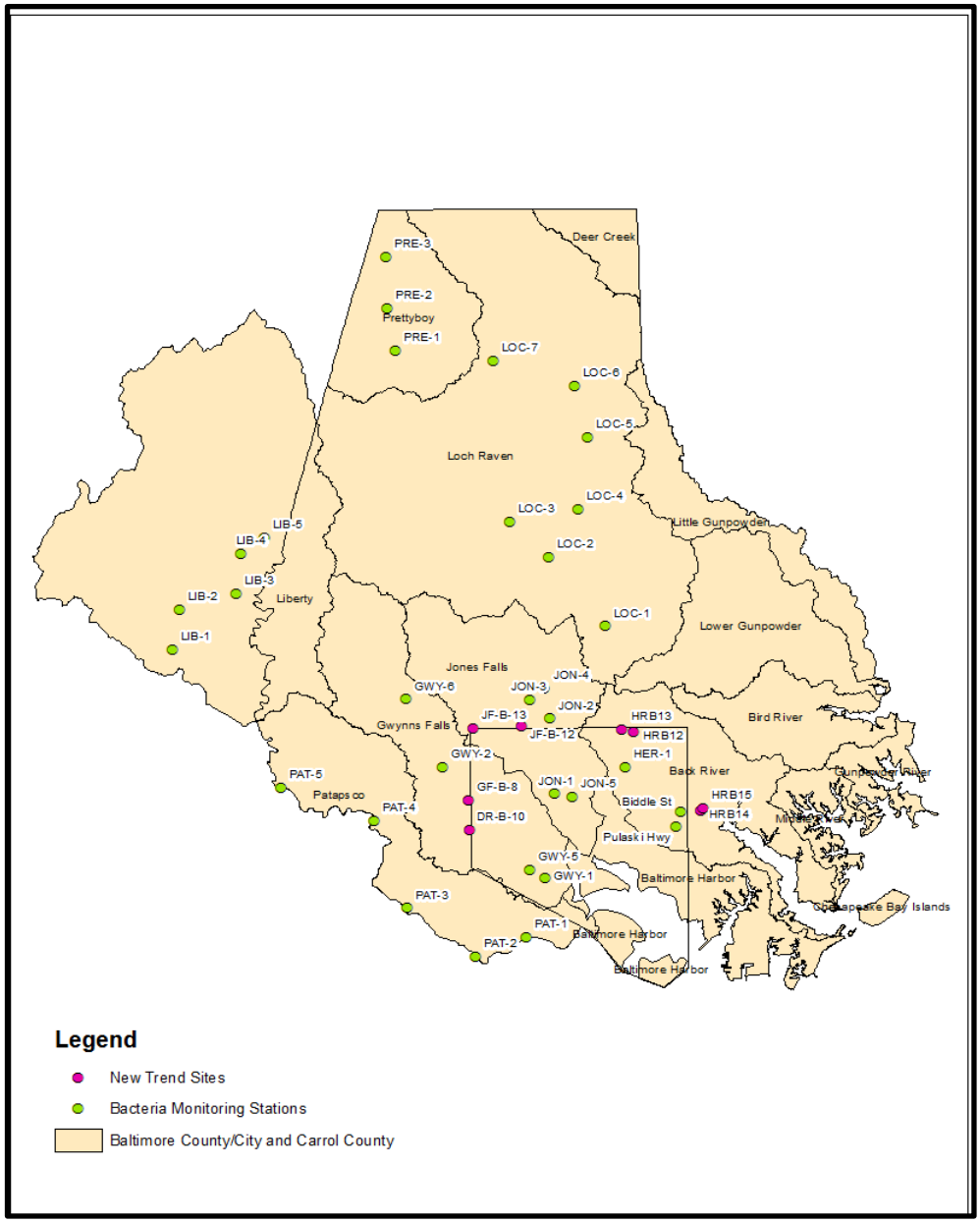
Site	Drainage Area (ac)	TSS	Nitrate / Nitrite	Total Nitrogen	Total Phosphorus	Chloride	Sodium
GW01	194.46	51.59	2.46	5.71	0.31	296.78	242.60
GW04	4,731.00	1.19	0.53	0.66	0.03	51.45	18.78
GW10	3,507.70	18.21	3.53	8.60	0.44	714.33	288.96
GW11	2,998.00	172.05	4.36	6.89	0.41	223.70	89.26
GW12	11,735.89	181.46	6.41	9.58	0.63	615.46	254.61

As shown in the table above, the County also estimated pollutant loads at their five Gwynns Falls stations. (2018 County MS4 report, Table 9-19 page 9-46).

[30] Baltimore County. NPDES Municipal Stormwater Discharge Permit 2018 Annual Report. December 21, 2018.

H.3.c. Nontidal Bacteria – Baltimore County Monitoring

Baltimore County also conducts bacteria monitoring at the stations shown in the map below. There are seven bacteria trend monitoring sites in the Gwynns Falls watershed. Two of the monitoring sites are in the city and five are in the county. The table on the next page presents the number of samples and the geometric mean for high (wet) flow and low (dry) flow by year. It also presents the geometric mean of all samples by year regardless of condition. The table is stratified by annual data (includes all data collected for the year) and seasonal data (includes only those samples collected between May 1st and September 30th each year). The next table provides the frequency of exceedance of single samples to the water quality standard (126 MPN). The zero percent exceedances are highlighted in green. These results are displayed graphically below the tables.



The County graphed E. coli geometric mean concentrations for both annual and seasonal flow periods stratified by flow condition as shown on the following pages (2018 County MS4 report Figures 9-43 thru 9-49, pages 9-75 thru 9-79). Additionally, the County noted that samples taken in 2016 were almost completely during low flows.

Map: Baltimore County bacteria monitoring sites. (2018 County MS4 report Figure 9-27 page 9-54)

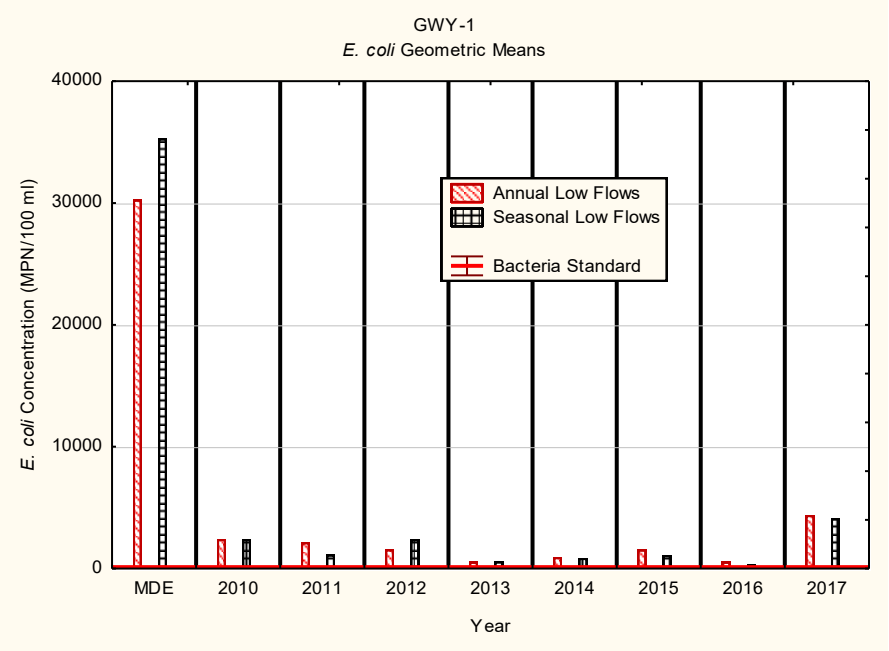
Gwynns Falls E. coli Results on an Annual and Seasonal Basis (2018 County MS4 report Table 9-33 page 9-75)

Annual Data (MPN/100 ml)											
Site	Flow Type	2013		2014		2015		2016		2017	
		N	MPN	N	MPN	N	MPN	N	MPN	N	MPN
GWY-1 City	High	2	2420	4	1742	3	1754	2	3404	0	n/a
	Low	10	542	7	925	7	1534	7	546	6	4369
	All	12	696	11	1164	10	1597	9	921	6	4369
GWY-2	High	2	212	4	1451	3	1372	2	517	0	n/a
	Low	10	***87***	8	269	8	132	7	213	6	253
	All	12	101	12	471	11	299	9	238	6	253
GWY-5 City	High	2	1646	4	1844	3	970	2	2420	0	n/a
	Low	10	***91***	7	237	6	514	7	265	6	971
	All	12	148	11	499	9	635	9	364	6	971
GWY-6	High	3	927	4	1330	6	737	6	1396	2	246
	Low	9	***72***	7	***119***	11	***97***	11	140	15	296
	All	12	137	11	285	17	199	17	315	17	290
DR-B-10	High					6	2027	4	1566	3	2989
	Low					11	465	12	198	14	249
	All					17	782	16	388	17	386
GF-B-8	High					6	1444	4	3609	3	3727
	Low					11	300	12	804	14	856
	All					17	522	16	1171	17	1110
SL-B-3	High									2	1289
	Low									14	164
	All									16	212
Seasonal Data (May 1st to September 30th) (MPN/100 ml)											
Site	Flow Type	2013		2014		2015		2016		2017	
		N	MPN	N	MPN	N	MPN	N	MPN	N	MPN
GWY-1 City	High	1	2420	2	2420	1	2420	0	n/a	0	n/a
	Low	4	570	3	855	3	1081	4	376	3	4097
	All	5	761	5	1296	4	1322	4	376	3	1097
GWY-2	High	1	172	2	2420	1	1553	0	n/a	0	n/a
	Low	4	181	3	314	3	189	4	267	3	199
	All	5	180	5	711	4	321	4	267	3	199
GWY-5 City	High	1	1120	2	2420	1	2420	0	n/a	0	n/a
	Low	4	177	3	175	3	667	4	164	3	1133
	All	5	256	5	501	4	921	4	164	3	1133
GWY-6	High	1	921	2	1773	3	1685	3	1967	1	866
	Low	4	***96***	2	298	7	232	7	173	9	300
	All	5	151	4	727	10	420	10	358	10	333
DR-B-10	High					3	1971	1	2420	2	2420
	Low					7	634	9	344	8	1189
	All					10	891	10	418	10	1371
GF-B-8	High					3	1727	1	2420	2	1540
	Low					7	238	9	791	8	275
	All					10	432	10	885	10	389
SL-B-3	High									1	687
	Low									9	171
	All									10	196

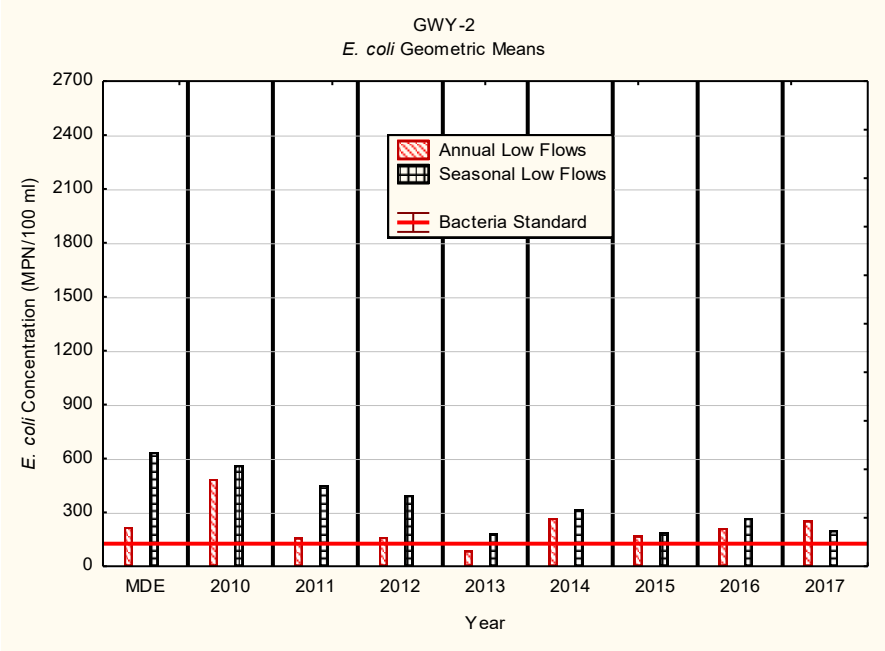
Frequency of Exceedance of Single Sample Water Quality Standards (2018 County MS4 report Table 9-34 page 9-81)

Site	Year	N		Percent Single Sample Exceedance (MPN)							
		Flow Type		576		410		298		235	
		High	Low	High	Low	High	Low	High	Low	High	Low
GWY-1 City	2013	1	4	100%	50%	100%	75%	100%	75%	100%	75%
	2014	2	3	100%	100%	100%	100%	100%	100%	100%	100%
	2015	1	3	100%	100%	100%	100%	100%	100%	100%	100%
	2016	0	4		25%		50%		75%		75%
	2017	0	3		100%		100%		100%		100%
GWY-2	2013	1	4	0%	0%	0%	0%	0%	0%	0%	25%
	2014	2	3	100%	67%	100%	67%	100%	67%	100%	67%
	2015	1	3	100%	0%	100%	0%	100%	0%	100%	33%
	2016	0	4		0%		0%		25%		75%
	2017	0	3		0%		0%		0%		33%
GWY-5 City	2013	1	4	100%	25%	100%	25%	100%	25%	100%	25%
	2014	2	3	100%	0%	100%	0%	100%	33%	100%	33%
	2015	1	3	100%	67%	100%	67%	100%	67%	100%	67%
	2016	0	4		0%		0%		0%		0%
	2017	0	3		67%		67%		67%		67%
GWY-6	2013	1	4	100%	0%	100%	0%	100%	0%	100%	0%
	2014	2	2	100%	50%	100%	50%	100%	50%	100%	50%
	2015	3	7	100%	14%	100%	29%	100%	29%	100%	43%
	2016	3	7	100%	14%	100%	14%	100%	14%	100%	14%
	2017	1	9	100%	22%	100%	44%	100%	44%	100%	44%
DR-B-10	2013										
	2014										
	2015	1	9	100%	14%	100%	14%	100%	29%	100%	43%
	2016	1	9	100%	33%	100%	33%	100%	44%	100%	44%
	2017	2	8	100%	100%	100%	100%	100%	100%	100%	100%
GF-B-8	2013										
	2014										
	2015	3	7	100%	57%	100%	57%	100%	71%	100%	86%
	2016	1	9	100%	56%	100%	78%	100%	78%	100%	89%
	2017	2	8	100%	38%	100%	38%	100%	50%	100%	63%
SL-B-3	2013										
	2014										
	2015										
	2016										
	2017	1	9	100%	22%	100%	22%	100%	22%	100%	33%

At stations GWY-1 and GWY-2, the E. coli geometric mean concentrations are presented below for both annual and seasonal flow periods stratified by flow condition. MDE monitoring results shown are from 2002-2003. The horizontal red line represents the water quality standard of 126 MPN/100 ml for E. coli. (2018 County MS4 report Figures 9-43 and 9-44, page 9-76)

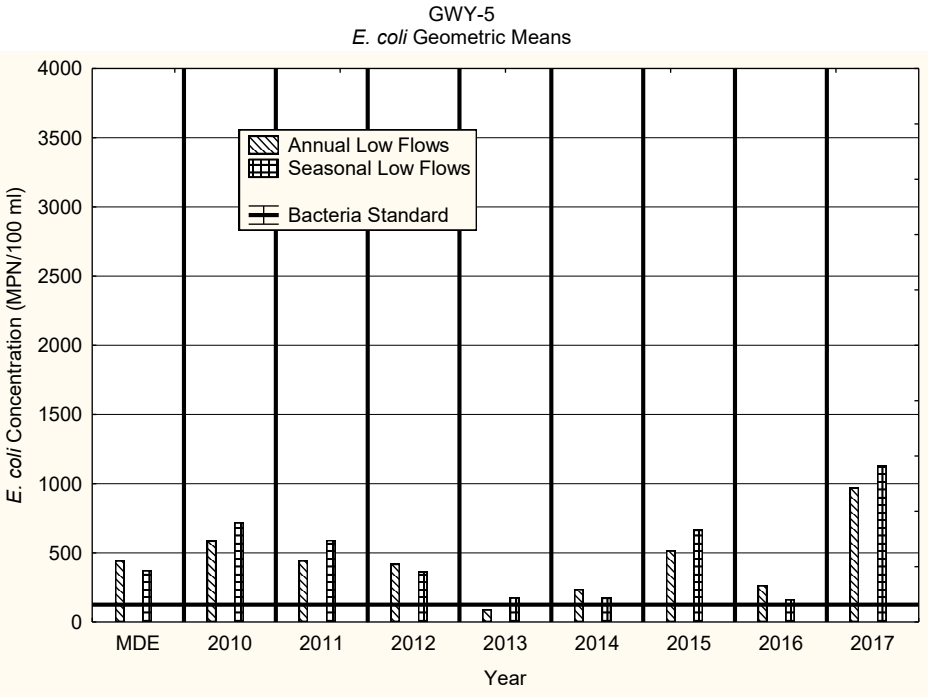


GWY-1: County analysis indicates conditions are generally downward trend in the dry weather seasonal geometric mean year over year, maintained when 2017 data is included, would indicate the conditions are improving at this station based on the difference between the two monitoring periods.

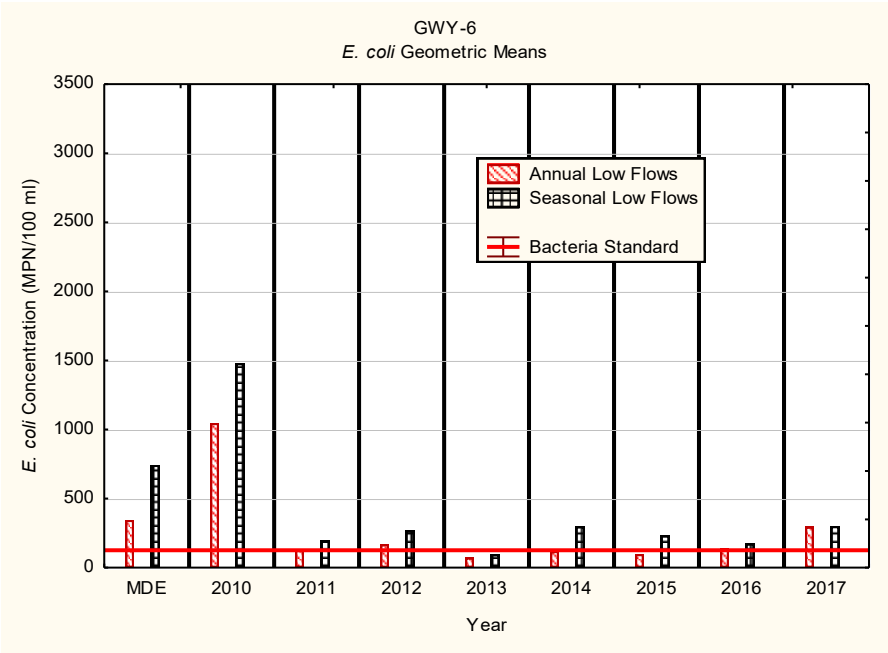


GWY-2: County analysis indicates that there has been slight improvement at this site.

At stations GWY-5 and GWY-6, the E. coli geometric mean concentrations are presented below for both annual and seasonal flow periods stratified by flow condition. MDE monitoring results shown are from 2002-2003. The horizontal red line represents the water quality standard of 126 MPN/100 ml for E. coli. (2018 County MS4 report Figures 9-45 and 9-46, page 9-77)

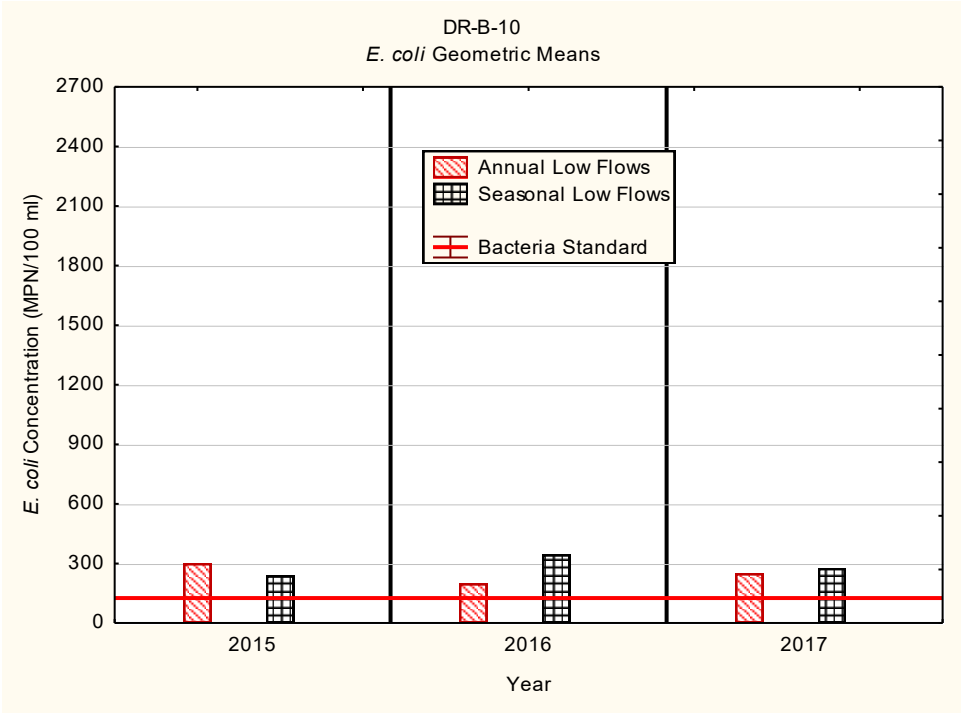


GWY-5: County analysis indicates that there has been slight improvement at this site.

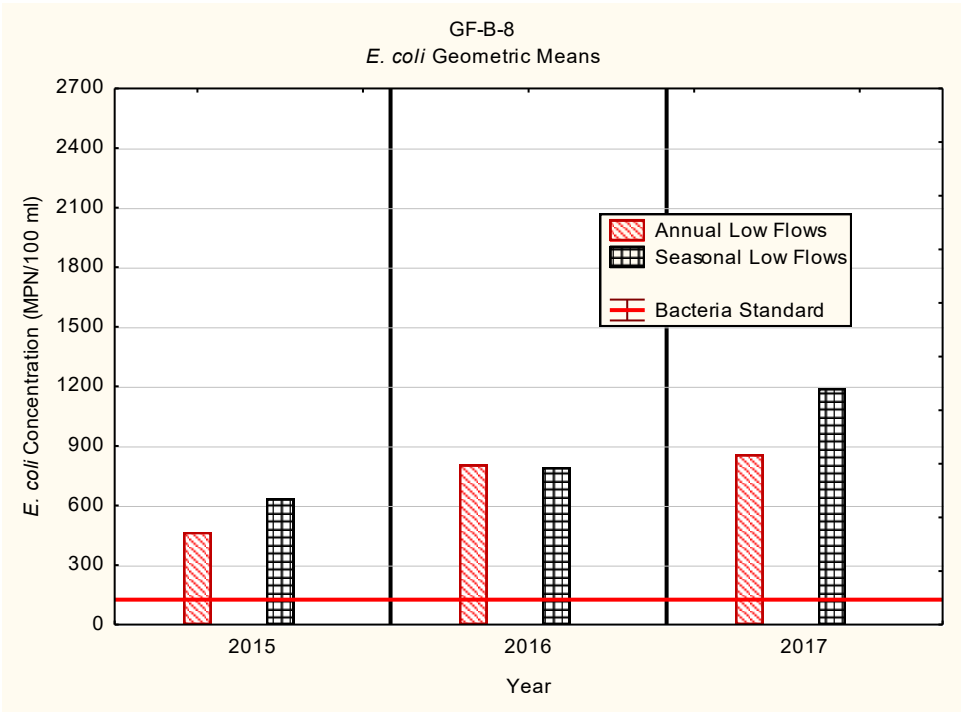


GWY-6: County analysis indicates that there has been slight improvement at this site.

At stations DR-8-10 and GF-B-8, the E. coli geometric mean concentrations are presented below for both annual and seasonal flow periods stratified by flow condition. The horizontal red line represents the water quality standard of 126 MPN/100 ml for E. coli. (2018 County MS4 report Figures 9-47 and 9-48, page 9-78)

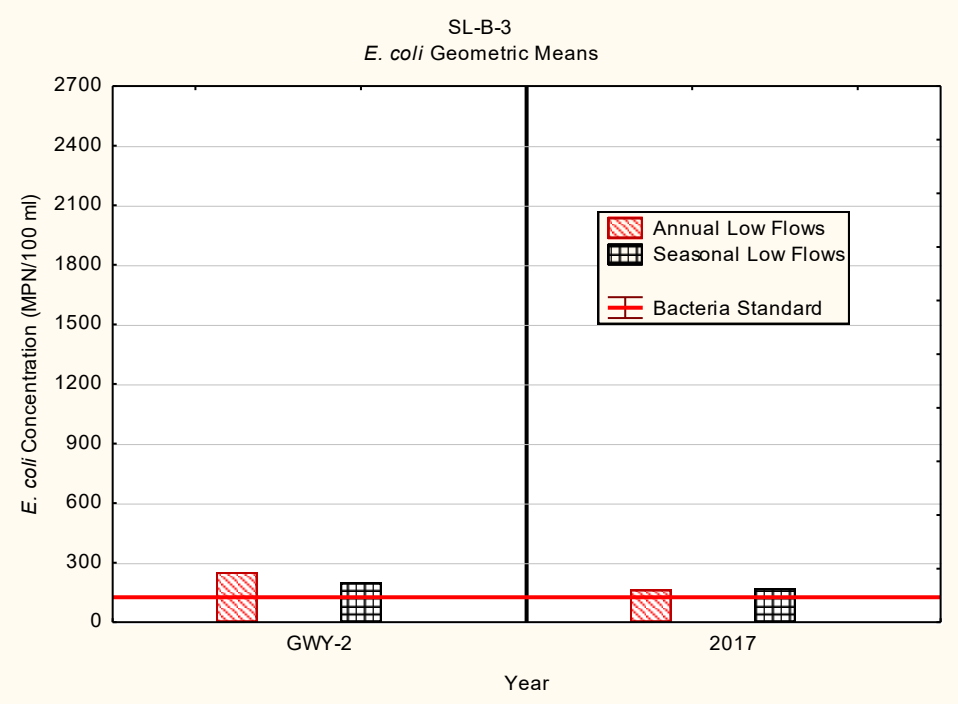


DR-B-10: County analysis indicates that there has been slight degradation at this site.



GF-B-8: County analysis indicates that there has been slight improvement at this site.

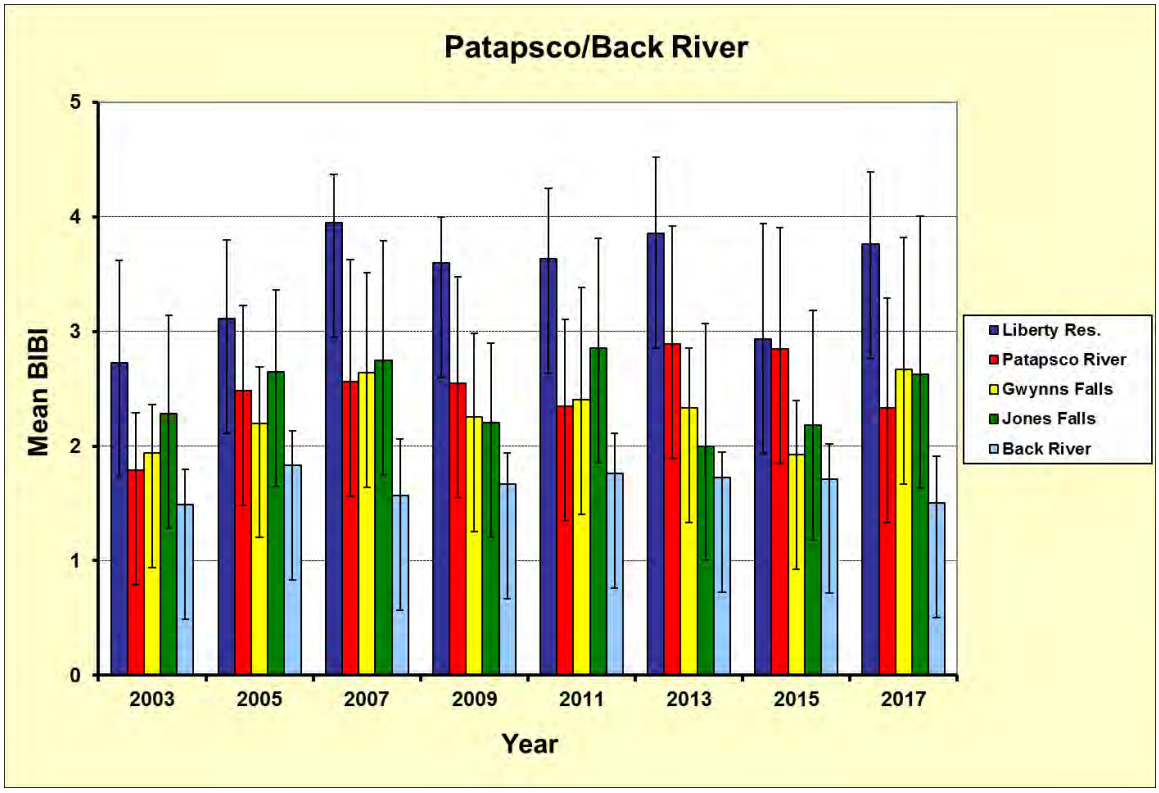
At station SL-B-3, the E. coli geometric mean concentrations are presented below for both annual and seasonal flow periods stratified by flow condition. The horizontal red line represents the water quality standard of 126 MPN/100 ml for E. coli. (2018 County MS4 report Figure 9-49, page 9-79)



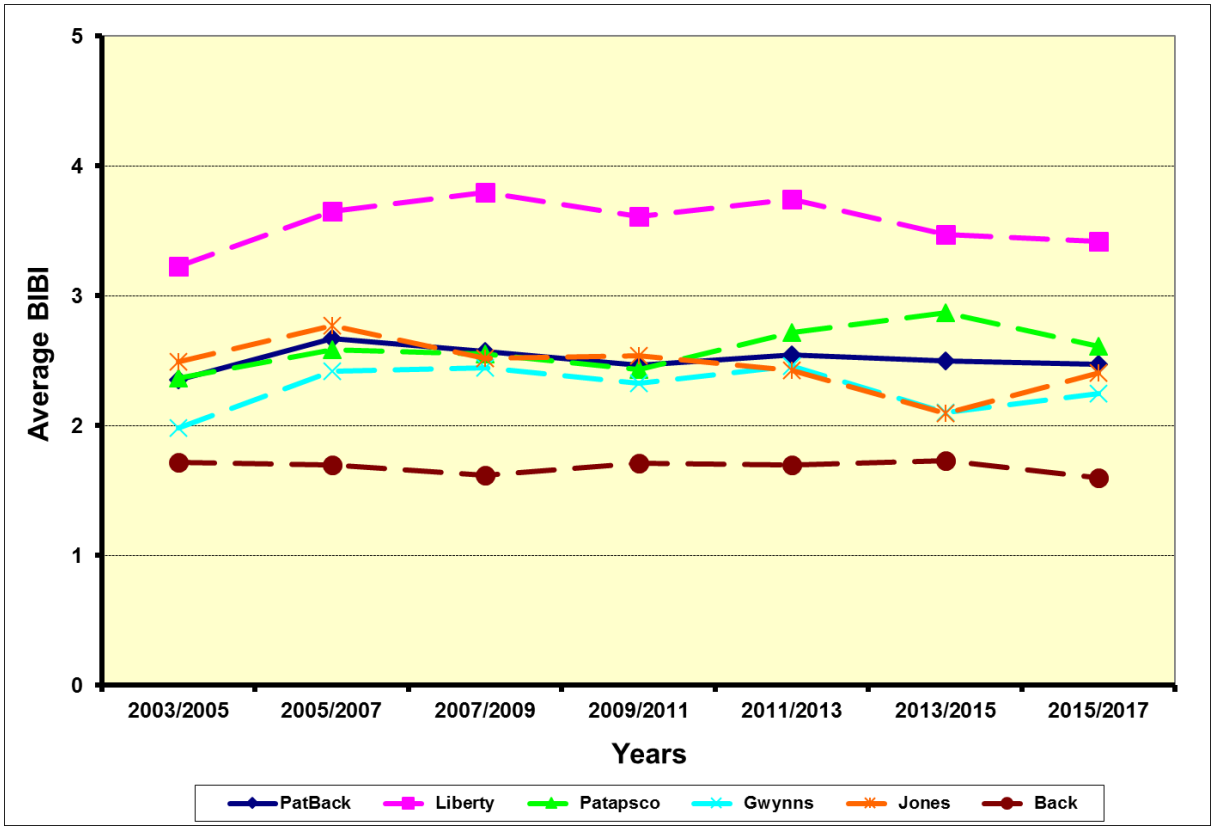
SL-B-3: County analysis indicates that the site seems to have fairly low loads, but still above the 126 MPN/100ml limit. Continued monitoring will help detect trends in this site.

H.3.d Nontidal Biology – Baltimore County

One the five biological monitoring programs conducted by Baltimore County is used to assess ecological health of streams using a probabilistic monitoring approach in freshwater and tidal waters using the Maryland Biological Stream Survey protocol. Fifty randomly selected sites are monitored annually for the entire County. Baltimore County visits areas associated with their 319 priority watersheds every other year. The MBSS system is used to rank the conditions observed, which as summarized in the two graphs below (Very Poor = 1.00 thru 1.99, Poor = 2.00 thru 2.99, Fair = 3.00 thru 3.99, Good = 4.00 thru 4.99):



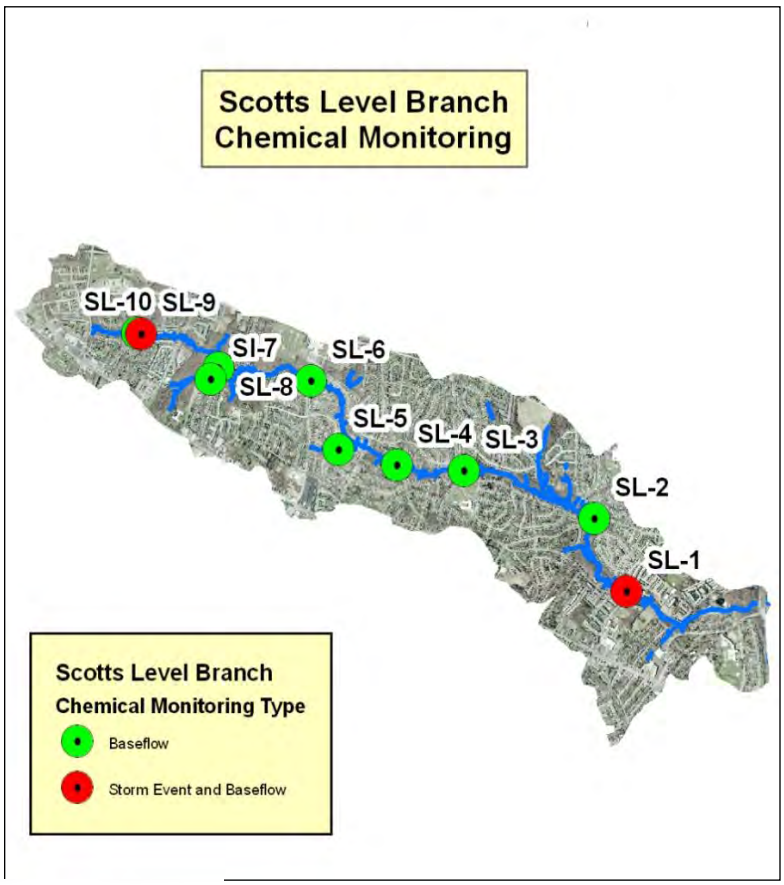
Means and one standard deviation of BIBI scores between 2003 and 2017
(2018 County MS4 report, Figure 9-64, page 9-102)

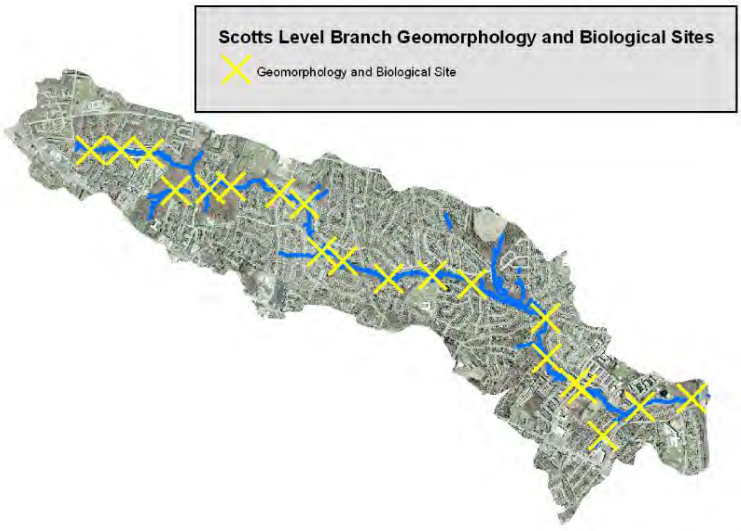


BIBI rolling averages for probabilistic monitoring sites between 2003 and 2017.
(2018 County MS4 report, Figure 9-67, page 9-105)

H.4 Scotts Level Branch Long Term Monitoring

The purpose of this long term monitoring program is to gauge environmental results in a suburban watershed where a number of restoration projects are implemented. According to Baltimore County, "The ability to detect effects of individual restoration projects will be dependent on the size of the restoration project in relation to the total subwatershed size. Therefore each restoration project will be monitored for project effectiveness, dependent on staff availability. The cumulative effects of restoration will be measured at the long-term in-stream monitoring site. In order to assess restoration progress in the Scotts Level Branch subwatershed, a before-after design concept will be used. Stream restoration work on Scotts Level Branch began in the fall of 2013 with the start of the McDonogh Road project. Construction was completed in the spring of 2014, which included 1,900 linear feet of stream channel, 2 acres of forested wetland, and 4 acres of floodplain wetlands, with a total of 7 acres of buffer plantings."





The map above shows the water quality monitoring station locations, including storm event and baseflow monitoring in the entire Scotts Level Branch watershed. The adjacent map shows the sites where geomorphic and biological monitoring is conducted. (2018 County MS4 report pages 9-5 and 9-7 respectively) The County has used short term findings to estimate source loads, etc. However, the monitoring timeline has not extended far enough to the begin determining trends for pollutant loads.

H.5 Before/After Monitoring: McDonogh Road Stream Restoration Project

Baltimore County stream restoration work in the Scotts Level Branch at the McDonogh Road for stream restoration and riparian enhancement began in December 2013 on approximately 1600 linear feet of stream channel and 4 acres of land surface in Scotts Level Branch, upstream of McDonogh Road. The projected was completed in 2014. Pre-implementation had been conducted and post restoration monitoring began in Autumn 2014. The map below shows the water quality monitoring sites. The monitoring includes flow, chemical (water quality), geomorphological, and biological.

Scotts Level Branch McDonogh Road stream restoration project boundaries (yellow line) and water quality monitoring sites. (2018 County MS4 report page 9-24)

Baltimore County biological and habitat findings are shown in the table below. The County did not report finding any significant trend in the data for the 2011-2017 timeframe.

Station	Status – Stream Restoration	Year	BIBI	FIBI	PHI
S-11 Mainstem Downstream of Restoration	Pre	2011	1.33	1.67	58
	Pre	2012	1.00	2.00	53
	Pre	2013	1.00	1.67	59
	Post – 0 Year	2014	2.33	2.00	59
	Post – 1 Year	2015	2.00	1.67	57
	Post – 2 Year	2016	1.00	2.33	53
	Post – 3 Year	2017	2.00	2.00	53
S-11a Mainstem Within Restoration	Pre	2011	1.33	1.67	52
	Pre	2012	1.00	1.67	55
	Pre	2013	1.00	2.00	58
	Post – 0 Year	2014	2.33	2.00	58
	Post – 1 Year	2015	2.33	1.67	57
	Post – 2 Year	2016	1.67	2.00	55
	Post – 3 Year	2017	1.33	2.67	51
SL-12 Tributary Within Restoration	Pre	2011	1.33	1.67	54
	Pre	2012	1.00	2.00	46
	Pre	2013	1.00	1.33	56
	Post – 0 Year	2014	NA	2.00	56
	Post – 1 Year	2015	2.67	1.33	47
	Post – 2 Year	2016	1.00	2.33	50
	Post – 3 Year	2017	2.00	2.33	52
SL-12a Tributary Upstream of Restoration	Pre	2011	2.00	1.33	40
	Pre	2012	1.33	1.00	25
	Pre	2013	1.00	1.33	43
	Post – 0 Year	2014	2.00	1.33	43
	Post – 1 Year	2015	2.00	*	44
	Post – 2 Year	2016	1.00	1.00	48
	Post – 3 Year	2017	2.00	2.00	41
SL-13 Upstream of Restoration	Pre	2011	2.00	1.33	52
	Pre	2012	1.00	1.67	55
	Pre	2013	1.67	1.67	66
	Post – 0 Year	2014	1.66	2.00	66
	Post – 1 Year	2015	2.00	1.33	45
	Post – 2 Year	2016	1.33	1.33	63
	Post – 3 Year	2017	2.33	2.00	55

BIBI, FIBI and PHI findings for the steam restoration project at McDonogh Road (2018 County MS4 Report pages 9-27 thru 9-28.

Appendix I: Sassafras River Watershed in Cecil and Kent Counties, Maryland Watershed Eligible for 319(h) Grant Implementation Funding

I.1. Introduction

The *Sassafras Watershed Action Plan* was completed by the Sassafras River Association, a private nonprofit organization, in December 2009. EPA accepted the plan in January 2010. The watershed plan encompasses the portion of the watershed in Cecil and Kent Counties, Maryland. The upstream portion of the watershed in Delaware is not included in the watershed plan. The watershed plan can be found here: https://mde.maryland.gov/programs/Water/319NonPointSource/Documents/Watershed%20Plans/A-I_EPA_Accepted_Plans/Sassafras-SWAP.pdf.

Pollutant reduction goals are in the watershed plan Executive Summary Table E.5 and are reiterated in Table 5.4 on page 108. The phosphorus load reduction goal equals the TMDL limit for NPS phosphorus. The implementation measures that the plan proposes to meet the phosphorus goal will also reduce nitrogen and sediment loads. The estimates of the load reductions for nitrogen and sediment associated with these implementation measures are the basis for the plans reduction goals for nitrogen and sediment (see watershed plan section E6.0, paragraph 1, on page xxv).

BMP implementation goals are in the watershed plan Executive Summary Table E.4 on pages xxv thru xxviii and are reiterated in Table 5.3 on pages 105 thru 108.

Base Year for watershed plan implementation is 1999. Pollutant load reductions that year and thereafter can be counted toward meeting watershed plan goals. The Sassafras River phosphorus TMDL Section 2.2 on page 6 indicates that monitoring data used to create the TMDL was collected in 1999.

I.2. Milestones

Maryland's 2015-2019 NPS Management Plan Objective 5 lists one milestone for this watershed: annually report progress in the 319 Annual Report.

I.3. Monitoring the Sassafras Watershed

I.3.a Water Quality – Sassafras River Association

The Sassafras River Association (now part of ShoreRivers) conducts tidal and nontidal water quality monitoring in the Sassafras River watershed. Their most recent assessment is presented at the end of this Appendix for the Sassafras River watershed.

I.3.b Water Quality - State Agencies

Maryland Department of Natural Resources information [31]

- Water quality in the Sassafras River is fair due to high sediment levels. Habitat quality for underwater grasses is poor due to poor water clarity and high algal densities. Summer bottom dissolved oxygen levels are good.
- The Sassafras River is in the 'High Agriculture/Low Developed' land use category. Nitrogen and phosphorus levels are higher than most rivers and sediment levels are moderate. Algal levels are among the highest of all the rivers and water clarity is very low. Summer bottom dissolved oxygen levels are moderate.

Maryland Department of the Environment information [32, 33]

- MDE nontidal monitoring projects funded by the 319(h) Grant have not been active in this watershed.

[31] DNR. *Water Quality Summary 2013-2015*. Preliminary report received via personal communication 11/6/17.
[32] Maryland Department of the Environment. MDE Targeted Watershed Project. 319(h) Grant FFY2017 Project 4.
[33] Maryland Department of the Environment. MDE Biological Assessment for Water Quality Protection and TMDL Implementation. 319(h) Grant FFY2017 Project 5.

I.4 Grant Funded Implementation Projects

The following pages present tables summarizing the status or grant-funded NPS BMP implementation from the following grant sources:

- 319(h) Grant and State Revolving Fund
- Chesapeake and Atlantic Coastal Bays Trust Fund

Sassafras River Watershed										
2009-SFY18 Completed 319(h) NPS Implementation Projects - 319(h) Grant and State Revolving Fund										
Project Summary			**Project Expenditures**					**Pollutant Load Reduction**		
Area/Lead	**Name/Description**	**End Date**	**Grant Funding Source**	**Grant Funds**		**Non Federal Match**	**Total**	**Nitrogen (lb/yr)**	**Phosphorus (lb/yr)**	**Sediment (ton/yr)**
				Federal	**State**					
SRA	Galena Elementary School stormwater wetland	2013	319 FFY12 #8	$14,000.00		$9,333.33	$25,000.00	1.38	0.24	0.05
SRA	Phipps Treatment Wetlands & sediment traps	SFY15	319 FFY13 #8	$50,000		$33,333	$83,333	99.3	19.9	2.6
	No SRF projects in this watershed							0.0	0.0	0
			TOTAL	$64,000.00	$0.00	$42,666.67	$108,333.33	100.7	20.2	2.65

SRA: Sassafras River Association, a private nonprofit organization.

For phosphorus pollutant load reduction, BMPs installed 1999 and later can be counted toward watershed plan implementation.

SFY18 NPS Implementation Projects In Progress - 319(h) Grant and State Revolving Fund - Sassafras River Watershed										
Project Summary			**Project Expenditures**					**Pollutant Load Reduction**		
Area/Lead	**Name/Description**	**End Date**	**Grant Funding Source**	**Grant Funds**		**Non Federal Match**	**Total**	**Nitrogen (lb/yr)**	**Phosphorus (lb/yr)**	**Sediment (ton/yr)**
				Federal	**State**					
Kent SCD	Harbor View and Colchester Farms	2019	319 FFY17 #10	$216,234		$144,156	$360,390	2,783.0	162.0	65.85
	Starkey Project	2019	319 FFY17 #11	$144,514		$96,343	$240,857	1,992.5	105.5	0.67

Sassafras River Watershed

Chesapeake and Atlantic Coastal Bays Trust Fund

SFY18 NPS Implementation Project Status (1)

Year Funded	PartnerCD	ProjectTitle	ProjectType	County	TrustFund Dollars	Status	BMP Units	BMPs Reported	Annual LbsN	Annual LbsP	Annual TonsTSS
FY12	Md Dept of Agriculture	Poultry Manure Subsurfer	Agricultural Practices	Cecil	65,628	Complete			7,800	7,500	0
FY12	Sassafras River Association	Phipps Dairy Farm Vertical Flow Treatment Wetland	Wetland Restoration	Kent	224,350	Complete			75	7	0
FY13	Kent County Public Schools	Sassafras Natural Resource Management Area Waterway and Drainage Buffer Restoration and Enhancement Project	Tree Planting Projects	Kent	29,989	Complete	acres	15	443	18	3
	Sassafras River Association	Budds Landing	Stream Restoration	Cecil	170,864	Complete			0	90	1
		Crawford Treatment Wetland	Stormwater Management	Cecil	165,101	Complete			2,993	863	12
		Rt 301 Stormwater Conveyance	Stream Restoration	Cecil	440,000	Complete			120	109	12
		Salfner Farm Stream Restoration	Stream Restoration	Cecil	90,000	Complete			120	41	93
FY14	Chesapeake Bay Trust	Greener Wheeler Avenue Project, Phase 1	Stormwater Management	Kent	43,000	Complete			0	0	0
	Kent County Public Schools	Sassafras Natural Resource Management Area Site II	Tree Planting Projects	Kent	16,865	Complete	acres	3.65	162	7	1
	Sassafras River Association	Turners Creek Natural Resource Area Ravine Restoration	Stream Restoration	Kent	121,644	Complete			38	7	0
FY15	Sassafras River Associa	Swantown Creek Stream Restoration	Stream Restoration	Kent	1,198,922	Complete			2,555	460	85
FY16	Washington College	Leigh	Agricultural Practices	Kent	14,102	Complete			133	8	4
FY16	Washington College	Oldfield Farm	Agricultural Practices	Kent	18,630	Complete			190	11	5
FY16	Washington College	Leigh Farm	Agricultural Practices	Kent	4,658	Complete			48	3	1
FY16	Ridge to Reefs	Harbor View Farm Project 1 - Multi-celled Treatment Wetland	Agricultural Practices	Kent	95,000	Complete			112	11	1
FY16	Ridge to Reefs	Harbor View Farm Project 2 - Forebay and Bioretention	Agricultural Practices	Kent	23,000	Complete			359	29	5
FY16	Ridge to Reefs	Harbor View Farm Project 3 - Woodchip Infiltration Trench	Agricultural Practices	Kent	25,000	Complete			53	0	0
FY16	Ridge to Reefs	Colchester Farm Project 1 - Multi-celled Treatment Wetland	Agricultural Practices	Kent	54,000	Complete			94	10	1
FY16	Ridge to Reefs	Colchester Farm Project 2 - Woodchip Infiltration Trench	Agricultural Practices	Kent	23,000	Complete			51	0	0
FY16	Washington College	Leigh	Agricultural Practices	Kent	31,220	Complete			135	8	4
FY16	Washington College	Oldfield Farm	Agricultural Practices	Kent	45,126	Complete			190	11	5
FY16	Washington College	Leigh Farm	Agricultural Practices	Kent	11,807	Complete			48	3	1
FY16	Town of Betterton	Betterton Beach Parking and Main Street Outfall	Stormwater Management	Kent	383,253	Complete			74	6	2
FY16	Washington College	Oldfield Farm 2	Agricultural Practices	Kent	6,528	Complete			2,300	99	35
FY17	Sassafras River Associa	Starkey Farm	Stormwater Management	Kent	286,500	Complete			23	1	2,356
	(1) Maryland DNR provided this data 2/21/19 and indicated it is the full extent available.			TOTALS	3,588,185.47				18,115.1	9,301.5	2,629.2
FY17	Washington College	Natural Lands: Sassafras NRMA	Agricultural Practices	Kent	60,955	Design/Planning			572	34	15
FY18	Sassafras River Associa	Oakshire/ISE Floodplain Restoration	Stream Restoration	Cecil	992,492	Design/Planning			194	135	14.8
	(1) Maryland DNR provided this data 2/21/19 and indicated it is the full extent available.			TOTALS	1,053,447.00				766.0	169.0	29.80

SFY2018 Agricultural BMP Implementation Sassafras River Watershed In Cecil County and Kent County, MD			Estimated Pollutant Load Reduction			Sassafras River Watershed Plan					Prior Years' Progress Toward Watershed Plan Goals					
						Management Measures			Progress		Prior to SFY14	Extracted from State Data reported by MDE to EPA Bay Program				
Agricultural BMP	Unit	SFY18 Total	Nitrogen Total (lbs)	Phosphorus Total (lbs)	Sediment Total (tons)	Watershed Plan Table 5.1	Goal	Units	SFY14-SFY18	Units		SFY14	SFY15	SFY16	SFY17	Units
Annual Practices																
Cover Crops	acres	11,793	50,886.7	267.7	141.9	Cover Crops (#17, 19)	5000	acres/yr								
Multi-Year Practices																
Alternative Crops	acres								0	acres		0	0	0	0	acres
Amendments for Treatment of Ag Was	AU								0	AU		0	0	0	0	AU
Animal Mortality Facility	count								0	count		0	0	0	0	count
Conservation Cover	acres	32.9	278.3	8.9	2.1				124.1	acres		0	17.3	25.60	48	acres
Conservation Plans/SCWQP	acres	2842	2,250.5	184.9	95.8				14,516	acres		3512	3824	2,327.00	2,011	acres
Critical Area Planting	acres								0.5	acres		0.5	0	0	0	acres
Dead Bird Composting Facility	acres								0	acres		0	0	0	0	acres
Fencing	feet								0	feet		0	0	0	0	feet
Field Border	acres								0	acres		0	0	0	0	acres
Filter Strip	acres								1.2	acres		1.2	0	0	0	acres
Grassed Waterway	acres								14.04	acres		5	0.24	1.20	8	acres
Horse Pasture Management	acres								0	acres		0	0	0	0	acres
Loafing Lot Management System	acres								1.25	acres		1	0.1	0	0	acres
Pasture & Hay Planting	acres								0	acres		0	0	0	0	acres
Prescribed Grazing	acres								0	acres		0	0	0	0	acres
P-sorbing Materials	acres								0	acres		0	0	0	0	acres
Riparian Forest Buffer	acres					#15 Stream Buffers	2	miles	0	acres		0	0	0	0	acres
Riparian Herbaceous Cover	acres								26.2	acres		24.8	0	0	1	acres
Roof Runoff Structure	count								3	count		2	0	0	1	count
Stream Restoration Ag	feet								720	feet		0	720	0	0	feet
Tree/Shrub Establishment*	acres	1.4	32	1	0.43				1.65	acres		0	0.25	0	0	acres
Waste Storage Facility	count								2	count		2	0	0	0	count
Wastewater Treatment Strip	acres								0	acres		0	0	0	0	acres
Water Control Structure	count								6	count		2	4	0	0	count
Watering Facility	count								0	count		0	0	0	0	count
Wetland Creation	acres					#21 Wetland Creation	5	count	0.5	acres		0	0.5	0	0	acres
Wetland Restoration	acres								0	acres		0	0	0	0	acres
Windbreak/Shelterbelt Establishment	feet								0	feet		0	0	0	0	feet
Total Annual Practices (2)			50,886.7	267.7	141.93											
Total Multi-year Practices			2,560.8	194.8	98.3											
Total Pollutant Load Reduction			53,447.6	462.6	240.2											

Data by locals in annual reports is not compatible with this reporting methodology.

"SFY18 Total" column data is MDA 2/21/19. MDE used MAST to estimate pollutant load reduction. The Maryland Department of Agriculture defines annual practices as cover crops, nutrient mgmt, manure transport, conservation tillage & high residue tillage.

*Reductions for this practice were calculated using Phase 6 Chesapeake Assessment Scenario Tool output

SFY18 Urban BMPs Implemented

Sassafras River Watershed

In Cecil County and Kent County, Maryland

Urban Management Practices	Unit	BMPs Reported	Estimated Pollutant Load Reduction		
			Nitrogen lb/yr	Phosphorus lb/yr	Sediment ton/yr
Bioretention	acres				
Cisterns and Rain Barrels	acres				
Bioswale	acres				
Disconnection of Rooftop Runoff	acres				
Dry Detention Ponds & Hydro Structures*	acres	2	0.95	0.26	0.043
Dry Extended Detention Ponds	acres				
Dry Well	acres				
Filtering Practices*	acres	2	6.11	1.26	0.294
Forest Conservation	acres				
Forest Harvesting Practices	acres				
Infiltration Practices	acres				
Permeable Pavement	acres				
Rain Garden	acres				
Reduction of Impervious Surface	acres				
Riparian Forest Buffers on Urban Lands	acres				
Septics Connections to Sewers	count				
Septic Denitrification Critical Area	count	12	93.60		
Septic Denitrification outside of 1000 feet	count	1	5.60		
Septic Denitrification within 1000 feet	count				
Septic Tank Pumpout	count				
Stream Restoration Urban	feet				
Street Sweeping	acres				
Tree Planting	acres				
Urban Forest Buffer	acres				
Wet Extended Detention	acres				
Wet Ponds & Wetlands	acres				
Urban BMPs Total Pollutant Load Reduction			106.25	2	0

(1) "BMPs Reported" is MDE data. MDE used MAST to estimate polutant load reduction.

*Reductions for this practice were calculated using Phase 6 Chesapeake Assessment Scenario Tool output

Sassafras River Watershed Plan

Urban Management Measures Watershed Plan Table 5.1	GOAL	Units	Progress		
			SFY18	SFY14-SFY18	Units
			0	0	acres
			0	0	acres
			0	0	acres
			0	0	acres
			2	2	acres
			0	0	acres
			0	0	acres
			2	2	acres
			0	0	acres
			0	0	acres
			0	0	acres
			0	0	acres
			0	0	acres
			0	0	acres
			0	0	acres
			0	0	count
				22	count
#5, #6, #10 Septic system upgrades	150	count	13	6	count
				12	count
			0	0	count
			0	0	feet
			0	0	acres
			0	0	acres
			0	0	acres
			0	0	acres
			0	0	acres
#1 Road retrofit & stream restore	3	count			
#12 Stabilize eroding ravines	1	miles			
#13 Stabilize eroding shoreline	0.5	miles			

Note: The watershed plan goals tracked in this table are consistent with units of measure used for State reporting. All other watershed plan goals differ and are not tracked in this table.

Prior Years' Progress Toward Watershed Plan Goals

Data reported by locals	Extracted from State Data reported by MDE to EPA Bay Program				
	SFY14	SFY15	SFY16	SFY17	Units
Data by locals in annual reports is not compatible with this reporting methodology.	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	count
	0	3	3	4	count
	0	1	2	2	count
	0	9	1	2	count
	0	0	0	0	count
	0	0	0	0	feet
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres
	0	0	0	0	acres

WASTEWATER TREATMENT PLANT UPGRADES WILL HELP IMPROVE THE HEALTH OF THE SASSAFRAS

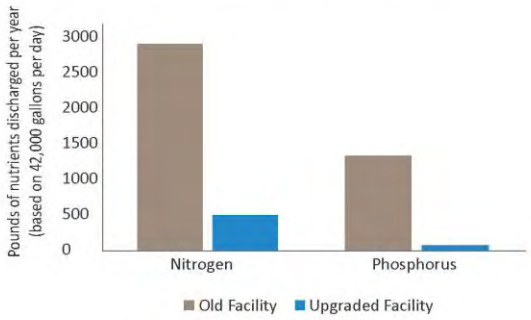
Nitrogen and phosphorus are nutrients that are a natural part of our aquatic ecosystems when present in appropriate concentrations. When nutrient levels in the river are too high, they fuel the overproduction of algae which is termed a "bloom."

Algae blooms harm beneficial underwater grasses by blocking sunlight from reaching them. During decomposition, algae blooms deplete oxygen levels in the water, which can kill fish and other aquatic organisms.

Other than agricultural runoff, the largest single contributor to nutrient pollution in the Sassafras River is inefficient sewage treatment. Boaters should always use pump out stations, and homeowners should regularly service their septic systems.

Even when working properly, the Wastewater Treatment Plants (WWTP) at Betterton and Galena with outdated technology were discharging treated water that contained high levels of nutrients. Both plants are now being upgraded to Enhanced Nutrient Removal (ENR) systems, and will soon be removing a significant amount of nitrogen and phosphorus from the discharge water.

Upgrading the WWTP facilities will significantly reduce the amount of nutrients entering the Sassafras



Information provided by McCrone Engineering

Thanks to the Maryland Department of Environment, the U.S. Department of Agriculture, Kent County Commissioners, Betterton and Galena Officials, and a supportive citizenry, both WWTP's will be in full operation by summer 2018, and will be a great help in ensuring a cleaner and healthier Sassafras River.

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ShoreRivers
114 S. Washington St., Suite 301
Easton, MD 21601

2017 was an exciting and eventful year for the Sassafras River Association! As of January 1, 2018, we merged with two other RIVERKEEPER organizations on the Eastern Shore of Maryland - the Midshore Riverkeeper Conservancy and Chester River Association. Together, we are now ShoreRivers.

Since our founding in 2004, the Sassafras River Association maintained a scientific approach to improving the health of the Sassafras River. Our science-based tidal and non-tidal water quality sampling program will continue, and going forward we will standardize the protocols throughout our new organization.

The formation of ShoreRivers complements and expands our deep commitment to a fishable, swimmable, clean and healthy Sassafras River.

We look forward to the continuing support of our friends in the boating, tourist, and resident communities. Visit us at *www.shorerivers.org*.

Thank you to our partners and supporters:

WATERKEEPER ALLIANCE MEMBER · WATERKEEPERS CHESAPEAKE · LaMotte · RAUCH FOUNDATION · UNIVERSITY OF DELAWARE · MTAC Mid-Atlantic Tributary Assessment Coalition

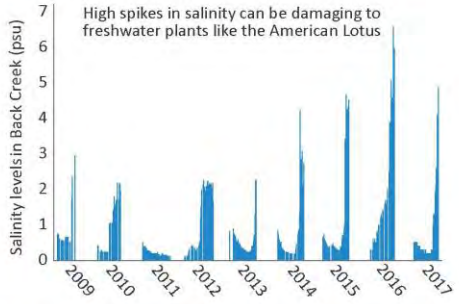
THE MYSTERY OF THE DYING LOTUS

The Sassafras River Association, and now ShoreRivers, has actively tested water quality since 2004. We test water at seven sites in the river, and in 11 of the non-tidal feeder streams. This regularly scheduled sampling provides an ongoing understanding of our river's health.

The accumulated data became particularly useful in the spring and summer of 2017, when the beautiful American Lotus plants in some of the tributary creeks began prematurely dying. The reason for the die-off presented a mystery.

We shipped three of the stressed plants to the University of Maryland. Analysis by their Plant Diagnostic Lab showed that the Lotus had been infected by a root rot called Phytopythium, which is usually a secondary invader of roots damaged from other causes.

An investigation into our historical water quality data showed a remarkable change in one water quality indicator - salinity, the level of salt in the water. In the fall of 2016, the salinity levels rose markedly from previous years. A drought in Pennsylvania reduced the amount of fresh water entering the Bay from the Susquehanna - allowing saltier Bay water to come north to the Sassafras.



We know that the American Lotus is primarily a fresh water plant, and the higher salinity was a stressor. While not positively proven, our water quality sampling provides a possible solution to the mystery - and indicates the die-off was due to natural, not man-made, causes.

TIDAL SAMPLING

Our RIVERKEEPER™ samples seven sites weekly from April through October, and one site is electronically monitored by the Maryland Department of Natural Resources for the same indictors every 15 minutes throughout the year. The grading includes submerged aquatic vegetation (SAV), which is measured in acres by the Virginia Institute of Marine Science.

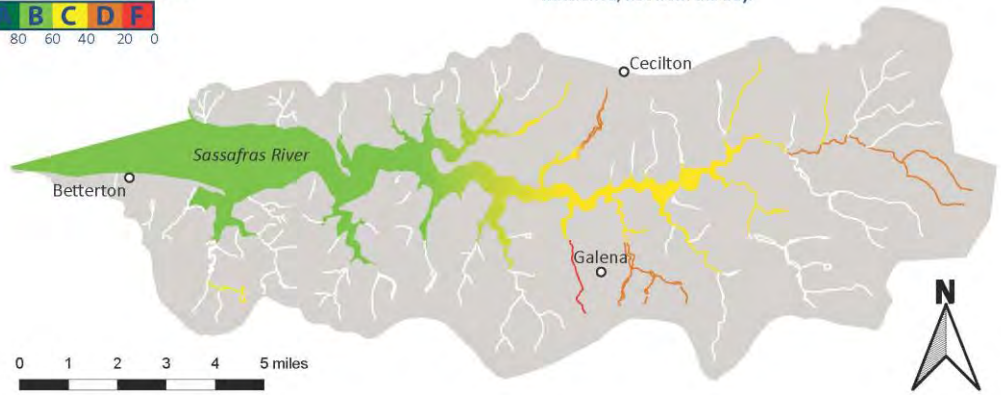
River (Tidal) Health Indicators		Lower River Average of 5 Sites	Upper River Average of 3 Sites
Dissolved Oxygen		A	A
Water Clarity		C	C
Chlorophyll-a		A	D
Aquatic Vegetation		F	F
Nutrients	Total Nitrogen	A	B
	Total Phosphorus	A	C
Final Grades		B	C

Watershed Health Scale

Very good — Very poor

A B C D F

100% 80 60 40 20 0



NON-TIDAL SAMPLING

ShoreRivers is fortunate to have 19 trained - and periodically re-trained - volunteers who conduct year round water quality monitoring at 11 sites on the non-tidal streams that run into the Sassafras River. We proudly call our volunteers the "Sassafras Samplers."

Creek Bed Organism data were not included because they were last analyzed in 2009 and are not considered indicative of current creek health.

Creek (Non-Tidal) Health Indicators		Average of 11 sites
Dissolved Oxygen		A
Turbidity		F
Nutrients	Total Nitrogen	D
	Total Phosphorus	B
Final Grade		D

Our data show poorer water quality farther up river indicating that most of the pollution impacting the Sassafras is coming from within our own watershed, not from the Bay.

Appendix J: Upper Choptank River Watershed in Caroline County, Maryland Watershed Eligible for 319(h) Grant Implementation Funding

J.1. Introduction

The *Upper Choptank River Watershed Based Plan* was completed by Caroline County in November 2010 and EPA accepted the plan in December 2010. The part of the watershed encompassed by the watershed plan is in Caroline County, Maryland. Two parts of the Choptank River watershed are not included in the plan: 1) the upstream portion of the watershed in Delaware and a very small area of Queen Anne's County, and 2) the downstream portion of the watershed in the State 8-digit watershed designated 02130404 in Talbot County and further downstream. The watershed plan can be found here: https://mde.maryland.gov/programs/Water/319NonPointSource/Documents/Watershed%20Plans/A-I_EPA_Accepted_Plans/ChoptankRiverUpper.pdf.

Pollutant reduction goals are presented in the watershed plan in Table 3 on page 13.

BMP implementation goals are in three parts of the plan:

- Agricultural BMPs in Table 4 on page 15
- Urban BMPs in Table 5 on page 18
- Septic system upgrades or connection to treatment plants in Table 6 on page 20.

Base Year for watershed plan implementation is 2002. Pollutant load reductions that year and thereafter are counted toward meeting watershed plan goals. The baseline year and plan goals are derived from Maryland Tributary Team targets for the Choptank River Basin. No TMDL for nutrients and/or sediments applied to the watershed at the time the watershed plan was written.

J.2. Milestones

Maryland's 2015-2019 NPS Management Plan Objective 5 includes two milestones for this watershed:

- Annually: Report progress in the 319 Annual Report, and
- 2015: Assess implementation progress and update the plan if needed. Caroline County completed review and determined that an update was not necessary.

J.3. Water Quality Monitoring Activity, Overall Condition, Trends

Maryland DNR's water quality analysis Summary Information [34]	
Nontidal	Nitrogen, phosphorus and sediment loads from the watershed to the non-tidal waters of the Choptank have increased. Nitrogen and phosphorus levels in the water have increased when the effect of flow is accounted for.
Tidal	Maryland DNR's most recent reporting said that water quality in the tidal upper Choptank is poor. Nitrogen, phosphorus and sediment levels are too high. Habitat quality for underwater grasses is poor because algal densities are too high and water clarity is poor. Summer bottom dissolved oxygen levels are good. There are no long-term water quality monitoring stations in the middle Choptank River. The Choptank River is in the 'High Agriculture/ Low Developed' land use category. In the Choptank River overall, nitrogen and phosphorus levels are moderate compared with other high agricultural systems. Sediment and algal densities are low compared to other high agricultural systems. Water clarity is high and summer bottom dissolved oxygen levels are moderate compared with other high agricultural systems.

J.3.a Nontidal – Index of Biological Integrity [35]

MDE's 319(h) Grant-funded biological monitoring project samples benthic macroinvertebrates and fish in healthy nontidal streams as part of Maryland's Tier II Antidegradation Program. These two measures serve as a gauge of existing stream health using a scale of 1 to 5:

good (4.0-5.0), fair (3.0-3.9), poor (2.0-2.9), very poor (1.0-1.9)
BIBI = benthic index of biological integrity
FIBI = fish index of biological integrity

In previously identified healthy waters within the Upper Choptank River watershed in Caroline County four sites have been sampled to determine if healthy conditions are continuing. A score of 4.000 or above means Tier II healthy water criteria are continuing to be met. A lower score indicates that conditions have degraded below Maryland's Tier II healthy water criteria:

- Herring Run MDE-UPCK-211-A-2017
  - BIBI 4.429 FIBI 3.333 no longer meets Tier II
- Watts Creek MDE-UPCK-229-A-2017
  - BIBI 4.143 FIBI 3.667 no longer meets Tier II
- Forge Branch MDE-UPCK-311-A-2016
  - FIBI 4.667 on 6/9/16
- Marsh Creek MDE-UPCK-201-A-2014
  - BIBI 3.857 on 3/12/14, FIBI 4.67 in 2014
- Unnamed Tributary MDE-UPCK-119-A-2015
  - BIBI 4.143 on 3/4/15, FIBI 3.667 on 8/4/15
- Watts Creek MDE-UPCK-212-A-2016
  - FIBI 4.000 on 6/14/16

[34] Maryland Department of Natural Resources. *Water Quality Summary 2013-2015*. Preliminary report received via personal communication 11/6/17 from Renee Karrh.
[35] Maryland Department of the Environment. MDE Biological Assessment for Water Quality Protection and TMDL Implementation. 319(h) Grant FFY2017 Project 5.

The 2017 fish sampling results are presented in tables on the next page. [36]

Hog Creek (Upper Choptank River Tributary), Station MDE-UPCK-210-A-2018 FIBI=4.667 June 13, 2018						
Common Name	Tolerance	Native or Introduced	Trophic Status	Lithophilic Spawner	Composition	# sampled @ Station
Least Brook Lamprey	NOTYPE	N	FF	N	B	15
American eel	NOTYPE	N	GE	N		23
Creek chubsucker	NOTYPE	N	IV	N	R	9
Brown bullhead	T	N	OM	N		7
Tadpole madtom	NOTYPE	N	IV	N	B	24
Yellow bullhead	NOTYPE	N	OM	N		10
Chain pickerel	NOTYPE	IY	TP	N		4
Redfin pickerel	T	IY	TP	N		1
Eastern mudminnow	T	N	IV	N		23
Pirate perch	T	N	IV	N		2
Bluegill	T	IC	IV	N		60
Largemouth bass	T	IC	TP	N		2
Swamp darter	I	N	IV	N	B	1

J.3.b Nontidal - Water Quality Monitoring Before/After Plan Implementation

MDE nontidal monitoring projects funded by the 319(h) Grant have not been active in this watershed. [37]

ShoreRivers conducts tidal water quality monitoring in the Upper Chotank River watershed. Their most recent assessment is presented at the end of this Appendix for the Upper Choptank River watershed.

J.4 Grant-Funded Implementation Projects

The following pages present tables summarizing the status of grant-funded NPS BMP Implementation from the following grant sources:

- 319(h) Grant and State Revolving Fund
- Chesapeake and Atlantic Coastal Bays Trust Fund

[36] Maryland Department of the Environment. *Q3Report MDE Biological Assessment FFY-17 GRTS#5 thru 7-13-2018*. Charles Poukish.and Chris Luckett July 13, 2018. 47 pages.
[37] Maryland Department of the Environment. MDE Targeted Watershed Project. 319(h) Grant FFY2017 Project 4.

Upper Choptank River Watershed
2004-SFY18 Completed NPS Implementation Grant Projects - 319(h) Grant and State Revolving Fund

Project Summary			Project Expenditures					Pollutant Load Reduction		
Area/Lead	Name/Description	End Date	Grant Funding Source	Grant Funds		Match	Total	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)
				Federal	State					
MDA / Caroline Soil Conservation District (SCD)	Upper Choptank Cover Crop Demo	2004	319 FFY03 #12	$48,161.00		$32,107.33	$80,268.33	0	0	461.8
	Upper Choptank Cover Crop Demo	2005	319 FFY03 #21	$114,000.00		$76,000.00	$190,000.00	23,097	642	0
	Agricultural Technical Assistance	2005	319 FFY04 #13	$49,949.00		$33,299.33	$83,248.33	0	0	393.1
	Upper Choptank Cover Crop Demo	2006	319 FFY04 #20	$150,000.00		$100,000.00	$250,000.00	19,465	458	0
	Agricultural Technical Assistance	2007	319 FFY04 #32	$55,990.64		$37,327.09	$93,317.73	20,646.14	1,979.37	99.89
	Agricultural Technical Assistance	2006	319 FFY05 #9	$39,167.70		$26,111.80	$65,279.50	9,139.8	1,461.3	23.84
	Upper Choptank Cover Crop Demo	2007	319 FFY05 #18	$121,600.00		$81,066.67	$202,666.67	33,192	0	0
Caroline SCD	Agricultural Technical Assistance	2010	319 FFY07 #21	$56,256.00		$37,504.00	$93,760.00	33,169.01	5,832.24	107.97
	Agricultural Technical Assistance	2009	319 FFY08 #2	$48,314.98		$32,209.99	$80,524.97	82,140.24	2,707.31	41.2
Caroline Co.	DPW Stormwater Retrofits	2012	319 FFY10 #7	$46,213.30		$30,808.87	$77,022.17	11.39	7.89	0.91
	U. Choptank Watershed Restoration	2014	319 FFY12 #6	$130,781.17		$87,187.45	$217,968.62	8.01	0.85	0
	U. Choptank Watershed Restoration	2014	319 FFY13 #6	$138,378.63		$92,252.42	$230,631.05	16.06	2.69	0.23
	Volunteer Fire Comp. SWM upgrades	SFY16	319 FFY12 #14	$37,834.00		$25,222.67	$63,056.67	4.29	0.75	0.12
	Dept. Emergency Services Porous Parking	SFY16	319 FFY14 #6	$137,449.01		$91,632.67	$229,081.68	2.37	0.17	0.01
TOTAL for completed projects				$1,174,095.43	$0.00	$782,730.29	$1,956,825.72	220,891.3	13,092.6	1,129.07
TOTAL Pollutant Load Reduction for Multi-Year Projects excluding cover crop projects (grey shaded)								145,137.3	11,988.1	666.91

SFY18 NPS Implementation Projects in Progress - 319(h) Grant and State Revolving Fund - Upper Choptank River Watershed

Project Summary			Project Funding					Future Pollutant Load Reduction		
Lead	Name/Description	End Date	Grant Funding Source	Grant Funds		Non Federal Match	Total	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment (ton/yr)
				Federal	State					
Caroline County	Lockerman Middle School Stormwater Retrofits	2019	319 FFY17 #7	$100,000.00		$66,667.00	$166,667	3.23	0.38	0.09
Caroline Soil Conservation District	Morton Farm Bio-retention and Bioswale Project	2019	319 FFY17 #8	$88,220.00		$53,813.00	$142,033	98	162	65.85

Footnote: No State Revolving Fund projects have been reported during the period 2004 to SFY2018.

J.5 BMPs Reported for Agricultural and Urban Practices

Upper Choptank River Watershed
Chesapeake and Atlantic Coastal Bays Trust Fund
SFY 2018 NPS Implementation Project Status (1)

Year Funded	PartnerCD	ProjectTitle	ProjectType	County	TrustFund Dollars	Status	BMP Units	BMPs Reported	Annual LbsN	Annual LbsP	Annual TonsTSS
FY13	Delmarva RC & D Council	Choptank Wetlands Restoration: Royal Oak	Wetland Restoration	Statewide	10,804	Complete			144	10	2
		Choptank Wetlands Restoration: Knox Farm	Wetland Restoration	Statewide	10,143	Complete			302	20	4
		Choptank Wetlands Restoration: Morris Farm	Wetland Restoration	Statewide	14,754	Complete			115	8	1
		Choptank Wetlands Restoration: Snowdon Farm	Wetland Restoration	Statewide	9,748	Complete			546	37	7
		Choptank Wetlands Restoration: Toulson Farm	Wetland Restoration	Statewide	25,650	Complete			215	15	3
		Choptank Wetlands Restoration: Durham Farm	Wetland Restoration	Statewide	13,500	Complete			129	9	2
		Choptank Wetlands Restoration: Brenner Farm	Wetland Restoration	Statewide	13,000	Complete			158	11	2
FY14	Caroline County	Ober Community Park (Greensboro)	Tree Planting Projects	Caroline	3,771	Complete			6	0	0
		Ganey's Wharf Public Landing (west of Harmony)	Tree Planting Projects	Caroline	2,286	Complete			3	0	0
		Marydel Community Park (Marydel)	Tree Planting Projects	Caroline	14,072	Complete			148	6	1
		Town of Denton (Sharp Road)	Tree Planting Projects	Caroline	10,592	Complete			9	1	0
		Caroline Co. Dept. of Emergency Services Facility	Tree Planting Projects	Caroline	11,946	Complete			17	1	0
	Town of Greensboro	Greensboro Stream Restoration Project	Stream Restoration	Caroline	99,696	Complete			8	0	15
	Ducks Unlimited	Furr	Wetland Restoration	Statewide	38,897	Complete			416	35	12
FY15	Midshore Riverkeeper Conservanc	Voorhees	Agricultural Practices	Caroline	17,638	Complete			1,609	0	0
	Delmarva RC & D Council	Street #1	Wetland Restoration	Caroline	2,201	Complete			16	1	417
	Delmarva RC & D Council	Street #2	Wetland Restoration	Caroline	2,931	Complete			33	3	194
	Delmarva RC & D Council	Street #3	Wetland Restoration	Caroline	1,843	Complete			16	1	194
FY17	Delmarva RC & D Council	Wegener Wetland	Wetland Restoration	Caroline	22,966	Complete			21	3	0
	Delmarva RC & D Council	Street Floodplain reconnection	Stream Restoration	Caroline	7,220	Complete			30	4	0
	(1) Maryland DNR provided this data 2/21/19 and indicated it is the full extent available.			TOTALS	333,658				3,940	164	854
FY17	Town of Greensboro	Choptank River Park	Stormwater Management	Caroline	299,734	Design/Planning			27	3	517
FY14	Town of Greensboro	Choptank River Park at Greensboro	Wetland Restoration	Caroline	0	Design/Planning			0	0	0
	(1) Maryland DNR provided this data 2/21/19 and indicated it is the full extent available.			TOTALS	299,734				27	3	517

SFY2018 Agricultural BMP Implementation Upper Choptank River Watershed In Caroline County, Maryland			Estimated Pollutant Load Reduction			Upper Choptank River Watershed Plan Agricultural BMP Implementation Goals				Prior Years' Progress Toward Watershed Plan Goals 2003-2013 2013 Annual Report	Extracted from State Data reported by MDE to EPA Bay Program				
Agricultural Best Management Practice	**Unit**	SFY2018 Total	Total Nitrogen (lbs)	Total Phosphorus (lbs)	Total Sediment (tons)	Management Practice Watershed Plan Table 4	Goal	Units	Progress 2003 thru SFY2018		SFY14	SFY15	SFY16	SFY17	**Units**
Annual Practices															
Cover Crops	acres	29,874.0	105,221.4	0.1	50.47	Cover Crops	50,000	acres/yr	29,874						
						Commodity Cover Crops	15,000	acres/yr							
Multi-Year Practices															
Alternative Crops	acres								0		0	0	0	0	acres
Amendments for Treatment of Ag Waste	AU	374.00	0.00	0.00	0.000				1,374		180	0	820	0	AU
Animal Mortality Facility	count	4.0	15.9	2.3	0				14		0	0	4	6	count
Conservation Cover	acres	3.0	22.6	0.5	0.06				55		0	0	39.9	12.3	acres
Conservation Plans/SCWQP	acres	6,316.0	3,726.0	0.0	37.87	Soil Conservation WQ Plans	66,000	acres	48,315	4,699.9	8,401	8792	11317	8789	acres
Critical Area Planting	acres								5		0.3	3.95	0.3	0	acres
Dead Bird Composting Facility*	count	2.0	0.0	0.0	0.00				9		5	2	0	0	count
Fencing*	feet	3264.0	1.0	0.3	0.00	Stream protection with fencing	130	acres	3,264	0 acres	0	0	0	0	feet
Field Border	acres	2.9	25.5	0.6	0.11				15.3		0.5	1.61	0	10.3	acres
Filter Strip*	acres	6.7	0.47	0.01	0.00				7		0	0	0	0	acres
Grassed Waterway†	acres	0.4	0.0	0.0	0.00				1.6		1.2	0	0	0	acres
Horse Pasture Management	acres								19		0	0	19.1	0	acres
Loafing Lot Management System	acres	1.3	916.1	155.8	0.01				6.0		1.6	1.56	0.1	1.41	acres
Pasture & Hay Planting	acres	7.4	55.7	0.5	0.15				15		0	0	0	7.4	acres
Prescribed Grazing	acres	22	0	0	0.01				110		0	0	33.2	55	acres
P-sorbing Materials	acres								0		0	0	0	0	acres
Riparian Forest Buffer*	acres	0.3	0.0	0.0	0.00	Buffers Forested - Agriculture	1,000	acres	0	0	0	0	0	0	acres
Riparian Herbaceous Cover	acres	29.7	480.9	13.9	1.47	Buffers Grassed - Agriculture	5,500	acres	135.6	64.2	14.1	9.06	2.33	16.17	acres
Roof Runoff Structure	count					Runoff Control	8	count	4	2	1	0	1	0	count
Stream Restoration Ag	feet								1,045		0	995	50	0	feet
Tree/Shrub Establishment	acres					Tree Planting - Agriculture	100	acres	119	0	0	0	95.7	23.6	acres
Waste Storage Facility	count	6.0	2,846.7	406.1	0	Animal Waste Mgmt - Livestock	2	count	43	1	4	3	4	10	count
						Animal Waste Mgmt - Poultry	4			15					
Wastewater Treatment Strip	acres										0	0	0	0	acres
Water Control Structure	count					Drainage Control Structures	65	count	11	no report	1	5	1	4	count
Watering Facility	count										0	0	0	0	count
Wetland Creation	acres					Wetland - Agriculture	1,200	acres	262.4	12.1	1.5	0	0	0	acres
Wetland Restoration	acres										0	1.9	194.3	52.6	acres
Windbreak/Shelterbelt Establishment†	feet	13502.0	0.0	0.0	0.00				15,708		0	2206	0	0	feet
						Conservation Tillage	20,000	acres/yr	0						
						Nutrient Management	48,000	acres	0						
						Precision Agriculture	25,000	acres	0						
						Retirement of Highly Erodible Land	500	acres							
						Stream protection with no fencing	32	acres							
Total Annual Practices (2)			105,221.4	0.1	50.5										
Total Multi-year Practices			8,090.8	580.0	39.7										
Total Pollutant Load Reduction			113,312.2	580.1	90.2										

(1) "SFY18 Total" column is Maryland Dept. of Agriculture data.

(2) Annual Practices: cover crops, nutrient mgmt, manure transport, conservation tillage & high residue tillage.

†Reductions could not be calculated with units reported

*Reductions for this practice were calculated using Phase 6 Chesapeake Assessment Scenario Tool

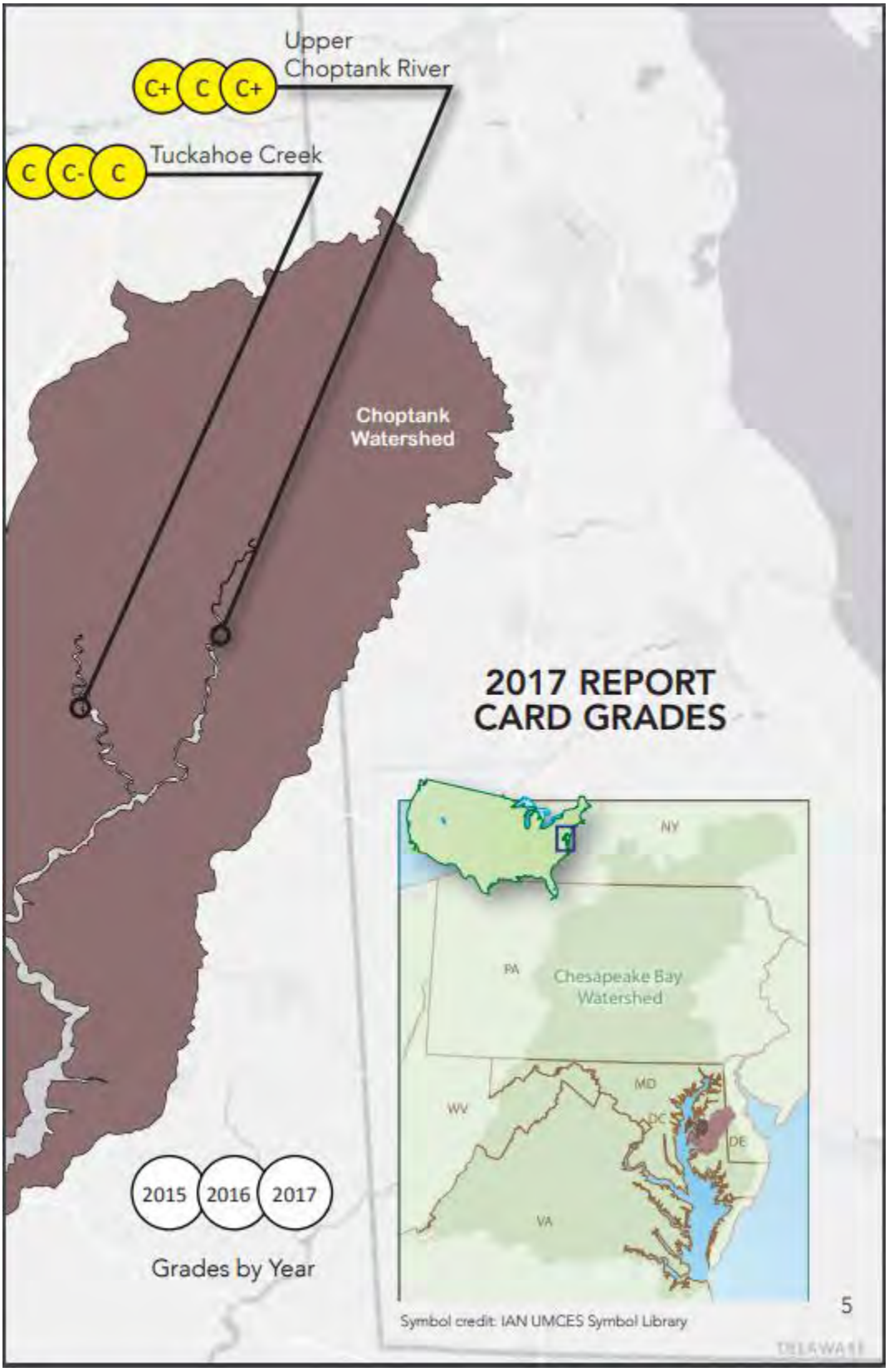
SFY2018 Urban BMP Implementation Upper Choptank River Watershed In Caroline County, Maryland						Upper Choptank River Watershed Plan Urban BMP Implementation Goals					Prior Years' Progress Toward Watershed Plan Goals					
Management Practice	Unit	BMPs Reported	Estimated Pollutant Load Reduction Nitrogen lb/yr	Phosphorus lb/yr	Sediment tons/yr		Management Practice	Goal	Units	Progress SFY14 thru SFY18	Local Data 2003-2013 in 2013 Annual Report	Extracted from State Data reported by MDE to EPA Bay Program SFY14	SFY15	SFY16	SFY17	Units
Bioretention (1)	acres								acres	0		0	0	0	0	acres
Cisterns and Rain Barrels (1)	acres								acres	0		0	0	0	0	acres
Bioswale (1)	acres								acres	0		0	0	0	0	acres
Disconnection of Rooftop Runoff (1)	acres								acres	0		0	0	0	0	acres
Dry Detention Ponds & Hydro Structures (1)	acres								acres	0		0	0	0	0	acres
Dry Extended Detention Ponds (1)	acres								acres	0		0	0	0	0	acres
Dry Well (1)	acres								acres	0		0	0	0	0	acres
Filtering Practices (1)	acres								acres	0		0	0	0	0	acres
Forest Conservation	acres								acres	0		0	0	0	0	acres
Forest Harvesting Practices	acres								acres	0		0	0	0	0	acres
Infiltration Practices (1)	acres								acres	0		0	0	0	0	acres
Permeable Pavement (1)	acres								acres	0.5		0	0.5	0	0	acres
Rain Garden (1)	acres								acres	0		0	0	0	0	acres
Reduction of Impervious Surface (1)	acres								acres	0		0	0	0	0	acres
Riparian Forest Buffers on Urban Lands (2)	acres								acres	0		0	0	0	0	acres
Septics Connections to Sewers	count					Table 6	Septic Connections to WWTP	750	count	0	no report	0	0	0	0	count
Septic Denitrification critical area	count	8	78.40								no report	15	7	12	6	count
Septic Denitrification outside of 1000 feet	count	1	3.40			Table 6	Enhanced Septic Denitrification	5,051	count	144	no report	8	14	21	11	count
Septic Denitrification within 1000 feet	count	10	55.00								no report	21	5	4	1	count
Septic Tank Pumpout	count								count	0		0	0	0	0	count
Stream Restoration Urban	feet								feet	0		0	0	0	0	feet
Street Sweeping (1)	acres								acres	0		0	0	0	0	acres
Tree Planting	acres								acres	0		0	0	0	0	acres
Urban Forest Buffer (2)	acres								acres	0		0	0	0	0	acres
Wet Extended Detention (1)	acres								acres	0		0	0	0	0	acres
Wet Ponds & Wetlands (1)	acres								acres	0		0	0	0	0	acres
						Table 5	Buffers Forested, Urban (2)	60	acres	0	0					
						Table 5	Erosion and Sediment Control	895	acres/yr							
						Table 5	Nutrient Management, Urban	12,000	acres	0	0					
						Table 5	Stormwater Management (1)	8,400	acres	7.4	6.9					
		Urban BMPs TOTAL	136.80	0.00	0											

(3) "BMPs Reported" column is MDE data. MDE used MAST to estimate pollutant reduction.

(1) Watershed plan goal "stormwater management" aggregates reporting for BMPs footnoted (1).

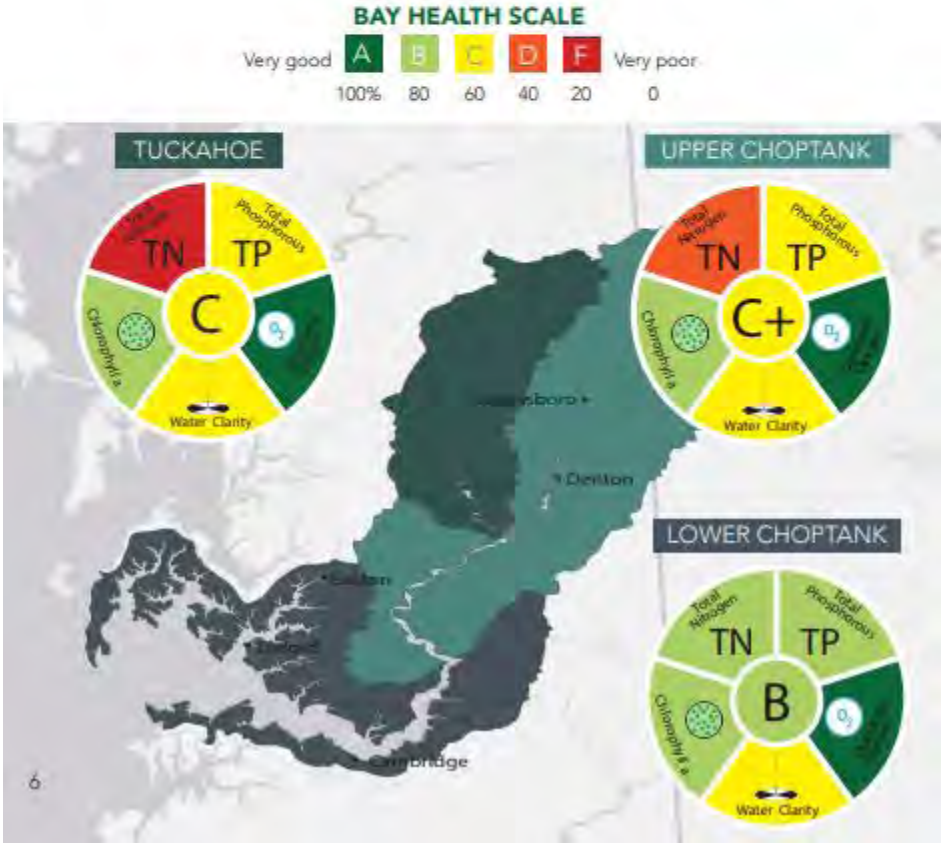
(2) Watershed plan goal "buffers forested, urban" aggregates reporting for BMPs footnoted (2).

J.6 Upper Choptank Report Card



CHOPTANK RIVERKEEPER

The overall pattern this year showed that the Upper Choptank River region had surprising improvements in water clarity and a notable improvement in TP; whereas the Lower Choptank River region reported worse water clarity and TN. Reviewing the weather data for 2017 pinpointed a unique rainfall pattern. The season saw an average amount of rainfall, but May, July, and August were very wet months with at least 7" of rain in each. In July and August, the rain was less frequent, but it was intense with greater amounts of precipitation per rain event. When the Lower Choptank River region received these storms, the runoff (or "input") was more impactful because the flow path from land to water was shorter. In the Upper Choptank region, where there are more narrow streams flowing through a larger landmass, that rainfall had more land to soak into before reaching our waterways. Many agricultural best management practices aim to slow down the flow of water to process pollution. We're optimistic that the many efforts to reduce the number of inputs coming from the land are working!



Appendix K – 2018 Integrated Report Executive Summary

Maryland's Final 2018 Integrated Report of Surface Water Quality

Submitted in Accordance with Sections 303(d), 305(b), and 314 of the Clean Water Act

Maryland
Department of
the Environment

Larry Hogan, Governor
Boyd Rutherford, Lt. Governor

Ben Grumbles, Secretary

Submittal Date: October 23, 2018
EPA Approval Date: April 9, 2019

EXECUTIVE SUMMARY

Maryland's 2018 Integrated Report (IR) is submitted in compliance with sections 303(d), 305(b) and 314 of the federal Clean Water Act (CWA). This biennial report describes ongoing efforts to monitor, assess, track and restore the chemical, physical and biological integrity of Maryland waters. This report also presents the current status of water quality in Maryland by placing all waters of the State into one of five categories which are described in detail in the introductory section of this document. In addition, the report provides information about the progress on addressing impaired waters (Categories 4 & 5) by documenting:

- Completed Total Maximum Daily Loads (TMDLs), which re-categorize impairments from Category 5 (impaired and needs a TMDL: the "list of impaired waters") to Category 4a (TMDL completed, but still impaired).
- Analyses of new water quality data that shows areas previously identified as impaired that are attaining standards. This can result from remediation, changes in water quality standards, or improved monitoring and/or data analysis.
- Assessment methodologies and watershed segmentation that enhance the use of available data and provide consistency with management and implementation strategies.
- Statewide water quality statistics for Maryland's surface waters.
- Maryland's prioritization of impairments for TMDL development.

Similar to previous Integrated Reports, Maryland has made significant efforts to incorporate non-state government data in ways that increase the resolution of the state's water quality assessments. Datasets used included those collected by federal agencies, county governments, water utility agencies, and non-profit watershed organizations. The 2018 IR will also include a GIS submittal that provides coverages for streams, impoundments, and tidal waters which depict assessment information at appropriate scales. MDE continues to make Integrated Reporting data available to the public in several user-friendly formats. Accessible via the web, users can query MDE's searchable IR database to find individual assessments or groups of assessments that are of interest. The searchable IR database and companion clickable map application are available online at http://www.mde.maryland.gov/programs/water/tmdl/integrated303dreports/pages/303d.aspx.

New this year is a revamped online map which displays water quality assessment information overlaid on top of TMDL watersheds. This newly reformatted map is meant to highlight the spatial relationship between the specific water body impaired for a given pollutant and the TMDL that accounts for all sources of that pollutant in that water body's watershed. Users can select as few or as many pollutants to display as they like with this fully interactive map. This map therefore replaces the previously provided single-pollutant maps and provides users with a one-stop map for visualizing water quality assessment information. The newly created map can be found at: http://mdewin64.mde.state.md.us/WSA/IR-TMDL/index.html.[1]

Also new this year, Maryland will be submitting the Integrated Report to the EPA through the Assessment, Total maximum daily load Tracking and Implementation System (ATTAINS), an online

[1] Please note that both the searchable IR database and map applications will be updated with information from the 2018 IR once the IR has gone through public review and comment and has been approved by the Environmental Protection Agency.

system for accessing information about the condition of the Nation's surface waters. All Integrated Report information will be made available in ATTAINS through web reports and other query tools. More information on the new ATTAINS reporting system can be found online at https://www.epa.gov/waterdata/attains. The Maryland Department of the Environment will continue to maintain Maryland's Integrated Report information along with associated GIS mapping on the Department's webpage.

Maryland's Water Quality Highlights

This Integrated Report made use of the most comprehensive dataset ever assembled for the Lower Susquehanna River in Maryland, in both the portion upstream of the Conowingo Dam (also known as the Conowingo Reservoir) and immediately downstream of the Dam. Several imminent regulatory processes required for the Dam's continued operation generated significant new biological, habitat, and water quality information in this area. This recently collected data and information has helped to inform: a new Category 5 listing for the public water supply use related to total phosphorus in the Conowingo Reservoir; a Category 2 (meeting some water quality criteria) listing for the aquatic life use for total phosphorus in Conowingo Reservoir; a Category 3 (insufficient data for assessment) listing for debris in the Conowingo Reservoir; and Maryland's first ever impairment listing (Category 4c – impaired by pollution not caused by a pollutant) for flow alteration (changes in depth and flow velocity) for the portion of the Susquehanna River immediately downstream of the Dam and extending to the head of tide. These assessment records represent an important step forward for Maryland's water quality monitoring efforts as the state strives to address previously unassessed or under-assessed waters. This information also underscores the importance of managing dam operations in a way that supports not only the creation of carbon-free energy but also aquatic life and recreational uses of the Susquehanna River as well. The federal relicensing process and the water quality certification for the Conowingo Dam issued in April 2018 represent a critical opportunity to determine how best to deal with the water quality challenges presented by the dam.

Other persistent water quality challenges facing the State include the increasing trends of conductivity and water temperature in non-tidal streams throughout the State. Increasing conductivity levels appear to be strongly linked to the widespread use of road salt deicers. A component of road salt and contributor to stream conductivity, is the aquatic life toxicant, chloride. MDE has now documented 28 watersheds as impaired for chloride. Likewise, the State has also documented a number of temperature impairments in Class III (and Class III-P) coldwater streams. The exceedance of the temperature criterion in these streams threatens the persistence of coldwater obligate species and presents an additional challenge for restoration efforts aimed at providing biological uplift. However, as described further below, efforts are underway to get a handle on these pollutants moving forward.

The State can also tout several water quality successes in the past several years. In 2016, submerged aquatic vegetation coverage, a key indicator for the attainment of water clarity criteria, reached the highest level recorded in the Chesapeake Bay and tidal tributaries since aerial surveys began in 1984. In another example of a water quality success, the 2018 IR marks the third IR cycle in a row where specific restoration projects, undertaken by the State, have been directly linked to attainment of water quality criteria. In this instance, MDE's Bureau of Mines Division used Clean Water Act Section 319(h) funding to coordinate the construction of acid mine drainage treatment systems on three separate stream segments in the Casselman River watershed in Garrett County, MD. These 3 stream segments,

Alexander Run, Tarkiln Run, and Spiker Run, were previously listed as impaired and had TMDLs established to address issues with low pH. The acid mine treatment systems, each installed more than 4 years ago, have demonstrated to be a reliable solution for increasing stream pH to levels within Maryland's pH criteria range (6.5 – 8.5). As a result, all three streams have been moved to Category 2 (meeting some water quality criteria) in recognition of meeting pH water quality criteria.

Maryland has made enormous progress in establishing TMDLs for the State's impaired water bodies. To date, Maryland has established 555 TMDLs out of a total of 839[2] water body-pollutant impairments. The water body size addressed by TMDLs for each major pollutant-type is shown in the figures below. As is evident from these figures, some pollutants have been almost completely addressed by TMDLs while others have not (e.g. chlorides, sulfates, stream temperature). For chlorides and stream temperature, the state is in the process of developing new water quality modeling methodologies for estimating loads and impacts.

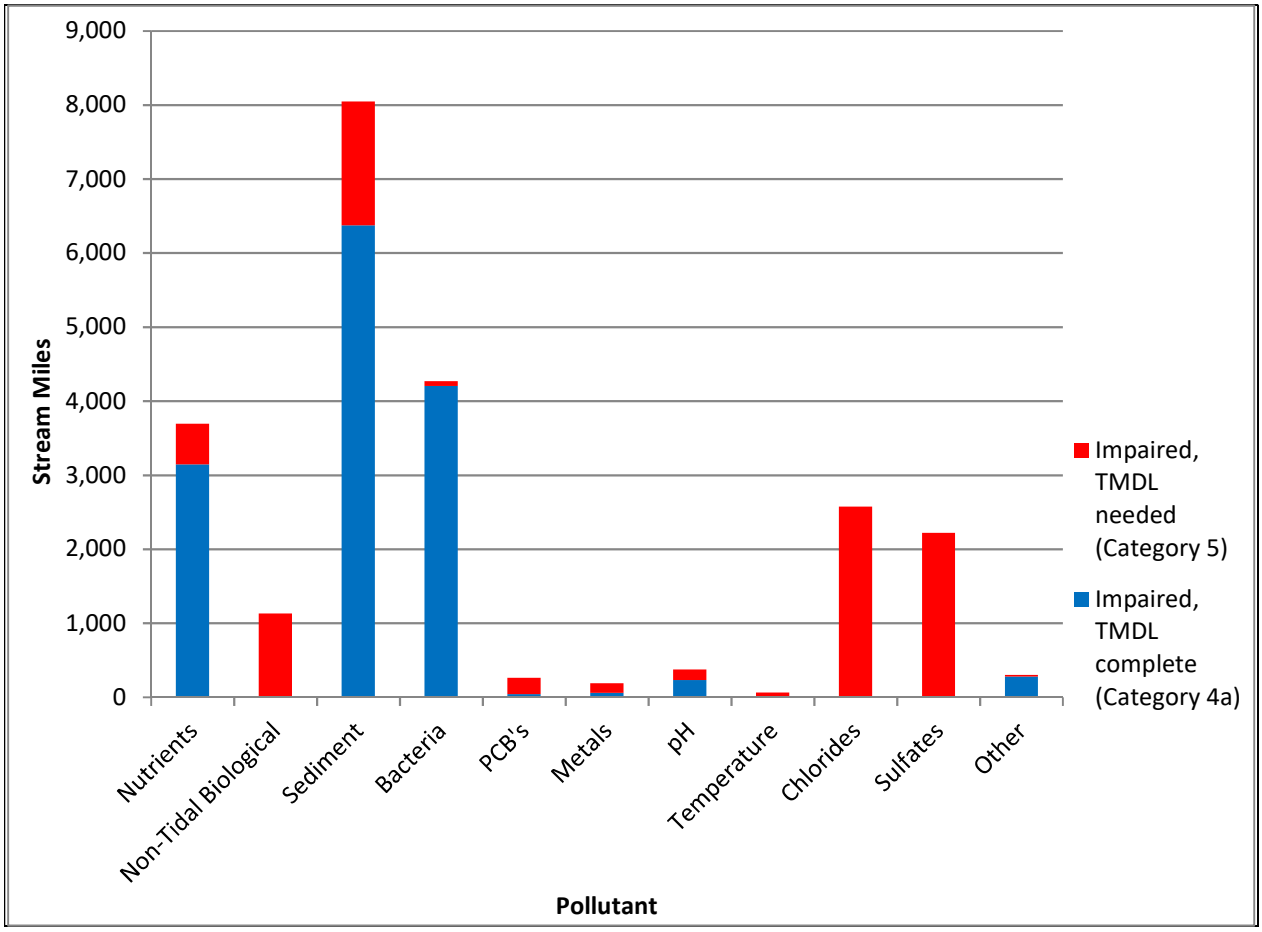


Figure 1: Stream miles impaired by various pollutants. Colors denote the stream miles currently addressed by TMDLs (blue) and those that still require TMDLs (red).

[2] These numbers can go up or down from IR cycle to IR cycle as impairments get added or delisted based on updated information and data.

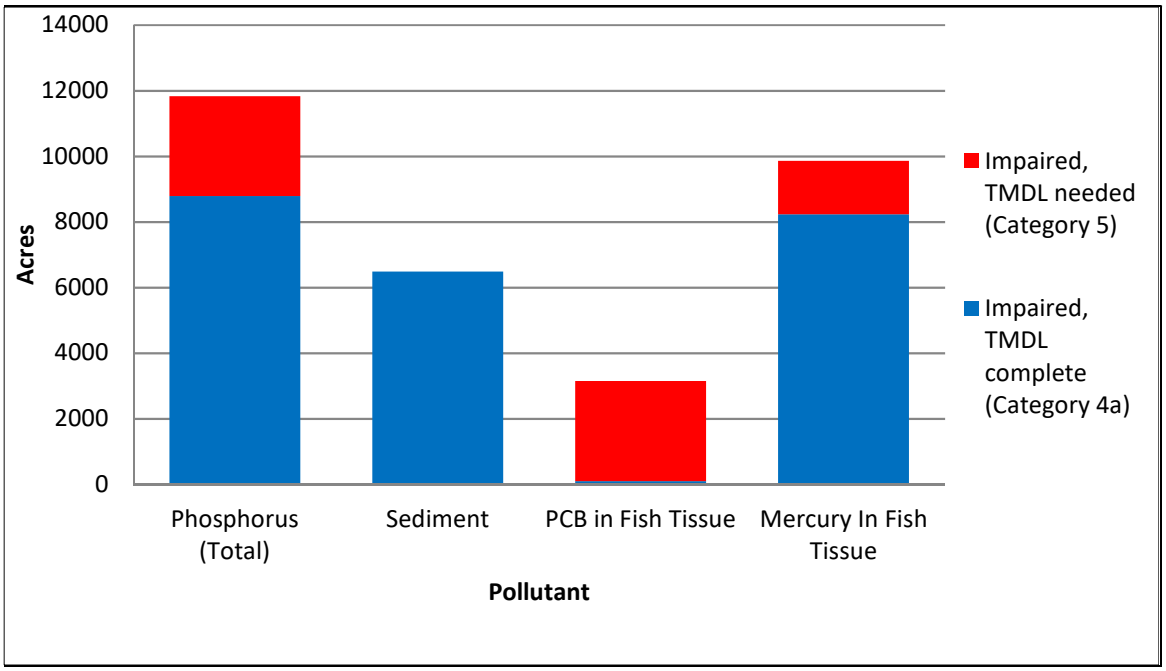


Figure 2: Impoundment size impaired by various pollutants. Colors denote the impoundment acres currently addressed by TMDLs (blue) and those that still require TMDLs (red).

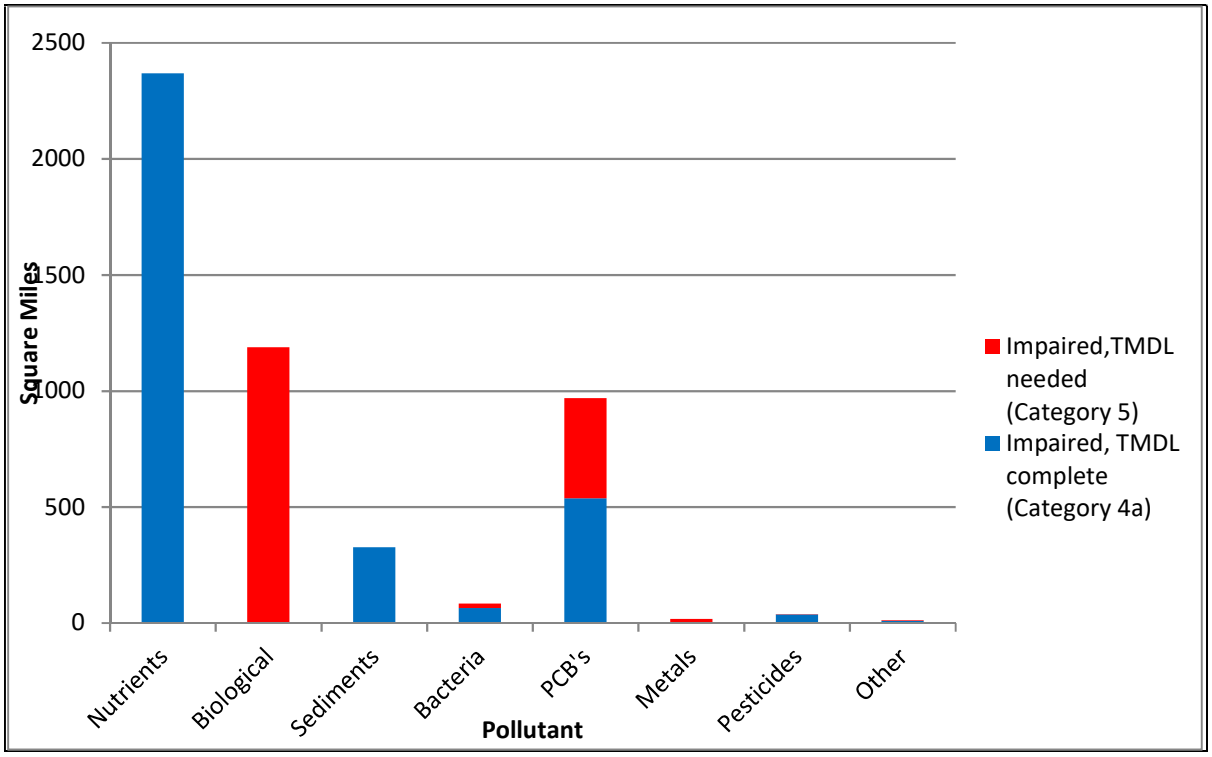


Figure 3: Size of estuarine waters impaired by various pollutants. Colors denote the square mileage of estuarine waters currently addressed by TMDLs (blue) and those that still require TMDLs (red).

Summary of Changes in the 2018 Integrated Report

There are a total of 42 additions to the list of Category 5 (impaired, TMDL needed) waters in 2018. Six of the new Category 5 waterbody-pollutant combinations (also referred to as listings or assessment records) resulted from MDE's Biological Stressor Identification Analyses (BSID). Of these 6 new 'biostressor' listings, three are for total suspended solids, two are for sulfates, and one is for chlorides. In addition, there are four new fecal coliform listings in shellfish harvesting waters, one new listing for PCBs in fish tissue, and one new listing for phosphorus. There are also 30 temperature listings that were moved from category 3 (insufficient information) to category 5 (impaired, TMDL needed) after the close of the public comment period. These 30 listings were changed based on a re-evaluation of these data using the policy of independent applicability which requires each individual data type (e.g. biological, water chemistry, etc) to be assessed independently and without weighting. Additional details about this re-evaluation are provided in Section C.3.1.1.

Table 1: Changes to Category 5 Listings from 2016 to 2018

Integrated Report Year/Status	Category 5 Listings
2016 Total Category 5 Listings	**261**
2018 New Category 5 Listings	42*
2018 New Delistings (Category 5 to Category 2 or 3) *(See Table 2)*	-11*
Approved TMDLs (since the 2016 IR)	-8^*
2018 Grand Total Category 5 Listings	**284***

^The reader may note that this number is smaller than in previous cycles. The reason for this is that Maryland's 2016 Integrated Report (IR) was delayed and as a result was completed less than a year ago. Therefore, not much time has passed in which TMDLs could have been developed by MDE and then subsequently reviewed and approved by EPA (after which they are reflected in the IR).

*The reader may note that this number has changed since the draft report. Please refer to Part H: Assessments That Were Modified After the Start of the Public Comment Period for more information.

Eleven waterbody-pollutant combinations were removed from Category 5 (impaired, TMDL needed) in 2018. Four biological listings without a specified impairing substance have been replaced by specific pollutant listings enumerated by the Biological Stressor Identification analyses. Another three (of the 11) listings, originally listed as impaired for exceedances above the pH criteria (i.e. > 8.5 pH units), were removed from Category 5 because new data showed that water quality standards were being met. The last four listings removed from Category 5 included two for fecal coliform in shellfish harvesting areas, one for mercury in fish tissue, and one for PCBs in fish tissue. All of these four listings were moved to Category 2 on the basis of new data that demonstrated water quality that met the applicable criterion.

Some of these listings were originally based on limited data. In these cases, it is not possible to attribute these waters now meeting standards to a particular restoration action. It is possible that the extensive restoration practices that have been applied statewide might be playing a contributory role but it may also be true that these listings were made based upon insufficient data. Table 2 shows the general water body-pollutant combinations that have been delisted from Category 5.

Table 2: 2018 Delistings (water body-pollutant combinations removed from Category 5 (impaired, TMDL needed) and placed in Category 2 or 3 (non-impaired).

Type of Impairment Listing	Number of Listings Removed from Category 5
Generic Biological Listings – specific pollutant now specified (BSID process)	4
pH – water quality criteria now met	3*
Fecal Coliform – meeting water quality criteria for the shellfish harvesting use	2
Hg - fish tissue concentrations now meeting fishing designated use	1
PCBs - fish tissue concentrations now meeting fishing designated use	1
2018 Total Number of Delistings	**11**

* The reader may note that this number has changed since the draft report. Please refer to Part H: Assessments That Were Modified Since the Public Comment Period for more information.

In addition, there were other water quality listings removed from the impaired part of the IR but which were not counted in Table 2 because they were previously in Category 4a (impaired, TMDL approved). Four such delistings occurred in tidal tributaries to the Chesapeake Bay including the Chester River Oligohaline, Honga River Mesohaline, Middle River Oligohaline, and the Port Tobacco River Oligohaline segments. In this case, all four water body segments had recent assessment data that demonstrated attainment of the shallow water submerged aquatic vegetation (SAV) use and water clarity criteria (i.e. SAV coverage and water clarity). Other noteworthy assessments captured on the 2018 IR and which were not counted in Table 2, were the removal (from Category 4a) of the three low pH impairments in the Casselman River watershed that were mentioned above. For more details on the Category 4a delistings please see Section C.3.1.2.

Other notable actions taken by the State include:

- The passage of House Bill (HB) 1325 during Maryland's 2017 Legislative Session. This bill, signed by the Governor, banned the practice of hydraulic fracturing in the state. After much deliberation on the issue and comprehensive research by state agency staff, legislators and the Governor "concluded that the risks of hydraulic fracturing outweighed any potential benefits."
- Passage of the Clean Water Commerce Act (HB417/SB314) which expands the authorized uses of the Bay Restoration Fund to include funding urban stormwater retrofits to reduce nitrogen, phosphorus, and sediment going to the Chesapeake Bay.
- Issuing a notice of intent to award a contract to both remove the sediment built-up behind the Conowingo Dam and identify opportunities for innovative/beneficial reuse. EPA Chesapeake Bay Program modeling shows that, without addressing these sediments, Maryland will not be able to meet the requirements of the Chesapeake Bay TMDLs, thus making addressing the impacts of these accumulated sediments a high priority.
- Proposing road salt management strategies in the next round of Phase I Municipal Separate Storm Sewer System (MS4) permits thereby taking action to address the increasing chloride levels in Maryland's streams, groundwater, and drinking water reservoirs and subsequent water quality impairments identified in this report.

- The development of stream temperature modeling methods designed to address, through a TMDL or other mechanism, the 101 temperature impairments to Class III and III-P streams.

Maryland continues to work closely with EPA's Chesapeake Bay Program (CBP) and other state partners (VA, PA, D.C., NY, and DE) to refine and enhance the various tools used to monitor, assess, model, and restore this iconic estuary. This year, the Chesapeake Bay Midpoint Assessment was completed which provides a comprehensive review of mid-course progress towards meeting the Chesapeake Bay TMDLs. This assessment helps jurisdictions identify any necessary adjustments in strategies to ensure that the partnership can achieve its pollutant loading reductions by 2025 while accounting for future growth and a changing climate. As a result, the Midpoint Assessment will be used to inform the Phase III Watershed Implementation Plans (WIP) that will serve as the detailed road map for meeting nutrient and sediment reduction goals out to 2025. At the same time, the State also continues work in Maryland's Coastal Bays and Youghiogheny River watersheds to ensure that the unique challenges for these water bodies are properly assessed and managed to restore, protect, and maintain water quality.

Appendix L - Milestones
NPS Management Plan Tracking in the Annual Report

Maryland's 2015-2019 NPS Management Plan that was approved by EPA in January 2015 included many new NPS milestones to track progress associated with the:

Chesapeake Bay TMDL
Chesapeake Bay Agreement
NPS Management statewide

Progress tracking is generally based on the state fiscal year July thru June.

SFY 2018 Milestones Progress Summary

- 2-Year Milestones: Maryland agencies and jurisdictions are working to assess progress toward meeting BMP and Programmatic milestones for 2017-2018.
- Maryland 2015-2019 NPS Program – Statewide Milestones. These milestones are designed to help meet a series of objectives named on the State NPS management plan. Progress thru SFY16 for the following objectives is presented in this appendix:
    - Objective 3: Pollutants and Stressors
    - Objective 4: Pollutant Sources
    - Objective 5: Types of Waterbodies
    - Objective 6: Protection and Restoration
    - Objective 7: Priority Setting
    - Objective 8: Program Management and Evaluation

Maryland 2015-2019 NPS Program – Statewide Milestones Objective 3: Pollutants & Stressors	Lead	Goal SFY2018	Report SFY2018	Annual Publication link to
Annual Nitrogen Nonpoint Source Loads to Bay: Used to show progress on nutrient load reductions. (reported for state fiscal year)	MDE	report progress	42,917,233	
Nitrogen: For all watersheds with EPA-accepted plans, overall total annual reduction by NPS implementation completed during the past year. (Cumulative lbs/yr nitrogen starting 2015 excluding annual practices)	MDE	200,000	1,364,096.0	
Annual Phosphorus Nonpoint Source Loads to Bay: Used to show progress on nutrient load reductions. (reported for state fiscal year)	MDE	report progress	3,152,847	
Phosphorus: For all watersheds with EPA-accepted plans, overall total annual reduction by NPS implementation completed during the past year. (Cumulative lbs/yr nitrogen starting 2015 excluding annual practices)	MDE	4,000	96,551.0	
Sediment: 319-funded projects estimated annual reductions... (Cumulative starting in 2015 tons/yr)	MDE	20	4,860.00	
Sediment: For all watersheds with EPA-accepted plans, overall total annual reduction by NPS implementation... (Cumulative tons/yr sediment starting 2015 excluding annual practices.)	MDE	800	10,345.00	
Bacteria: Annual Report on Monitoring Results for Maryland Beaches	MDE	report findings	posted on Internet	http://mde.maryland.gov/programs/Water/Beaches/Pages/index.aspx
Bacteria: Conduct Annual Meeting of County Beach Management Programs	MDE	report findings		http://mde.maryland.gov/programs/Water/Beaches/Pages/index.aspx
Bacteria: Conduct Shoreline Field Surveys near Shellfish Waters to identify potential pollutant sources of concern (part of a 7-year cycle).	MDE	report findings	posted on Internet	http://mde.maryland.gov/programs/Marylander/fishandshellfish/Pages/index.aspx
Bacteria: Conduct Sanitary Surveys of relevant data for all shellfish growning areas	MDE	report findings	posted on Internet	http://mde.maryland.gov/programs/Marylander/fishandshellfish/Pages/index.aspx
Chloride: Number of water bodies that have a detailed watershed assessment based on monitoring data. (Cumulative starting in 2015)	MDE	5		
Chloride: TMDL development (Cumulative # of new TMDLs starting 2015)	MDE		0	
Chloride: Annual Road Salt Application Management Training by State Highway Administration.	MDE	report result	0	
PCBs: TMDL development (Cumulative # of new TMDLs starting 2015)	MDE	12	8	
PCBs: Conduct monitoring in an attempt to locate upland sites contaminated by high concentrations of PCBs. Annually report monitoring plans and findings.	MDE	report status	1	
Mercury: Update Maryland's 319 Program webpage to summarize Maryland's existing mercury mitigation activities.	MDE		No Acitvity	
Mercury: Update Maryland's 319 Program webpage to summarize regional, national and international initiatives designed to reduce mercury.	MDE		No Acitvity	
Mercury Gap Analysis: Based on findings and refinement of previous two years research in support of webpage enhancements identify any gaps, which might reflect recommendations of other's studies of opportunities to further reduce existing sources of mercury. Report summary findings in an Annual Report appendix.	MDE		No Acitvity	
Mercury in Fish Tissue: Report Median statewide mercury concentration in black bass (including largemouth and smallmouth) for the previous 5 years. The fish tissue contaminant concentration is a quantitative measure of the average contaminant level for the compounds most responsible for fish consumption advisories in waters of the State of Maryland to protect human health.	MDE	report findings	posted on Internet	http://mde.maryland.gov/programs/Marylander/fishandshellfish/Pages/fishconsumptionadvisory.aspx

Maryland 2015-2019 NPS Program – Statewide Milestones Objective 4: Pollutant Sources	Lead	Goal SFY2018	Report SFY2018	Annual Publication link to
Agricultural Milestones				
Maintain Annual Cover Crop Implementation Acreage Levels	MDA	418,000	558,797	
Maintain Annual Nutrient Management Plan Acreage Levels	MDA	713,516	353,904	
Maintain Annual Soil Conservation and Water Quality Plan Acreage Levels (acres)	MDA	1.041 million	923,895	
Maintain Annual Manure Transported out of Chesapeake Bay watershed (tons)	MDA	55,000	79,664	
Maintain Annual Conservation Tillage Acreage Levels	MDA	765,000	841,193	
Plant Riparian Forest Buffers (Acres/year)	MDA	710	Can't estimate annual change due to new P6 model	
Wetland Restoration (Acres treated/year)	MDA	1,806	Can't estimate annual change due to new P6 model	
Phosphorus Management Tool regulation adoption	MDA			
On-site Disposal Systems				
Upgrade septic systems to nitrogen removal technology (systems/year)	MDE	1,200	1,751	http://mde.maryland.gov/programs/Water/BayRestorationFund/AnnualReports/Pages/Water/CBWRF/annualreports/index.aspx
Refine septic system nitrogen reduction strategy for the Chesapeake Bay	MDE		Done; awaiting EPA approval	https://mde.maryland.gov/programs/Water/TMDL/TMDLImplementation/Pages/Phase3WIP.aspx
Adopt online system for reporting installation of Best Available Technology OSDSs.	MDE	report status	software being developed	
Facilitate refinement of septic system information and submit it to the EPA Chesapeake Bay Program (numbers, locations and types of systems)	MDE		refinement complete, reporting ongoing	
Urban/Suburban Stormwater and Erosion & Sediment Control				
Stormwater retrofits of land without sufficient controls (pounds nitrogen reduced/year)	MDE	22,000	14,638	
Refine stormwater nitrogen and phosphorus reduction strategies for the Chesapeake Bay	MDE		Done; awaiting EPA approval	https://mde.maryland.gov/programs/Water/TMDL/TMDLImplementation/Pages/Phase3WIP.aspx
Complete the development of an MS4 geodatabase that will aid MDE in the assessment of management programs and improve current Phase I data tracking, collection and validation of BMPs:	MDE		completed	
Online BMP Reporting Tool for Non-MS4 local governments:	MDE		being constructed	
Outreach to non-MS4 jurisdictions on reporting stormwater controls on new development and retrofitting development with insufficient controls.	MDE		ongoing	
Historical BMP Cleanup as part of the Chesapeake Bay Midpoint Assessment	MDE		updated	
SMART Homeowner BMP Tracking Tool: Make the tool available to users.	UME		now in use	http://extension.umd.edu/watershed/smart-tool
Online BMP Reporting Tools for MS4 and Non-MS4 local governments: Make the tool available to users.	MDE		developing tool for non-MS4 jurisdictions	
Issue tentative determination for Phase II MS4 permits.	MDE		completed	https://mde.maryland.gov/programs/Water/StormwaterManagementProgram/Pages/NPDES_MS4_New.aspx
Local Stormwater WLA Implementation Plans: Review Plans submitted as part of Phase I MS4 requirements. (Number of jurisdictions, which may include multiple plans for each jurisdiction)	MDE		All WLA reviewed	
Erosion and Sediment site "inspection coverage rate" conducted by MDE (Source: Annual Enforcement & Compliance Report)	MDE	report rate	Not yet reported	

Maryland 2015-2019 NPS Program – Statewide Milestones Objective 4: Pollutant Sources	Lead	Goal SFY2018	Report SFY2018	Annual Publication link to
Forestry				
Develop Lawn-to-Woodland Program, Program rules and partners in place	DNR		Not yet reported	
Update Maryland's 5-year Forest State Assessment & Strategy	DNR		Major update is due in 2020	
Planting Forests on 43,960 acres by 2020 from 2006 baseline as part of Maryland's Greenhouse Gas Reduction Act (GGRA) plan goals.	DNR	report acres	Not yet reported	
Bay WIP Targets: Add Phase III Watershed Implementation Plan targets to this table of Milestones in 2019 and track in future 319 NPS Management Plan milestones. The GGRA metric will be used as the common measure between now and 2019.	DNR		TN - 45.8M lbs/yr; TP - 3.68 M lbs/yr	https://mde.maryland.gov/programs/Water/TMDL/TMDLImplementation/Documents/Phase%20III%20WIP%20Report/Draft%20Phase%20III%20WIP%20Document/Main%20Report_Phase%20III%20WIP-Draft_Maryland_4.11.2019.pdf
Resource Extraction				
Coal Mining site "inspection coverage rate" conducted by MDE	MDE	report rate	Not yet reported	
Non-Coal Mining site "inspection coverage rate" conducted by MDE	MDE	report rate	Not yet reported	
Hydromodifications				
Non-tidal wetlands and floodplains permit site "inspection coverage rate"	MDE	report rate	Not yet reported	
Tidal wetlands permit site "inspection coverage rate"	MDE	report rate	Not yet reported	

Maryland 2015-2019 NPS Program – Statewide Milestones Objective 5: Types of Waterbodies	Lead	Goal SFY2018	Report SFY2018	Link to publications
Statewide Lakes and Reservoirs				
Lakes/Reservoirs: Local Phase I MS4 jurisdiction stormwater waste load allocation (WLA) implementation plans for reservoir TMDLs developed and reviewed by MDE. (Report the plans submitted and reviewed).	MDE		All applicable plans reviewed	
Patuxent Reservoirs Annual Report of the Technical Advisory Committee	WSSC	report	WSSC Restoration Plan done 2015. Last annual report was 2013	
Central Maryland - Chesapeake Bay Drainage				
Antietam Creek Watershed	Plan is eligible for 319(h) Grant implementation funding.			http://mde.maryland.gov/programs/Water/319NonPointSource/Pages/Programs/WaterPrograms/319nps/factsheet.aspx
Watershed plan milestones: Report progress in the 319 Annual Report.	WCSCD	report	see Annual Report	
Assess Implementation Progress toward sediment and bacteria reduction watershed plan milestones and update the plan if needed.		update	Plan update currently being conducted	
Back River - Tidal Watershed	Plan is eligible for 319(h) Grant implementation funding.			http://mde.maryland.gov/programs/Water/319NonPointSource/Pages/Programs/WaterPrograms/319nps/factsheet.aspx
Watershed plan milestones: Report progress in the 319 Annual Report.	Baltimore County	report	see Annual Report	
Assess action items progress: #2 lawn fertilizer, #3 bayscape education, #34 outfall inspections, #53 outfall inspections, and #60 incentives.			future	
Assess action item progress: #37 hot spots			future	
Assess action item progress: #10 stormwater retrofits		assess	future	
Assess action item progress: #31 wetland plantings			future	
Back River - Upper Watershed	Plan is eligible for 319(h) Grant implementation funding.			http://mde.maryland.gov/programs/Water/319NonPointSource/Pages/Programs/WaterPrograms/319nps/factsheet.aspx
Watershed plan milestones: Report progress in the 319 Annual Report.	Baltimore County	report	see Annual Report	
Assess plan implementation progress, particularly: open space tree planting, impervious area removal on institution land.		assess	future	
Assess hotspot investigation and follow-up			future	
Choptank River - Upper Watershed	Plan is eligible for 319(h) Grant implementation funding.			http://mde.maryland.gov/programs/Water/319NonPointSource/Pages/Programs/WaterPrograms/319nps/factsheet.aspx
Watershed plan milestones: Report progress in the 319 Annual Report.	Caroline County	report	see Annual Report	
Assess plan implementation progress and update plan if needed.			County determined plan update not needed	
Corsica River Watershed	Plan is eligible for 319(h) Grant implementation funding.			http://mde.maryland.gov/programs/Water/319NonPointSource/Pages/Programs/WaterPrograms/319nps/factsheet.aspx
Watershed plan milestones: Report progress in the 319 Annual Report.	Caroline County	report	see Annual Report	
Assess plan implementation progress and update plan if needed.			future	
Gwynns Falls - Middle Watershed	Plan is eligible for 319(h) Grant implementation funding.			http://mde.maryland.gov/programs/Water/319NonPointSource/Pages/Programs/WaterPrograms/319nps/factsheet.aspx
Report implementation progress in the 319 Annual Report.	Baltimore County	report	see Annual Report	
Jones Falls - Lower Watershed	Plan is eligible for 319(h) Grant implementation funding.			http://mde.maryland.gov/programs/Water/319NonPointSource/Pages/Programs/WaterPrograms/319nps/factsheet.aspx
Watershed plan milestones: Report progress in the 319 Annual Report.	Baltimore County	report	see Annual Report	

Maryland 2015-2019 NPS Program – Statewide Milestones Objective 5: Types of Waterbodies	Lead	Goal SFY2018	Report SFY2018	Link to publications
Monocacy River - Lower Watershed	Plan is eligible for 319(h) Grant implementation funding.			http://mde.maryland.gov/programs/Water/319NonPointSource/Pages/Programs/WaterPrograms/319nps/factsheet.aspx
Watershed plan milestones: Report progress in the 319 Annual Report.	Frederick County	report	see Annual Report	
Assess plan implementation progress and update plan if needed.		assess	future	
Sassafras River Watershed	Plan is eligible for 319(h) Grant implementation funding.			http://mde.maryland.gov/programs/Water/319NonPointSource/Pages/Programs/WaterPrograms/319nps/factsheet.aspx
Watershed plan milestones: Report progress in the 319 Annual Report.	SR Assoc.	report	see Annual Report	
Central Maryland - Chesapeake Bay Drainage	Plans not designed to seek 319(h) implementation funds.			
Phase III Watershed Implementation Plan for the Chesapeake Bay TMDL: Develop and submit draft and final versions of Maryland's Phase III WIP to EPA. Includes the 2017 Interim Strategy for pollutant load reductions to be achieved for particular nonpoint sources of nitrogen, phosphorus and sediment. Progress will be assessed and findings will be provided in a report.	MDE	Report	Done; WIP developed and is currently out for public review	https://mde.maryland.gov/programs/Water/TMDL/TMDLImplementation/Pages/Phase3WIP.aspx
Western Maryland - Casselman River and Youghiogeny River				
Casselman River Watershed	Plan is eligible for 319(h) Grant implementation funding.			http://mde.maryland.gov/programs/Water/319NonPointSource/Pages/Programs/WaterPrograms/319nps/factsheet.aspx
Watershed plan milestones: Report progress in the 319 Annual Report, including, number/percentage of pH impaired stream segments, NPS Program Success Stories and implementation progress.	MDE	report	see Annual Report	
Percentage of impaired stream segments in watershed that are remediated and meet the State water quality standard for pH.			None as of 6/30/18	
Report 303(d) stream segments that achieve pH criteria via Maryland's Integrated Report.			None as of 6/30/18	
Deep Creek Lake Watershed Plan	Plan not designed to seek 319(h) Grant implementation funding.			
Plan was completed 2014/2016 with no milestones.	DNR	NA	NA	http://www.dnr.state.md.us/ccs/dcl_wmp.asp
Coastal Region - Coastal Bays and Atlantic Ocean				
Coastal Bays Conservation and Management Plan	Plan not designed to seek 319(h) Grant implementation funding.			
Plan completion anticipated in 2015. Potential milestones TBD.	MCBP	NA	New plan currently being developed by county	http://www.mdcoastalbays.org/

Maryland 2015-2019 NPS Program – Statewide Milestones Objective 6: Protection and Restoration	Lead	Goal SFY2018	Report SFY2018	Annual Publication link to
Conduct biological monitoring of approximately 30 sites annually to support implementation of Maryland's Antidegradation Policy in areas with pending significant development projects. Produce a report of results annually.	MDE	monitor & report	22 sites (319 FFY17 project #5)	
303(d) Program Vision: For the 2016 reporting cycle and beyond, in addition to the traditional TMDL development priorities and schedules for waters in need of restoration, Maryland will identify protection planning priorities and approaches along with schedules to help prevent impairments in healthy waters, in a manner consistent with each State's systematic prioritization. (see Objective 7, Priorities, for a related objective)	MDE	report results4	Work continues as reported for SFY2018: Tier II high quality streams continue to be the priority for state protection.	
Expand Antidegradation pilot project with MDE Waterways and Wetlands Program beyond Central Maryland.	MDE		MDE is working to apply Tier II review statewide	
Revise Maryland's Antidegradation regulations to be more clear and protective.	MDE		Regulations will continue unchanged. Focus is on updating the list of designated waters.	
Conduct State Clearinghouse reviews of state and federally funded projects to ensure consistency with the State Anti-degradation Policy (approximately 400/year)	MDE	report results	Not yet reported	

Maryland 2015-2019 NPS Program – Statewide Milestones Objective 7: Priority Setting	Lead	Goal SFY2018	Report SFY2018	Annual Publication link to
Biological monitoring to support implementation of Maryland's Antidegradation Policy in areas with pending significant development projects. Produce a list of about 30 high-priority monitoring sites annually.	MDE	list & report		
Award 319(h) Grant funding annually according to prioritization criteria. Provide scopes of work for each seleced project.	MDE	report	FFY18 funds were awarded	
303(d) Program Vision: Priorites - For the 2016 integrated reporting cycle and beyond, Maryland will review, systematically prioritize, and report priority watersheds or waters for restoration and protection in the biennial integrated reports to facilitiate State strategic planning for acheiving water quality goals.	MDE	report	Report SFY18: Maryland's 2016 IR included the State "Vision" for reviewing and prioritizing impaired waters for TMDL development. EPA approved the 2016 IR on 11/01/17.	
303(d) Program Vision: Alternatives - By 2018, Maryland will use alternative approaches, in addition to TMDLs, that incorporate adaptive management and are tailored to specific circumstances where such approaches are better suited to implement priority watershed or water actions that acheive the water quality goals, including identifying and reducing nonpoint sources of pollution. (Assess alternatives to influence priorities)	MDE	report	Report 2018: Maryland has continued to explore the feasibility of a range of alternative approaches that could be initiated in Maryland.	

Maryland 2015-2019 NPS Program – Statewide Milestones Objective 8: Program Management and Evaluation	Lead	Goal SFY2018	Report SFY2018	Annual Publication link to
Chesapeake Bay Two-Year Milestones: Maryland has set benchmarks to gauge BMP implementation and programmative progress for 2014-2015… For future two-year periods, including the 2017 Mid-Point Assessment, progress compared to the milestones will be assessed and reported. Based on the findings, milestones will be updated for the following two-year period. (2017 Interim loading target has already been set)	MDE	Update Milestones	Milestones Updated	https://mde.maryland.gov/programs/water/TMDL/TMDLImplementation/Pages/milestones.aspx
Produce Maryland's Integrated Water Quality Monitoring and Assessment Report every even calendar year (Integrated Report). Post the report on the Internet following EPA approval.	MDE	report	2018 approved 4/9/19.	https://mde.maryland.gov/programs/Water/TMDL/Integrated303dReports/Pages/2018IR.aspx
Number of water bodies identified in Integrated Report as being primarily NPS impaired that are particially or fully restored: Partially or fully restore water bodies identified in state's Integrated Report primarily impaired by NPS. Partially restored means at least one water quality criterion is achieved in cases where the waterbody has multiple water quality criteria violations. (Cumulative starting in 2015)	MDE	1	3 according to Final Report Executive Summary Table 2	
Report NPS BMP implementation progress annually	MDE	report	see SFY18 Annual Rpt	
BMP Implementation Verification Protocols: Draft documentation due to EPA Chesapeake Bay Program	MDE		Completed	
Produce Maryland's 319 NPS Program Annual Report (319 Annual Report). Annually report if findings necessitate a future NPS Management Program Plan update. Post the report on the Internet following EPA review.	MDE	report	Working on Management Plan Update	
Report progress achieved toward goals for 319-eligible water plans in Maryland's 319 Annual Report.	MDE	report	see SFY18 Annual Rpt	
Report significant findings from targeted watershed monitoring plan in Maryland's 319 Annual Report.	MDE	report	see SFY18 Annual Rpt Appendix - Watersheds	
Report at least one success story documenting water quality and/or ecological improvement annually. If none can be documented during a given year, then report at least two programmatic success stories for that time period.	MDE	report	see SFY18 Annual Rpt	
Evaluate progress on each of these 319 Program milestones and report the status in Maryland's NPS Program Annual Report.	MDE	report	see SFY18 Annual Rpt Appendix - Milestones Obj 5	
Evaluate Local Chesapeake Bay 2014-2015 2-year Milestones for Bay Restoration (post local milestones and State evaluation to MDE webpage)	MDE		completed	http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Pages/MD_Milestone_Goals_2014-2015.aspx
Adopt State Chesapeake Bay 2016-2017 2-Year Milestones as 319 Plan Milestones by reference (Document via 319 Annual Report)	MDE		completed	https://mde.maryland.gov/programs/Water/TMDL/TMDLImplementation/Pages/MD_Milestone_Goals_2016-2017.aspx
Evaluate Local Chesapeake Bay 2016-2017 2-year Milestones for Bay Restoration (post local milestones and State evaluation to MDE webpage)	MDE		completed	https://mde.maryland.gov/programs/Water/TMDL/TMDLImplementation/Pages/MD_Milestone_Goals_2016-2017.aspx
Adopt State Chesapeake Bay 2018-2019 2-Year Milestones as 319 Plan Milestones by reference (Document via 319 Annual Report)	MDE		completed	https://mde.maryland.gov/programs/Water/TMDL/TMDLImplementation/Pages/2018-2019-Milestones.aspx
Maintain/increase State agency investment in NPS programs and implementation. Report status by state fiscal year. (See Annual Report Appendix A)	MDE	report	See Annual Report Appendix - Financial	
303(d) Program Vision: Integration - By 2016, in cooperation with EPA, identify and coordinate implementation of key point source and nonpoint source control actions that foster effective integration across CWA programs, other statutory programs (e.g. CERCLA, RCRA, SDWA, CAA), and the water quality efforts of other Federal departments and agencies (e.g. Agriculture, Interior, Commerce) to achieve Maryland's water quality goals.	MDE		In progress	
Continuing Planning Process (CPP) update for consistency with this NPS Program Management Strategy	MDE		future	
State Monitoring Strategy Update	MDE	update & report	future	
See Objective 4 (Pollutants and Stressors) for additional evaluation milestones				
See Objective 3 (Pollutant Sources) for additional evaluation milestones				

Appendix M – Success Story (Draft under EPA review)

Tarkiln Run pH Impairment Remedied by Successful Acid Mine Drainage Treatment

Waterbody Improved

Maryland's Tarkiln Run, a tributary to Casselman River in Garrett County, was impaired by low pH associated with acid mine drainage (AMD) and was added to the Clean Water Act (CWA) section 303(d) list in 1996. An assessment of an AMD seep impacting Casselman River tributaries ranked this stream high priority for mitigation. Successful AMD mitigation brought the stream into compliance with the state water quality standard for pH. As a result, the Maryland Department of the Environment (MDE) is delisting Tarkiln Run for pH impairment in Maryland's 2018 Integrated Report.

Problem

Tarkiln Run headwaters are in Maryland's Savage River State Forest south of US I-68 near Amish Road; it is a tributary to the Casselman River's North Branch (Figure 1). Western Maryland's Casselman River watershed drains to Pennsylvania toward the Ohio River. Prior to WWII, the river and its tributaries were commonly high-quality waterways that supported native brook trout. During several following decades, coal mining changed the local hydrology, which resulted in AMD that caused pH declines in numerous streams, including Tarkiln Run.

The Casselman River watershed, including Tarkiln Run and other streams, was listed for pH impairment in 1996. In 2005, water quality monitoring to support pH total maximum daily load (TMDL) development found that Tarkiln Run was consistently below the Maryland water quality standard for pH, which requires that pH be within the range 6.5–8.5. In 2008 EPA approved the pH TMDL for pH-impaired streams in western Maryland, including Tarkiln Run. Water quality monitoring in 2010–2013 showed that Tarkiln Run pH continued to fall below Maryland's water quality pH standard most of the time.

A benthic macroinvertebrate assessment performed in 2011 and 2012 rated the stream as 2.25, which is classified as poor on the benthic index of biological integrity. Maryland's 2014 Integrated Report clarified the pH conditions in the Casselman River watershed by separately listing Tarkiln Run for pH impairment.

Results

After installing the limestone sand application sites, MDE's Abandoned Mine Land Division (AMLD) periodically monitored the pH at Tarkiln Run and scheduled delivery of limestone sand to the application sites as needed. After a period of adjustment in late 2013 and early 2014, water quality data collected in Tarkiln Run from mid-2014 through 2016 demonstrated that in-stream pH consistently met Maryland's water quality standard (Figure 3). As a result, MDE is delisting Tarkiln Run for pH impairment in Maryland's 2018 Integrated Report.

Benthic macroinvertebrate assessments were performed in 2014, 2015 and 2016. The overall average rating was 3.167, which is categorized as fair on the benthic index of biological integrity—an improvement from the poor rating received in 2011–2012.

Project Highlights

In late 2008 MDE initiated watershed planning to make the Casselman River watershed eligible for CWA section 319(h) grant implementation funds. The planning process included assessment of potential AMD mitigation sites like Tarkiln Run. The plan also analyzed AMD mitigation technologies. One of the technologies recommended to address pH while also minimizing capital and operation and maintenance costs was limestone sand application, sometimes called a limestone "sand dump." This technique involves constructing a driveway for a dump truck to pull up adjacent to the stream so that measured quantities of pulverized limestone can be delivered directly to stream edge. Then, natural variation in stream flow distributes the particles of limestone downstream. The limestone sand particles in the stream tend to raise in-stream pH and increase acid neutralizing capacity. The amount and timing of limestone sand application at each site is determined by periodic monitoring of in-stream pH.

In 2011 the U.S. Environmental Protection Agency accepted the Casselman River Watershed Plan for pH Remediation, and section 319(h) grant funds were approved to help mitigate AMD-impacted areas. Tarkiln Run was selected to be one of 11 Phase I projects because the land was publicly owned, the site was accessible and permit requirements were attainable. In mid-2013 one limestone sand application site was constructed. During its first year of operation, the Tarkiln Run site received 41.65 tons of limestone sand (Figure 2).

Partners and Funding

MDE AMLD and MDE Integrated Water Planning Program (IWPP) cooperated to write the Casselman River Watershed Plan for pH Remediation. Drafting the plan used $55,000 from the federal fiscal year (FFY) 2008 CWA section 319(h) grant. MDE was awarded $644,115 from the FFY2009 CWA section 319(h) grant to help pay for mitigating more than a dozen different sites impaired by AMD in the Casselman River watershed. The Garrett Soil Conservation District (SCD) was hired to oversee contractor hiring, construction management and inspection for all these project sites, including the Tarkiln Run limestone sand application project. The SCD's total capital cost for the Tarkiln Run site was only $8,868.

Other partners contributed work at no cost to the project. Watershed plan drafting by MDE IWPP staff was funded by the section 319(h) grant that supports the state Nonpoint Source Management Program. Also, before/after water quality monitoring by MDE's Field Services Program was funded by separate ongoing section 319(h) grant projects. The Maryland Fisheries Service assessment and analysis was independently funded by the State of Maryland.

For additional information contact:
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BMPS BMP	Number Installed	Units	Comments
Limestone Sanding	10	UNITS	
Limestone Leach Bed/Pond	7	UNITS	
Limestone Sanding	3	UNITS	
Limestone Leach Bed/Pond	2	UNITS	