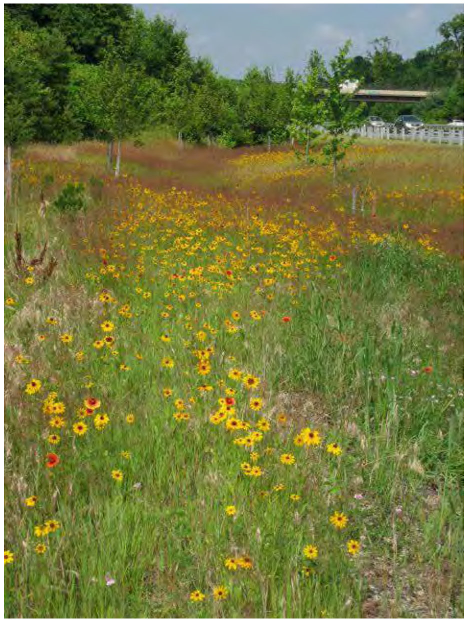
MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

IMPLEMENTATION PLAN FOR VARIOUS TMDLS IN MARYLAND

October 9, 2020



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IMPLEMENTATION PLAN FOR VARIOUS TMDLS IN MARYLAND

A. WATER QUALITY STANDARDS AND DESIGNATED USES

Total Maximum Daily Loads (TMDLs) focus on offsetting the impacts of pollutants to waterway designated uses. The Federal Clean Water Act (CWA) established requirements for each state to develop programs to address water pollution including:

- Establishment of water quality standards (WQSs);
- Implementation of water quality monitoring programs;
- Identification and reporting of impaired waters; and
- Development of maximum allowable pollutant loads that when met and not exceeded will restore WQSs to impaired waters, called TMDL documents.

WQSs are based on the concept of designating and maintaining specifically defined uses for each waterbody. **Table 1** lists the designated uses for waterways in the State of Maryland. TMDLs are based on these uses.

One means for the United States Environmental Protection Agency (EPA) to enforce these standards is through the National Pollutant Discharge Elimination System (NPDES) program, which regulates discharges from point sources. The Maryland Department of the Environment (MDE) is the delegated authority to issue NPDES discharge permits within Maryland and to develop WQSs for Maryland including the water quality criteria that define the parameters to ensure designated uses are met.

Table 1: Designated Uses in Maryland

	Use Classes							
Designated Uses	**I**	**I-P**	**II**	**II-P**	**III**	**III-P**	**IV**	**IV-P**
Growth and Propagation of Fish (not trout), other aquatic life and wildlife	✓	✓	✓	✓	✓	✓	✓	✓
Water Contact Sports	✓	✓	✓	✓	✓	✓	✓	✓
Leisure activities involving direct contact with surface water	✓	✓	✓	✓	✓	✓	✓	✓
Fishing	✓	✓	✓	✓	✓	✓	✓	✓
Agricultural Water Supply	✓	✓	✓	✓	✓	✓	✓	✓
Industrial Water Supply	✓	✓	✓	✓	✓	✓	✓	✓
Propagation and Harvesting of Shellfish			✓	✓				
Seasonal Migratory Fish Spawning and Nursery Use			✓	✓				
Seasonal Shallow-water Submerged Aquatic Vegetation Use			✓	✓				
Open-Water Fish and Shellfish Use			✓	✓				
Seasonal Deep-Water Fish and Shellfish Use			✓	✓				
Seasonal Deep-Channel Refuge Use			✓	✓				
Growth and Propagation of Trout					✓	✓		
Capable of Supporting Adult Trout for a Put and Take Fishery							✓	✓
Public Water Supply		✓		✓		✓		✓

Source: http://www.mde.maryland.gov/programs/water/TMDL/WaterQualityStandards/Pages/wqs_designated_uses.aspx

MS4 Permit Requirements

The Maryland Department of Transportation State Highway Administration (MDOT SHA) Municipal Separate Storm Sewer System (MS4) Permit requires coordination with county MS4 jurisdictions concerning watershed assessments and development of a coordinated TMDL implementation plan for each watershed that MDOT SHA has a wasteload allocation (WLA). Requirements from the MDOT SHA MS4 Permit specific to watershed assessments and coordinated TMDL implementation plans include *Part IV.E.1.* and *Part IV.E.2.b.*, copied below.

Watershed Assessments (Permit Part IV.E.1.)

SHA shall coordinate watershed assessments with surrounding jurisdictions, which shall include, but not be limited to the evaluation of available State and county watershed assessments, SHA data, visual watershed inspections targeting SHA rights-of-way and facilities, and approved stormwater WLAs to:

- *Determine current water quality conditions;*
- *Include the results of visual inspections targeting SHA rights-of-way and facilities conducted in areas identified as priority for restoration;*
- *Identify and rank water quality problems for restoration associated with SHA rights-of-way and facilities;*
- *Using the watershed assessments established under section a. above to achieve water quality goals by identifying all structural and nonstructural water quality improvement projects to be implemented; and*
- *Specify pollutant load reduction benchmarks and deadlines that demonstrate progress toward meeting all applicable stormwater WLAs.*

Coordinated TMDL Implementation Plans (Permit Part IV.E.2.b.)

Within one year of permit issuance, a coordinated TMDL implementation plan shall be submitted to MDE for approval that addresses all EPA approved stormwater WLAs (prior to the effective date of the permit) and requirements of Part VI.A., Chesapeake Bay Restoration by 2025 for SHA's storm sewer system. Both specific WLAs and aggregate WLAs which SHA is a part of shall be addressed in the TMDL implementation plans. Any subsequent stormwater WLAs for SHA's storm sewer system shall be addressed by the coordinated TMDL implementation plan within one year of EPA approval. Upon approval by MDE, this implementation plan will be enforceable under this permit. As part of the coordinated TMDL implementation plan, SHA shall:

- *Include the final date for meeting applicable WLAs and a detailed schedule for implementing all structural and nonstructural water quality improvement projects, enhanced stormwater management programs, and alternative stormwater control initiatives necessary for meeting applicable WLAs;*
- *Provide detailed cost estimates for individual projects, programs, controls, and plan implementation;*
- *Evaluate and track the implementation of the coordinated implementation plan through monitoring or modeling to document the progress toward meeting established benchmarks, deadlines, and stormwater WLAs; and*
- *Develop an ongoing, iterative process that continuously implements structural and nonstructural restoration projects, program enhancements, new and additional programs, and alternative BMPs where EPA approved TMDL stormwater WLAs are not being met according to the benchmarks and deadlines established as part of the SHA's watershed assessments.*

B. WATERSHED ASSESSMENT COORDINATION

According to the United States Geological Survey (USGS) (2016):

> *A watershed is an area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel. The word watershed is sometimes used interchangeably with drainage basin or catchment. The watershed consists of surface water--lakes, streams, reservoirs, and wetlands--and all the underlying ground water. Larger watersheds contain many smaller watersheds. Watersheds are important because the streamflow and the water quality of a river are affected by things, human-induced or not, happening in the land area "above" the river-outflow point.*

The 8-digit scale is the most common management scale for watersheds across the State, and therefore is the scale at which most of Maryland's local TMDLs are developed. See **Figure 1** for an illustration of an 8-digit watershed in Maryland with Piscataway Creek highlightend.

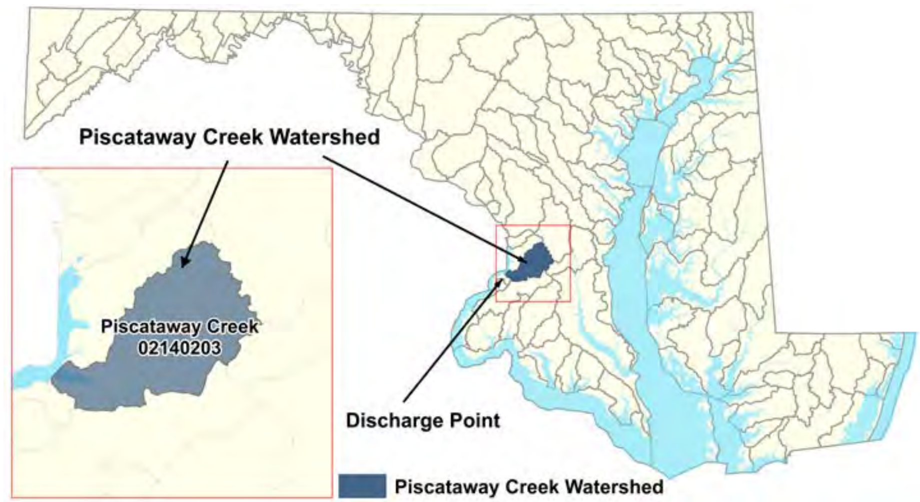


Figure 1: Maryland 8-digit Watershed Example

County Watershed Assessments

Each MS4 county performs detailed assessments of local watersheds as a part of its MS4 permit requirements. These assessments determine current water quality conditions and include visual inspections; the identification and ranking of water quality problems for restoration; the prioritization and ranking of structural and non-structural improvement projects; and the setting of pollutant reduction benchmarks and deadlines that demonstrate progress toward meeting applicable WQSs. MDOT SHA is not required to duplicate this effort, but is required to coordinate with the MS4 jurisdictions to obtain and review watershed assessments. Relying on assessments performed by other jurisdictions avoids redundant analysis and places the responsibility for developing the assessments with the jurisdictions that have a close connection to local communities and watershed groups.

Watershed assessment evaluations conducted by MDOT SHA focus on issues that MDOT SHA can improve through practices targeting MDOT SHA right-of-way (ROW) or infrastructure. This information is used to determine priority areas for best management practices (BMP) implementation and to identify potential project sites or partnership project opportunities. Summaries of these evaluations are included under **Section F**. MDOT SHA watershed assessment evaluations focus on the following:

- Impacts to MDOT SHA infrastructure such as failing outfalls and downstream channels;
- Older developed areas with little stormwater management (SWM) and available opportunities to install retrofits;
- Degraded streams;
- Priority watershed issues such as improvements within a drinking water reservoir, special protection areas, or Tier II catchments;
- Identification of areas most in need of restoration;
- Description of preferred structural and non-structural BMPs to use within the watershed;
- Potential project sites for BMPs; and
- In watersheds with Polychlorinated Biphenyl (PCB) TMDLs, identifying locations of any known PCB sources.

In addition to using information from the county watershed assessments, MDOT SHA also undertakes other activities to identify potential project sites and prioritize BMP implementation including:

- Coordination meetings with each of the MS4 counties to discuss potential partnerships with the mutual goal of improving water quality;
- Visual watershed inspections as described below; and
- Maximizing existing impervious treatment within new roadway projects (practical design initiative).

C. VISUAL INSPECTIONS TARGETING MDOT SHA ROW

MDOT SHA methodically reviews each watershed for potential restoration projects within MDOT SHA ROW to meet the load reductions for current pollutant WLAs. Each watershed is assessed using a grid system in conjunction with detailed corridor assessments. The watershed review process includes two phases to visually inspect each watershed and identify all structural and non-structural water quality improvement projects to be implemented.

Desktop Evaluation

Phase one is a desktop evaluation of the watershed using available county watershed assessments and MDOT SHA data. MDOT SHA has created a grid system of 1.5-mile square cells to track the progress of the visual ROW inspections, allowing prioritized areas to be targeted first. With this grid system, many spatial data sets are reviewed to determine the most effective use of each potential restoration site. The sites are documented geographically and stored in Geographic Information System (GIS). Viable sites are prioritized based on cost-effectiveness and those located within watersheds with the most pollutant reduction needs move forward to the second phase, which is to perform field investigations. Data reviewed includes:

- Aerial imagery;
- Street view mapping;
- Environmental features delineations such as critical area boundary, wetlands buffers, floodplain limits;
- County data such as utilities, storm drain systems, contour and topographic mapping;
- MDOT SHA ROW boundaries;

- Current MDOT SHA stormwater control and restoration practice locations; and
- Drainage area boundaries.

Figure 6, located in **Section F1**- **F3** illustrates the 1.5-mile grid system for the Non-Tidal West River watershed.

Field Investigations

Phase two is a field investigation of each viable site resulting from the watershed desktop evaluation. MDOT SHA inspects and assesses each site in the field to identify and document existing site conditions, water quality opportunities, and constraints. This information is used to determine potential restoration BMP types as well as estimated restoration credit quantities.

MDOT SHA will continue to prioritize visual inspections in the highest need watersheds. **Figure 2** is an example field investigation summary map that documents observations. A standardized field inspection form is used.

D. BENCHMARKS AND DETAILED COSTS

Benchmarks and deadlines demonstrating progress toward meeting all applicable stormwater WLAs are provided in **Section F**. It contains generalized cost information that includes an overall estimated cost to implement the proposed practices. Detailed costs for specific construction projects are available on MDOT SHA's website (www.roads.maryland.gov) under the Contractors Information Center.

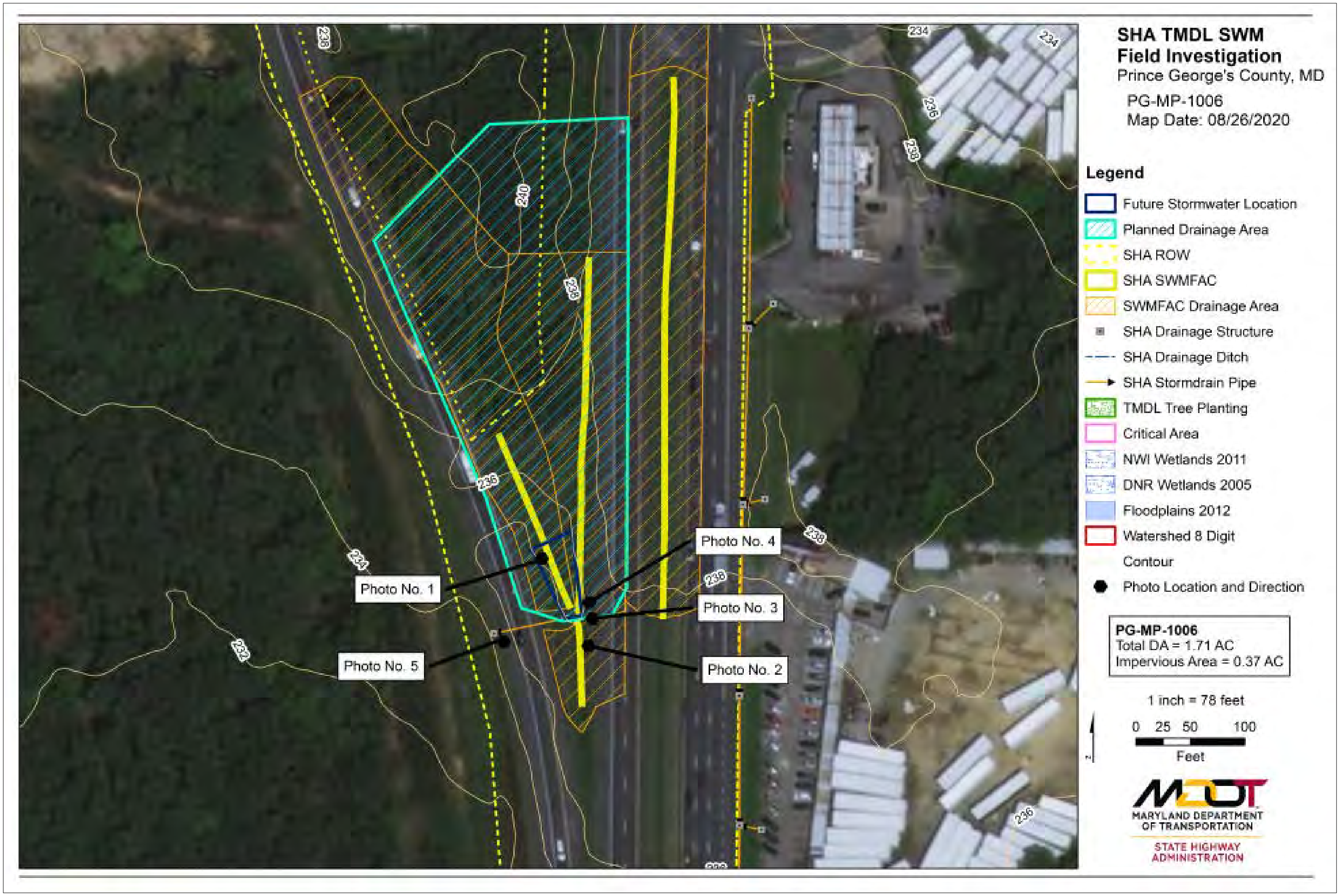


Figure 2: Example Field Investigation Summary Map

E. POLLUTION REDUCTION STRATEGIES

E.1. MDOT SHA TMDL Responsibilities

TMDLs define the maximum pollutant loading that can be discharged to a waterbody and still meet water quality criteria for maintaining designated uses. **Figure 3** illustrates the concept of maximum loading. The green area on the bar depicts the maximum load that maintains a healthy water environment for the pollutant under consideration. When this load is exceeded, the waterway is considered impaired as illustrated by the red portion of the bar. The example waterway needs restoration through implementation of practices to reduce the pollutant loading to or below the TMDL.

Generally, the formula for a TMDL is:

$$TMDL = \sum WLA + \sum LA + MOS$$

Where:

TMDL	= total maximum daily load
WLA	= wasteload allocation for point sources;
LA	= load allocation for non-point sources; and
MOS	= margin of safety.

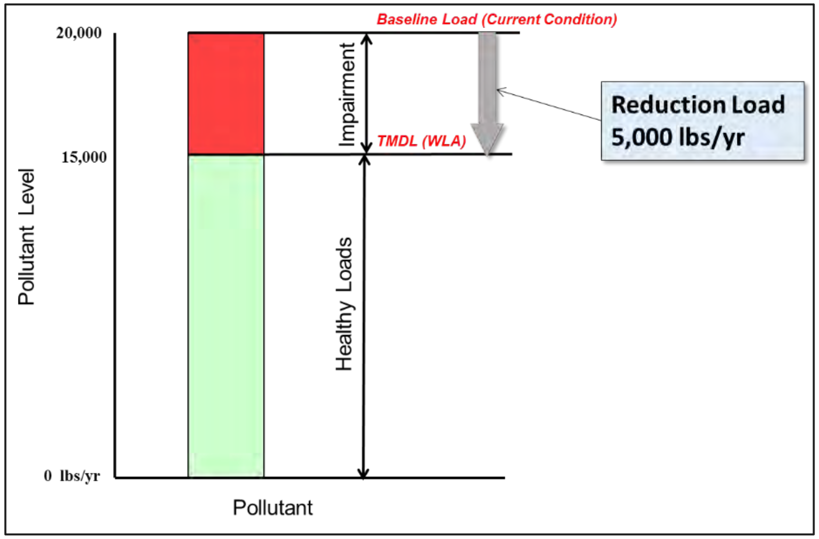


Figure 3: Example Wasteload and Reduction Requirement

Modeling Parameters

MDE requires that pollutant modeling follow the guidance in MDE's *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (MDE, 2014); if other methods are employed, they must be approved by MDE. MDOT SHA developed a restoration modeling protocol that describes the methods used for modeling pollutant load reductions for local TMDLs with MDOT SHA responsibility. This protocol was originally submitted to MDE as Appendix E in the 2016 MDOT SHA MS4 annual report. Updates to this protocol will be periodically implemented and resubmitted for MDE consideration. The most recent updated restoration modeling protocol was submitted in the 2019 Annual Report as Appendix D.

Different modeling methods are used depending upon the pollutants and current reduction practices in use. Brief descriptions of modeling methods are included in the following section, but the *MDOT SHA*

Restoration Modeling Protocol (MDOT SHA, 2019) should be consulted for a more detailed explanation.

Aggregated Loads

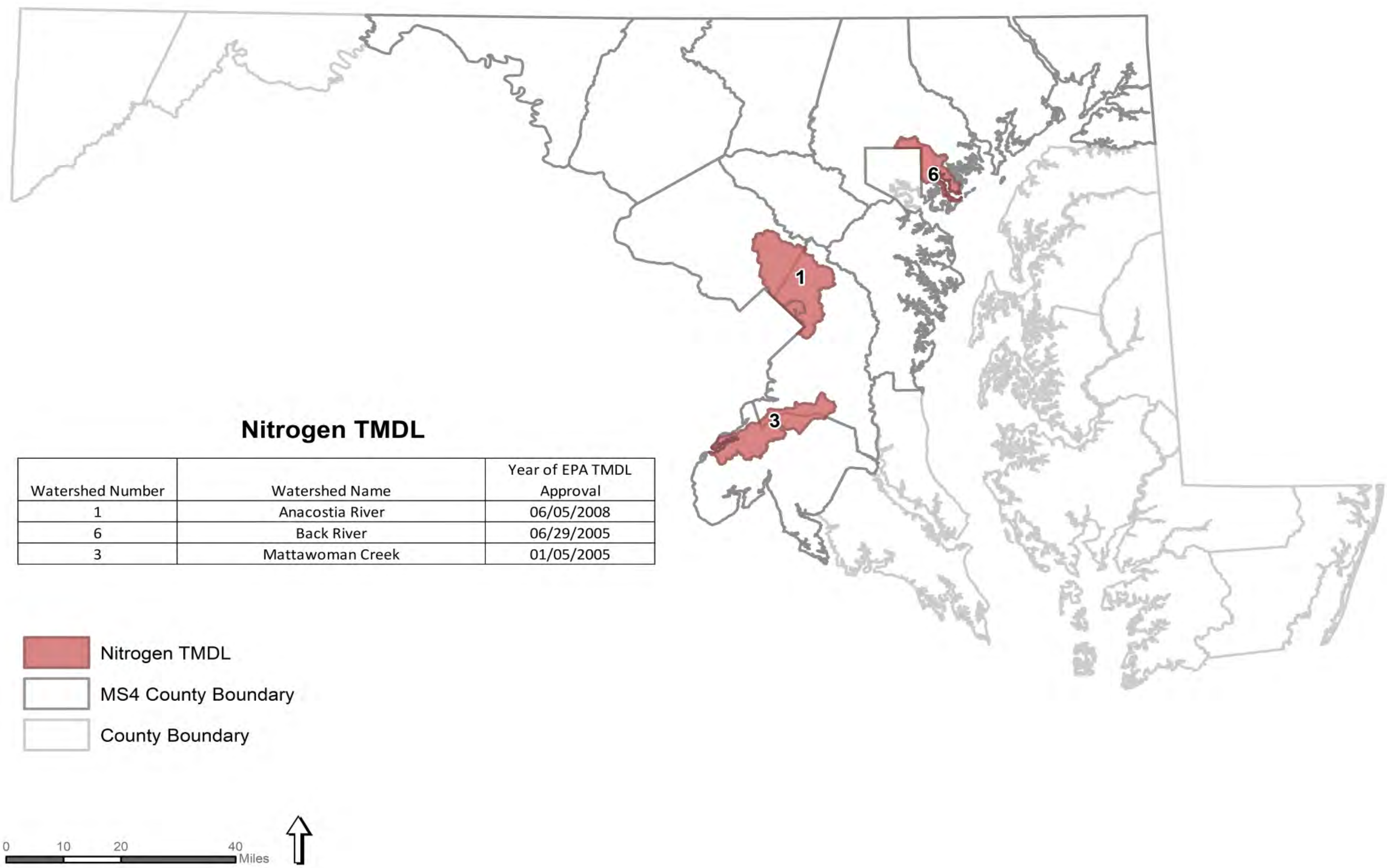
WLAs may be assigned to each MS4 jurisdiction separately or as an aggregated WLA for all urban stormwater MS4 permittees that combines them into one required allocation and reduction target. The modeling approach developed by MDOT SHA uses MDOT SHA data (both impervious and pervious land as well as BMPs built before the TMDL baseline year, also known as baseline BMPs) to calculate baseline loads and calibrated reduction targets. Following this approach, disaggregation is done for each TMDL.

Available Reduction Practices

MDOT SHA reserves the right to implement new BMPs, activities, and other practices that are not currently available to achieve local TMDL load reduction requirements. MDOT SHA will modify reduction strategies as necessary based on new, approved treatment guidance and will include revised strategies in updates to this implementation plan.

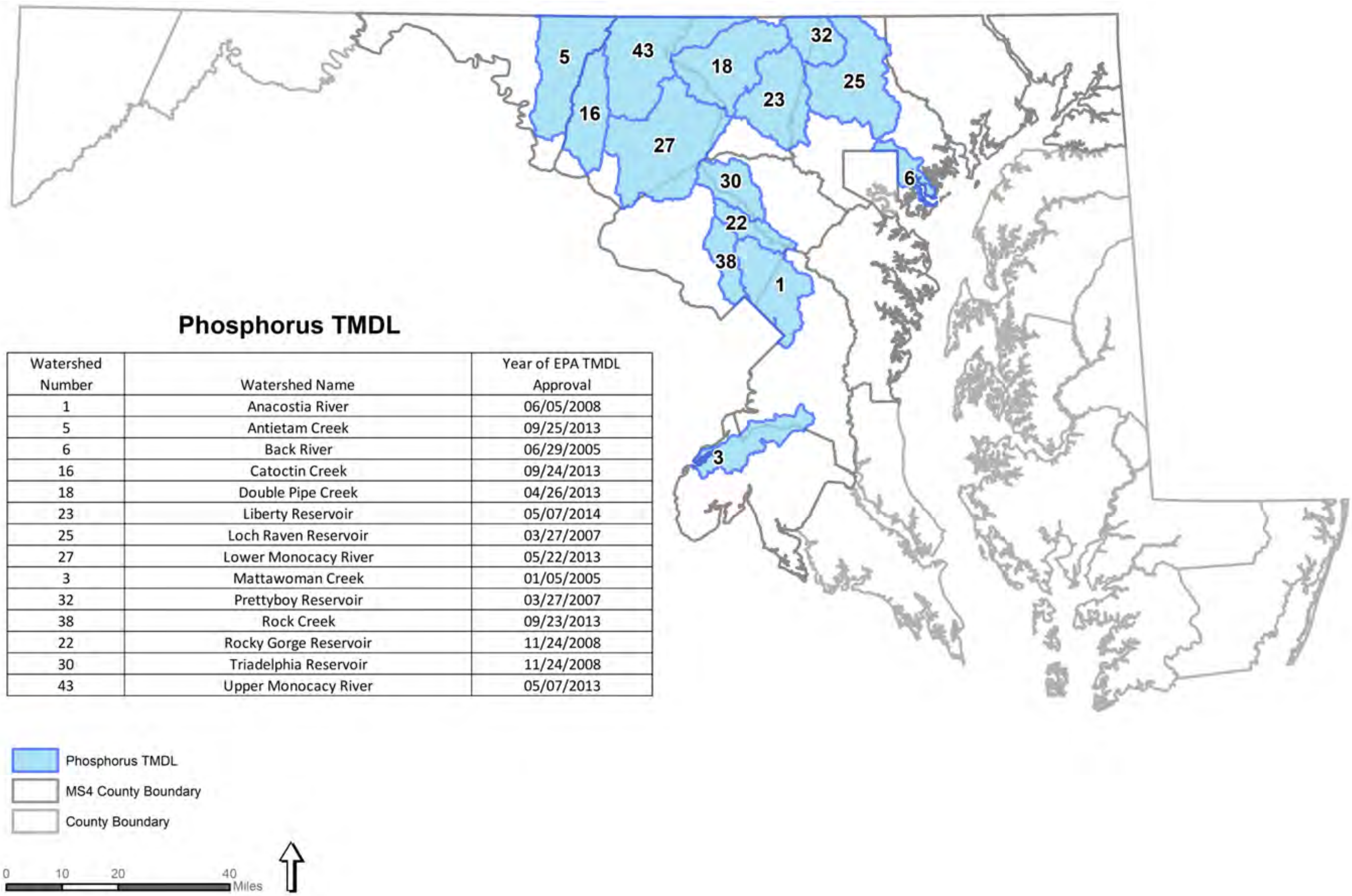
TMDL Responsibility Maps

Figures 4A through 4D show pollutant specific maps with watersheds identified where MDOT SHA has TMDL reduction requirements. Following the figures is Table 2 that summarizes MDOT SHA reduction targets within each of the watersheds for each pollutant, target end dates to meet the reductions, and projected benchmarks for interim target dates of FY2020 and FY2025. An explanation of the data contained in Table 2 is included prior to the table.



Watershed Number	Watershed Name	Year of EPA TMDL Approval
1	Anacostia River	06/05/2008
6	Back River	06/29/2005
3	Mattawoman Creek	01/05/2005

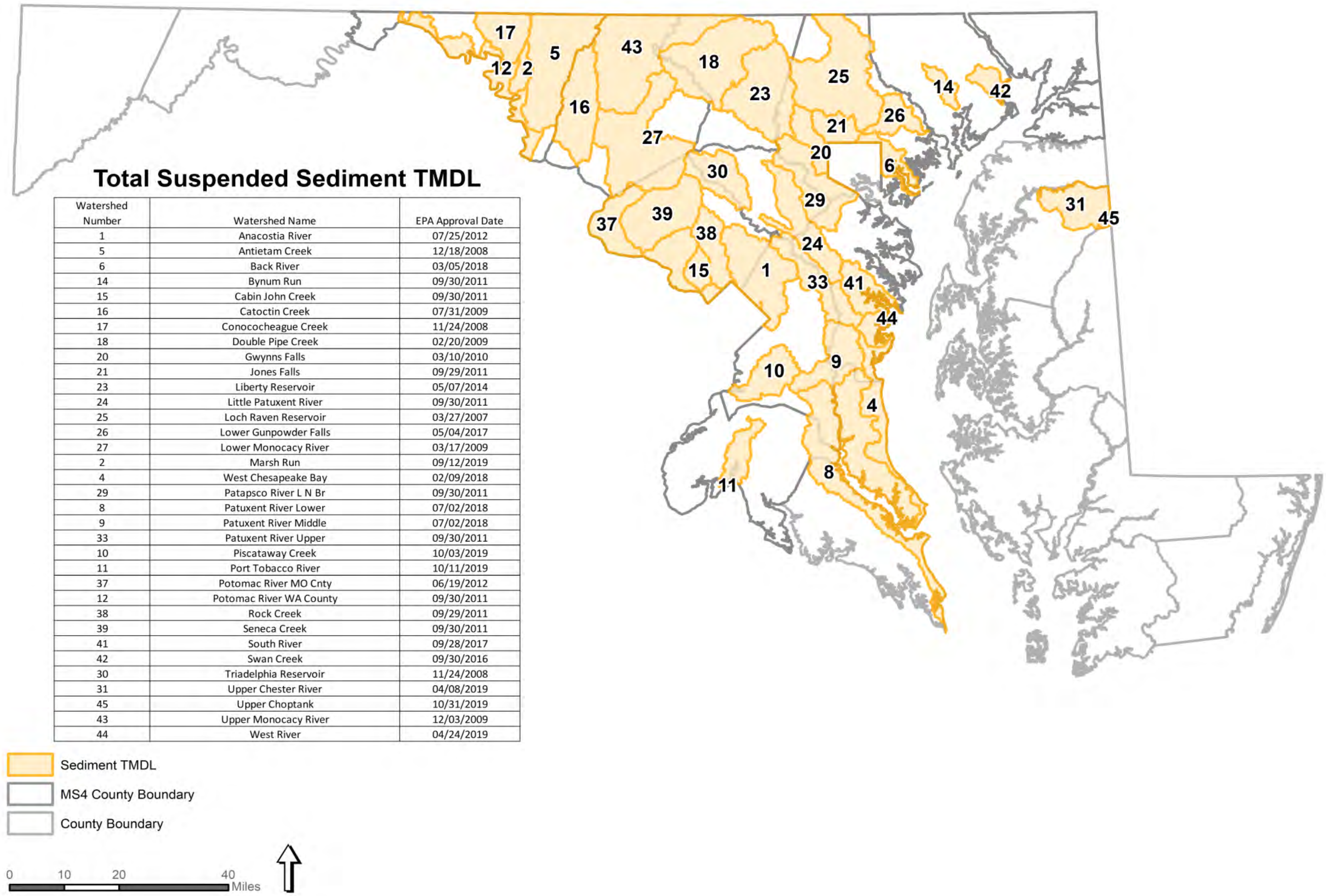
Figure 4A: Watersheds with MDOT SHA Nitrogen TMDLs



Phosphorus TMDL

Watershed Number	Watershed Name	Year of EPA TMDL Approval
1	Anacostia River	06/05/2008
5	Antietam Creek	09/25/2013
6	Back River	06/29/2005
16	Catoctin Creek	09/24/2013
18	Double Pipe Creek	04/26/2013
23	Liberty Reservoir	05/07/2014
25	Loch Raven Reservoir	03/27/2007
27	Lower Monocacy River	05/22/2013
3	Mattawoman Creek	01/05/2005
32	Prettyboy Reservoir	03/27/2007
38	Rock Creek	09/23/2013
22	Rocky Gorge Reservoir	11/24/2008
30	Triadelphia Reservoir	11/24/2008
43	Upper Monocacy River	05/07/2013

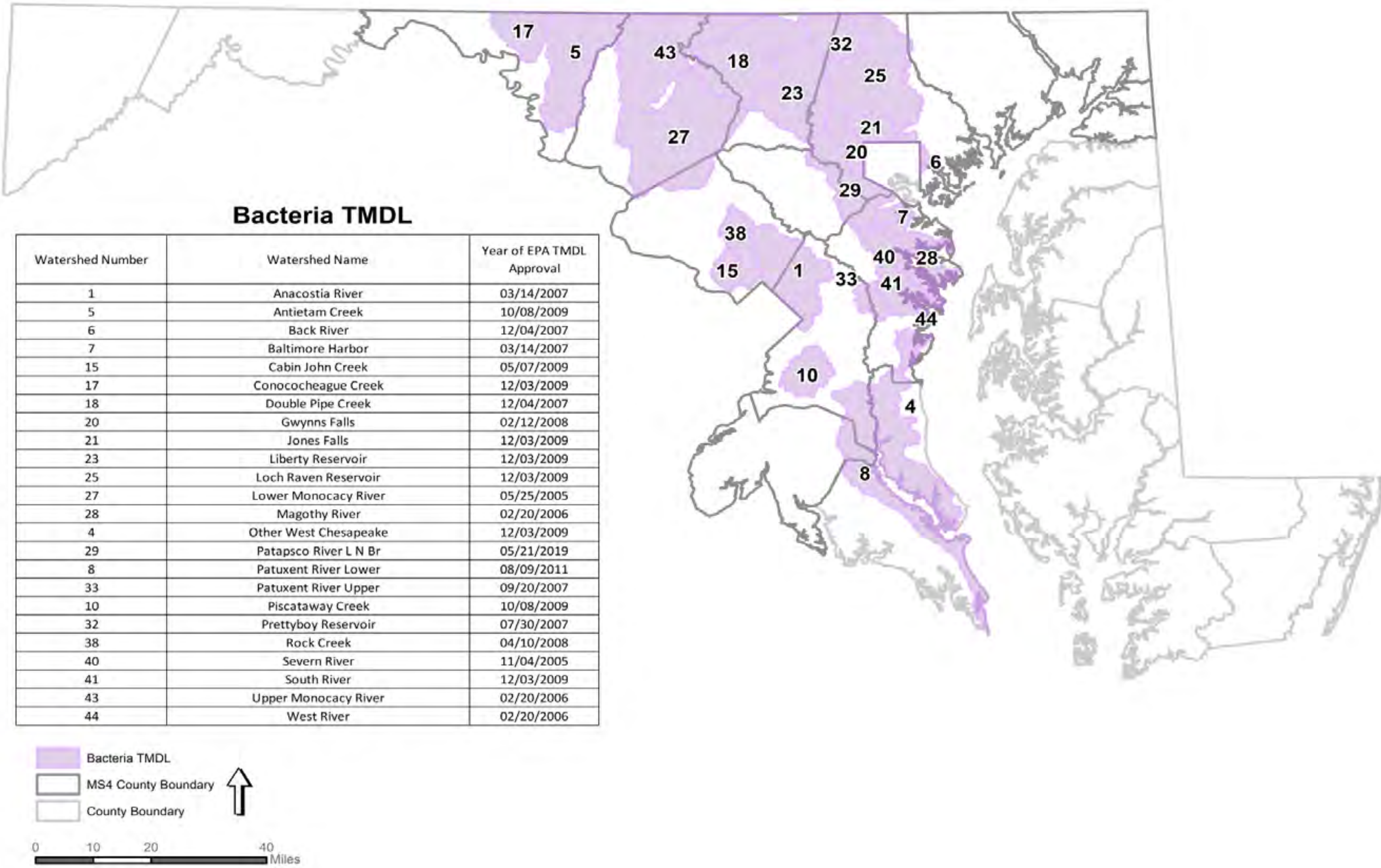
Figure 4B: Watersheds with MDOT SHA Phosphorus TMDLs



Total Suspended Sediment TMDL

Watershed Number	Watershed Name	EPA Approval Date
1	Anacostia River	07/25/2012
5	Antietam Creek	12/18/2008
6	Back River	03/05/2018
14	Bynum Run	09/30/2011
15	Cabin John Creek	09/30/2011
16	Catoctin Creek	07/31/2009
17	Conococheague Creek	11/24/2008
18	Double Pipe Creek	02/20/2009
20	Gwynns Falls	03/10/2010
21	Jones Falls	09/29/2011
23	Liberty Reservoir	05/07/2014
24	Little Patuxent River	09/30/2011
25	Loch Raven Reservoir	03/27/2007
26	Lower Gunpowder Falls	05/04/2017
27	Lower Monocacy River	03/17/2009
2	Marsh Run	09/12/2019
4	West Chesapeake Bay	02/09/2018
29	Patapsco River L N Br	09/30/2011
8	Patuxent River Lower	07/02/2018
9	Patuxent River Middle	07/02/2018
33	Patuxent River Upper	09/30/2011
10	Piscataway Creek	10/03/2019
11	Port Tobacco River	10/11/2019
37	Potomac River MO Cnty	06/19/2012
12	Potomac River WA County	09/30/2011
38	Rock Creek	09/29/2011
39	Seneca Creek	09/30/2011
41	South River	09/28/2017
42	Swan Creek	09/30/2016
30	Triadelphia Reservoir	11/24/2008
31	Upper Chester River	04/08/2019
45	Upper Choptank	10/31/2019
43	Upper Monocacy River	12/03/2009
44	West River	04/24/2019

Figure 4C: Watersheds with MDOT SHA Sediment TMDLs



Bacteria TMDL

Watershed Number	Watershed Name	Year of EPA TMDL Approval
1	Anacostia River	03/14/2007
5	Antietam Creek	10/08/2009
6	Back River	12/04/2007
7	Baltimore Harbor	03/14/2007
15	Cabin John Creek	05/07/2009
17	Conococheague Creek	12/03/2009
18	Double Pipe Creek	12/04/2007
20	Gwynns Falls	02/12/2008
21	Jones Falls	12/03/2009
23	Liberty Reservoir	12/03/2009
25	Loch Raven Reservoir	12/03/2009
27	Lower Monocacy River	05/25/2005
28	Magothy River	02/20/2006
4	Other West Chesapeake	12/03/2009
29	Patapsco River L N Br	05/21/2019
8	Patuxent River Lower	08/09/2011
33	Patuxent River Upper	09/20/2007
10	Piscataway Creek	10/08/2009
32	Prettyboy Reservoir	07/30/2007
38	Rock Creek	04/10/2008
40	Severn River	11/04/2005
41	South River	12/03/2009
43	Upper Monocacy River	02/20/2006
44	West River	02/20/2006

Figure 4D: Watersheds with MDOT SHA Bacteria TMDLs

Summary of Modeling Results

Table 2 summarizes results of MDOT SHA TMDL modeling for the pollutants depicted in the mapping above organized by pollutants and then watersheds. Modeling is performed according to parameters documented in the *MDOT SHA Restoration Modeling Protocol* (MDOT SHA, 2019). Results for nitrogen, phosphorus, sediment and bacteria modeling are grouped together in **Table 2** following a traditional TMDL method of determining baseline loading, calculating reduction requirement, determining BMPs to meet the reduction, and modeling projected loading for the proposed implementation plan.

In the table, information concerning the TMDL document is shown to the left in columns with gray headings including watershed name, watershed number, county, pollutant, EPA approval date, baseline year, and unit of measure for the pollutant. MDOT SHA modeling results include both load reduction requirements and projected reduction benchmarks by target years. MDOT SHA modeled requirements are shown in the middle with green headings including MDOT baseline loading, percent reduction target, and reduction target in unit measure (e.g., lbs./year). Projected benchmarks are shown to the right of the reduction requirements with tan headings including FY 2020 interim reduction load, FY 2025 interim reduction load. To the far right also in tan are the projected reduction load to be achieved by the target year and the target year proposed to meet the reduction requirement. Two additional columns are included with tan headings that provide comparative assessments of the 2020 and 2025 interim reduction target to be achieved relative to the MDOT SHA Reduction Target.

For all pollutants, the MDOT SHA percent reduction target (green heading) is from the published TMDL document. The baseline year is published on the MDE Data Center and will be used for MDOT SHA implementation planning. This usually correlates to the time-period when monitoring data was collected for the MDE TMDL analysis.

The Target Year (tan heading at far right) is the year MDOT SHA proposes to meet the WLA or show significant progress in efforts toward meeting the WLA. Progress implementing BMPs toward meeting benchmark reductions and target years will be documented in the MDOT SHA annual MS4 reports for each fiscal year. Thus, MDE will be able to track the increase in the reduction achieved from year to year.

Lists of proposed practices and costs to achieve the reduction targets are included in individual watershed implementation plans in Section F of this plan.

Table 2: MDOT SHA Various TMDLs Modeling Results

Watershed Name	Watershed Number	County	Pollutant	EPA Approval Date	Baseline Year	Unit	MDOT SHA Baseline Load	MDOT SHA % Reduction Target	MDOT SHA Reduction Target	MDOT SHA Proposed 2020 Interim Reduction	% 2020 Reduction Relative to Reduction Target	MDOT SHA Proposed 2025 Interim Reduction Target	% 2025 Reduction Relative to Reduction Target	MDOT SHA Target Year Reduction Load	% Target Year Reduction Relative to Reduction Target	Target Year
Nutrients and Sediment TMDLs																
Anacostia River - Nontidal	02140205	MO	Nitrogen	6/5/2008	1997	EOS-lbs/yr	26,707	81.0%	21,633	3,342	15.4%	3,342	15.4%	21,633	100.0%	2050
			Phosphorus	6/5/2008	1997	EOS-lbs/yr	2,209	81.2%	1,793	1,793	100.0%	1,793	100.0%	1,793	100.0%	2025
			Sediment	7/25/2012	1997	EOS-lbs/yr	544,402	85.0%	462,742	462,742	100.0%	462,742	100.0%	462,742	100.0%	2025
Anacostia River - Tidal	2140205	MO, PG	Nitrogen	6/5/2008	1997	EOS-lbs/yr	6,062	81.0%	4,910	42	0.9%	42	0.9%	4,910	100.0%	2050
			Phosphorus	6/5/2008	1997	EOS-lbs/yr	708	81.2%	575	17	2.9%	17	2.9%	575	100.0%	2040
			Sediment	7/25/2012	1997	EOS-lbs/yr	185,294	85.0%	157,500	5,011	3.2%	5,011	3.2%	157,500	100.0%	2040
Loch Raven Reservoir	02130805	BA,CL, HA	Phosphorus	3/27/2007	1995	EOS-lbs/yr	1,237	15.0%	186	186	100.0%	186	100.0%	186	100.0%	2025
Mattawoman Creek	02140111	CH,PG	Nitrogen	1/5/2005	2000	EOS-lbs/yr	5,317	54.0%	2,871	545	19.0%	545	19.0%	2,871	100.0%	2040
			Phosphorus	1/5/2005	2000	EOS-lbs/yr	693	47.0%	326	73	22.4%	73	22.4%	326	100.0%	2030
Non-Tidal Back River	02130901	BA	Nitrogen	6/29/2005	1995	EOS-lbs/yr	8,707	15.0%	1,306	552	42.3%	552	42.3%	1,306	100.0%	2040

Table 2: MDOT SHA Various TMDLs Modeling Results

Watershed Name	Watershed Number	County	Pollutant	EPA Approval Date	Baseline Year	Unit	MDOT SHA Baseline Load	MDOT SHA % Reduction Target	MDOT SHA Reduction Target	MDOT SHA Proposed 2020 Interim Reduction	% 2020 Reduction Relative to Reduction Target	MDOT SHA Proposed 2025 Interim Reduction Target	% 2025 Reduction Relative to Reduction Target	MDOT SHA Target Year Reduction Load	% Target Year Reduction Relative to Reduction Target	Target Year
			Phosphorus	6/29/2005	1995	EOS-lbs/yr	851	15.0%	128	128	100.0%	128	100.0%	128	100.0%	2025
Potomac River WA County	02140501	WA	Sediment	9/30/2011	2005	EOS-lbs/yr	1,324,637	15.2%	201,345	55,562	27.6%	55,562	27.6%	201,345	100.0%	2035
Prettyboy Reservoir	02130806	BA,CL	Phosphorus	3/27/2007	1995	EOS-lbs/yr	121	15.0%	18	18	100.0%	18	100.0%	18	100.0%	2025
Port Tobacco River	02140109	CH	Sediment	10/11/2019	2009	EOS-lbs/yr	79,798	33%	26,333	2,843	10.8%	2,843	10.8%	26,333	100.0%	2030
Rocky Gorge Reservoir	02131107	HO,MO ,PG	Phosphorus	11/24/2008	2000	EOS-lbs/yr	327	15.0%	49	16	31.7%	16	31.7%	49	100.0%	2030
Triadelphia Reservoir (Brighton Dam)	02131108	HO,MO	Phosphorus	11/24/2008	2000	EOS-lbs/yr	327	15.0%	49	3	5.7%	3	5.7%	49	100.0%	2030
Bacteria TMDLs																
Anacostia River, Downstream of NEB/NWB Confluence	02140205	PG	Bacteria - enterococci	3/14/2007	2003	billion MPN/ day	89,445	99.3%	88,819	1,022	1.2%	1,022	1.2%	88,819	100.0%	2050
Anacostia River, Upstream of NEB/NWB Confluence	02140205	MO,PG	Bacteria - enterococci	3/14/2007	2003	billion MPN/ day	311,792	84.1%	262,217	2,367	0.9%	2,367	0.9%	262,217	100.0%	2050

Table 2: MDOT SHA Various TMDLs Modeling Results

Watershed Name	Watershed Number	County	Pollutant	EPA Approval Date	Baseline Year	Unit	MDOT SHA Baseline Load	MDOT SHA % Reduction Target	MDOT SHA Reduction Target	MDOT SHA Proposed 2020 Interim Reduction	% 2020 Reduction Relative to Reduction Target	MDOT SHA Proposed 2025 Interim Reduction Target	% 2025 Reduction Relative to Reduction Target	MDOT SHA Target Year Reduction Load	% Target Year Reduction Relative to Reduction Target	Target Year
Antietam Creek	02140502	WA	Bacteria - E.coli	10/8/2009	2003	billion MPN/ year	170,412	98.0%	167,004	3,587	2.1%	3,587	2.1%	167,004	100.0%	2050
Cabin John Creek	02140207	MO	Bacteria - E.coli	3/14/2007	2003	billion MPN/ day	92,166	30.6%	28,203	512	1.8%	512	1.8%	28,203	100.0%	2050
Conococheag ue Creek	02140504	WA	Bacteria - E.coli	5/7/2009	2004	billion MPN/ year	105,861	99.0%	104,802	830	0.8%	830	0.8%	104,802	100.0%	2050
Double Pipe Creek	02140304	CL,FR	Bacteria - E.coli	12/3/2009	2004	billion MPN/ year	72,412	98.5%	71,326	0	0.0%	0	0.0%	71,326	100.0%	2050
Gwynns Falls	02130905	BA	Bacteria - E.coli	12/4/2007	2003	billion MPN/ day	157,179	99.3%	156,079	0	0.0%	0	0.0%	156,079	100.0%	2050
Herring Run	02130901	BA	Bacteria - E.coli	12/4/2007	2003	billion MPN/ year	30,714	92.2%	28,318	0	0.0%	0	0.0%	28,318	100.0%	2050
Jones Falls	02130904	BA	Bacteria - E.coli	2/12/2008	2003	billion MPN/ day	88,158	95.5%	84,191	0	0.0%	0	0.0%	84,191	100.0%	2050
Liberty Reservoir	02130907	BA,CL	Bacteria - E.coli	12/3/2009	2003	billion MPN/ year	127,606	89.2%	113,824	6,811	6.0%	6,811	6.0%	113,824	100.0%	2050
Loch Raven Reservoir	02130805	BA,CL, HO	Bacteria - E.coli	12/3/2009	2004	BN MPN/ yr	113,344	87.6%	99,289	1,818	1.8%	1,818	1.8%	99,289	100.0%	2050
Lower Monocacy River	02140302	CL,FR, MO	Bacteria - E.coli	12/3/2009	2004	billion MPN/ year	224,924	96.9%	217,952	2,789	1.3%	2,789	1.3%	217,952	100.0%	2050

Table 2: MDOT SHA Various TMDLs Modeling Results

Watershed Name	Watershed Number	County	Pollutant	EPA Approval Date	Baseline Year	Unit	MDOT SHA Baseline Load	MDOT SHA % Reduction Target	MDOT SHA Reduction Target	MDOT SHA Proposed 2020 Interim Reduction	% 2020 Reduction Relative to Reduction Target	MDOT SHA Proposed 2025 Interim Reduction Target	% 2025 Reduction Relative to Reduction Target	MDOT SHA Target Year Reduction Load	% Target Year Reduction Relative to Reduction Target	Target Year
Lower Patuxent River - Indian Creek	02131101 - Indian Creek	CH	Bacteria - fecal coliform	5/25/2005	2001	billion counts/day	5,567	43.6%	2,427	151	6.2%	151	6.2%	2,427	100.0%	2050
Magothy River - subsegment	02131001 - subsegment	AA	Bacteria - fecal coliform	2/20/2006	2001	billion counts/day	30,697	12.8%	3,929	86	2.2%	86	2.2%	3,929	100.0%	2050
Other West Chesapeake - Tracy and Rockhold Creeks	02131005 - Tracy and Rockhold Creeks	AA	Bacteria - fecal coliform	2/20/2006	2001	billion counts/day	7,275	81.6%	5,936	0	0.0%	0	0.0%	5,936	100.0%	2050
Piscataway Creek	02140203	PG	Bacteria - E.coli	9/20/2007	2003	billion MPN/day	32,126	42.5%	13,654	682	5.0%	682	5.0%	13,654	100.0%	2050
Rock Creek - Non-Tidal	02140206 - Non-Tidal	MO	Bacteria - enterococci	7/30/2007	2003	billion MPN/day	120,947	96.5%	116,713	856	0.7%	856	0.7%	116,713	100.0%	2050
Severn River - Mill Creek	02131002 - Mill Creek	AA	Bacteria - fecal coliform	4/10/2008	2002	billion counts/day	9,953	86.0%	8,560	220	2.6%	220	2.6%	8,560	100.0%	2050
Severn River - subsegment	02131002 - subsegment	AA	Bacteria - fecal coliform	4/10/2008	2002	billion counts/day	88,467	19.0%	16,809	2,078	12.4%	2,078	12.4%	16,809	100.0%	2050
Severn River - Whitehall & Meredith Creeks	02131002 - Whitehall & Meredith Creeks	AA	Bacteria - fecal coliform	4/10/2008	2002	billion counts/day	7,605	90.0%	6,844	558	8.2%	558	8.2%	6,844	100.0%	2050

Table 2: MDOT SHA Various TMDLs Modeling Results

Watershed Name	Watershed Number	County	Pollutant	EPA Approval Date	Baseline Year	Unit	MDOT SHA Baseline Load	MDOT SHA % Reduction Target	MDOT SHA Reduction Target	MDOT SHA Proposed 2020 Interim Reduction	% 2020 Reduction Relative to Reduction Target	MDOT SHA Proposed 2025 Interim Reduction Target	% 2025 Reduction Relative to Reduction Target	MDOT SHA Target Year Reduction Load	% Target Year Reduction Relative to Reduction Target	Target Year
South River - Ramsey Lake	02131003 - Ramsey Lake	AA	Bacteria - fecal coliform	11/4/2005	2001	billion counts/day	290	65.0%	189	0	0.0%	0	0.0%	189	100.0%	2050
South River - subsegment	02131003 - subsegment	AA	Bacteria - fecal coliform	11/4/2005	2001	billion counts/day	46,005	68.0%	31,283	4,946	15.8%	4,946	15.8%	31,283	100.0%	2050
Upper Monocacy River	02140303	CL,FR	Bacteria - E.coli	12/3/2009	2004	billion MPN/ year	79,007	97.0%	76,636	1,398	1.8%	1,398	1.8%	76,636	100.0%	2050
West River - Bear Neck Creek	02131004 - Bear Neck Creek	AA	Bacteria - fecal coliform	2/20/2006	2001	billion counts/day	2,374	43.2%	1,026	0	0.0%	0	0.0%	1,026	100.0%	2050
West River - Cadle Creek	02131004 - Cadle Creek	AA	Bacteria - fecal coliform	2/20/2006	2001	billion counts/day	957	72.2%	691	0	0.0%	0	0.0%	691	100.0%	2050
West River - subsegment	02131004 - subsegment	AA	Bacteria - fecal coliform	2/20/2006	2001	billion counts/day	3,563	35.3%	1,258	0	0.0%	0	0.0%	1,258	100.0%	2050

Note: MDOT SHA does not have a bacteria WLA reduction responsibility for the following watersheds: Magothy River - Forked Creek, Magothy River - Tar Cove, Prettyboy Reservoir, South River - Duval Creek, South River - Selby Bay, and West River - Parish Creek, Wicomico River Headwaters & Wills Creek either because there is no WLA assigned in the TMDL document, there is no MDOT SHA ROW in that segmentshed, and or the county in which the watersheds located in is currently out of MDOT SHA's MS4 jurisdiction.

E.2. Nutrients and Sediment Pollution Reduction Strategy

E.2.a. Nutrients and Sediment TMDLs Affecting MDOT SHA

There are 43 EPA approved nitrogen, phosphorus or sediment TMDLs with MDOT SHA responsibility spanning 34 Maryland 8-digit watersheds. The following TMDL documents for nitrogen, phosphorus and sediment are addressed in this plan:

- *Total Maximum Daily Loads of Nutrients/Biochemical Oxygen Demand for the Anacostia River Basin, Montgomery and Prince George's Counties, Maryland and The District of Columbia,* approved by EPA June 5, 2008;
- *Total Maximum Daily Loads of Nitrogen and Phosphorus for Back River in Baltimore City and Baltimore County, Maryland,* Approved June 29, 2005;
- *Total Maximum Daily Loads of Phosphorus and Sediments for Loch Raven Reservoir and Total Maximum Daily Loads of Phosphorus for Prettyboy Reservoir, Baltimore, Carroll and Harford Counties, Maryland,* approved by EPA March 27, 2007;
- *Total Maximum Daily Loads of Nitrogen and Phosphorus for Mattawoman Creek in Charles County and Prince George's County, Maryland,* approved by EPA January 5, 2005;
- *Total Maximum Daily Loads of Sediments in the Potomac River in the Potomac River Montgomery County Watershed, Montgomery and Frederick Counties, Maryland, approved by EPD January 19, 2012:*
- *Total Maximum Daily Load of Sediment in the Non-Tidal Port Tobacco River Watershed, Charles County, Maryland, approved October 11, 2019;*
- *Total Maximum Daily Loads of Phosphorus and Sediments for Triadelphia Reservoir (Brighton Dam) and Total Maximum Daily Loads of Phosphorus for Rocky Gorge Reservoir, Howard, Montgomery, and Prince George's Counties, Maryland, approved by EPA November 24, 2008.*

In **Table 2,** the projected reduction load achieved is found by modeling the nutrient or sediment load reduction that will be experienced by the construction of current and future BMPs in the given watershed. These BMPs are either currently under construction or are planned to be constructed in the future. To account for adaptive management, MDOT SHA has planned excess BMPs in the future to treat 115% of the required pollutant load. This treatment buffer will allow MDOT SHA to achieve the reduction targets even if some planned BMPs are eliminated prior to construction. The planned BMPs and associated reductions are discussed in **Sections F.5** of this plan.

E.2.b. Nutrient and Sediment Sources

Discussions in the TMDL concerning sediment sources focus on types of land use with information derived from the Chesapeake Bay Program Watershed Model (CBPWM). Cropland and regulated urban lands tend to be the most significant sources, followed by other agricultural uses and wastewater sources. Specific sources of each pollutant that could be useful for targeting controls are not included in the TMDL, but MDOT SHA researched a number of other references and determined sources beyond land uses that are summarized in **Table 3**. Sources of sediment include surface erosion from construction sites and cropland as well as stream erosion from high flows during storm events.

MDOT SHA Loading Sources

MDOT SHA-owned land is a small portion of each of the TMDL watersheds and it consists of relatively uniform land uses including roadways and roadside vegetation. In urbanized areas, the MDOT SHA ROW may extend to include sidewalks and portions of driveways. There are also parking areas associated with MDOT SHA land such as park and ride facilities, office complexes, and maintenance facilities.

Of the land uses in **Table 3**, MDOT SHA is a contributor of sediments mostly through urban and natural sources.

E.2.c. Nutrient and Sediment Reduction Strategies

To date, MDOT SHA has used a variety of structural, non-structural, and alternative BMPs in an effort to reduce sediment in the watersheds that have a corresponding TMDL. However, MDOT SHA understands that load reduction activities cannot be limited to just BMP implementation as opportunities to build new BMPs are limited. The use of nutrient credit trading will also be explored as a tool in reaching load reduction targets. When MDOT SHA partners on projects with other MS4 jurisdictions, load splitting can be used as a means to achieve WLA reductions.

BMP Implementation

As a requirement under the MS4 Permit, MDOT SHA must complete the implementation of restoration efforts for 20 percent of its impervious surface area. MDOT SHA has an extensive program to plan, design, and construct BMPs that offset untreated impervious surfaces in MDOT SHA ROW.

MDOT SHA intends to build these BMPs used for impervious restoration in watersheds that have a TMDL where possible. One of the major challenges with using a strategy of building BMPs to meet WLAs is that there can be a lack of feasible ROW for BMP placement opportunities. There are instances where MDOT SHA roadway encompasses a majority of the area in the ROW leaving very little land to construct BMPs. The visual watershed inspection process has indicated areas where BMP placement is possible and where it is not feasible due to utility relocation, land purchases, site access problems, and a host of other issues. Therefore, MDOT SHA is continually seeking new opportunities and partnerships to install BMPs.

Nutrient Credit Trading

In an effort to meet the MDOT SHA WLA in watersheds with limited BMP placement opportunities, MDOT SHA may explore the possibility of nutrient credit trading. It is expected that MS4 jurisdictions will have the ability to purchase pounds of phosphorus, nitrogen, and sediment in a quantity that will allow them to reach their intended WLA. To date no trading partnerships have been pursued. If and when MDOT SHA

Table 3: Nutrient and Sediment Sources from Various References

Land Use	Nutrient Sources	Sediment Sources
Agriculture	Chemical Fertilizer Manure	Soil Erosion
Urban	Pet Waste Lawn Fertilizer Parking Lot, Roof, and Street Runoff	Construction Erosion Parking Lot, Roof, and Street Runoff
Wastewater	Municipal Industrial Failed Septic Systems CSO/ SSO Leaking Sewers	
Natural	Atmospheric Deposition	Stream Erosion Shoreline Erosion

References used to develop this table are MDE, 2014; EPA, 2010; Hoos et al., 2000; and Schueler, 2011.

focuses on trading to meet the sediment WLA in this watershed it will be noted in the Annual Report.

TMDL End Date

Currently, MDOT SHA models BMP implementation for restoration practices that can be placed in the watershed based on the visual watershed inspection process. MDOT SHA will continue assessing this potential and will adjust the end dates as needed. After MDOT SHA has evaluated the building of all of the possible BMPs found during the “MDOT SHA Visual Inspection of ROW” detailed in **Section F.3**. of this plan, MDOT SHA will explore the possibility of nutrient credit trading or partnerships, which cannot be modeled at this time. Also, future changes to current BMP removal rates or efficiencies will be reviewed to determine impacts to anticipated WLA end dates.

E.3 Bacteria Pollution Reduction Strategy

E.3.a. Bacteria TMDLs Affecting MDOT SHA

There are 25 EPA approved bacteria TMDLs with MDOT SHA responsibility spanning five Maryland 8-Digit watersheds. The following TMDL documents for bacteria are addressed with this Plan:

- *Total Maximum Daily Loads of Fecal Bacteria for the Anacostia River Basin in Montgomery and Prince George's Counties, Maryland*, approved by EPA March 14, 2007;
- Total Maximum Daily Loads of Fecal Bacteria for Antietam Creek in Washington County, Maryland*, approved by EPA October 8, 2009;*
- *Total Maximum Daily Loads of Fecal Bacteria for the Herring Run Basin in Baltimore City and Baltimore County, Maryland*, approved by EPA December 4, 2007;
- *Total Maximum Daily Loads of Fecal Bacteria for the Non-tidal Cabin John Creek Basin in Montgomery County, Maryland,* approved by EPA March 14, 2007;
- *Total Maximum Daily Loads of Fecal Bacteria for the Conococheague Creek Basin in Washington County, Maryland,* approved by EPA May 7, 2009
- *Total Maximum Daily Loads of Fecal Bacteria for Double Pipe Creek in Frederick and Carroll Counties, Maryland,* approved by EPA December 3, 2009;
- *Total Maximum Daily Loads of Fecal Bacteria for the Non-Tidal Gwynns Falls Basin in Baltimore City and Baltimore County, Maryland*, approved by EPA December 4, 2007;
- *Total Maximum Daily Loads of Fecal Bacteria for the Non-Tidal Jones Falls Basin in Baltimore City and Baltimore County, Maryland*, approved by EPA February 12, 2008;
- *Total Maximum Daily Loads of Fecal Bacteria for Liberty Reservoir in Carroll and Baltimore Counties, Maryland,* approved by EPA December 3, 2009
- *Total Maximum Daily Loads of Fecal Bacteria for the Lower Monocacy River in Frederick, Carroll, and Montgomery Counties, Maryland,* approved by EPA December 3, 2009;
- *Total Maximum Daily Loads for Island Creek, Town Creek, Trent Hall Creek, St. Thomas Creek, Harper and Pearson Creeks, Goose Creek and Indian Creek and a Water Quality Analysis for Battle Creek of Fecal Coliform For Restricted Shellfish Harvesting Areas in the Lower Patuxent River Basin in Calvert, Charles and St. Mary's Counties, Maryland*, approved by EPA May 25, 2005;
- *Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in Magothy River, Tar Cove, and Forked Creek and a Water Quality Analysis of Fecal Coliform for Deep Creek of the Magothy River Basin in Anne Arundel County, Maryland*, approved by EPA February 20, 2006;
- *Total Maximum Daily Loads of Fecal Bacteria for the Non-Tidal Piscataway Creek Basin in Prince George's County, Maryland*, approved by EPA September 20, 2007;
- *Total Maximum Daily Loads of Fecal Bacteria for the Prettyboy Reservoir Basin in Baltimore and Carroll Counties, Maryland,* approved by EPA October 8, 2009;
- *Total Maximum Daily Loads of Fecal Bacteria for the Non-Tidal Rock Creek Basin in Montgomery County, Maryland,* approved by EPA July 30, 2007;

- *Total Maximum Daily Loads of Fecal Coliform for the Restricted Shellfish Harvesting Areas in Whitehall and Meredith Creeks, Mill Creek, and the Severn River Mainstem of the Severn River Basin in Anne Arundel County, Maryland,* approved by EPA April 10, 2008;

- *Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in the South River, Duvall Creek, Selby Bay, and Ramsey Lake of the South River Basin in Anne Arundel County, Maryland,* approved by EPA November 4, 2005;

- *Total Maximum Daily Loads of Fecal Bacteria for the Upper Monocacy River in Frederick and Carroll Counties, Maryland*, approved by EPA December 3, 2009;

- *Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in Tracy and Rockhold Creeks of the Other West Chesapeake Bay Drainages Basin in Anne Arundel County, Maryland,* approved by EPA February 20, 2006;

- *Total Maximum Daily Loads of Fecal Coliform for Restricted Shellfish Harvesting Areas in Bear Neck Creek, Cadle Creek, West River, and Parish Creek for the West River Basin in Anne Arundel County, Maryland,* approved by EPA February 20, 2006;

Table 2 shows a summary of the reduction requirements and projected reduction benchmarks by target year for the current MDOT SHA bacteria TMDLs. Refer to the *MDOT SHA Restoration Modeling Protocol* (MDOT SHA, 2019) for modeling methods, **Figure 4D** for watersheds with bacteria TMDLs, and **Section F1 – F22** for detailed watershed level implementation plans.

E.3.b. Bacteria Sources

Fecal indicator bacteria (FIB) are used to identify the presence of fecal matter, which indicates potential presence of pathogens associated with fecal matter. FIBs are not pathogens. A pathogen is a bacterium, virus, or other microorganism that can cause disease. MDE identified the FIB for which MDOT SHA is responsible, including:

- *E. coli*, and
- *Enterococcus.*

For most of the bacteria TMDLs, MDE has included some type of Bacterial Source Tracking (BST), which is a method of estimating the source of the bacteria by matching DNA or RNA with a library of samples from known species. BST has been used to categorize the fraction of bacteria coming from four general sources:

- humans,
- domestic pets,
- wildlife, or
- livestock.

It is important to note that BST is performed on samples from the impaired water body, and thus the estimate of the fraction from each source is relative to the watershed, not from particular locations, jurisdictions, or permittees. The sources of bacteria in the four categories can be categorized in further detail, as shown in **Table 4**. These have been derived from MDE's stormwater WLA bacteria guidance (MDE, 2014a) and Watershed Protection Techniques Article 17 (Schueler, 2000), which describes the sources to be addressed for load reduction in an implementation plan.

Table: 4 Bacteria Sources

Sector	MS4 Point Source	Non-Point Source
Human	Sanitary sewer illicit discharge	Septic systems
	Sanitary sewer exfiltration	SSO
	Homeless populations	CSO
		Recreational boating
Domestic Pets	Pets, urban areas	Pets, rural areas
Wildlife	Urban wildlife	Non-urban wildlife
Livestock		Agriculture, hobby farms
		Concentrated Animal Feeding Operations (CAFOs)

The bacteria sources listed as MS4 sources are all diffuse sources that enter the storm drain system either through runoff or cross-connections. MDOT SHA, as a MS4 permittee, by definition only has point source discharges. These sources can be treated by stormwater practices or load reduction strategies. Loads from the non-point source list are either discrete sources, which can only be addressed through a load reduction approach, or diffuse rural sources that do not flow through storm drains.

The sources are significant in relation to permit conditions. The TMDL SW-WLA is the only load that must be addressed to meet the permit requirements, so that reduction of loads from livestock, sewer overflows, or septic systems would not be applicable to meet the permit requirement. Bacteria from these sources generally enter the receiving waters directly.

Bacteria concentrations in stormwater runoff are typically elevated above the primary contact recreation standards, regardless of the type of land use in the watershed (Clary et al., 2008). This type of pollution is significant because, unlike the water that goes down a sink or toilet in your home and is fed to a WWTP or septic system, stormwater runoff that is not intercepted by a BMP, is untreated and drains directly to lakes, rivers, and ultimately the Bay.

MDOT SHA Bacteria Loading Sources

The MDOT SHA-owned land is a small portion of each of the TMDL watersheds. Very few of the bacteria sources listed in **Table 4** exist within MDOT SHA land. However, there is some very limited potential for bacteria to originate from MDOT SHA ROW.

MDOT SHA owns only two septic systems in these watersheds; one at the Hereford shop in Loch Raven Reservoir watershed and one at a salt storage facility in Patapsco Lower North Branch watershed. The MDOT SHA Facility Maintenance Division (FMD) has standard operating procedures that includes regular inspections and maintenance for facilities with onsite septic systems. This helps to prevent sanitary overflows that may cause bacteria pollution.

MDOT SHA does not own or maintain sanitary sewers, although some of these utilities may be present within the ROW. However, there is potential for a sewage leak from one of these utilities. MDOT SHA has a program that conducts regular inspections and testing for any suspected illicit discharge within the drainage system. If an illicit discharge is confirmed, the MDOT SHA works with local jurisdictions to disconnect the discharge from the drainage system.

Potential for human or animal waste contamination from MDOT SHA runoff is minimal. There are no residents or livestock pasture lands in the ROW, so the only source of animal waste bacteria would be feral animals, adjacent residents walking pets along MDOT SHA roads, drainage washing from pasture lands, or homeless individuals. Wildlife sources are typically generated as a non-point source throughout the watershed, and are typically deterred from MDOT SHA ROW for safety reasons.

E.3.c. Bacteria Reduction Strategies

The MDOT SHA bacteria reduction strategy will be an iterative process to address bacteria sources with the greatest impact on water quality, while considering the difficulty of implementation and cost. MDOT SHA first started with using the Watershed Treatment Model (WTM). Next, MDOT SHA will develop local monitoring data of stormwater outfalls in the MDOT SHA drainage system. Then, the data from the outfall monitoring effort is analyzed to identify any BMP in which water flowing from or in the BMP are not meeting bacteriological WQSs set by MDE. Source elimination will follow the analysis of the local monitoring data. In the source elimination stage MDOT SHA will seek to remove the source of the bacteria.

Watershed Treatment Modeling

The WTM was used to better understand what bacteria load reduction MDOT SHA can capture using the portfolio of BMPs that will be used to meet the required 20 percent impervious restoration goal. The idea is to determine what impact the impervious surface restoration has on reducing bacteria in the local watersheds. The expectation is where fecal bacteria are transported through our MS4 conveyance system, stormwater BMPs implemented to control urban runoff should help in reducing fecal bacteria loads in the watershed. The results of the WTM are shown in **Table 2**.

Local Monitoring Effort

MDOT SHA will develop a protocol for monitoring stormwater outfalls and/or other BMPs that may have possible contaminated flow. This protocol is expected to be developed and approved by MDE by 2025. After the monitoring protocol is in place, MDOT SHA will start with sampling outfalls and BMPs in the watershed with a bacteria TMDL.

It is expected that during the local monitoring effort, MDOT SHA will be able to determine if there are any waters flowing from the MS4 drainage system where water quality is not meeting bacteriological WQSs. Once locations are identified, an effort to further investigate the source of the bacteria will be undertaken. MDOT SHA will review MDE's BST data for the identified area and make a determination on what the potential source(s) of contaminate are. MDE's BST data tests microbial isolates collected from water samples and compares the isolates with a library from known sources to identify the host organism the bacteria came from. Once the BST data is examined a source can be identified and source elimination efforts can be focused.

Source Elimination

The effort to eliminate bacteria sources will focus on achieving load reductions for domestic pets, wildlife loads, and human waste. These actions may include but not be limited to:

- Eliminating illicit sewer discharges to stormwater conveyance systems;
- Addressing areas frequented by homeless populations in cooperation with local public health agencies; and
- Installing pet waste disposal bins within MDOT SHA ROW that have a high pet usage.

F1. ANACOSTIA RIVER WATERSHED

F.1. Watershed Description

The Anacostia River watershed (MD 8-digit Basin Code: 02140205) encompasses 145 square miles (approximately 92,800 acres) across both Montgomery and Prince George's Counties, Maryland and an additional 28 square miles (approximately 18,000 acres) in Washington, DC. The watershed terminates in Washington, D.C. where the Anacostia River flows into the Potomac River, which ultimately conveys water to the Chesapeake Bay.

The Anacostia River watershed is comprised of 15 subwatersheds: Briers Mill Run, Fort Dupont Tributary, Hickey Run, Indian Creek, Little Paint Branch, Lower Beaverdam Creek, Northeast Branch, Northwest Branch, Paint Branch, Pope Branch, Sligo Creek, Still Creek, Upper Beaverdam Creek, Watts Branch, and the tidal river.

Waters within the Anacostia River watershed are subject to the following impairments as noted on MDE's 2018, 303(d) List:

- Biochemical oxygen demand (BOD);
- Chlorides;
- Debris/Floatables/Trash;
- *Enterococcus;*
- Heptachlor Epoxide;
- Nitrogen (Total);
- PCB in Fish Tissue;
- Phosphorus (Total);
- Polychlorinated biphenyls;
- Sulfates; and
- Total Suspended Solids (TSS).

There are 349 centerline miles of MDOT SHA roadway located within the Anacostia River watershed. The associated ROW encompasses 3640 acres, of which 1900 acres are impervious. MDOT SHA facilities located within the watershed consist of one weigh station, one highway garage or shop, one highway office or lab, three park and ride facilities, and three salt storage facilities. See **Figure 5** for a map of MDOT SHA facilities within the Anacostia River watershed.

F.2. MDOT SHA TMDLs within Anacostia Watershed

TMDLs requiring reduction by MDOT SHA in the Anacostia River watershed include nitrogen, phosphorus (MDE, 2008b), sediment (MDE, 2007a), and *enterococci* bacteria (MDE, 2008a). Nitrogen is to be reduced by 81.0 percent, phosphorus by 81.2 percent and sediment is to be reduced by 85.0 percent in Montgomery and Prince George's Counties, as shown in **Table 2**. MDOT SHA is modeling nitrogen, phosphorus, and sediment separately for the Non-Tidal and Tidal portions of the Anacostia River watershed.

Enterococci bacteria in the subwatersheds downstream and upstream of the Northeast Branch/Northwest Branch confluence of the Anacostia River is required to be reduced by 99.3 percent in downstream of the confluence and 84.1 percent upstream of the confluence, as shown in **Table 2**.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 permit requires MDOT SHA perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Anacostia River watershed is shown in **Figure 6** which illustrates that 90 grid cells have been reviewed, encompassing portions of 42 state route corridors. Potential BMP sites identified as part of the visual inspections follow:

Structural SW Controls

Preliminary evaluation identified 412 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- Three sites constructed or under contract.
- 320 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 89 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 171 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 75 sites constructed or under contract.
- 15 additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 81 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified 82 sites as potential stream restoration locations. Further analysis of these locations resulted in:

- 12 sites constructed or under contract.
- 62 additional sites deemed potentially viable for stream restoration and pending further analysis may be candidates for future restoration opportunities.
- Eight sites deemed not viable for stream restoration and have been removed from consideration.

Grass Swale Rehabilitation

Preliminary evaluation identified seven sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- Five additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- Two sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

Preliminary evaluation identified 170 outfalls potential for stabilization. Further analysis of these sites resulted in:

- One site constructed or under contract.
- 24 outfall sites deemed potentially viable for outfall stabilization efforts and pending further analysis, may be candidates for future restoration opportunities.
- 145 outfall sites deemed not viable for outfall stabilization and have been removed from consideration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified 39 existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- Six sites constructed or under contract.
- 19 additional sites deemed potentially viable for restoration opportunities and pending further analysis, may be candidates for future restoration opportunities.
- 14 sites deemed not viable for future restoration opportunities and have been removed from consideration.

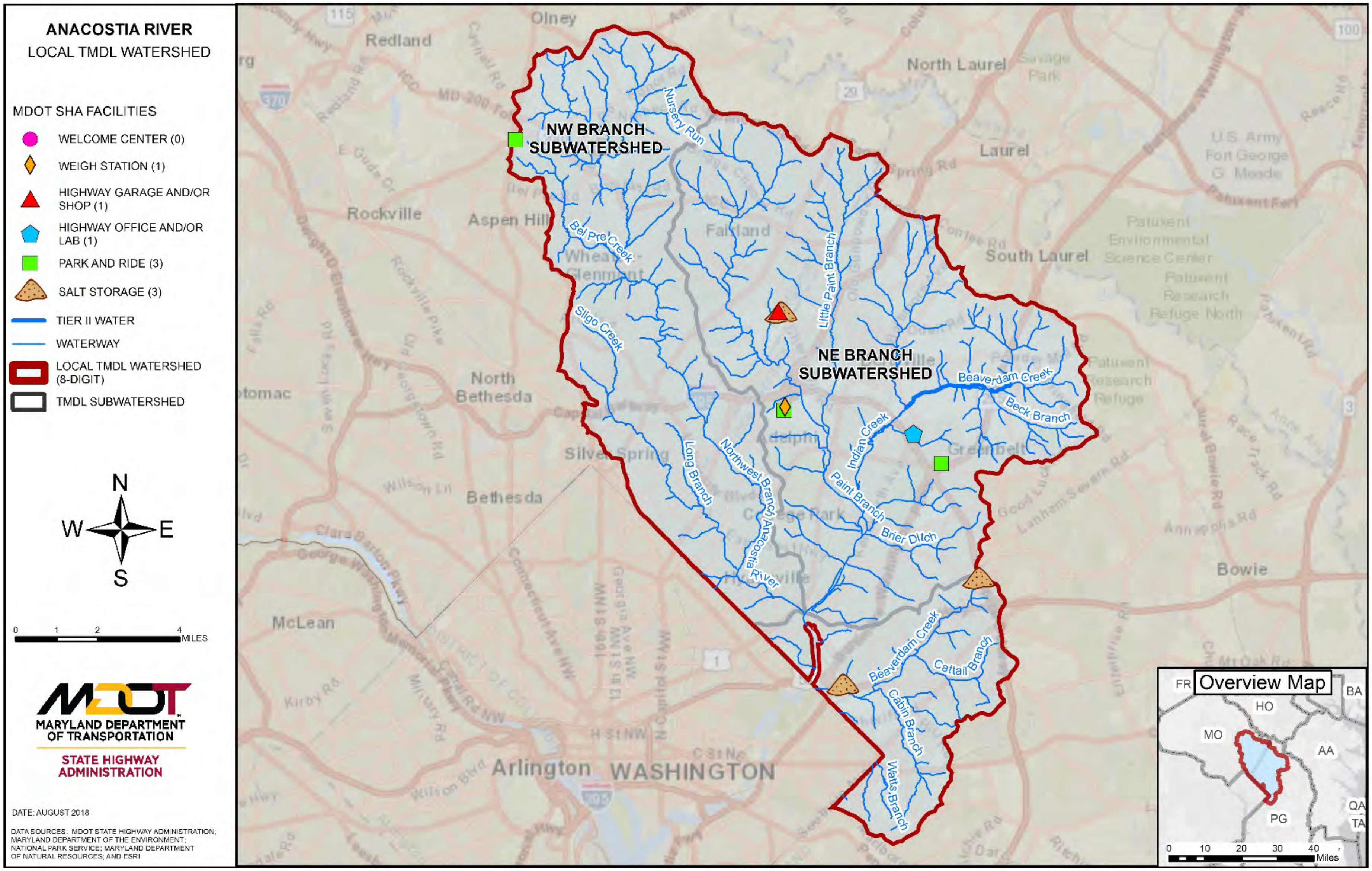


Figure 5: MODT SHA Facilities within Anacostia River Watershed

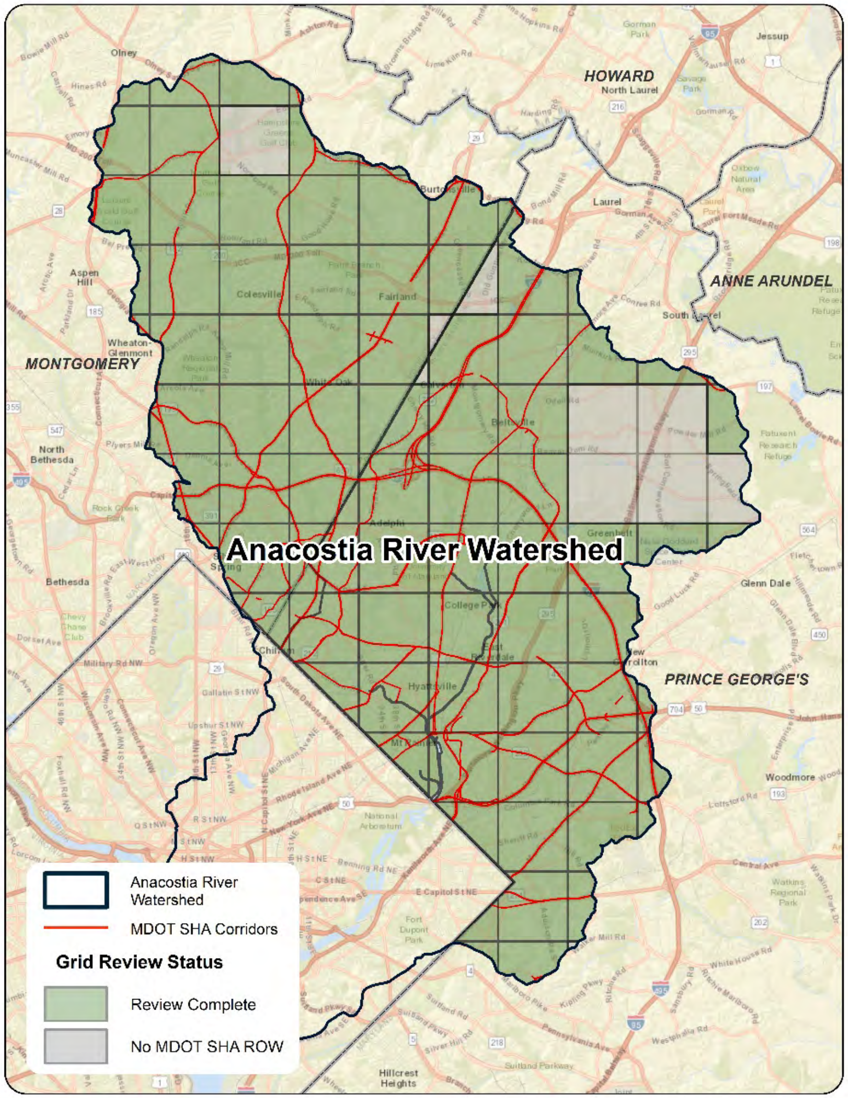


Figure 6: Anacostia River Site Search Grids

F.4. Summary of County Assessment Review

Both Montgomery and Prince George's Counties have conducted a watershed assessment for areas within the Anacostia River watershed. In January 2012, the *Anacostia Watershed Implementation Plan* (hereinafter referred to as the "Montgomery County Plan") was published for the Montgomery County Department of Environmental Protection (Biohabitats, et al., 2012a). In December 2015, the *Restoration Plan for the Anacostia River Watershed* (hereinafter referred to as the "Prince George's County Plan") was published for the Prince George's County Department of the Environment (Tetra Tech, 2015b).

Land cover in the watershed is as follows; in Montgomery County: Residential (68.00 percent), Forest (9.00 percent), Municipal/Institutional (8.00 percent), and Roadways (7.00 percent) (Biohabitats et al., 2012a, p. 11). Within Prince George's County land use is as follows: Urban (64.79 percent), Forest (25.30 percent), Agriculture (8.33 percent), and Water and Wetlands (0.55 percent) (Tetra Tech, 2015b, p. 14).

The Anacostia River watershed is a highly urbanized area, much of which was developed prior to modern SWM and erosion and sediment control regulations. Montgomery County identified 6,917.0 acres of impervious cover, 18.0 percent of the total watershed, 24.0 percent of the impervious cover is from roads (Biohabitats et al., 2012, p. 8). Likewise, Prince George's County identified 15,435.3 acres of impervious cover, 28.5 percent of the total watershed (Tetra Tech, 2015b, p. 16).

Montgomery County alone contributes; 206,312 pounds per year of nitrogen, 20,953 pounds per year of phosphorus to the watershed, 247,809 billion MPN per year of bacteria (enterococci), and 7,682 tons per year of sediment to the watershed (Biohabitats, et al., 2012a, p. 15).

In the Maryland portion of the watershed, the majority of the land is drained by MS4 outfalls; 9,500 acres drain directly to the Anacostia River and tributaries and the remaining 82,600 acres are drained via MS4 outfalls (Tetra Tech, 2015b, p. 11). MDOT SHA ROWs cross throughout the majority of the Anacostia watershed (**Figure 6**). The Montgomery County and the Prince George's County Plans did not indicate water quality problems for restoration associated with MDOT SHA facilities and ROW.

Soils within the Anacostia River watershed hold varying hydrologic characteristics; however, the majority are classified as hydrologic Group B and C, the least represented being hydrologic Group A. Most soils have been heavily altered by disturbance because of land development activities and urbanization resulting in more poorly drained compacted soils (Tetra Tech, 2015b, p. 12).

The subwatersheds in Prince George's County were prioritized by ranking the necessary total load reductions for each TMDL parameter including PCBs. The subwatershed AR-9 (which is at the headwaters to Beaverdam Creek) was ranked the highest priority for BMPs in the areas with the highest required pollutant loading reductions followed by AR-12, AR-16, AR-20, and AR-7 (Tetra Tech, 2015, p. 64-67). Within the AR-9 subwatershed, MDOT SHA has completed numerous tree plantings and a new efficiency BMP as shown in **Figure 7**.

Montgomery County noted that according to their testing parameters, Lower Paint Branch, Little Paint Branch, Northwest Branch, and Sligo Creek received consistent "poor" ratings, and should be targeted for restoration efforts (Biohabitats et al., 2012a, p. 13).

MDOT SHA has completed tree plantings along the Northwest Branch Anacostia River, Little Paint Branch, Long Branch, Indian Creek, and Beaverdam Creek. A new efficiency BMP was completed on Brier Ditch and retrofits were completed on Little Paint Branch. Stream restorations have been completed on Paint Branch and Bel Pre Creek. Outfall stabilization is proposed on Beaverdam Creek and a proposed tree planting is located on Paint Branch. Locations of MDOT SHA restoration strategies are shown in **Figure 7**.

Both counties identified several similar restoration strategies for meeting pollution reduction and improvement goals within the watershed listed below. Practices that may be relevant to MDOT SHA have been italicized.

- *Stormwater retrofit;*
- *Stream restoration;*
- *Wetland creation/restoration;*
- *Fish blockage removal/modification;*
- *Riparian reforestation/street tree planting;*
- Green roof;
- Dry water pond;
- *Bioswales;*
- *Permeable pavements/sidewalks;*
- Rain gardens and rain barrels;
- *Street sweeping; and*
- *Downspout disconnection.*

A bacteria source analysis was conducted by MDOT SHA for the Anacostia River watershed to identify specific potential sources and known areas of contamination. Two potentially contaminated bacteria sites were identified. See **Table 5** for details.

Table 5: Anacostia River Watershed Bacteria Source Analysis

Subwatershed	Pollutant	Site Name (NPDES Permit No.)	Source
Anacostia River NE Branch	Bacteria	BARC East Side (#MD0020842)	Final Approved TMDL
Anacostia River NE Branch	Bacteria	Beltsville USDA West (#MD0020851)	Final Approved TMDL

F.5. MDOT SHA Pollution Reduction Strategies

Table 2 lists the reduction requirements for Anacostia River watershed TMDL pollutants along with the Target Year for achieving the reductions. Anacostia River is listed for nitrogen, phosphorus, sediment, and bacteria with each TMDL having a different baseline year; 1997 for nitrogen, phosphorus, and sediment, and 2003 for bacteria.

MDOT SHA is over programming restoration projects to treat 115 percent of the required pollutant loads for nitrogen, phosphorus, and sediment as an adaptive management strategy. This treatment buffer will allow MDOT SHA to achieve the reduction targets even if some planned projects are eliminated prior to construction due to site design limitations or any other situation that may result in removing the project from the plan. The implementation required to treat 115 percent of the nitrogen reduction targets in the Non-Tidal and Tidal portions of the Anacostia River results in over treating for phosphorus and sediment (i.e., less BMPs were needed to treat the phosphorus and sediment reduction targets than were needed to treat the nitrogen reduction targets). A treatment buffer was not applied bacteria plans because this pollutant is not exclusively treated through stormwater or alternative BMPs. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking, contaminated site identification and potentially partnering with other jurisdictions where possible to pursue load reduction activities as outlined in sections E.3.c.

Proposed practices to meet nitrogen, phosphorus and sediment reduction in the Non-Tidal and Tidal portions of the Anacostia River watershed are shown in **Table 6** and **Table 7**, respectively. Projected nitrogen, phosphorus, and sediment reductions using these practices in the Non-Tidal portion of the Anacostia River watershed are 24,888 lbs./yr., 8,138 lbs./yr., and 2,683,527 lbs./yr., which are 115.0 percent, 456.3 percent, and 579.9 percent of the reduction target, respectively. Projected nitrogen, phosphorus, and sediment reductions using these practices in the Tidal portion of the Anacostia River watershed are 5,644 lbs./yr., 1,808 lbs./yr., and 429,078 lbs./yr., which are 115.0 percent, 314.7 percent, and 272.4 percent of the reduction target, respectively.

Proposed practices to meet bacteria reductions in the subwatersheds downstream and upstream of the Northeast Branch/Northwest Branch confluence of the Anacostia River are shown in **Table 8** and **Table 9**, respectively. Projected bacteria reductions using these practices in the subwatersheds downstream and upstream of the Northeast Branch/Northwest Branch confluence are 1,022 billion MPN/day and 1,695 billion MPN/day, which are 1.2 percent and 0.6 percent of the reduction target, respectively. These practices are described in **Section E.** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the baseline year. In this case the baseline for nitrogen, phosphorus, and sediment is 1997, and the baseline for bacteria is 2003;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and

- Future BMPS to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Non-Tidal portion of the Anacostia River watershed total $275,866,500 and the costs within the Tidal portion of the Anacostia watershed total $67,553,000. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 10** and **Table 11** for a summary of estimated BMP costs.

Figure 7 shows a map of MDOT SHA watershed restoration strategies throughout the Anacostia River watershed. The practices shown only include those that are under design or constructed.

Table 6: Anacostia River Nontidal Restoration Nitrogen, Phosphorus, and Sediment BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 1997)	Restoration BMPs			
			2020	2025	Target Year[3]	Restoration Totals
New Stormwater	drainage area acres	137.1	4.0		3,430.0	3,434.0
Stormwater Retrofit	drainage area acres		74.1		85.8	159.8
Grass Swale	drainage area acres	168.9				
Tree Planting	acres of tree planting		62.2		1,805.3	1,867.5
Stream Restoration	linear feet		34,025.0		66,885.0	100,910.0
Inlet Cleaning[1]	dry tons		11.2			11.2
Pipe Cleaning[1]	dry tons		23.1			23.1
Street Sweeping[1]	acres swept		21.4			21.4
Cross-Jurisdictional[2]	drainage area acres	26.6				
Impervious Disconnects	credit acres	13.1				
Annual Load Reductions	TN EOS lbs./yr.	1,693.9	3,283.3		21,604.2	24,887.6
	TP EOS lbs./yr.	209.2	2,388.5		5,794.9	8,183.3
	TSS EOS lbs./yr.	63,549.1	1,303,948.7		1,379,578.8	2,683,527.5

1 Inlet cleaning, pipe cleaning, and street sweeping are annual practices. They are reflected only once for the year the annual reduction is achieved. Once achieved, this annual reduction will be sustained each year the load reduction is claimed.
2 Cross-jurisdictional BMPs may be a mix of various stormwater control structures.
3 Refer to Table 2 for Target Year.

Table 7: Anacostia River Tidal Restoration Nitrogen, Phosphorus, and Sediment BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 1997)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	1.1			962.0	962.0
Grass Swale	drainage area acres	0.7				
Tree Planting	acres of tree planting					
Stream Restoration	linear feet				379.7	379.7
Outfall Stabilization	linear feet				21,645.0	21,645.0
Inlet Cleaning[1]	dry tons		11.7			11.7
Pipe Cleaning[1]	dry tons		0.4			0.4
Street Sweeping[1]	acres swept		0.2			0.2
Impervious Disconnects	credit acres	1.2				
Annual Load Reductions	TN EOS lbs./yr.	16.5	41.8		5,602.5	5,644.3
	TP EOS lbs./yr.	2.3	16.6		1,791.7	1,808.2
	TSS EOS lbs./yr.	686.1	5,012.2		424,066.3	429,078.5

[1] *Inlet cleaning, pipe cleaning, and street sweeping are annual practices. They are reflected only once for the year the annual reduction is achieved. Once achieved, this annual reduction will be sustained each year the load reduction is claimed.*
[2] *Refer to Table 2 for Target Year.*

Table 8: Anacostia River Downstream of NEB/NWB Confluence Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2003)	Restoration BMPs			
			2020	2025	Target Year[1]	Restoration Totals
New Stormwater	drainage area acres	28.8	1.5		N/A	1.5
Stormwater Retrofit	drainage area acres		26.0		N/A	26.0
Annual Load Reductions	Enterococci billion MPN/day	2,738.0	1,022.0		N/A	1,022.0

[1] *Refer to Table 2 for Target Year.*

Table 9: Anacostia River Upstream of NEB/NWB Confluence Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2003)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	170.4	2.5		N/A	2.5
Stormwater Retrofit	drainage area acres		48.0		N/A	48.0
Cross-Jurisdictional[1]	drainage area acres	26.6			N/A	
Annual Load Reductions	Enterococci billion MPN/day	28,153.0	1,695.0		N/A	1,695.0

[1] *Cross-jurisdictional BMPs may be a mix of various stormwater control structures.*
[2] *Refer to Table 2 for Target Year.*

Table 10: Anacostia Non-Tidal River Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater	$243,000		$161,074,000	$161,317,000
Stormwater Retrofit	$2,827,000		$4,370,000	$7,197,000
Tree Planting	$2,101,000		$60,929,000	$63,030,000
Stream Restoration	$14,922,000		$29,334,000	$44,256,000
Inlet Cleaning	$64,000			$64,000
Pipe Cleaning	$500			$500
Street Sweeping	$2,000			$2,000
			Total Restoration Cost	$275,866,500

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs. Costs for operational BMPs (inlet cleaning, pipe cleaning, and street sweeping) are annual costs that are incurred each year to sustain load reductions.*
[2] *Refer to Table 2 for Target Year.*

Table 11: Anacostia River Tidal Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater			$45,176,000	$45,176,000
Tree Planting			$12,816,000	$12,816,000
Stream Restoration			$9,493,000	$9,493,000
Inlet Cleaning	$67,000			$67,000
Pipe Cleaning	$500			$500
Street Sweeping	$500			$500
			Total Restoration Cost	$67,553,000

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs. Costs for operational BMPs (inlet cleaning, pipe cleaning, and street sweeping) are annual costs that are incurred each year to sustain load reductions.*
[2] *Refer to Table 2 for Target Year.*

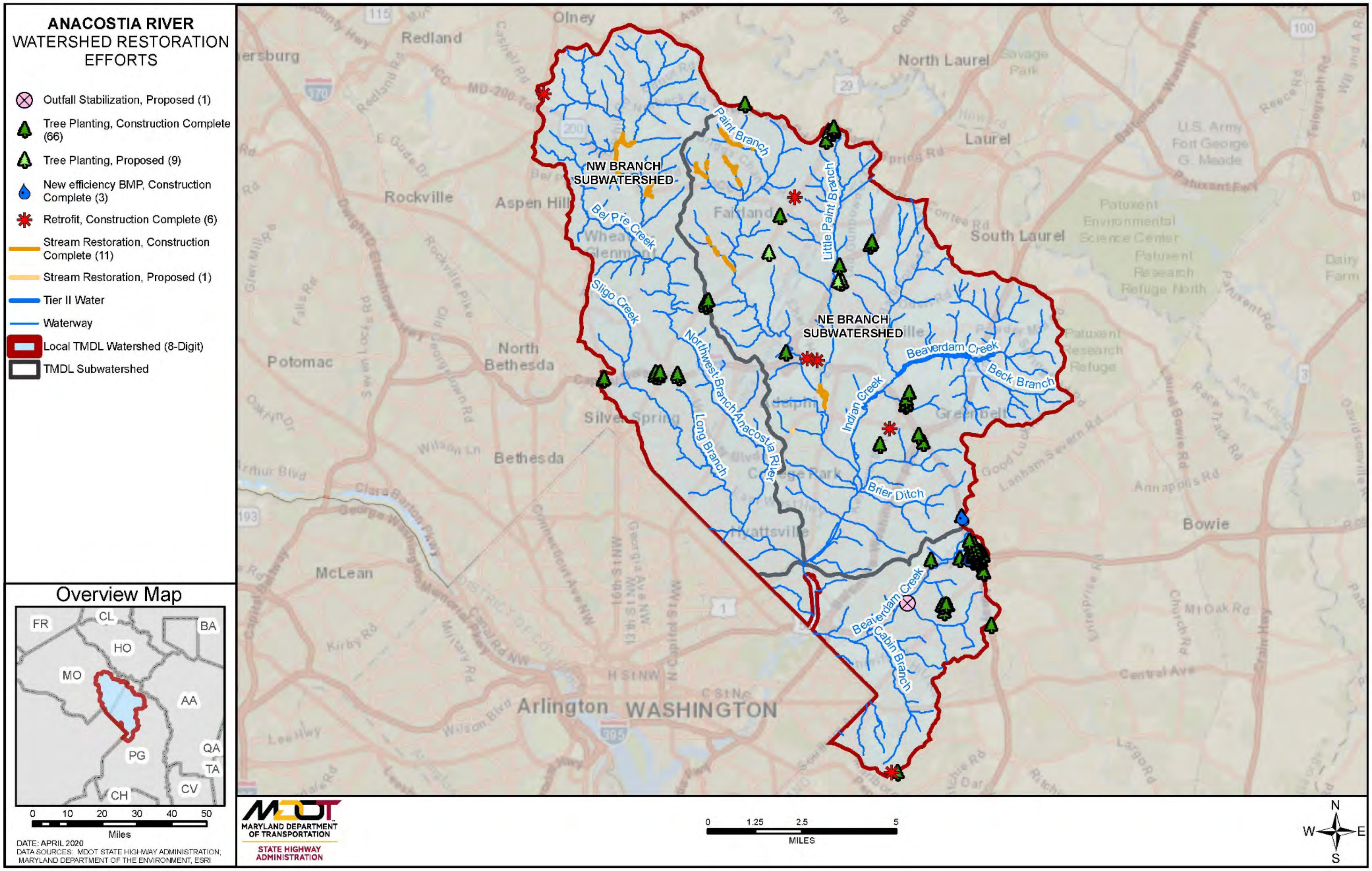


Figure 7: MDOT SHA Restoration Strategies within the Anacostia River Watershed

F2. ANTIETAM CREEK WATERSHED

F.1. Watershed Description

The Antietam Creek watershed encompasses 290 square miles with 185 square miles in Maryland. Approximately 75 percent of this watershed occurs in Washington County with the remainder in Franklin and Adams Counties, Pennsylvania. Antietam Creek flows about 54 miles from its headwaters in Pennsylvania's Michaux State Forest to the Potomac River near Antietam, Maryland. Major tributary creeks and streams of the Antietam Creek watershed in Maryland include Little Antietam Creek, Beaver Creek, and Marsh Run.

There are approximately 744 miles of MDOT SHA roadway located within the Antietam Creek watershed. The associated ROW encompasses 2,201 acres, of which approximately 853 acres are impervious. MDOT SHA facilities located within the watershed consist of five park and ride facilities, four salt storage facilities, and two highway garage or shop facilities. See **Figure 8** for a map of the watershed and these facilities.

F.2. MDOT SHA TMDLs within Antietam Creek Watershed

TMDLs requiring reduction by MDOT SHA include phosphorus, sediment, and *E. coli* bacteria (MDE, 2012a; 2009b; 2009a). This implementation plan focuses on the bacteria TMDL which is to be reduced by 98.0 percent as shown in **Table 2**.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Antietam watershed is shown in **Figure 9** which illustrates that 84 grid cells have been reviewed, encompassing portions of 684 state route corridors. Potential BMP sites identified as part of the visual inspections follow:

Structural SW Controls

Preliminary evaluation identified 1,219 locations as potential new structural SW control locations. Further analysis resulted in:

- 24 new structural SW controls constructed or under contract.
- 507 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 688 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 598 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 100 sites constructed or under contract.
- 66 additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 432 sites deemed not viable for tree planting and have been removed from consideration.

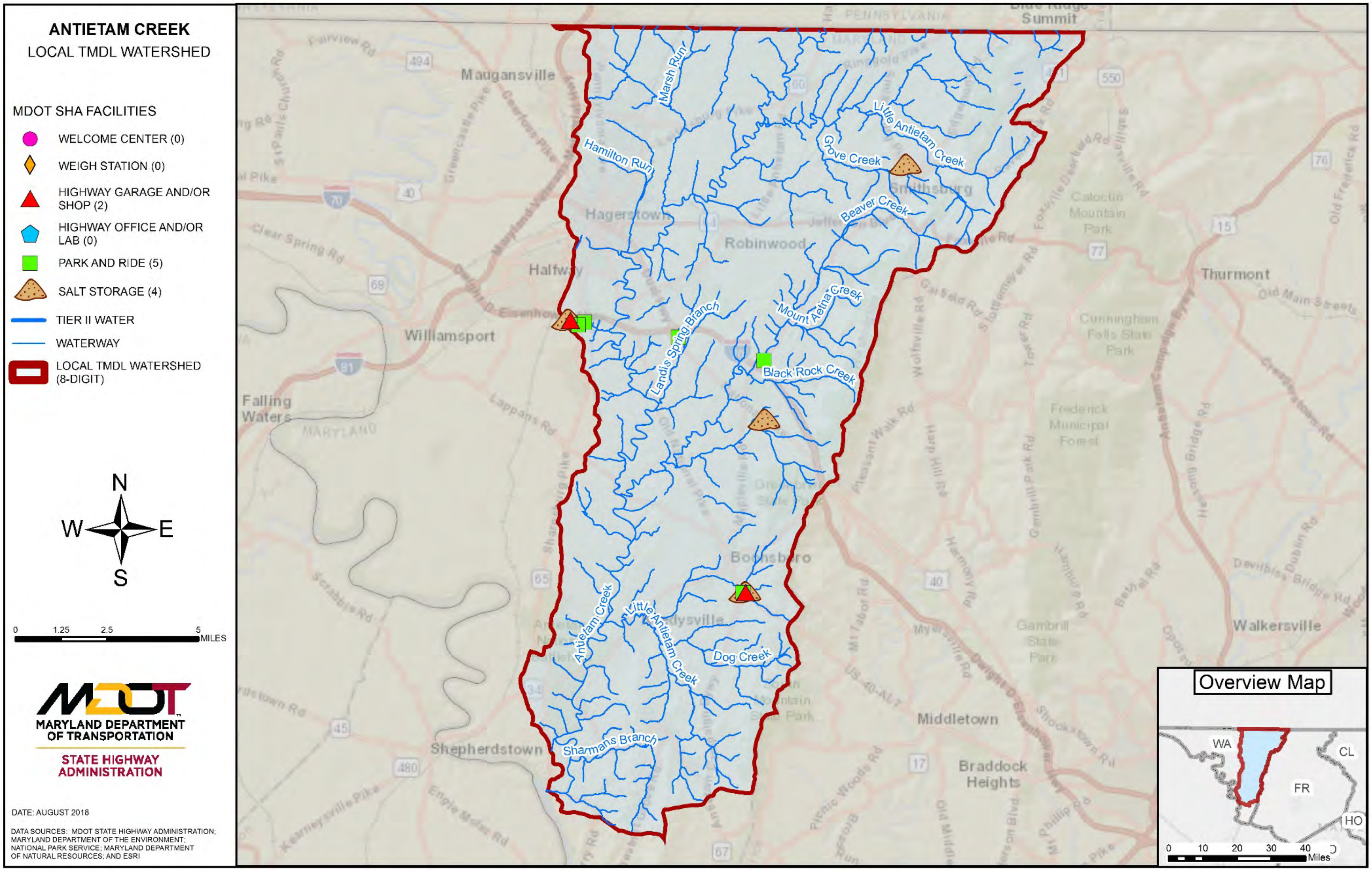


Figure 8: MDOT SHA Facilities within Antietam Creek Watershed

Stream Restoration

Preliminary evaluation identified 30 sites as potential stream restoration locations. Further analysis of these locations resulted in:

- 10 additional sites deemed potentially viable for stream restoration and pending further analysis may be candidates for future restoration opportunities.

- 20 sites deemed not viable for stream restoration and have been removed from consideration.

Grass Swale Rehabilitation

Preliminary evaluation identified 28 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- One additional site deemed potentially viable for new structural SW controls and pending further analysis, may be a candidate for future restoration opportunities.

- 27 sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

No outfall stabilization sites were identified within this watershed for potential restoration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified six existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- One site constructed or under contract.

- Two additional sites deemed potentially viable for restoration opportunities and pending further analysis, may be candidates for future restoration opportunities.

- Three retrofit sites deemed not viable for future restoration opportunities and have been removed from consideration.

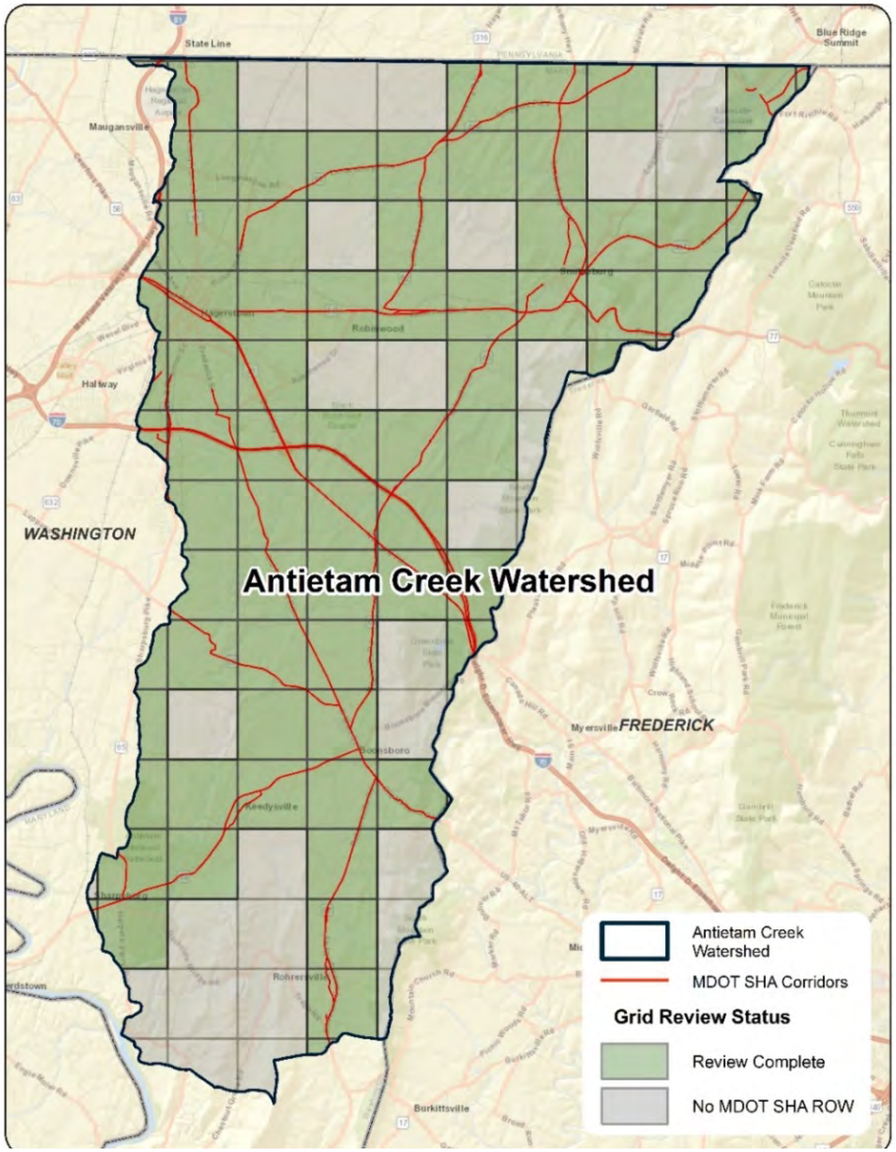


Figure 9: Antietam Creek Site Search Girds

F.4. Summary of County Assessment Review

Waters within the Antietam Creek watershed are subject to the following impairments as noted on MDE's 2018, 303(d) List:

- *Escherichia coli;*
- PCB in Fish Tissue
- Phosphorus (Total);
- Sulfates;
- Temperature, water; and
- TSS.

The 2012 Antietam Creek Watershed Restoration Plan was developed through a partnership (comprised of several organizations including MDE and led by the Washington County Soil Conservation District [WCSCD]) as a comprehensive summary of the issues impacting the watershed area (WCSCD et al., 2012). There are currently completed TMDLs for Antietam Creek for phosphorus, TSS, and E. coli. However, TMDLs are still necessary for PCB in fish tissue, sulfates, and temperature (water).

The watershed has been divided into nine subwatersheds. The Antietam Creek Watershed Restoration Plan classified land use within Washington County as forest (31 percent), crop (28 percent), urban (27 percent), and pasture (14 percent). The majority of the urban land use areas are "urban pervious," which is urban or suburban areas that are not covered with rooftops, roads, or other surfaces that make the land impervious to water. Only five percent of the total land use is categorized as urban impervious. There are two MS4 permits for Hagerstown and Washington County which cover regulated urban sediment load (WSCD et al., 2012, p. 7).

MDOT SHA facilities are located in the Antietam Creek watershed along Antietam Creek, Grove Creek, Little Antietam Creek, and Landis Spring Branch as well as ROW (**Figures 8 & 9**). The Antietam Creek

Watershed Restoration Plan did not indicate water quality problems for restoration associated with MDOT SHA facilities and ROW.

The majority of soils within the Antietam Creek watershed are classified as Hydrologic Group B, which indicates moderately low runoff potential, followed by Hydrologic Group C, which indicates moderately high runoff potential (WSCD et al., 2012, p. 11-12).

Bacteria source tracking was conducted at 9 MBSS stations in the watershed to identify relative contributions of different sources of bacteria. Bacteria sources were evenly distributed and defined as; domestic (pets and human associated animals), human (human waste), livestock (agricultural animals), and wildlife (mammals and waterfowl). Human sources present in Antietam Creek watershed include sewage treatment facilities (12 active municipal and two industrial NPDES permitted point source facilities), discharges from MS4s, failing or nonexistent on-site sewage disposal systems (also called "septic systems"), and storm water runoff from pasture and cropland (WCSCD et al., 2012).

After review and evaluation, it was determined that three of the nine watersheds be targeted for pollutant reduction implementation: Antietam Creek at Marsh Run (ANT0277), Marsh Run (MRS0000), and Beaver Creek (BEC0001) (WSCD et al., 2012, p. 2).

Tree plantings, retrofits, and new efficiency BMP installations have been completed and additional tree plantings are proposed by MDOT SHA on the Antietam Creek and its tributaries (**Figure 10**).

Because a significant portion of the watershed is agricultural land use (42 percent), there are separate BMPs listed for agricultural practices and urban areas. The suggested BMPs for watershed restoration are shown in **Table 12**.

Table 12: Suggested BMPs in the Antietam Creek Watershed

Agricultural BMPs	Urban BMPs
Pet Waste Runoff Campaign*	Bioretention/Rain Gardens*
Septic System Upgrades	Bio-Swale*
Grass Buffers*	Dry Detention Ponds*
Riparian Forest Buffers*	Dry Extended Detention Ponds*
Stream Protection with Fencing*	Forest Conservation (pervious only)*
Stream Protection without Fencing*	Impervious Urban Surface Reduction*
Livestock Stream Crossing	Permeable Pavement
Nutrient Management Planning*	Urban Forest Practices*
Runoff Control Systems*	Urban Filtering Practices*
Cover Crops	Urban Infiltration Practices*
Animals Waste Management	Street Sweeping*
Conservation Tillage	Urban Nutrient Management*
Retire Highly Erodible Lands	Vegetated Open Channel*
Natural Stream Designs/Armored Steam Banks*	Wet Ponds & Wetlands*
** Denotes practices that may be applicable to MDOT SHA's program*	
Source: WCSCD et al. (2012)	

A bacteria source analysis was conducted by MDOT SHA for Antietam Creek watershed to identify specific potential sources. Several WWTPs were identified in the TMDL document (MDE, 2009a) with NPDES permits regulating the discharge of fecal bacteria into the Antietam Creek watershed, as shown in **Table 13**.

Table 13: Antietam Creek Bacteria Source Analysis

Source Name (NPDES Permit Number)
BARC East Side (#MD0020842)
Beltsville USDA West (#MD0020851)
Funkstown WWTP (#MD0020362)
Highland View Academy (#MD0024627)
Brook Lane Psychiatic Center (#MD0053198)
Smithsburg WRF (#MD0024317)
Hagerstown WPCP (MD0021776)
Boonsboro WTF (#MD0020231)
Hunter Hill Apartments WWTP (#MD0022926)
Antietam WRF (#MD0062308)
Winebrenner WRF (#MD0003221)
MD Correctional Institute WWTP (#MD0023957)
Fahrney-Keedy Memorial Home WWTP (#MD0053066)
Greenbrier State Park WWTP (#MD0023868)
Albert Powell Fish Hatchery (#MD0054054)
St. Lawrence Cement Co. (#MD0002151)

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirement for Antietam Creek watershed TMDL pollutant along with the Target Year for achieving the reduction. Antietam Creek is listed for a bacteria TMDL with a baseline year of 2003 MDOT SHA is over programming restoration to treat 115 percent of the required pollutant loads for phosphorus and sediment as an adaptive management strategy. This treatment buffer will allow MDOT SHA to achieve the reduction target even if some planned projects are eliminated prior to construction due to site design limitations or any other situation that may result in removing the project from the plan A treatment buffer was not applied to bacteria because this pollutant is not treated exclusively through stormwater or alternative BMPs. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in section E.3.c.

Proposed practices to meet the bacteria reduction requirement in the Antietam Creek watershed is shown in **Table 14**. The projected bacteria reduction using these practices are 5,387 billion MPN/yr. which is 3.2 percent of the reduction target. These practices are described in **Section E.** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the baseline year. In this case, the bacteria baseline is 2003;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Antietam Creek watershed total $35,337,000. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 15** for a summary of estimated BMP costs.

Figure 10 shows a map of the MDOT SHA watershed restoration strategies throughout the Antietam Creek watershed. The practices shown include those that are under design or construction.

Table 14: Antietam Creek Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2003)	Restoration BMPs			
			2020	2025	Target Year[1]	Restoration Totals
New Stormwater	drainage area acres	2.7	75.9		N/A	75.9
Stormwater Retrofit	drainage area acres		28.8		N/A	28.8
Annual Load Reductions	E. coli billion MPN/day	476.0	5,387.0		N/A	5,387.0

[1] *Refer to Table 2 for Target Year.*

Table 15: Antietam Creek Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater	$2,805,000		$31,381,000	$34,186,000
Stormwater Retrofit	$1,151,000			$1,151,000
			Total Restoration Cost	$35,337,000

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs.*
[2] *Refer to Table 2 for Target Year.*

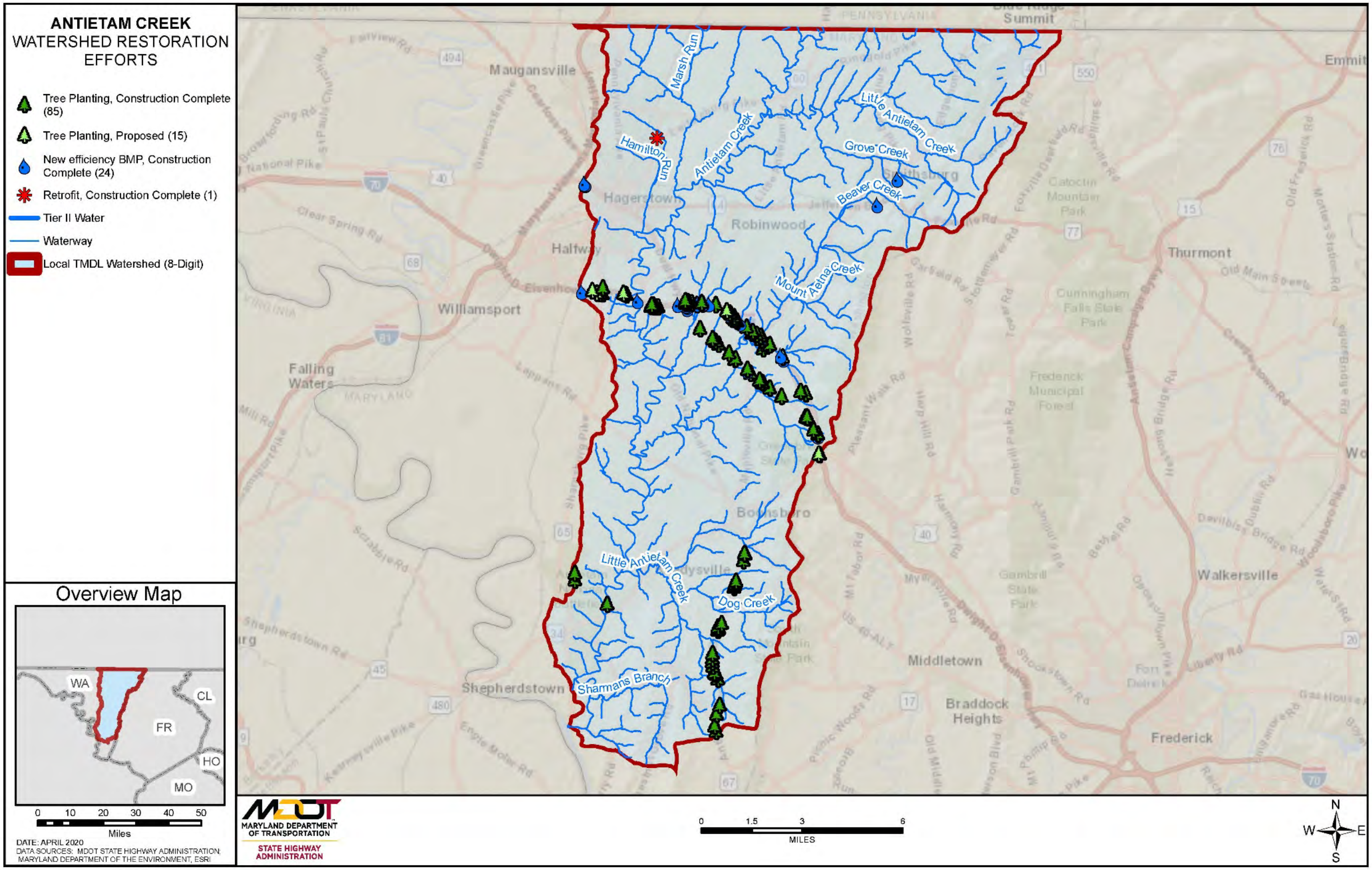


Figure 10: MDOT SHA Restoration Strategies within the Antietam Creek Watershed

F3. BACK RIVER WATERSHED

F.1. Watershed Description

The Back River watershed (MD 8-digit Basin Code: 02130901) encompasses approximately 55 square miles (35,014 acres) in the western shore region of Maryland within the City of Baltimore and Baltimore County. Approximately 0.6 percent of the drainage area is covered by water. The Back River watershed drains into the Back River, which ultimately discharges into the Chesapeake Bay (MDE, 2012b).

The designated uses of the non-tidal portion of the Back River are Use Class I – Water Contact Recreation and Protection of Nontidal Warmwater Aquatic Life and Use Class IV – Recreational Trout Waters. The designated use of the tidal tributaries and the Back River mainstem is Use Class II – Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting (MDE, 2017a).

Waters within the Back River watershed are subject to the following impairments as noted on MDE's 2018, 303(d) List:

- Chlordane;
- Chloride;
- Fecal Coliform;
- Nitrogen, Total;
- PCBs in Fish Tissue;
- Phosphorus, Total;
- Polychlorinated biphenyls (PCBs);
- Sulfate; and
- Total Suspended Solids (TSS).

There are 103 centerline miles of MDOT SHA roadway located within the Back River watershed. The associated ROW encompasses 1,194 acres, of which 524 acres are impervious. MDOT SHA facilities located within the Back River watershed consist of three salt storage facilities, and two highway garage or shop facilities. See **Figure 11** for a map of MDOT SHA facilities within the watershed.

F.2. MDOT SHA TMDLs within Back River Watershed

MDOT SHA is included in the nitrogen (MDE, 2005a), phosphorus (MDE, 2005a), and sediment (MDE, 2017a)TMDLs for the non-tidal portion of the Back River watershed with restoration requirements of 15.0 percent for nitrogen and phosphorus.

MDOT SHA is also included in the *E. coli* bacteria TMDL (MDE; 2007d) for the Herring Run subwatershed of the Back River with a reduction requirement of 92.2 percent.

Reduction requirements for all pollutants are shown in **Table 2**.

While the non-tidal portion of the Back River watershed with nitrogen and phosphorus TMDLs and the Herring Run watershed are located in Baltimore County and Baltimore City, MDOT SHA does not have jurisdiction within city limits and thus has no reduction requirements within Baltimore City. Therefore, Section F.3., Section F.4., and Section F.5. below only pertain to the portion of the non-tidal portion of the Back River watershed for nitrogen and phosphorus and Herring Run watershed in Baltimore County.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Back River watershed is shown in **Figure 12** which illustrates that 31 grid cells have been reviewed, encompassing portions of 16 state route corridors. Potential BMP sites identified as part of the visual inspections follow:

Structural SW Controls

Preliminary evaluation identified 206 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- One site constructed or under contract.
- 193 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 12 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 148 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 68 sites constructed or under contract.
- Nine additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 71 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified eight sites as potential stream restoration locations. Further analysis of these locations resulted in:

- One site constructed or under contract.
- Two additional sites deemed potentially viable for stream restoration and pending further analysis may be candidates for future restoration opportunities.
- Five sites deemed not viable for stream restoration.

Grass Swale Rehabilitation

Preliminary evaluation identified 101 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- 25 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 76 sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

Preliminary evaluation identified 46 outfalls potential for stabilization. Further analysis of these sites resulted in:

- 46 outfall sites deemed not viable for outfall stabilization and have been removed from consideration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified five existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- One site constructed or under contract.
- Four retrofit sites deemed not viable for retrofit and have been removed from consideration.

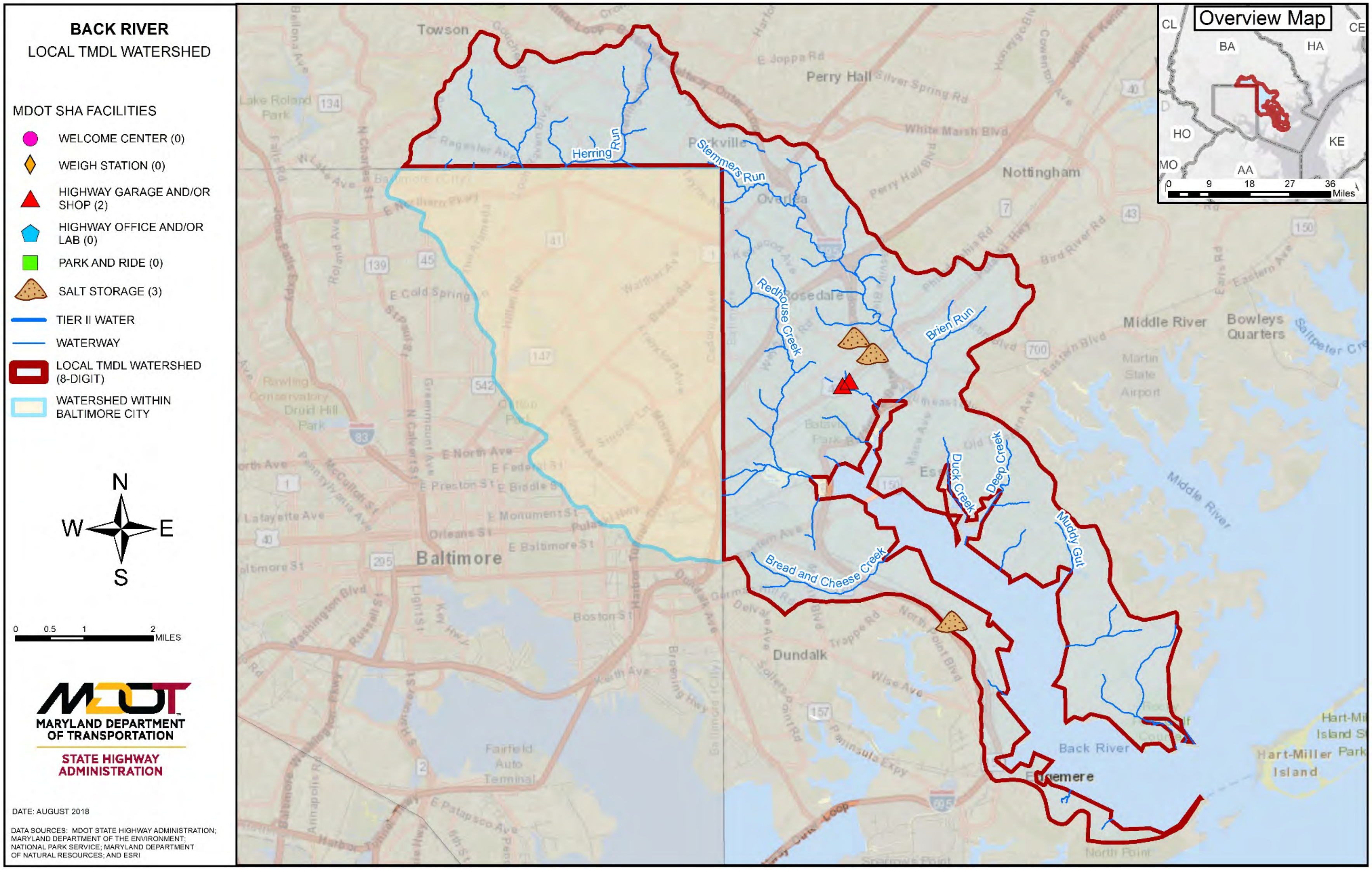


Figure 11: MDOT SHA Facilities within Back River Watershed

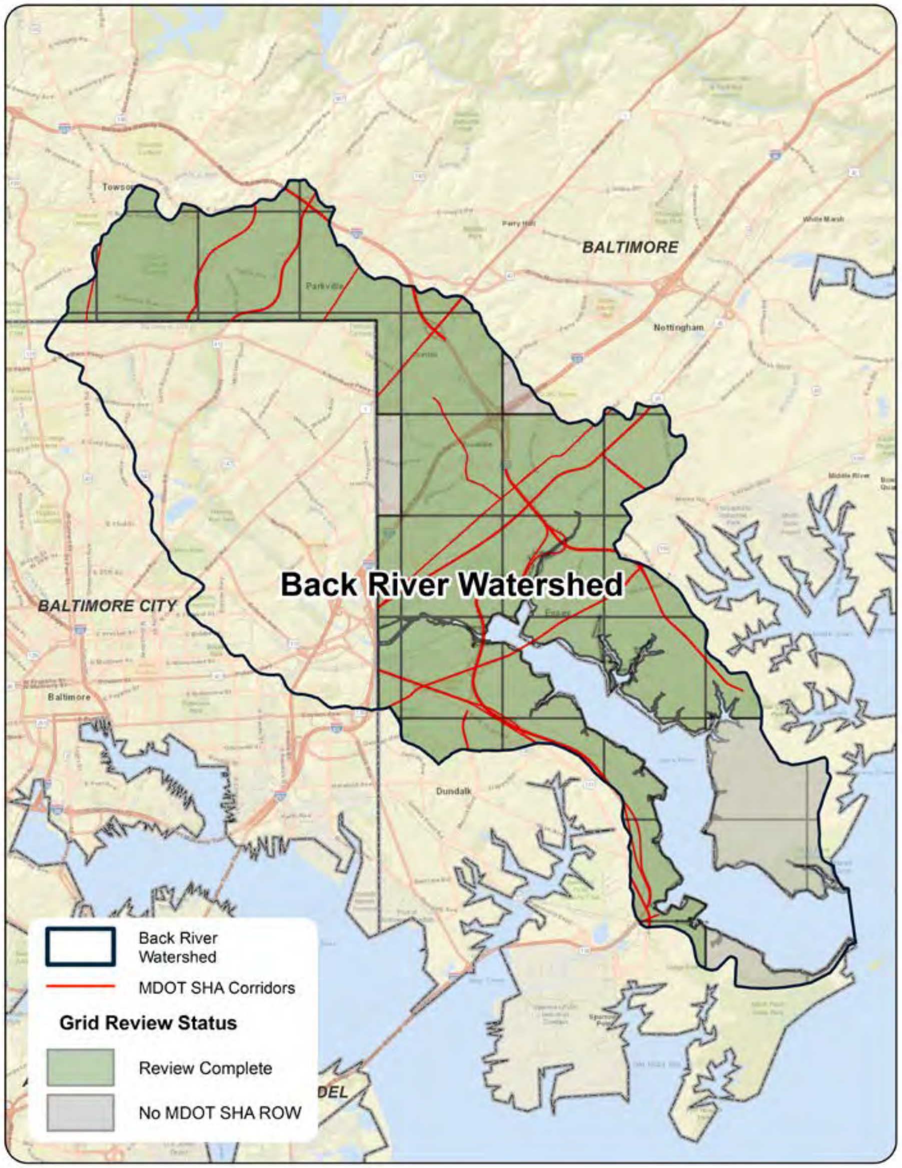


Figure 12: Back River Site Search Grids

F.4. Summary of County Assessment Review

The Back River watershed is comprised of the nontidal Upper Back River (UBR) planning area and the estuarine Tidal Back River (TBR) planning area [Back River Oligohaline (BACOH)]. The Upper Back River Small Watershed Action Plan was prepared by the Baltimore County Department of Environmental Protection and Resource Management (BA-DEPRM) in consultation with the Upper Back River SWAP Steering Committee in November 2008 (BA-DEPRM, 2008a). The Tidal Back River Small Watershed Action Plan was prepared by Parsons Brinckerhoff (PB) on behalf of the BA-DEPRM in February 2010 (PB, 2010a). Three TMDLs have been developed by MDE for addressing water quality impairments within the Back River watershed: nutrients, PCBs, and sediment. Baltimore City is not currently under MDOT SHA MS4 Phase I Permit Coverage; therefore, only Baltimore County's watershed assessments will be summarized in this section.

The UBR watershed is a 43 square mile (27,712 acres) area located in the southeastern region of Baltimore County and northeastern portion of Baltimore City. The UBR planning area includes the higher portion of the Back River watershed and the mouth of Back River. It represents 78 percent of the total Back River watershed and is broken down into 14 subwatersheds. Jurisdictionally, 45 percent of the UBR is in Baltimore City and 56 percent is in the County. Land use within the UBR watershed is as follows: Residential (55.4 percent), Forest (11.5 percent), Commercial (9.9 percent), Institutional (8.0 percent), Industrial (6.5 percent), and Open Urban (6.2 percent). The total impervious cover at the time the UBR SWAP was approximately 31 percent of the watershed (BA-DEPRM, 2008b, p. 1-5 – 1-6).

The TBR watershed consists of approximately 12 square miles (7,680 acres) or 22 percent of the entire Back River watershed and is located entirely in Baltimore County. The TBR planning area comprises the lower portion of the Back River watershed which ultimately discharges to the Chesapeake Bay. It is divided into 10 subwatersheds. The land use within the watershed is as follows: Residential (34.0 percent), Forest (32.1 percent), Other Urban (11.4 percent), Commercial (7.2 percent), Institutional (4.4 percent), Agriculture (4.4 percent), Industrial (3.5 percent), and Water/Wetlands (3.0 percent). The total impervious cover at the time the TBR SWAP was 18.4 percent of the watershed (PB, 2010a, p. 10).

The most common Hydrologic Soil Group in the UBR is Group D (approximately 47 percent); indicating high runoff potential. (BA-DEPRM, 2008a, p. 1-5). The majority (57 percent) of slopes within the UBR watershed are categorized as low-medium (3-8 percent). Overall, the watershed has a fairly even distribution of soil erodibility, with a large proportion of the soils being prone to at least moderate or high soil erodibility (BA-DEPRM, 2008b, p. 2-4 & 2-11).

The most common Hydrologic Soil Group in the TBR is Group C (40.8 percent); indicating moderately high runoff potential (PB, 2010a, p.10). The majority (51 percent) of slopes within the TBR watershed are categorized as gentle, sloping (2-10 percent) followed by 45 percent nearly level (0-3 percent). Overall, the watershed has a fairly even distribution of soil erodibility, with a larger proportion of the soils being prone to at least moderate to high soil erodibility (PB, 2010b, p. 13).
There are five MDOT SHA Facilities located within the Back River watershed in addition to roadway ROW; three salt storage facilities and two highway garages and/or shops. The UBR SWAP and TBR SWAP did not indicate water quality problems for restoration associated with MDOT SHA facilities and ROW.

The SWAPs suggest the following generalized restoration strategies to aid in meeting restoration goals within the Back River watershed. Practices that may be applicable to MDOT SHA have been italicized.

- *SWM for new development and redevelopment;*
- SWM retrofits;
- *Stream restoration;*
- *Street sweeping and storm drain inlet cleaning;*
- Illicit connection detection and disconnection program and hotspot remediation;
- Sanitary sewer consent decrees;
- *Downspout disconnection;*
- *Citizen awareness (fertilizer application and pet waste);*
- Shoreline enhancement projects;
- Urban nutrient management;
- *Pollutant loading and removal analysis; and*
- *Reforestation and tree planting.*

Both SWAPs prioritized their subwatersheds in order to identify which subwatersheds have the greatest need and potential for restoration. A total prioritization score for each subwatershed was based on ranking criteria including, but not limited to; Phosphorus and Nitrogen Loads, Impervious Surfaces, Municipal Street Sweeping and Stormwater Conversions, Stream Buffer Improvement, and Illicit Discharge Data.

For the UBR watershed, the Chinquapin Run, Tiffany Run, Herring Run Mainstem, Armistead Run, Biddison Run, Moore’s Run, and Redhouse Run subwatersheds were rated “very high” and West Branch Herring Run, East Branch Herring Run, and an unnamed tributary were rated “high” in terms of restoration need and potential (BA-DEPRM, 2008b, p. 4-7 – 4-8). The majority of these subwatersheds are located within Baltimore City, therefore, not within MDOT SHA MS4 Phase I Permit Coverage. Within the East Branch Herring Run subwatershed, MDOT SHA has completed several tree plantings (**Figure 13**).

For the TBR watershed, the Deep Creek, Duck Creek, and Bread and Cheese Creek subwatersheds were rated “very high” and Lynch Point Cove, Back River-G, and Muddy Gut were rated “high” in terms of restoration need and potential (PB, 2010a, p. 61). Within the subwatersheds rated “very high” and “high”, MDOT SHA has completed many tree plantings, one retrofit, and one new efficiency BMP (**Figure 13**).

A bacteria source analysis was conducted by MDOT SHA for the Back River watershed to identify specific potential sources and known areas of contamination. One potentially contaminated Bacteria site was identified. See **Table 16** for details.

Table 16: Back River Bacteria Source Analysis

Watershed	Pollutant	Site Name	Source
Back River	Bacteria	Back River WWTP	Final Approved TMDL

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirements for the Back River watershed TMDL pollutants along with the Target Year for achieving the reductions. Back River is listed for nitrogen, phosphorus, and bacteria with each TMDL having a different baseline year; 1995 for nitrogen and phosphorus, and 2003 for bacteria.

MDOT SHA is over programming restoration projects to treat 115 percent of the required pollutant loads for nitrogen, phosphorus, and sediment as an adaptive management strategy. This treatment buffer will allow MDOT SHA to achieve the reduction target even if some planned projects are eliminated prior to construction due to site design limitations or any other situation that may result in removing the project from the plan. The implementation required to treat 115 percent of the sediment reduction target results in over treating for nitrogen and phosphorus (i.e., less BMPs were needed to treat the nitrogen and phosphorus reduction targets than were needed to treat the sediment reduction target). The sediment TMDLs is not shown in this plan as it was submitted to MDE in 2019.

A treatment buffer was not applied to bacteria because this pollutant is not treated exclusively through stormwater or alternative BMPs. The majority of pollutant load reduction for a bacteria TMDL will be treated through source tracking, contaminated site identification and potentially partnering with other jurisdictions where possible to pursue load reduction activities as outlined in sections E.3.c.

Proposed practices to meet nitrogen, phosphorus, and bacteria reductions in the Back River watershed are shown in **Table 17**, and **Table 18**. Projected nitrogen and phosphorus reductions in the Non-Tidal portion of the Back River watershed using these practices are 3,943 lbs./yr. and 588 lbs./yr., which are 301.9 percent and 460.3 percent of the reduction targets, respectively. There are currently no practices planned in the Herring Run subwatershed. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the baseline for nitrogen and phosphorus is 1995, and the baseline for bacteria is 2003;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target year.

Estimated costs to design, construct, and implement BMPs within the Back River watershed total $115,322,500. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 19** for a summary of estimated BMP costs.

Figure 14 shows a map of MDOT SHA watershed restoration strategies throughout the Back River watershed. The practices shown only include those that are under design or constructed.

Table 17: Non-Tidal Back River Restoration Nitrogen and Phosphorus BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 1995)	Restoration BMPs			
			2020	2025	Target Year[3]	Restoration Totals
New Stormwater	drainage area acres	33.3	4.0		2,397.5	2,401.5
Stormwater Retrofit	drainage area acres		12.3			12.3
Grass Swale	drainage area acres	73.3				
Tree Planting	acres of tree planting		43.5			43.5
Stream Restoration	linear feet		770.0			770.0
Inlet Cleaning[1]	dry tons		43.2			43.2
Pipe Cleaning[1]	dry tons		39.9			39.9
Street Sweeping[1]	acres swept		46.9			46.9
Cross-Jurisdictional[2]	drainage area acres	15.7				
Impervious Disconnects	credit acres	5.9				
Annual Load Reductions	TN EOS lbs./yr.	500.0	551.2		3,391.6	3,942.9
	TP EOS lbs./yr.	57.5	150.1		437.6	587.7

[1] *Inlet cleaning, pipe cleaning, and street sweeping are annual practices. They are reflected only once for the year the annual reduction is achieved. Once achieved, this annual reduction will be sustained each year the load reduction is claimed.*
[2] *Cross-jurisdictional BMPs may be a mix of various stormwater control structures.*
[3] *Refer to Table 2 for Target Year.*

Table 18: Herring Run Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2003)	Restoration BMPs			
			2020	2025	Target Year[1]	Restoration Totals
Annual Load Reductions	E.coli billion MPN/yr.	0.0			N/A	0.0

[1] *Refer to Table 2 for Target Year.*

Table 19: Back River Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater	$136,000		$112,588,000	$112,724,000
Stormwater Retrofit	$541,000			$541,000
Tree Planting	$1,467,000			$1,467,000
Stream Restoration	$338,000			$338,000
Inlet Cleaning	$247,000			$247,000
Pipe Cleaning	$500			$500
Street Sweeping	$5,000			$5,000
			Total Restoration Cost	$115,322,500

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs. Costs for operational BMPs (inlet cleaning, pipe cleaning, and street sweeping) are annual costs that are incurred each year to sustain load reductions.*
[2] *Refer to Table 2 for Target Year.*

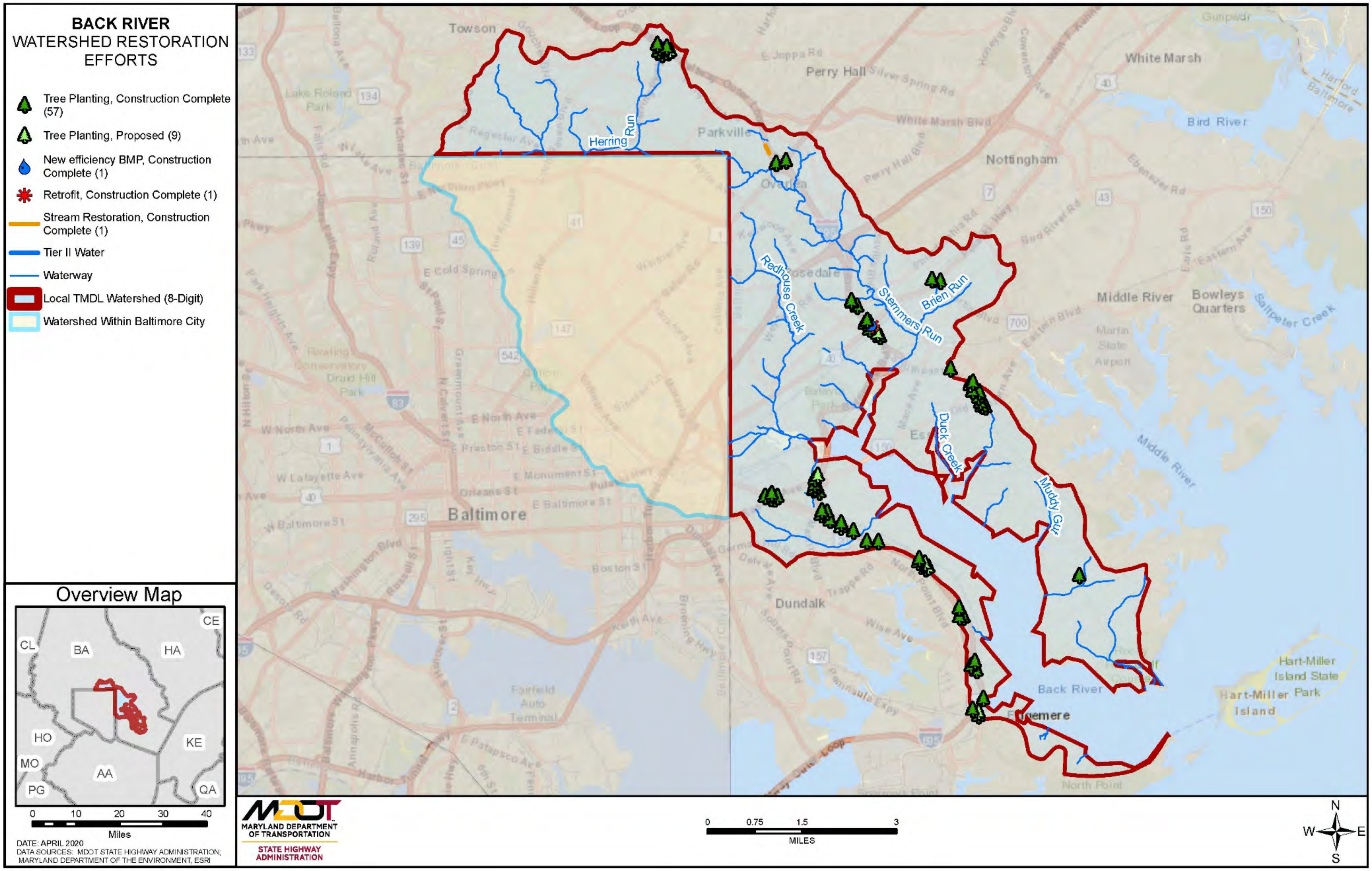


Figure 14: MDOT SHA Restoration Strategies within the Back River Watershed

F4. CABIN JOHN CREEK WATERSHED

F.1. Watershed Description

The Cabin John Creek watershed (MD 8 digit Basin Code: 02140207) encompasses approximately 25 square miles (16,022 acres) solely within the southern portion of Montgomery County, Maryland. Cabin John Creek originates in the City of Rockville and flows south approximately 11 miles to its confluence with the nontidal Potomac River near Cabin John and Glen Echo. Cabin John Creek and all its tributaries are nontidal.

Major tributary creeks and streams of the Cabin John Creek watershed include Bogley Branch, Booze Creek, Buck Branch, Congressional Branch, Ken Branch, Old Farm Branch, Snakeden Branch, and Thomas Branch.

The designated use of the Cabin John Creek watershed is Use I-P – Water Contact Recreation and Protection of Aquatic Life and Public Water Supply (MDE, 2011).

There are 353 miles of MDOT SHA roadway located within the Cabin John Creek watershed. The associated ROW encompasses 863 acres, of which approximately 485 acres are impervious. There are no MDOT SHA facilities located within the Cabin John Creek watershed. See **Figure 15** for a map of the watershed.

F.2. MDOT SHA TMDLs within Cabin John Creek Watershed

Waters within the Cabin John Creek watershed are subject to the following impairments as noted on MDE's 2018, 303(d) List:

- *Escherichia coli*;
- Chlorides;
- Sulfates; and
- TSS.

MDOT SHA is included in the sediment (TSS) (MDE, 2011d) and *E. coli* bacteria (MDE, 2006c) TMDLs. This implementation plan focuses on the bacteria TMDL which is to be reduced by 30.6 percent as shown in **Table 2**.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Cabin John Creek watershed is shown in **Figure 16** which illustrates that 21 grid cells have been reviewed, encompassing portions of 12 state route corridors. Potential BMP sites identified as part of the visual inspections follow:

Structural SW Controls

Preliminary evaluation identified 57 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- 49 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.

- Eight sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 24 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 10 sites constructed or under contract.
- Two additional sites deemed potentially viable for tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 12 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified six sites as potential stream restoration locations. Further analysis of these locations resulted in:

- Three additional sites deemed potentially viable for stream restoration and pending further analysis may be candidates for future restoration opportunities.
- Three sites deemed not viable for stream restoration and have been removed from consideration.

Grass Swale Rehabilitation

No grass swale rehabilitation sites were identified within this watershed for potential restoration.

Outfall Stabilization

Preliminary evaluation identified two outfalls as potential for stabilization. Further analysis of these sites resulted in:

- Two sites constructed or under contract

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified nine existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- Two sites constructed or under contract.
- Seven retrofit sites deemed not viable for retrofit and have been removed from consideration.

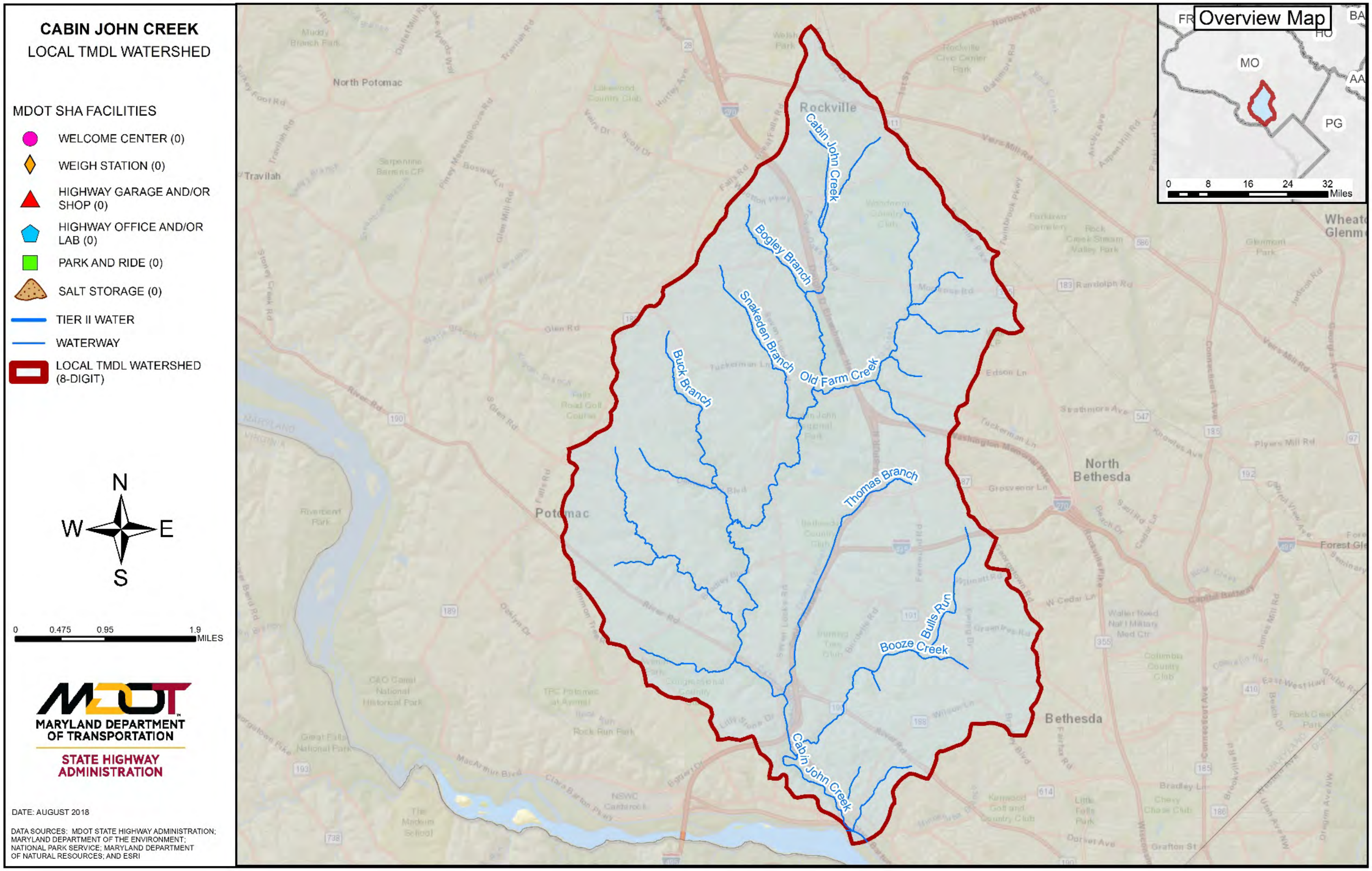


Figure 15: Cabin John Creek Watershed

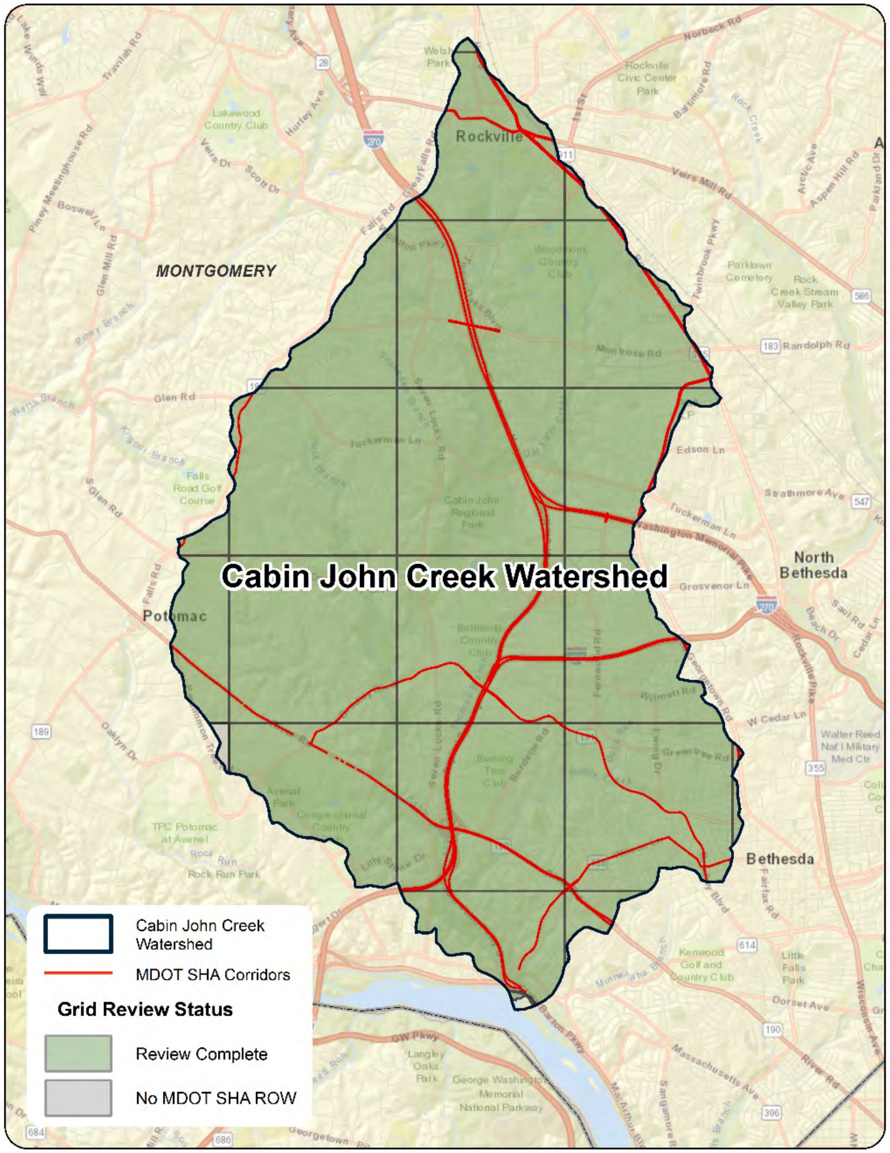


Figure 16: Cabin John Creek Site Search Grids

F.4. Summary of County Assessment Review

The Cabin John Creek Implementation Plan was prepared for the Montgomery County Department of Environmental Protection in January 2012 (Versar et al., 2012a). The implementation plan provides a comprehensive approach for watershed restoration targeting bacteria reduction, sediment and nutrient reduction, runoff management, and trash management. The Cabin John Creek watershed currently has completed TMDLs for sediment and fecal bacteria.

The County MS4 Permit area comprises 74 percent (11,880 acres) of the total watershed area, which includes approximately 20 percent (2,422) impervious cover. The Plan focuses the restoration efforts within the MS4 Permit area. An estimated 33.5 percent reduction compared to baseline conditions is projected based on full implementation of BMPs identified in this Plan. BMPs implemented by the county proposed within Cabin John Creek watershed are estimated to result in 41.9 percent load reductions for total nitrogen, 41.7 percent for total phosphorus, and 29.5 percent for TSS (Versar et al., 2012a, p 3-4). For Bacteria (E.coli), the target county MS4 load is approximately a 30.7 percent reduction from the 2006 baseline load (Versar et al., 2012a, p 12).

Within the MS4 Permit area, the Cabin John Creek watershed comprises primarily residential land use, covering approximately 69 percent of the watershed. The remaining land use is categorized as municipal/institutional (13 percent), roadways (7 percent), forest (5 percent), commercial and industrial facilities (5 percent), and the remaining 1 percent includes rural, open water, and bare ground (Versar et al., 2012a, p 8). Of the 20 percent impervious cover: approximately 35 percent are roads, 16 percent are parking lots, 46 percent are roofs, 2 percent are sidewalks, and the remaining 1 percent are schools (Versar et al., 2012a, p 13). No MDOT SHA Facilities are located within the Cabin John Creek Watershed, only roadway ROW (**Figure 16** and **Figure 17**). The Cabin John Creek Implementation Plan did not indicate water quality problems for restoration associated with SHA ROW.

The majority of the stream resource conditions in Cabin John Creek were assessed as “Fair” (82.5 percent) (Cabin John Creek, Buck Branch, Bogley Branch, Old Farm Creek), the remaining 17.5 percent were assessed as “Poor” (Thomas Branch, Bills Run, Boole Creek). Zero stream miles were assessed as “Good” or “Excellent” (Versar et al., 2012a, p 19). MDOT SHA has completed tree plantings along Thomas Branch, as well as two outfall stabilization projects and two retrofits near Cabin John Creek and Bodley Branch (**Figure 17**).

A bacteria source analysis was conducted by MDOT SHA for the Cabin John Creek watershed to identify specific potential sources. No point sources were identified.

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirement for the Cabin John Creek watershed TMDL pollutant along with the Target Year for achieving the reduction. Cabin John Creek is listed for bacteria with a baseline year; of 2003 for bacteria. A treatment buffer was not applied to bacteria because this pollutant is not treated exclusively through stormwater or alternative BMPs. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in **Section E.3.c.**.

Proposed practices to meet the bacteria reduction in the Cabin John Creek watershed are shown in **Table 20**. The projected bacteria reduction using these practices are 512 billion MPN/day which is 1.8 percent of the reduction target. These practices are described in **Section E** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the bacteria baseline is 2003;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Cabin John Creek watershed total $ 432,000. They are based on an average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 21** for a summary of estimated BMP costs.

Figure 17 shows a map of MDOT SHA watershed restoration strategies throughout the Cabin John Creek watershed. The practices shown only include those that are under design or constructed.

Table 20: Cabin John Creek Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2003)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	74.0			N/A	
Stormwater Retrofit	drainage area acres		14.1		N/A	14.1
Cross-Jurisdictional[1]	drainage area acres	1.6			N/A	
Annual Load Reductions	E.coli billion MPN/day	8,440.2	512.0		N/A	512.0

[1] Cross-jurisdictional BMPs may be a mix of various stormwater control structures.
[2] Refer to Table 2 for Target Year.

Table 21: Cabin John Creek Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
Stormwater Retrofit	$432,000			$432,000
			Total Restoration Cost	$432,000

[1] Costs do not include maintenance, inspection, or remediation for built BMPs.
[2] Refer to Table 2 for Target Year.

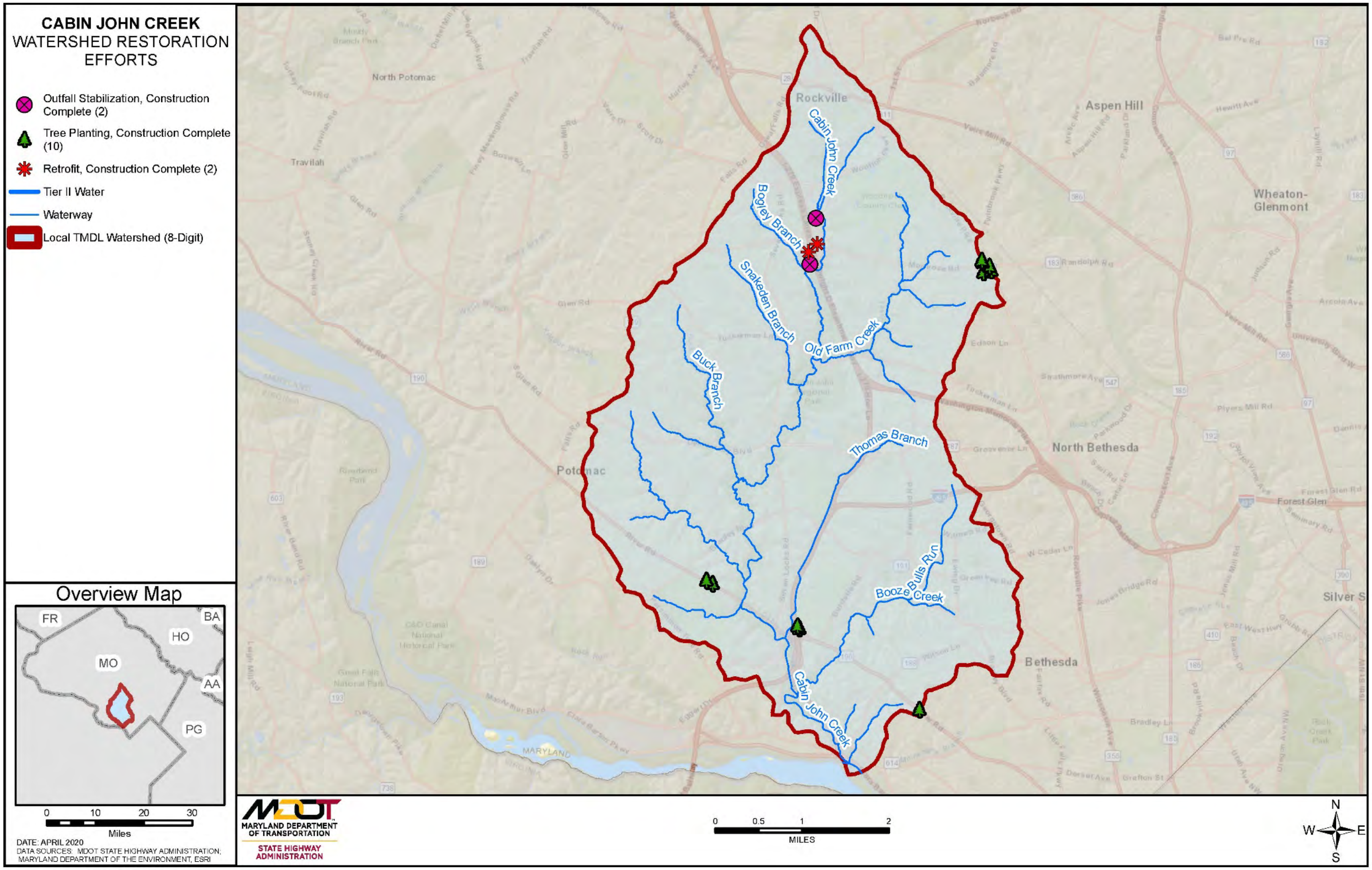


Figure 17: MDOT SHA Restoration Strategies within the Cabin John Creek Watershed

F5. CONOCOCHEAGUE CREEK WATERSHED

F.1. Watershed Description

The Conococheague Creek watershed encompasses 65 square miles within Washington County, Maryland. The entire watershed is approximately 566 square miles, most of which is located in Pennsylvania. Conococheague Creek flows 80 miles south from its headwaters in Pennsylvania to the Potomac River near Williamsport, Maryland. Tributary creeks and streams of the Conococheague Creek watershed, within Maryland, include Meadow Brook, Rockdale Run, Rush Run, Semple Run, and Toms Run.

There are approximately 286 centerline miles of MDOT SHA roadway located within the Conococheague Creek watershed. The associated ROW encompasses 1,428 acres, of which approximately 490 acres are impervious. MDOT SHA facilities located within the watershed consist of one park and ride facility and one salt storage facility. See **Figure 18** for a map of the watershed and these facilities.

F.2. MDOT SHA TMDLs within Conococheague Creek

MDOT SHA is included in the sediment (TSS) (MDE, 2008c) and E. coli bacteria (MDE, 2009e) TMDLs. This implementation plan focuses on the bacteria TMDL which is to be reduced by 99.0 percent as shown in **Table 2**.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Conococheague watershed is shown in **Figure 19** which illustrates that 37 grid cells have been reviewed, encompassing portions of 13 state route corridors. Potential BMP sites identified as part of the visual inspections follow:

Structural SW Controls

Preliminary evaluation identified 508 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- 25 sites constructed or under contract.
- 267 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 216 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 209 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 26 sites constructed or under contract.
- 58 additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 125 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified 17 sites as potential stream restoration locations. Further analysis of these locations resulted in:

- 17 sites deemed not viable for stream restoration and have been removed from consideration.

Grass Swale Rehabilitation

Preliminary evaluation identified 88 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- 12 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 76 sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

No outfall stabilization sites were identified within this watershed for potential restoration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified four existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- Two sites constructed or under contract
- Two retrofit sites deemed not viable for retrofit and have been removed from consideration.

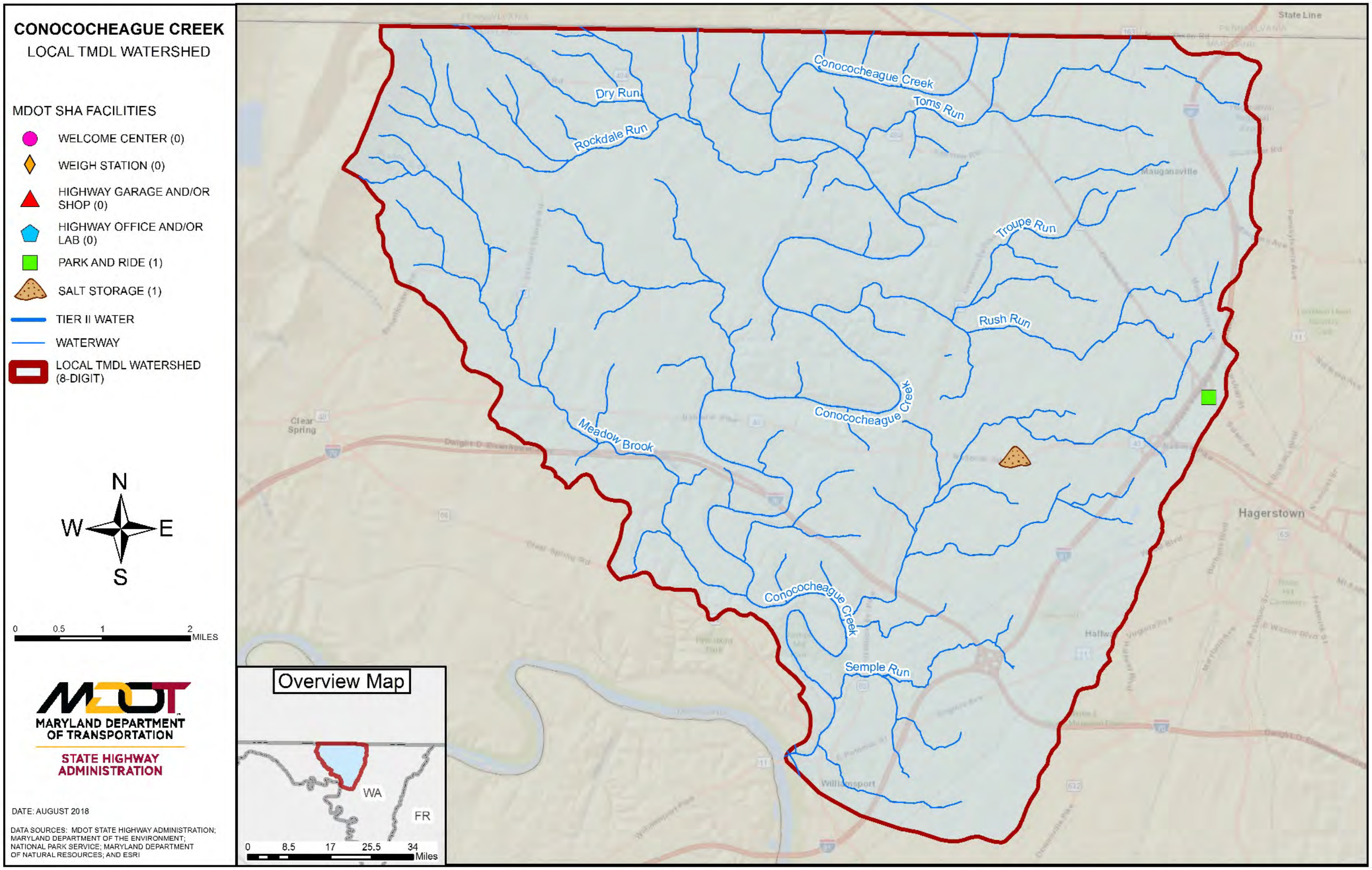


Figure 18: MDOT SHA Facilities within Conococheague Creek Watershed

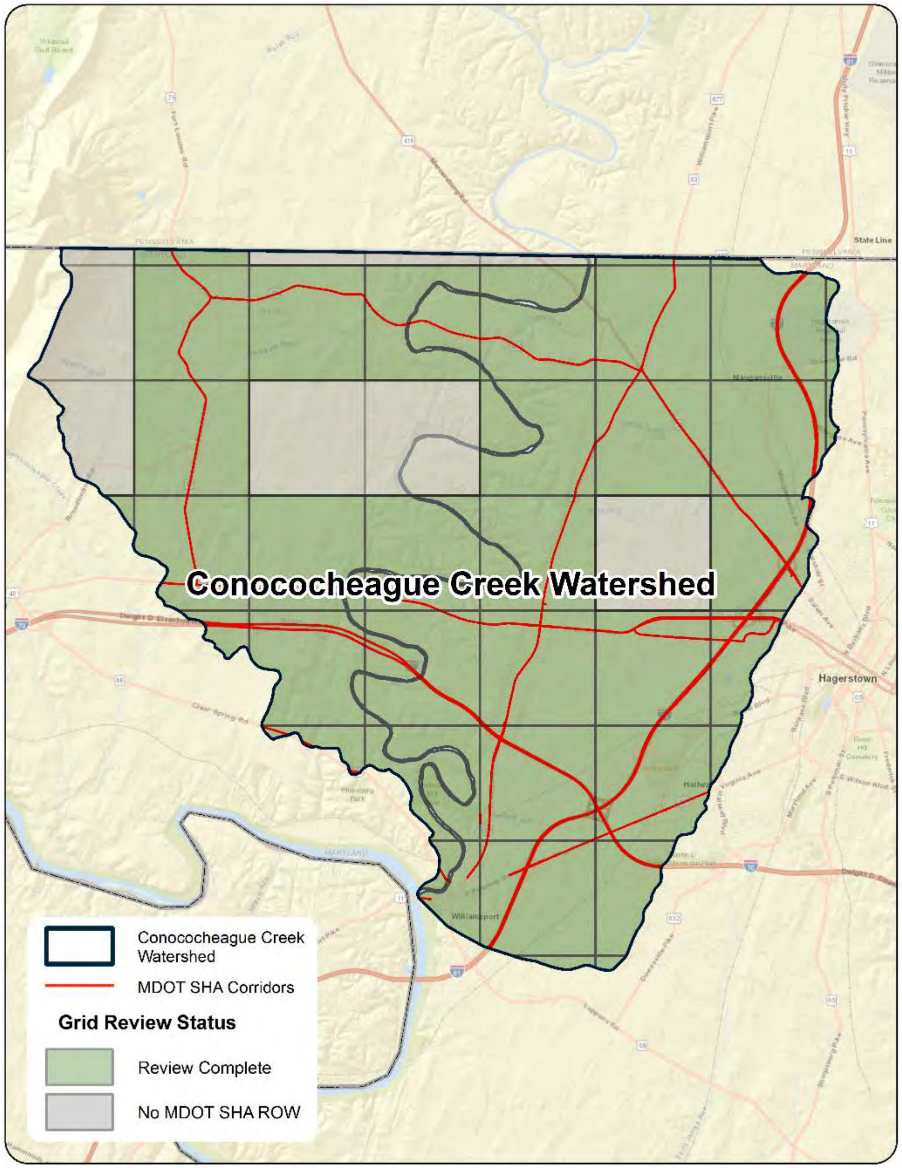


Figure 19: Conococheague Creek Site Search Grids

F.4. Summary of County Assessment Review

Waters within the Conococheague Creek watershed are subject to the following impairments as noted on MDE's 2018, 303(d) List:

- Chlorides;
- *Escherichia coli;*
- Mercury in Fish Tissue;
- PCB in Fish Tissue;
- pH, High;
- Phosphorus (Total);
- Sulfates; and
- TSS.

According to the 2014 Washington County NPDES MS4 Annual Report (WA-DPW, 2014), a restoration plan for the Conococheague Creek watershed was expected to be completed in 2015. Washington County NPDES reports have been published for subsequent years up to 2019; however, the Conococheague Creek watershed restoration plan has not been published online as of 2019.

MDOT SHA has completed many new efficiency BMPs around the intersection of US Route 40 and Interstate 81 outside of Hagerstown as well as numerous tree plantings along Interstate 70 and throughout the Conococheague Creek watershed. Additionally, MDOT SHA has completed construction of two retrofits. Locations of MDOT SHA Restoration Strategies are found in **Figure 20**.

A bacteria source analysis was conducted by MDOT SHA for the Conococheague Creek watershed to identify specific potential sources. One WWTP was identified in MDE's Maryland Point Source Discharges database (MDE, 2009e) with an active NPDES permit regulating the discharge of fecal bacteria into the Conococheague Creek watershed, Conococheague WWTP in Williamsport.

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirements for Conococheague Creek watershed TMDL pollutant along with the Target Year for achieving the reduction. Conococheague Creek is listed for bacteria with a different baseline year 2004 for bacteria. A treatment buffer was not applied to bacteria because this pollutant is not treated exclusively through stormwater or alternative BMPs. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in section E.3.c.

Proposed practices to meet the bacteria reduction in the Conococheague Creek watershed is shown in **Table 22**. The projected bacteria reduction using these practices is 830 billion MPN/yr. which is 0.8 percent of the reduction target. These practices are described in **Section E** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the bacteria baseline is 2004;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct and implement BMPs within the Conococheague Creek watershed total $1,680,000. They are based average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 23** for a summary of estimated BMP costs.

Figure 20 shows a map of MDOT SHA watershed restoration strategies in the Conococheague watershed. The practices shown only include those that are under design or constructed.

Table 22: Conococheague Creek Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2004)	Restoration BMPs			
			2020	2025	Target Year[1]	Restoration Totals
New Stormwater	drainage area acres	20.3	22.3		N/A	22.3
Stormwater Retrofit	drainage area acres		12.7		N/A	12.7
Annual Load Reductions	E.coli billion MPN/yr.	2,258.0	830.0		N/A	830.0

[1] *Refer to Table 2 for Target Year.*

Table 23: Conococheague Creek Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater	$1,140,000			$1,140,000
Stormwater Retrofit	$540,000			$540,000
			Total Restoration Cost	$1,680,000

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs.*
[2] *Refer to Table 2 for Target Year.*

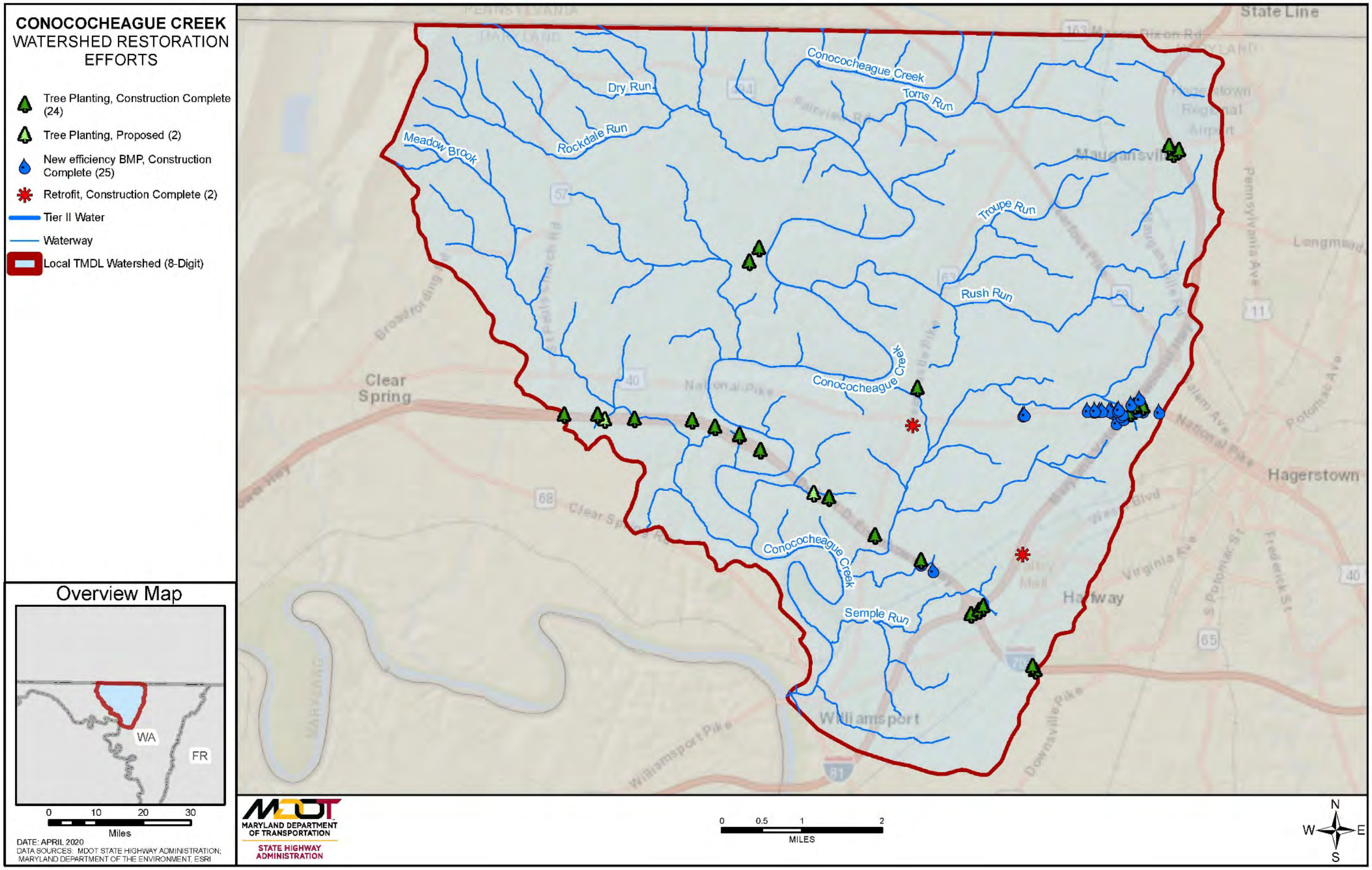


Figure 20: MDOT SHA Restoration Strategies within the Conococheague Creek Watershed

F6. DOUBLE PIPE CREEK WATERSHED

F.1. Watershed Description

The Double Pipe Creek watershed encompasses 193 square miles spanning Carroll and Frederick Counties, and is composed of Big Pipe Creek, which makes up 58 percent of the watershed, and Little Pipe Creek, which makes up the remaining 42 percent. The portion of the watershed within Carroll County is approximately 86 percent of the watershed, with 14 percent within Frederick County. This watershed drains into the Monocacy River, which is a State-designated Scenic River. The headwaters of Double Pipe Creek originate in Westminster and Manchester, and flows west toward Rocky Ridge, into the Monocacy River and ultimately into the Middle Potomac River near the town of Dickerson. Tributary creeks and streams of the Double Pipe Creek watershed include Bear Branch, Big Pipe Creek, Cherry Branch, Deep Run, Dickenson Run, Little Pipe Creek, Meadow Branch, Prisetland Branch, Sams Creek, Silver Run, Turkeyfoot Run, and Wolf Pit Creek.

There are approximately 45 centerline miles of MDOT SHA roadway located within the Double Pipe Creek watershed. The associated ROW encompasses 1,107 acres, of which approximately 420 acres are impervious. MDOT SHA facilities located within the Double Pipe Creek watershed consist of one park and ride facility and one salt storage facility. See **Figure 21** for a map of the watershed and these facilities.

F.2. MDOT SHA TMDLs within Double Pipe Creek

Waters within the Double Pipe Creek watershed are subject to the following impairments as noted on MDE's 2018, 303(d) List:

- *Escherichia coli;*
- Phosphorus (Total); and
- TSS.

MDOT SHA is included in the phosphorus TMDL (MDE, 2013c), sediment (TSS) TMDL (MDE, 2009c), and E.coli bacteria TMDL (MDE, 2009f). This implementation plan focuses on the bacteria TMDL which is to be reduced by 98.5 percent as shown in **Table 2**.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. For each BMP type, implementation teams have performed preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Double Pipe Creek watershed is shown in **Figure 22** which illustrates that 84 grid cells have been reviewed, encompassing portions of 16 state route corridors. Potential BMP sites identified as part of the visual inspections follow:

Structural SW Controls

Preliminary evaluation identified 431 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- One site constructed or under contract.
- 302 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 128 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 232 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 66 sites constructed or under contract.
- 40 additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 126 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified 11 sites as potential stream restoration locations. Further analysis of these locations resulted in:

- One site constructed or under contract.
- Two additional sites deemed potentially viable for stream restoration and pending further analysis, may be candidates for future restoration opportunities
- Eight sites deemed not viable for stream restoration and have been removed from consideration.

Grass Swale Rehabilitation

Preliminary evaluation identified 14 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- 12 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- Two sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

No outfall stabilization sites were identified within this watershed for potential restoration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified three existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- One retrofit site deemed potentially viable for retrofit and pending further analysis may be a candidate for future restoration opportunities.
- Two retrofit sites deemed not viable for retrofit and have been removed from consideration.

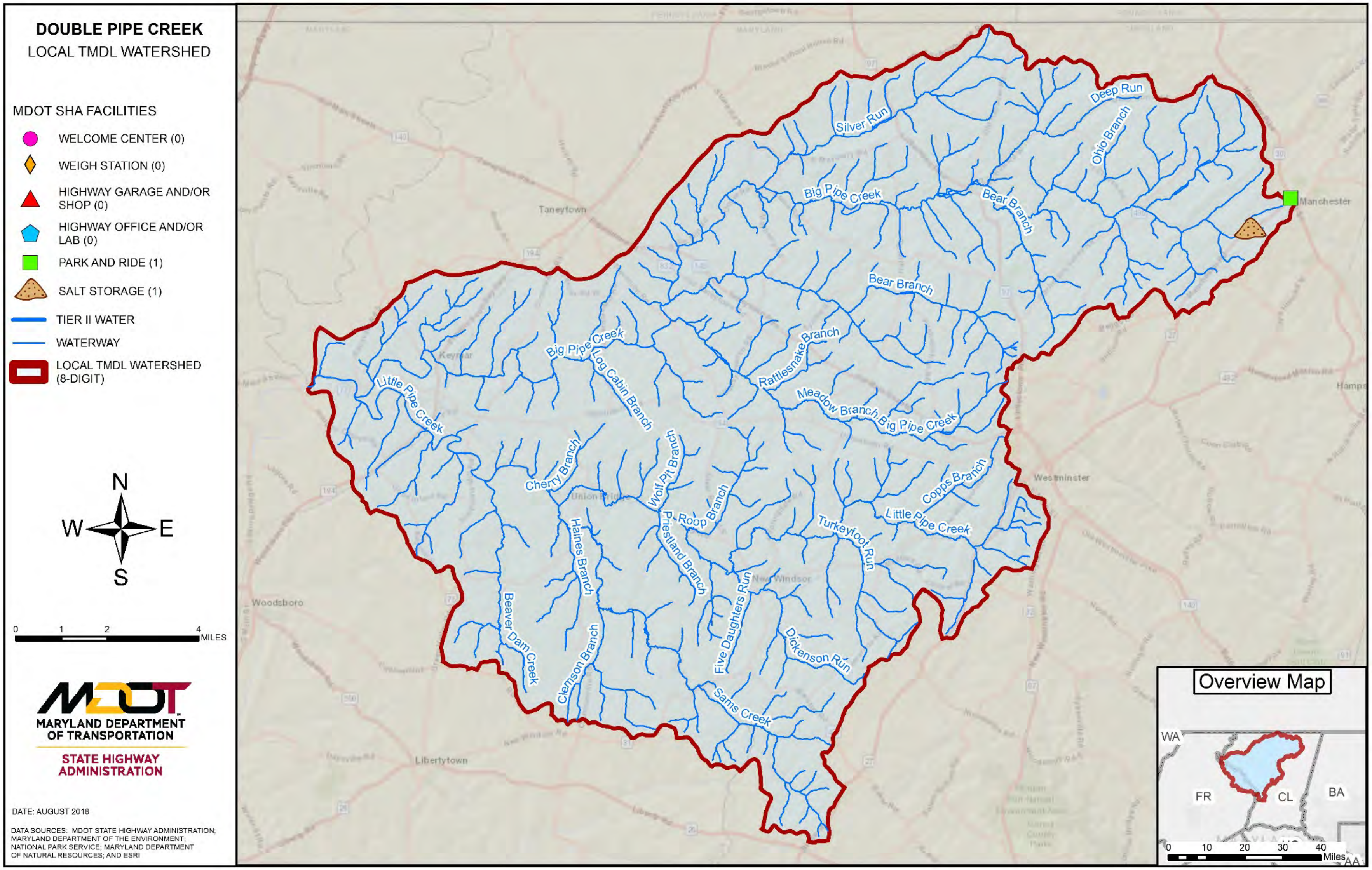


Figure 21: MDOT SHA Facilities within Double Pipe Creek Watershed

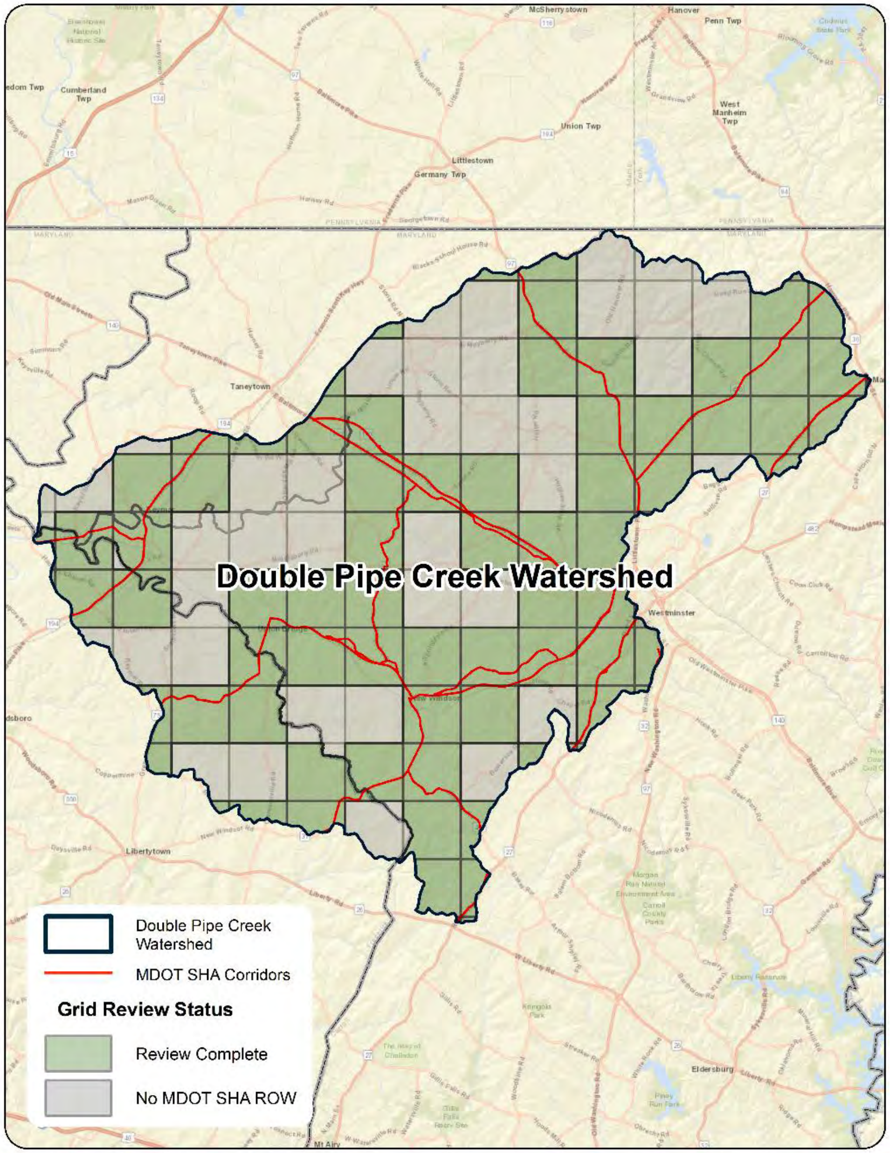


Figure 22: Double Pipe Creek Site Search Grids

F.4. Summary of County Assessment Review

In the fall of 2019, the Double Pipe Creek Watershed Characterization Plan (CCBRM, 2019) was prepared by the Carroll County Bureau of Resource Management to characterize watershed conditions, serve as a tool in efforts to restore and protect water quality, and inform and direct the county's future watershed implementation plan.

The Double Pipe Creek watershed spans both Carroll and Frederick counties. It is located in the Piedmont physiographic province of Maryland and lies across the northwestern portion of Carroll County and the eastern portion of Frederick County, consisting of 21 major subwatersheds in Carroll County (CCBRM, 2019, p. 1) and nine subwatersheds in Frederick County (AKRF, Inc., 2019, p. 6).

The total watershed area within Carroll County is 105,457 acres. The dominant land use within this area as recorded in 2016 is agriculture (31.4 percent pasture/hay, 32.2 percent cropland), followed by forest (24.4 percent) and residential (6.9 percent). Impervious land cover comprises 3.7 percent of the watershed area. The Little Pipe Creek (0276) subwatershed has the highest percentage of total impervious area for the entire watershed (10.6 percent), as this subwatershed contains a large portion of the City of Westminster. The most common Hydrologic Soil Group is Group B (approximately 60 percent), indicating moderate infiltration and moderate runoff potential. Most of the remaining watershed (39 percent of the total area) is made up of Group C and Group D soils, which have a higher potential for runoff. Current impairments within the watershed are bacteria, phosphorus, and sediment (CCBRM, 2019, p. 3, 9-10, 25-26, 32-33, 51).

A SCA was completed in 2016 for the Carroll County portion of the watershed to identify priority locations for restoration. Within the watershed, 170 of 514 stream miles were assessed. Impairments identified include but are not limited to erosion sites, inadequate streamside buffers, and fish barriers. Subwatershed Little Pipe Creek (0276) exhibited the greatest number of impairments with 115 total impacts, followed by Meadow Branch (0277) with 88 total impacts, Sams Creek (0268) with 56 total impacts, and Bear Branch (0281) with 46 total impacts (CCBRM, 2019, p. 72, 75). MDOT SHA has roadway ROW (**Figure 22**) in all of these subwatersheds. MDOT SHA has completed tree planting within the Meadow Branch subwatershed and the Little Pipe Creek subwatershed, as shown in **Figure 23**.

In February 2019 (revised May 2019) the Double Pipe Creek Watershed Assessment (AKRF, Inc., 2019) was prepared for the Frederick County Office of Sustainability & Environmental Resources by AKRF, Inc. to assist the county in its water quality restoration efforts. The total area of the Double Pipe Creek watershed within Frederick County is 18,000 acres, containing approximately 64 miles of stream. The dominant land use within this area is agriculture (76 percent), followed by forest (12 percent) and low density residential (5 percent). Impervious land cover comprises five percent of the watershed area. The watershed currently has TMDLs for phosphorus, sediment, and bacteria (AKRF, Inc., 2019, p.4-5, 10, 15, 38).

A desktop site assessment was completed by AKRF, Inc. to identify opportunities for stream restoration and stormwater BMPs. Each stream restoration opportunity site was then ranked based on 20 criteria grouped within four broad sub-categories: Nutrient and Impervious Acre Credits, Costs, Construction, and Community and Watershed Impacts. Stormwater BMP opportunity sites were ranked based on 21 criteria grouped into the same four sub-categories. Following the desktop review, field investigations were conducted for the highest priority sites. 47,751 linear feet of stream and four potential BMP opportunity sites were investigated (AKRF, Inc., 2019, p. 16-21).

According to the county assessment, opportunities for stormwater BMPs are limited due to the rural nature of the watershed area within Frederick County. Only two county-owned facilities and one non-county owned facility were identified. MDOT SHA does not have any facilities located within this portion of the watershed. The highest ranked priority sites were identified as three stream restoration sites located along Beaver Dam Road, Nicholson Road, and Clemsonville Road. MDOT SHA has roadway Right of Way adjacent to two of the three priority sites (LIPI-2018-STRE-0001 and LIPI-2018-STRE-0002) and within the vicinity of the third (LIPI-2018-STRE-0003), as shown in Figure 4-29 (AKRF, Inc., 2019, p. 18, 22, 34).

MDOT SHA reviewed the County Assessment plan but did not find any specific information to MDOT SHA ROW or facilities. A bacteria source analysis was conducted by MDOT SHA for the Double Pipe Creek watershed to identify specific potential sources. Six WWTPs were identified in TMDL document (MDE, 2009f) with active NPDES permits regulating the discharge of fecal bacteria into the Double Pipe Creek watershed, see **Table 24** below for details.

Table 24: Bacteria Source Analysis

Watershed	Pollutant	Site Name (NPDES Permit No.)	Source
Double Pipe Creek	Bacteria	Westminster WWTP (#MD0021831)	Final Approved TMDL
Double Pipe Creek	Bacteria	New Windsor WWTP (#MD0022586)	Final Approved TMDL
Double Pipe Creek	Bacteria	Union Bridge WWTP (#MD0022454)	Final Approved TMDL
Double Pipe Creek	Bacteria	Silver Oak Academy (#MD0067571)	Final Approved TMDL
Double Pipe Creek	Bacteria	Runnymede WWTP (#MD0065927)	Final Approved TMDL
Double Pipe Creek	Bacteria	Pleasant Valley WWTP (#MD0066745)	Final Approved TMDL

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirement for the Double Pipe Creek watershed TMDL pollutant along with the Target Year for achieving the reduction. Double Pipe Creek is listed for bacteria with a baseline year of 2004. A treatment buffer was not applied to bacteria because this pollutant is not treated exclusively through stormwater or alternative BMPs. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in **Section E.3.c.**

There are currently no BMPs planned in the Double Pipe Creek watershed for bacteria. These practices are described in **Section E** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the baseline for the baseline for bacteria is 2004;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Double Pipe Creek watershed total $ 0.00. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 26** for a summary of estimated BMP costs.

Figure 23 shows a map of MDOT SHA watershed restoration strategies throughout the Double Pipe Creek watershed. The practices shown only include those that are under design or construction.

Table 25: Double Pipe Creek Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2004)	Restoration BMPs			
			2020	2025	Target Year[1]	Restoration Totals
New Stormwater	drainage area acres	0.8			N/A	
Annual Load Reductions	E.coli billion MPN/yr.	3.5			N/A	0.0

[1] *Refer to Table 2 for Target Year.*

Table 26: Double Pipe Creek Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater				$0.00
			Total Restoration Cost	$0.00

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs.*
[2] *Refer to Table 2 for Target Year.*

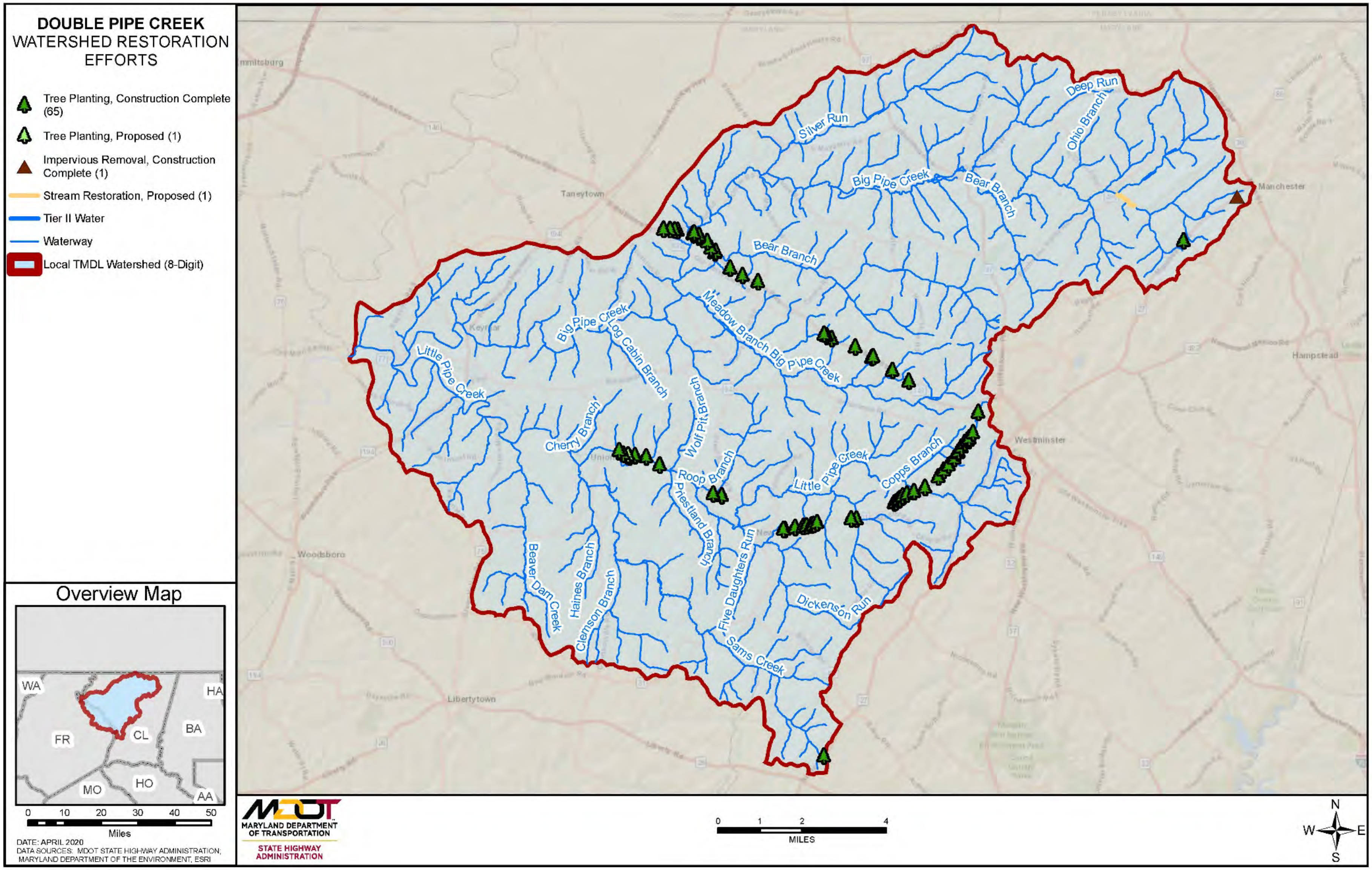


Figure 23: MDOT SHA Restoration Strategies within the Double Pipe Creek Watershed

F7. GWYNNS FALLS WATERSHED

F.1. Watershed Description

The Gwynns Falls watershed (MD 8-digit Basin Code: 02130905) encompasses approximately 65 square miles (41,600 acres) within Baltimore County and the City of Baltimore. The Gwynns Falls flows from Baltimore County for 25 miles in a southeasterly direction to City of Baltimore where it empties into the Patapsco River, which runs into the Chesapeake Bay.

Gwynns Falls mainstem and tributaries above Reisterstown Road have been designated as Use III – Nontidal Cold Water; Dead Run and tributaries have been designated as Use IV – Recreational Trout Waters; and all remaining waters have been designated as Use I – Water Contact Recreation, and Protection of Nontidal Warmwater Aquatic Life (MDE, 2015c).

On the 2018 MDE 303(d) List the following impairments were listed for the waters within the Gwynns Falls watershed:

- Chloride;
- Fecal Coliform;
- PCBs in Fish Tissue;
- Temperature; and,
- TSS.

There are approximately 1,056 centermiles of MDOT SHA roadway located within the Gwynns Falls watershed. The associated ROW encompasses 1,516 acres, of which approximately 893 acres are impervious. MDOT SHA facilities located within the Gwynns Falls watershed consist of one park and ride facility, one highway garage or shop facility and two salt storage facilities. See **Figure 24** for a map of the watershed and these facilities.

F.2. MDOT SHA TMDLs within Gwynns Falls Watershed

MDOT SHA is included in the sediment (TSS) TMDL (MDE, 2010b), Middle Branch and Northwest Branch Patapsco TMDL for Trash (MDE, 2015c), and *E.coli* bacteria TMDL (MDE, 2006d) for a subwatershed of the Gwynns Falls. This implementation plan focuses on the bacteria TMDL which is to be reduced by 99.3 percent as shown in **Table 2**.

While the Gwynns Falls watershed is located in Baltimore County and Baltimore City, MDOT SHA does not have jurisdiction within city limits and thus has no reduction requirements within Baltimore City. Therefore, Section F.3., Section F.4., and Section F.5. below only pertain to the portion of the Gwynns Falls watershed in Baltimore County.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Gwynns Falls watershed is shown in **Figure 25** which illustrates that 34 grid cells have been reviewed, encompassing portions of 13 state route corridors. Potential BMP sites identified as part of the visual inspections follow:

Structural SW Controls

Preliminary evaluation identified 178 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- 164 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.

- 14 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 110 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 63 sites constructed or under contract.

- 13 additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 34 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified five sites as potential stream restoration locations. Further analysis of these locations resulted in:

- Five sites deemed not viable for stream restoration and have been removed from consideration.

Grass Swale Rehabilitation

Preliminary evaluation identified 57 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- Two additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.

- 55 sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

Preliminary evaluation identified 14 outfalls potential for stabilization. Further analysis of these sites resulted in:

- 14 outfall sites deemed not viable for outfall stabilization and have been removed from consideration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified 12 existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- Seven retrofit sites deemed potentially viable for retrofit and pending further analysis may be candidates for future restoration opportunities.

- Five retrofit sites deemed not viable for retrofit and have been removed from consideration.

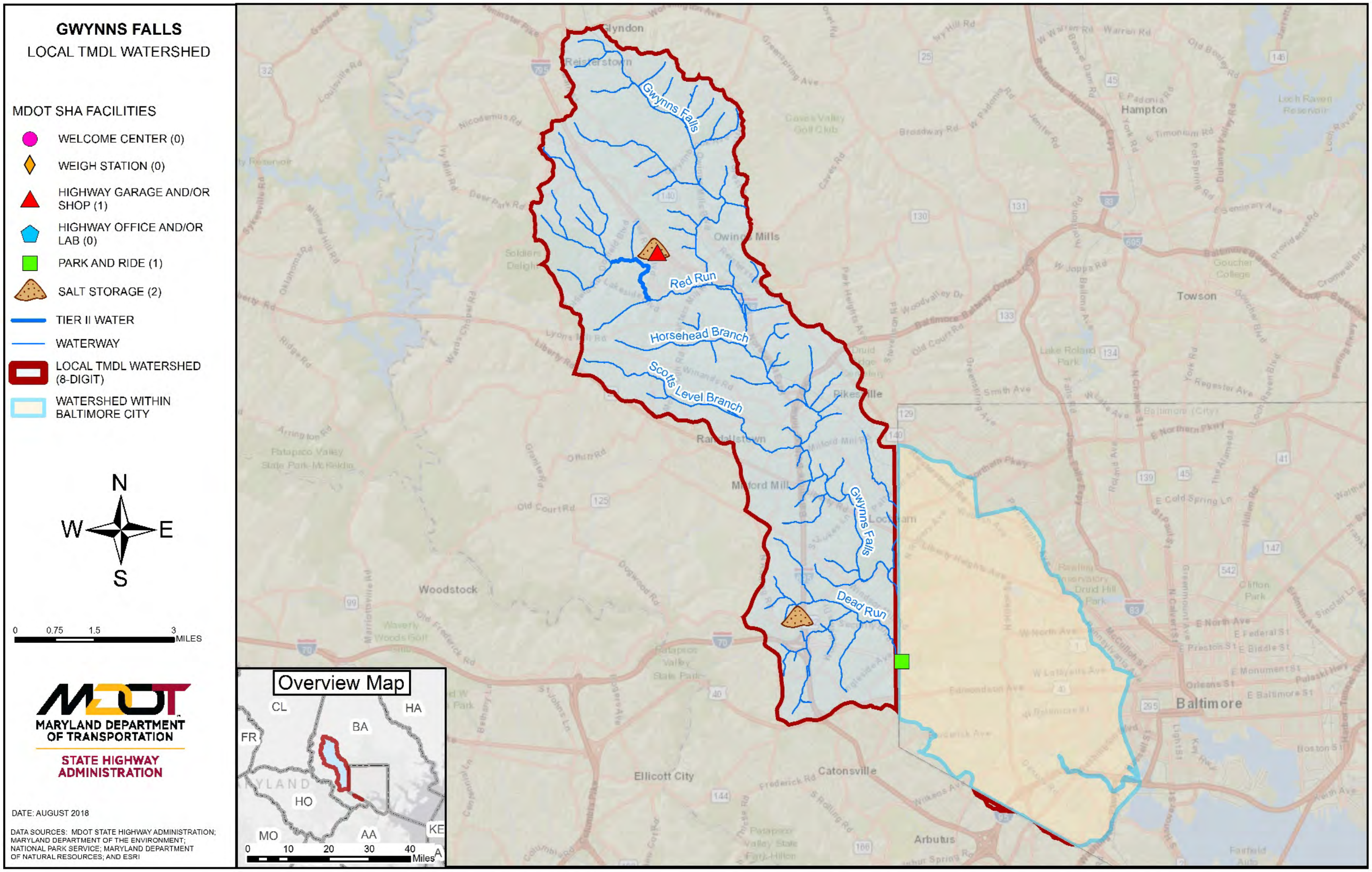


Figure 24: MDOT SHA Facilities within Gwynns Falls Watershed

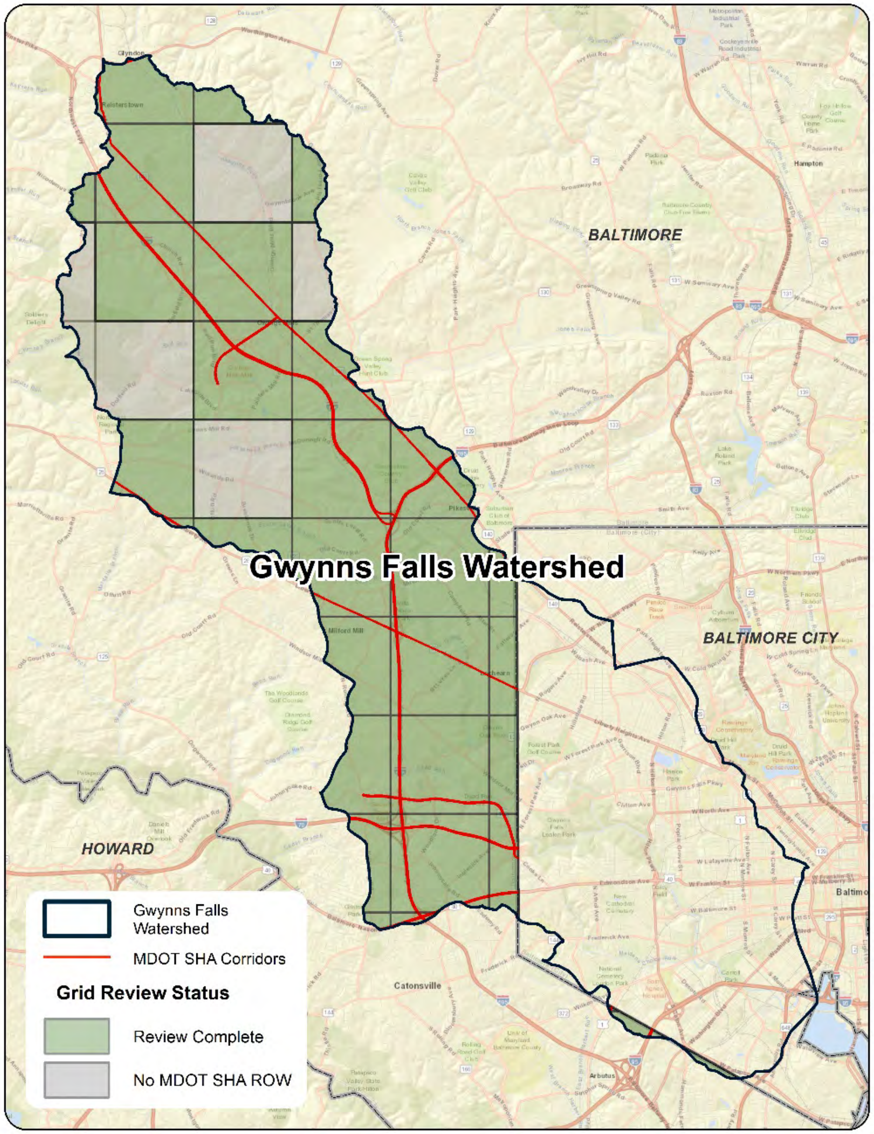


Figure 25: Gwynns Falls Site Search Grids

F.4. Summary of County Assessment Review

The Baltimore County Department of Environmental Protection and Sustainability (BC-DEPS) completed Small Watershed Action Plans (SWAPs) for the Gwynns Falls watershed's Upper Gwynns Falls (UGF) watershed (AMT Inc., 2011a) and the Middle Gwynns Falls (MGF) watershed (PB, 2013). The SWAPs serve as the watershed restoration and preservation plan and implementation strategy for the small watersheds.

The UGF watershed encompasses approximately 21 square miles (13,615 acres) and is located in the western portion of Baltimore County just above the MGF. Land use within the watershed is as follows; urban/residential (49.0 percent), forest (23.1 percent), commercial (7.9 percent), agriculture (6.9 percent), industrial (4.7 percent), institutional lands (5.3 percent), transportation (2.0 percent), and extractive, water/wetlands, and bare ground account for the remaining percent (AMT Inc., 2011a, p. 8). The UGF watershed is one of the most impacted watersheds in Baltimore County and has degraded water quality in densely populated areas (AMT, Inc., 2011a, p. vii).

The MGF watershed encompasses approximately 23 square miles (14,881 acres) and is located in the southwestern portion of Baltimore County. Land use within the watershed is as follows; urban/residential (66.1 percent), forest (12.5 percent), commercial (8.3 percent), industrial (3.5 percent), institutional lands (6.4 percent), transportation (2.9 percent), and agricultural (0.2 percent) (PB, 2013, p. 10).

Impervious land cover makes up approximately 20 percent of the UGF watershed and approximately 29 percent of the MGF watershed. Approximately 11 percent of soils within the UGF watershed and approximately 31 percent of the soils within the MGF watershed are considered of high runoff potential (Hydrologic Group D) (AMT Inc., 2011a, p. 8& PB, 2013, p. 10). The County estimates that impervious urban land use is responsible for contributing 39,029 lbs. of nitrogen and 6,256 lbs. of phosphorus in the UGF watershed per year and 74,468 lbs.

of nitrogen, 6,502 lbs. of phosphorus, and 8,833,323 lbs. of sediment in the MGF watershed per year (AMT Inc., 2011a, p.22 & PB, 2013, p. 22).

There are 28 NPDES-permitted facilities within the UGF watershed, including a MDOT SHA maintenance yard. There are five process water sources with explicit sediment limits within the watershed. The total sediment load from all process water sources within the watershed is estimated at 213.2 tons per year (AMT, Inc., 2011b, p.). The location of the MDOT SHA maintenance yard as well as two salt storage facilities within the Gwynns Falls watershed are shown on **Figure 24**.

The SWAPs specify the following small watershed wide restoration strategies. Practices that may be applicable to MDOT SHA have been italicized.

- Municipal Strategies
  - *Stormwater management;*
  - *Stream restoration;*
  - *Reforestation;*
  - *Street sweeping; and*
  - *Illicit connection detection/disconnection.*
- Pollutant Load and Removal Analyses
  - *Land use pollutant loading;*
  - *Septic system pollutant loading;*
  - *Existing urban restoration practices pollutant removal analysis; and*
  - *Proposed restoration practices pollutant removal analysis.*
- Citizen-based strategies
  - Bayscaping;
  - *Reforestation;*
  - Rain gardens; and
  - Lawn maintenance education.
- Agricultural BMP
  - Farm conservation plans;
  - Agricultural riparian forest/grass buffers;
  - Cover crops; and
  - *Stream protection with fencing.*

The subwatersheds within the small watersheds were ranked and prioritized regarding restoration need and potential. Within the UGF watershed, the UGF-D subwatershed was rated very high and the UGF-B and Roche's Run subwatersheds were rated high, the Red Run subwatershed was ranked as medium priority, and the Horsehead Branch was rated medium-low (AMT, Inc., 2011a, p. 56). Within the MGF watershed, the Dead Run subwatershed was rated very high and the Gwynns Falls subwatershed was rated high, the Madien Choice Run was rated medium priority, and the Powder Mill Run subwatershed was ranked medium-low (PB, 2013, p. 59).

MDOT SHA has completed tree plantings along the mainstems and tributaries of Red Run, Gwynns Falls, and Dead Run. Additional tree plantings are proposed along Red Run and Gwynns Falls (**Figure 26**).

A bacteria source analysis was conducted by MDOT SHA for the Gwynns Falls watershed to identify specific potential sources. Two WWTPs were identified in the *E.coli* bacteria TMDL (MDE, 2006d) document with active NPDES permits regulating the discharge of fecal bacteria into the Gwynns Falls watershed, Back River and Patapsco WWTPs.

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirement for the Gwynns Falls watershed TMDL bacteria pollutant along with the Target Year for achieving this reduction. Gwynns Falls is listed for the bacteria TMDL having a baseline year 2003 for bacteria. A treatment buffer was not applied to bacteria because this pollutant is not treated exclusively treated through stormwater or alternative BMPs. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in **Section E.3.c.**

There are currently no BMPs planned in the Gwynns Falls watershed for bacteria. These practices are described in **Section E** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the baseline year. In this case, the baseline for bacteria is 2003;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Gwynns Falls watershed total $0.00. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 28** for a summary of estimated BMP costs.

Figure 26 shows a map of MDOT SHA's restoration strategies throughout the Gwynns Falls watershed. The practices shown only include those that are under design or constructed.

Table 27: Gwynns Falls Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2003)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	35.2			N/A	
Cross-Jurisdictional[1]	drainage area acres	0.9			N/A	
Annual Load Reductions	E.coli billion MPN/day	2,882.7			N/A	0.0

[1] *Cross-jurisdictional BMPs may be a mix of various stormwater control structures.*
[2] *Refer to Table 2 for Target Year.*

Table 4-28: Gwynns Falls Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater				$0.00
			Total Restoration Cost	$0.00

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs..*
[2] *Refer to Table 2 for Target Year.*

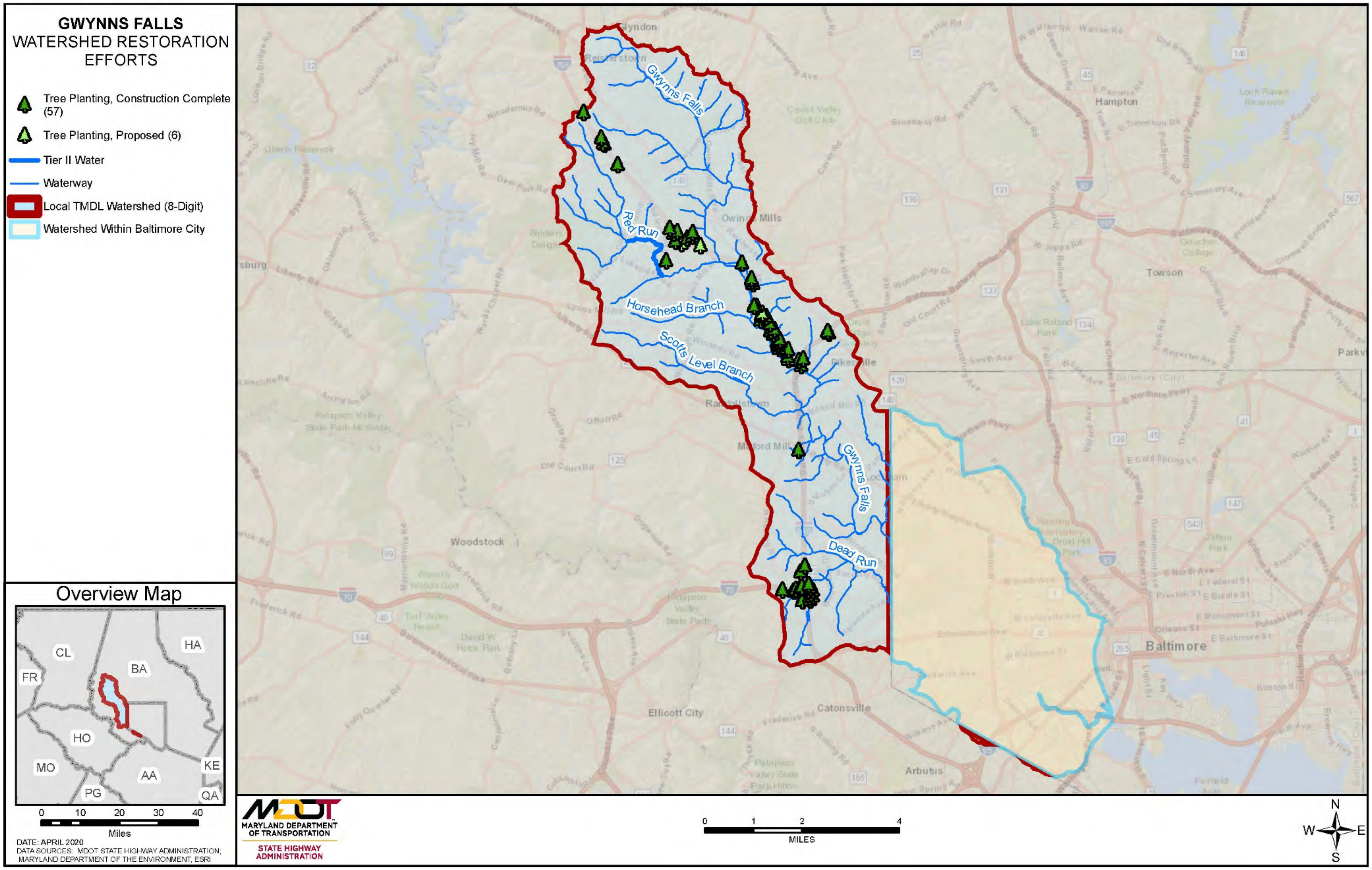


Figure 26: MDOT SHA Restoration Strategies within the Gwynns Falls Watershed

F8. JONES FALLS WATERSHED

F.1. Watershed Description

The Jones Falls watershed (MD 8 digit basin code: 02130904) encompasses approximately 58 square miles (37,290 acres) within Baltimore County and the City of Baltimore (MDE, 2015c). The headwaters of the Jones Falls are located near Garrison in Greenspring Valley, from which it flows east until it reaches Lake Roland, where it is impounded. The Lake Roland impoundment subwatershed encompasses approximately 37 square miles (23,910 acres) (MDE, 2011e).

The designated use of the Jones Falls mainstem and its tributaries above Lake Roland is Use Class III – Nontidal Cold Water, the designated use of the Jones Falls mainstem and its tributaries below Lake Roland is Use Class I – Water Contact Recreation and Protection of Warm Water Nontidal Aquatic Life, except for Stoney Run and its tributaries and the portion of the Jones Falls mainstem between North Avenue and Lake Roland, which are designated as Use Class IV – Recreational Trout Waters (MDE, 2011e).

There are approximately 791 centerline miles of MDOT SHA roadway located within the Jones Falls watershed. The associated ROW encompasses 858 acres, of which approximately 583 acres are impervious. MDOT SHA facilities located within the Jones Falls watershed consist of one salt storage facility and one highway office or lab facility that is located outside of the MDOT SHA MS4 Permit coverage area. See **Figure 27** for a map of the watershed and these facilities.

F.2. MDOT SHA TMDLs within Jones Falls Watershed

Waters within the Jones Falls watershed are subject to the following impairments as noted on MDE’s 2018, 303(d) List:

- Chloride;
- PCBs in Fish Tissue;
- Sulfate and;
- Temperature;

MDOT SHA is included in the sediment TMDL (MDE, 2011e), Lake Roland subwatershed PCBs TMDL (MDE, 2014b), Middle Branch and Northwest Branch Patapsco TMDL for Trash (MDE, 2015c), and fecal bacteria TMDL (MDE, 2006e). This implementation plan focuses on the fecal bacteria TMDL which is to be reduced by 95.5 percent as shown in **Table 2**.

While the Jones Falls watershed is located in Baltimore County and Baltimore City, MDOT SHA does not have jurisdiction within city limits and thus has no reduction requirements within Baltimore City. Therefore, Section F.3., Section F.4., and Section F.5. below only pertain to the portion of the Jones Falls watershed in Baltimore County.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Jones Falls watershed is shown in **Figure 28** which illustrates that 29 grid cells have been reviewed, encompassing portions of 13 state route corridors. Potential BMP sites identified as part of the visual inspections follow:

Structural SW Controls

Preliminary evaluation identified 180 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- 170 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 10 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 64 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 35 sites constructed or under contract.
- Two additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 27 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified seven sites as potential stream restoration locations. Further analysis of these locations resulted in:

- One site constructed or under contract.
- Six sites deemed not viable for stream restoration and have been removed from consideration.

Grass Swale Rehabilitation

Preliminary evaluation identified 55 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- 13 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 42 sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

Preliminary evaluation identified 40 outfalls potential for stabilization. Further analysis of these sites resulted in:

- 40 outfall sites deemed not viable for outfall stabilization and have been removed from consideration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified six existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- Two retrofit site deemed potentially viable for retrofit and pending further analysis may be a candidate for future restoration opportunities.
- Four retrofit site deemed not viable for retrofit and have been removed from consideration.

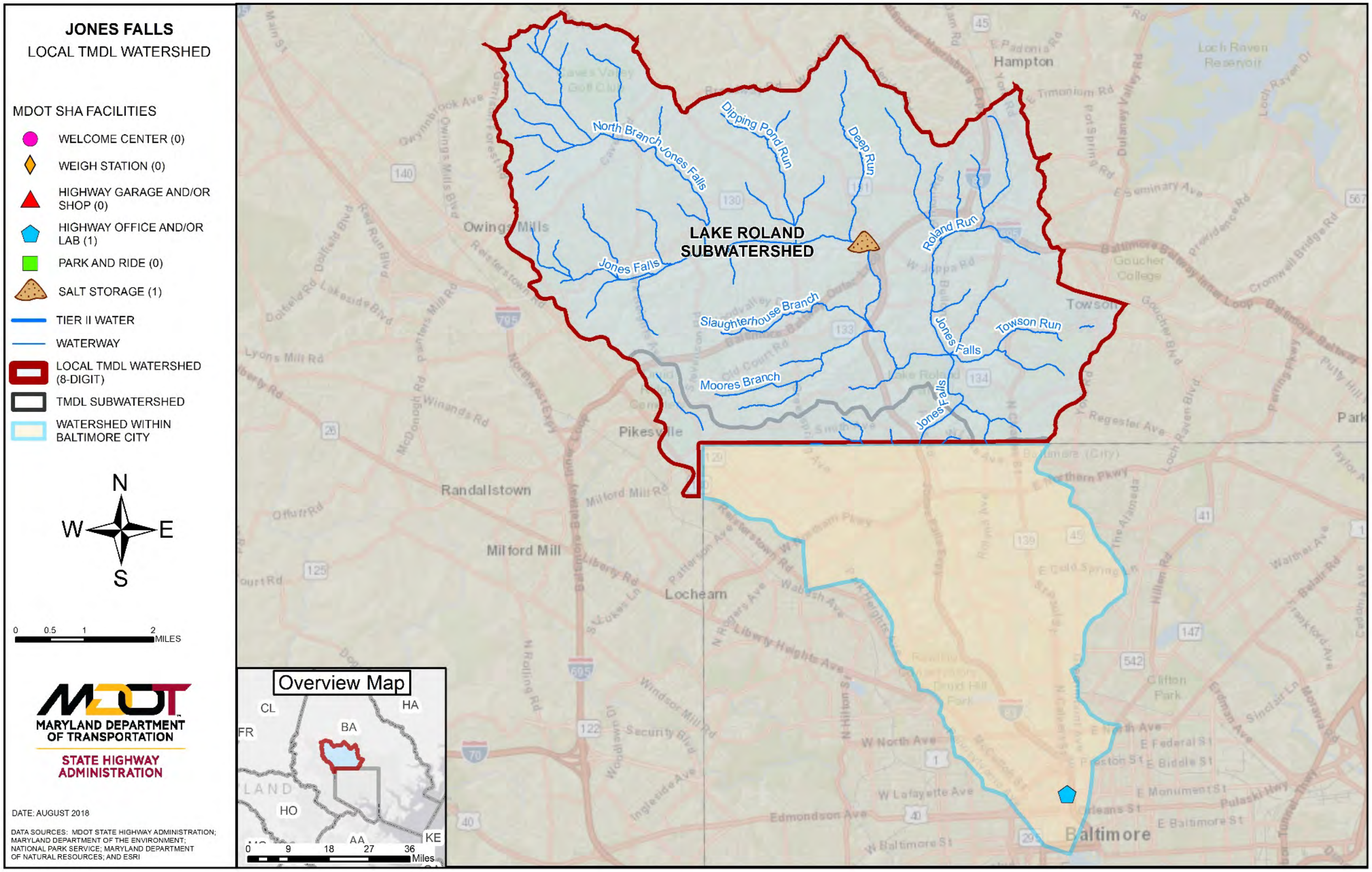


Figure 27: Jones Falls Watershed

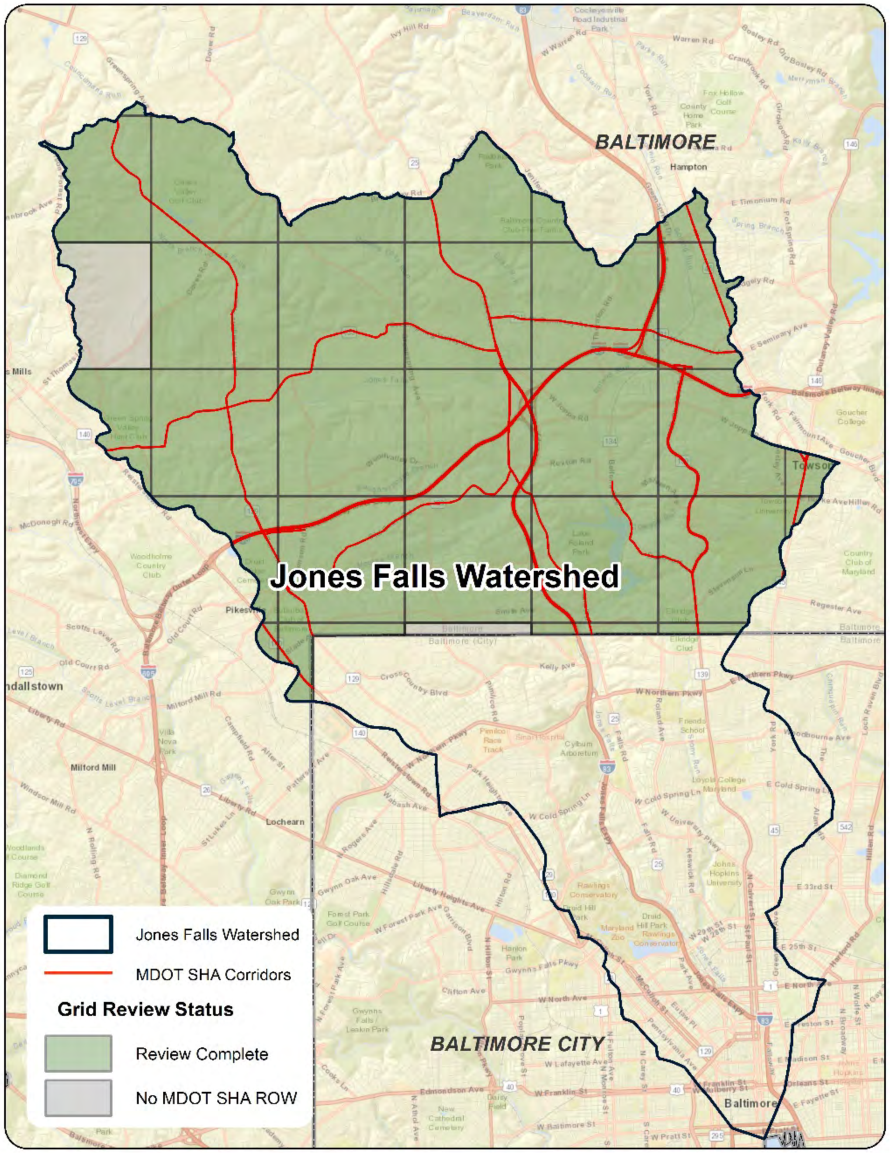


Figure 28: Jones Falls Site Search Grids

F.4. Summary of County Assessment Review

The Baltimore County Department of Environmental Protection and Sustainability completed Small Watershed Action Plans (SWAPs) for the Upper Jones Falls (UJF) watershed, the Northeastern Jones Falls (NJF) watershed, and the Lower Jones Falls (LJF) watershed. The following provides summaries of the SWAPS completed for the Jones Falls watershed published from 2008 through 2015. Each SWAP includes a watershed restoration plan and implementation strategy that will serve as guidance for Baltimore County in restoring and protecting water quality.

The Jones Falls watershed currently has TMDLs for sediment and fecal coliform in the mainstem and PCBs in an impoundment (Lake Roland). Jones Falls also has Category Five impairment listings (i.e., TMDL required) for chlorides and sulfates in the mainstem and temperature in the Slaughterhouse Branch and two unknown tributaries.

The UJF small watershed is the largest of the small watersheds that make up the Jones Falls watershed, comprising of approximately 21 square miles (13,187 acres) or 51.5 percent of the total Jones Falls watershed. The UJF small watershed is comprised of four subwatersheds. Land use is primarily comprised of low density residential (39 percent), followed by forest (18 percent) and agriculture (15 percent). The impervious cover in the UJF small watershed is low at approximately nine percent. Soils within the UJF small watershed are rated from low runoff potential (Hydrologic Group A) to high runoff potential (Hydrologic Group D). The majority of soils were rated as Hydrologic Group B (69 percent) and Hydrologic Group C (22 percent) indicating moderate to low infiltration rates (BA-DEPS, 2012).

The NJF small watershed is the smallest of the small watersheds that make up the Jones Falls watershed, comprising of approximately 11 square miles (6,957 acres). The NJF small watershed is comprised of four subwatersheds. Land use is primarily covered by medium-density residential (32 percent), followed by low-density residential (20 percent), commercial (10 percent), forest (9 percent), institutional (9 percent), institutional (9 percent), high-density residential (8 percent), industrial (6 percent), and open urban (6 percent). The impervious cover in the NJF small watershed is approximately 25 percent. The soils within the NJF small watershed are rated as primarily Hydrologic Group B (61 percent) and Hydrologic Group C (24 percent) indicating moderate to low infiltration rates (BC-DEPS, 2012).

The LJF small watershed is located in Baltimore City and Baltimore County and contains the Lake Roland impoundment. The small watershed comprises approximately 8 square miles (4,980 acres) in Baltimore County and 18 square miles (11,570 acres) in Baltimore City. The small watershed is comprised of six subwatersheds, three of which are in Baltimore City. Land use is primarily covered by medium-density residential (24 percent) and high-density residential (21 percent) followed by forest (14 percent), low-density residential (11 percent), institutional (11 percent), commercial (7 percent), open urban land (6 percent), and highway (2 percent). The soils within the LJF small watershed are dominated by soils rated as Hydrologic Group D (60 percent) indicating very low infiltration rates (CWP, 2008).

The County prioritized subwatersheds within the UJF and NJF watersheds to identify which subwatersheds have the greatest need and potential for restoration. Within the UJF watershed, the Jones Falls subwatershed was rated "high" in terms of restoration potential (KCI, 2015). Within the NJF watershed, Roland Run was rated "very high" and Towson Run was rated "high" in terms of restoration need and potential (BC-DEPS, 2012). MDOT SHA has ROW within these high priority subwatersheds and has completed numerous tree plantings and one stream restoration on a tributary to Townson Run as shown in **Figure 29**.

Baltimore County did not prioritize subwatersheds within the LJF watershed, however, the SCA identified Moore's Branch as the most impacted subwatershed based on stream erosion and inadequate buffer (CWP, 2008).

MDOT SHA reviewed the SWAPs for water quality problems and restoration opportunities associated with MDOT SHA ROW and facilities. The UJF SWAP stated that incentive based reforestation programs such as MDOT SHA's TMDL Program which partners with public property owners increases successful planting efforts within in the small watershed (KCI, 2015). The NJF SWAP identified that MDOT SHA's Transportation Enhancement Program may be a potential funding source to address water pollution due to highway runoff (BC-DEPS, 2012).

According to the SWAPs, the County has selected the following generalized restoration strategies to aid in meeting restoration goals within the Jones Falls watershed. Practices that may be applicable to MDOT SHA have been italicized.

- *SWM for new development and redevelopment;*
- SWM retrofits;
- *Stream corridor restoration;*
- *Street sweeping;*
- *Storm drain inlet cleaning;*
- Illicit connection detection and disconnection program and hotspot remediation;
- Sanitary sewer consent decrees;
- *Downspout disconnection;*
- *Citizen awareness (fertilizer application and pet waste);*
- *Pervious Area Restoration (reforestation and tree planting*); and
- Agricultural BMPs (stream protection via fencing and conservation tillage).

Additionally, Baltimore County identified potential restoration sites within each subwatershed. The County identified five potential stormwater dry pond conversions in the NJF watershed as "high" priorities for improving water quality and eighteen potential stream restoration project sites in the NJF watershed, however, location information for these sites is not included in the SWAP.

The following potential stream restoration sites within the Jones Falls watershed are identified in the SWAPs as shown in **Table 29.**

A bacteria source analysis was conducted by MDOT SHA for the Jones Falls watershed to identify specific potential sources and known areas of contamination. Two WWTPs were identified in the bacteria TMDL document (MDE, 2006e) with active NPDES permits regulating the discharge of fecal bacteria into the Jones Falls watershed, Stevenson University and Baltimore County Back River WWTPs.

Table 29: County Identified Potential Stream Restoration Sites in Jones Falls Watershed

Watershed	Reach	Number of Sites	Total Linear Feet	Conditions
UJF	Deep Run	1	-	Fish Barrier
UJF	Dipping Pond Run	10	2,214	Severe erosion, fish barrier, unstable outfalls, inadequate buffers
NJF	Towson Run	1	-	Inadequate buffers, requires naturalization
LJF	Jones Falls	1	-	Inadequate buffers, requires naturalization
LJF	Western Run	1	-	Runoff of I-695
LJF	Lower Jones Falls	1	-	Runoff from upstream urbanization
Sources: CWP et al. (2015); BA-EPS (2012); and CWP (2008b)				

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirement for the Jones Falls watershed TMDL pollutant along with the Target Year for achieving the reduction. Jones Falls is listed for bacteria with a baseline year of 2003. A treatment buffer was not applied to the bacteria implementation plan because this pollutant is not treated exclusively through stormwater or alternative BMPs. The majority of pollutant load reduction for bacteria will be treated through source tracking, contaminated site identification and potentially partnering with other jurisdictions where possible to pursue load reduction activities as outlined in **Section E.C.3**.

There are currently no practices planned in the Jones Falls watershed for bacteria exclusively. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the baseline for bacteria is 2003;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the target year.

Estimated costs to design, construct, and implement BMPs within the Jones Falls watershed for treatment of the Bacteria TMDL total $0. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 31** for a summary of estimated BMP costs.

Figure 29 shows a map of MDOT SHA watershed restoration strategies throughout the Jones Falls Watershed. The practices shown only include those that are under design or constructed.

Table 30: Jones Falls Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2003)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	68.8			N/A	
Cross-Jurisdictional[1]	drainage area acres	11.1			N/A	
Annual Load Reductions	E.coli billion MPN/day	11,741.7			N/A	0.0

[1] *Cross-jurisdictional BMPs may be a mix of various stormwater control structures.*
[2] *Refer to Table 2 for Target Year.*

Table 31: Jones Falls Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater			$0.00	$0.00
			Total Restoration Cost	$0.00

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs.*
[2] *Refer to Table 2 for Target Year.*

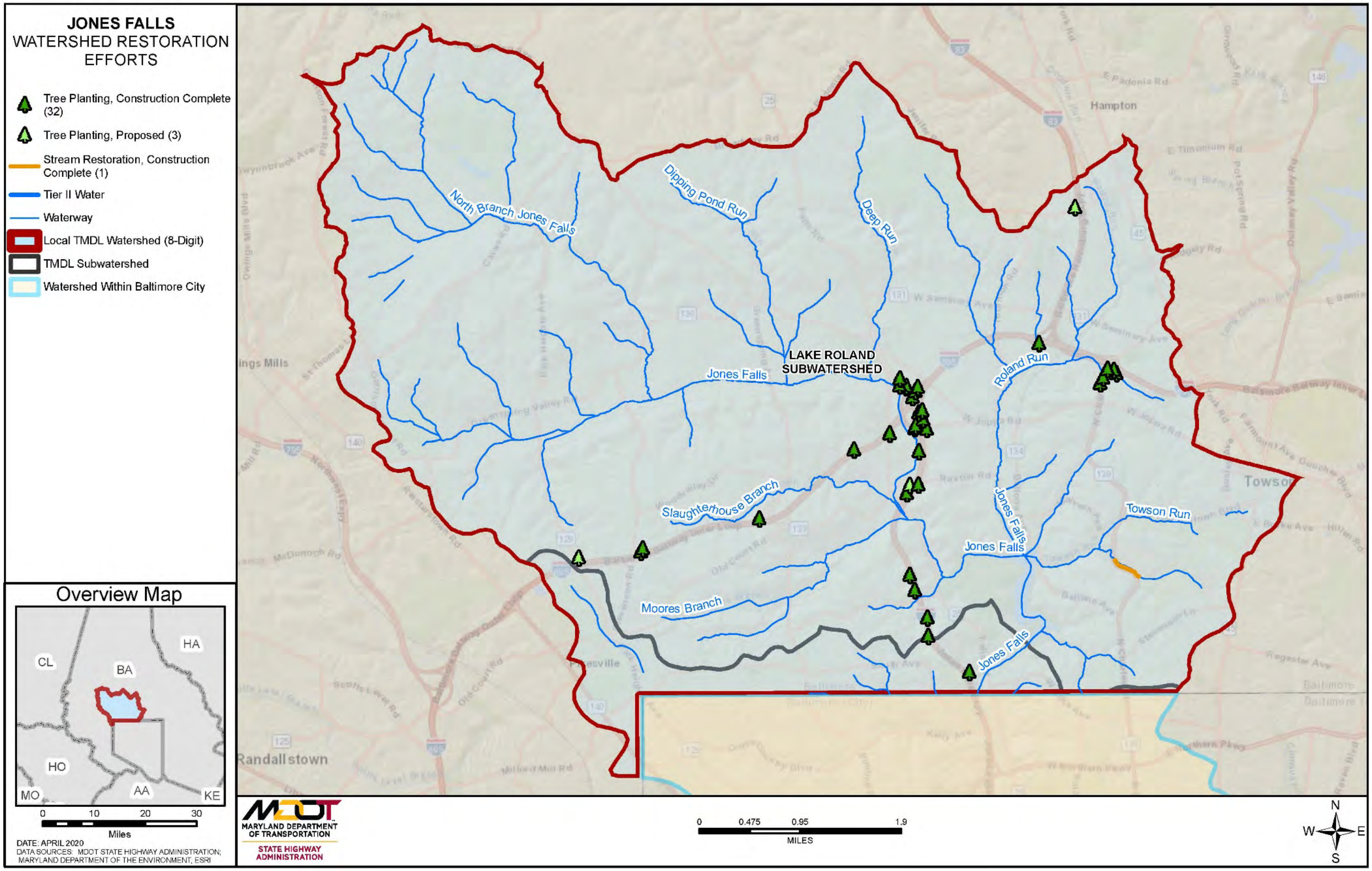


Figure 29: MDOT SHA Restoration Strategies within the Jones Falls Watershed

F9. LIBERTY RESERVOIR WATERSHED

F.1. Watershed Description

The Liberty Reservoir watershed (MD: 8 digit Basin Code: 02130907) encompasses approximately 164 square miles (104,800 acres) within eastern Carroll County and western Baltimore County, Maryland. The reservoir is part of the water supply system for the Baltimore County Department of Public Works, which provides drinking water to Baltimore City, Baltimore County, and Carroll County (MDE, 2012c).

Liberty Reservoir and its tributaries have been designated as Use I-P – Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply (MDE, 2012c).

Waters within the Liberty Reservoir watershed are subject to the following impairments as noted on MDE's 2018, 303(d) List:

- Chloride;
- Escherichia coli (E. Coli);
- Phosphorus, Total;
- Sedimentation/siltation; and
- Temperature.

There are approximately 621 centerline miles of MDOT SHA roadway located within the Liberty Reservoir watershed. The associated ROW encompasses 1,979 acres, of which approximately 633 acres are impervious. MDOT SHA facilities located within the watershed consist of one highway garage or shop facility, two park and rides, and two salt storage facilities. See **Figure 30** for a map of the watershed and these facilities.

F.2. MDOT SHA TMDLs within Liberty Reservoir Watershed

MDOT SHA is included in the phosphorus and sediment TMDLs (MDE, 2012c) and *E. coli* bacteria TMDL (MDE, 2017b). This implementation plan focuses on the E. coli bacteria TMDL which is to be reduced by 89.2 percent as shown in **Table 2**.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Liberty Reservoir watershed is shown in **Figure 31** which illustrates that 75 grid cells have been reviewed, encompassing portions of 17 state route corridors. Potential BMP sites identified as part of the visual inspections follow:

Structural SW Controls

Preliminary evaluation identified 905 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- Two sites constructed or under contract.
- 567 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 336 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 180 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 32 sites constructed or under contract.
- 66 additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 82 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified 24 sites as potential stream restoration locations. Further analysis of these locations resulted in:

- One site constructed or under contract.
- One additional site deemed potentially viable for stream restoration and pending further analysis, may be a candidate for future restoration opportunities
- 22 sites deemed not viable for stream restoration.

Grass Swale Rehabilitation

Preliminary evaluation identified 37 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- 37 sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

Preliminary evaluation identified four outfalls potential for stabilization. Further analysis of these sites resulted in:

- Four outfall sites constructed or under contract.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified 13 existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- 10 retrofit sites deemed potentially viable for retrofit and pending further analysis may be candidates for future restoration opportunities.
- Three retrofit sites deemed not viable for retrofit and have been removed from consideration.

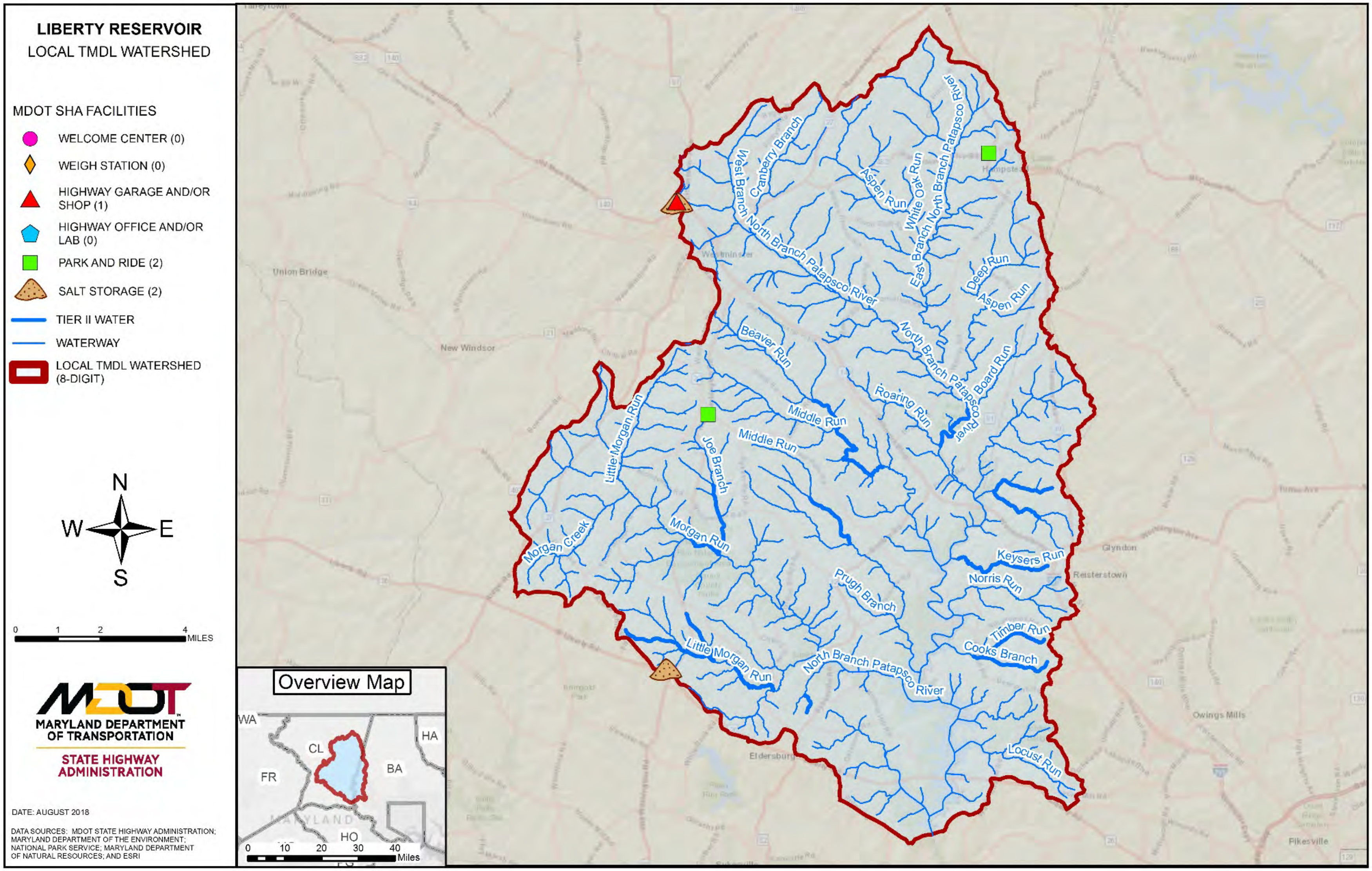


Figure 30: Liberty Reservoir Watershed

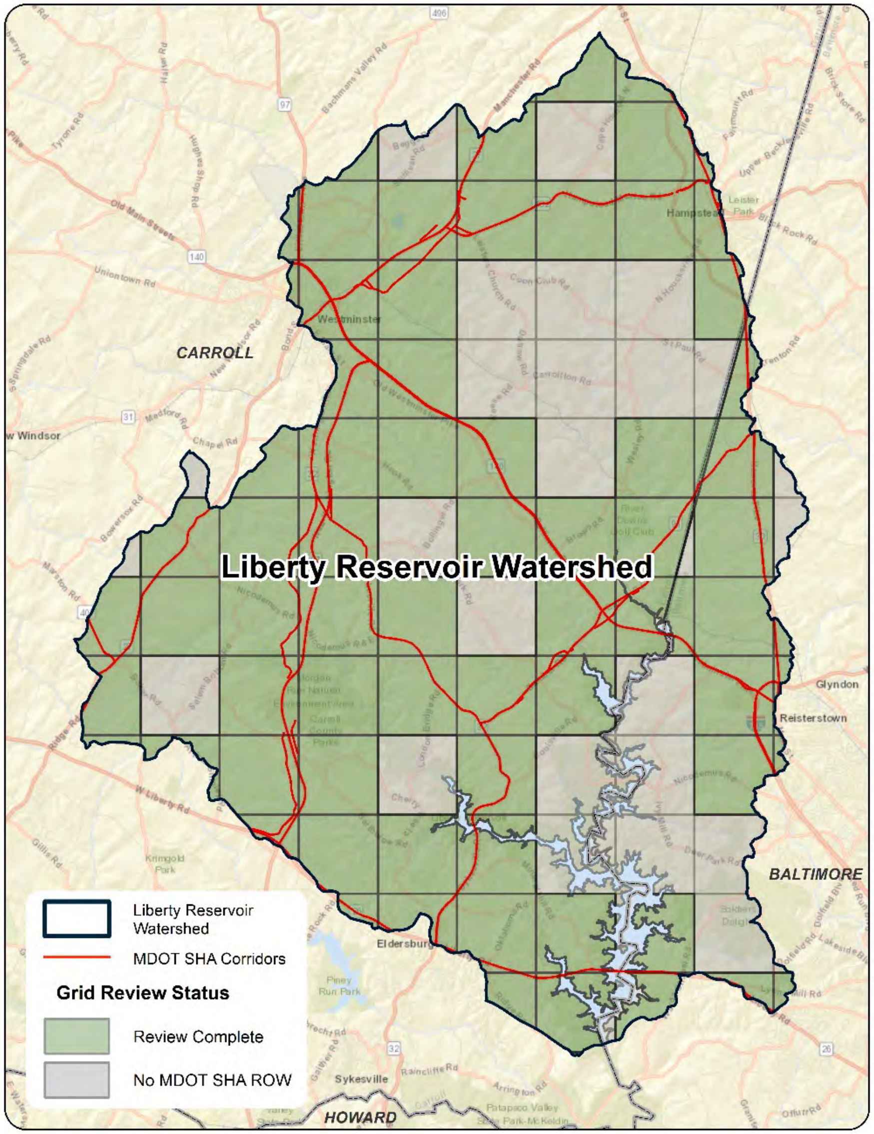


Figure 31: Liberty Reservoir Site Search Grids

F.4. Summary of County Assessment Review

Baltimore County Assessment

The *Liberty Reservoir Small Watershed Action Plan* (SWAP) was completed for the Baltimore County Department of Environmental Protection and Sustainability (BA-DEPS) in March 2015. The SWAP identifies strategies for bringing the watershed into compliance with water quality criteria and serves as the watershed's restoration and preservation plan and implementation strategy (PB, 2015, p. 1). There are no MDOT SHA facilities within the Baltimore County portion of the Liberty Reservoir watershed. The *Liberty Reservoir SWAP* did not indicate water quality problems for restoration associated with MDOT SHA ROW.

The Liberty Reservoir watershed encompasses approximately 26 square miles (16,449 acres) in the western portion of Baltimore County. The watershed is comprised of 14 subwatersheds ranging in size from 0.44 square miles (280 acres) to 4.91 square miles (3,142 acres). Land use within the watershed primarily consists of forest (42.1 percent), residential (25.6 percent), and agriculture (24.5 percent), with small portions of commercial (1.6 percent), institutional lands (1.6 percent), urban (1.5 percent) and transportation (0.5 percent). Approximately four percent of the watershed is covered by impervious surfaces. MDOT SHA owns approximately 0.46 square miles (299 acres) of land within the watershed (PB, 2015, p. 9-11, 36).

The soils within the Baltimore County portion of the Liberty Reservoir watershed are rated from low runoff potential (Hydrologic Group A) to high runoff potential (Hydrologic Group D). Approximately 16 percent of soils are considered of high runoff potential (Hydrologic Group D) with the majority (65 percent) of soils are considered low-to-moderate runoff potential (hydrologic group B) (PB, 2015, p. 11).

The 14 subwatersheds in the Liberty Reservoir were ranked and prioritized regarding restoration need and potential. The Norris Run and Keyser Run subwatersheds were ranked as very high for restoration potential, followed by Cliffs Branch and Glen Falls Run as High. Broad-Aspen Run and Liberty Reservoir-B were ranked as Medium, Timber Run, Cooks Branch, and Liberty Reservoir-F were ranked as Medium-Low, and Liberty Reservoir-A, Chimney Branch, and Liberty Reservoir-C were ranked as Low for restoration potential (PB, 2015, p. 65)

Within the ranked high priority Norris Run and Keyser Run subwatersheds, MDOT SHA has completed tree plantings and is proposing an outfall stabilization. All suggested BMPs for the subwatersheds ranked as very high and high within the Liberty Reservoir watershed are shown in Table **32**. The SWAP details restoration strategies for each subwatershed.

Carroll County Assessment

The Carroll County Bureau of Resource Management (CL-BRM) completed the *Liberty Reservoir Watershed Characterization Plan* in Fall 2019. The implementation plan will be used to identify opportunities for water quality improvements within the watershed as required by the County's NPDES permit and to meet approved TMDLs for the Liberty Reservoir watershed (CL-BRM, 2019, p. 1).

There are numerous MDOT SHA facilities including one highway garage and /or shop, two park and rides, and two salt storage facilities within the Carroll County portion of the watershed. The *Liberty Reservoir Watershed Characterization Plan* did not indicate water quality problems for restoration associated with SHA facilities and ROW.

As of 2020, the Liberty Reservoir watershed implementation plan is not available on the Carroll County website and therefore only the characterization plan is briefly summarized below.

The Liberty Reservoir watershed encompasses approximately 136 square miles (87,249 acres) in Carroll County. The watershed is comprised of 17 subwatersheds ranging in size from 3.7 square miles (2,337 acres) to 15.8 square miles (10,153 acres). Land use within the watershed primarily consists of agricultural (pasture/hay and cropland) (43 percent), forest (34 percent), urban/residential (19 percent), open water (2 percent), and wetland (1 percent). Approximately 7 percent of the watershed is covered by impervious surfaces. The West Branch Patapsco and Beaver Run subwatersheds contain the highest amount of impervious coverage (CL-BRM, 2019, p. 3, 22 & 28).

The soils within the Carroll County portion of the Liberty Reservoir watershed are rated from low runoff potential (Hydrologic Group A) to high runoff potential (Hydrologic Group D). Approximately three percent of soils are considered of high runoff potential (Hydrologic Group D) with the majority (58 percent) of soils are considered low-to-moderate runoff potential (Hydrologic Group B) (CL-BRM, 2019, p. 8-9). There are several Tier II waters within the Carroll County portion of the Liberty Reservoir watershed (CL-BRM, 2019, p. 46).

There are three current impairments for the Liberty Reservoir watershed: bacteria, phosphorous, and sediment.

Between 1995 and 2009, MBSS fish and benthic biotic integrity (IBI) data was collected in the watershed, showing 80% of the fish samples were in 'good' condition and of the benthic samples, 48% were in 'fair' condition. The West Branch Patapsco subwatershed was determined to have the lowest overall IBI ratings (CL-BRM, 2019, p. 72). Within the West Branch Patapsco subwatershed, MDOT SHA has completed tree plantings and one new efficiency BMP.

A bacteria source analysis was conducted by MDOT SHA for the Liberty Reservoir watershed to identify specific potential sources. Two points sources were identified in TMDL document (MDE, 2017b) with active industrial NPDES permits regulating the discharge of fecal bacteria into the Liberty Reservoir watershed, Congoleum Corporation and BTR Hampstead WWTP.

Table 32: Potential Actions Identified for Subwatersheds Ranked Very High and High within the Liberty Reservoir Watershed

Recommended Action	Norris Run	Keyser Run	Cliffs Branch	Glen Falls Run
Tree Planting*	N, I		H, I	N, H, I
Trash Management*	H, I	H		N
Storm Drain Marking	N, I	N	I	N
Downspout disconnection (rain gardens/barrels, redirection)	N, I	N	N	N
Stormwater Retrofit (includes wetland/SWM pond creation and conversions)*	I	H	I	
Fertilizer Reduction (promote proper lawn care, encourage residents to reduce fertilizer use)	N	N	N	N
Bayscaping	N	N	N	N, H
Lot Canopy Improvement	N		N	N
Public Education	N			
Impervious Cover Removal*	I		I	
Vegetative (includes buffer Improvement and invasive removal)*	I	N	I	I
Hotspot Follow-up Inspection	H	H	H	H
Actions Identified for: I = Institutional Sites; N = Neighborhoods; H = Hotspots **** Denotes may be applicable to MDOT SHA***				
Source: PB (2015)				

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirement for the Liberty Reservoir watershed TMDL pollutant along with the Target Year for achieving the reduction. Liberty Reservoir is listed for bacteria having a baseline year of 2003. A treatment buffer was not applied to bacteria because this pollutant is not treated exclusively through stormwater or alternative BMPs. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in **Section E.3.c.**

Proposed practices to meet the bacteria reductions in the Liberty Reservoir watershed are shown in **Table 33**. The projected bacteria reduction using these practices are 6,811 billion MPN/yr. which is 6.0 percent of the reduction targets. These practices are described in **Section E** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the the bacteria baseline is 2003;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year

Estimated costs to design, construct, and implement BMPs within the Liberty Reservoir watershed total $44,584,000. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 34** for a summary of estimated BMP costs.

Figure 32 shows a map of MDOT SHA watershed restoration strategies in the Liberty Reservoir watershed. The practices shown only include those that are under design or constructed.

Table 33: Liberty Reservoir Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2003)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	29.6	128.1		N/A	128.1
Cross-Jurisdictional[1]	drainage area acres	10.4			N/A	
Annual Load Reductions	E.coli billion MPN/yr.	4,596.2	6,811.0		N/A	6,811.0

[1] Cross-jurisdictional BMPs may be a mix of various stormwater control structures.
[2] Refer to Table 2 for Target Year.

Table 34: Liberty Reservoir Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater	$2,672,000		$41,912,000	$44,584,000
			Total Restoration Cost	$44,584,000

[1] Costs do not include maintenance, inspection, or remediation for built BMPs.
[2] Refer to Table 2 for Target Year.

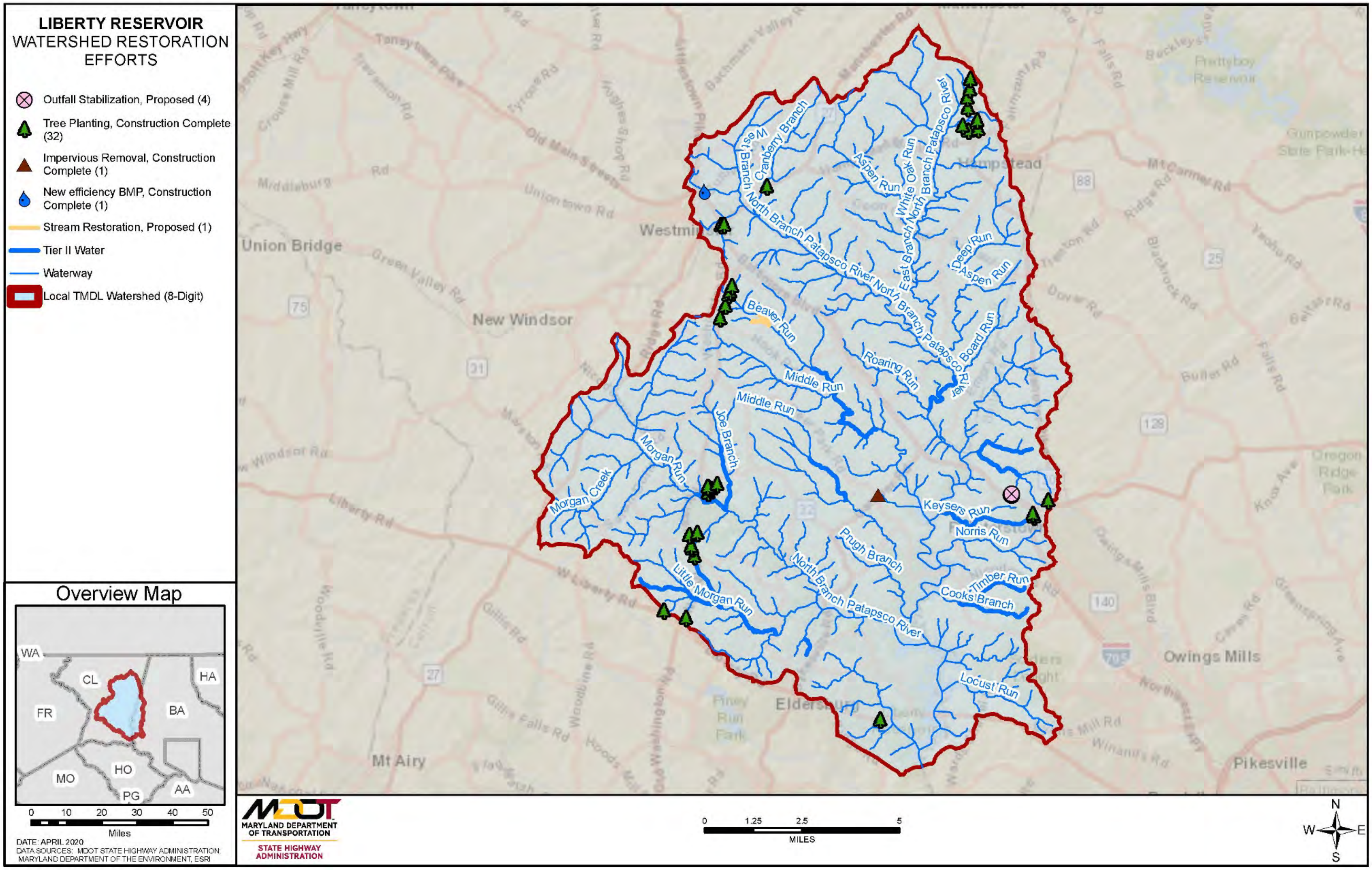


Figure 32: MDOT SHA Restoration Strategies within the Liberty Reservoir Watershed

F10. LOCH RAVEN AND PRETTYBOY RESERVOIRS WATERSHEDS

F.1. Watershed Description

The Gunpowder Reservoirs consist of the Loch Raven Reservoir (MD 8-digit basin code: 02130805) and the Prettyboy Reservoir (MD 8-digit basin code: 02130806) within the Gunpowder Falls watershed located north of the City of Baltimore. Both reservoirs are part of the water supply system for Baltimore City and surrounding jurisdictions. The Prettyboy Reservoir is upstream of the Loch Raven Reservoir and is used as a secondary reservoir to maintain capacity in Loch Raven Reservoir. The reservoirs capture a total of approximately 383 square miles (245,120 acres) of drainage area (MDE, 2006f).

The designated use of the Gunpowder Reservoirs watershed is Use Class III-P – Nontidal Cold Water and Public Water Supply (MDE, 2006f).

The Loch Raven Reservoir watershed is located primarily within Baltimore County, with small areas in Carroll and Harford Counties, Maryland as well in a portion within York County, Pennsylvania. The watershed encompasses a total of approximately 224 square miles (143,617 acres), the Maryland portion encompasses approximately 220 square miles (140,905 acres) and the Pennsylvania portion encompasses approximately 4 square miles (2,712 acres). The watershed includes the towns of Lutherville, Timonium, Cockeysville, Phoenix, Parkton, and Hampstead in Maryland. There are seven “high quality,” or Tier II, stream segments (totaling 10.33 miles) located within the Loch Raven watershed (MDE, 2009g).

On the 2018 MDE 303(d) List (MDE, 2018) the following impairments were listed for the waters within the Loch Raven Reservoir watershed:

- Chloride;
- Escherichia coli (E. Coli);
- Mercury in Fish Tissue;
- Sedimentation/siltation;
- Sulfate;
- Phosphorus, Total; and
- Temperature.

There are 168 centerline miles of MDOT SHA roadway located within the Loch Raven Reservoir watershed. The associated ROW encompasses 1,660 acres, of which 794 acres are impervious. MDOT SHA facilities located within the watershed consist of one (1) highway garage or shop, one (1) highway office or lab, one (1) salt storage facility, one (1) weigh station, and four (4) park and ride facilities.

See **Figure 33** for a map of MDOT SHA facilities within the watershed.

F.2. MDOT SHA TMDLs within Loch Raven and Prettyboy Reservoirs Watersheds

MDOT SHA is included in the phosphorus and sediment TMDL (MDE, 2006f) for the Loch Raven watershed with reduction requirements of 15.0 percent and 0.0 percent, respectively, as shown in **Table 2**. The following section only applies to the phosphorus reduction requirement. MDOT SHA is also included in the *E.coli* bacteria TMDL (MDE, 2009g) for the Loch Raven watershed with a reduction requirement of 87.6 percent, as shown in **Table 2**.

MDOT SHA is included in the phosphorus TMDL (MDE, 2006f) for the Prettyboy Reservoir watershed with a reduction requirement of 15.0 percent, as shown in **Table 2**. MDOT SHA is also included in the *E.coli* bacteria TMDL (MDE, 2008e) for the Prettyboy watershed; however there is no MDOT SHA reduction requirement for this TMDL.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Loch Raven watershed is shown in **Figure 34** which illustrates that 99 grid cells have been reviewed, encompassing portions of 23 state route corridors. Potential BMP sites identified as part of the visual inspections follow:

Structural SW Controls

Preliminary evaluation identified 419 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- 21 sites constructed or under contract.
- 355 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 43 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 100 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 59 sites constructed or under contract.
- 10 additional sites deemed potentially viable for tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 31 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified 33 sites as potential stream restoration locations. Further analysis of these locations resulted in:

- Six sites constructed or under contract.
- Two additional sites deemed potentially viable for stream restoration and pending further analysis may be candidates for future restoration opportunities.
- 25 sites deemed not viable for stream restoration and have been removed from consideration.

Grass Swale Rehabilitation

Preliminary evaluation identified 128 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- 50 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 78 sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

Preliminary evaluation identified 222 outfalls potential for stabilization. Further analysis of these sites resulted in:

- 12 sites constructed or under contract

- 25 outfall sites deemed potentially viable for outfall stabilization efforts and pending further analysis, may be candidates for future restoration opportunities.

- 185 outfall sites deemed not viable for outfall stabilization and have been removed from consideration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified 15 existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- One site constructed or under contract.

- Three retrofit sites deemed potentially viable for retrofit and pending further analysis may be candidates for future restoration opportunities.

- 11 retrofit sites deemed not viable for retrofit and have been removed from consideration.

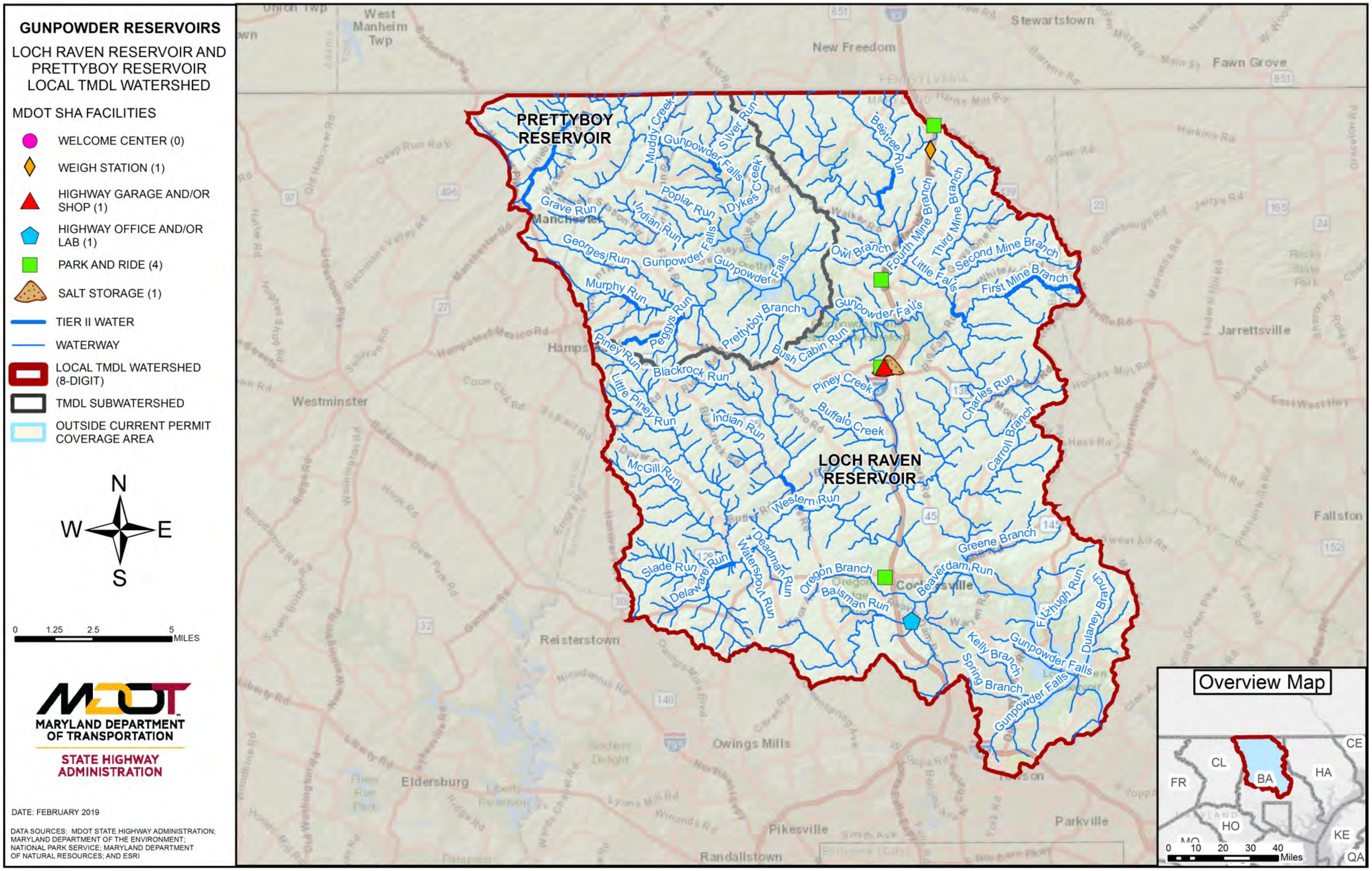


Figure 33: MDOT SHA Facilities within Loch Raven and Prettyboy Reservoirs Watersheds

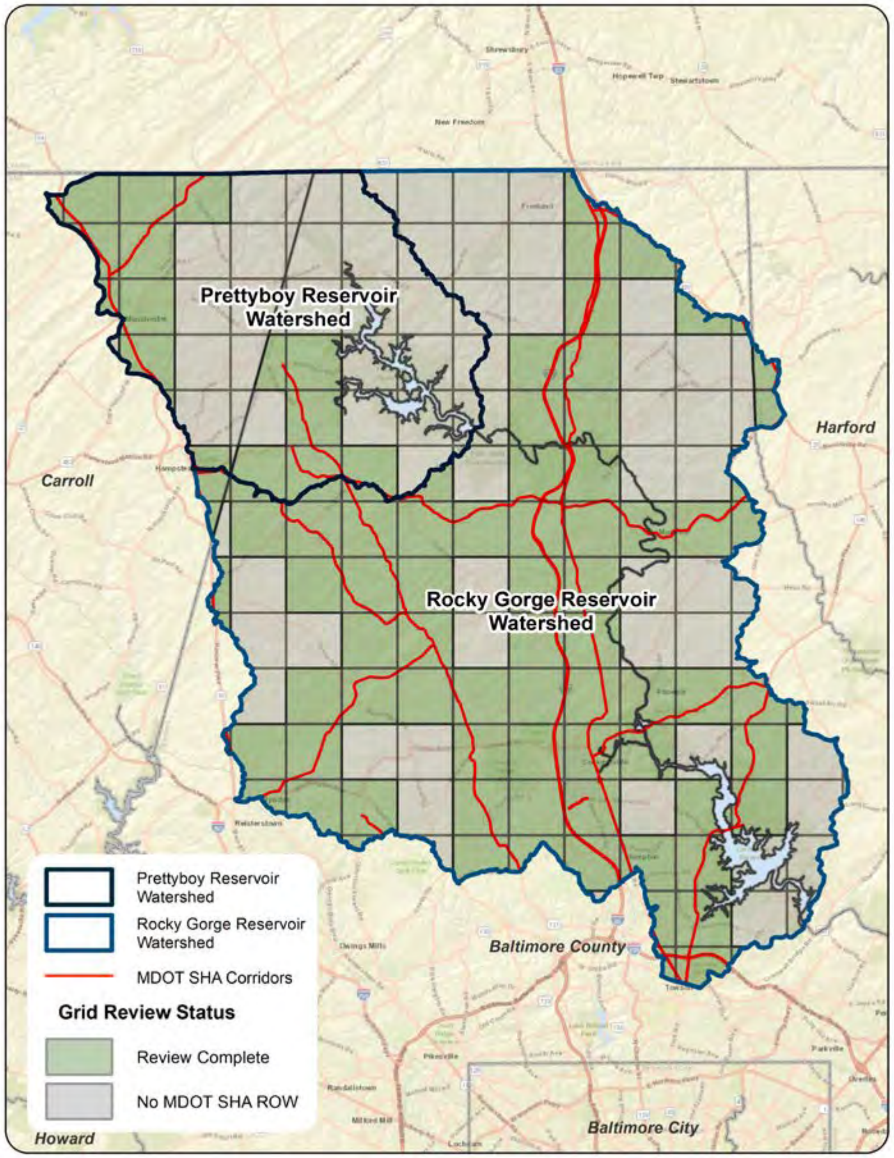


Figure 34: Loch Raven and Prettyboy Reservoirs Watersheds Site Search Grids

F.4. Summary of County Assessment Review

Loch Raven Reservoir Baltimore County Assessment

The Baltimore County Department of Environmental Protection and Sustainability (BC-DEPS) divided the Loch Raven Reservoir watershed is into five small watersheds; Loch Raven North, Loch Raven East, Loch Raven South, Loch Raven West; and Beaverdam Run, Baisman Run, and Oregon Branch collectively known as the BBO small watershed. The BC-DEPS completed Small Watershed Action Plans (SWAPs) for each of the small watersheds. The SWAPs identify strategies for bringing the small watershed into compliance with water quality criteria and serve as each small watershed's restoration and implementation strategy.

The following provides summaries of the five SWAPS for the Loch Raven Reservoir watershed published from 2008 through 2018. The Loch Raven North watershed is the largest of the small watersheds within the Loch Raven Reservoir watershed. The small watershed contributes 32 percent of the drainage area to the Loch Raven Reservoir and is located in the most northern portion of the watershed. The small watershed is comprised of 17 subwatersheds in Baltimore, Harford, and Carroll Counties Maryland. A portion of this small watershed is located in Pennsylvania. The Loch Raven North small watershed has a total drainage area of approximately 96 square miles (61,436 acres). Land use within the small watershed is as follows: forest (37 percent), agriculture (36 percent), low density residential (13 percent), and very low density residential (12 percent), commercial/industrial/institutional (1 percent), and other (1 percent). The impervious cover in the Loch Raven North small watershed is approximately 3 percent (2,068 acres). In the Loch Raven North small watershed, 70.4 percent of soils are rated as Group B (low to moderate runoff potential), 11.7 percent are rated as Group C, and 17.6 percent are rated as Group D (PBa, 2015, p 14).The Loch Raven East small watershed is located in central Baltimore County contributes 8.2 percent of the drainage area to the Loch Raven Reservoir. The small watershed is directly adjacent to the Loch Raven

Reservoir on the northeastern side. The small watershed is comprised of six subwatersheds that make up a total of approximately 18 square miles (11,567 acres). Land use within the Loch Raven East small watershed is as follows: forest and water (36 percent), low density residential (31 percent), agriculture (18 percent), very low density residential (10 percent), open urban land (4 percent), and commercial/industrial/institutional (1 percent). The impervious cover in the Loch Raven East small watershed is approximately 4.8 percent (555 acres). In the Loch Raven East small watershed, 0.4 percent are rated as Group A, 81.5 percent are rated as Group B (low to moderate runoff potential), 11.6 percent are rated as Group C, and 2 percent are rated as Group D (CWP et al., 2014, p. 22).

The Loch Raven South small watershed contributes 12.5 percent of the drainage area to the Loch Raven Reservoir and is located directly adjacent to the Loch Raven Reservoir on the southwestern side. The Loch Raven South watershed is comprised of 16subwatersheds within Baltimore County totaling approximately 27 square miles (17,506 acres). Land use within the Loch Raven South watershed is as follows; forest (31 percent), commercial/industrial/institutional (17 percent), low density residential (17 percent), medium density residential (15 percent), high density residential (10 percent), open urban and other (7 percent), and agriculture (1 percent). The impervious cover in the Loch Raven South small watershed is 19 percent (3,387 acres). In the Loch Raven South small watershed, 2 percent are rated as Group A, 65 percent are rated as Group B (low to moderate runoff potential), and 17 percent are rated as Group D (BA-DEPS, 2018, p. 12).

The Loch Raven West small watershed contributes 28 percent of the drainage area to the Loch Raven Reservoir and is located in the most western portion of the Loch Raven Reservoir watershed with the majority in Baltimore County and only a portion of the Piney Run subwatershed in Carroll County. The small watershed is comprised of 11 subwatersheds that make up approximately 60 square miles (38,488 acres). Land use within the Loch Raven West small watershed is as follows; agriculture (54 percent), forest (31 percent), low density residential (8 percent), very low density (5 percent), commercial/industrial/institutional (1 percent), and open urban (1 percent). The impervious cover in the Loch Raven West small watershed is approximately 3 percent (1,027 acres). In the Loch Raven West small watershed, 68.5 percent are rated as Group B (low to moderate runoff potential), 28.3 percent are rated as Group C, and less than one percent are rated as Group D (WSP, 2017, p. 12).

The BBO small watershed is located in central Baltimore County and contributes 6 percent of the drainage area to the Loch Raven Reservoir. The BBO small watershed is west of the Loch Raven South small watershed. The BBO small watershed is comprised of three subwatersheds (Beaverdam Run, Baisman Run, and Oregon Branch) that make up approximately 13 square miles (8,350 acres). Land use within the BBO small watershed is as follows: low density residential (47 percent), forest (23 percent), agriculture (15 percent), very low density residential (11 percent), and open urban land (4 percent). The impervious cover in the BBO small watershed is approximately 7 percent (543 acres). The BBO watershed is located outside the URDL, which ensures limited development in the watershed. The watershed is found to support populations of native brook trout, which indicates high water quality. In the BBO small watershed, 61 percent are rated Group B (low to moderate runoff potential), 32.8 percent are rated Group C, and 5 percent are rated as Group D (CWP et al., 2011, p. 13-14).

rated as Group B, and 17 percent are rated as Group D (BA-DEPS, 2018). In the Loch Raven West small watershed, 68.5 percent are rated as Group B, 28.3 percent are rated as Group C, and less than one percent are rated as Group D (WSP, 2017). In the BBO small watershed, 61 percent are rated Group B, 32.8 percent are rated Group C, and 5 percent are rated as Group D (CWP et al., 2011).

The SWAPs specify small watershed wide restoration strategies in terms of municipal, citizen-based, agricultural BMPs, and pollutant loading and removal analyses. Municipal strategies include stormwater management, stream restoration, reforestation, street sweeping, and illicit connection detection/disconnection. Citizen-based strategies include reforestation, rain gardens, lawn maintenance education, and bayscaping. Agricultural BMP strategies include farm conservation plans, agricultural riparian forest/grass buffers, cover crops, and stream protection with fencing. Pollutant load and removal analyses include land use pollutant loading, septic system pollutant loading, existing urban restoration practices pollutant removal analysis, and proposed restoration practices pollutant removal analysis.

The subwatersheds within the small watersheds were ranked and prioritized regarding restoration need and potential. Subwatersheds given a very high priority are those with greater pollution and restoration potential, while those with low priority have lower pollution and restoration potential.

In the Loch Raven North subwatersheds, of the 17 subwatersheds ranked, Piney Creek and Little Falls were prioritized as very high, followed by Beetree Run and Owl Branch as high (PBa, 2015, p. 42).

In the Loch Raven East small watershed, the six subwatersheds were ranked by the total prioritization scores to determine ranking for restoration and protection. Dulaney Valley Branch and Greene Branch were assigned a high rank for restoration and Royston Run and Greene Branch scored the highest for protection (CWP et al., 2014, p. 66).

In the Loch Raven South small watershed, of the 16 subwatersheds ranked, Long Quarter Branch, Beaver Dam Run, Goodwin Run, and Spring Branch were ranked as very high indicating a greater level of pollution and restoration potential (BA-DEPS, 2018, p. 65). These subwatersheds are located along or near major highways, I-83 and I-695.

In the Loch Raven West small watershed, of the 11 subwatersheds ranked, Blackrock Run, Western Run, and Piney Run were categorized as very high (WSP, 2017, p. 53).

In the BBO small watershed, Baisman Run was ranked high for protection prioritization and Beaverdam Run was ranked high for restoration prioritization (CWP et al., 2011, p. 75). Each SWAP details restoration strategies for each specific subwatershed.

Loch Raven Reservoir Carroll County Assessment

The *Loch Raven Watershed Carroll County, Maryland Interim Restoration Plan* was published in 2019 by the Carroll County Government Bureau of Resource Management (CL-BRM). The Interim Restoration Plan serves as the restoration strategy proposed by the County to meet watershed specific water quality standards, associated TMDL WLAs, and to protect the source water for the Loch Raven Reservoir and ecologically sensitive and threatened species (CL-BRM, 2019a, p. 12).

The portion of the Loch Raven Reservoir watershed within Carroll County is located in the northeast corner of the County and covers approximately 1 square mile (592 acres). Land use within the watershed is as follows; low density residential (30 percent), cropland (28 percent), low density mixed urban (20 percent), pasture/hay (8 percent), medium density mixed urban (7 percent), forest (4 percent), high density mixed urban (2 percent), and wetland (1 percent). Impervious cover accounts for approximately 109 acres (19 percent of the watershed) (CL-BRM, 2019, p. 9).

A SCA was completed in 2016 to aid in ranking impairments and the prioritization of restoration opportunities. During the SCA, erosion problems were identified along 1,990 linear feet of streams within the Lock Raven Reservoir Watershed. Priority for restoration projects will be based on the amount of impervious area in need of treatment and will focus on areas that will address significant downstream erosion that reduces nutrient and sediment loadings (CL-BRM, 2019, p. 13).

The Interim Restoration Plan describes restoration projects that have been implemented in the watershed as well as potential restoration opportunities. Completed restoration projects include a stream restoration project at the Hampstead Wastewater Treatment Plant, tree plantings, reforestations, and a county-wide stream buffer initiative to address inadequate buffers. Additionally, the County and Municipalities in Carroll County perform road maintenance projects including regular maintenance to infrastructure (inlet cleaning, street sweeping, storm drain cleaning, and impervious to pervious). Inlet cleaning performed annually in the Loch Raven Reservoir watershed has removed 7.14 tons of debris (CL-BRM, 2019, p. 24-25).

As of 2019, the completed projects have resulted in a reduction of 6.5 lbs of TP, exceeding the WLA requirement of 3.73 lbs. The majority of the reduction is the result of the stream restoration project at the Hampstead WWTP (5.98 lbs) (CL-BRM, 2019, p. 29).

A bacteria source analysis was conducted by MDOT SHA for the Loch Raven Reservoir watershed to identify specific potential sources. One point source was identified in TMDL document (MDE, 2009g) with an active municipal NPDES permits regulating the discharge of fecal bacteria into the Loch Raven Reservoir watershed, Hampstead WWTP.

Loch Raven Reservoir Harford County Assessment

The *Harford County, Maryland Loch Raven Reservoir Total Maximum Daily Load (TMDL) for Bacteria, Mercury, Nutrients, and Sediment* was published in March 2016 by the Harford County Department of Public Works. From Harford County, there is approximately 800 acres of agriculture and forest that drain into the 194,000 acres of the Loch Raven Reservoir Watershed (HA-DPW, 2016).

There is a 15 percent (6 lbs/yr) reduction requirement for TP in the Harford County portion of the Loch Raven Reservoir; however, the cost far out outweighs the benefit to the Loch Raven TMDL considering the minor contribution from Harford County. Therefore, Harford County will coordinate with Baltimore County and Harford County Soil Conservation District to identify potentially more cost-effective restoration opportunities within the Loch Raven Reservoir watershed (HA-DPW, 2016).

Prettyboy Reservoir Baltimore County Assessment

The Baltimore County Department of Environmental Protection and Resource Management (BA-DEPRM) initiated the *Prettyboy Reservoir Watershed Restoration Action Strategy* in 2005 to address issues relating to water quality, aquatic and terrestrial habitat. The Prettyboy Reservoir watershed encompasses a total of 80 square miles (51,145 acres) and is located in Baltimore (50 percent) and Carroll County (41 percent) in Maryland and York County (9 percent) Pennsylvania. The Prettyboy Reservoir watershed comprises the headwaters of the Gunpowder Basin, with the lower extent defined by the Prettyboy Reservoir dam. Water from the reservoir flows into the main stem of the Gunpowder River and supplies water to the Loch Raven Reservoir. The Prettyboy Reservoir is a holding reservoir, supplementing the water supply provided by the Loch Raven Reservoir (BA-DEPRM, 2008, ES-1).

The Prettyboy Reservoir watershed is primarily rural in nature with the dominate land use of agriculture (50 percent), followed by forest cover (38 percent), and urban/suburban (12 percent) (mainly as low density residential development). A TMDL was developed for phosphorus as the impairing nutrient in the reservoir and determined that a 54 percent reduction of watershed phosphorus loads are necessary to meet water quality standards (BA-DEPRM, 2008, ES-1).

Baltimore County prioritized subwatersheds for restoration and preservation within the Prettyboy Reservoir watershed. Gunpowder Falls, Muddy Creek, and Prettyboy Direct Drainage 3 were ranked as the highest priority for subwatershed restoration. Prettyboy Direct Drainage 3, Gunpowder Falls, and Walker Run were ranked as the highest priority for preservation (BA-DEPRM, 2008, p. 4-2).

Restoration strategies for these subwatersheds focus agricultural and residential BMPs that will result in phosphorus load reductions. Agricultural pastures present an opportunity for fencing and reforestation of riparian buffers to reduce erosion and improve aquatic habitat. Reforestation of riparian forest buffers and areas devoid of forest is recommended on large lot residential subdivisions. Preservation of existing forests is also included as a strategy. New development within the watersheds will be subjected to the existing Baltimore County development regulations that are protective of streams and forest. Also for the residential communities, educational programs will focus on lawn fertilizer reduction, septic system maintenance, and the planting of additional trees where possible (BA-DEPRM, 2008, p 4-5 to p4-34).

Prettyboy Reservoir Carroll County Assessment

The *Prettyboy Reservoir Watershed Carroll County, Maryland Interim Restoration Plan* was published in 2019 by the Carroll County Government Bureau of Resource Management (CL-BRM). The Interim Restoration Plan serves as the restoration strategy proposed by the County to meet watershed specific water quality standards, associated TMDL WLAs, and to protect the source water for the Prettyboy Reservoir and ecologically sensitive and threatened species.

The Prettyboy Watershed is composed of five major subwatershed that cover a total of 33 square miles (21,025 acres) within Carroll County, MD. Agriculture is the dominant land cover at about 48 percent of the total land, followed by forest which accounts for 29 percent, and residential, which accounts for about 18 percent of the total land cover. Mixed urban accounts for less than 2 percent of the total land cover, which represents the relatively rural nature of the Prettyboy watershed (CL-BRM, 2019b, p 8). The Prettyboy Watershed is estimated to have 993 acres of total impervious within the catchment and accounts for approximately 4.7 percent of the total land area (CL-BRM, 2019b, p 9). Within the Prettyboy Watershed, the Gunpowder Falls and South Branch Gunpowder Falls are the only subwatersheds listed as Tier II waters (CL-BRM, 2019b, p 12).

A stream corridor assessment (SCA) was completed in 2016 to aid in ranking impairments and the prioritization of restoration opportunities. During the SCA, erosion problems were identified along 60,759 linear feet of streams within the Prettyboy Reservoir Watershed Priority for restoration projects will be based on the amount of impervious area in need of treatment and will focus on areas that will address significant downstream erosion that reduces nutrient and sediment loadings (CL-BRM, 2019b, p. 15).

As of 2019, the completed projects have resulted in a reduction of 13.52 lbs and planned projects will result in a reduction of 17.55 lbs (15 percent of reduction achieved) of TP, which is the WLA requirement (CL-BRM, 2019b, p. 36).

Prettyboy Reservoir Harford County Assessment

The *Harford County, Maryland Loch Raven Reservoir Total Maximum Daily Load (TMDL) for Bacteria, Mercury, Nutrients, and Sediment* was published in March 2016 by the Harford County Department of Public Works. From Harford County, there is approximately 800 acres of agriculture and forest that drain into the 194,000 acres of the Loch Raven Reservoir Watershed (HA-DPW, 2016, p. 1).

There is a 15 percent (6 lbs/yr) reduction requirement for TP in the Harford County portion of the Loch Raven Reservoir; however, the cost far out outweighs the benefit to the Loch Raven TMDL considering the minor contribution from Harford County. Therefore, Harford County will coordinate with Baltimore County and Harford County Soil Conservation District to identify potentially more cost-effective restoration opportunities within the Loch Raven Reservoir watershed (HA-DPW, 2016, p. 2).

Several MDOT SHA Facilities were identified within the Loch Raven Reservoir Watershed in addition to roadway rights-of-ways. These facilities include one weigh station, one highway garage and/or shop, one highway office and/or lab, four park and rides, and one salt storage facility. No SHA facilities were identified within the Prettyboy Reservoir Watershed (**Figure 33**). None of the Subwatershed Summary Reports indicated water quality problems for restoration associated with MDOT SHA ROW. MDOT SHA Restoration Strategies within the Loch Raven and Prettyboy Reserviors Watersheds are shown on **Figure 35**.

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirements for Loch Raven Reservoir and Prettyboy Reservoir watersheds TMDL pollutants along with the Target Year for achieving the reductions. Loch Raven Reservoir is listed for phosphorus and bacteria and Prettyboy Reservoir is listed for phosphorus with each TMDL having a different baseline year; 1995 for both phosphorus TMDLs and 2004 for bacteria. MDOT SHA is over programming restoration projects to treat 115 percent of the required pollutant loads for phosphorus as an adaptive management strategy. This treatment buffer will allow MDOT SHA to achieve the reduction targets even if some planned projects are eliminated prior to construction due to site design limitations or any other situation that may result in removing the project from the plan. A treatment buffer was not applied to bacteria because this pollutant is not treated exclusively through stormwater or alternative BMPs. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in **Section E.3.c.**

Proposed practices to meet the phosphorus and bacteria reductions in the Loch Raven Reservoir watershed and phosphorus reductions in the Prettyboy Reservoir watershed are shown in **Table 35**, **Table 36**, and **Table 37**, respectively. Projected phosphorus and bacteria reductions in the Loch Raven Reservoir using these practices are 893 lbs./yr. and 861 billion MPN/yr. which are 481.6 percent and 0.9 percent of the reduction target, respectively. Projected phosphorus reductions in the Prettyboy Reservoir using these practices are 543 lbs./yr. which is 2,991.5 percent of the reduction target. These practices are described in **Section E** of this plan. Phosphorus reductions exceeded the 115 percent treatment buffer for Loch Raven Reservoir and Prettyboy Reservoir watersheds due to multiple stream restoration projects in both watersheds yielding large phosphorus reductions. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the baseline for phosphorus in both watersheds is 1995 and the baseline for bacteria is 2004;
- BMPs built after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Loch Raven Reservoir watershed total $10,984,500 and costs within the Prettyboy Reservoir watershed total $3,497,500. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 38** and **Table 39** for a summary of estimated BMP costs.

Figure 35 shows a map of MDOT SHA watershed restoration strategies throughout the Loch Raven Reservoir and Prettyboy Reservoir watersheds. The practices shown only include those that are under design or constructed.

Table 35: Loch Raven Reservoir Restoration Phosphorus BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 1995)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	19.9	38.8			38.8
Stormwater Retrofit	drainage area acres		4.9			4.9
Grass Swale	drainage area acres	57.8	4.0			4.0
Tree Planting	acres of tree planting		76.2			76.2
Stream Restoration	linear feet		8,527.7	1,335.0		9,862.7
Outfall Stabilization	linear feet		959.7	282.0		1,241.7
Inlet Cleaning[1]	dry tons		10.8			10.8
Pipe Cleaning[1]	dry tons		9.7			9.7
Street Sweeping[1]	acres swept		9.1			9.1
Impervious Disconnects	credit acres	6.5				
Annual Load Reductions	TP EOS lbs./yr.	44.7	764.3	129.1		893.4

[1] *Inlet cleaning, pipe cleaning, and street sweeping are annual practices. They are reflected only once for the year the annual reduction is achieved. Once achieved, this annual reduction will be sustained each year the load reduction is claimed.*
[2] *Refer to Table 2 for Target Year.*

Table 36: Loch Raven Reservoir Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2004)	Restoration BMPs			
			2020	2025	Target Year[1]	Restoration Totals
New Stormwater	drainage area acres	62.2	38.8		N/A	38.8
Stormwater Retrofit	drainage area acres		4.9		N/A	4.9
Annual Load Reductions	E.coli billion MPN/yr.	4,875.0	861.0		N/A	861.0

[1] *Refer to Table 2 for Target Year.*

Table 37: Prettyboy Reservoir Restoration Phosphorus BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 1995)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
Stream Restoration	linear feet		7,972.0			7,972.0
Inlet Cleaning[1]	dry tons		0.1			0.1
Pipe Cleaning[1]	dry tons		0.9			0.9
Impervious Disconnects	credit acres	1.8				
Annual Load Reductions	TP EOS lbs./yr.	4.0	542.8			542.8

[1] *Inlet cleaning and pipe cleaning are annual practices. They are reflected only once for the year the annual reduction is achieved. Once achieved, this annual reduction will be sustained each year the load reduction is claimed.*
[2] *Refer to Table 2 for Target Year.*

Table 38: Loch Raven Reservoir Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater	$1,211,000			$1,211,000
Stormwater Retrofit	$242,000			$242,000
Grass Swale	$163,000			$163,000
Tree Planting	$2,571,000			$2,571,000
Stream Restoration	$3,740,000	$585,000		$4,325,000
Outfall Stabilization	$1,862,000	$547,000		$2,409,000
Inlet Cleaning	$62,000			$62,000
Pipe Cleaning	$500			$500
Street Sweeping	$1,000			$1,000
			Total Restoration Cost	$10,984,500

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs. Costs for operational BMPs (inlet cleaning, pipe cleaning, and street sweeping) are annual costs that are incurred each year to sustain load reductions.*
[2] *Refer to Table 2 for Target Year.*

Table 39: Prettyboy Reservoir Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
Stream Restoration	$3,496,000			$3,496,000
Inlet Cleaning	$1,000			$1,000
Pipe Cleaning	$500			$500
			Total Restoration Cost	$3,497,500

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs. Costs for operational BMPs (inlet cleaning and pipe cleaning) are annual costs that are incurred each year to sustain load reductions.*
[2] *Refer to Table 2 for Target Year.*

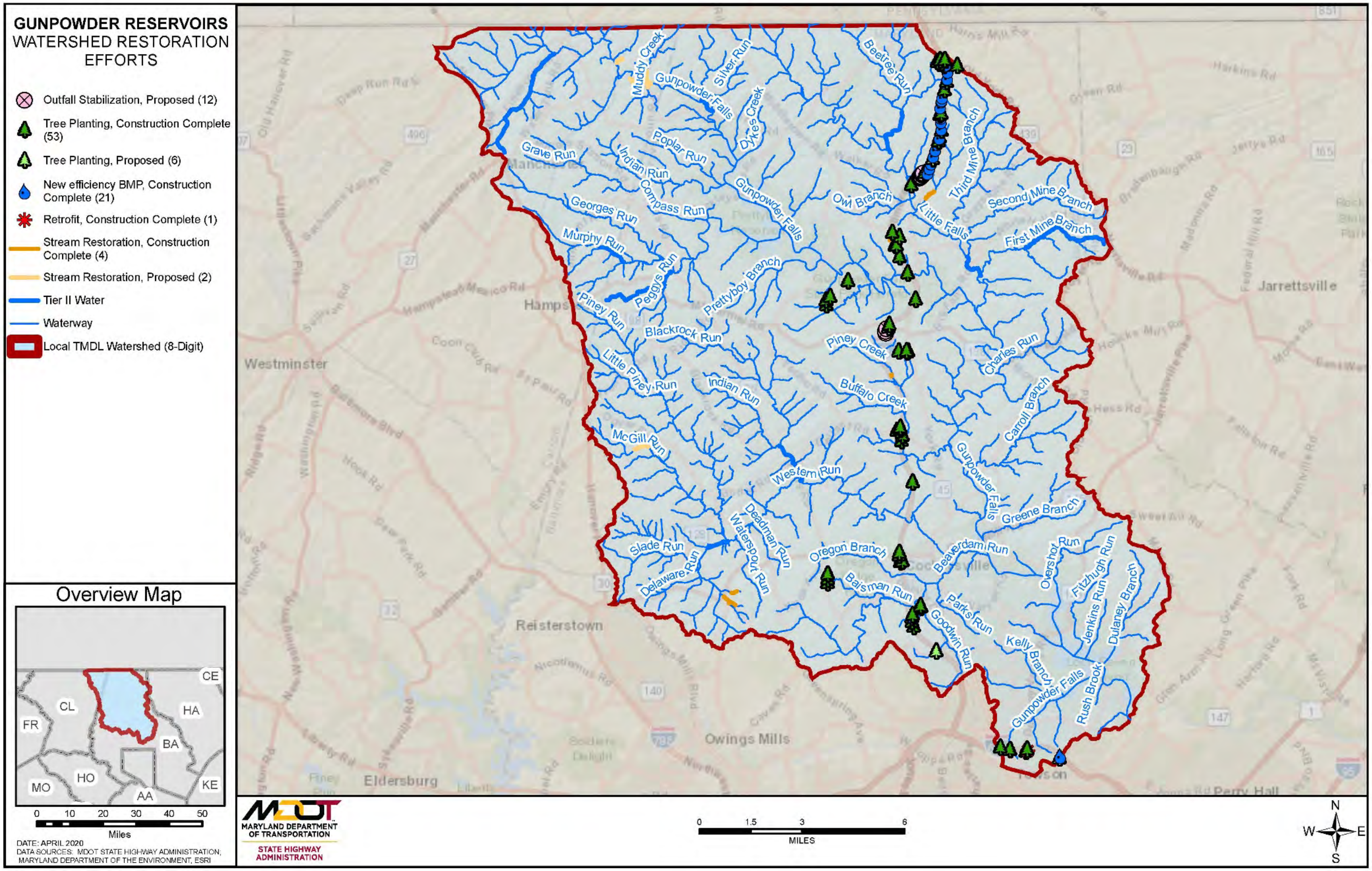


Figure 35: MDOT SHA Restoration Strategies within the Loch Raven and Prettyboy Reservoirs Watersheds

F11. LOWER MONOCACY RIVER WATERSHED

F.1. Watershed Description

The Lower Monocacy watershed encompasses 495 square miles primarily within Frederick County as well as small areas of Montgomery and Carroll Counties. The Monocacy River originates in Pennsylvania and flows through Maryland ultimately into the Potomac River. The Lower Monocacy River flows south through Frederick, and ultimately into the Middle Potomac River near the town of Dickerson. Tributary creeks and streams of the Lower Monocacy Watershed include Israel Creek, Carroll Creek, Linganore Creek, Bush Creek, Bennett Creek, and Ballenger Creek. The Lower Monocacy River watershed land use consists of crops (29.4 percent), forest (29.4 percent), residential (17.5 percent), pasture (8.8 percent), commercial (5.2 percent), and water (0.4 percent).

There are approximately1,225 centerline miles of MDOT SHA roadway located within the Lower Monocacy watershed. The associated ROW encompasses 3,563 acres, of which approximately 1,886 acres are impervious. MDOT SHA facilities located within the watershed consist of one highway office or lab, two salt storage facilities, three weigh stations, and seven park and ride facilities. See **Figure 40** for a map of the watershed and these facilities.

F.2. MDOT SHA TMDLs within Lower Monocacy River Watershed

MDOT SHA is included in phosphorus (MDE, 2013d), sediment (MDE, 2009h), and *E.coli* bacteria TMDLs (MDE, 2009i). This plan will focus on E.coli bacteria which is to be reduced by 96.9 percent, as shown in **Table 2**.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Lower Monocacy River watershed is shown in **Figure 41** which illustrates that 123 grid cells have been reviewed, encompassing portions of 23 state route corridors. Potential BMP sites identified as part of the visual inspections follow:

Structural SW Controls

Preliminary evaluation identified 1,370 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- 29 new structural SW controls constructed or under contract.
- 803 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 538 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 288 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 119 sites constructed or under contract.
- 40 additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.

- 129 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified 48 sites as potential stream restoration locations. Further analysis of these locations resulted in:

- Five sites constructed or under contract.
- Eight additional sites deemed potentially viable for stream restoration and pending further analysis may be candidates for future restoration opportunities.
- 35 sites deemed not viable for stream restoration and have been removed from consideration.

Grass Swale Rehabilitation

Preliminary evaluation identified 175 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- 96 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 79 sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

No outfall stabilization sites were identified within this watershed for potential restoration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified 34 existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- Retrofit of three existing structural SW controls constructed or under contract.
- Nine retrofit sites deemed potentially viable for retrofit and pending further analysis may be candidates for future restoration opportunities.
- 22 retrofit sites deemed not viable for retrofit and have been removed from consideration.

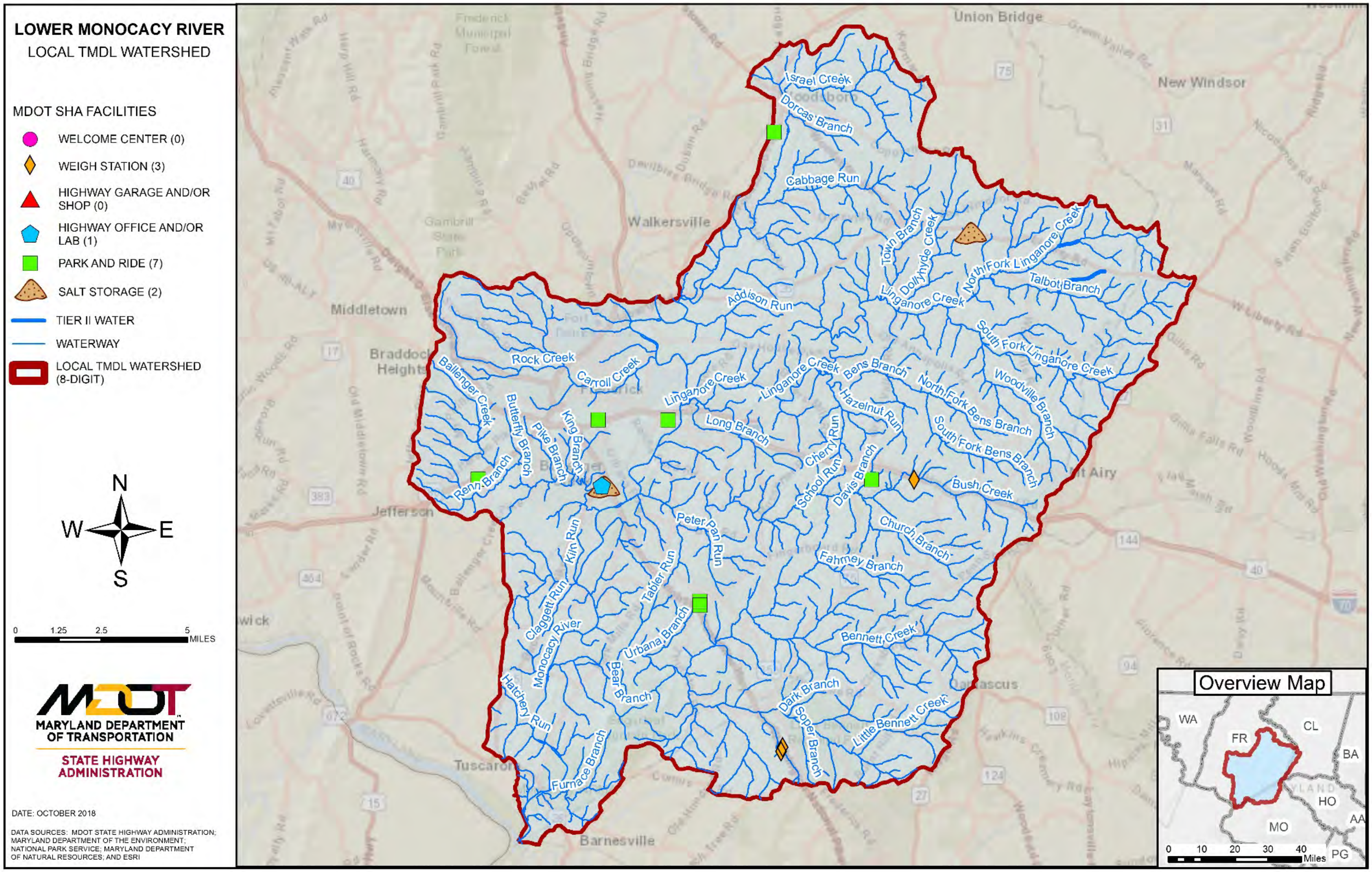


Figure 40: MDOT SHA Facilities within Lower Monocacy River Watershed

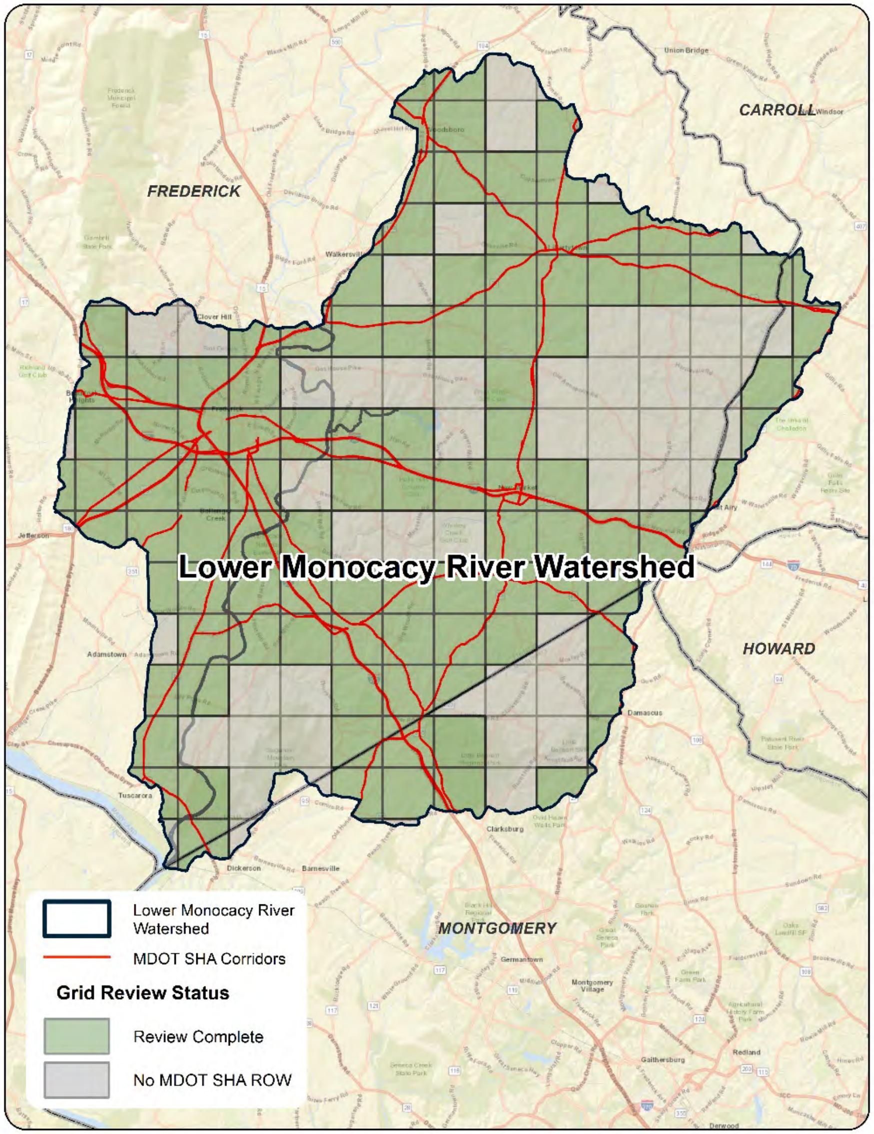


Figure 41: Lower Monocacy River Site Search Grids

F.4. Summary of County Assessment Review

Waters within the Lower Monocacy watershed are subject to the following impairments as noted on MDE's 303(d) List:

- *Escherichia coli;*
- Phosphorus (Total);
- Sedimentation/siltation;
- Temperature, water; and
- TSS.

Frederick County Assessment

The Lower Monocacy River Watershed Restoration Action Strategy (WRAS), prepared by the Frederick County Division of Public Works, was adopted in May 2004 (FR-DPW, 2004). The WRAS is based off the findings of the Lower Monocacy Stream Corridor Survey also prepared in 2004 (MD-DNR, 2004), which is overall assessment of the condition of the watershed and the streams it contains. Data collected during the Stream Corridor Assessment were used to help define present environmental conditions and possible restoration opportunities in the watershed.

The Lower Monocacy River Watershed is part of the Potomac River Watershed and encompasses 194,700 acres in three counties in Maryland: Frederick (87 percent), Montgomery (10 percent), and Carroll (3 percent). The 264 square miles of the watershed within Frederick County are the main focus of the WRAS. The Watershed is ranked in the state's Clean Water Action Plan as a "Priority Category 1 and Select Category 3 Watershed" (FD-DPW, 2004, Abstract).

Within the Frederick County portion of the Lower Monocacy River watershed, there is numerous MDOT SHA facilities including park and rides, salt storage, weigh station, and a highway office and/or lab. There is also MDOT SHA ROW throughout the watershed. Neither the *Lower Monocacy River WRAS* or the *Lower Monocacy Stream Corridor Survey* indicated water quality problems for restoration associated with SHA ROW.

Land use in the watershed is 47 percent agricultural, 30 percent forest, and 22 percent developed. Development is most concentrated in Carroll Creek, Ballenger Creek and Upper Bush Creek subwatersheds. An estimated 10 percent of the watershed (or 16,395 acres) is permanently protected from development (FR-DPW, 2004, p. 11). The Carroll Creek and Ballenger Creek subwatersheds have the greatest impervious area compared to other watersheds (18.6 percent and 13.4 percent respectively). The average proportion of impervious surface across the watershed is 4.4 percent. Another critical factor affecting water quality is the high proportion of highly erodible soils in the Lower Monocacy River, which averages 23 percent across the watershed and is as high as 30 percent in the Bennett Creek subwatershed and 29 percent in the Lower Linganore Creek subwatershed (FD-DPW, 2004, p. 14).

A TMDL adopted in 2003 calls for a 90 percent reduction in the amount of phosphorus entering Lake Linganore in order to eliminate phosphorus-related impairments. To attain this reduction, nutrient controls will be needed at sewage treatment plants and on agricultural and residential lands. A TMDL adopted in 2003 calls for a 45% reduction in the amount of sediment entering Lake Linganore in order to eliminate sediment-related impairments. To attain this reduction, erosion controls and stormwater management will be needed (FD-DPW, 2004, p. 11).

The Lower Monocacy Stream Corridor Survey found 359 potential environmental problem sites along the watershed's streams following a survey of 85 out of 740 miles. Issues identified included inadequate stream buffers (115 sites), erosion (81 sites), fish barriers (57 sites), pipe outfalls (45 sites), channel alterations (35 sites), trash dumping (14 sites), exposed pipes (1 site), and unusual conditions (11 sites) (MD-DNR, 2004, p. 14).

The Linganore Creek subwatershed (88 square miles) was identified as a high WRAS priority because of the TMDL on Lake Linganore for phosphorus and sediment, the high proportion of highly erodible soil in the watershed, the relatively low proportion of forest cover (28.5 percent), few protected areas, the fact that headwaters of significant branches including Woodville Branch and Cherry Run are in developed and rapidly growing communities, both New Market and Mt. Airy, and more than half of the landscape is in agricultural use. Problems affecting water quality in Lower Linganore Creek and its tributaries are predominantly those arising from both urban and agricultural nonpoint sources. Several initiatives include: stream buffers, cover crops, "gap filling" BMPs (including for horse operations, etc), citizen backyard buffering, headwater area protections (FD-DPW, 2004, p. 21).

A SCA evaluated the relative health of three streams in the Upper Linganore Creek Watershed: Woodville, Talbot and Town Branches. Town Branch is the first WRAS priority because it appears to have the most sediment transport to Lake Linganore and six instances of livestock accessing the creek. Talbot Branch is the second WRAS priority and Woodville Branch is the third (FD-DPW, 2004, p. 23, p. 25, and p. 32). Twelve priority restoration sites were identified within Town Branch, two sites were identified within Talbot Branch, and eleven sites in Woodville Branch (FD-DPW, 2004, p. 65). In addition to the Linganore Creek Watershed, twenty-three restoration sites were identified in the Bennet Creek Watershed, which also exhibits inadequate buffers and high levels of nitrate/nitrates in several of its major tributaries (FD-DPW, 2004, p. 66-67). Restoration strategies include reforestation, fencing out livestock, assisting farmers to improve or add BMPs, wetland restoration, and preservation of existing forests. The location of these restoration sites can be found in the Lower Monocacy Watershed Restoration Action Strategy.

MDOT SHA has completed and have proposed many restoration efforts throughout the Frederick County portion of the Lower Monocacy watershed including; tree plantings, impervious removal, new efficiency BMPs, retrofits, and stream restorations (**Figure 42**).

Montgomery County Assessment

Montgomery County published the Lower Monocacy Implementation Plan in 2012 (Biohabitats et al., 2012) to assist with watershed restoration that targets runoff, pollutants, trash, and litter management. The Lower Monocacy River watershed is located in western Montgomery County. Four subwatersheds drain nearly 30 square miles of land: Little Bennett Creek, Bennett Creek, Furnace Branch, and Fahrney Branch. Watershed area subject to the MS4 Permit is approximately 1,827 acres (9 percent of the total watershed) with approximately 153 acres (8 percent) of impervious cover (Biohabitats et al., 2012, p 4-5). Currently, just over 16% of the impervious cover in the watershed is treated by a range of BMPs. Land use within the MS4 permit area includes rural and forest land use as the dominant land use in the watershed, covering about 52 percent of the watershed. This is followed by residential at 37 percent and roadway at over 5 percent (Biohabitats et al., 2012, p. 8).

The majority of the stream conditions in Lower Monocacy were assessed as "Good" (68 percent) and "Excellent" (32 percent) (Biohabitats et al., 2012, p. 10).

There are MDOT SHA weigh station facilities and roadway ROW within the Montgomery County portion of the Lower Monocacy watershed, however, the *Lower Monocacy Implementation Plan* did not indicate water quality problems for restoration associated with MDOT SHA facilities or ROW. MDOT SHA has completed one tree planting within the Montgomery County portion of the watershed (**Figure 42**).

Carroll County Assessment

Carroll County published the Lower Monocacy River Watershed Characterization Plan in 2016 (CL-BRM, 2019c). The watershed area within Carroll County covers 5,463 acres and is comprised of two subwatersheds: North Fork and South Fork (CL-BRM, 2019c, p. 1).

The majority of the Lower Monocacy River Watershed in Carroll County are Hydrologic Group B soils (low to moderate run off potential), making up over 82% of the Watershed (CL-BRM, 2019c, p. 9). Agriculture (43 percent) is the dominant land use within the Lower Monocacy Watershed, followed by forest (38 percent) and residential (22 percent) (CL-BRM, 2019c, p. 17). Approximately 6.3 percent of the watershed within Carroll County is impervious (CL-BRM, 2019c, p. 28). Within the Lower Monocacy River watershed, there are no listed Tier II waters, though portions of the watershed are part of Tier II catchment basins (CL-BRM, 2019c, p. 43).

A SCA was performed in 2014 and found that approximately 0.71 mile, or 3 percent, of the 24 miles assessed were found to have an erosion problem, primarily low to moderate impacted. Streamside buffers were identified as inadequate along 3.6% of the streams assessed, most of the sites identified the stream as unshaded and on lawns (CL-BRM, 2019c, p. 57). The SCA found 57 potential environmental problem sites along the watershed's streams. Issues identified included inadequate stream buffers (9 sites), erosion (20 sites), fish barriers (23 sites), pipe outfalls (2 sites), channel alterations (0 sites), trash dumping (1 sites), exposed pipes (0 sites), and unusual conditions (2 sites) (CL-BRM, 2019c, p. 53).

There are no MDOT SHA facilities in the Carroll County portion of the Lower Monocacy Watershed, however, there is MDOT SHA ROW. The *Lower Monocacy River Watershed Characterization Plan* did not indicate water quality problems for restoration associated with the MDOT SHA ROW. Numerous MDOT SHA tree plantings are located within the North Fork subwatershed (**Figure 42**).

A bacteria source analysis was conducted by MDOT SHA for the Lower Monocacy River watershed to identify specific potential sources. Twelve point sources were identified in TMDL document (MDE, 2009i) with active NPDES permits regulating the discharge of fecal bacteria into the Lower Monocacy River watershed. See **Table 40** for details.

Table 40: Lower Monocacy River Bacteria Source Analysis

Watershed	Pollutant	Site Name (NPDES Permit No.)	Source
Lower Monocacy River	Bacteria	Woodsboro WWTP (#MD0058661)	Final Approved TMDL
Lower Monocacy River	Bacteria	Kemptown School WWTP (#MD0056481)	Final Approved TMDL
Lower Monocacy River	Bacteria	New Life Foursquare Church/School WWTP (#MD0057100)	Final Approved TMDL
Lower Monocacy River	Bacteria	Concord Trailer Park WWTP (#MD0023060)	Final Approved TMDL
Lower Monocacy River	Bacteria	Hyattstown WWTP (#MD0067768)	Final Approved TMDL
Lower Monocacy River	Bacteria	Mill Bottom WWTP (#MD0065439)	Final Approved TMDL
Lower Monocacy River	Bacteria	Springview Mobile Home WWTP (#MD0022870)	Final Approved TMDL
Lower Monocacy River	Bacteria	Pleasant Branch WWTP (#MD0065269)	Final Approved TMDL
Lower Monocacy River	Bacteria	Dan-Dee Motel and Country Inn WWTP (#MD0023710)	Final Approved TMDL
Lower Monocacy River	Bacteria	Frederick City WWTP (#MD0021610)	Final Approved TMDL
Lower Monocacy River	Bacteria	Fort Detrick WWTP (#MD0020877)	Final Approved TMDL
Lower Monocacy River	Bacteria	Ballenger Creek WWTP (#MD0021822)	Final Approved TMDL

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirements for the Lower Monocacy watershed TMDL pollutant along with the Target Year for achieving the reduction. Lower Monocacy is listed for bacteria with a different baseline year of 2004. A treatment buffer was not applied to bacteria because this pollutant is not treated exclusively through stormwater or alternative BMPs. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in **Section E.3.c.**

Proposed practices to meet the bacteria reduction in the Lower Monocacy River watershed is shown in **Table 41.** The projected bacteria reduction using these practices are 2,768 billion MPN/yr.,which is 1.3 percent of the reduction target.. These practices are described in **Section E** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the bacteria baseline is 2004;
- BMPs implemented after the baseline through fiscal year 2020;

- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Lower Monocacy River watershed total $4,344,000. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 42** for a summary of estimated BMP costs.

Figure 42 shows a map of MDOT SHA watershed restoration strategies in the Lower Monocacy watershed. The practices shown only include those that are under design or constructed.

Table 41: Lower Monocacy River Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2004)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	240.2	31.9		N/A	31.9
Stormwater Retrofit	drainage area acres		63.2		N/A	63.2
Cross-Jurisdictional[1]	drainage area acres	14.3			N/A	
Annual Load Reductions	E.coli billion MPN/yr.	24,030.0	2,768.0		N/A	2,768.0

[1] Cross-jurisdictional BMPs may be a mix of various stormwater control structures.
[2] Refer to Table 2 for Target Year.

Table 42: Lower Monocacy River Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater	$1,798,000			$1,798,000
Stormwater Retrofit	$2,546,000			$2,546,000
			Total Restoration Cost	$4,344,000

[1] Costs do not include maintenance, inspection, or remediation for built BMPs.
[2] Refer to Table 2 for Target Year.

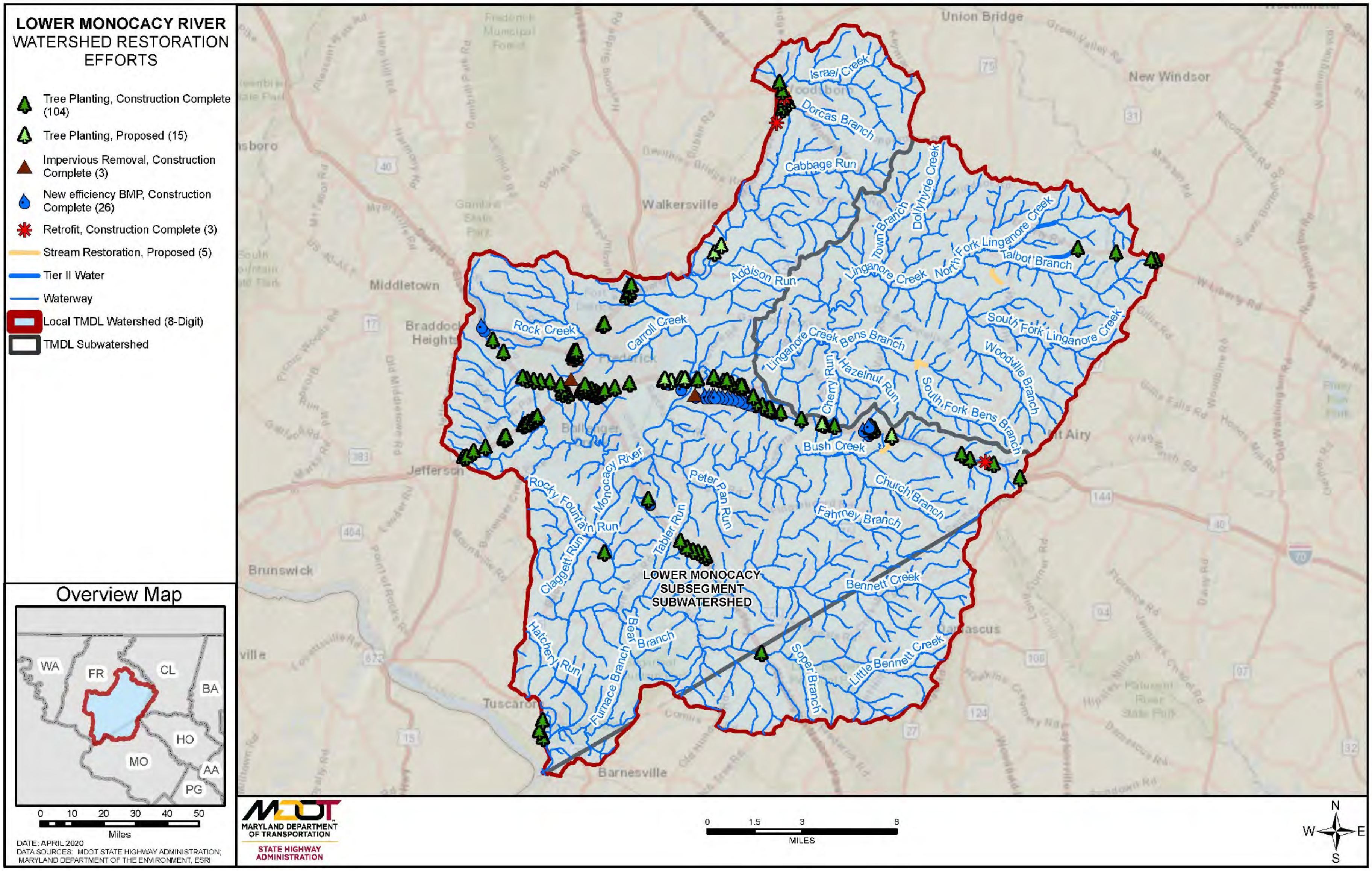


Figure 42: MDOT SHA Restoration Strategies within the Lower Monocacy River Watershed

F12. PATUXENT RIVER LOWER WATERSHED

F.1. Watershed Description

The Patuxent River Lower watershed (MD 8-digit Basin Code: 02131101) is approximately 321.10 square mile (205,500 acres) area, not including water/wetlands, located in Anne Arundel, Calvert, Charles, Prince George's, and St. Mary's Counties, Maryland. Approximately 2.81 square miles (1,800 acres) of the watershed is covered by water (MDE, 2018a).

The designated use of the Patuxent River Lower watershed's non-tidal tributaries is Use Class I – Water Contact Recreation and Protection of Aquatic Life (MDE, 2018a).

Waters within the Patuxent River Lower watershed are subject to the following impairments as noted on MDE's 303(d) List (MDE, 2018):

- Fecal Coliform;
- Nitrogen (Total);
- Mercury in Fish Tissue;
- PCB in Fish Tissue;
- Phosphorous (Total); and
- Total Suspended Solids (TSS).

There are 38 centerline miles of MDOT SHA roadway located within the Patuxent River Lower watershed. The associated ROW encompasses 342 acres, of which 152 acres are impervious. MDOT SHA facilities located within the watershed consist of 1 highway garage and/or shop, 6 park and rides, and 3 salt storage facilities.

See **Figure 43** for a map of MDOT SHA facilities within the Patuxent River Lower watershed.

F.2. MDOT SHA TMDLs within Patuxent River Lower Watershed

MDOT SHA is included in the sediment TMDL (MDE, 2018a) and there is also a bacteria TMDL (MDE, 2005b) within the Indian Creek watershed, a subsegment of the Patuxent River Lower watershed. This plan will focus on the Bacteria TMDL which is to be reduced by 43.6 percent, as shown in **Table 2**.

While the Patuxent River Lower watershed is located in Anne Arundel, Calvert, Charles, Prince George's, and St. Mary's Counties, Calvert and St. Mary's Counties are currently outside of the MDOT SHA NPDES MS4 current permit coverage area. Therefore, **Section F.3.**, **Section F.4.**, and **Section F.5.** below only pertain to the portion of the Patuxent River Lower watershed in Anne Arundel, Charles, and Prince George's Counties. When MDOT SHA's next permit is issued and if Calvert and St. Mary's Counties become a part of the next permit coverage area this implementation plan will be re-evaluated.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Patuxent River Lower watershed is shown in **Figure 44** which illustrates that thirty grid cells have been reviewed, encompassing portions of nine state route corridors. Potential BMP sites identified as part of the visual inspections follow:

Structural Stormwater Controls

Preliminary evaluation identified 44 locations as potential new structural stormwater (SW) control locations. Further analysis of these locations resulted in:

- Seven new structural SW controls constructed.
- 33 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- Four sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 65 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 43 sites constructed.
- 22 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

No stream sites were identified in this watershed for restoration.

Grass Swale Rehabilitation

Preliminary evaluation identified 23 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- 23 sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

Preliminary evaluation identified 14 outfalls potential for stabilization. Further analysis of these sites resulted in:

- Five outfall sites deemed potentially viable for outfall stabilization efforts and pending further analysis, may be candidates for future restoration opportunities.
- Nine outfall sites deemed not viable for outfall stabilization and have been removed from consideration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified three existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

Three retrofit sites deemed potentially viable for retrofit and pending further analysis may be candidates for future restoration opportunities

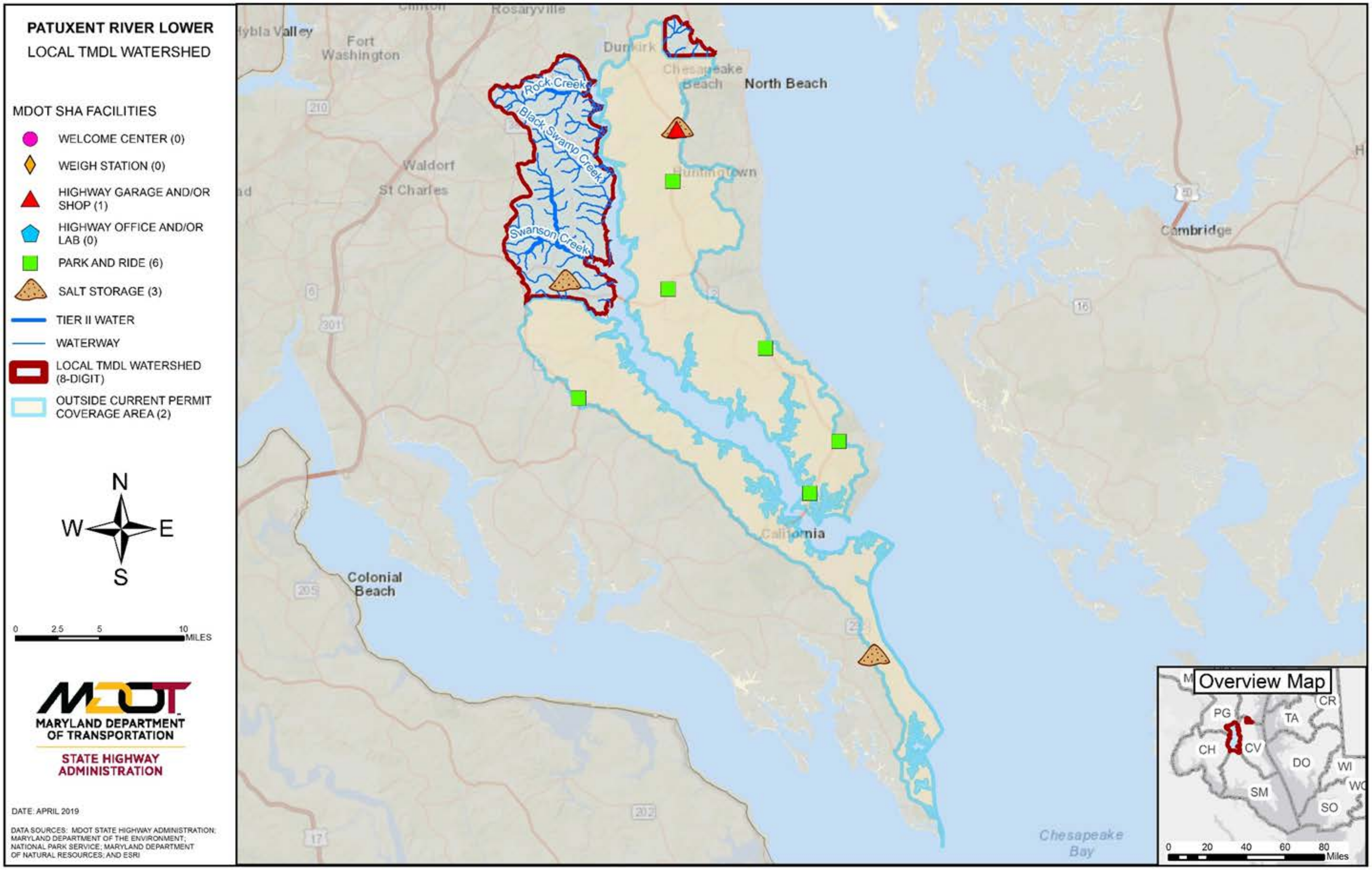


Figure 43 MDOT SHA Facilities within Patuxent River Lower Watershed

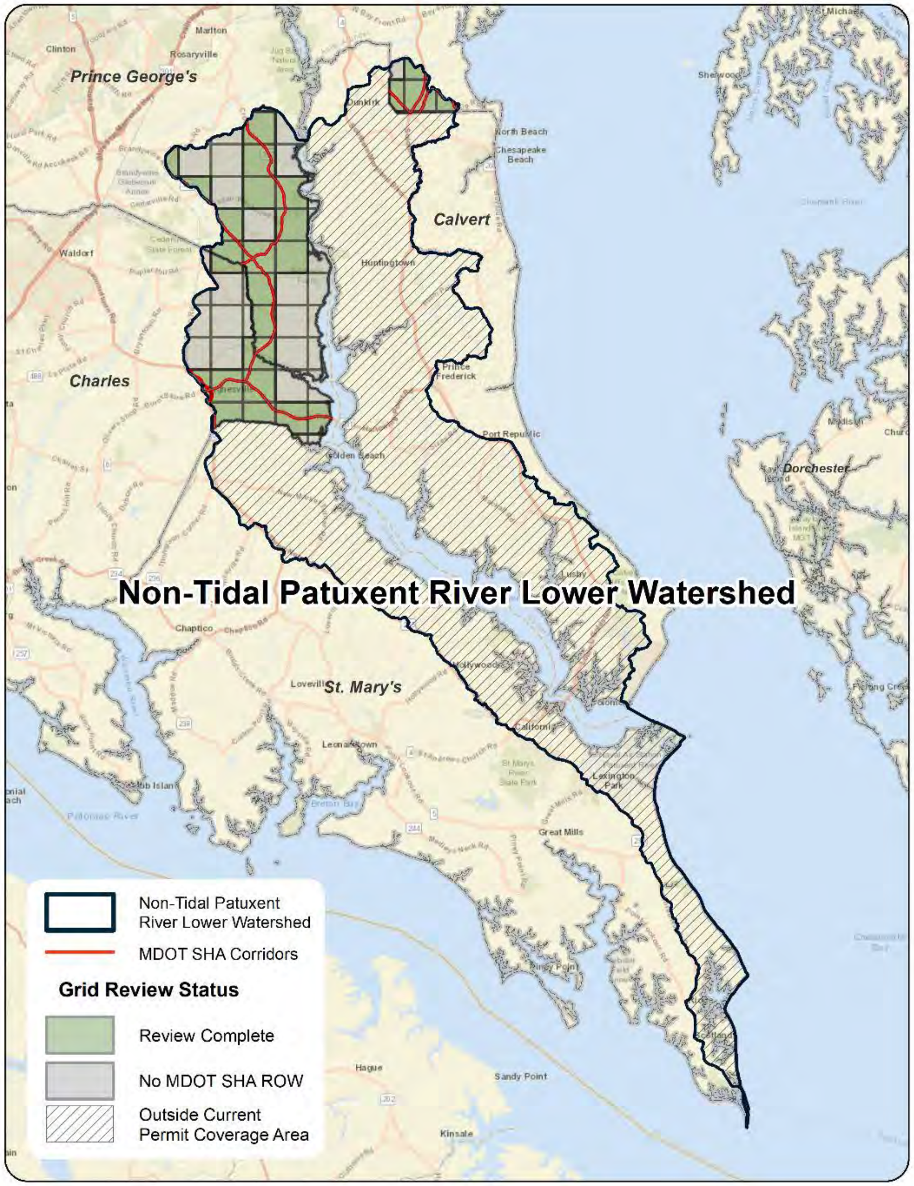


Figure 44: Non-Tidal Patuxent River Lower Site Search Grids

F.4. Summary of County Assessment Review

Anne Arundel County Assessment

The *Herring Bay, Middle Patuxent, and Lower Patuxent Watershed Assessment Comprehensive Summary Report* was published in June 2018 (hereinafter referred to as the "2018 Report"). The 2018 Report was the result of a collaborative effort between the Watershed Protection and Restoration Program within the Anne Arundel County Department of Public Works (AA-DPW), KCI Technologies, Inc., and Coastal Resources, Inc. (AA-DPW et al., 2018).

A small portion of the Patuxent River Lower watershed is within Anne Arundel County. This portion is Hall Creek, which is divided into three subwatersheds: MPC, MPX, and MPY. These subwatersheds represent an approximately five square-mile area in the most southern region of the County.

In the Patuxent River Lower watershed, the majority of soils have a moderately low runoff potential; the remainder of soils are predominately identified as having high runoff potential. In addition, the majority of land is classified as highly erodible. The fastest development occurred in the MPC subwatershed of Hall Creek between 1980-1999. Development is expected to continue to occur, most of which is expected to be commercial development in the MPX subwatershed (KCI, 2016).

Stormwater BMPs in the Patuxent River Lower watershed are typically owned by private land owners, MDOT SHA, and the County. While the majority of BMPs in the watershed are privately owned, MDOT SHA-owned BMPs account for a portion of drainage areas within the Patuxent River Lower watershed within Anne Arundel County (AA-DPW et al., 2018). Examples of privately owned BMPs include small bioretention cells and Environmental Site Design (ESD) facilities such as rain gardens and downspout disconnection.

Four types of assessments were conducted for the Patuxent River Lower watershed in Anne Arundel County: stream restoration, subwatershed restoration, subwatershed preservation, and parcel scale. All four types of assessments utilized a prioritization rating scale of High, Medium High, Medium, or Low.

Priority ranking for stream restoration took into consideration many factors including stream habitat, morphology, land cover, infrastructure, and hydrology/hydraulics. Subwatersheds MPC, MPX, and MPY all received the majority of their reaches ranked as Medium High or Medium for stream restoration.

The subwatershed restoration assessment used a suite of indicator ratings that were weighed and combined to obtain a single restoration rating for each subwatershed. The indicators were grouped into one of seven categories: stream ecology, 303(d) list, septics, BMPs, hydrology/hydraulics, water quality, and landscape. In the Patuxent River Lower watershed, subwatersheds MPX and MPY were rated high priority for restoration and subwatershed MPC was rated medium high priority.

The subwatershed preservation assessment also used a suite of indicator ratings that were weighed and combined to obtain a single preservation rating for each subwatershed. The indicators were grouped into one of five categories: stream ecology, future departure of water quality conditions, soils, landscape, and aquatic living resources. Subwatershed MPC was ranked medium priority for preservation, while MPX and MPY were both ranked low priority.

Lastly, a parcel scale assessment was conducted. The 2018 Report noted that this additional assessment was completed due to the fact that the general land use conditions in the southern portions of Anne Arundel County differ from the rest of the County in that the southern areas are less developed and contain more agricultural and forest cover. Consequently, the amount of impervious surface area in the southern portions of the County is "considerably less" than in other parts of the County (AA-DPW et al., 2018, p. 91). Based on this information, the County has recognized that preservation is critical in the Patuxent River Lower watershed. The County supplemented its subwatershed preservation assessment with three separate but related prioritization models that identified areas at the parcel level as good candidates for 1 preservation, 2 tree planting and/or riparian buffer restoration, and 3 impervious treatment (removal and conversion to pervious). The 2018 Report provides a visual summary of the identified good candidate sites for these actions in the form of several large maps (see Map 4.4 for the good candidate sites for preservation, Map 4.5 for the good candidate sites for reforestation, and Map 4.6 for the good candidate sites for impervious treatment in the 2018 Report).

Calvert County Assessment

Calvert County is currently outside of the MDOT SHA NPDES MS4 current permit coverage area.

Charles County Assessment

In June 2016, KCI Technologies, Inc. completed the *Lower Patuxent River Watershed Assessment* (KCI, 2016) for the Charles County Department of Planning and Growth Management Watershed Protection and Restoration Program, hereinafter referred to as the "Charles County Plan".
The Patuxent River Lower watershed portion of Charles County is an approximately 30-square-mile area in the northeastern portion of the county. Land use within the area is as follows: forested (44 percent), developed land (37 percent), and agriculture (13 percent) (KCI, 2016).

Charles County conducted a stream corridor assessment (SCA) for its portion of the Patuxent River Lower watershed. The County utilized the *Stream Corridor Assessment Survey: SCA Survey Protocols* (Yetman, 2001) as the main survey and investigation method in determining water quality improvement projects and prioritizing where such projects would be most effective.

Potential water quality improvement projects outlined in the Charles County Plan include:

- Stream Restoration;
- Shoreline Erosion Control;
- Stormwater BMPs;
- Reforestation; and
- Homeowner Practices.

During the SCA, stream segments were evaluated and ranked on a scale of 1 (most severe) to 5 (least severe) based on its severity, correctability, and accessibility to determine priority ranking. One stream with a total length of 3,400 linear feet was determined for restoration, specifically for bank and bed stabilization and potential floodplain reconnectivity. This restoration project would result in 15 pounds of TSS reduced per linear foot (KCI, 2016).

Within the watershed, Swanson Creek, Indian Creek, and the Lower Patuxent River were identified as areas with high significant erosion control (4 to 8+ feet of erosion per year). Of these three, one site for shoreline erosion project was identified along the Lower Patuxent River at the Prince Frederick Road Bridge. This shoreline erosion control project will reduce 137 pounds per linear foot of TSS (KCI, 2016).

The potential to provide stormwater management through BMP facilities throughout the Lower Patuxent River watershed is relatively low due to the watershed's low impervious cover and high percentage of forest cover (KCI, 2016). Small BMPs such as bioretention next to parking lots would be effective in providing stormwater management in this watershed. A desktop analysis determined potential sites for BMPs and further field investigations narrowed down the list to three sites, one proposed Filterra and two proposed Bioretentions to treat a total of 2.25 acres of drainage (KCI, 2016).

The SCA; however, also identified several inadequate buffer sites that were not feasible for reforestation. Therefore, a desktop analysis was performed to determine potential reforestation sites. A potential site was determined for tree planting, pervious removal, and conversion of impervious urban to forest which would result in 0.5 TSS pound reduction per year (KCI, 2016).

Water Quality improvement projects identified as "Homeowner Practices" are cost effective strategies that also encourage community stewardship. The strategies in focus are three practices: rain barrels, rain gardens, and downspout disconnection. Each practice treats rainfall and removes sediment and nutrients from entering the watershed. The County determined 630 homes to participate with rain barrels, 210 homes for rain gardens, and 210 homes for downspout disconnection to treat a total of 19.8 treated impervious acres (KCI, 2016).

Prince George's County Assessment

As of December 2018, a watershed restoration plan for the Patuxent River Lower for portions of the watershed that fall inside the County is not available online on Prince George's Watershed Restoration Planning Site (http://pgcdoe.net/pgcountyfactsheet/Factsheet/Default). A Watershed Existing Conditions Report covering the Patuxent River Lower portion within Prince George's County is also not currently available on the site.

St. Mary's County Assessment

St. Mary's County is currently outside of the MDOT SHA MS4 NPDES current permit coverage area.

A bacteria source analysis was conducted by MDOT SHA for the Indian Creek subsegment watershed. No permitted point sources were identified in the TMDL document (MDE, 2005b).

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirement for the Lower Patuxent River - Indian Creek watershed TMDL pollutant along with the Target Year for achieving the reduction. Lower Patuxent River – Indian Creek is listed for bacteria having a baseline year of 2001. A treatment buffer was not applied to bacteria because this pollutant is not treated exclusively through stormwater or alternative BMPs. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in **Section E.3.c.**

Proposed practices to meet the bacteria reduction in the Lower Patuxent River – Indian Creek watershed are shown in **Table 43**. The projected bacteria reduction using these practices are is 151 billion counts/day which is 6.2 percent of the reduction target. These practices are described in **Section E** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the baseline for bacteria is 2001;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Lower Patuxent River – Indian Creek watershed total $305,000. The cost is based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 44** for a summary of estimated BMP costs.
Figure 45 shows a map of MDOT SHA watershed restoration strategies throughout the Non-Tidal Patuxent River Lower watershed. The practices shown only include those that are under design or constructed.

Table 43: Lower Patuxent River – Indian Creek Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2001)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres		5.9		N/A	5.9
Cross-Jurisdictional[1]	drainage area acres	1.6			N/A	
Annual Load Reductions	fecal coliform billion counts/day	266.4	151.0		N/A	151.0

[1] *Cross-jurisdictional BMPs may be a mix of various stormwater control structures.*
[2] *Refer to Table 2 for Target Year.*

Table 44: Patuxent River Lower Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater	$305,000			$305,000
			Total Restoration Cost	$305,000

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs.*
[2] *Refer to Table 2 for Target Year.*

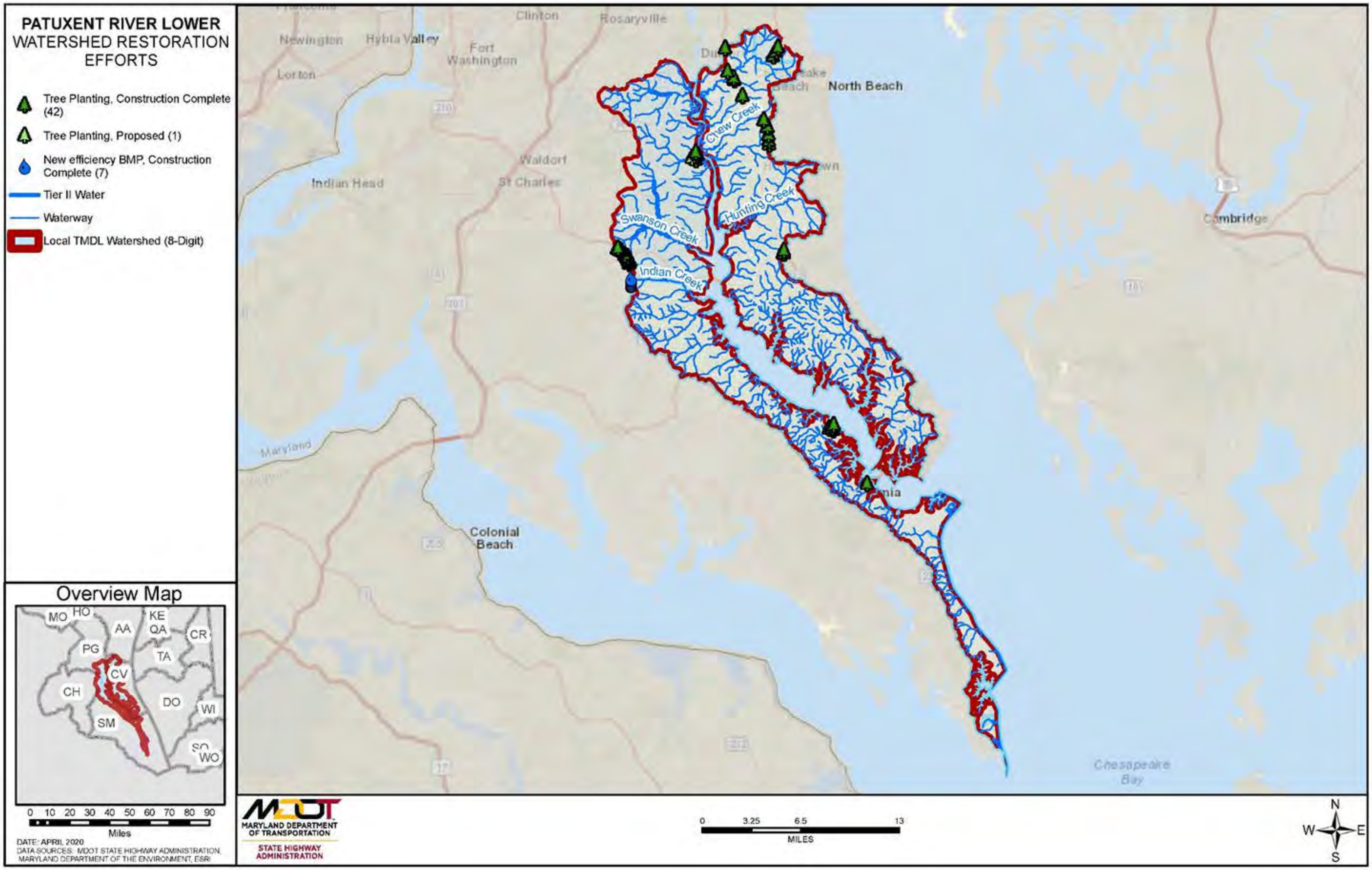


Figure 45: MDOT SHA Programmed Restoration Strategies within the Patuxent River Lower Watershed

F13. MAGOTHY RIVER WATERSHED

F.1. Watershed Description

The Magothy River watershed (MD 8-digit Basin Code: 02131001) encompasses approximately 36 square miles (22,901 acres) within in Anne Arundel County, Maryland. The Magothy River is a 6-mile long tidal tributary of the Chesapeake Bay. There are four restricted shellfish harvesting areas for bacteria within the watershed, Magothy River, Tar Cove, Forked Creek, and Deep Creek.

The Magothy River has been designated as Use II – Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting (MDE, 2015a).

Waters within the Magothy River watershed are subject to the following impairments as noted on MDE's 2018, 303(d) List:

- Chloride;
- Fecal Coliform;
- Nitrogen, Total;
- PCBs in Fish Tissue;
- Phosphorus, Total; and
- Total Suspended Solids (TSS).

There are 21 centerline miles of MDOT SHA roadway located within the Magothy River watershed. The associated ROW encompasses 222 acres, of which 81 acres are impervious. There are no MDOT SHA facilities located within this watershed. See **Figure 46** for a map of MDOT SHA facilities within the watershed.

F.2. MDOT SHA TMDLs within Magothy River Watershed

MDOT SHA is included in the fecal coliform bacteria TMDL (MDE, 2006g) for a subsegment of the Magothy River watershed. Bacteria is to be reduced by 12.8 percent, as shown in **Table 2**. Two additional subsegments of the Magothy River watershed, Tar Cove and Forked Creek, have TMDLs for *E.coli* bacteria (MDE, 2006g). There are no reduction requirements for the NPDES Regulated Stormwater Sector WLA for the Tar Cove bacteria TMDL; therefore, MDOT SHA does not have a reduction requirement for this TMDL. Although MDOT SHA has a reduction requirement of 26.3 percent for the Forked Creek watershed, there is currently no MDOT SHA right-of-way within this subsegment; and therefore, no modeled bacteria load to reduce.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Magothy watershed is shown in **Figure 47** which illustrates that 20 grid cells have been reviewed, encompassing portions of eight state route corridors. Potential BMP sites identified as part of the visual inspections follow.

Structural Stormwater Controls

Preliminary evaluation identified 58 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- Two sites constructed or under contract.

- 52 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- Four sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 26 locations as potential tree planting locations. Further analysis of these locations resulted in:

- One site constructed or under contract.
- Eight additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 17 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified two sites as a potential stream restoration location. Further analysis of these locations resulted in:

- One additional site deemed potentially viable for stream restoration and pending further analysis may be a candidate for future restoration opportunities.
- One site deemed not viable for stream restoration.

Grass Swale Rehabilitation

Preliminary evaluation identified 13 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- Four additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- Nine sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

Preliminary evaluation identified 80 outfall potential for stabilization. Further analysis of this site resulted in:

- 10 outfall sites deemed potentially viable for outfall stabilization efforts and pending further analysis, may be candidates for future restoration opportunities.
- 70 outfall sites deemed not viable for outfall stabilization and have been removed from consideration.

Retrofit of Existing Structural SW Controls

No existing structural SW controls were identified in this watershed for potential retrofits.

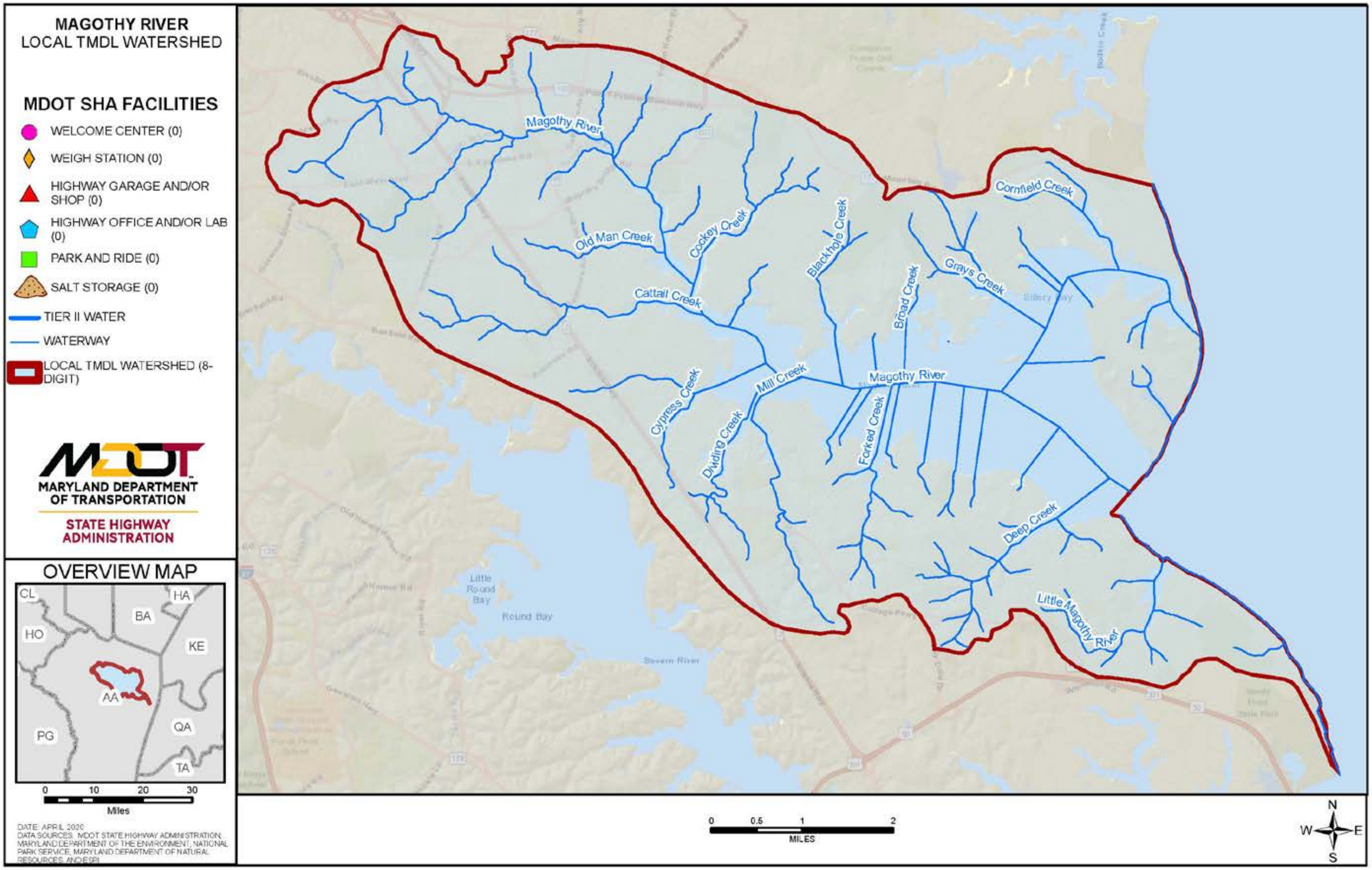


Figure 46: MODT SHA Facilities within Magothy River Watershed

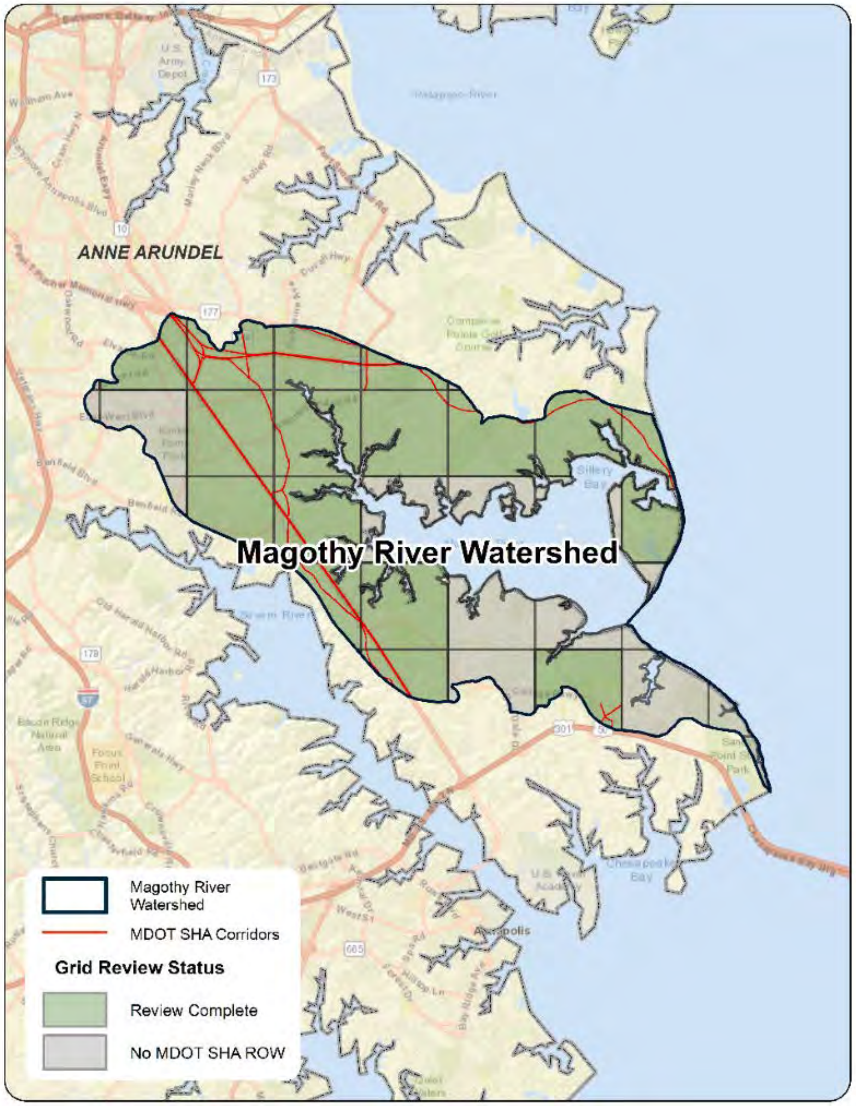


Figure 47: Magothy River Site Search Grids

F.4. Summary of County Assessment Review

The *Magothy River Watershed Assessment Comprehensive Summary Report* was published in June 2010 as a result of a collaborative effort between the Watershed Protection and Restoration Program within the Anne Arundel County Department of Public Works (AA-DPW), LimnoTech, and the Magothy River Association (AA-DPW et al., 2010). The report serves as Anne Arundel County's assessment of the 8-digit Magothy River watershed.

The Magothy River watershed is located in the northeastern portion of Anne Arundel County and is divided into 68 subwatersheds, 41 non-tidal and 27 tidal. Many sensitive environmental features can be found throughout the watershed, including wetlands, bogs primarily in the northern portion of the watershed, Greenways, forested areas, Chesapeake Bay Critical Area (CA), and Federal Emergency Management Agency (FEMA) floodplains (AA-DPW et al., 2010, p. 7-8).

Soils within the Magothy River watershed hold diverse hydrologic characteristics and erodibility; however, the majority of slopes are categorized as highly erodible (24 percent) or potentially highly erodible (66 percent). The majority of soils (62 percent) are classified as Hydrologic Group B, which indicates moderately low runoff potential. Land use within the watershed is as follows (approximately): residential (54 percent); woods (32 percent); commercial (5 percent); transportation (4 percent); open space (4 percent); industrial, forested wetland, open wetland, pasture/hay, row crops, and water (less than 1 percent). Impervious surfaces comprise approximately 22 percent of the watershed (AA-DPW et al., 2010, p. 7-8).

The stormwater BMPs in the Magothy River watershed are typically owned by private landowners, the County, or other State agencies, such as the MDOT SHA. At the time of the watershed assessment, the BMPs treated a total of 2,913 acres of drainage area. While the majority of BMPs in the watershed are owned by the county or are privately owned, the MDOT SHA-owned infiltration BMPs along State-owned roadways account for 28 acres of drainage (AA-DPW et al., 2010, p. 24-25). There are no MDOT SHA facilities located in the Magothy River watershed, however, there is ROW (**Figure 47**). The *Magothy River Watershed Assessment Comprehensive Summary Report* did not indicate water quality problems for restoration associated with ROW.

Three types of assessments were conducted for the Magothy River watershed in Anne Arundel County: stream restoration, subwatershed restoration, and subwatershed preservation.

Subwatersheds with greater than one-third of their perennial streams rated as High or Medium High priorities for restoration include: Cypress Creek (MGC), Magothy Narrows (MRM), Little Magothy River (MGV), Dividing Creek (MGH), Magothy Branch 1 (MR3), and Forked Creek (MGL) (AA-DPW et al., 2010, p. 40).

Subwatersheds rated High priorities for subwatershed restoration include: Cypress Creek (MGC), Deep Creek (MGT), Little Magothy River (MGV), Indian Village Branch (MGW), Hunters Harbor (MRD), Cattail Creek 2 (MRO), Beechwood Branch (MR5), Mill Creek (MGI), Magothy River Tidal (MGF), and Unnamed Tributary (MGA) (AA-DPW et al., 2010, p. 43).

Subwatersheds rated High priorities for subwatershed preservation include: Blackhole Creek (MRG), Otter Pond (MGE), Magothy Narrows (MRM), Cornfield Creek (MR0), Cockey Creek (MR6), Broad Creek (MGJ), Magothy Branch 1 (MR3), Magothy River Tidal (MGX), Nannys Branch (MGY), James Pond (MRJ), Rouses Branch (MRA), Brookfield Branch (MR4), Sillery Bay (MG8), and Podickery Creek (MGZ) (AA-DPW et al., 2010, p. 44).

MDOT SHA has completed a tree planting in the Magothy Branch 1 (MR3) subwatershed and installed a new efficiency BMP in the Dividing Creek (MGH) and Mill Creek (MGI) subwatershed (**Figure 48**).

Anne Arundel County presented six generalized restoration projects that represent a wide range of commonly used options with proven effectiveness in terms of implementability, cost, and performance (AA-DPW et al., 2010). Practices that may be applicable to MDOT SHA have been italicized.

1. Shallow marsh and regenerative wetland seepage system;
2. Regenerative step pool outfall sand filtration device;
3. Dry pond retrofit;
4. Concrete ditch retrofit to water quality swale;
5. *Enhanced stormwater retrofit (bioretention facility);* and
6. Onsite sewage discharge systems retrofits.

A bacteria source analysis was conducted by MDOT SHA for the Magothy River subsegment watershed. No point sources were identified in the TMDL document (MDE, 2006g).

F.5. MDOT SHA Pollutant Reduction Strategies

A subsegment of the Magothy River watershed is listed for bacteria with a TMDL baseline year of 2001. **Table 2** presents the reduction requirement for Magothy River subsegment watershed bacteria TMDL along with the Target Year for achieving the reduction. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in **Section E.3.c**.

Proposed practices to meet bacteria reductions in the Magothy River subsegment watershed are shown in **Table 45**. Projected bacteria reductions using these practices are 86 billion counts/day which is 2.2 percent of the reduction target. These practices are described in **Section E** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the baseline is 2001;
- BMPs implemented after the baseline through fiscal year 2020;

- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Magothy River subsegment watershed total $137,000. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 46** for a summary of estimated BMP costs.

Figure 48 shows a map of MDOT SHA watershed restoration practices in the Magothy River subsegment watershed. The practices shown only include those that are under design and constructed.

Table 45: Magothy River Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2001)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	54.2	2.0		N/A	2.0
Cross-Jurisdictional[1]	drainage area acres	13.8			N/A	
Annual Load Reductions	Fecal coliform billion counts/day	8,599.5	86.0		N/A	86.0

[1] Cross-jurisdictional BMPs may be a mix of various stormwater control structures.
[2] Refer to Table 2 for Target Year.

Table 46: Magothy River Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater	$137,000		N/A	$137,000
			Total Restoration Cost	$137,000

[1] Costs do not include maintenance, inspection, or remediation for built BMPs.
[2] Refer to Table 2 for Target Year.

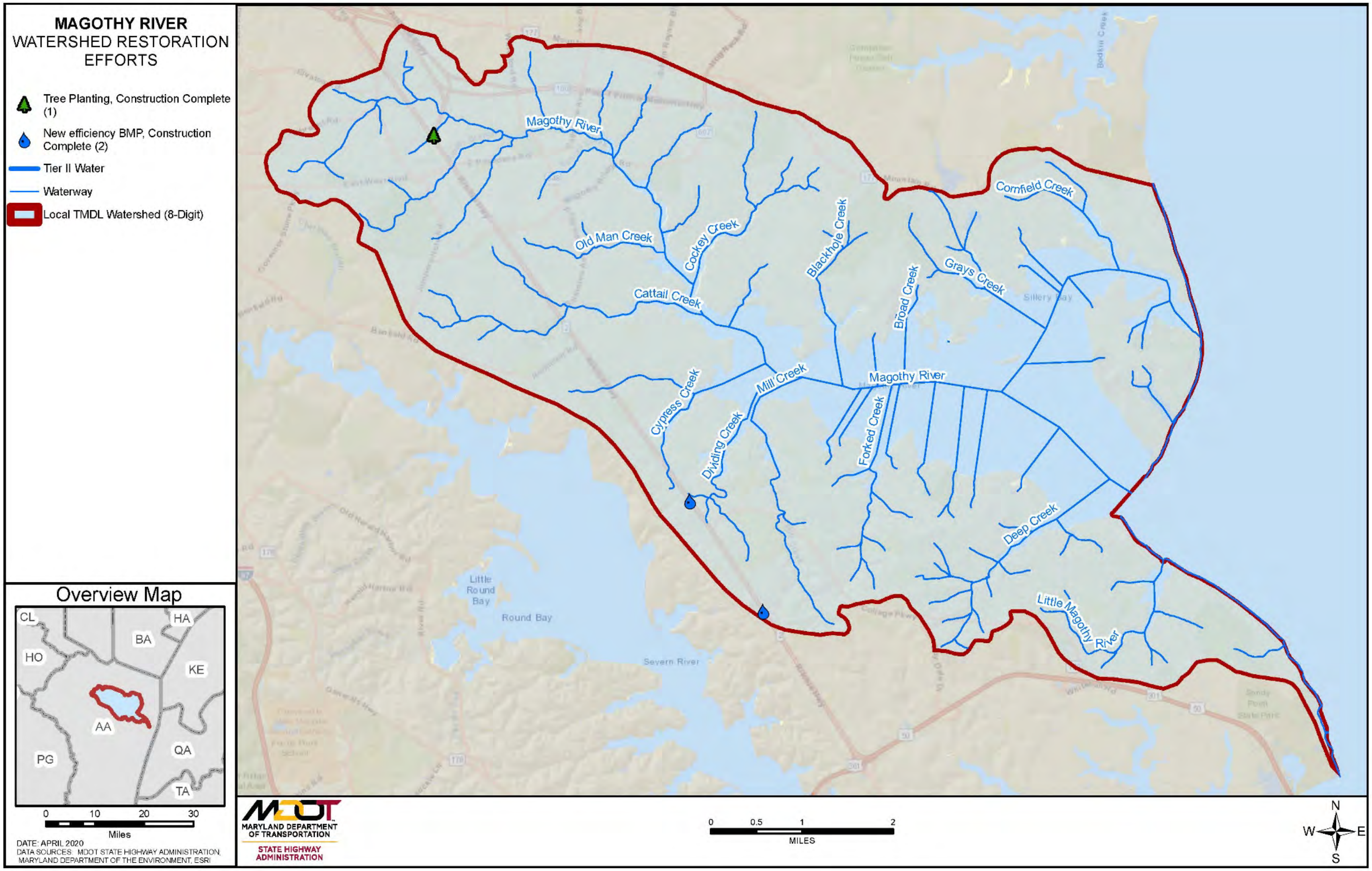


Figure 48: MDOT SHA Programmed Restoration Strategies within the Magothy River Watershed

F14. MATTAWOMAN CREEK

F.1. Watershed Description

Located south of the District of Columbia dividing Charles County to the south and Prince George's County to the north, the Mattawoman Creek watershed (MD 8-digit Basin Code: 02140111) is a shallow, tidally influenced embayment of the Potomac River Estuary that encompasses 97.62 square-miles of drainage area (62,474 acres) (MDE, 2005c).

Mattawoman Creek is designated as Use I - Water Contact Recreation, Fishing, and Protection of Aquatic Lift and Wildlife and Use II- Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting (Tetra Tech, 2015b).

There are 97 centerline miles of MDOT SHA roadway located within the Mattawoman Creek watershed. The associated ROW encompasses 855 acres, of which 479 acres are impervious. MDOT SHA facilities located within the Mattawoman Creek watershed consist of one salt storage facilities. See **Figure 49** for a map of the watershed.

F.2. MDOT SHA TMDLs within Mattawoman Creek Watershed

MDOT SHA is included in the nitrogen and phosphorus TMDLs (MDE, 2005c) with a reduction requirement of 54.0 and 47.0 percent, respectively, as shown in **Table 2.**

There is also a TMDL for PCBs in the Mattawoman Creek Tidal Fresh watershed; however, PCB loads from NPDES regulated stormwater will be achieved through reductions in atmospheric deposition and do not have to be addressed directly. Therefore, there are no MDOT SHA reduction requirements for this TMDL.

F.3. MDOT SHA Visual Inventory of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C,** describes the MDOT SHA visual assessment process. For each BMP type, implementation teams have performed preliminary evaluations for each grid and/or major state route corridor within the watershed as part of desktop and field evaluations. The grid-system used for the Mattawoman Creek watershed is shown in **Figure 50** which illustrates that 76 grid cells have been reviewed, encompassing portions of 13 state route corridors. Results of the visual inventory categorized by BMP type follow:

Structural SW Controls

Preliminary evaluation identified 104 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- Five sites constructed or under contract.
- 92 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- Seven sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 72 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 29 sites constructed or under contract.

- Eight additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 35 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

No stream restoration sites were identified within this watershed for potential restoration.

Grass Swale Rehabilitation

Preliminary evaluation identified 97 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- 19 additional sites deemed potentially viable for a new structural SW control and pending further analysis, may be candidates for future restoration opportunities.
- 78 sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

Preliminary evaluation identified 37 outfalls potential for stabilization. Further analysis of these sites resulted in:

- 37 outfall sites deemed not viable for outfall stabilization and have been removed from consideration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified 17 existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- One site constructed or under contract.
- One retrofit site deemed potentially viable for retrofit and pending further analysis may be a candidate for future restoration opportunities.
- 15 retrofit sites deemed not viable for retrofit and have been removed from consideration.

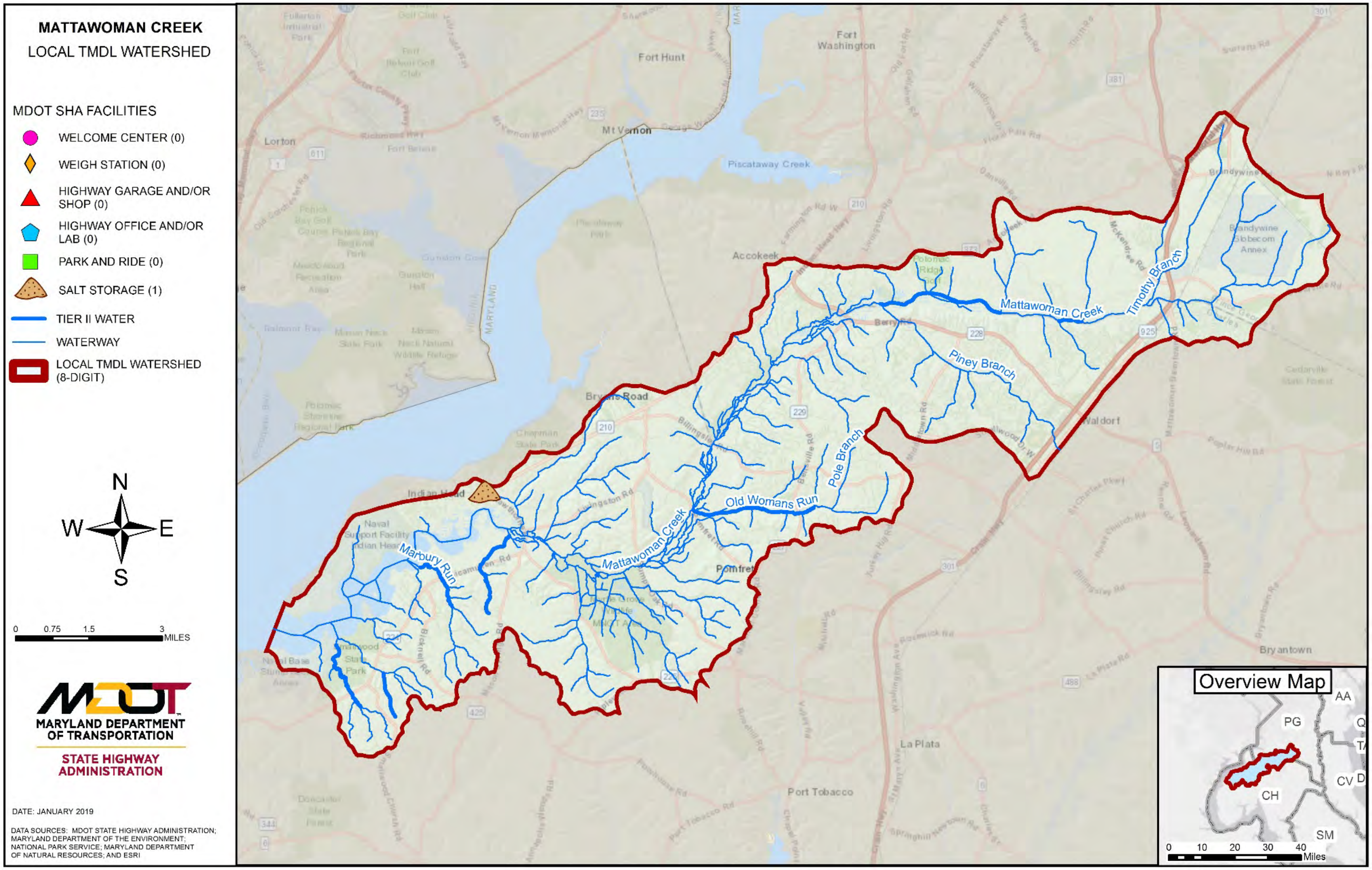


Figure 49: MODT SHA Facilities within Mattawoman Creek Watershed

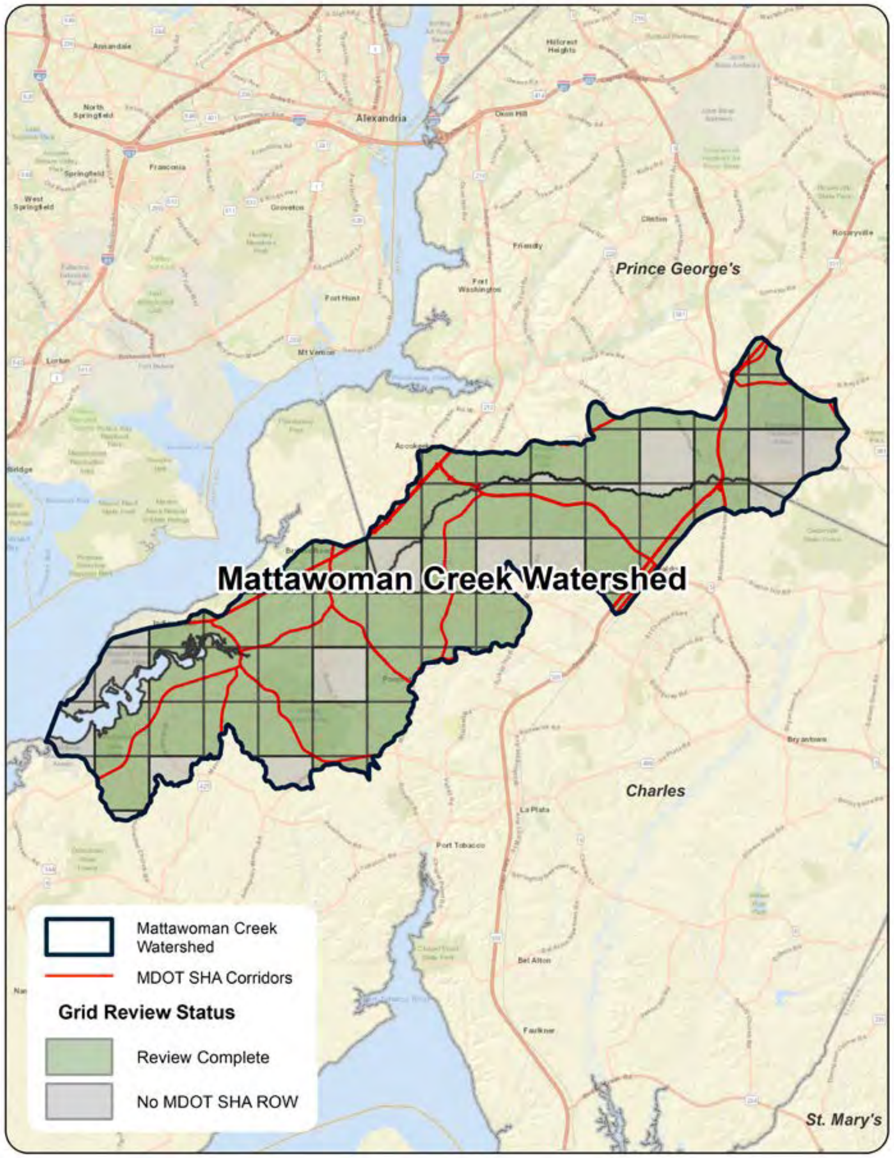


Figure 50: Mattawoman Creek Site Search Grids

F.4. County Assessment Review Summary

Waters within the Mattawoman Creek watershed are subject to the following impairments as noted on MDE's 2018, 303(d) List:

- Chlorides;
- Nitrogen (Total);
- PCB in Fish Tissue;
- Phosphorous (Total);
- pH, low.

In December 2015, Tetra Tech, Inc. completed the *Restoration Plan for the Mattawoman Creek Watershed in Prince George's County* (Tetra Tech, 2015b) for the Prince George's County Department of the Environment Stormwater Management Division – hereinafter referred to as the "Prince George's County Plan".

In June 2016, KCI Technologies, Inc. completed the *Mattawoman Creek Watershed Assessment* (KCI, 2016) for the Charles County Department of Planning and Growth Management Watershed Protection and Restoration Program – hereinafter referred to as the "Charles County Plan".

The Mattawoman Creek watershed is located within the Coastal Plain Province in the most south region of Prince George's County and the northwest region of Charles County. The total drainage area within Prince George's County is approximately 16,000 acres. The majority of area within both counties, besides the federal and state government properties, is covered by the County's MS4 permit (Tetra Tech, 2015b, p. 9).

Land cover varies greatly throughout the watershed. In Charles County, the watershed is predominately forested (53 percent) followed by developed land (39 percent) and agriculture (7 percent). In Prince George's County, the land cover is also predominately forested (61.31 percent), followed by urban (18.07 percent), and agriculture (15.95

percent). The areas dominated by urban and suburban land use include the towns of Waldorf and Brandywine. Major named tributaries include; Harrison Cut, Piney Branch, Old Woman's Run, Laurel Branch, Timothy Branch, and Marbury Run (Tetra Tech, 2015b, p. 6-9).

The soils of the Prince George's County portion of the watershed are moderately well drained with the majority of the soils being classified as hydrologic Group C. There is 1,026.0 acres of impervious area within the watershed with the majority comprised of roads and highways (35.74 percent of impervious), parking lots (23.33 percent), and buildings (18.20 percent) (Tetra Tech, 2015b, p. 14).

The DNR stated that the "Mattawoman [watershed] represents as near to ideal conditions as can be found in the northern Chesapeake Bay" and "Mattawoman is the best, most productive tributary in the Bay." This watershed is considered a high-quality aquatic ecosystem and supports rare and diverse animal assemblages. Portions of the nontidal stream system have excellent water quality and biodiversity, including one MD DNR Maryland Biological Stream Survey's Sentinel Site, Tier II waters, and stronghold watersheds (Tetra Tech, 2015b, p. 16).

The Prince George's County portion of the watershed is broken down further into 13 subwatersheds that are referred to as "MC-1" through "MC-13". These subwatersheds were prioritized and ranked for implementation of BMPs by ranking the total load reductions for each TMDL parameter and then averaging the individual ranks to obtain an overall rank for the subwatershed (Tetra Tech, 2015b, p. 58-59).

In the Charles County Plan, watershed assessment methods including upland assessments, a nutrient synoptic survey, neighborhood source assessment reconnaissance, hotspot site investigations, stream corridor assessment, and water quality investigations were completed. Individual projects, as opposed to subwatersheds, were then ranked based on benefits, constraints, and cost. The projects with the lowest rank number represent projects that have the greatest benefits and the least constraints compared to the rest of the projects. This served as the prioritization of projects.

The Prince George's County Plan highlights five main BMP types:

1. Runoff Reduction Practices;
2. Stormwater Treatment Practices;
3. Alternative Practices;
4. Load Reductions from Street Debris;
5. Structural Practices not meeting MDE Manual Performance Criteria.

Charles County had similar BMP categorization and further highlighted additional strategies such as reforestation, shoreline erosion control, inlet cleaning, trash clean-up, and homeowner practices.

The Prince George's Plan determined subwatersheds MC-1 and MC-9 were ranked as the highest priority, followed by MC-2 and MC-8. These watersheds correlate to where the most impervious area coverage is as MC-1 has the highest amount of impervious cover at 776.2 acres, followed by MC-9 with 412.4 acres, MC-2 with 393.9 acres, and MC-8 with 289.1 acres.

The Charles County Plan prioritized reforestation and trash cleanup projects due to their relatively low cost and low constraints. Beyond these projects, there is a diversity of high priority projects including wet pond retrofits, step pool stormwater conveyance, and stream restorations (KCI, 2016).

There are no MDOT SHA facilities other than roadway ROW within the Prince George's County portion of the Mattawoman watershed. The *Restoration Plan for the Mattawoman Creek Watershed in Prince George's County* did not indicate water quality problems for restoration associated with MDOT SHA facilities or ROW. MDOT SHA has completed one retrofit and multiple tree plantings within the Prince George's County portion of the watershed (**Figure 51**).

There is one salt storage MDOT SHA facility other than roadway ROW within the Charles County portion of the Mattawoman watershed. The

Mattawoman Creek Watershed Assessment did not indicate water quality problems for restoration associated with MDOT SHA facilities or ROW. MDOT SHA has completed multiple tree plantings (with eight proposed tree plantings) and five new efficiency BMPs within the Charles County portion of the watershed (**Figure 51**).

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirements for the Mattawoman Creek watershed TMDL pollutants along with the Target Year for achieving the reductions. Mattawoman Creek is listed for both nitrogen and phosphorus with a TMDL baseline year of 2000 for both pollutants. MDOT SHA is over programming restoration projects to treat 115 percent of the required pollutant loads as an adaptive management strategy. This treatment buffer will allow MDOT SHA to achieve the reduction targets even if some planned projects are eliminated prior to construction due to site design limitations or any other situation that may result in removing the project from the plan. The implementation required to treat 115 percent of the nitrogen reduction target results in over treating for phosphorus (i.e., less BMPs were needed to treat the phosphorus reduction target than were needed to treat the nitrogen reduction target).

Proposed practices to meet nitrogen and phosphorus reductions in the Mattawoman Creek watershed are shown in **Table 47**. Projected nitrogen and phosphorus reductions using these practices are 3,301 lbs./yr. and 419 lbs./yr. which are 115.0 percent and 128.5 percent of the reduction target, respectively. These practices are described in **Section E** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the baseline is 2000 for both nitrogen and phosphorus;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Mattawoman Creek watershed total $67,764,500. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 48** for a summary of estimated BMP costs.

Figure 51 shows a map of MDOT SHA watershed restoration strategies throughout the Mattawoman Creek watershed. The practices shown only include those that are under design or constructed.

Table 47: Mattawoman Creek Restoration Nitrogen & Phosphorus BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2000)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	24.7	10.2		1,347.5	1,357.7
Stormwater Retrofit	drainage area acres		4.8			4.8
Grass Swale	drainage area acres	77.4				
Tree Planting	acres of tree planting		102.9			102.9
Inlet Cleaning[1]	dry tons		9.1			9.1
Pipe Cleaning[1]	dry tons		4.8			4.8
Street Sweeping[1]	acres swept		69.7			69.7
Impervious Disconnects	credit acres	12.6				
Annual Load Reductions	TN EOS lbs./yr.	472.1	481.1		2,820.3	3,301.4
	TP EOS lbs./yr.	77.0	48.3		370.3	418.5

[1] *Inlet cleaning, pipe cleaning, and street sweeping are annual practices. They are reflected only once for the year the annual reduction is achieved. Once achieved, this annual reduction will be sustained each year the load reduction is claimed.*

[2] *Refer to Table 2 for Target Year.*

Table 48: Mattawoman Creek Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater	$753,000		$63,279,000	$64,032,000
Stormwater Retrofit	$202,000			$202,000
Tree Planting	$3,471,000			$3,471,000
Inlet Cleaning	$52,000			$52,000
Pipe Cleaning	$500			$500
Street Sweeping	$7,000			$7,000
			Total Restoration Cost	$67,764,500

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs. Costs for operational BMPs (inlet cleaning, pipe cleaning, and street sweeping) are annual costs that are incurred each year to sustain load reductions.*

[2] *Refer to Table 2 for Target Year.*

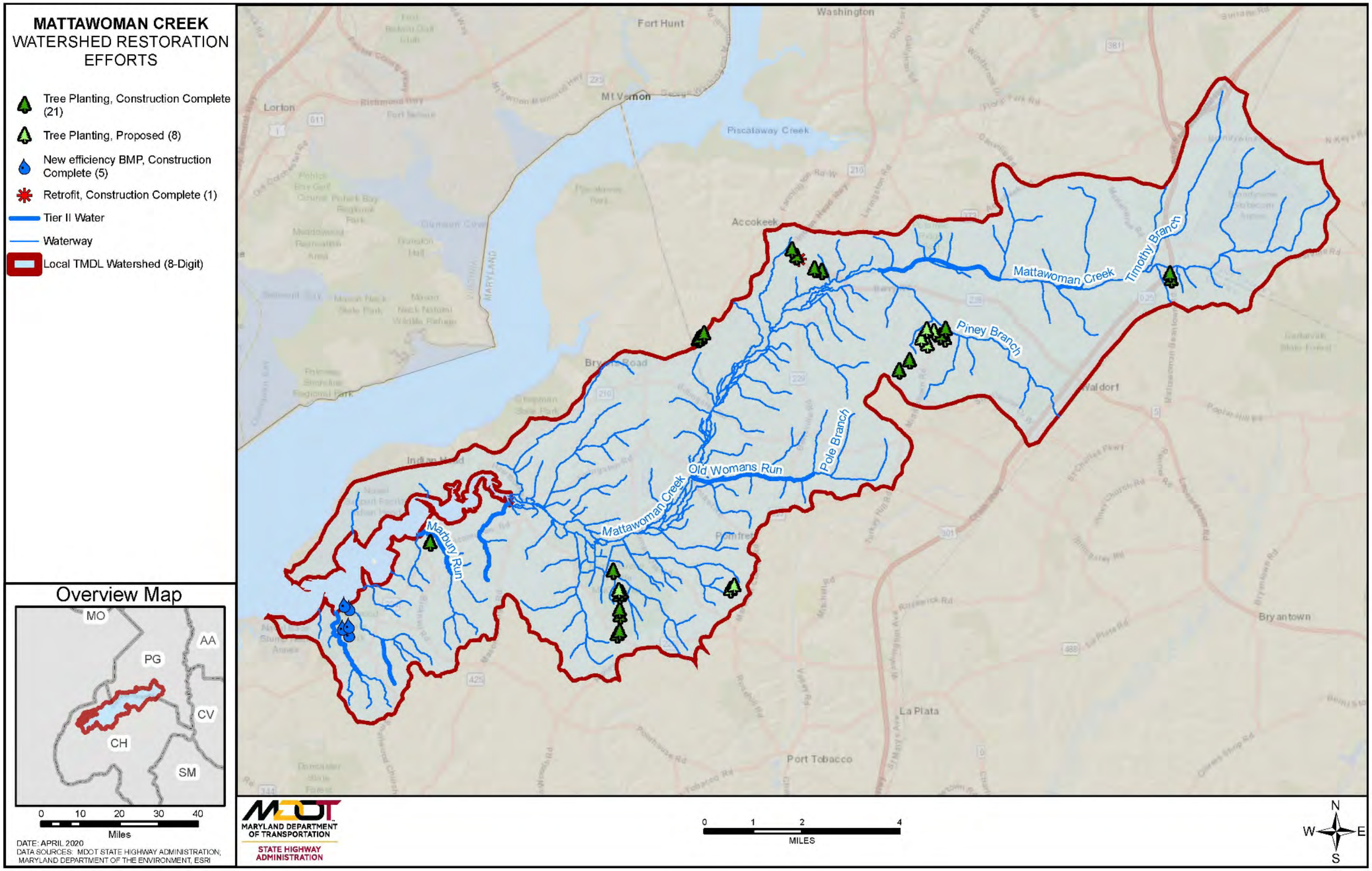


Figure 51: MDOT SHA Restoration Strategies within the Mattawoman Creek Watershed

F15. PISCATAWAY CREEK WATERSHED

F.1. Watershed Description

The Piscataway Creek watershed (MD 8-digit Basin Code: 02140203) encompasses approximately 69 square miles (44,160 acres) entirely within Prince George's County, Maryland. Headwaters of the Piscataway Creek begin to the east and west of the Andrews Air Force Base (AFB) around the Camp Springs, Clinton, and Woodyard areas of Prince George's County.

The non-tidal portion of the Piscataway Creek water are designated as Use I – Water Contact Recreation, and Protection of Nontidal Warmwater Aquatic Life, and the tidal tributaries are designated Use Class II - Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting (MDE, 2019).

On the 2018 MDE 303(d) List the following impairments were listed for the Piscataway Creek watershed (MDE, 2018):

- Chloride;
- *Escherichia coli* (E. Coli);
- Nitrogen, Total;
- Phosphorus, Total;
- PCBs in Fish Tissue; and
- Total Suspended Solids (TSS).

There are 52 centerline miles of MDOT SHA roadway located within the Piscataway Creek watershed. The associated ROW encompasses 702 acres, of which 315 acres are impervious.

As indicated on the map in **Figure 52** there are no MDOT SHA facilities within the Piscataway Creek watershed.

F.2. MDOT SHA TMDLs within Piscataway Creek Watershed

MDOT SHA is included in the sediment TMDL (MDE, 2019) and *E.coli* bacteria TMDL (MDE, 2006h) for a subwatershed of Piscataway Creek. This plan will focus on the Bacteria TMDL which is to be reduced by 42.5 percent, as shown in **Table 2**.

There is also a TMDL for PCBs in the Piscataway Creek watershed; however, PCB loads from NPDES regulated stormwater will be achieved through reductions in atmospheric deposition and do not have to be addressed directly. Therefore, there are no MDOT SHA reduction requirements for this TMDL.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** of this plan**,** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major State route corridor within the watershed as part of desktop and field evaluations. The grid-system used for the Piscataway Creek watershed is shown in **Figure 53** which illustrates that seventeen grid cells have been reviewed, encompassing portions of five State route corridors. Potential BMP sites identified as part of the visual inspections follow.

Structural Stormwater Controls

Preliminary evaluation identified 49 locations as potential new structural stormwater (SW) control locations. Further analysis of these locations resulted in:

- 43 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.

- Six sites have been removed from consideration.

Tree Planting

Preliminary evaluation identified 61 locations as potential tree planting locations. Further analysis of these locations resulted in:

- Six sites constructed.
- 10 additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 45 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified 19 sites as potential stream restoration locations. Further analysis of these locations resulted in:

- Seven additional sites deemed potentially viable for stream restoration and pending further analysis may be candidates for future restoration opportunities.
- 12 sites deemed not viable for stream restoration and have been removed from consideration.

Grass Swale Rehabilitation

No grass swale sites were identified in this watershed for restoration.

Outfall Stabilization

Preliminary evaluation identified 156 outfalls with potential for stabilization. Further analysis of these sites resulted in:

- Seven sites constructed or under contract.
- Nine outfall sites deemed potentially viable for outfall stabilization efforts and pending further analysis, may be candidates for future restoration opportunities.
- 140 outfall sites deemed not viable for outfall stabilization and have been removed from consideration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified 11 existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- Three sites constructed or under contract.
- Two retrofit sites deemed potentially viable for retrofit and pending further analysis may be candidates for future restoration opportunities.

Six retrofit sites deemed not viable for retrofit and have been

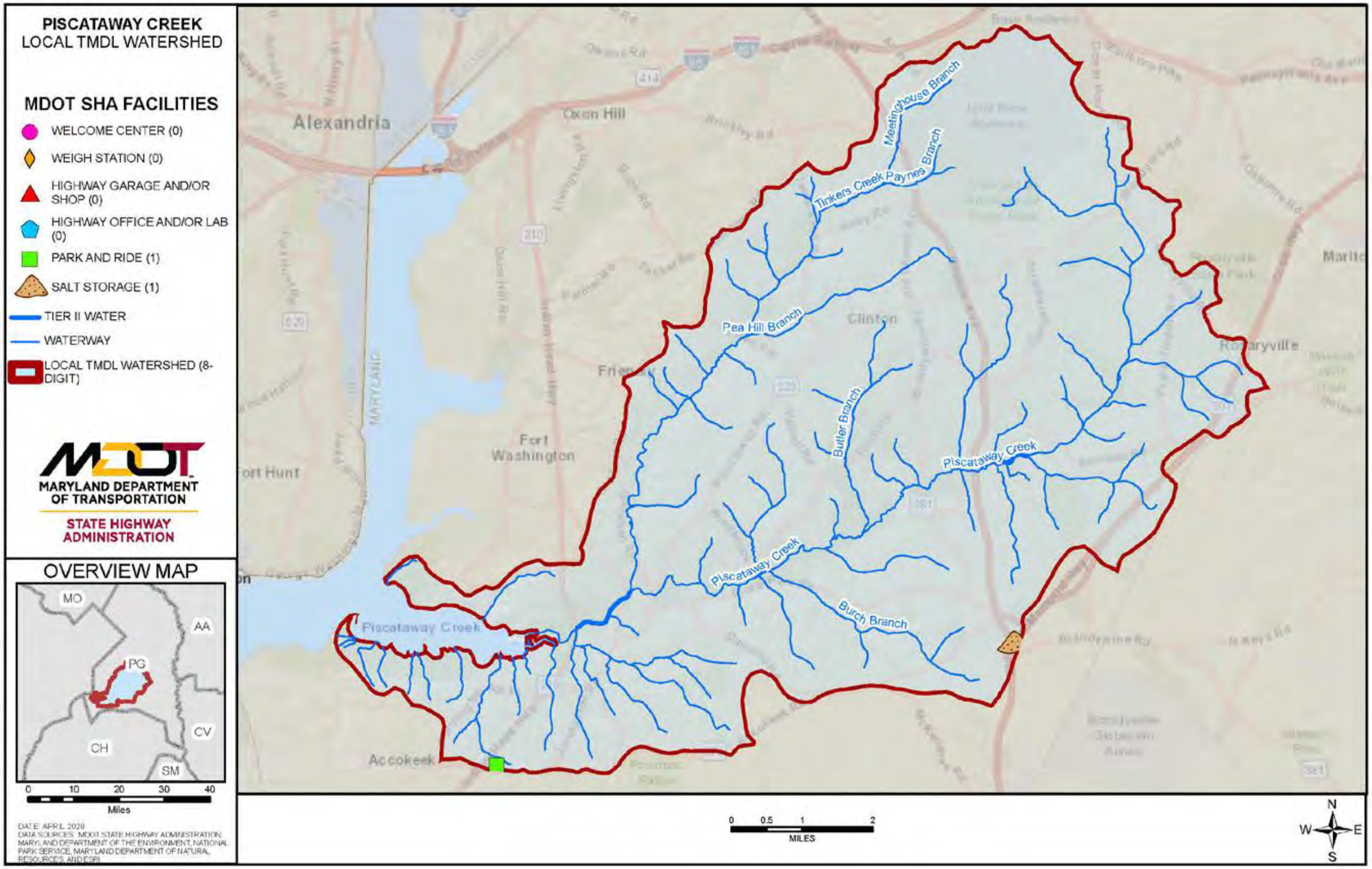


Figure 52: MDOT SHA Facilities within Piscataway Creek Watershed

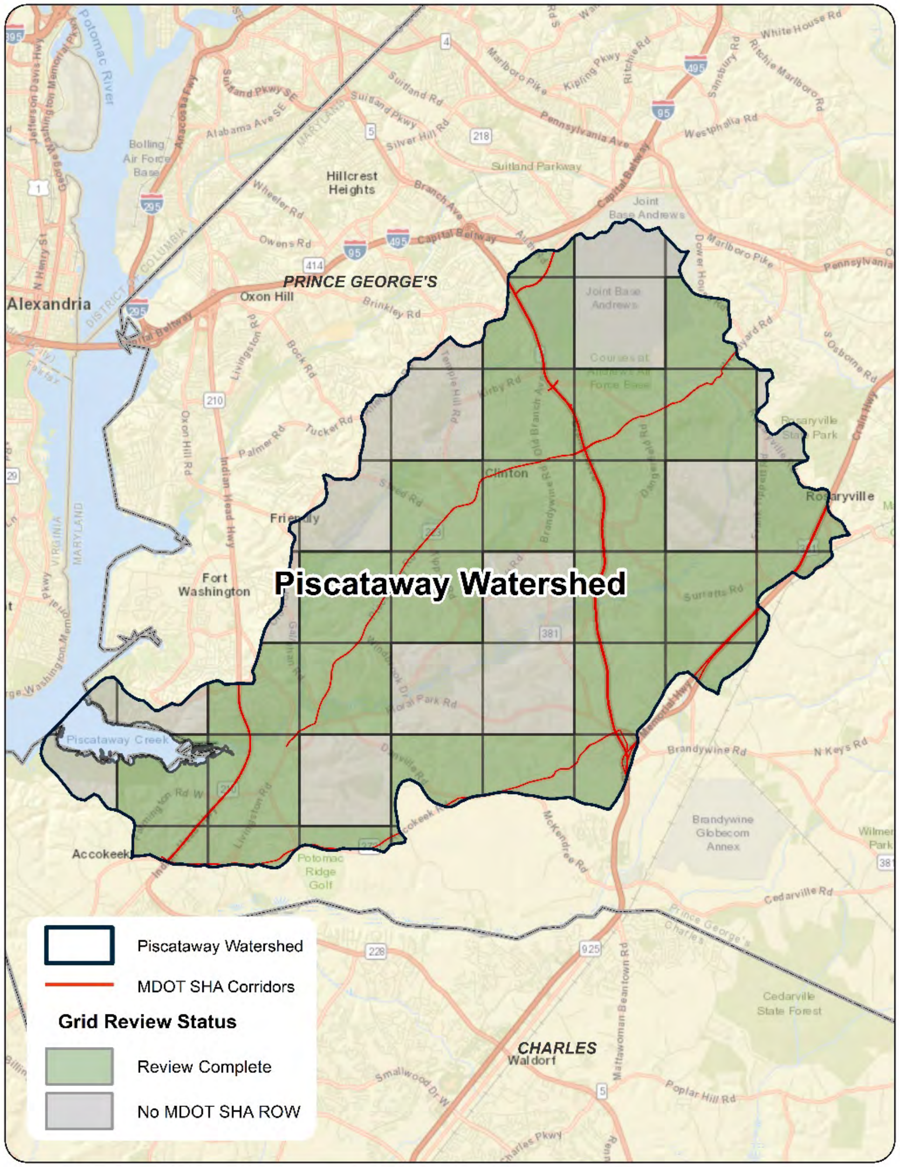


Figure 53: Piscataway Creek Site Search Grids

F.4. Summary of County Assessment Review

In December 2015, the *Restoration Plan for the Piscataway Creek Watershed in Prince George's County* was prepared for the Prince George's County Department of the Environment Stormwater Management Division by Tetra Tech, Inc. (Tetra Tech, 2015c). The plan serves as the first stage in watershed-based planning to protect, restore, and enhance habitat in the watershed (Tetra Tech, 2015c). The Piscataway Creek watershed has completed TMDLs for bacteria and PCBs.

The Piscataway Creek watershed lies across the southwestern portion of Prince George's County. The Piscataway Creek watershed is divided into two major subwatersheds, the mainstem of the Piscataway Creek and Tinkers Creek. Most of the land in the northern watershed (Tinkers Creek) is drained by MS4 outfalls. Land use within the watershed are as follows; Urban (45 percent), Forest (43 percent), Agriculture (10 percent), and Other and Water and Wetlands (3 percent). Impervious area covers 5,812 acres (9 square miles), approximately 13 percent of the total watershed (Tetra Tech, 2015c, p. 11). Roadways (27.9 percent) and roofs (25.2 percent) are the largest groups of impervious surfaces (Tetra Tech, 2015c, p. 15). Many areas of the Piscataway Creek watershed were developed before the adoption of stormwater regulations and practices in the 1970s and 1980s, when no stormwater management facilities existed (Tetra Tech, 2015c, p. 13). The majority of soils within the watershed are categorized by Group C (46 percent in the mainstem subwatershed and 45 percent in the Tinkers Creek subwatershed) and Group B (30 percent in both subwatersheds), indicating low to moderate infiltration rates and runoff potential (Tetra Tech, 2015c, p 10).

Two countywide bioassessment studies were completed, one in 1999-2003 and the second in 2010-2013. Results showed that approximately 60 percent of sites within the Piscataway Creek watershed were rated as biologically degraded, having Benthic Index of Biotic Integrity ratings of Poor to Very Poor and ten percent were rated Good. Degraded stream miles accounted for approximately 67 percent of the total stream miles in the Tinkers Creek subwatershed and 15 percent of the total stream miles in the mainstem of Piscataway Creek (Tetra Tech, 2015c, p 17).

There are two MDOT SHA Facilities, one salt storage and one park and ride, located within the Piscataway Creek Watershed in addition to roadway ROW (**Figure 52**). The *Restoration Plan for the Piscataway Creek Watershed in Prince George's County* did not indicate water quality problems for restoration associated with MDOT SHA Facilities or ROW.

The Restoration Plan ranked and prioritized 33 subwatersheds for restoration. Subwatersheds PC-14 and PC-11, both of which are at the headwaters to Tinkers Creek, were the highest ranked for fecal coliform bacteria, and thus are the highest ranked subwatersheds as a whole. Subwatershed PC-14 had the highest total impervious cover of 489.9 acres, which includes the highest amount of ROW/Transportation, Institutional, Commercial/Industrial, and residential coverage of the other 32 subwatersheds. Overall, the subwatersheds ranked as the highest priorities were in areas with greater amounts of impervious cover. These subwatersheds are primarily located along MD Route 5. A detailed map of prioritized subwatersheds can be found in the plan; Figure 5-3 (Tetra Tech, 2015c, p. 55-57).

Implementation activities proposed by the County for the Piscataway Creek Watershed include programmatic initiatives and BMP implementation that may be applicable to MDOT SHA. Programmatic initiatives include, but are not limited to, the Clean Water Partnership Program, Street Sweeping, and Storm Drain Maintenance: Inlet, Storm Drain, and Channel Cleaning. Programmatic initiatives such as Mater Gardeners and Animal Management Programs often rely on public involvement. BMP implementation strategies include first upgrading dry ponds, then installing ESD BMPs on public ROW and public areas, and lastly installing BMPs on privately owned land. BMP types and locations are not explicitly specified in the plan to allow for flexibility in selecting practices as well as an adaptive management approach (Tetra Tech, 2015c, p. 28-39).

A bacteria source analysis was conducted by MDOT SHA for the Piscataway Creek watershed to identify specific potential sources. One WWTP was identified in the bacteria TMDL document (MDE, 2006h) with an active NPDES permit regulating the discharge of fecal bacteria into the Piscataway Creek watershed, Cheltenham Boy's Village Youth Facility WWTP.

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirement for the Piscataway Creek watershed TMDL pollutant along with the Target Year for achieving the reduction. Piscataway Creek is listed for bacteria having a baseline year of 2003 for bacteria. A treatment buffer was not applied to bacteria because this pollutant is not treated exclusively through stormwater or alternative BMPs. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in **Section E.C.3**.

Proposed practices to the bacteria reduction in the Piscataway Creek watershed are shown in **Table 49**. The projected bacteria reduction using these practices are 682 billion MPN/yr. which is 5.0 percent of the reduction target. These practices are described in **Section E.** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the baseline for bacteria is 2003;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Piscataway Creek watershed total $4,849,000. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 50** for a summary of estimated BMP costs.

Figure 54 shows a map of MDOT SHA watershed restoration strategies throughout the Piscataway Creek watershed. The practices shown only include those that are under design and constructed.

Table 49: Piscataway Creek Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2003)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	54.0			N/A	
Stormwater Retrofit	drainage area acres		82.3		N/A	82.3
Cross-Jurisdictional[1]	drainage area acres	0.9			N/A	
Annual Load Reductions	E.coli billion MPN/day	8,513.7	682.0		N/A	682.0

[1] *Cross-jurisdictional BMPs may be a mix of various stormwater control structures.*
[2] *Refer to Table 2 for Target Year.*

Table 50: Piscataway Creek Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
Stormwater Retrofit	$4,849,000			$4,849,000
			Total Restoration Cost	$4,849,000

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs.*
[2] *Refer to Table 2 for Target Year.*

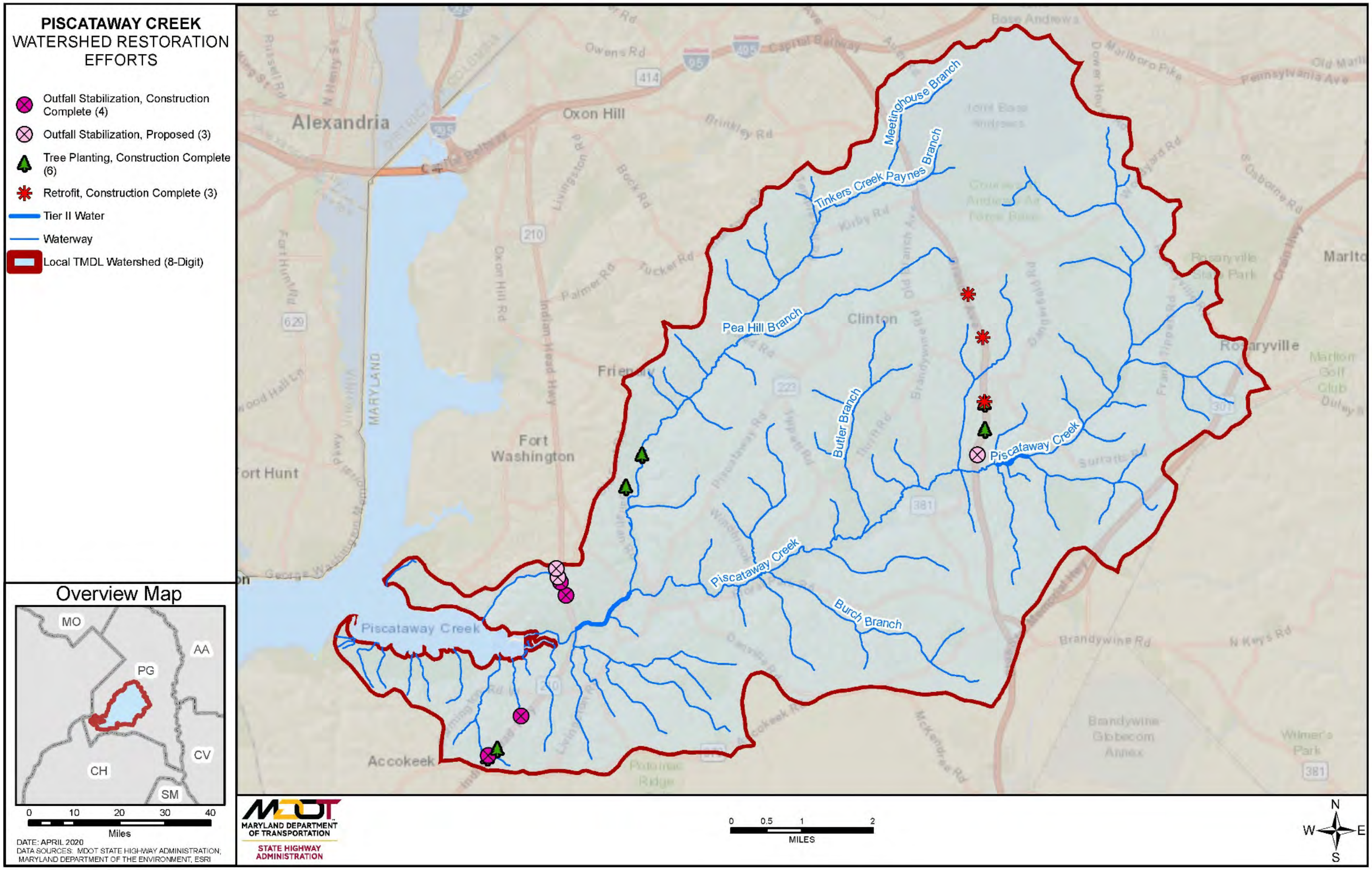


Figure 54: MDOT SHA Programmed Restoration Strategies within the Piscataway Creek Watershed

F16. ROCK CREEK WATERSHED

F.1. Watershed Description

The Rock Creek watershed encompasses 61 square miles within Montgomery County, Maryland and Washington, D.C. Rock Creek headwaters are located in the Laytonsville area from which the river flows south to Washington, D.C, where it empties into the Potomac River. Tributary creeks and streams of the Rock Creek Watershed include Alexandra Aqueduct, Crabbs Creek, Mill Creek, and North Branch Rock Creek. The Rock Creek watershed in Maryland comprises primarily of residential land use, covering approximately 65 percent of the watershed. Municipal/institutional land comprises approximately ten percent, and roadway comprises approximately eight percent. Approximately six percent is identified as forest, open water, or bare ground.

There are 801.0 centerline miles of MDOT SHA roadway located within the Rock Creek watershed. The associated ROW encompasses 1,358.1 acres, of which 832.8 acres are impervious. MDOT SHA facilities located within the watershed consist of one salt storage facility and one highway garage or shop. See **Figure 55** for a map of the watershed.

F.2. MDOT SHA TMDLs within Rock Creek Watershed

MDOT SHA is included in the phosphorus (MDE, 2013e), sediment (MDE, 2011j) TMDLs.

MDOT SHA is also included in the *enterococci* bacteria TMDL (MDE, 2007c) for the non-tidal portion of the Rock Creek watershed. This plan will focus on the bacteria TMDL which is to be reduced by 96.5 percent, as shown in **Table 2**.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Rock Creek watershed is shown in **Figure 56** which illustrates that 45 grid cells have been reviewed, encompassing portions of 25 state route corridors. Potential BMP sites identified as part of the visual inspections follow:

Structural SW Controls

Preliminary evaluation identified 147 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- 83 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.

- 64 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 20 locations as potential tree planting locations. Further analysis of these locations resulted in:

- Seven sites constructed or under contract.

- One additional site deemed potentially viable for tree planting and pending further analysis, may be a candidate for future restoration opportunities.

- 12 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified 12 sites as potential stream restoration locations. Further analysis of these locations resulted in:

- Three sites constructed or under contract.
- One additional site deemed potentially viable for stream restoration and pending further analysis, may be a candidate for future restoration opportunities
- Eight sites deemed not viable for stream restoration.

Grass Swale Rehabilitation

Preliminary evaluation identified nine sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- Five additional site deemed potentially viable for new structural SW control and pending further analysis, may be a candidate for future restoration opportunities.
- Four sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

Preliminary evaluation identified 40 outfalls potential for stabilization. Further analysis of these sites resulted in:

- One outfall site deemed potentially viable for outfall stabilization efforts and pending further analysis, may be a candidate for future restoration opportunities.
- 39 outfall sites deemed not viable for outfall stabilization and have been removed from consideration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified 13 existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- Three sites constructed or under contract.
- Four retrofit sites deemed potentially viable for retrofit and pending further analysis may be candidates for future restoration opportunities.
- Six retrofit sites deemed not viable for retrofit and have been removed from consideration.

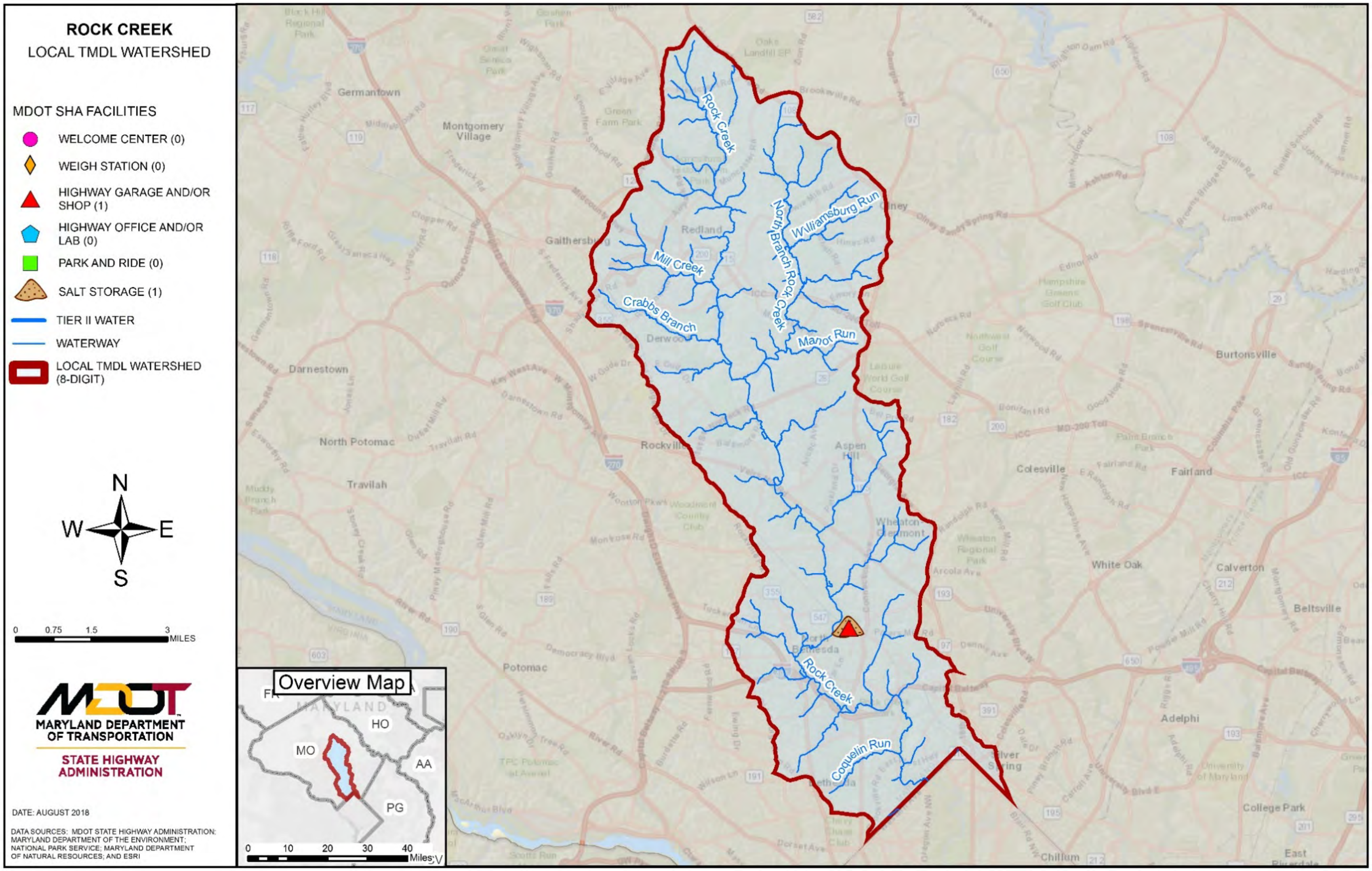


Figure 55: MDOT SHA Facilities within Rock Creek Watershed

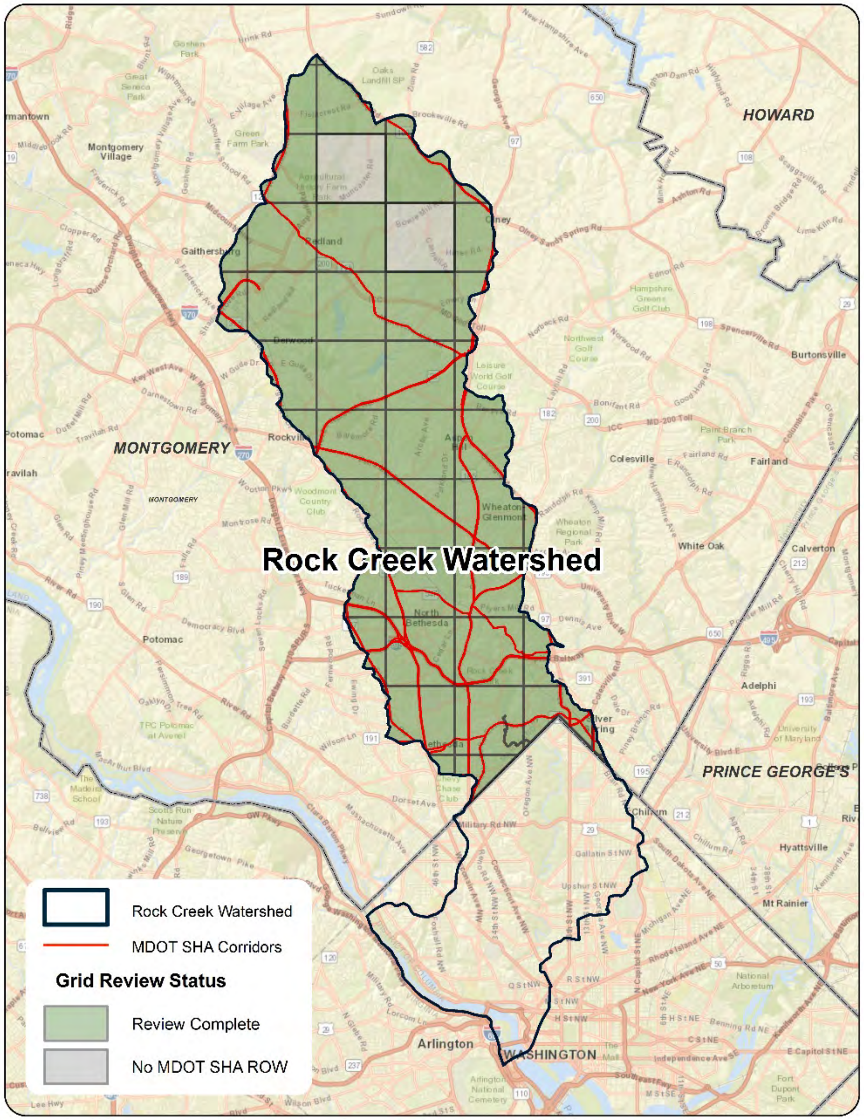


Figure 56: Rock Creek Site Search Grids

F.4. Summary of County Assessment Review

Waters within the Rock Creek watershed are subject to the following impairments as noted on MDE's 303(d) List:

- *Enterococcus*;
- Phosphorus (Total);
- Temperature, water; and
- TSS.

The *Rock Creek Implementation Plan* (Biohabitats et al., 2012c), prepared for the Montgomery County Department of Environmental Protection, was adopted in January 2012. This document provides a comprehensive plan for watershed restoration targeting bacteria reduction, sediment and nutrient reduction, runoff management and impervious cover treatment, and trash management.

The MS4 Permit area land use in the watershed encompasses 69 percent of the total watershed (27,300 acres). Impervious cover subject to MS4 Permit is approximately 24 percent of the watershed (6,600 acres). The impervious cover excluded federal and state roads (Biohabitats et al., 2012, p. 5).

Residential land use is the dominant land use in the MS4 permit watershed, covering about 65 percent of the watershed. This is followed by municipal/institutional at 13 percent and roadways at 8 percent. Commercial development is 4 percent and rural land use is 5 percent. The watershed is largely built-out, with just over 6 percent identified as forest, open water, or bare ground (Biohabitats et al., 2012, p. 8).

The majority of the stream resource conditions in Rock Creek were assessed as "fair" (53 percent), 18 percent were assessed as "good," and 22 percent as "poor." The remaining 2 percent were assessed as "excellent." Approximately 5 percent of the streams were not accessed (Biohabitats et al., 2012, p. 10).

Montgomery County's BMPs proposed within Rock Creek watershed are estimated to result in 52 percent load reductions for total nitrogen, 53 percent for total phosphorus, and 49 percent for TSS. An approximate 55 percent reduction of trash over baseline conditions is also anticipated (Biohabitats et al., 2012 p. 4).

Preferred BMPs include ESD property retrofits, new structural SWM facilities, retrofitting underperforming SWM facilities, and stream restoration projects. Projects sites for ESD, pond retrofits, and new stormwater ponds have been identified and are focused on county-owned properties and priority neighborhood areas, which do not include MDOT SHA ROW. Two MDOT SHA Facilities, one highway garage and/or shop and one salt storage facility, are located within the Rock Creek Watershed along with roadway ROW (**Figure 55**). The *Rock Creek Implementation Plan* did not indicate water quality problems for restoration associated with SHA ROW.

MDOT SHA has completed five tree plantings (two additional tree plantings are proposed), three retrofits, and three stream restoration projects throughout the Rock Creek Watershed (**Figure 57**).

Table 51 identifies the High and Low Priority Projects for the Rock Creek Watershed.

A bacteria source analysis was conducted by MDOT SHA for the non-tidal portion of the Rock Creek watershed. No permitted point sources were identified in the TMDL document (MDE, 2007c).

Table 51: High and Low Priority Projects within the Rock Creek Watershed

Project Type	Project Name	
Environmental Site Design (ESD)	Aspen Hill Library Board of Elections Bushy Drive Recreation Center Chevy Chase Library District 2 – Bethesda Police Station Donnybrook Drive	Kensington Park Library Noyes Children's Library Station 16 – Silver Spring Station 25- Kensington Twin Brook Library
New Stormwater Pond	Derwood Industrial Park SWM Mill Creek South Number 4	NIH Pond Suburban Propane (Washington Gas) SWM Retro
Stormwater Pond Retrofit	Allegis Health, ED marsh Aspen Hill SC SF construct BB-1 Loehmanns Plaza SF construct BB-2 Randolph Hills SR construct Cashell Manor No, 1, SWM retro Emory Grove No. 2, SWM retrofit Georgian Woods Colony 1 (Site 21) Manor Country Club 2 Metro Park N 1, SWM retro	Metro Park N 2, SWM retro Mill Creek South No. 3 SWM retro Mineral Springs, SWM retro Norbeck Est SWM retro Old Georgetown Village SWM Silver Spring Ride-on/Brookville Bus Depot Stoneybrook 2 Landscape ED Marsh Tuckerman Lane SWM retro Wheaton Plaza sand filter
Source: Biohabitats et al., 2012, Appendix A		

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirement for Rock Creek watershed TMDL pollutant along with the Target Year for achieving the reduction. Rock

Creek is listed for bacteria having a baseline year of 2003 for the bacteria TMDL. A treatment buffer was not applied to bacteria because this pollutant is not treated exclusively through stormwater or alternative BMPs. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in **Section E.3.c**.

Proposed practices to meet the bacteria reduction in the Rock Creek watershed are shown in **Table 52**. The projected bacteria reduction using these practices are 856 billion MPN/day which is 0.7 percent of the reduction target. These practices are described in **Section E** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the bacteria baseline is 2003;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Rock Creek watershed total $996,000. These projected costs are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 53** for a summary of estimated BMP costs.

Figure 57shows a map of the MDOT SHA watershed restoration strategies throughout the Rock Creek watershed. The practices shown only include those that are under design and constructed.

Table 52: Rock Creek Non-Tidal Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2003)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	61.5			N/A	
Stormwater Retrofit	drainage area acres		29.4		N/A	29.4
Cross-Jurisdictional[1]	drainage area acres	18.0			N/A	
Annual Load Reductions	Enterococci billion MPN/day	7,448.5	856.0		N/A	856.0

[1] Cross-jurisdictional BMPs may be a mix of various stormwater control structures.
[2] Refer to Table 2 for Target Year.

Table 53: Rock Creek Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
Stormwater Retrofit	$996,000			$996,000
			Total Restoration Cost	$996,000

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs.*
[2] *Refer to Table 2 for Target Year.*

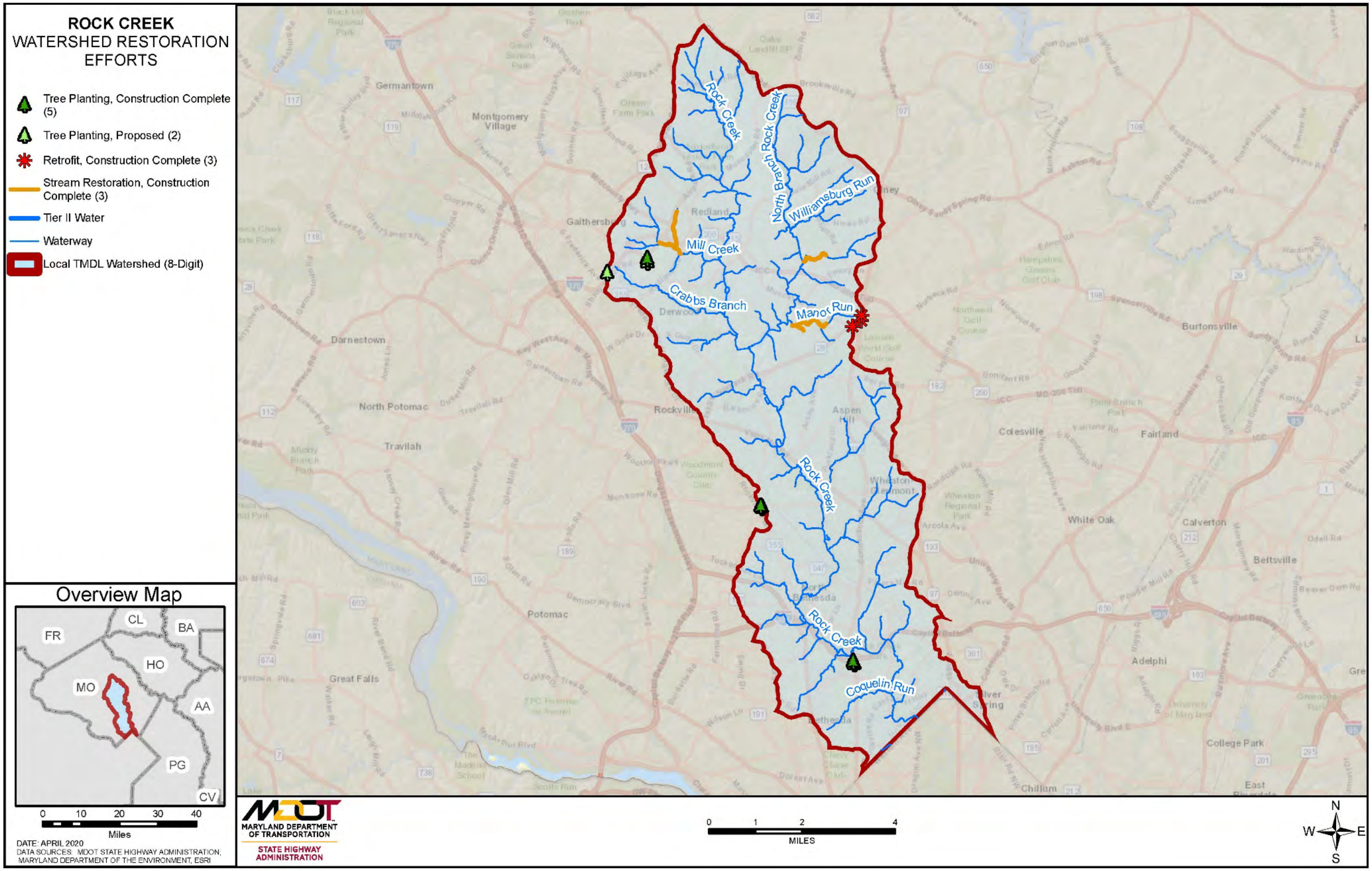


Figure 57: MDOT SHA Restoration Strategies within the Rock Creek Watershed

F17. TRIADELPHIA AND ROCKY GORGE RESERVOIRS WATERSHEDS

F1. Watershed Description

The Patuxent Reservoirs consist of the Brighton Dam/Triadelphia Reservoir (8-digit basin code: 02131108) and the Rocky Gorge Reservoir (8-digit basin code: 02131107) within the Patuxent River watershed located primarily in Howard and Montgomery Counties. A small portion of the Rocky Gorge Reservoir lies in Prince George's County. The Patuxent Reservoirs cover a total of 132 square-miles (approximately 85,000 acres) and encompass a total of 209.3 square-miles (approximately 134,000 acres) of drainage area to the reservoirs (MDE, 2008d).

The designated use class of the Brighton Dam/Triadelphia Reservoir and Rocky Gorge Reservoir are Use IV-P and Use I-P, respectively.

There are approximately 84 centerline miles of MDOT SHA roadway located within the Brighton Dam/Triadelphia Reservoir and Rocky Gorge Reservoir Watershed, associated ROW comprises approximately 854 acres, of which 365 acres are impervious. There are no MDOT SHA facilities located within the Potomac River Washington County watershed. See **Figure 58** for a map of the Patuxent Reservoirs watershed.

F.2. MDOT SHA TMDLs within Triadelphia and Rocky Gorge Reservoirs Watersheds

MDOT SHA is included in the phosphorus TMDLs (MDE, 2008d) for the Triadelphia Reservoir and Rocky Gorge Reservoir watersheds with reduction requirements of 15.0 percent for both, as shown in **Table 2**. There is also a TMDL for sediment in the Triadelphia Reservoir watershed; however, there is no MDOT SHA reduction requirement for this TMDL.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Triadelphia and Rocky Gorge Reservoirs watersheds are shown in **Figure 59** which illustrates that 73 grid cells have been reviewed, encompassing portions of 16 state route corridors. Potential BMP sites identified as part of the visual inspections follow:

Structural SW Controls

Preliminary evaluation identified 143 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- 117 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 26 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 101 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 28 sites constructed or under contract
- 20 additional sites deemed potentially viable for tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 53 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified 15 sites as potential stream restoration locations. Further analysis of these locations resulted in:

- Five additional sites deemed potentially viable for stream restoration and pending further analysis may be candidates for future restoration opportunities.
- 10 sites deemed not viable for stream restoration.

Grass Swale Rehabilitation

Preliminary evaluation identified 34 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- Three additional sites deemed potentially viable for new structural SW control and pending further analysis, may be candidates for future restoration opportunities.
- 31 sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

Preliminary evaluation identified 34 outfalls potential for stabilization. Further analysis of these sites resulted in:

- Two outfall sites deemed potentially viable for outfall stabilization efforts and pending further analysis, may be candidates for future restoration opportunities.
- 32 outfall sites deemed not viable for outfall stabilization and have been removed from consideration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified 12 existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- Nine retrofit sites deemed potentially viable for retrofit and pending further analysis may be candidates for future restoration opportunities.
- Three retrofit sites deemed not viable for retrofit and have been removed from consideration.

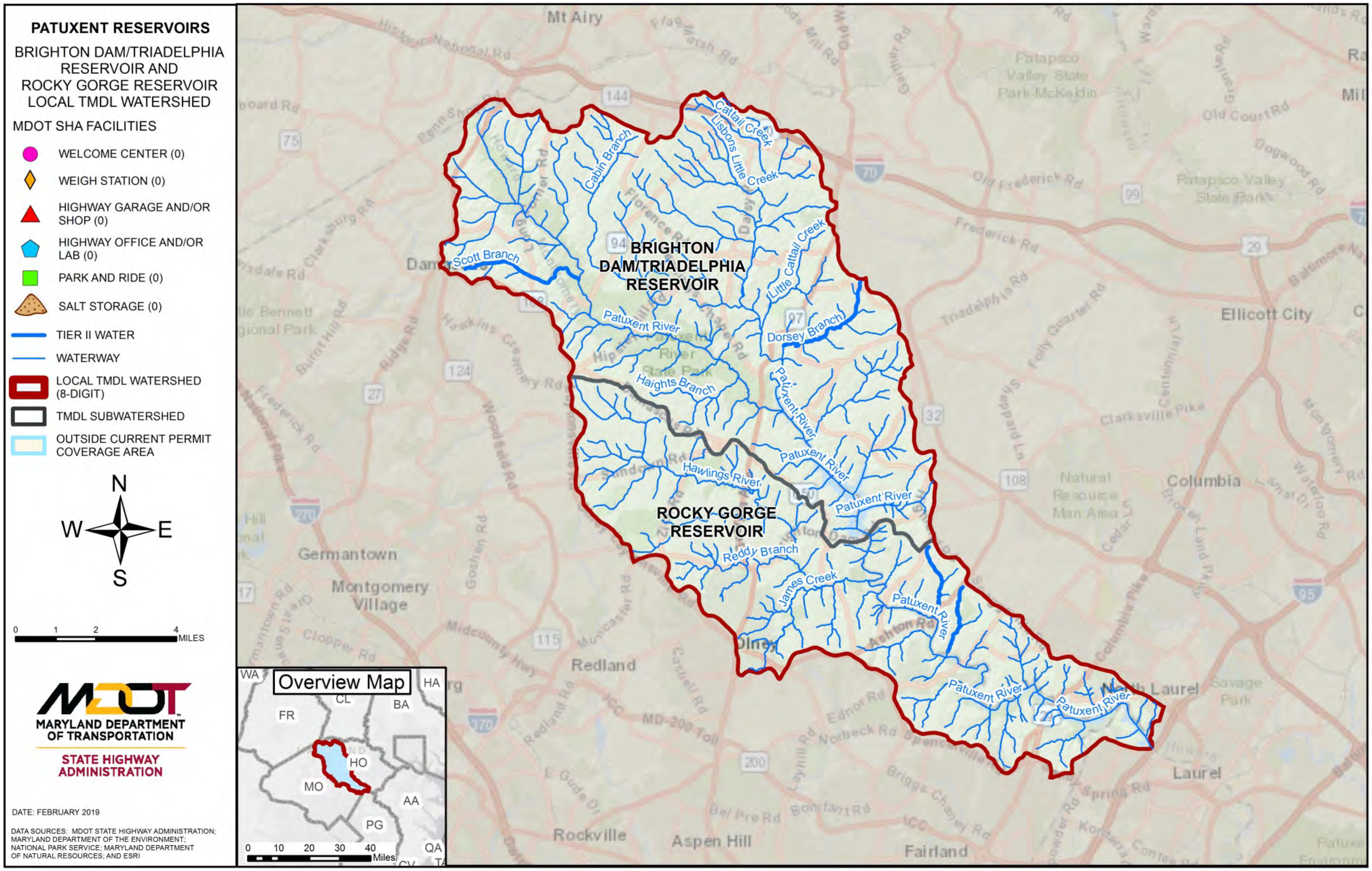


Figure 58: Triadelphia and Rocky Gorge Reservoirs Watersheds

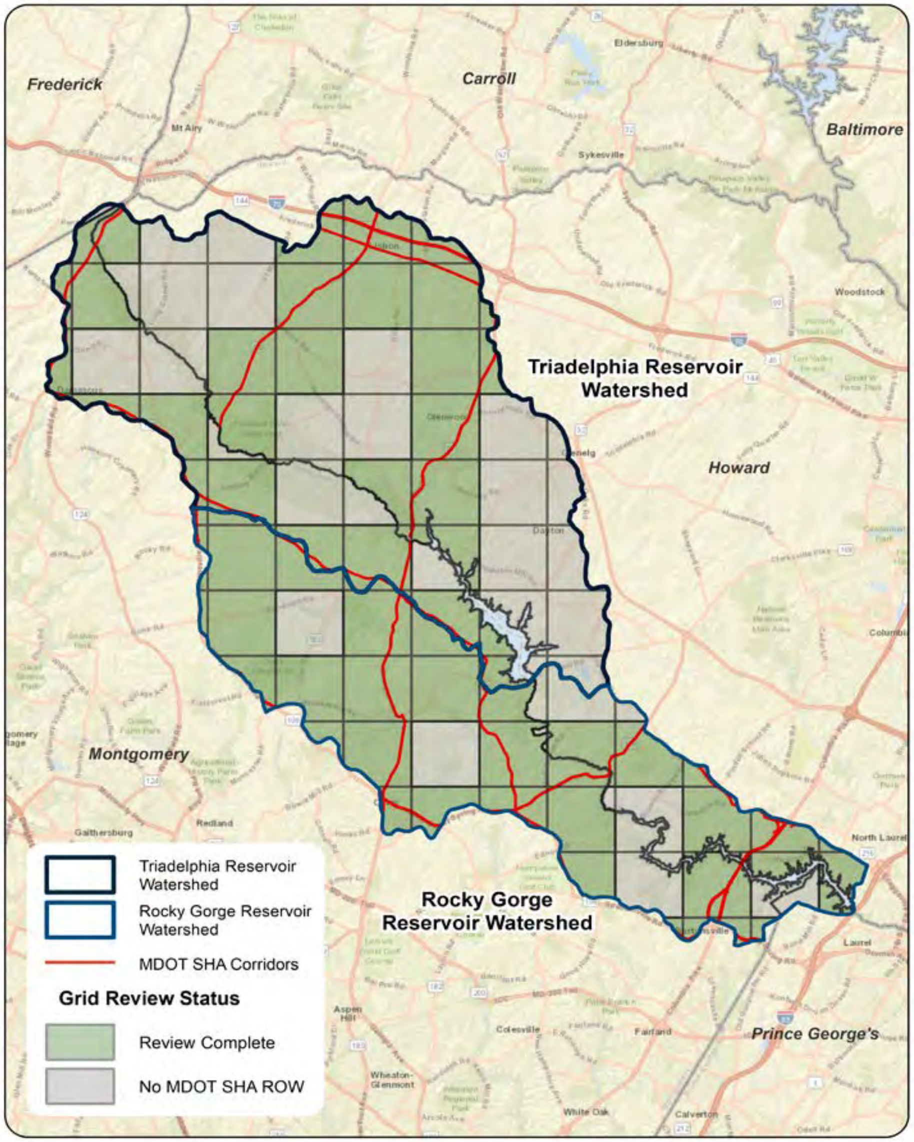


Figure 59: Triadelphia and Rocky Gorge Reservoirs Watersheds Site Search Grids

F.4. Summary of County Assessment Review

Waters within the Brighton Dam/Triadelphia Reservoir watershed are subject to the following impairments as noted on MDE's 2018, 303(d) List:

- Phosphorus (Total);
- Sedimentation/siltation;
- Temperature, water.

Waters within the Rocky Gorge Reservoir watershed are subject to the following impairments as noted on MDE's 2018, 303(d) List:

- Cause Unknown;
- Phosphorus (Total).

Howard County Assessment

The 2017 *Patuxent River: Brighton Dam, Rocky Gorge Dam, and Patuxent River Upper Watershed Assessment* (KCI, 2017)—hereinafter referred to as the "2017 Howard County Assessment"—serves as Howard County's assessment of the 8-digit Brighton Dam, Rocky Gorge Dam, and Patuxent River Upper watershed portions within Howard County. The Howard County portion of the Brighton Dam watershed is a 57.7-square-mile area located in northwestern Howard County. The Howard County portion of the Rocky Gorge Dam watershed is a 12.5-square-mile area located in the southwestern region of the County (KCI, 2017, p. 10).

In Howard County, land use within the Brighton Dam and Rocky Gorge Dam watersheds varies greatly. Primary land uses in Brighton Dam are split between agricultural, urban, and forest, while the Rocky Gorge Dam is primarily urban, followed by forest. The "urban" use in these watersheds is predominantly residential. More specifically, land use within the Brighton Dam watershed is as follows: agricultural (37.5 percent), urban (34.5 percent), and forest (26.6 percent). Land use within the Rocky Gorge Dam watershed is agricultural (14.6 percent), urban (47.1 percent), and forest (34.1 percent) (KCI, 2017). The majority of soils within the Brighton Dam and Rocky Gorge Dam watersheds have moderate infiltration rates (KCI, 2017, p. 16-17).

There are no MDOT SHA facilities other than roadway ROW within the Howard County portion of the Brighton Dam/Triadelphia Reservoir and Rocky Gorge Reservoir watersheds. In addition, the 2017 Howard County Assessment did not indicate water quality problems for restoration associated with MDOT SHA facilities or ROW.

Howard County conducts biological monitoring at randomly selected stations in its Countywide monitoring program, which began in 2001. Of the 239 sites in Brighton Dam, Rocky Gorge Dam, and Patuxent River Upper watersheds, 107 (48 percent) were in Good condition, 68 (30 percent) were in Fair condition, 33 (15 percent) were in Poor condition, and 15 (7 percent) were in Very Poor condition. Brighton Dam had the most sites in Good condition, while Patuxent River Upper sites were mostly in Poor or Very Poor condition. Stream habitat condition was also evaluated and of the 50 sites assessed, 11 sites (22 percent) were rated as minimally degraded (the highest scoring category), 28 (56 percent) were rated as partially degraded, 6 (12 percent) were rated as degraded, and 5 (10 percent) were rated as severely degraded. These scores indicate that many streams in the Patuxent River watershed show evidence of habitat degradation (KCI, 2017, p. 17-18)In order to further treat the watersheds, the 2017 Howard County Assessment examined five types of potential retrofit and restoration opportunities: (1) BMP conversions, (2) new BMPs, (3) tree planting, (4) stream restoration, and (5) outfall stabilization (KCI, 2017).

The concept plans provide the location of the project, current site conditions, implementation information, potential impervious treatment or pollution reduction credits, and a cost estimate. (The complete set of concept plans is available in Appendix G of the 2017 Howard County Assessment [KCI, 2017]). MDOT SHA has completed numerous tree plantings within the Howard County portion of the watershed as shown in **Figure 60**.

Montgomery County Assessment

The 2012 *Patuxent Watershed Implementation Plan (including Pre-Assessment)* (Versar et al., 2012)—hereinafter referred to as the "Montgomery County Plan"—serves as Montgomery County's assessment of the 8-digit Brighton Dam and Rocky Gorge Dam watershed portions within Montgomery County.

The Montgomery County portion of the Brighton Dam watershed (referred to in the Montgomery County Plan as the "Upper Patuxent River" subwatershed) drains a 21-square mile (13,316 acres) area located in the northern/northeastern region of the County. Of that, 10 percent (1,346 acres) is subject to the county MS4 permit and 7 percent (95 acres) is impervious (Versar et al., 2012, p 8). Roads account for the largest percentage of impervious cover in the watershed at just over 48 percent (Versar et al., 2012, p 34). Streams within Montgomery County's portion of the Brighton Dam watershed are generally of high quality: the streams naturally support a healthy brown trout population with many of the streams serving as reference streams for the County's stream monitoring program (Versar et al., 2012, p 6). County MS4 land use within the Montgomery County portion of the watershed consists of rural (38 percent), residential (28 percent), forest (27 percent), and commercial/municipal/roadway (7 percent) (Versar et al., 2012, p 26).

The Montgomery County portion of the Rocky Gorge Dam watershed (referred to in the Montgomery County Plan as the "Hawlings River" and the "Lower Patuxent River" subwatersheds) drains a 39-square mile area located in the northeastern/eastern region of the County. Of that, 16 percent (4,082 acres) is subject to the county MS4 permit and 18 percent (731 acres) is impervious (Versar et al., 2012, p 9). Roads account for the largest percentage of impervious cover in the watershed at 32 percent (Versar et al., 2012, p 34).Streams in the Montgomery County portion of the Rocky Gorge Dam watershed are subject to more impairment than the streams in the Montgomery County portion of the Brighton Dam watershed (Versar et al., 2012, p 6-7). County MS4 land use within the Montgomery County portion of the Rocky Gorge Dam consists of residential (47 percent), forest (20 percent), Rural (17 percent), and commercial/municipal/roadway (15 percent) (Versar et al., 2012, p 27).

Applicable types of restoration practices being considered for future BMPs include new ESD retrofit practices (rainwater harvesting, upland reforestation, green roofs, etc.); ESD upgrades (retrofit ESD practices within existing publicly owned or privately owned stormwater infrastructure); voluntary ESD implementation (Low Impact Development [LID] practices installed as a result of County education and incentive programs [e.g., rainscape incentives offered in priority neighborhoods]); programmatic and operational practices (e.g., lawn care education); traditional retrofits (e.g., new ponds); credit for BMP maintenance upgrades; and riparian reforestation (Versar et al., 2012, p. 60).

There are no MDOT SHA facilities other than roadway ROW within the Montgomery County portion of the Brighton Dam/Triadelphia Reservoir and Rocky Gorge Reservoir watersheds. In addition, the Montgomery County Plan did not indicate water quality problems for restoration associated with MDOT SHA facilities or ROW. MDOT SHA has completed several tree plantings within the Montgomery County portion of the watersheds (**Figure 60**).

Priority status for stormwater BMP retrofit projects are categorized as high, medium, or low priority. Low priority BMP projects include low scoring residential neighborhoods and golf courses. Medium priority projects include land-use types involving commercial/industrial, churches, private schools, apartments and condominiums (multi-family residential), townhouse units, and high and medium scoring residential neighborhood assessment areas. High priority projects are projects that modify existing BMPs that were permitted before 1986 (Versar et al., 2012, p. 23-24).

Current watershed restoration opportunities within the Montgomery County portion of the Brighton Dam watershed include an ESD (low priority) involving the Damascus Library. In the Montgomery County portion of the Rocky Gorge Dam watershed, there are several stream restoration opportunities (low priority), mostly along the Hawlings River and Reddy Branch. In addition, there is one ESD (high priority) opportunity at Longwood Community Center and two ESDs (low priority) opportunities at Ross Boddy Recreation Center near the city of Olney and at the Burtonsville Park and Ride. There are also several retrofit opportunities, including a retrofit (low priority) of the dry pond at the Sandy Spring Meadow community in Olney (Versar et al., 2012, Appendix A).

Prince George's County Assessment

In 2015, Prince George's County Department of the Environment published the *Restoration Plan for the Upper Patuxent River and Rocky Gorge Reservoir Watersheds in Prince George's County* (Tetra-Tech, 2015d) (hereinafter referred to as the "Prince George's County Plan").

Only 0.83 square miles (530 acres) of the Rocky Gorge Dam (referred to as the "Rocky Gorge Reservoir" watershed in the 2015 Restoration Plan) is located within Prince George's County (Tetra Tech, 2015d, p.10). Prince George's portion of the Rocky Gorge Dam watershed is impaired with phosphorus associated with both upstream point and non-point sources (Tetra Tech, 2015d, p. 8). Almost all of the watershed contains hydrologic Group B soils (high to moderate infiltration rates) (Tetra-Tech, 2015d, p.11). Land use in Prince George's portion of the Rocky Gorge Dam consists of mostly forest (51 percent), followed by urban (23 percent), agricultural (18 percent), and water/wetlands (8 percent) (Tetra Tech, 2015d, p.14). Approximately 6.1 percent of the land in Prince George's part of the Rocky Gorge Dam watershed is impervious, with roads and highways comprising the largest impervious type (32 percent) (Tetra Tech, 2015d, p17). Within in the Rocky Gorge Dam, the percent of total impervious area in the MS4 area is 0 (Tetra Tech, 2015d, p. 91).

There are no MDOT SHA facilities other than roadway ROW within the Prince George's County portion of the Brighton Dam/Triadelphia Reservoir and Rocky Gorge Reservoir watersheds. In addition, the Prince George's County Plan did not indicate water quality problems for restoration associated with MDOT SHA facilities or ROW. MDOT SHA has not completed any watershed restoration efforts within the Prince George's County portion of the watersheds (**Figure 60)**.

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirements for the Triadelphia Reservoir and Rocky Gorge Reservoir watersheds TMDL pollutants along with the Target Year for achieving the reductions. Triadelphia Reservoir and Rocky Gorge Reservoir are both listed for phosphorus with both TMDL having a baseline year of 2000. MDOT SHA is over programming restoration projects to treat 115 percent of the required pollutant loads as an adaptive management strategy. This treatment buffer will allow MDOT SHA to achieve the reduction targets even if some planned projects are eliminated prior to construction due to site design limitations or any other situation that may result in removing the project from the plan.

Proposed practices to meet phosphorus reductions in the Triadelphia Reservoir and Rocky Gorge Reservoir watersheds are shown in **Table 54**and **Table 55**, respectively. Projected phosphorus reductions using these practices are 56.4 lbs./yr. in the Triadelphia Reservoir watershed and 56.3 lbs./yr. in the Rocky Gorge Reservoir watershed which are both 115.0 percent of the reduction target. These practices are described in **Section E** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the phosphorus TMDL baseline. In this case, the phosphorus baseline is 2000 for both watersheds;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Triadelphia Reservoir and Rocky Gorge Reservoir watersheds total $664,500 and $900,500, respectively. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. Please see **Table 56** and **Table 57** for a summary of estimated BMP costs for the Triadelphia Reservoir and Rocky Gorge Reservoir watersheds, respectively.

Figure 60 shows a map of MDOT SHA watershed restoration strategies throughout the Triadelphia Reservoir and Rocky Gorge Reservoir watersheds. The practices shown only include those that are under design or constructed.

Table 54: Triadelphia Reservoir Restoration Phosphorus BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2000)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	4.0				
Grass Swale	drainage area acres	35.8				
Tree Planting	acres of tree planting		4.0			4.0
Stream Restoration	linear feet				797.3	797.3
Inlet Cleaning[1]	dry tons		0.6			0.6
Pipe Cleaning[1]	dry tons		0.7			0.7
Impervious Disconnects	credit acres	4.0				
Annual Load Reductions	TP EOS lbs./yr.	30.4	2.2		54.2	56.4

[1] *Inlet cleaning and pipe cleaning are annual practices. They are reflected only once for the year the annual reduction is achieved. Once achieved, this annual reduction will be sustained each year the load reduction is claimed.*

[2] *Refer to Table 2 for Target Year.*

Table 55: Rocky Gorge Reservoir Restoration Phosphorus BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2000)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	36.2				
Grass Swale	drainage area acres	11.3				
Tree Planting	acres of tree planting		13.6			13.6
Stream Restoration	linear feet				599.3	599.3
Inlet Cleaning[1]	dry tons		7.9			7.9
Pipe Cleaning[1]	dry tons		2.9			2.9
Street Sweeping[1]	acres swept		10.2			10.2
Impervious Disconnects	credit acres	4.9				
Annual Load Reductions	TP EOS lbs./yr.	32.5	15.6		40.8	56.4

[1] Inlet cleaning, pipe cleaning, and street sweeping are annual practices. They are reflected only once for the year the annual reduction is achieved. Once achieved, this annual reduction will be sustained each year the load reduction is claimed.

[2] Refer to Table 2 for Target Year.

Table 56: Triadelphia Reservoir Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
Tree Planting	$135,000			$135,000
Stream Restoration			$525,000	$525,000
Inlet Cleaning	$4,000			$4,000
Pipe Cleaning	$500			$500
			Total Restoration Cost	$664,500

[1] Costs do not include maintenance, inspection, or remediation for built BMPs. Costs for operational BMPs (inlet cleaning and pipe cleaning) are annual costs that are incurred each year to sustain load reductions.
[2] Refer to Table 3-2 for Target Year.

Table 57: Rocky Gorge Reservoir Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
Tree Planting	$460,000			$460,000
Stream Restoration			$394,000	$394,000
Inlet Cleaning	$45,000			$45,000
Pipe Cleaning	$500			$500
Street Sweeping	$1,000			$1,000
			Total Restoration Cost	$900,500

[1] Costs do not include maintenance, inspection, or remediation for built BMPs. Costs for operational BMPs (inlet cleaning, pipe cleaning, and street sweeping) are annual costs that are incurred each year to sustain load reductions.
[2] Refer to Table 3-2 for Target Year.

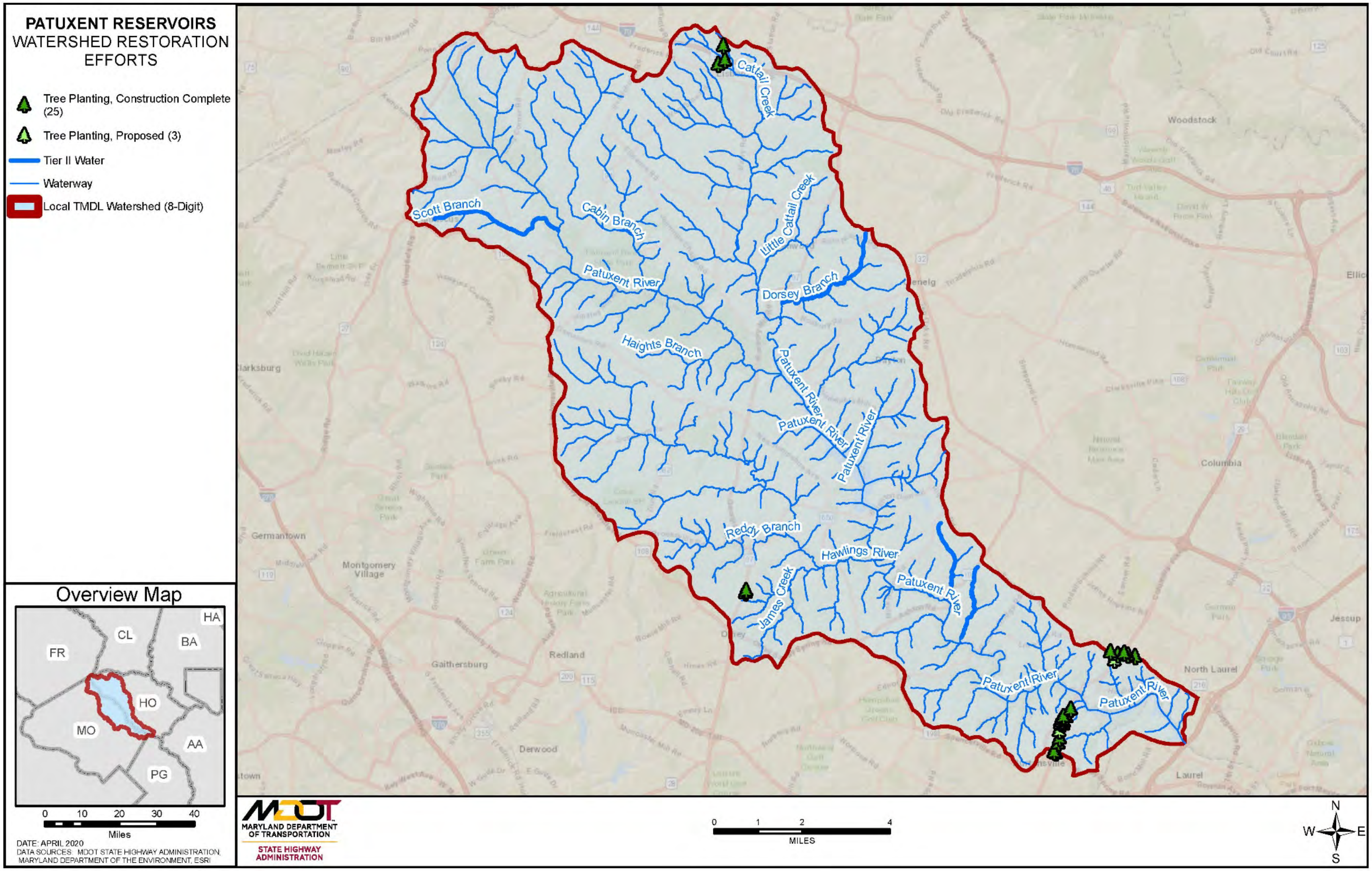


Figure 60: MDOT SHA Restoration Strategies within the Triadelphia and Rocky Gorge Reservoirs Watersheds

F18. SEVERN RIVER WATERSHED

F.1. Watershed Description

The Severn River watershed (MD 8-digit Basin Code: 02131002) encompasses approximately 68.7 square miles (43,985 acres) in the Western Shore of the Chesapeake Bay within Anne Arundel County, Maryland. The City of Annapolis is located within the watershed. The Severn River is approximately 12.5 miles in length and contains three restricted shellfish harvesting areas for bacteria: Whitehall and Meredith Creeks, Mill Creek, and the Severn River mainstem (MDE, 2008f).

The designated use of the Severn River is Use Class II – Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting (MDE, 2008f).

Waters within the Severn River watershed are subject to the following impairments as noted on MDE's 303(d) List:

- Fecal Coliform;
- Nitrogen, Total;
- PCBs in Fish Tissue;
- Phosphorus, Total; and
- Total Suspended Solids (TSS).

There are 98 centerline miles of MDOT SHA roadway located within the Severn River watershed. The associated ROW encompasses 1490 acres, of which 631 acres are impervious. MDOT SHA facilities located within the watershed consist of two welcome centers, one park and ride, and one salt storage. See **Figure 61** for a map of MDOT SHA facilities within the Severn River watershed.

F.2. MDOT SHA TMDLs within Severn River Watershed

MDOT SHA is included in the fecal coliform bacteria TMDL (MDE, 2008f) for multiple subwatersheds within the Severn River watershed with each subwatershed having a different reduction requirement: 86.0 percent for Mill Creek, 19.0 percent for a subsegment of the Severn River, and 90.0 percent for Whitehall and Meredith Creeks, as shown in **Table 2**.

The Severn River Mesohaline subwatershed is also included in the PCB TMDL; however, there is a 0.0 percent reduction requirement for regulated stormwater sources (MDE, 2016a). Therefore, there are no MDOT SHA reduction requirements for the Severn River Mesohaline subwatershed included in this plan.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Severn River watershed is shown in **Figure 62** which illustrates that twenty grid cells have been reviewed, encompassing portions of eight state route corridors. Potential BMP sites identified as part of the visual inspections follow.

Structural Stormwater Controls

Preliminary evaluation identified 137 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- Eight sites constructed or under contract.
- 84 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.

- 45 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 122 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 46 sites constructed or under contract.
- 17 additional sites deemed potentially viable for tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 59 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

No stream restoration sites were identified in this watershed for restoration.

Grass Swale Rehabilitation

Preliminary evaluation identified six sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- Six new structural SW controls constructed or under contract.

Outfall Stabilization

Preliminary evaluation identified 154 outfall potential for stabilization. Further analysis of this site resulted in:

- Two sites constructed or under contract.
- 23 outfall sites deemed potentially viable for outfall stabilization efforts and pending further analysis, may be candidates for future restoration opportunities.
- 129 outfall sites deemed not viable for outfall stabilization and have been removed from consideration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified 38 existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- Six sites constructed or under contract
- 12 retrofit sites deemed potentially viable for retrofit and pending further analysis may be candidates for future restoration opportunities.
- 20 retrofit sites deemed not viable for retrofit and have been removed from consideration.

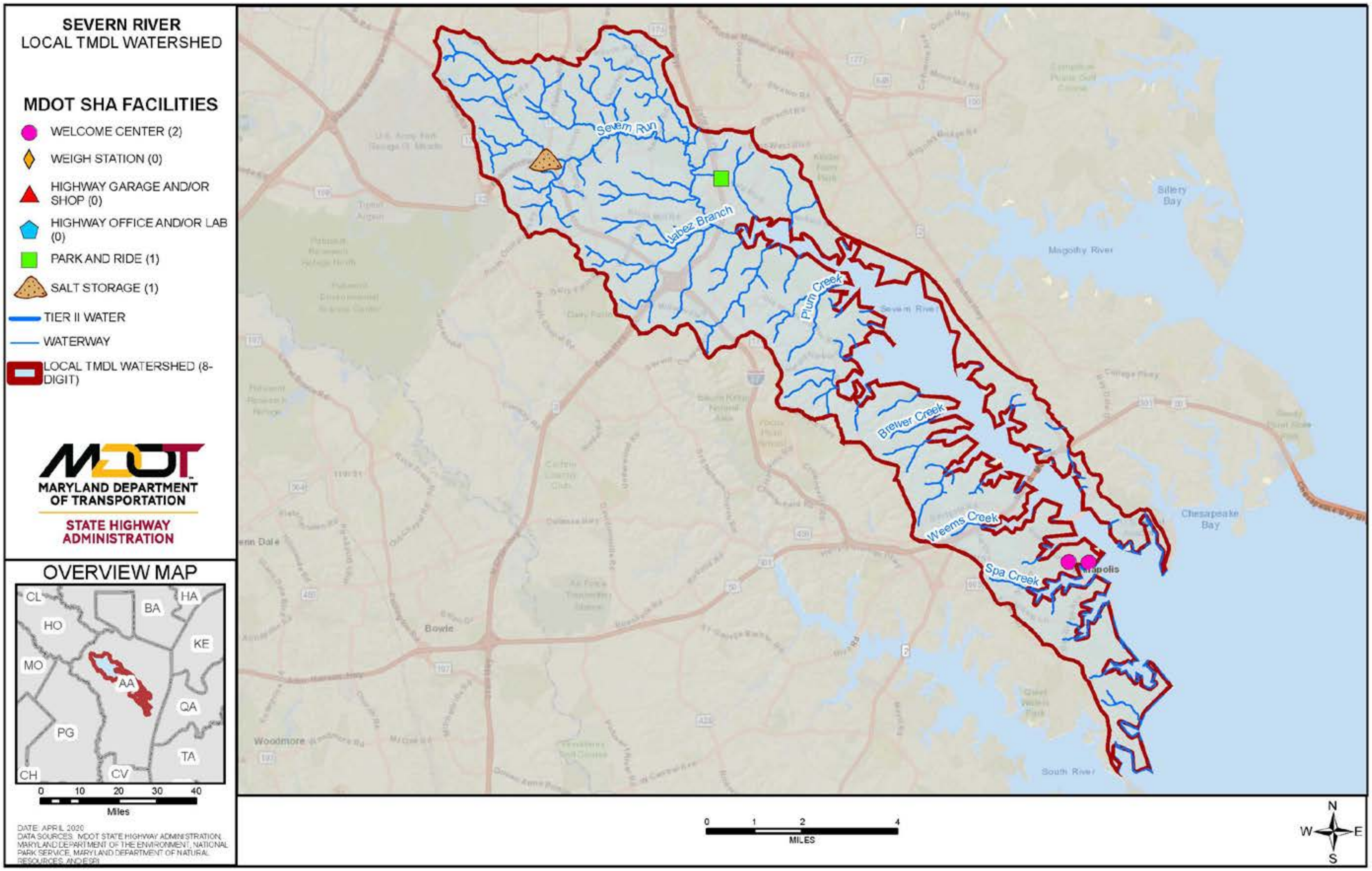


Figure 61: MDOT SHA Facilities within Severn River Watershed

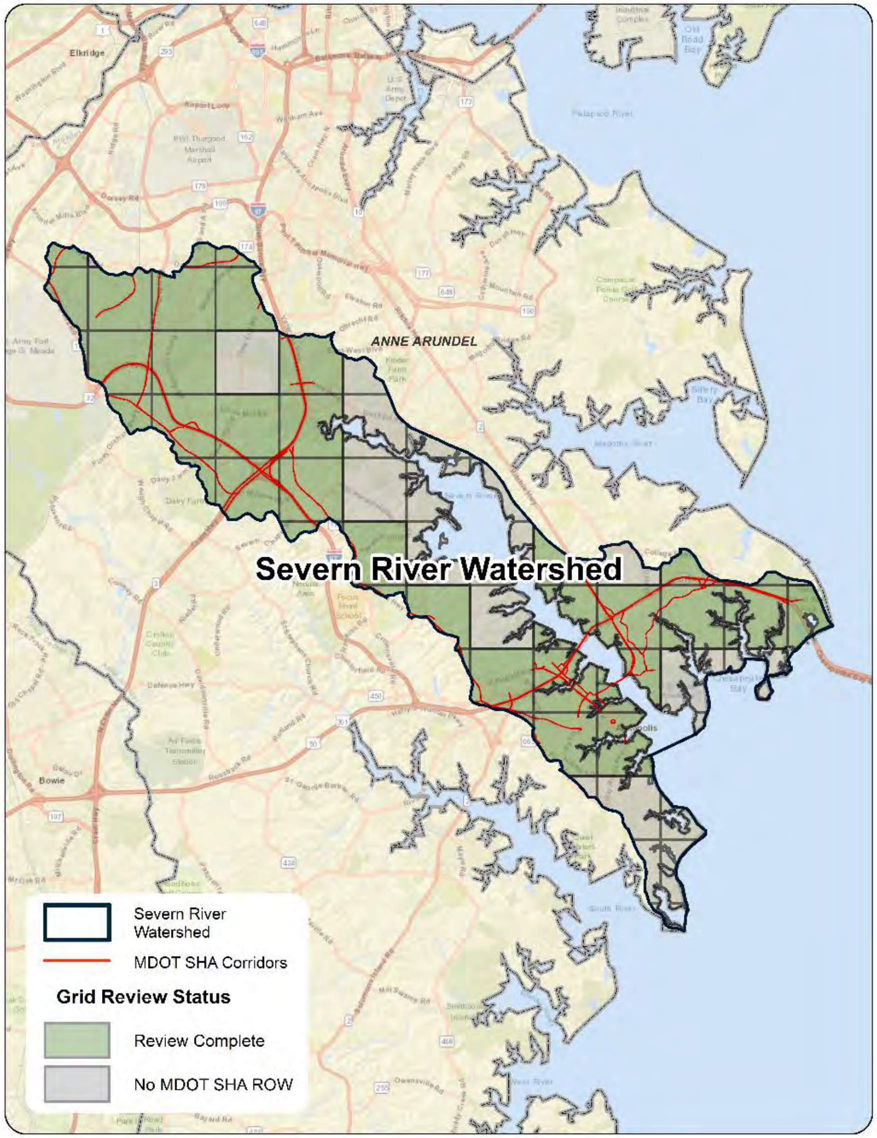


Figure 62: Severn River Watershed Site Search Grids

F.4. Summary of County Assessment Review

The Severn River Watershed Management Master Plan (KCI Technologies, Inc., 2006) was published in February 2006 for the Anne Arundel County Office of Environmental and Cultural Resources Watershed Management Program. The Severn River Watershed Management Master Plan serves to characterize the watershed's baseline conditions and resources, assess existing and potential concerns, and propose restoration and preservation improvements with a systematic watershed perspective (KCI Technologies, Inc., 2006, p. ES-1).

The Severn River watershed is divided into 70 subwatersheds. The Severn River mainstem is a designated Maryland Scenic River and the watershed includes many unique and ecologically important natural features including numerous bogs and naturally reproducing brook trout populations. Land use within the Severn River watershed is dominated by single family residential (38 percent), forest (32 percent), and commercial, industrial, and the City of Annapolis (15 percent) (KCI Technologies, Inc., 2006, p. ES-2).

MDOT SHA owns four facilities within the watershed: two welcome centers, one park and ride, and one salt storage (**Figure 61**). In addition, MDOT SHA ROW is located throughout the watershed (**Figure 62**). The Severn River Watershed Management Master Plan did not indicate water quality problems for restoration associated with MDOT SHA facilities and ROW.

A total of 152 miles of stream were assessed within the Severn River watershed, the majority of stream miles were found to be perennial (58.8 percent). For each perennial stream reach, Maryland Physical Habitat Index (MPHI) score were complete to assess the physical habitat. MPHI scores indicate the ability of each stream reach to support aquatic life. Forty percent of the stream miles were rated Good, twenty-five percent were ranked as Fair, twenty-nine percent as Poor, and six percent were rated as Very Poor. In addition to the MPHI assessment, 63 sites located in 30 of the subwatersheds were assessed for water quality, macroinvertebrates, and physical habitat. Forty of the sixty-three sites were in the Poor to Very Poor range and only three sites scored in the Good range (KCI Technologies, Inc., 2006, p. 22-23).

Three types of assessments were conducted for the Severn River watershed: subwatershed restoration, subwatershed preservation, and stream restoration ranking.

Five subwatersheds were ranked as highest priority for restoration: Woolchurch Cove, Picture Spring Branch, Jabez Branch 3, Weems Creek, and Hacketts to Sandy Point. These subwatersheds are those with the fewest remaining high quality natural features and those where runoff characteristics lead to high flows and pollutant loads (KCI Technologies, Inc., 2006, p. 96-97).

For the subwatershed preservation, five subwatersheds were ranked as high priority; Maynadier Creek, Severn Run Mainstem 4, Gumbottom Branch 2, Indian Creek Branch, and Brewer Pond. These subwatersheds are those with the least amount of urbanization and those with unique habitat or natural resources (KCI Technologies, Inc., 2006, p. 99).

The stream reaches ranked highest priority for stream restoration are ST6006, MAC011, RGC004, ST5018, and SM3006 (KCI Technologies, Inc., 2006, p. 101).

MDOT SHA has completed many projects to improve water quality in the Severn Run watershed including two outfall stabilizations, forty-three tree plantings, six grass swales, eight new efficiency BMPs, and four retrofit projects (**Figure 63**).

The County determined the following recommendations of highest priority for the Severn River watershed by combining the results for cost effectiveness and non-quantitative criteria, such as accessibility and ease of implementation, as well as recommendations from the legislative review. Priority for implementation is as follows (KCI Technologies, Inc., 2006, p. ES-11 – ES-12). Practices that may be applicable to MDOT SHA have been italicized.

1. Existing SWM Regulations;
2. Cluster Development;
3. Enhancement of existing buffer regulations;
4. Dry-to-Wet Pond Retrofits;
5. Commercial/Industrial Bioretention Retrofits;
6. Greenways;
7. Residential Bioretention Retrofits;
8. Expanded Buffers; and
9. Septic System Upgrades.

A bacteria source analysis was conducted by MDOT SHA for the Severn River watershed. Two municipal point source facilities were identified in the bacteria TMDL document (MDE, 2008f) with active NPDES permits regulating the discharge of fecal bacteria into the Severn River watershed, the Annapolis Water Reclamation Facility and the U. S. Naval Academy.

F.5. MDOT SHA Pollutant Reduction Strategies

Severn River is listed for bacteria with a TMDL baseline year of 2002. **Table 2** lists the reduction requirements for the Severn River watershed bacteria TMDL along with the Target Year for achieving the reductions. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in **Section E.3.c**.

Proposed practices to meet bacteria reductions in the Mill Creek, Severn River subsegment, and Whitehall and Meredith Creeks subwatersheds of the Severn River watershed are shown in **Table 58**, **Table 59**, and **Table 60**, respectively. Projected bacteria reductions in Mill Creek, the Severn River subsegment, and Whitehall and Meredith Creeks using these practices are 220 billion counts/day, 2,078 billion counts/day, and 558 billion counts/day which are 2.6 percent, 12.4

percent, and 8.2 percent of the reduction target, respectively. These practices are described in **Section E** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the baseline is 2002;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Severn River watershed total $223,000 for the Mill Creek subwatershed, $3,218,000 for the Severn River subsegment subwatershed, and $1,297,000 for Whitehall and Meredith Creeks subwatershed. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 61**, **Table 62**, and **Table 63** for a summary of estimated BMP costs.

Figure 63 shows a map of MDOT SHA watershed restoration strategies throughout the Severn River watershed. The practices shown only include those that are under design or constructed.

Table 58: Severn River – Mill Creek Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2002)	Restoration BMPs			
			2020	2025	Target Year[1]	Restoration Totals
New Stormwater	drainage area acres	18.7	4.5		N/A	4.5
Annual Load Reductions	fecal coliform billion counts/day	2,248.0	220.0		N/A	220.0

[1] *Refer to Table 2 for Target Year.*

Table 59: Severn River - subsegment Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2002)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	398.8	4.6		N/A	4.6
Stormwater Retrofit	drainage area acres		103.3		N/A	103.3
Cross-Jurisdictional[1]	drainage area acres	11.6			N/A	
Annual Load Reductions	Fecal coliform billion counts/day	44,297.1	2,078.0		N/A	2,078.0

[1] *Cross-jurisdictional BMPs may be a mix of various stormwater control structures.*
[2] *Refer to Table 2 for Target Year.*

Table 60: Severn River – Whitehall & Meredith Creeks Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2002)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	65.3			N/A	
Stormwater Retrofit	drainage area acres		18.4		N/A	18.4
Cross-Jurisdictional[1]	drainage area acres	0.6			N/A	
Annual Load Reductions	Fecal coliform billion counts/day	7,804.4	558.0		N/A	558.0

[1] *Cross-jurisdictional BMPs may be a mix of various stormwater control structures.*
[2] *Refer to Table 2 for Target Year.*

Table 61: Severn River – Mill Creek Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater	$223,000		N/A	$223,000
			Total Restoration Cost	$223,000

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs.*
[2] *Refer to Table 2 for Target Year.*

Table 62: Severn River - subsegment Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater	$247,000		N/A	$247,000
Stormwater Retrofit	$2,971,000		N/A	$2,971,000
			Total Restoration Cost	$3,218,000

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs.*
[2] *Refer to Table 2 for Target Year.*

Table 63: Severn River – Whitehall & Meredith Creeks Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
Stormwater Retrofit	$1,297,000		N/A	$1,297,000
			Total Restoration Cost	$1,297,000

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs.*
[2] *Refer to Table 2 for Target Year.*

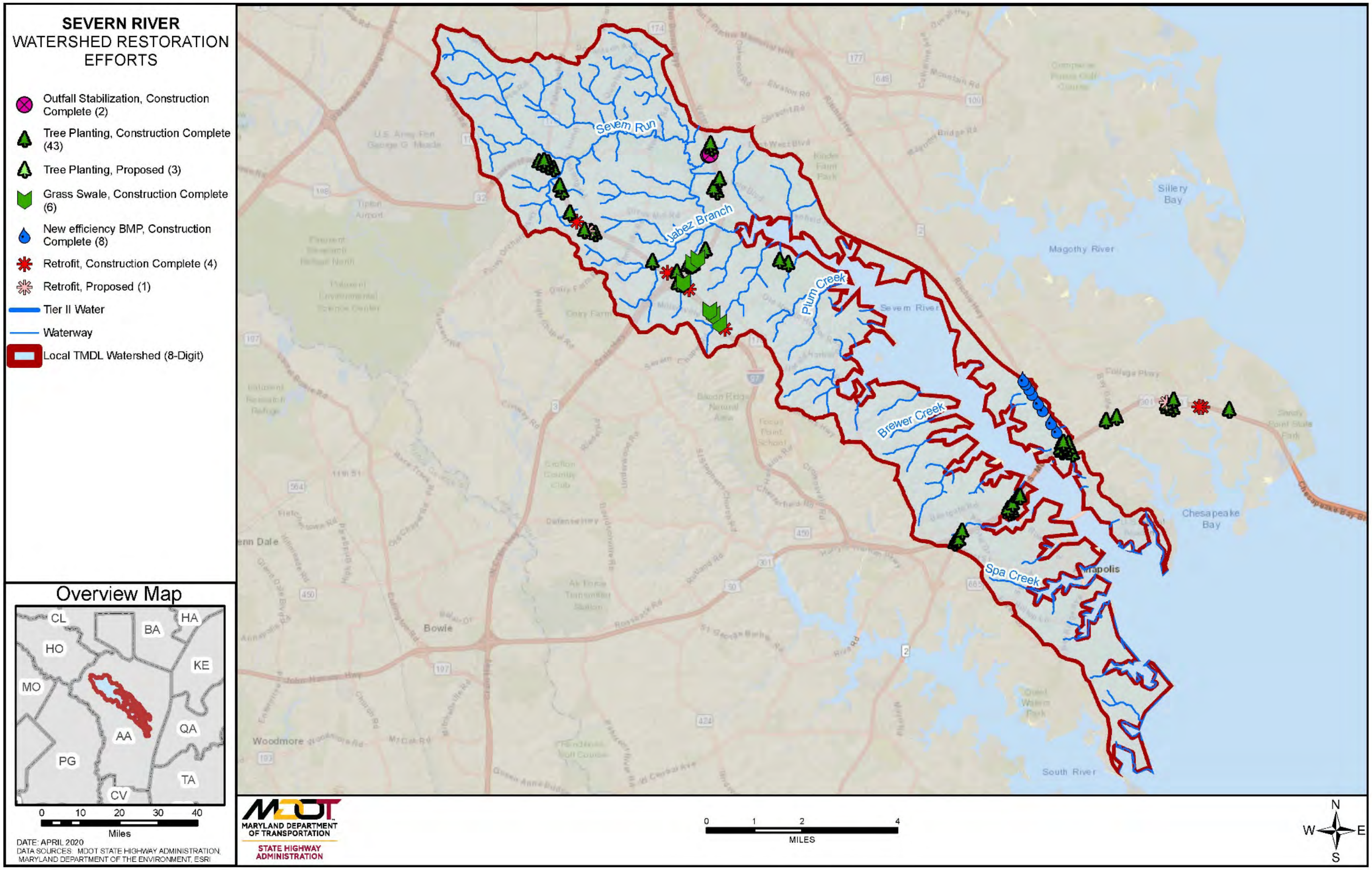


Figure 63: MDOT SHA Programmed Restoration Strategies within the Severn River Watershed

F19. SOUTH RIVER WATERSHED

F.1. Watershed Description

Located entirely within central Anne Arundel County, the South River watershed (MD 8-digit Basin Code: 02131003) drains to the South River, a ten mile long tidal tributary which discharges to the Chesapeake Bay. The South River is associated with two assessment units: a non-tidal and an estuary portion (Chesapeake Bay segment South River Mesohaline). The South River watershed is approximately 56.4 square miles (36,126 acres). There are no "high quality," or Tier II, stream segments within the South River watershed. The major non-tidal tributaries include the North River and Bacon Ridge Branch (MDE, 2017). There are four restricted areas for shellfish harvesting due to bacteria within the South River watershed: The South River restricted area, Duvall Creek, Selby Bay, and Ramsey Lake (MDE, 2005d).

The designated use of the non-tidal portion of the South River is Use Class I – Water Contact Recreation and Protection of Nontidal Warmwater Aquatic Life. The tidal tributaries and the South River mainstem are designated as Use Class II – Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting (MDE, 2017).

Waters within the South River watershed are subject to the following impairments as noted on MDE's 2018, 303(d) List:

- Chloride;
- Fecal Coliform;
- Nitrogen (Total);
- PCBs in Fish Tissue;
- Phosphorus (Total); and
- Total Suspended Solids (TSS).

There are 76 centerline miles of MDOT SHA roadway located within the South River watershed. The associated ROW encompasses 1,291 acres, of which 433 acres are impervious. MDOT SHA facilities located within the watershed consist of one highway office or lab, two park and rides, and one salt storage facility. See **Figure 64** for a map of MDOT SHA facilities within the South River watershed.

F.2. MDOT SHA TMDLs within South River Watershed

MDOT SHA is included in the sediment TMDL (MDE, 2017). This TMDL only applies to the non-tidal portion of the South River watershed.

MDOT SHA is also included in the fecal coliform bacteria TMDL (MDE, 2005d) for two subwatersheds within the South River watershed with each subwatershed having a different reduction requirement: 65.0 percent for Ramsey Lake and 68.0 percent for a subsegment of the South River. Although MDOT SHA has a reduction requirement of 17.4 percent for the Duval Creek watershed and 45.1 percent for the Selby Bay watershed, there is currently very little to no MDOT SHA right-of-way within this subsegment; and therefore, no significant modeled bacteria load to reduce.

There is a PCB TMDL for the mesohaline portion of the South River watershed; however, there are no reduction requirements for regulated stormwater sources.

For this implementation plan MDOT SHA will only focus on the fecal coliform bacteria TMDL.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the South River watershed is shown in **Figure 65** which illustrates that 47 grid cells have been reviewed, encompassing portions of 14 state route corridors. Potential BMP sites identified as part of the visual inspections follow.

Structural SW Controls

Preliminary evaluation identified 144 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- Four sites constructed or under contract.
- 125 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 15 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 46 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 21 sites constructed or under contract.
- Seven additional sites deemed potentially viable for tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 18 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified 14 sites as potential stream restoration locations. Further analysis of these locations resulted in:

- Three sites constructed or under contract.
- Two additional sites deemed potentially viable for stream restoration and pending further analysis, may be a candidate for future restoration opportunities
- Nine sites deemed not viable for stream restoration.

Grass Swale Rehabilitation

Preliminary evaluation identified 19 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- 19 sites constructed or under contract.

Outfall Stabilization

Preliminary evaluation identified 81 outfalls along 2 State roadway corridors as potential for stabilization. Further analysis of these sites resulted in:

- 13 outfall sites deemed potentially viable for outfall stabilization efforts and pending further analysis, may be candidates for future restoration opportunities.
- 68 outfall sites deemed not viable for outfall stabilization and have been removed from consideration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified 38 existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- Retrofit of eight existing structural SW controls constructed or under contract.
- 10 retrofit sites deemed potentially viable for retrofit and pending further analysis may be candidates for future restoration opportunities.
- 20 retrofit sites deemed not viable for retrofit and have been removed from consideration.

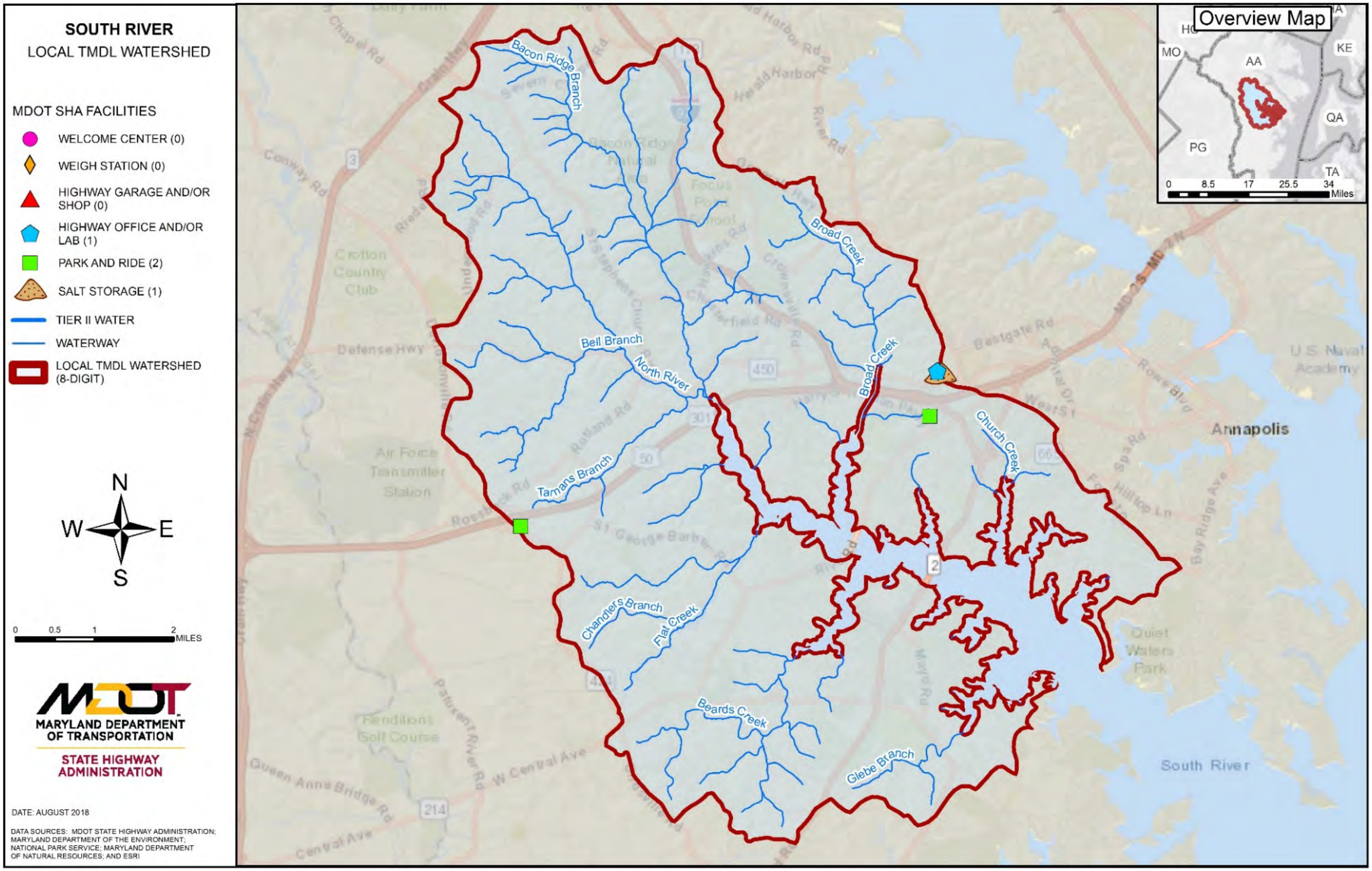


Figure 64: MDOT SHA Facilities within South River Watershed

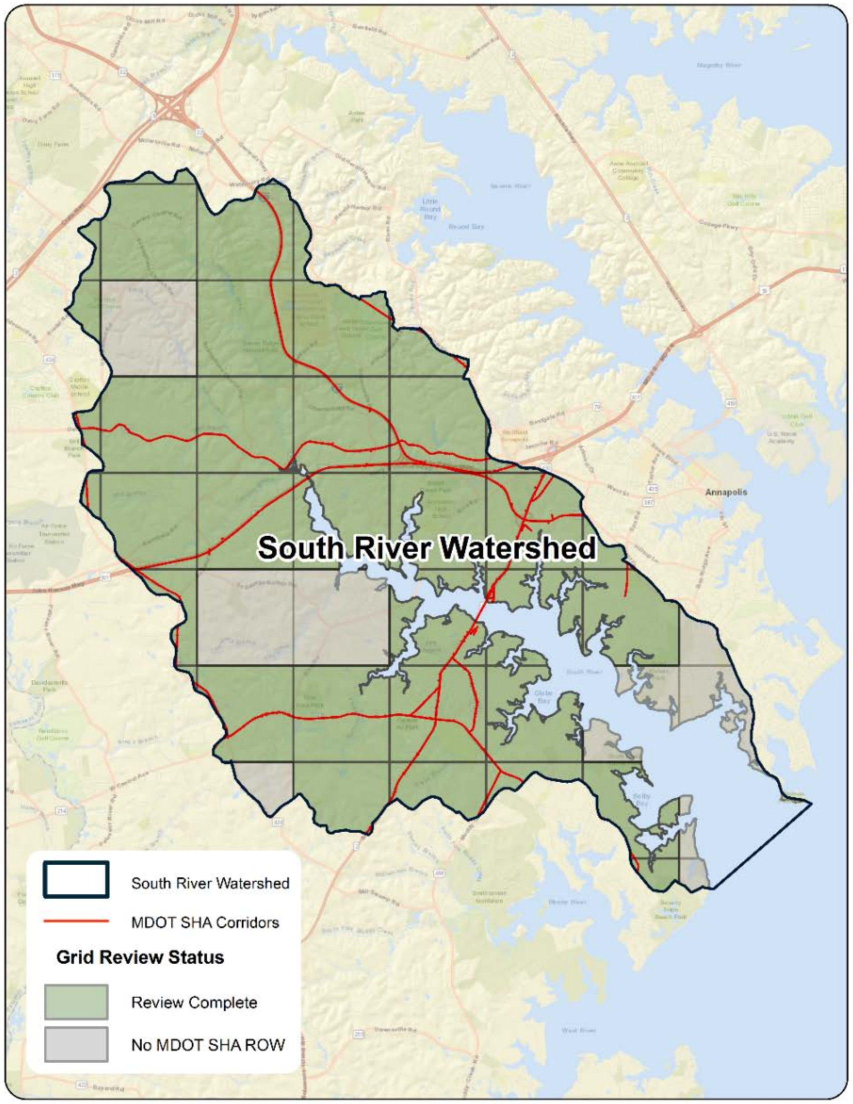


Figure 65: South River Site Search Grids

F.4. Summary of County Assessment Review

The *South River Watershed Study Summary Report* was published in November 2008 by the Anne Arundel County Department of Public Works (AA-DPW) in collaboration with CH2MHILL and KCI Technologies, Inc. (AA-DPW, et al., 2008). The Watershed Study Summary Report serves to provide a baseline of the physical watershed conditions within the South River watershed as well as rank and prioritize the watershed at stream reach and catchment-wide scales.

The *South River Watershed Study Summary Report* did not indicate water quality problems for restoration associated with MDOT SHA ROW. MDOT SHA Restoration Strategies within the South River Watershed are shown on **Figure 66**.

The South River watershed is divided into 59 subwatersheds grouped into three clusters: the Headwaters, North Shore, and South Shore.

The Headwaters cluster of subwatersheds lies almost entirely north of U.S. Route 301 (US 301) and includes 151.4 miles of streams with three major streams: North River, Bacon Ridge Branch, and Tarnans Branch. The Headwaters cluster area also includes the majority of the Broad Creek watershed to the north of US 301. The cluster is approximately 16,200 acres (25.3 square miles), of which 9 percent is impervious. According to the report, this indicates that conditions are supportive of aquatic and plant life, and the stream quality level is good. Approximately half of the impervious area is residential, and a quarter is transportation, which is due to the cluster being bisected by several major road corridors such as Interstate 97 and MD Route 450. The Headwaters cluster area is less populated than either the North Shore or South Shore clusters. While the Headwaters cluster has several residential (22 percent) and agricultural areas (8 percent), most notably in this cluster are the large tracts of contiguous forested land (58 percent) (AA-DPW, et al., 2008, Appendix A).

The North Shore cluster of subwatersheds lies south of US 301 to the north of South River and includes a portion of the city of Annapolis. Major streams include Church Creek, Crab Creek, and a portion of the Broad Creek watershed. The North Shore cluster is approximately 6,900 acres (10.8 square miles), of which 27 percent is impervious. According to the report, this indicates that this is non-supportive for optimal stream health and the level of stream quality is fair. It includes 21.3 miles of streams, with at least half of the subwatersheds containing streams that are completely influenced by tides. Of the 21.3 stream miles, 56 percent are perennial. The North Shore is dominated by residential (50 percent) and commercial development (10 percent). While this cluster also has a large percentage of forested land (29 percent), it is much more fragmented than in the Headwaters cluster (AA-DPW, et al., 2008, Appendix A).

The South Shore cluster lies south of US 301 to the south of South River. Major streams include Flat Creek, Beards Creek, and Glebe Creek. The South Shore cluster is approximately 13,000 acres (20.3 square miles), of which 15 percent is impervious. According to the report, this indicates that the stream health is impacted by the surrounding impervious surface and the level of stream quality is fair. It includes 69.8 miles of streams, with 53 percent being perennial. There is a high residential (37 percent) concentration in the South Shore cluster subwatersheds that is directly adjacent to the South River. The rest of the South Shore cluster area contains a significant amount of contiguous forested land (43 percent). Commercial and agriculture together account for 10 percent of the land use (AA-DPW, et al., 2008, Appendix A).

Pollutant load modeling for the South River watershed was completed for TN, TP, TSS, and fecal coliform. **Table 64** displays the existing and future summary of highest nutrient loads for the South River. The table indicates higher pollutant loads in the North Shore cluster specifically in the subwatersheds immediately surrounding Broad Creek and Church Creek as well as in the South Shore cluster in the subwatersheds immediately surrounding Glebe Creek (AA-DPW, et al., 2008, Appendix A).

Three types of assessments were conducted for the prioritization of the South River watershed: stream reach restoration, subwatershed restoration, and subwatershed preservation. The prioritization models utilized indicators related to stream assessment, stormwater BMPs, land use, and pollutant-loading. **Table 65** provides a summary of the prioritization assessments findings.

Table 64: Highest Nutrient Loads for South River (2008)

Nutrient	Amount Range	Subwatershed	Nutrient	Amount Range	Subwatershed
Existing Conditions			*Future Conditions*		
TN	9,980 to 15,881 lbs/yr	Church Creek Broad Creek 1 Broad Creek 2	Total Nitrogen	8,084 to 14,733 lbs/yr	Church Creek Broad Creek 1 Beards Creek 2 Glebe Creek 1
TP	527 to 576 tons/yr	Church Creek Broad Creek 1 Glebe Creek 1	Total Phosphorus	571 to 1,194 lbs/yr	Church Creek Broad Creek 1 Glebe Creek 1
TSS	280 to 576 tons/yr	Church Creek Broad Creek 1 Glebe Creek 1	Total Suspended Solids	315 to 611 tons/yr	Church Creek Broad Creek 1 Glebe Creek 1
Fecal Coliform	7.5e+001 to 1.6e+012 org/yr	Church Creek Broad Creek 1 Glebe Creek 1 Duvall Creek Aberdeen Creek Crab Creek	Fecal Coliform	9.8e+011 to 1.7e+012 org/yr	Church Creek Broad Creek 1 Glebe Creek 1
Source: (AA-DPW, et al., 2008, p 3-5)					

The stream reach restoration assessment found that in the Headwaters cluster, approximately eight percent of the stream reaches were rated as the Worst Condition and twenty-five percent were on the Best Condition. In the North Shore cluster, only approximately six percent of the stream reaches were rated as Worst Condition and 18 percent were in the Best Condition. In the South Shore cluster, only approximately five percent of the stream reaches were rated as Worst Condition and 18 percent where in the Best Condition (AA-DPW, et al., 2008, Appendix A).

The subwatershed restoration ranking determined that in the Headwaters cluster, there are 17 subwatersheds; no subwatersheds were ranked in the Worst Condition category. Three subwatersheds were within one level of the Worst Condition ranking: North River 5, Tarnans Branch, and Broad Creek 2. In the North Shore cluster, there are 33 subwatersheds. Only one small subwatershed was ranked as in the Best Condition and four watersheds were rated in the Worst Condition. Those four watersheds rated in the Worst Condition have the highest residential and commercial development of the cluster. In the South Shore cluster, there are 21 subwatersheds. Six subwatersheds with the highest residential development and impervious surface percentages, when compared with the remainder of the cluster, were ranked as the Worst Condition. Three subwatersheds were ranked as in the best condition (AA-DPW, et al., 2008, Appendix A).

The subwatershed preservation ranking found that in the Headwaters cluster, nearly 40 percent of the subwatersheds were ranked as the Highest Priority for preservation and 30 percent were ranked as the next highest priority. In the North Shore cluster, none of the subwatersheds were ranked as Highest Priority for preservation, which can be attributed to the significant amount of development within the subwatersheds in this cluster. In the South Shore cluster, only two subwatersheds were attributed as the High Priority for preservation (AA-DPW, et al., 2008, Appendix A).

A bacteria source analysis was conducted by MDOT SHA for the South River watershed to identify specific potential sources and known areas of contamination. Two sites were identified in the bacteria TMDL document (MDE, 2005d) with NPDES permits regulating the discharge of fecal bacteria into the South River watershed, however neither site discharges directly into the restricted shellfish harvesting areas.

Table 65: Subwatershed Rankings (2008)					
Rank	**Cluster**	**Subwatershed**	**Cluster**	**Rank**	**Subwatershed**
Restoration			*Preservation*		
Headwater	Worst Condition	None	Headwater	Highest Priority	Bacon Ridge Branch 1, Bacon Ridge Branch 3, Bacon Ridge Branch 4, Broad Creek 3, Broad Creek 5, North River 1, North River 4
Headwater	Best Condition	Bacon Ridge Branch 2, Bacon Ridge Branch 3, Bacon Ridge Branch 5, Broad Creek 4, Broad Creek 5	Headwater	Lowest Priority	Bacon Ridge Branch 6
North Shore	Worst Condition	Gingerville Creek, Church Creek, Aberdeen Creek, Duvall Creek	North Shore	Highest Priority	None
North Shore	Best Condition	Loden Pond	North Shore	Lowest Priority	Maccubins Cove, Gingerville Creek, Church Creek, Aberdeen Creek, Little Aberdeen Creek, Hillsmere Lake, Duvall Creek, Cherrytree Cove, South River Tidal
South Shore	Worst Condition	Granville Creek, Beards Creek 1, Warehouse Creek, Glebe Creek 1, Almshouse Creek, Ramsey Lake	South Shore	Highest Priority	Flat Creek 1, Sheppards Cove 2
South Shore	Best Condition	Sheppards Cove 2, Flat Creek 2, Flat Creek 3, Limehouse Cove	South Shore	Lowest Priority	Flat Creek 5, Beards Creek 5, Sheppards Cove 4, Granville Creek, Beards Creek 1, Spring Lake, Warehouse Creek, Almshouse Creek, Ramsey Creek
Source: (AA-DPW, et al., 2008)					

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirements for the South River watershed TMDL pollutant along with the Target Year for achieving the reductions. South River is listed for bacteria having a baseline year of 2001 for bacteria. A treatment buffer was not applied to bacteria because this pollutant is not treated exclusively through stormwater or alternative BMPs. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in **Section E.3.c.**

Proposed practices to meet the bacteria reductions in the South River watershed are shown in **Table 66** and **Table 67**. Projected bacteria reductions in the subsegment of South River using these practices are 3,476 billion counts/day, which is 11.1 percent of the reduction target. These practices are described in **Section E** of this plan. There are currently no practices planned in the Ramsey Lake bacteria subwatershed. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the baseline is 2001 for bacteria;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the South River watershed total $20,635,500. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 68** for a summary of estimated BMP costs.

Figure 66 shows a map of MDOT SHA watershed restoration strategies throughout the South River watershed. The practices shown only include those that are under design or constructed.

Table 66: South River – Ramsey Lake Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2001)	Restoration BMPs			
			2020	2025	Target Year[1]	Restoration Totals
Annual Load Reductions	Fecal coliform billion counts/day	0.0			N/A	0.0

[1] *Refer to Table 2 for Target Year.*

Table 67: South River – Subsegment Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2001)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	231.9	3.3		N/A	3.3
Stormwater Retrofit	drainage area acres		140.5		N/A	140.5
Cross-Jurisdictional[1]	drainage area acres	14.5			N/A	
Annual Load Reductions	Fecal coliform billion counts/day	26,406.4	3,476.0		N/A	3,476.0

[1] *Cross-jurisdictional BMPs may be a mix of various stormwater control structures.*
[2] *Refer to Table 2 for Target Year.*

Table 68: South River Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater	$233,000			$233,000
Stormwater Retrofit	$7,335,000			$7,335,000
			Total Restoration Cost	$7,568,000

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs.*
[2] *Refer to Table 2 for Target Year.*

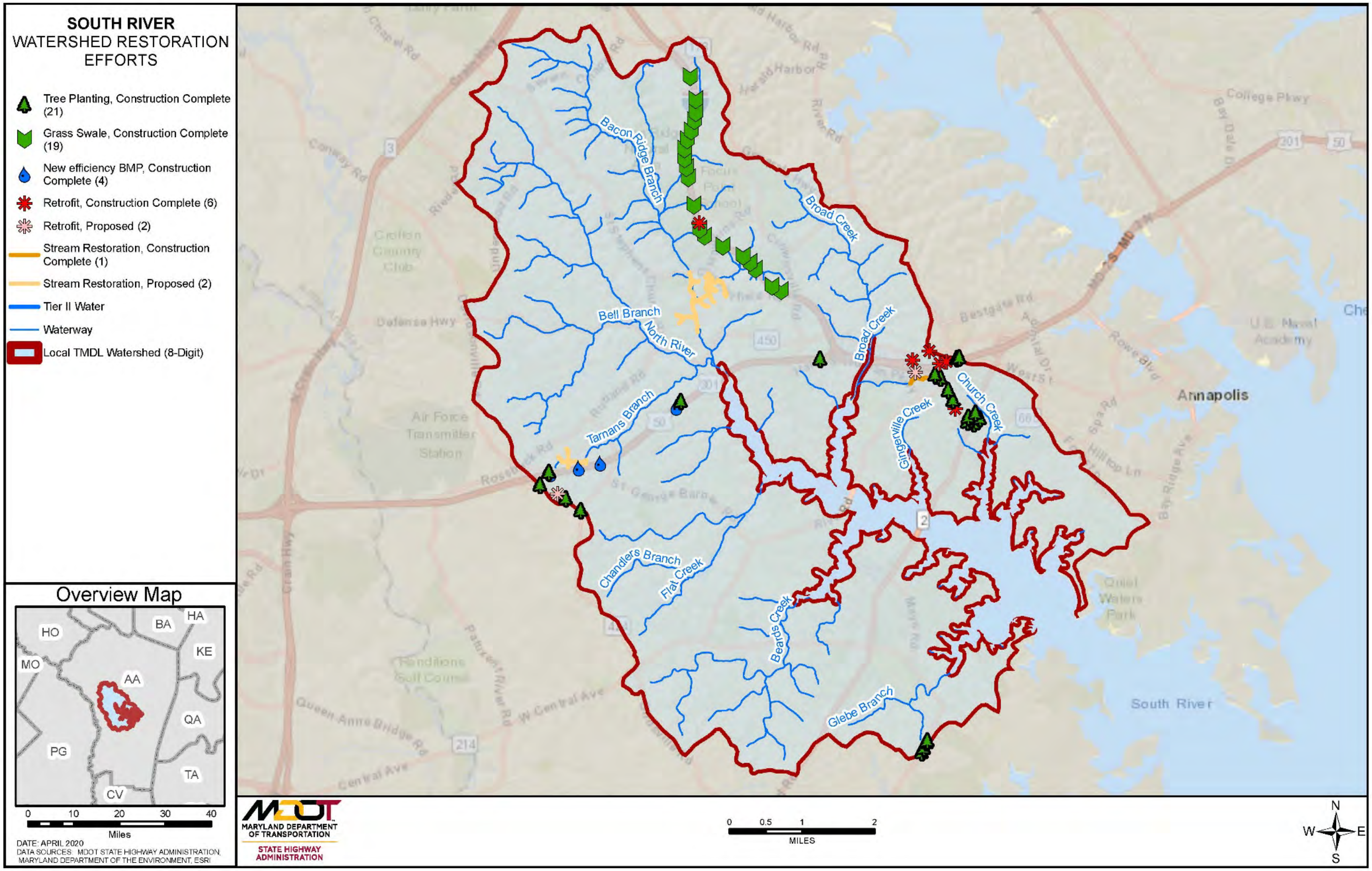


Figure 66: MDOT SHA Programmed Restoration Strategies within the South River Watershed

F20. UPPER MONOCACY RIVER WATERSHED

F.1. Watershed Description

The Upper Monocacy River originates in Pennsylvania and flows through Maryland ultimately into the Potomac River. The watershed encompasses approximately 274 square miles within the state of Pennsylvania and approximately 724 square miles in both Frederick and Carroll Counties, Maryland. In Frederick County, it is divided into six subwatersheds: Fishing Creek, Glade Creek, Hunting Creek, Owens Creek, Toms Creek, and Tuscarora Creek.

There are approximately 665 centerline miles of MDOT SHA roadway located within the Upper Monocacy River watershed. The associated ROW encompasses 1,220 acres, of which approximately 631 acres are impervious. MDOT SHA facilities located within the watershed consist of one highway garage or shop, one welcome center, and two salt storage facilities. See **Figure 67** for a map of the watershed and these facilities.

F.2. MDOT SHA TMDLs within Upper Monocacy River Watershed

MDOT SHA is included in the phosphorus (MDE, 2013f), sediment (MDE, 2009j), and *E. coli* TMDLs (MDE, 2009k). This plan focuses on the E. coli TMDL in the Upper Monocacy River watershed with a reduction requirement of 97 percent, as shown in **Table 2**.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Upper Monocacy River watershed is shown in **Figure 68** which illustrates that 84 grid cells have been reviewed, encompassing portions of 13 state route corridors. Potential BMP sites identified as part of the visual inspections follow:

Structural SW Controls

Preliminary evaluation identified 971 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- 39 sites constructed or under contract.
- 731 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 201 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 211 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 82 sites constructed or under contract.
- 14 additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 115 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified 10 sites as potential stream restoration locations. Further analysis of these locations resulted in:

- Seven additional sites deemed potentially viable for stream restoration and pending further analysis, may be a candidate for future restoration opportunities
- Three sites deemed not viable for stream restoration and have been removed from consideration.

Grass Swale Rehabilitation

Preliminary evaluation identified 40 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- Eight additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 32 sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

No outfall stabilization sites were identified within this watershed for potential restoration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified seven existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- Retrofit of one existing structural SW controls constructed or under contract.
- Six retrofit sites deemed not viable for retrofit and have been removed from consideration.

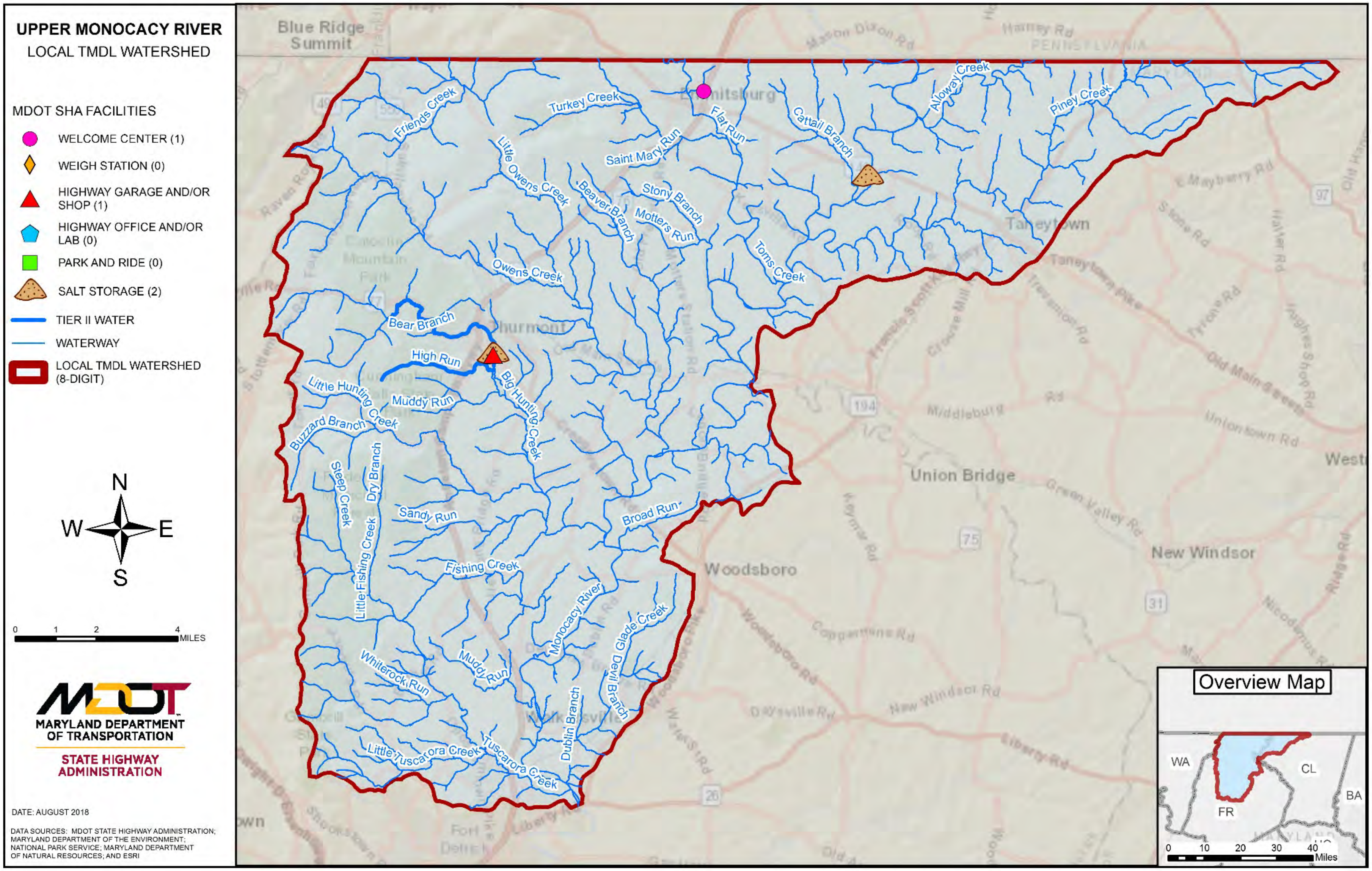


Figure 67: MDOT SHA Facilities within Upper Monocacy River Watershed

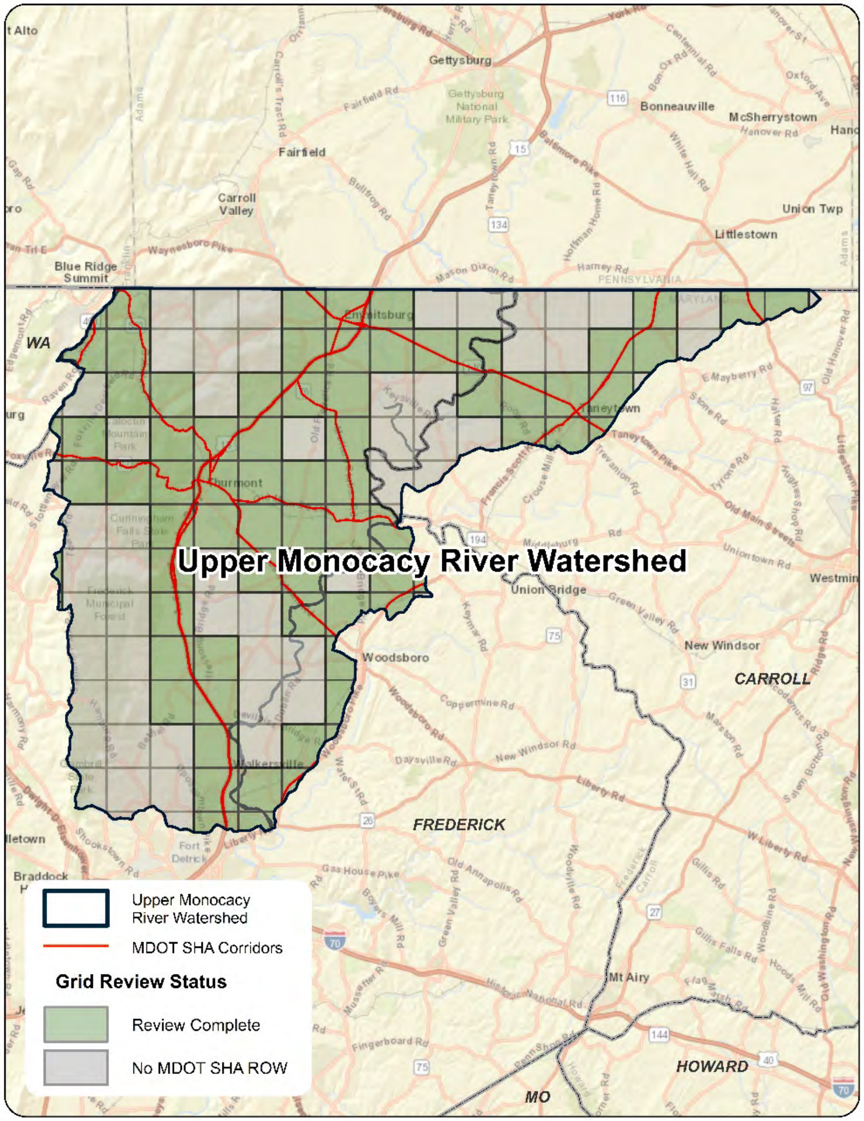


Figure 68: Upper Monocacy River Site Search Grids

F.4. Summary of County Assessment Review

Waters within the Upper Monocacy River watershed are subject to the following impairments as noted on MDE's 2018, 303(d) List:

- *Escherichia coli*;
- Phosphorus (Total);
- Temperature, water; and
- TSS.

In May 2017, the *Upper Monocacy River Watershed Assessment* (EA, 2017) was prepared for the Frederick County Division of Public Works by EA Engineering, Science, and Technology, Inc., PBC (EA) to act as a guide in the county's efforts to restore and protect water quality.

The Upper Monocacy watershed in Frederick County has an approximate area of 204 square miles and contains approximately 424 miles of stream. The watershed is divided into six subwatersheds: Toms Creek, Owens Creek, Hunting Creek, Fishing Creek, Tuscarora Creek, and Glade Creek. The dominant land uses as recorded in 2002 are agriculture (45 percent) and forest (45 percent) (EA, 2017, p. 2). Soils are classified as highly erodible in the mountainous areas of the watershed, with a small amount of hydric soils scattered throughout (EA, 2017, p. 6).

In accordance with the Maryland Biological Stream Survey (MBSS), mean Physical Habitat Indicator (PHI) scores were assigned to each subwatershed based on the percentage of stream miles considered to be Marginally Degraded, Partially Degraded, Degraded, or Severely Degraded. Of the six, two subwatersheds are classified as Degraded based on their mean PHI score: Glade Creek and Toms Creek. Four were classified as Partially Degraded: Fishing Creek, Hunting Creek, Owens Creek, and Tuscarora Creek. Also, in accordance with MBSS, each subwatershed was assigned a condition class of Good, Fair, Poor, or Very Poor based on biotic integrity. Only Glade Creek fell into the

Poor category. The remaining five subwatersheds were classified as Fair (EA, 2017, p. 9, 22-23).

A desktop analysis was conducted to identify potential project sites within the county. Sites identified during the desktop analysis were field verified and a list of priority sites was finalized. The final list of proposed projects was then ranked and assigned a priority level (EA, 2017, p. 34-35, 45). Of the highest priority projects, four are located within the Tuscarora subwatershed, three within Toms Creek, and one within Hunting Creek (EA, 2017, Appendix A-1).

MDOT SHA has ROW in all three subwatersheds, as shown in Figure 4-84, and has completed 81 tree plantings within the greater Upper Monocacy watershed, as shown in **Figure 69**. A number of these tree planting sites are located within the three subwatersheds highlighted by the county as priority areas for restoration. Additionally, there are 36 newly completed MDOT SHA BMPs located within the Upper Monocacy watershed, a portion of those within the Tuscarora subwatershed. The *Upper Monocacy River Watershed Assessment* did not indicate any specific information to or water quality problems for restoration associated with MDOT SHA Facilities or ROW.

A bacteria source analysis was conducted by MDOT SHA for the Upper Monocacy River subsegment watershed to identify specific potential sources. Three point sources were identified with active NPDES permits regulating the discharge of fecal bacteria into the Upper Monocacy River subsegment watershed. See **Table 69** for details.

Table 69: Upper Monocacy River Subsegment Watershed Bacteria Source Analysis

Watershed	Pollutant	Site Name (NPDES Permit No.)	Source
Upper Monocacy River Subsegment	Bacteria	Thurmont WWTP (MDR001882)	MDE's Significant Wastewater Treatment Plants Database
Upper Monocacy River Subsegment	Bacteria	Taneytown WWTP (MD0020672)	MDE's Significant Wastewater Treatment Plants Database
Upper Monocacy River Subsegment	Bacteria	Town of Emmitsburg WWTP (MD0020257)	MDE's Significant Wastewater Treatment Plants Database

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirement for the Upper Monocacy River watershed TMDL pollutant along with the Target Year for achieving the reduction. Upper Monocacy River is listed for bacteria with a baseline year of 2004. A treatment buffer was not applied to bacteria because this pollutant is not treated exclusively through stormwater or alternative BMPs. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in **Section E.3.c.**

Proposed practices to meet the bacteria reduction in the Upper Monocacy River watershed are shown in **Table 70**. The projected bacteria reduction using these practices are 1,398 billion MPN/yr. which is 1.8 percent of the reduction target. These practices are described in **Section E** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the bacteria baseline is 2004;
- BMPs implemented after the baseline through fiscal year 2020;

- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Upper Monocacy River watershed total $2,242,000. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 71** for a summary of estimated BMP costs.

Figure 69 shows a map of MDOT SHA watershed restoration strategies throughout the Upper Monocacy River watershed. The practices shown only include those that are under design or constructed.

Table 70: Upper Monocacy River Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2004)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	10.1	56.1		N/A	56.1
Cross-Jurisdictional[1]	drainage area acres	1.0			N/A	
Annual Load Reductions	E.coli billion MPN/yr.	1,255.4	1,398.0		N/A	1,398.0

[1] Cross-jurisdictional BMPs may be a mix of various stormwater control structures.
[2] Refer to Table 2 for Target Year.

Table 71: Upper Monocacy River Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater	$2,242,000			$2,242,000
			Total Restoration Cost	$2,242,000

[1] Costs do not include maintenance, inspection, or remediation for built BMPs.
[2] Refer to Table 2 for Target Year.

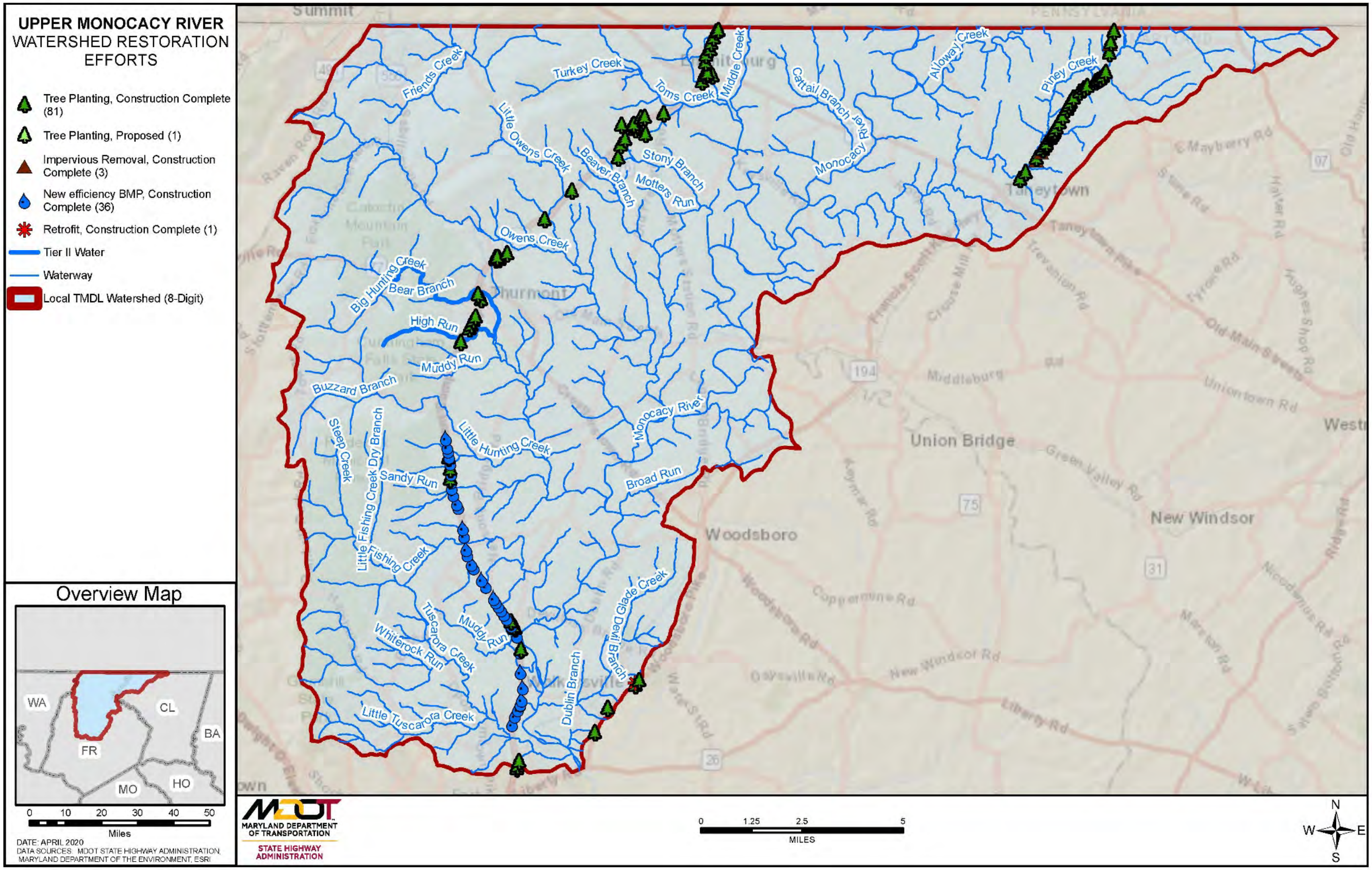


Figure 69: MDOT SHA Restoration Strategies within the Upper Monocacy River Watershed

F21. OTHER WEST CHESAPEAKE WATERSHED

F.1. Watershed Description

The Other West Chesapeake Bay watershed (MD 8-digit Basin Code: 02131005) is located on the Western Shore of the Chesapeake Bay within the Lower Western Shore tributary basin in Anne Arundel and Calvert Counties. The total drainage area of the Other West Chesapeake watershed is approximately 80 square miles (51,170 acres), not including water/wetlands. Approximately 0.8 square miles (505 acres) of the watershed is covered by water. While the Lower Western Shore tributary basin includes several rivers such as the Magothy, Severn, South, West, and Rhode Rivers, the Other West Chesapeake watershed contains no major rivers. The watershed is entirely within the Coastal Plains physiographic region and contains no "high quality," or Tier II, stream segments (MDE, 2017c).

The designated use of the non-tidal portion of the Other West Chesapeake is Use Class I – Water Contact Recreation, and Protection of Nontidal Warmwater Aquatic Life (MDE, 2017c).

Waters within the Other West Chesapeake watershed are subject to the following impairments as noted on MDE's 2018, 303(d) List:

- Fecal Coliform;
- Nitrogen (Total);
- Phosphorous (Total); and
- Total Suspended Solids (TSS).

There are 21 centerline miles of MDOT SHA roadway located within the Other West Chesapeake watershed. The associated ROW encompasses 222 acres, of which 81 acres are impervious. MDOT SHA facilities located within the watershed consist of one highway garage and/or shop, one park and ride, and one salt storage facility.

See **Figure 70** for a map of MDOT SHA facilities within the Other West Chesapeake watershed.

F.2. MDOT SHA TMDLs within Other West Chesapeake Watershed

MDOT SHA is included in the sediment (MDE, 2017c) TMDL in the Other West Chesapeake watershed and fecal coliform bacteria TMDL (MDE, 2005e) within the Tracy and Rockhold Creeks subwatersheds of the Other West Chesapeake Watershed. This plan will focus on the Bacteria TMDL which is to be reduced by 81.6 percent, as shown in **Table 2**.

While the Other West Chesapeake watershed is located in both Anne Arundel and Calvert Counties, Calvert County is currently outside of the MDOT SHA current permit coverage area. Therefore, **Section F.3.**, **Section F.4.**, and **Section F.5.** below only pertain to the portion of the Other West Chesapeake watershed in Anne Arundel County. When MDOT SHA's next permit is issued and if Calvert County becomes a part of the next permit coverage area this implementation plan will be re-evaluated.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major state route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Other West Chesapeake watershed is shown in **Figure 71** which illustrates that 20 grid cells have been reviewed, encompassing portions of eight state route corridors. Potential BMP sites identified as part of the visual inspections.

Structural Stormwater Controls

Preliminary evaluation identified 83 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

- 81 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- Two sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 18 locations as potential tree planting locations. Further analysis of these locations resulted in:

- Five sites constructed or under contract.
- Three additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 10 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified two sites as potential stream restoration locations. Further analysis of this location resulted in:

- Two sites deemed not viable for stream restoration.

Grass Swale Rehabilitation

No grass swale rehabilitation sites were identified in this watershed for restoration.

Outfall Stabilization

Preliminary evaluation identified five outfalls potential for stabilization. Further analysis of this site resulted in:

- Five outfall sites deemed not viable for outfall stabilization and have been removed from consideration.

Retrofit of Existing Structural SW Controls

No existing structural SW controls were identified in this watershed for potential retrofits.

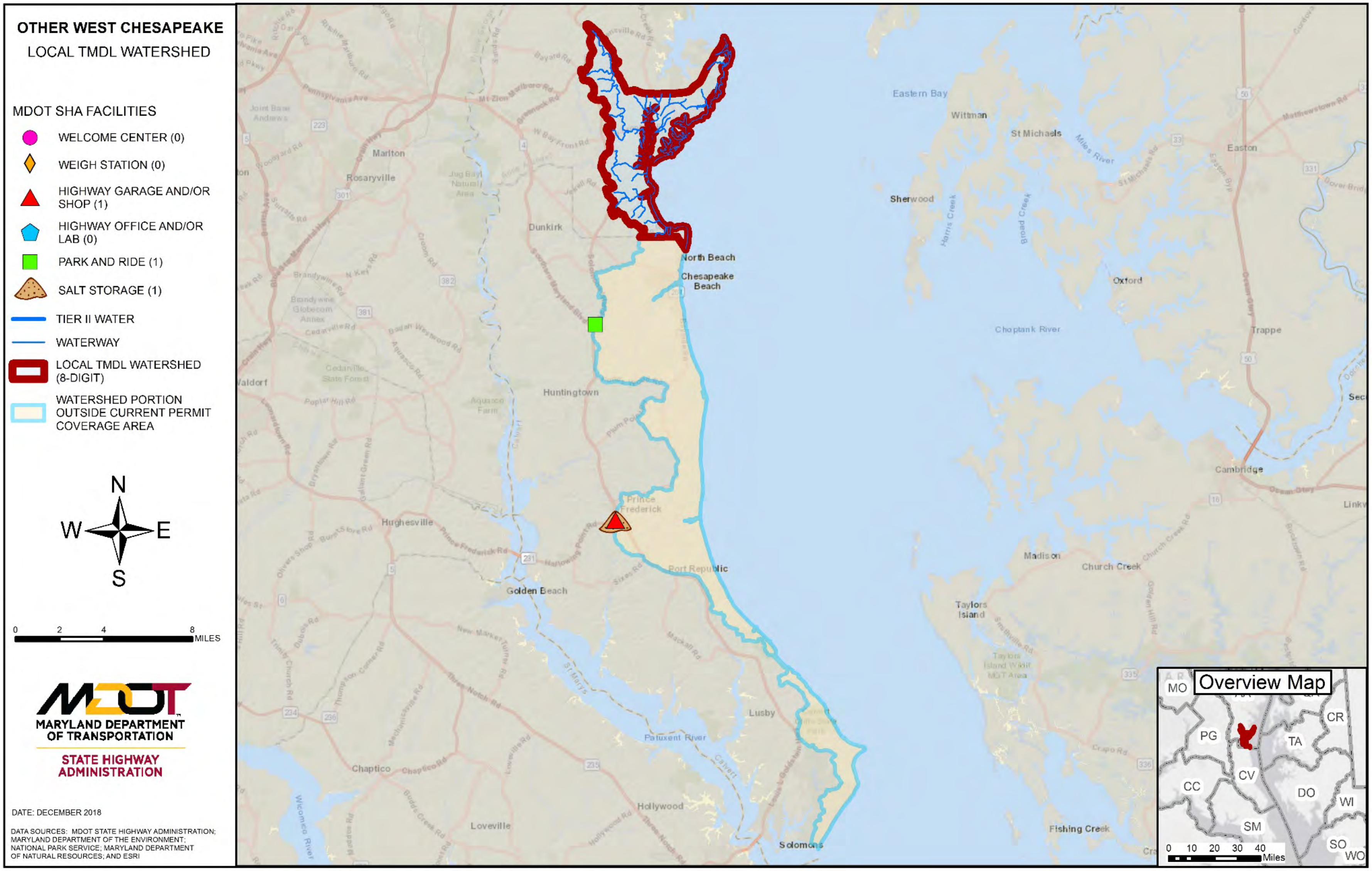


Figure 70: MDOT SHA Facilities within Other West Chesapeake Watershed

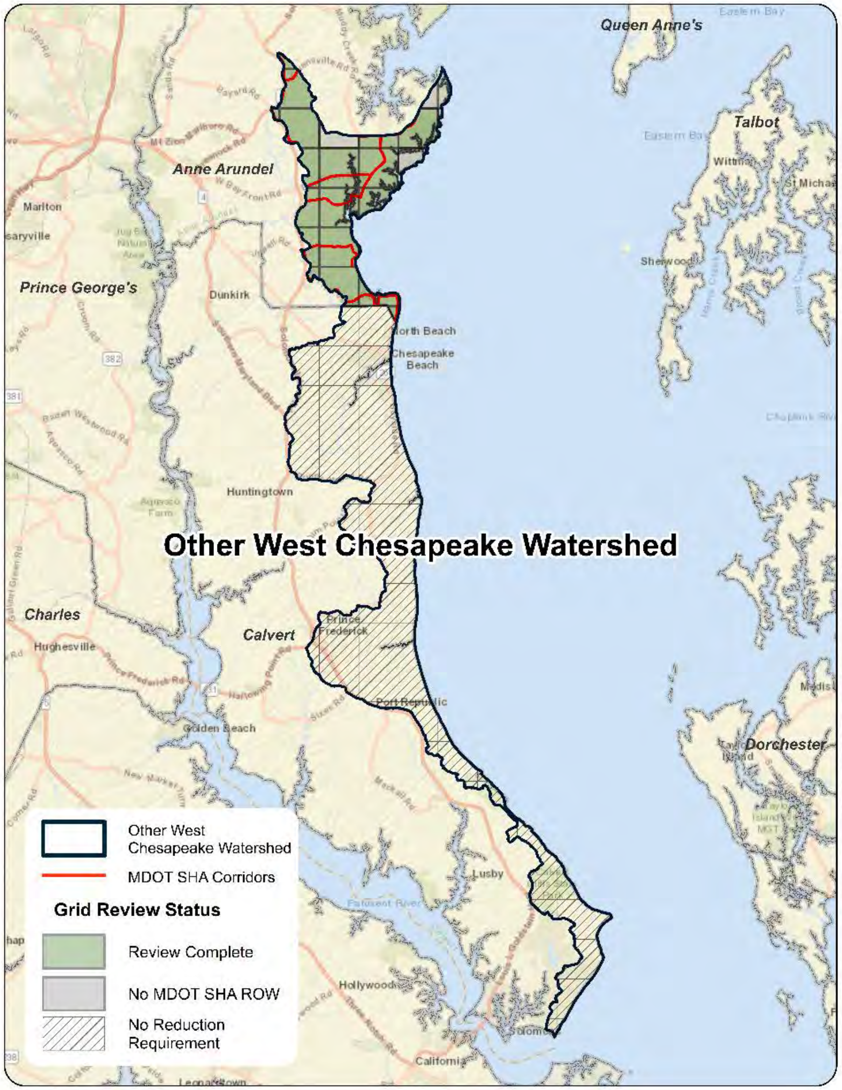


Figure 71: Other West Chesapeake Site Search Grids

F.4. Summary of County Assessment Review

The Herring Bay, Middle Patuxent, and Lower Patuxent Watershed Assessment Comprehensive Summary Report was published in June 2018 through a collaborative effort between the Watershed Protection and Restoration Program within the Anne Arundel County Department of Public Works (AA-DPW), KCI Technologies, Inc., and Coastal Resources, Inc. (AA-DPW et al., 2018). The Anne Arundel County portion of the Other West Chesapeake Bay watershed is the Herring Bay watershed. A portion of the Other West Chesapeake Bay watershed is located within Calvert County; however, Calvert County is outside of the current MDOT SHA NPDES MS4 permit coverage area and therefore only Anne Arundel County's portion is summarized below.

The Herring Bay watershed is located in the eastern and southeastern region of the County. The watershed's total eastern portion is located on the mainstem of the Chesapeake Bay and the southern portion shares a boundary with Calvert County. Many sensitive environmental features can be found throughout the watershed, including wetlands primarily in the eastern portion of the watershed, greenways, forested areas, Chesapeake Bay Critical Area, and Federal Emergency Management Agency (FEMA) floodplains. These high quality habitats are sensitive to anthropogenic stress and have been identified as priorities for protection (AA-DPW et al., 2018, p. 14).

Land use within the Herring Bay watershed is as follows: woods (41.78 percent); residential (23.37 percent); forested wetlands (9.41 percent), and industrial (less than 1 percent). Open space, open wetland, pasture/hay, commercial, row crops, and transportation each account for approximately 2 to 7 percent of the watershed. Development of the land is expected to continue (AA-DPW et al., 2018, p. 14-15).

Soils within the Herring Bay watershed hold diverse hydrologic characteristics; however, the majority are categorized as having a medium-high (33 percent) to high (24 percent) susceptibility to soil erosion. While the majority are classified as Group B soils (46 percent), the more erodible Group C and Group D soils together account for 54 percent of the watershed (43 and 11 percent, respectively), which could pose a challenge to implementing BMPs. The watershed has approximately 953.4 acres of impervious cover or 6.5 percent. MDOT SHA property accounts for 34 percent of the watershed's impervious cover (AA-DPW et al., 2018, p. 9 & 16).

Based on the calculated Maryland Physical Habitat Index (MPHI) score, each stream reach was assigned a condition category of Severely Degraded, Degraded, Partially Degraded, or Minimally Degraded. The average length-weighted MPHI score for the Herring Bay watershed is 76.1, which corresponds to the Partially Degraded condition. Erosion impacts primarily due to encroachment from agricultural fields and residential lawns, as well as stream crossing impacts and riparian buffer impacts had the highest total cumulative impact scores of all the inventoried features (AA-DPW et al., 2018, p. 25).

MDOT SHA owns one percent of the BMPs within the Herring Bay watershed, which manages three percent of the total 100.6-acre drainage area (AA-DPW et al., 2018). There are no MDOT SHA facilities located within the Anne Arundel County portion of the watershed, however, there is ROW throughout the majority of the area (Figures 5 & 6). The Herring Bay, Middle Patuxent, and Lower Patuxent Watershed Assessment Comprehensive Summary Report did not indicate water quality problems for restoration associated with ROW.

Streams and subwatersheds in the Herring Bay watershed in Anne Arundel County were prioritized for stream restoration, subwatershed restoration, and subwatershed preservation.

Subwatersheds with one or more stream reaches rated High priorities for restoration include Rockhold Creek (HB0), Tracys Creek II (HB2), Parker Creek (HBF), Trotts Branch (HBL), and Unnamed Tributary II (HBQ). Six stream reaches were rated as high priority for restoration and are located in the Tracys Creek II subwatershed (AA-DPW, 2018, p. 79).

Subwatersheds rated High priorities for subwatershed restoration include: Rockhold Creek (HB0), Cedarhurst (HB7), Chesapeake Bay (HBB), Broadwater Creek (HBC), Parker Creek (HBF), Herring Bay (HBM), and Herrington Harbor (HBU) (AA-DPW, 2018, p. 82). Subwatersheds rated High priorities for subwatershed preservation include: Deep Dove Creek (HB9), Unnamed Tributary II (HBQ), and Chesapeake Bay II (HBV) (AA-DPW, 2018, p. 86).

MDOT SHA has completed five tree planting projects (**Figure 72**).

Part of the County's NPDES MS4 permit requires efforts to address problems with litter and floatables. Currently, the County undertakes 18 programs to reduce and remove litter and trash focusing on three major approaches:

1. Source reduction and reuse;
2. Recycling/composting; and
3. Treatment and disposal.

Future programs will adhere to these three approaches and include plastic bag bans, polystyrene foam bans, a smoking ban, trash receptacles, street sweeping, catch basin cleaning, storm drain vacuuming, trash nets, and booms and skimmers. Determination of success for these programs will depend on monitoring; therefore, a monitoring program will need to be established to determine baseline levels of litter, what type of litter is most prevalent, where the hotspots for the litter are, and how effective litter reduction programs are (AA-DPW et al., 2018).

A bacteria source analysis was conducted by MDOT SHA for the Tracy and Rockhold Creeks subwatersheds of the Other West Chesapeake Watershed. No specific point sources were identified in the TMDL document (MDE, 2005e).

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirement for Other West Chesapeake watershed TMDL pollutant along with the Target Year for achieving the reduction. The Other West Chesapeake watershed is listed for bacteria having a baseline year of 2001 for bacteria. A treatment buffer was not applied to bacteria because this pollutant is not treated exclusively through stormwater or alternative BMPs. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in **Section E.3.c**.

Proposed practices to meet the bacteria reduction in the Other West Chesapeake watershed is shown in **Table 72**. There are currently no practices planned in the bacteria subwatersheds. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the baseline for bacteria is 2001;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Other West Chesapeake watershed total $0.00. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 73** for a summary of estimated BMP costs.

Figure 72 shows a map of MDOT SHA watershed restoration strategies throughout the Other West Chesapeake watershed. The practices shown only include those that are under design and constructed.

Table 72: Other West Chesapeake – Tracy & Rockhold Creeks Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2001)	Restoration BMPs			
			2020	2025	Target Year[1]	Restoration Totals
Annual Load Reductions	fecal coliform billion counts/day	0.0			N/A	0.0

[1] *Refer to Table 2 for Target Year.*

Table 73: Other West Chesapeake Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
			Total Restoration Cost	$0.00

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs.*
[2] *Refer to Table 2 for Target Year.*

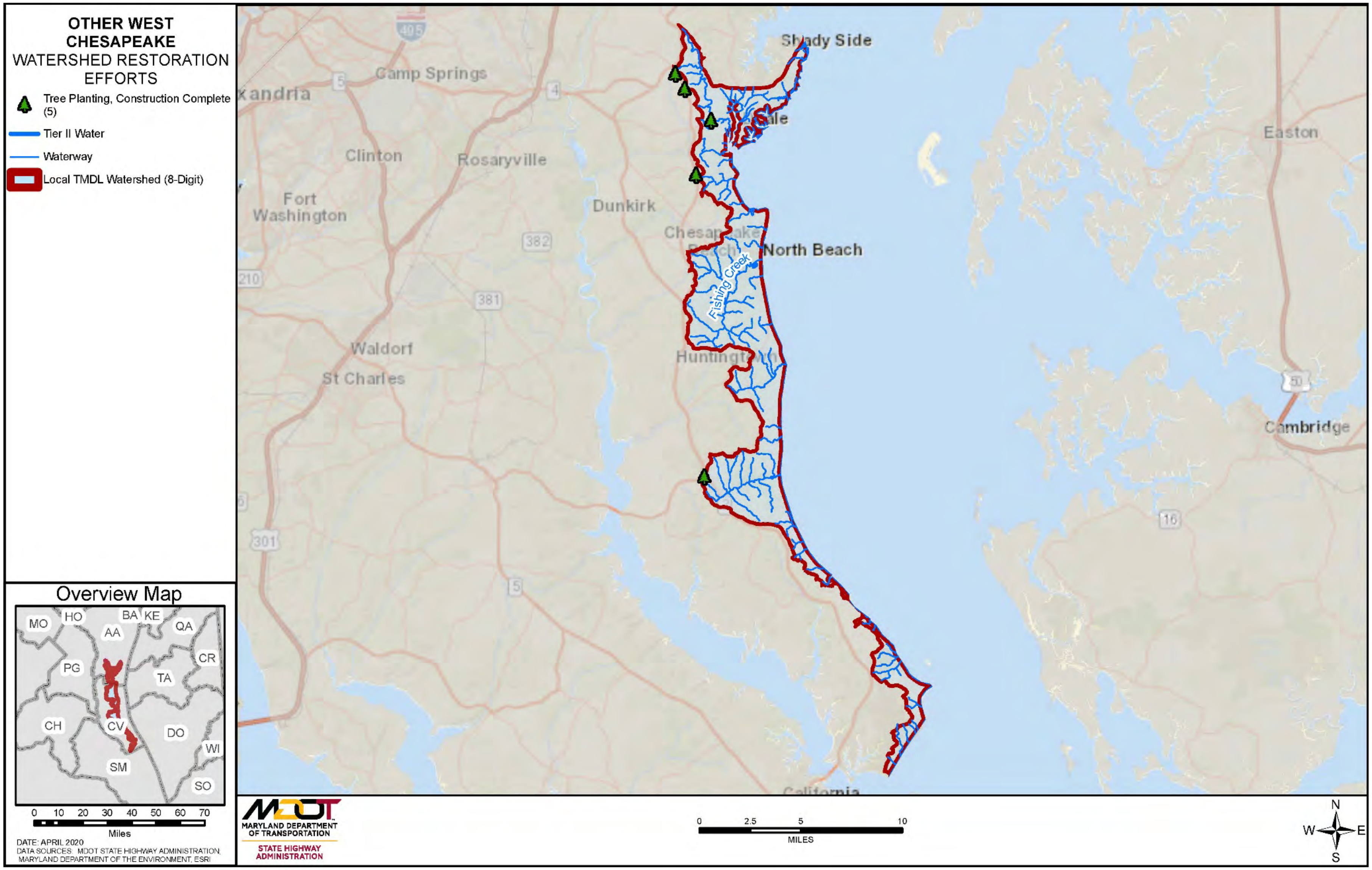


Figure 72: MDOT SHA Programmed Restoration Strategies within the Other West Chesapeake Watershed

F22. WEST RIVER WATERSHED

F.1. Watershed Description

The West River watershed (MD 8-digit Basin Code: 02131004) is associated with three assessment units in Maryland's Integrated Report: a non-tidal watershed and two estuary portions, West River Mesohaline (WSTMH) and Rhode River Mesohaline (RHDMH), located entirely within Anne Arundel County, Maryland. The drainage area of the entire watershed is approximately 25.5 square miles (16,300 acres) and includes approximately 5.5 square miles (3,550 acres) of tidal water (MDE, 2019a).

The designated use of the West River watershed's non-tidal tributaries is Use Class I – Water Contact Recreation and Protection of Nontidal Warmwater Aquatic Life. The designated use of the tidal portions of the West River watershed are Use Class II – Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting (MDE, 2019a).

On the 2018 MDE 303(d) List (MDE, 2018) the following impairments were listed for the West and Rhode River Mesohaline watersheds:

- Fecal Coliform;
- Nitrogen, Total;
- PCB in Fish Tissue;
- Phosphorus, Total;
- Sulfate; and
- Total Suspended Solids (TSS).

There are 18 centerline miles of MDOT SHA roadway located within the West River watershed. The associated ROW encompasses 169 acres, of which 81 acres are impervious. As indicated on the map in **Figure 73** there are no MDOT SHA facilities within the West River watershed.

F.2. MDOT SHA TMDLs within West River Watershed

MDOT SHA is included in the sediment (TSS) TMDL (MDE, 2019a). This TMDL only applies to the non-tidal portion of the West River watershed.

The West River Mesohaline Chesapeake Bay Segment within the West River watershed has a TMDL for PCBs (MDE, 2016b). However, MDOT SHA does not have a reduction requirement for this TMDL.

MDOT SHA is included in the fecal bacteria TMDL for Restricted Shellfish Harvesting Areas in Bear Neck Creek, Cadle Creek, West River subsegment, and Parish Creek for the West River Basin (MDE, 2006i). Bacteria is to be reduced by 43.2 percent for Bear Neck Creek, 72.2 percent for Cadle Creek, and 35.3 percent for the West River subsegment. There is currently no MDOT SHA right-of-way within the Parish Creek watershed; and therefore, no modeled PCB load to reduce. This plan will focus only on the bacteria TMLD.

NN.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major State route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the West River watershed is shown in **Figure 74** which illustrates that seventeen grid cells have been reviewed, encompassing portions of five State route corridors. Potential BMP sites identified as part of the visual inspections follow.

Structural Stormwater Controls

Preliminary evaluation identified 52 locations as potential new structural stormwater SW control locations. Further analysis of these locations resulted in:

- Fifty one additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.

- One site deemed not viable for new structural SW controls and has been removed from consideration.

Tree Planting

Preliminary evaluation identified 16 locations as potential tree planting locations. Further analysis of these locations resulted in:

- Four sites constructed or under contract.

- Four additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.

- Eight sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified six sites as potential stream restoration locations. Further analysis of these locations resulted in:

- One additional site deemed potentially viable for stream restoration and pending further analysis, may be a candidate for future restoration opportunities

- Five sites deemed not viable for stream restoration and have been removed from consideration.

Grass Swale Rehabilitation

No grass swale sites were identified in this watershed for restoration.

Outfall Stabilization

Preliminary evaluation identified 14 outfalls with potential for stabilization. Further analysis of these sites resulted in:

- Three outfall sites deemed potentially viable for outfall stabilization efforts and pending further analysis, may be candidates for future restoration opportunities.

- Eleven outfall sites deemed not viable for outfall stabilization and have been removed from consideration.

Retrofit of Existing Structural SW Controls

No existing structural SW controls were identified for potential retrofits in this watershed for restoration.

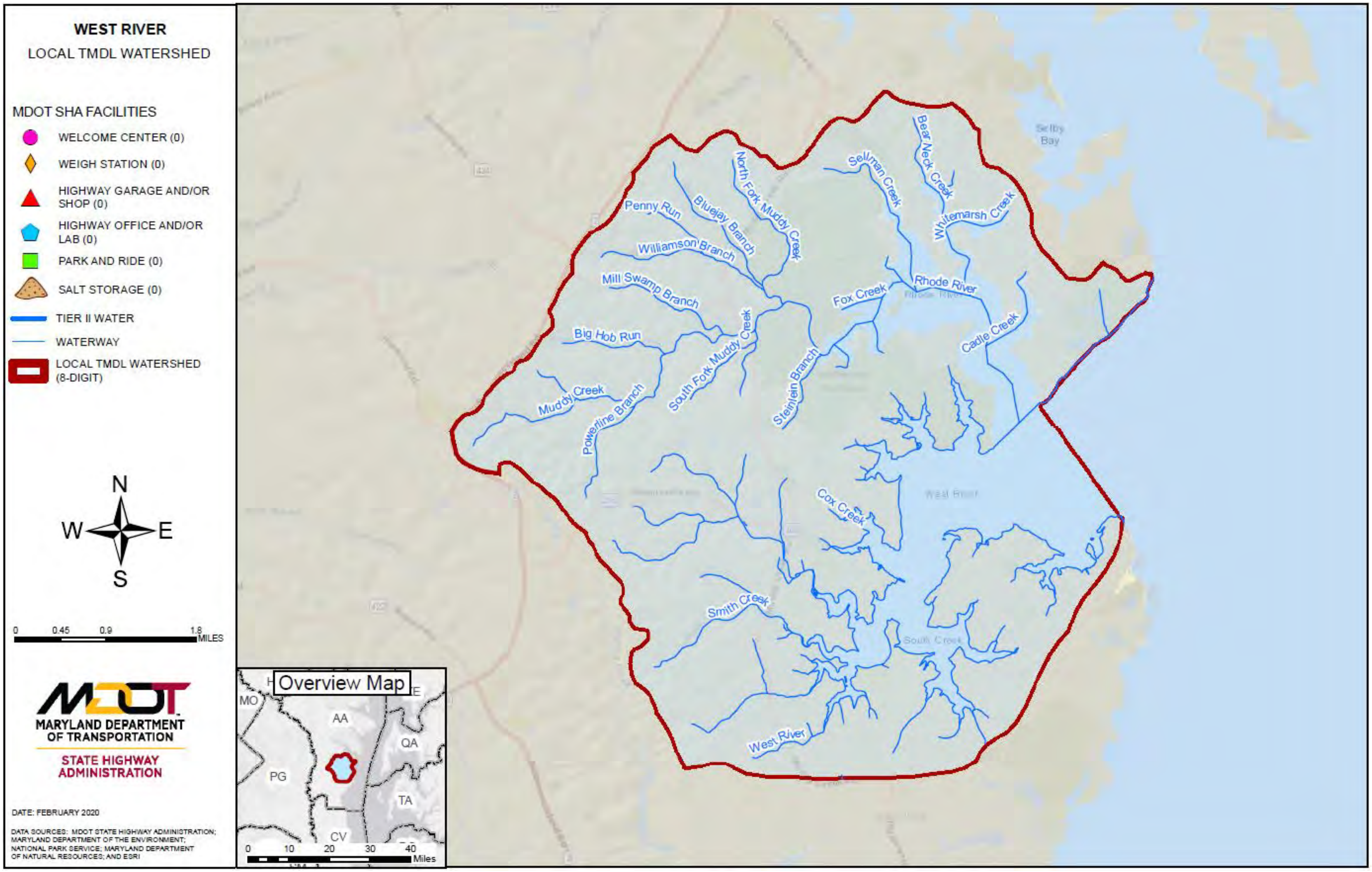


Figure 73: MDOT SHA Facilities within West River Watershed

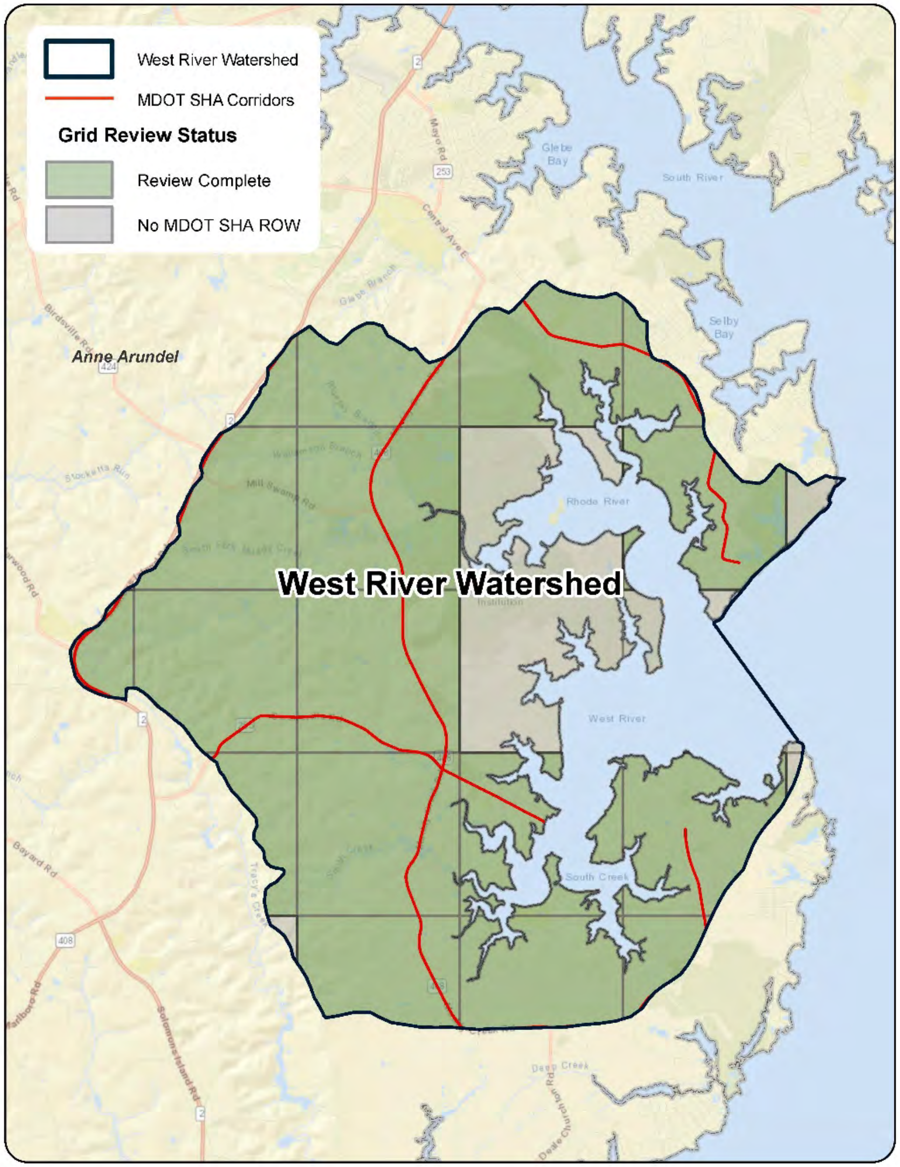


Figure 74: West River Site Search Grids

F.4. Summary of County Assessment Review

The *West and Rhode Watersheds Assessment Comprehensive Summary Report* (AA-DPW, et al., 2016) was published in December 2016 as the result of a collaborative effort between the Watershed Protection and Restoration Program within the Anne Arundel County Department of Public Works (AA-DPW), LimnoTech, and Versar. The report serves as a systematic assessment of current watershed conditions to support and prioritize watershed management and planning decisions and develop detailed restoration plans (AA-DPW et al., 2016, p. 1).

The West and Rhode River Mesohaline watersheds are located entirely within the lower western portion of Anne Arundel County. The West River watershed is comprised of 13 subwatersheds ranging in size from 191 to 1,386 acres (0.3 to 2.2 square miles). The Rhode River watershed is comprised of 15 subwatersheds ranging in size from 229 to 1,541 acres (0.4 to 2.4 square miles) (AA-DPW et al., 2016, p. 7-8).

In the West River watershed, the majority of soils have a moderately high runoff potential; the remainder of soils are predominately identified as having moderately low runoff potential. In addition, most of the land is classified as not highly erodible land. The fastest development occurred in the Parish Creek subwatershed (subwatershed code: WRA) seeing the fastest development in 2000-2015. The overall highest rate of development occurred from 1940-1999 in the South Creek I (WR8) subwatershed (AA-DPW et al., 2016, p. 7-11).

In the Rhode River watershed, the majority of soils have a moderately low runoff potential; the remainder of the soils are predominately identified as having moderately high runoff potential. In addition, most of the land is classified as highly erodible land (55 percent). The fastest development occurred in the Bear Neck Creek subwatershed (RR1) during 1940-2015 (AA-DPW et al., 2016, p. 7-11).

Stormwater BMPs in the West and Rhode River watershed are typically owned by private landowners, the County, or State Agencies such as MDOT SHA. Within the watershed, the majority of BMPs are privately owned (87 percent). When evaluated by the percent of the drainage area that BMPs manage or treat in the watershed; private BMPs cover 55 percent, public BMPs cover 27 percent of the managed area, and the MDOT SHA and other state agencies account for the remaining 18 percent of the managed land (AA-DPW et al., 2016, p. 36-37).

There are no MDOT SHA Facilities located within the West and Rhode River Mesohaline watersheds, however, there is roadway ROW throughout the watersheds. in addition to roadway ROW (**Figure 73 & 74**). The *West and Rhode Watersheds Assessment Comprehensive Summary Report* did not indicate water quality problems for restoration associated with MDOT SHA ROW.

Three types of prioritization assessments were conducted for the West and Rhode River watershed in Anne Arundel County: stream restoration, subwatershed restoration, and subwatershed preservation. All three types of assessments utilized a prioritization rating scale of High, Medium High, Medium, or Low.

In the West River, the stream restoration priority assessment ranked 69 perennial stream reaches in the 13 subwatersheds. Out of the 69, eight were rated as High and 17 were rated as Medium High priority for restoration. In the Rhode River watershed, 197 perennial stream reaches were assessed in the 15 subwatersheds. Out of the 197, 22 were rated as High and 58 were rated as Medium High (AA-DPW et al., 2016, p. 62-63).

The subwatershed restoration assessment rated four subwatersheds within the West River watershed as High priorities for restoration; Tenthouse Creek (WR7), South Creek 1 (WR8), Parish Creek (WRA), and Gales Creek (WR3). The four subwatersheds ranked "High" represent approximately thirty-one percent of the subwatersheds in the West River watershed. Within the Rhode River watershed, three subwatersheds were rated High priorities for restoration; Beverley Beach (RRB), Cadle Creek (RR6), Bear Neck Creek (RR1). The three subwatersheds ranked High represent twenty percent of the subwatersheds in the Rhode River watershed (AA-DPW et al., 2016, p. 66).

The subwatershed preservation assessment ranked four in the West River watershed, four were rated High priorities for preservation; Popham Creek (WR4), West River Tidal (WR0), Cheston Creek (WR2), and Smith Creek 2 (WRC). These subwatersheds represent 18 percent of the subwatersheds in the West River watershed. Within the Rhode River watershed, five were rated High priorities for preservation; Boathouse Creek (RRE), Many Fork Branch (RR3), Sellman Creek (RR2), Williamson Branch (RR7), and North Fork Muddy Creek (RR8). These subwatersheds represent one-third of the subwatersheds within the Rhode River watershed (AA-DPW et al., 2016, p. 68).

MDOT SHA has completed four tree plantings within the West and Rhode River Mesohaline watersheds (**Figure 75**).

A bacteria source analysis was conducted by MDOT SHA for the West River watershed to identify specific potential sources. One point source was identified in MDE's Maryland Point Source Discharges database (2006i) with an active NPDES permit regulating the discharge of fecal bacteria into the West River Bear Neck Creek subsegment, the Mayo Large Communal Water Reclamation Facility in Edgewater.

F.5. MDOT SHA Pollutant Reduction Strategies

Table 2 lists the reduction requirements for the West River watershed TMDL pollutant along with the Target Year for achieving the reductions. West River is listed for bacteria with a TMDL baseline year of 2001. A treatment buffer was not applied to bacteria plans because bacteria is not treated exclusively through stormwater or alternative BMPs. The majority of pollutant load reduction for the bacteria TMDL will be treated through source tracking to pursue load reduction activities as outlined in **Section E.3.c.**

Proposed practices to meet bacteria reductions in the Bear Neck Creek, Cadle Creek, and West River subsegment watersheds are shown in **Table 74**, **Table 75**, and **Table 76**, respectively. There are currently no practices planned in the bacteria subwatersheds. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baselines. In this case, the bacteria baselines are 2001;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the West River watershed total $0.00. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 77** for a summary of estimated BMP costs.

Figure 75 shows a map of MDOT SHA watershed restoration strategies throughout the West River watershed. The practices shown only include those that are under design and constructed.

Table 74: West River – Bear Neck Creek Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2001)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
Cross-Jurisdictional[1]	drainage area acres	0.7			N/A	
Annual Load Reductions	Fecal coliform billion counts/day	106.9			N/A	0.0

[1] Cross-jurisdictional BMPs may be a mix of various stormwater control structures.
[2] Refer to Table 2 for Target Year.

Table 75: West River – Cadle Creek Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2001)	Restoration BMPs			
			2020	2025	Target Year[1]	Restoration Totals
Annual Load Reductions	Fecal coliform billion counts/day	0.0			N/A	0.0

[1] *Refer to Table 2 for Target Year.*

Table 76: West River - subsegment Restoration Bacteria BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2001)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
Cross-Jurisdictional[1]	drainage area acres	0.6			N/A	
Annual Load Reductions	Fecal coliform billion counts/day	108.8			N/A	0.0

[1] *Cross-jurisdictional BMPs may be a mix of various stormwater control structures.*
[2] *Refer to Table 2 for Target Year.*

Table 77: West River Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
			Total Restoration Cost	$0.00

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs.*
[2] *Refer to Table 2 for Target Year.*

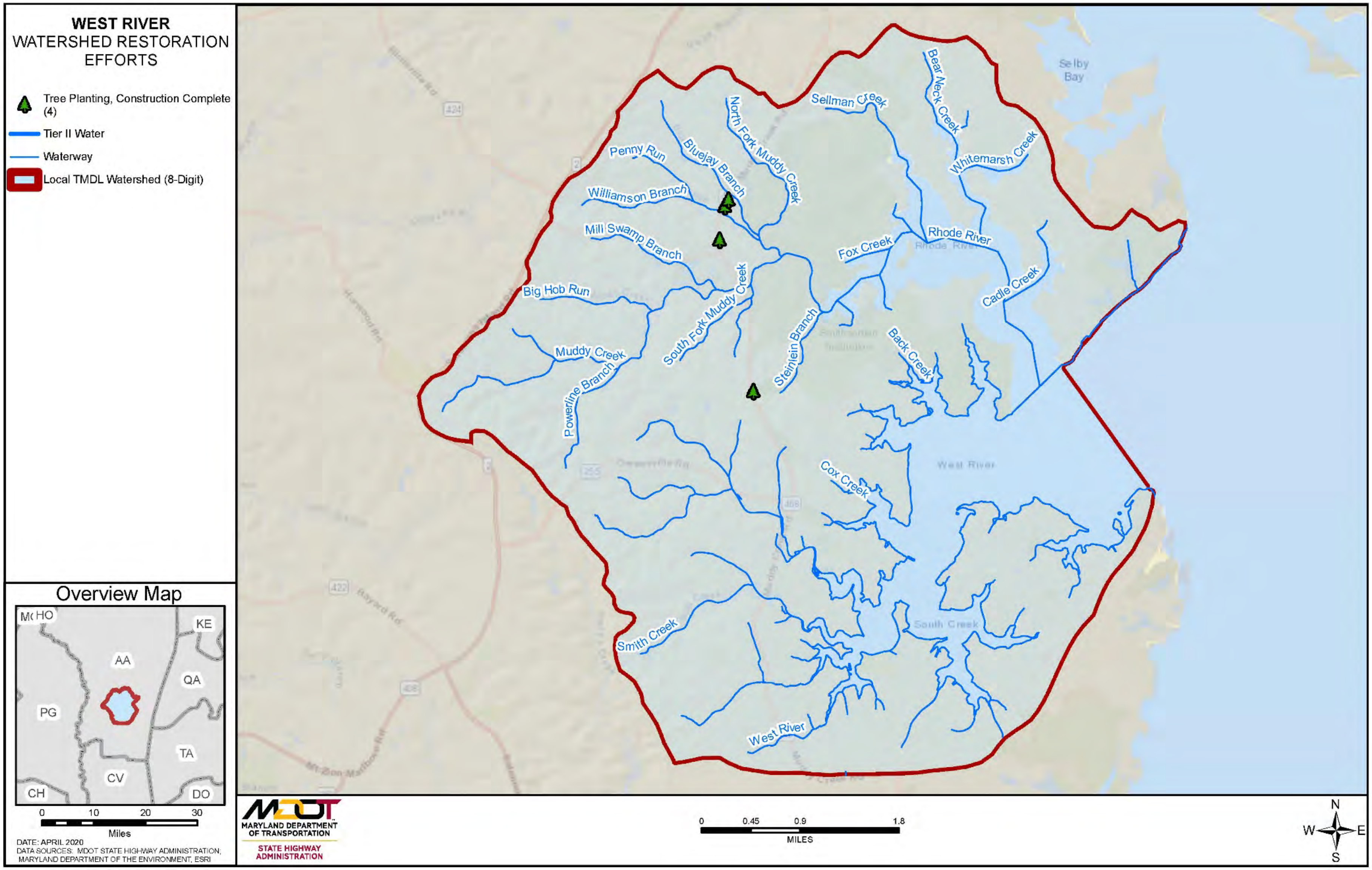


Figure 75: MDOT SHA Programmed Restoration Strategies within the West River Watershed

F23. PORT TOBACCO RIVER WATERSHED

F.1. Watershed Description

The Port Tobacco River watershed (MD 8-digit Basin Code: 02140109) is located entirely within Charles County, on the lower western shore of the state of Maryland. The watershed encompasses approximately 43.75 square miles (28,000 acres), including approximately 3.13 (2,000 acres) of tidal waters. There are two "high quality," or Tier II, stream segments within the watershed (MDE, 2019x).

The nontidal tributaries of the Port Tobacco River watershed are designated as Use Class I – Water Contact Recreation, and Protection of Nontidal Warmwater Aquatic Life, and the tidal tributaries are designated as Use Class II – Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting (MDE, 2019x).

Waters within the Port Tobacco River watershed are subject to the following impairments as noted on MDE's 303(d) List:

- Chloride;
- Enterococcus;
- Nitrogen (Total);
- Phosphorous (Total);
- Sulfate; and
- Total Suspended Solids (TSS).

There are 35 centerline miles of MDOT SHA roadway located within the Port Tobacco River watershed. The associated ROW encompasses 314 acres, of which 191 acres are impervious. MDOT SHA facilities located within the watershed consist of one highway garage and/or shop and one park and ride facility.

See **Figure 76** for a map of MDOT SHA facilities within the Port Tobacco River watershed.

F.2. MDOT SHA TMDLs within Port Tobacco River Watershed

MDOT SHA is included in the sediment TMDL (MDE, 2019b), with a reduction requirement of 33.0 percent, as shown in **Table 2**.

F.3. MDOT SHA Visual Inspection of ROW

The MS4 Permit requires MDOT SHA to perform visual assessments. **Section C** describes the MDOT SHA visual assessment process. Preliminary evaluations for each grid and/or major State route corridor within the watershed have been conducted including both desktop and field evaluations. The grid-system used for the Port Tobacco River watershed is shown in **Figure 77** which illustrates that 35 grid cells have been reviewed, encompassing portions of 9 state route corridors. Potential BMP sites identified as part of the visual inspections .

Structural Stormwater Controls

Preliminary evaluation identified 58 locations as potential new structural stormwater (SW) control locations. Further analysis of these locations resulted in:

- Nine new structural SW controls constructed.
- 33 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 16 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 30 locations as potential tree planting locations. Further analysis of these locations resulted in:

- Three sites constructed.
- One additional sites deemed potentially viable tree planting and pending further analysis, may be candidates for future restoration opportunities.
- 26 sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified four sites as potential stream restoration locations. Further analysis of these locations resulted in:

- Two additional sites deemed potentially viable for stream restoration and pending further analysis may be a candidate for future restoration opportunities.
- Two sites deemed not viable for stream restoration and have been removed from consideration

Grass Swale Rehabilitation

Preliminary evaluation identified 82 sites as potential grass swale rehabilitation. Further analysis of these locations resulted in:

- 34 additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 48 sites deemed not viable for structural SW controls and have been removed from consideration.

Outfall Stabilization

No outfall stabilization sites were identified within this watershed for potential restoration.

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified four existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- Two retrofit sites deemed potentially viable for retrofit and pending further analysis may be candidates for future restoration opportunities.
- Two retrofit sites deemed not viable for retrofit and have been removed from consideration.

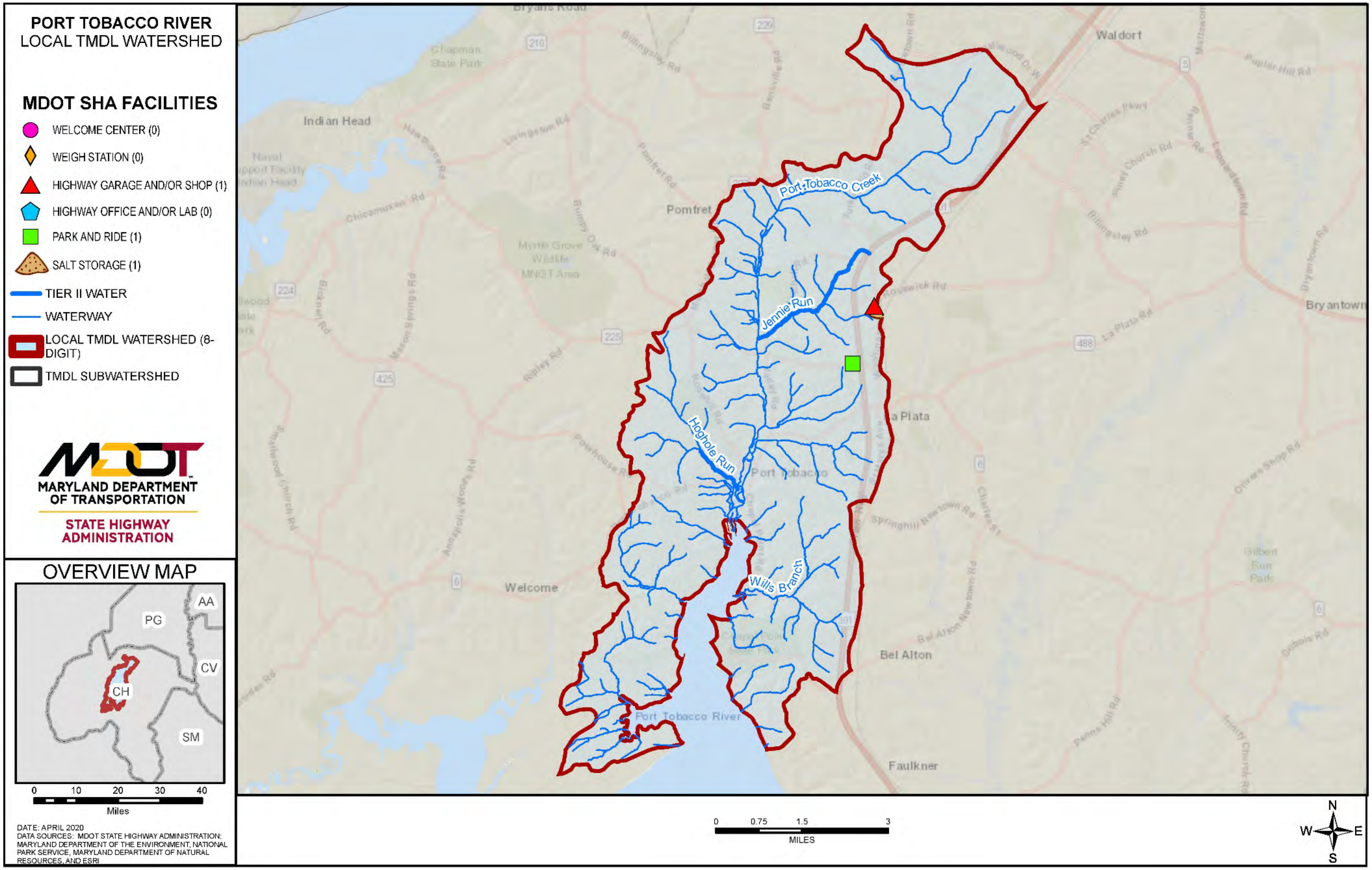


Figure 76: MDOT SHA Facilities within Port Tobacco River Watershed

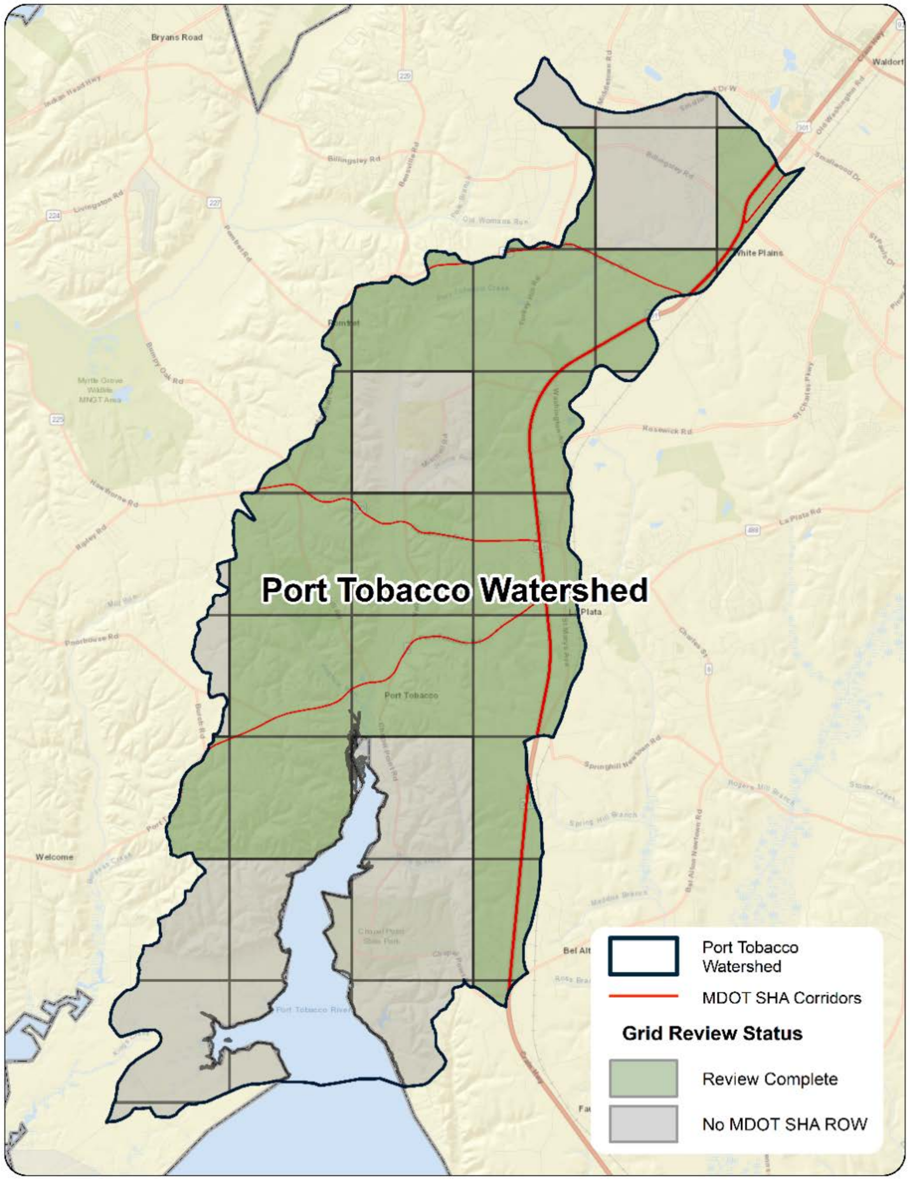


Figure 77: Port Tobacco River Site Search Grids

F.4. Summary of County Assessment Review

As of May 2020, a watershed restoration plan for the Port Tobacco watershed is not available online through the Charles County Department of Planning and Growth Management Watershed Protection and Restoration Program. A Watershed Existing Conditions Report covering the Port Tobacco River watershed is also not currently available. The MDE Total Maximum Daily Load of Sediment in the Non-Tidal Port Tobacco River Watershed, Charles County, Maryland is briefly summarized below.

The Port Tobacco watershed is located within the Lower Potomac River watershed in Charles County, Maryland. The watershed is comprised of several major tributaries including, the mainstream of Port Tobacco Creek, Jennie Run, Hoghole Run, and Wills Branch (MDE, 2019b).

The soils within the Port Tobacco watershed are predominately rated as Hydrologic Group C (48.0 percent), indicating low infiltration rates and moderate runoff potential. The remainder of soils are rated; Hydrologic Group B (37.0 percent), Group D (15.0 percent), and Group A (0.3 percent) (MDE, 2019b).

Land use within the watershed is as follows; forest (64.6 percent), agriculture (11.0 percent), regulated urban (24.0 percent), and water (0.4 percent) (MDE, 2019b).

The baseline load of TSS in the watershed is approximately 1,780 tons per year, 52 percent of which is from crop land use, 33 percent from regulated urban land use, and 14.5 percent from forest land use. Animal feeding operations, pasture, and municipal point sources combined make up less than one percent of contributions (MDE, 2019b).

F.5. MDOT SHA Pollutant Reduction Strategies

Port Tobacco River is listed for sediment with a TMDL baseline year of 2009. **Table 2** lists the reduction requirements for the Port Tobacco River watershed sediment TMDL along with the Target Year for achieving the reductions. MDOT SHA is over programming restoration projects to treat 115 percent of the required sediment loads as an adaptive management strategy. This treatment buffer will allow MDOT SHA to achieve the reduction target even if some planned projects are eliminated prior to construction due to site design limitations or any other situation that may result in removing the project from the plan.

Proposed practices to meet sediment reduction in the Port Tobacco River watershed are shown in **Table 78**. Projected sediment reductions using these practices are 30,283 lbs./yr which is 115.0 percent of the reduction target. These practices are described in **Part E** of this plan. Four timeframes are included in the tables below:

- BMPs implemented before the TMDL baseline. In this case, the baseline is 2009;
- BMPs implemented after the baseline through fiscal year 2020;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025 through the Target Year.

Estimated costs to design, construct, and implement BMPs within the Port Tobacco River watershed total $1,515,500. They are based on average cost per impervious acre treated derived from a cost history for each BMP type. See **Table 79** for a summary of estimated BMP costs.

Figure 78 shows a map of MDOT SHA watershed restoration strategies throughout the Port Tobacco River watershed. The practices shown only include those that are under design and constructed.

Table 78: Port Tobacco River Restoration Sediment BMP Implementation Strategy

BMP	Unit	Baseline BMPs (Built before 2009)	Restoration BMPs			
			2020	2025	Target Year[2]	Restoration Totals
New Stormwater	drainage area acres	2.2	10.4			10.4
Grass Swale	drainage area acres	39.8				
Tree Planting	acres of tree planting		5.3			5.3
Stream Restoration	linear feet				1,829.4	1,829.4
Pipe Cleaning[1]	dry tons		1.6			1.6
Street Sweeping[1]	acres swept		7.6			7.6
Annual Load Reductions	TSS EOS lbs./yr.	7,128.1	2,843.2		27,440.3	30,283.5

[1] *Pipe cleaning and street sweeping are annual practices. They are reflected only once for the year the annual reduction is achieved. Once achieved, this annual reduction will be sustained each year the load reduction is claimed.*
[2] *Refer to Table 2 for Target Year.*

Table 79: Port Tobacco River Restoration Implementation Cost[1]

BMP	2020	2025	Target Year[2]	Restoration Totals
New Stormwater	$532,000			$532,000
Tree Planting	$180,000			$180,000
Stream Restoration			$802,000	$802,000
Pipe Cleaning	$500			$500
Street Sweeping	$1,000			$1,000
			Total Restoration Cost	$1,515,500

[1] *Costs do not include maintenance, inspection, or remediation for built BMPs. Costs for operational BMPs (pipe cleaning and street sweeping) are annual costs that are incurred each year to sustain load reductions.*
[2] *Refer to Table 2 for Target Year.*

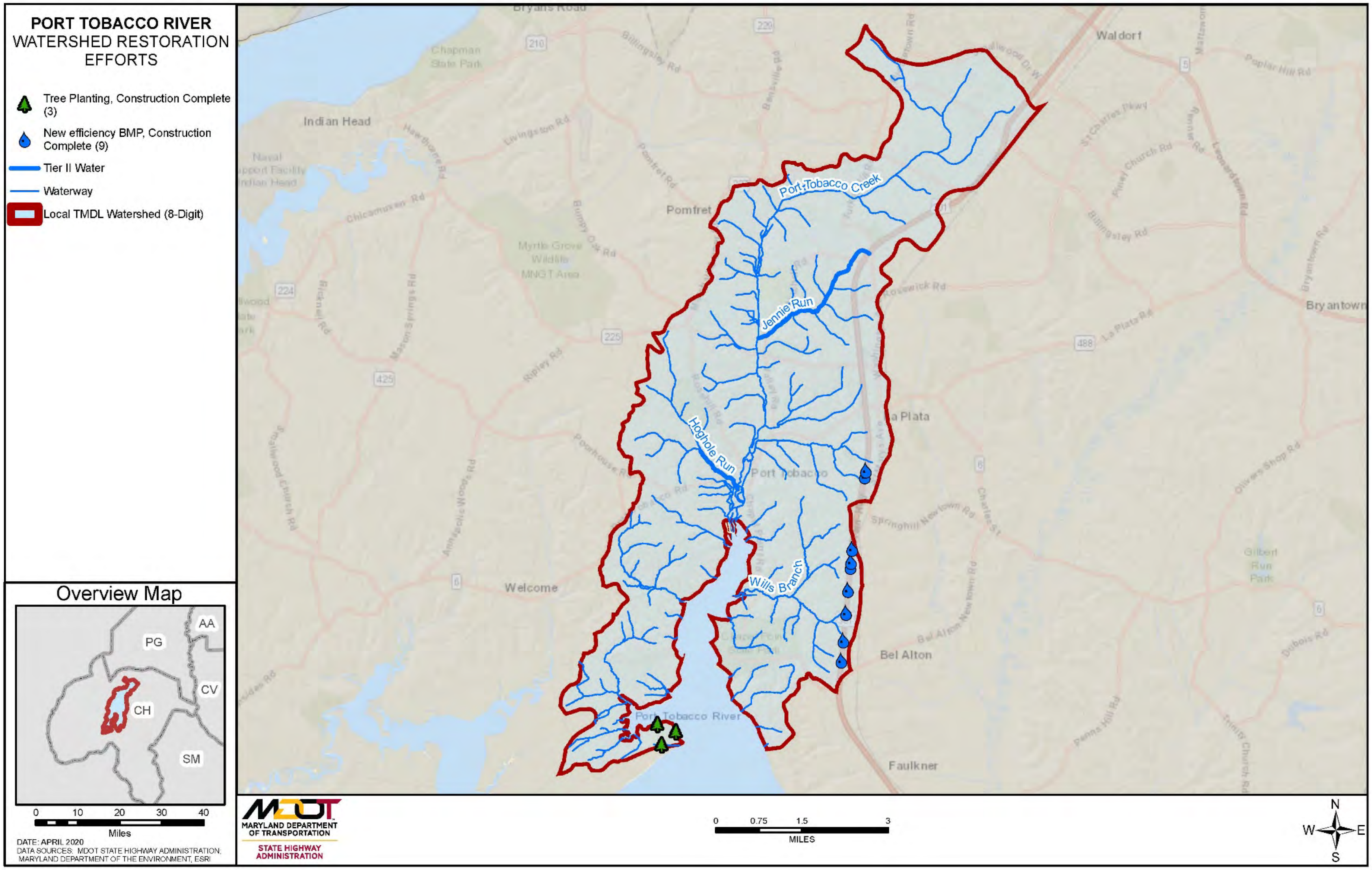


Figure 78: MDOT SHA Programmed Restoration Strategies within the Port Tobacco River Watershed

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Anacostia River - Nontidal
County Name	Montgomery
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	1997
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1997
Impervious Acres in Implementation Baseline Year	1,098
Pervious Acres in Implementation Baseline Year	868

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	81.0%
Required reduction % for TP	
Required reduction % for TSS	

Available on TMDL Data Center WLA Search

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**		**2020 Q2**		**Target Year**			**2050**	
					1997	Progress Reductions				Future Reductions				
							Reductions achieved between 1997 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	**Type**	**Unit**	BMPs installed before 1997	BMPs installed from 1997 to 2020 Q2	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2020 Q2 to 2050	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR**	**Cumulative**	Impervious Acres Treated						686.0	6,522.8			686
				Pervious Acres Treated						1,029.0				1,029
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		0.7	5.9							0.7
				Pervious Acres Treated		0.8								0.8
		Grass Swales	Cumulative	Impervious Acres Treated	75.4									75.4
				Pervious Acres Treated	93.5									93.5
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		1.4	10.1							1.4
				Pervious Acres Treated		1.1								1.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	16.1									16.1
				Pervious Acres Treated	20.7									20.7
	Stormwater Treatment (ST) Practices	**Non-Specified ST**	**Cumulative**	Impervious Acres Treated						686.0	3,776.3			686.0
				Pervious Acres Treated						1,029.0				1,029.0
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	2.3									2.3
				Pervious Acres Treated	0.2									0.2
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	22.5	325.2			34.3	188.8			56.8
				Pervious Acres Treated	n/a	51.5				51.5				103.0
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	61.1									61.1
				Pervious Acres Treated	36.6									36.6
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		21.4	2.2							21.4
		Pipe Cleaning	Annual **	Dry tons removed		23.1	62.4							23.1
		Inlet Cleaning	Annual **	Dry tons removed		11.2	39.3							11.2
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		62.2	286.3			1,805.3	6,099.9			1,867.5
		Urban Stream Restoration	Cumulative	Linear feet restored		33,289.0	2,496.7			67,621.0	5,071.6			100,910.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	13.1									
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	15.9									15.9
				Pervious Acres Treated	10.7									10.7
				REDUCTIONS:		**TOTAL**	**3,228**	**0**	**0**	**TOTAL**	**21,659**	**0**	**0**	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
26,707		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

TN	TP	TSS
23,479	0	0

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
1,820	0	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
81.0%	0.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
5,074	0	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1997 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Anacostia River - Tidal
County Name	Montgomery / Prince George's
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	1997
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1997
Impervious Acres in Implementation Baseline Year	437
Pervious Acres in Implementation Baseline Year	419

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	81.0%
Required reduction % for TP	
Required reduction % for TSS	

Available on TMDL Data Center WLA Search

					Scenario Name: Baseline Year	Progress Fiscal Year 2020 Q2				Target Year 2050				
					1997	Progress Reductions				Future Reductions				
							Reductions achieved between 1997 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	**Type**	**Unit**	BMPs installed before 1997	BMPs installed from 1997 to 2020 Q2	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2020 Q2 to 2050	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR**	**Cumulative**	Impervious Acres Treated						144.3	1,372.1			144
				Pervious Acres Treated						216.5				216
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	0.3									0.3
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.2									0.2
				Pervious Acres Treated	0.1									0.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST**	**Cumulative**	Impervious Acres Treated						240.5	1,323.9			240.5
				Pervious Acres Treated						360.8				360.8
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.7									0.7
				Pervious Acres Treated	0.1									0.1
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		0.2	0.01							0.2
		Pipe Cleaning	Annual **	Dry tons removed		0.4	1.0							0.4
		Inlet Cleaning	Annual **	Dry tons removed		11.7	40.8							11.7
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious						379.7	1,283.1			379.7
		Urban Stream Restoration	Cumulative	Linear feet restored						21,645.0	1,623.4			21,645.0
		Outfall Stabilization	Cumulative	Linear feet										
		Impervious Disconnects	Cumulative	Credit Acres	1.2									1.2
				REDUCTIONS:		TOTAL	42	0	0	TOTAL	5,602	0	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
6,062		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

TN	TP	TSS
6,020	0	0

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
417	0	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL | **Legend** | Does not meet TMDL

TMDL Reductions

TN	TP	TSS
81.0%	0.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
1,152	0	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chesepeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1997 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Mattawoman Creek
County Name	Charles / Prince George's
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2000
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2000
Impervious Acres in Implementation Baseline Year	481
Pervious Acres in Implementation Baseline Year	377

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	54.0%
Required reduction % for TP	
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year 2000: BMPs installed before 2000	Progress Fiscal Year 2020 Q2 – Progress Reductions: BMPs installed from 2000 to 2020 Q2	Reductions achieved between 2000 and 2020 Q2: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2040 – Future Reductions: BMPs planned for installation from 2020 Q2 to 2040	Planned reductions from 2020 Q2 to 2040: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR**	**Cumulative**	Impervious Acres Treated						539.0	2,820.3			539
				Pervious Acres Treated						808.5				809
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	38.8									38.8
				Pervious Acres Treated	38.6									38.6
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.5	1.3	7.5							1.8
				Pervious Acres Treated	0.5	0.5								1.0
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	3.8									3.8
				Pervious Acres Treated	4.8									4.8
	Stormwater Treatment (ST) Practices	**Non-Specified ST**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	1.1	18.5							1.1
				Pervious Acres Treated	n/a	3.7								3.7
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	9.3	4.6	21.4							13.9
				Pervious Acres Treated	5.7	3.8								9.5
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		69.7	2.0							69.7
		Pipe Cleaning	Annual **	Dry tons removed		4.8	13.0							4.8
		Inlet Cleaning	Annual **	Dry tons removed		9.1	32.0							9.1
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		39.3	147.0			63.6	239.8			102.9
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	12.6									
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	19.2									19.2
				Pervious Acres Treated	6.6									6.6
				REDUCTIONS:		**TOTAL**	**241**	**0**	**0**	**TOTAL**	**3,060**	**0**	**0**	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
5,317		

This represents the load from the watershed at the baseline year of the implementation plan

TMDL Reductions

TN	TP	TSS
54.0%	0.0%	0.0%

From top of worksheet

Current Load

TN	TP	TSS
5,076	0	0

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
2,016	0	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

Target Load

TN	TP	TSS
2,446	0	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2000 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Non-Tidal Back River
County Name	Baltimore
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	1995
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1995
Impervious Acres in Implementation Baseline Year	518
Pervious Acres in Implementation Baseline Year	661

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	15.0%
Required reduction % for TP	
Required reduction % for TSS	

Available on TMDL Data Center WLA Search

		BMP Name	Type	Unit	Baseline Year 1995: BMPs installed before 1995	Progress Fiscal Year 2020 Q2: BMPs installed from 1995 to 2020 Q2	Reductions achieved between 1995 and 2020 Q2: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2040: BMPs planned for installation from 2020 Q2 to 2040	Planned reductions from 2020 Q2 to 2040: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR**	**Cumulative**	Impervious Acres Treated						335.7	1,634.4			336
				Pervious Acres Treated						503.5				503
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	26.6									26.6
				Pervious Acres Treated	46.7									46.7
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	7.0									7.0
				Pervious Acres Treated	11.7									11.7
	Stormwater Treatment (ST) Practices	**Non-Specified ST**	**Cumulative**	Impervious Acres Treated						623.4	1,757.3			623.4
				Pervious Acres Treated						935.0				935.0
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	4.7	27.5							4.7
				Pervious Acres Treated	n/a	7.7								7.7
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	6.9	1.1	18.6							8.0
				Pervious Acres Treated	7.7	3.0								10.7
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		46.9	5.2							46.9
		Pipe Cleaning	Annual **	Dry tons removed		39.9	107.8							39.9
		Inlet Cleaning	Annual **	Dry tons removed		43.2	151.0							43.2
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		43.5	183.4							43.5
		Urban Stream Restoration	Cumulative	Linear feet restored		770.0	57.8							770.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	5.9									
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	7.5									7.5
				Pervious Acres Treated	8.2									8.2
				REDUCTIONS:		**TOTAL**	**551**	**0**	**0**	**TOTAL**	**3,392**	**0**	**0**	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
8,707		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

TN	TP	TSS
8,156	0	0

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
4,764	0	0

This represents the load from the watershed in the year that the plan is fully implemented

Legend: meets TMDL | Does not meet TMDL

TMDL Reductions

TN	TP	TSS
15.0%	0.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
7,401	0	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1995 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Anacostia River - Nontidal
County Name	Montgomery
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	1997
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1997
Impervious Acres in Implementation Baseline Year	1,098
Pervious Acres in Implementation Baseline Year	868

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	81.2%
Required reduction % for TSS	

Available on TMDL Data Center WLA Search

				Scenario Name:	Baseline Year	Progress Fiscal Year	2020 Q2			Target Year	2025			
					1997	Progress Reductions				Future Reductions				
							Reductions achieved between 1997 and 2020 Q2				Planned reductions from 2020 Q2 to 2025			
		BMP Name	**Type**	**Unit**	BMPs installed before 1997	BMPs installed from 1997 to 2020 Q2	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2020 Q2 to 2025	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR**	**Cumulative**	Impervious Acres Treated						686.0		563.5		686
				Pervious Acres Treated						1,029.0				1,029
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		0.7		0.8						0.7
				Pervious Acres Treated		0.8								0.8
		Grass Swales	Cumulative	Impervious Acres Treated	75.4									75.4
				Pervious Acres Treated	93.5									93.5
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		1.4		1.5						1.4
				Pervious Acres Treated		1.1								1.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	16.1									16.1
				Pervious Acres Treated	20.7									20.7
	Stormwater Treatment (ST) Practices	**Non-Specified ST**	**Cumulative**	Impervious Acres Treated						686.0		443.9		686.0
				Pervious Acres Treated						1,029.0				1,029.0
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	2.3									2.3
				Pervious Acres Treated	0.2									0.2
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	22.5		31.6		34.3		22.2		56.8
				Pervious Acres Treated	n/a	51.5				51.5				103.0
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	61.1									61.1
				Pervious Acres Treated	36.6									36.6
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		21.4		0.32						21.4
		Pipe Cleaning	Annual **	Dry tons removed		23.1		13.9						23.1
		Inlet Cleaning	Annual **	Dry tons removed		11.2		15.7						11.2
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		62.3		11.0		1,805.3		217.1		1,867.5
		Urban Stream Restoration	Cumulative	Linear feet restored		33,289.0		2,263.7		67,621.0		4,598.2		100,910.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	13.1									
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	15.9									15.9
				Pervious Acres Treated	10.7									10.7
				REDUCTIONS:		**TOTAL**	**0**	**2,338**	**0**	**TOTAL**	**0**	**5,845**	**0**	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
	2,209	

This represents the load from the watershed at the baseline year of the implementation plan

TMDL Reductions

TN	TP	TSS
0.0%	81.2%	0.0%

From top of worksheet

Current Load

TN	TP	TSS
0	-130	0

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
0	-5,975	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

Target Load

TN	TP	TSS
0	415	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1997 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Anacostia River - Tidal
County Name	Montgomery / Prince George's
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	1997
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1997
Impervious Acres in Implementation Baseline Year	437
Pervious Acres in Implementation Baseline Year	419

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	81.2%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**			**2020 Q2**	**Target Year**			**2040**	
					1997	Progress Reductions				Future Reductions				
							Reductions achieved between 1997 and 2020 Q2				Planned reductions from 2020 Q2 to 2040			
		BMP Name	**Type**	**Unit**	BMPs installed before 1997	BMPs installed from 1997 to 2020 Q2	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2020 Q2 to 2040	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR**	**Cumulative**	Impervious Acres Treated						144.3		118.5		144
				Pervious Acres Treated						216.5				216
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	0.3									0.3
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.2									0.2
				Pervious Acres Treated	0.1									0.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST**	**Cumulative**	Impervious Acres Treated						240.5		155.6		240.5
				Pervious Acres Treated						360.8				360.8
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.7									0.7
				Pervious Acres Treated	0.1									0.1
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		0.2		0.001						0.2
		Pipe Cleaning	Annual **	Dry tons removed		0.4		0.2						0.4
		Inlet Cleaning	Annual **	Dry tons removed		11.7		16.3						11.7
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious						379.7		45.7		379.7
		Urban Stream Restoration	Cumulative	Linear feet restored						21,645.0		1,471.9		21,645.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	1.2									
				REDUCTIONS:		**TOTAL**	**0**	**17**	**0**	**TOTAL**	**0**	**1,792**	**0**	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
	708	

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

TN	TP	TSS
0	691	0

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
0	-1,101	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	81.2%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
0	133	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1997 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Loch Raven Reservoir
County Name	Baltimore / Carroll / Harford
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	1995
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1995
Impervious Acres in Implementation Baseline Year	716
Pervious Acres in Implementation Baseline Year	835

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	15.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

		BMP Name	Type	Unit	Baseline Year 1995: BMPs installed before 1995	Progress Fiscal Year 2020 Q2: BMPs installed from 1995 to 2020 Q2	Reductions achieved between 1995 and 2020 Q2: TN lbs/year	TP lbs/year	TSS lbs/year	Target Year 2025: BMPs planned for installation from 2020 Q2 to 2025	Planned reductions from 2020 Q2 to 2025: TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		10.1		15.0						10.1
				Pervious Acres Treated		27.6								27.6
		Grass Swales	Cumulative	Impervious Acres Treated	24.3	1.0		1.1						25.3
				Pervious Acres Treated	33.5	3.0								36.5
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		0.4		0.5						0.4
				Pervious Acres Treated		0.8								0.8
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	4.7									4.7
				Pervious Acres Treated	11.9									11.9
	Stormwater Treatment (ST) Practices	**Non-Specified ST**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	1.8		2.5						1.8
				Pervious Acres Treated	n/a	3.1								3.1
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	2.9									2.9
				Pervious Acres Treated	0.4									0.4
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		9.1		0.1						9.1
		Pipe Cleaning	Annual **	Dry tons removed		9.7		5.8						9.7
		Inlet Cleaning	Annual **	Dry tons removed		10.8		15.1						10.8
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		76.2		13.8						76.2
		Urban Stream Restoration	Cumulative	Linear feet restored		568.0		38.6		9,294.7		632.0		
		Outfall Stabilization	Cumulative	Linear feet						1,241.7		168.9		1,241.7
		Impervious Disconnects	Cumulative	Credit Acres	6.5									
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	3.2									3.2
				Pervious Acres Treated	1.8									1.8
				REDUCTIONS:		**TOTAL**	**0**	**93**	**0**	**TOTAL**	**0**	**801**	**0**	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
	1,237	

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

TN	TP	TSS
0	1,144	0

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
0	343	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL | **Legend** | Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	15.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
0	1,051	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1995 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Mattawoman Creek
County Name	Charles / Prince George's
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2000
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2000
Impervious Acres in Implementation Baseline Year	481
Pervious Acres in Implementation Baseline Year	377

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	47.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

					Scenario Name: Baseline Year	Progress Fiscal Year	2020 Q2			Target Year	2030			
					2000	Progress Reductions				Future Reductions				
							Reductions achieved between 2000 and 2020 Q2				Planned reductions from 2020 Q2 to 2030			
		BMP Name	**Type**	**Unit**	BMPs installed before 2000	BMPs installed from 2000 to 2020 Q2	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2020 Q2 to 2030	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR**	**Cumulative**	Impervious Acres Treated						539.0		370.3		539
				Pervious Acres Treated						808.5				809
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	38.8									38.8
				Pervious Acres Treated	38.6									38.6
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.5	1.3		1.4						1.8
				Pervious Acres Treated	0.5	0.5								1.0
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	3.8									3.8
				Pervious Acres Treated	4.8									4.8
	Stormwater Treatment (ST) Practices	**Non-Specified ST**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	1.1		1.9						1.1
				Pervious Acres Treated	n/a	3.7								3.7
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	9.3	4.6		4.5						13.9
				Pervious Acres Treated	5.7	3.8								9.5
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		69.7		0.4						69.7
		Pipe Cleaning	Annual **	Dry tons removed		4.8		2.9						4.8
		Inlet Cleaning	Annual **	Dry tons removed		9.1		12.8						9.1
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		39.3		9.3		63.6		15.2		102.9
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	12.6									
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	19.2									19.2
				Pervious Acres Treated	6.6									6.6
				REDUCTIONS:		**TOTAL**	**0**	**33**	**0**	**TOTAL**	**0**	**385**	**0**	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
	693	

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

TN	TP	TSS
0	660	0

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
0	274	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	47.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
0	367	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2000 land use is unavailable; so baseline loads will be modeled using 20105 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Non-Tidal Back River
County Name	Baltimore
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	1995
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1995
Impervious Acres in Implementation Baseline Year	518
Pervious Acres in Implementation Baseline Year	661

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	15.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year	2020 Q2			Target Year	2025			
					1995	Progress Reductions				Future Reductions				
							Reductions achieved between 1995 and 2020 Q2				Planned reductions from 2020 Q2 to 2025			
		BMP Name	Type	Unit	BMPs installed before 1995	BMPs installed from 1995 to 2020 Q2	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2020 Q2 to 2025	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR**	**Cumulative**	Impervious Acres Treated						335.7		177.7		336
				Pervious Acres Treated						503.5				503
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	26.6									26.6
				Pervious Acres Treated	46.7									46.7
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	7.0									7.0
				Pervious Acres Treated	11.7									11.7
	Stormwater Treatment (ST) Practices	**Non-Specified ST**	**Cumulative**	Impervious Acres Treated						623.4		259.9		623.4
				Pervious Acres Treated						935.0				935.0
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	4.7		4.0						4.7
				Pervious Acres Treated	n/a	7.7								7.7
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	6.9	1.1		1.7						8.0
				Pervious Acres Treated	7.7	3.0								10.7
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		46.9		0.5						46.9
		Pipe Cleaning	Annual **	Dry tons removed		39.9		23.9						39.9
		Inlet Cleaning	Annual **	Dry tons removed		43.2		60.4						43.2
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		43.5		7.2						43.5
		Urban Stream Restoration	Cumulative	Linear feet restored		770.0		52.4						770.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	5.9									
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	7.5									7.5
				Pervious Acres Treated	8.2									8.2
				REDUCTIONS:		**TOTAL**	0	150	0	**TOTAL**	0	438	0	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
	851	

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

TN	TP	TSS
0	701	0

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
0	263	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	15.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
0	723	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1995 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Prettyboy Reservoir
County Name	Baltimore / Carroll
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	1995
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1995
Impervious Acres in Implementation Baseline Year	75
Pervious Acres in Implementation Baseline Year	30

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	15.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**			**2020 Q2**	**Target Year**			**2025**	
					1995	Progress Reductions				Future Reductions				
							Reductions achieved between 1995 and 2020 Q2				Planned reductions from 2020 Q2 to 2025			
		BMP Name	**Type**	**Unit**	BMPs installed before 1995	BMPs installed from 1995 to 2020 Q2	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2020 Q2 to 2025	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed		0.9		0.6						0.9
		Inlet Cleaning	Annual **	Dry tons removed		0.1		0.1						0.1
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored						7,972.0		542.1		7,972.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	1.8									
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	2.2									2.2
				Pervious Acres Treated	1.4									1.4
				REDUCTIONS:		**TOTAL**	**0**	**1**	**0**	**TOTAL**	**0**	**542**	**0**	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
	121	

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

TN	TP	TSS
0	120	0

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
0	-422	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	15.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
0	103	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1995 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Rocky Gorge Reservoir
County Name	Howard / Montgomery / Prince George's
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2000
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2000
Impervious Acres in Implementation Baseline Year	184
Pervious Acres in Implementation Baseline Year	229

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	15.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**			**2020 Q2**	**Target Year**			**2030**	
					2000	Progress Reductions				Future Reductions				
							Reductions achieved between 2000 and 2020 Q2				Planned reductions from 2020 Q2 to 2030			
		BMP Name	**Type**	**Unit**	BMPs installed before 2000	BMPs installed from 2000 to 2020 Q2	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2020 Q2 to 2030	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	5.7									5.7
				Pervious Acres Treated	6.6									6.6
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	5.6									5.6
				Pervious Acres Treated	6.6									6.6
	Stormwater Treatment (ST) Practices	**Non-Specified ST**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	8.9									8.9
				Pervious Acres Treated	8.7									8.7
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	4.9									4.9
				Pervious Acres Treated	1.6									1.6
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		10.2		0.2						10.2
		Pipe Cleaning	Annual **	Dry tons removed		2.9		1.7						2.9
		Inlet Cleaning	Annual **	Dry tons removed		7.9		11.0						7.9
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		13.6		2.6						13.6
		Urban Stream Restoration	Cumulative	Linear feet restored						599.3		40.8		599.3
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	4.9									
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	0.9									0.9
				Pervious Acres Treated	3.2									-
				REDUCTIONS:		**TOTAL**	**0**	**16**	**0**	**TOTAL**	**0**	**41**	**0**	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
	327	

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

TN	TP	TSS
0	311	0

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
0	270	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	15.0%	0.0%

From top of worksheet

Target Load

TN	TP	TSS
0	278	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2000 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Triadelphia Reservoir (Brighton Dam)
County Name	Howard / Montgomoery
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2000
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2000
Impervious Acres in Implementation Baseline Year	171
Pervious Acres in Implementation Baseline Year	247

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	15.0%
Required reduction % for TSS	
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year			2020 Q2	Target Year			2030	
					2000	Progress Reductions				Future Reductions				
							Reductions achieved between 2000 and 2020 Q2				Planned reductions from 2020 Q2 to 2030			
		BMP Name	Type	Unit	BMPs installed before 2000	BMPs installed from 2000 to 2020 Q2	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2020 Q2 to 2030	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	12.5									12.5
				Pervious Acres Treated	23.3									23.3
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	1.4									1.4
				Pervious Acres Treated	0.3									0.3
	Stormwater Treatment (ST) Practices	**Non-Specified ST**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	2.2									2.2
				Pervious Acres Treated	0.1									0.1
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed		0.7		0.4						0.7
		Inlet Cleaning	Annual **	Dry tons removed		0.6		0.9						0.6
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		4.0		0.9						4.0
		Urban Stream Restoration	Cumulative	Linear feet restored						797.3		54.2		797.3
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	4.0									
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	4.3									4.3
				Pervious Acres Treated	2.4									-
				REDUCTIONS:		**TOTAL**	**0**	**2**	**0**	**TOTAL**	**0**	**54**	**0**	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
TN	TP	TSS
	327	

This represents the load from the watershed at the baseline year of the implementation plan

Current Load		
TN	TP	TSS
0	325	0

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation		
TN	TP	TSS
0	271	0

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
TN	TP	TSS
0.0%	15.0%	0.0%

From top of worksheet

Target Load		
TN	TP	TSS
0	278	0

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2000 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Anacostia River - Nontidal
County Name	Montgomery
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	1997
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1997
Impervious Acres in Implementation Baseline Year	1,098
Pervious Acres in Implementation Baseline Year	868

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	85.0%

Available on TMDL Data Center WLA Search

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**			**2020 Q2**	**Target Year**			**2025**	
					1997	Progress Reductions				Future Reductions				
							Reductions achieved between 1997 and 2020 Q2				Planned reductions from 2020 Q2 to 2025			
		BMP Name	**Type**	**Unit**	BMPs installed before 1997	BMPs installed from 1997 to 2020 Q2	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2020 Q2 to 2025	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR**	**Cumulative**	Impervious Acres Treated						686.0			165,455.9	686
				Pervious Acres Treated						1,029.0				1,029
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		0.7			225.3					0.7
				Pervious Acres Treated		0.8								0.8
		Grass Swales	Cumulative	Impervious Acres Treated	75.4									75.4
				Pervious Acres Treated	93.5									93.5
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		1.4			455.5					1.4
				Pervious Acres Treated		1.1								1.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	16.1									16.1
				Pervious Acres Treated	20.7									20.7
	Stormwater Treatment (ST) Practices	**Non-Specified ST**	**Cumulative**	Impervious Acres Treated						686.0			156,001.3	686.0
				Pervious Acres Treated						1,029.0				1,029.0
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	2.3									2.3
				Pervious Acres Treated	0.2									0.2
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	22.5			9,392.2	34.3			7,800.1	56.8
				Pervious Acres Treated	n/a	51.5				51.5				103.0
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	61.1									61.1
				Pervious Acres Treated	36.6									36.6
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		21.4			313.6					21.4
		Pipe Cleaning	Annual **	Dry tons removed		23.1			6,929.0					23.1
		Inlet Cleaning	Annual **	Dry tons removed		11.2			4,718.7					11.2
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		62.2			2,639.3	1,805.3			47,046.6	1,867.5
		Urban Stream Restoration	Cumulative	Linear feet restored		33,289.0			1,268,235	67,621.0			1,014,315.0	100,910.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	13.1									
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	15.9									15.9
				Pervious Acres Treated	10.7									10.7
				REDUCTIONS:		**TOTAL**	**0**	**0**	**1,292,909**	**TOTAL**	**0**	**0**	**1,390,619**	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
		544,402

This represents the load from the watershed at the baseline year of the implementation plan

TMDL Reductions

TN	TP	TSS
0.0%	0.0%	85.0%

From top of worksheet

Current Load

TN	TP	TSS
0	0	-748,506

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
0	0	-2,139,125

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

Target Load

TN	TP	TSS
0	0	81,660

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1997 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Anacostia River - Tidal
County Name	Montgomery / Prince George's
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	1997
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	1997
Impervious Acres in Implementation Baseline Year	437
Pervious Acres in Implementation Baseline Year	419

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	85.0%

Available on TMDL Data Center WLA Search

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**			**2020 Q2**	**Target Year**			**2040**	
					1997	Progress Reductions				Future Reductions				
							Reductions achieved between 1997 and 2020 Q2				Planned reductions from 2020 Q2 to 2040			
		BMP Name	**Type**	**Unit**	BMPs installed before 1997	BMPs installed from 1997 to 2020 Q2	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2020 Q2 to 2040	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR**	**Cumulative**	Impervious Acres Treated						144.3			34,803.6	144
				Pervious Acres Treated						216.5				216
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	0.3									0.3
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.2									0.2
				Pervious Acres Treated	0.1									0.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST**	**Cumulative**	Impervious Acres Treated						240.5			54,691.4	240.5
				Pervious Acres Treated						360.8				360.8
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.7									0.7
				Pervious Acres Treated	0.1									0.1
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		0.2			1.4					0.2
		Pipe Cleaning	Annual **	Dry tons removed		0.4			115.8					0.4
		Inlet Cleaning	Annual **	Dry tons removed		11.7			4,895.1					11.7
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious						379.7			9,896.2	379.7
		Urban Stream Restoration	Cumulative	Linear feet restored						21,645.0			324,675.0	21,645.0
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	1.2									
				REDUCTIONS:		**TOTAL**	0	0	5,012	**TOTAL**	0	0	424,066	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
		185,294

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

TN	TP	TSS
0	0	180,282

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
0	0	-243,785

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL | **Legend** | Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	0.0%	85.0%

From top of worksheet

Target Load

TN	TP	TSS
0	0	27,794

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 1997 land use is unavailable; so baseline loads will be modeled using 2005 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Potomac River - WA County
County Name	Washington
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2005
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2005
Impervious Acres in Implementation Baseline Year	359
Pervious Acres in Implementation Baseline Year	805

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	15.2%

Available on TMDL Data Center WLA Search

				Scenario Name: Baseline Year	Progress Fiscal Year 2020 Q2				Target Year 2035				
				2005	Progress Reductions				Future Reductions				
						Reductions achieved between 2005 and 2020 Q2				Planned reductions from 2020 Q2 to 2035			
		BMP Name	**Type**	**Unit**	BMPs installed before 2005	BMPs installed from 2005 to 2020 Q2	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2020 Q2 to 2035	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		13.0			38,851.7					13.0
				Pervious Acres Treated		27.3								27.3
		Grass Swales	Cumulative	Impervious Acres Treated	7.7	2.3			7,012.6					10.0
				Pervious Acres Treated	12.7	7.0								19.7
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		0.3			1,254.0					0.3
				Pervious Acres Treated		1.9								1.9
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	6.2									6.2
				Pervious Acres Treated	13.4									13.4
	Stormwater Treatment (ST) Practices	**Non-Specified ST**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed		1.3			390.7					1.3
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		27.4			8,645.8					27.4
		Urban Stream Restoration	Cumulative	Linear feet restored						3,896.7			175,350.0	3,896.7
		Outfall Stabilization	Cumulative	Linear feet										-
		Impervious Disconnects	Cumulative	Credit Acres	6.7									
				REDUCTIONS:		**TOTAL**	0	0	56,155	**TOTAL**	0	0	175,350	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
		1,324,637

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

TN	TP	TSS
0	0	1,268,482

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
0	0	1,093,132

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	0.0%	15.2%

From top of worksheet

Target Load

TN	TP	TSS
0	0	1,123,292

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Port Tobacco River
County Name	Charles
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
TN	see notes below	
TP		
TSS		

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2009
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2009
Impervious Acres in Implementation Baseline Year	190
Pervious Acres in Implementation Baseline Year	118

REDUCTIONS REQUIRED UNDER THE TMDL

Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	33.0%

Available on TMDL Data Center WLA Search

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**			**2020 Q2**	**Target Year**			**2030**	
					2009	Progress Reductions				Future Reductions				
							Reductions achieved between 2009 and 2020 Q2				Planned reductions from 2020 Q2 to 2030			
		BMP Name	**Type**	**Unit**	BMPs installed before 2009	BMPs installed from 2009 to 2020 Q2	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2020 Q2 to 2030	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		4.6			2,020.4					4.6
				Pervious Acres Treated		5.8								5.8
		Grass Swales	Cumulative	Impervious Acres Treated	18.9									18.9
				Pervious Acres Treated	20.9									20.9
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	0.9									0.9
				Pervious Acres Treated	0.8									0.8
	Stormwater Treatment (ST) Practices	**Non-Specified ST**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	0.6									0.6
				Pervious Acres Treated	0.0									-
Alternative Practice	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept		7.6			38.8					7.6
		Pipe Cleaning	Annual **	Dry tons removed		1.6			470.7					1.6
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious		5.3			313.4					5.3
		Urban Stream Restoration	Cumulative	Linear feet restored						1,829.4			27,440.3	1,829.4
		Outfall Stabilization	Cumulative	Linear feet										-
				REDUCTIONS:		**TOTAL**	0	0	2,843	**TOTAL**	0	0	27,440	

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

TN	TP	TSS
		79,798

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

TN	TP	TSS
0	0	76,955

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
0	0	49,514

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

TN	TP	TSS
0.0%	0.0%	33.0%

From top of worksheet

Target Load

TN	TP	TSS
0	0	53,465

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to *MDOT SHA Restoration Modeling Protocol* for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates have been calculated at the most detailed level feasible: the land-river segments from the Chespeake Bay model / MAST P5.3.2. Therefore, Loading Rates for Untreated Land are not provided in this summary sheet because impervious/pervious rates vary by land-river segment.
- Accurate MDOT SHA data for 2009 land use is unavailable; so baseline loads will be modeled using 2011 land use. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Anacostia River, Downstream of NEB/NWB Confluence
County Name	Prince George's
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	476
Pervious Acres in Implementation Baseline Year	516

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/day	99.3%
Available on TMDL Data Center WLA Search	

					Baseline Year	Progress Fiscal Year			2020 Q2	Target Year			2050	
				Scenario Name:	**2003**	Progress Reductions				Future Reductions				
							Reductions achieved between 2003 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	**Type**	**Unit**	BMPs installed before 2003	BMPs installed from 2003 to 2020 Q2	Bacteria billion MPN/day			BMPs planned for installation from 2020 Q2 to 2050	Bacteria billion MPN/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		0.7								0.7
				Pervious Acres Treated		0.8								0.8
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.6									0.6
				Pervious Acres Treated	0.1									0.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	3.3									3.3
				Pervious Acres Treated	3.9									3.9
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.3									0.3
				Pervious Acres Treated	0.0									-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	9.5								9.5
				Pervious Acres Treated	n/a	16.5								16.5
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated			n/a				n/a			
				Pervious Acres Treated			n/a				n/a			
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated			n/a				n/a			
				Pervious Acres Treated			n/a				n/a			
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	11.8									11.8
				Pervious Acres Treated	8.8									8.8
Alternative Practice	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
				REDUCTIONS:		TOTAL	1,022			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion MPN/day		
89,445		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion MPN/day		
88,423		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion MPN/day		
88,423		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions		
billion MPN/day		
99.3%		
From top of worksheet		

Target Load		
billion MPN/day		
626		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Anacostia River, Upstream of NEB/NWB Confluence
County Name	Montgomery / Prince George's
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	1,627
Pervious Acres in Implementation Baseline Year	1,460

REDUCTIONS REQUIRED UNDER THE TMDL

Required Reduction BN MPN/day	84.1%

Available on TMDL Data Center WLA Search

		BMP Name	Type	Unit	Baseline Year 2003: BMPs installed before 2003	Progress Fiscal Year 2020 Q2 (Progress Reductions): BMPs installed from 2003 to 2020 Q2	Reductions achieved between 2003 and 2020 Q2: Bacteria billion MPN/day			Target Year 2050 (Future Reductions): BMPs planned for installation from 2020 Q2 to 2050	Planned reductions from 2020 Q2 to 2050: Bacteria billion MPN/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		1.4								1.4
				Pervious Acres Treated		1.1								1.1
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	15.7									15.7
				Pervious Acres Treated	18.8									18.8
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	7.9									7.9
				Pervious Acres Treated	5.4									5.4
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	13.1								13.1
				Pervious Acres Treated	n/a	35.0								35.0
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	73.1									73.1
				Pervious Acres Treated	49.6									49.6
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	15.9									15.9
				Pervious Acres Treated	10.7									10.7
				REDUCTIONS:		TOTAL	1,695			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion MPN/day		
311,792		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion MPN/day		
310,097		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion MPN/day		
310,097		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

billion MPN/day		
84.1%		

From top of worksheet

Target Load

billion MPN/day		
49,575		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Antietam Creek
County Name	Washington
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	836
Pervious Acres in Implementation Baseline Year	1,500

REDUCTIONS REQUIRED UNDER THE TMDL

Required Reduction BN MPN/yr	98.0%

Available on TMDL Data Center WLA Search

		BMP Name	Type	Unit	Baseline Year 2003: BMPs installed before 2003	Progress Fiscal Year 2020 Q2 – Progress Reductions: BMPs installed from 2003 to 2020 Q2	Reductions achieved between 2003 and 2020 Q2: Bacteria billion MPN/yr			Target Year 2050 – Future Reductions: BMPs planned for installation from 2020 Q2 to 2050	Planned reductions from 2020 Q2 to 2050: Bacteria billion MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		7.0								7.0
				Pervious Acres Treated		15.7								15.7
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		11.5								11.5
				Pervious Acres Treated		34.4								34.4
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	8.9								8.9
				Pervious Acres Treated	n/a	19.9								19.9
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	1.8	3.0								4.8
				Pervious Acres Treated	0.9	4.2								5.1
Alternative Practice	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
				REDUCTIONS:		TOTAL	5,387			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion MPN/yr		
170,412		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion MPN/yr		
165,025		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion MPN/yr		
165,025		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

billion MPN/yr		
98.0%		

From top of worksheet

Target Load

billion MPN/yr		
3,408		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Cabin John Creek
County Name	Montgomery
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	442
Pervious Acres in Implementation Baseline Year	421

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/day	30.6%
Available on TMDL Data Center WLA Search	

				Scenario Name:	Baseline Year	Progress Fiscal Year		2020 Q2		Target Year		2050		
					2003	Progress Reductions				Future Reductions				
							Reductions achieved between 2003 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	Type	Unit	BMPs installed before 2003	BMPs installed from 2003 to 2020 Q2	Bacteria billion MPN/day			BMPs planned for installation from 2020 Q2 to 2050	Bacteria billion MPN/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	5.5									5.5
				Pervious Acres Treated	18.8									18.8
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.1									0.1
				Pervious Acres Treated	0.4									0.4
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	3.3								3.3
				Pervious Acres Treated	n/a	10.9								10.9
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	19.7									19.7
				Pervious Acres Treated	29.5									29.5
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	0.8									0.8
				Pervious Acres Treated	0.8									0.8
				REDUCTIONS:		**TOTAL**	**512**			**TOTAL**	**0**			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion MPN/day		
92,166		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion MPN/day		
91,654		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion MPN/day		
91,654		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion MPN/day		
30.6%		
From top of worksheet		

Target Load		
billion MPN/day		
63,963		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Conococheague Creek
County Name	Washington
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2004
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2004
Impervious Acres in Implementation Baseline Year	472
Pervious Acres in Implementation Baseline Year	958

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	99.0%
Available on TMDL Data Center WLA Search	

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**		**2020 Q2**		**Target Year**		**2050**		
					2004	Progress Reductions				Future Reductions				
							Reductions achieved between 2004 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	**Type**	**Unit**	BMPs installed before 2004	BMPs installed from 2004 to 2020 Q2	Bacteria billion MPN/yr			BMPs planned for installation from 2020 Q2 to 2050	Bacteria billion MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.2	6.3								6.5
				Pervious Acres Treated	0.2	9.4								9.6
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	1.0									1.0
				Pervious Acres Treated	0.7									0.7
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	3.0								3.0
				Pervious Acres Treated	n/a	9.6								9.6
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	5.3	2.1								7.4
				Pervious Acres Treated	12.8	4.5								17.3
Alternative Practice	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
				REDUCTIONS:		TOTAL	830			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion MPN/yr		
105,861		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load		
billion MPN/yr		
105,031		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation		
billion MPN/yr		
105,031		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions		
billion MPN/yr		
99.0%		

From top of worksheet

Target Load		
billion MPN/yr		
1,059		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2004 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Double Pipe Creek
County Name	Carroll
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2004
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2004
Impervious Acres in Implementation Baseline Year	414
Pervious Acres in Implementation Baseline Year	682

REDUCTIONS REQUIRED UNDER THE TMDL

Required Reduction BN MPN/yr	98.5%

Available on TMDL Data Center WLA Search

		BMP Name	Type	Unit	Baseline Year 2004: BMPs installed before 2004	Progress Fiscal Year 2020 Q2 — Progress Reductions: BMPs installed from 2004 to 2020 Q2	Reductions achieved between 2004 and 2020 Q2: Bacteria billion MPN/yr			Target Year 2050 — Future Reductions: BMPs planned for installation from 2020 Q2 to 2050	Planned reductions from 2020 Q2 to 2050: Bacteria billion MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	0.1									0.1
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	0.2									0.2
				Pervious Acres Treated	0.0									-
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Clenaing	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	1.9									1.9
				Pervious Acres Treated	1.5									1.5
				REDUCTIONS:		**TOTAL**	0			**TOTAL**	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion MPN/yr		
72,412		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion MPN/yr		
72,412		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion MPN/yr		
72,412		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

billion MPN/yr		
98.5%		

From top of worksheet

Target Load

billion MPN/yr		
1,086		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2004 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Gwynns Falls
County Name	Baltimore
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	682
Pervious Acres in Implementation Baseline Year	980

REDUCTIONS REQUIRED UNDER THE TMDL

Required Reduction BN MPN/day	99.3%

Available on TMDL Data Center WLA Search

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**			**2020 Q2**	**Target Year**			**2050**	
					2003	Progress Reductions				Future Reductions				
							Reductions achieved between 2003 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	**Type**	**Unit**	BMPs installed before 2003	BMPs installed from 2003 to 2020 Q2	Bacteria billion MPN/day			BMPs planned for installation from 2020 Q2 to 2050	Bacteria billion MPN/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	0.5									0.5
				Pervious Acres Treated	0.1									0.1
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	9.1									9.1
				Pervious Acres Treated	25.5									25.5
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	0.8									0.8
				Pervious Acres Treated	0.1									0.1
				REDUCTIONS:		**TOTAL**	0			**TOTAL**	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion MPN/day		
157,179		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion MPN/day		
157,179		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion MPN/day		
157,179		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

billion MPN/day		
99.3%		

From top of worksheet

Target Load

billion MPN/day		
1,100		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Herring Run
County Name	Baltimore
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	128
Pervious Acres in Implementation Baseline Year	76

REDUCTIONS REQUIRED UNDER THE TMDL

Required Reduction BN MPN/yr	92.2%

Available on TMDL Data Center WLA Search

				Scenario Name:	Baseline Year	Progress Fiscal Year 2020 Q2				Target Year 2050				
					2003	Progress Reductions				Future Reductions				
							Reductions achieved between 2003 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	Type	Unit	BMPs installed before 2003	BMPs installed from 2003 to 2020 Q2	Bacteria billion MPN/yr			BMPs planned for installation from 2020 Q2 to 2050	Bacteria billion MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practice	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
				REDUCTIONS:		TOTAL	0			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion MPN/yr		
30,714		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion MPN/yr		
30,714		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion MPN/yr		
30,714		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

billion MPN/yr		
92.2%		

From top of worksheet

Target Load

billion MPN/yr		
2,396		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Jones Falls
County Name	Baltimore
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	481
Pervious Acres in Implementation Baseline Year	431

REDUCTIONS REQUIRED UNDER THE TMDL

Required Reduction BN MPN/day	95.5%

Available on TMDL Data Center WLA Search

				Scenario Name:	Baseline Year	Progress Fiscal Year 2020 Q2				Target Year 2050				
					2003	Progress Reductions				Future Reductions				
							Reductions achieved between 2003 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	**Type**	**Unit**	BMPs installed before 2003	BMPs installed from 2003 to 2020 Q2	Bacteria billion MPN/day			BMPs planned for installation from 2020 Q2 to 2050	Bacteria billion MPN/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	3.8									3.8
				Pervious Acres Treated	6.9									6.9
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	7.7									7.7
				Pervious Acres Treated	1.7									1.7
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	26.0									26.0
				Pervious Acres Treated	22.8									22.8
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	7.4									7.4
				Pervious Acres Treated	3.7									3.7
				REDUCTIONS:		TOTAL	0			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion MPN/day		
88,158		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion MPN/day		
88,158		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion MPN/day		
88,158		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

billion MPN/day		
95.5%		

From top of worksheet

Target Load

billion MPN/day		
3,967		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Liberty Reservoir
County Name	Baltimore / Carroll
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	641
Pervious Acres in Implementation Baseline Year	1,361

REDUCTIONS REQUIRED UNDER THE TMDL	
Required Reduction BN MPN/yr	89.2%
Available on TMDL Data Center WLA Search	

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**			**2020 Q2**	**Target Year**			**2050**	
					2003	Progress Reductions				Future Reductions				
							Reductions achieved between 2003 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	**Type**	**Unit**	BMPs installed before 2003	BMPs installed from 2003 to 2020 Q2	Bacteria billion MPN/yr			BMPs planned for installation from 2020 Q2 to 2050	Bacteria billion MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.1									0.1
				Pervious Acres Treated	1.2									1.2
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	4.7									4.7
				Pervious Acres Treated	1.6									1.6
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	8.3	22.8								31.1
				Pervious Acres Treated	13.7	105.3								119.0
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	7.5									7.5
				Pervious Acres Treated	2.9									2.9
				REDUCTIONS:		**TOTAL**	6,811			**TOTAL**	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion MPN/yr		
127,606		
This represents the load from the watershed at the baseline year of the implementation plan		

Current Load		
billion MPN/yr		
120,795		
This represents the load from the watershed at the time the implementation plan was developed		

Load under full implementation		
billion MPN/yr		
120,795		
This represents the load from the watershed in the year that the plan is fully implemented		
meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion MPN/yr		
89.2%		
From top of worksheet		

Target Load		
billion MPN/yr		
13,781		
This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %		

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Loch Raven Reservoir
County Name	Baltimore / Carroll / Howard
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2004
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2004
Impervious Acres in Implementation Baseline Year	751
Pervious Acres in Implementation Baseline Year	856

REDUCTIONS REQUIRED UNDER THE TMDL

Required Reduction BN MPN/yr	87.6%

Available on TMDL Data Center WLA Search

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**			**2020 Q2**	**Target Year**			**2050**	
					2004	Progress Reductions				Future Reductions				
							Reductions achieved between 2004 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	**Type**	**Unit**	BMPs installed before 2004	BMPs installed from 2004 to 2020 Q2	Bacteria BN MPN/yr			BMPs planned for installation from 2020 Q2 to 2050	Bacteria BN MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.2	10.1								10.3
				Pervious Acres Treated	0.6	27.6								28.2
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.0	0.4								0.4
				Pervious Acres Treated	1.0	0.8								1.8
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	4.7									4.7
				Pervious Acres Treated	30.7									30.7
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	0.6									0.6
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	1.8								1.8
				Pervious Acres Treated	n/a	3.1								3.1
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	2.7									2.7
				Pervious Acres Treated	21.3									21.3
Alternative Practice	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
				REDUCTIONS:		**TOTAL**	861			**TOTAL**	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

BN MPN/yr		
113,344		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

BN MPN/yr		
112,483		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

BN MPN/yr		
112,483		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

BN MPN/yr		
87.6%		

From top of worksheet

Target Load

BN MPN/yr		
14,055		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WMT as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2004 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Lower Monocacy River
County Name	Carroll / Frederick / Montgomery
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2004
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2004
Impervious Acres in Implementation Baseline Year	1,400
Pervious Acres in Implementation Baseline Year	2,383

REDUCTIONS REQUIRED UNDER THE TMDL

Required Reduction BN MPN/yr	96.9%
Available on TMDL Data Center WLA Search	

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**		**2020 Q2**		**Target Year**		**2050**		
					2004	Progress Reductions				Future Reductions				
							Reductions achieved between 2004 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	**Type**	**Unit**	BMPs installed before 2004	BMPs installed from 2004 to 2020 Q2	Bacteria billion MPN/yr			BMPs planned for installation from 2020 Q2 to 2050	Bacteria billion MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.5	9.3								9.8
				Pervious Acres Treated	0.2	8.6								8.8
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	6.3	5.2								11.5
				Pervious Acres Treated	5.2	8.7								13.9
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	10.0									10.0
				Pervious Acres Treated	11.1									11.1
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	0.3									0.3
				Pervious Acres Treated	0.1									0.1
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	14.4								14.4
				Pervious Acres Treated	n/a	48.8								48.8
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	70.7									70.7
				Pervious Acres Treated	135.9									135.9
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	6.3									6.3
				Pervious Acres Treated	8.0									8.0
				REDUCTIONS:		TOTAL	2,768			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion MPN/yr		
224,924		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion MPN/yr		
222,156		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion MPN/yr		
222,156		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

billion MPN/yr		
96.9%		

From top of worksheet

Target Load

billion MPN/yr		
6,973		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2004 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Lower Patuxent River - Indian Creek
County Name	Charles / St. Mary's
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	42
Pervious Acres in Implementation Baseline Year	48

REDUCTIONS REQUIRED UNDER THE TMDL

Req'd Reduction BN counts/day	43.6%

Available on TMDL Data Center WLA Search

				Scenario Name:	Baseline Year	Progress Fiscal Year	2020 Q2			Target Year	2050			
					2001	Progress Reductions				Future Reductions				
							Reductions achieved between 2001 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	Type	Unit	BMPs installed before 2001	BMPs installed from 2001 to 2020 Q2	Bacteria billion counts/day			BMPs planned for installation from 2020 Q2 to 2050	Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		2.6								2.6
				Pervious Acres Treated		3.3								3.3
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	1.0									1.0
				Pervious Acres Treated	0.6									0.6
				REDUCTIONS:		**TOTAL**	151			**TOTAL**	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion counts/day		
5,567		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion counts/day		
5,416		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion counts/day		
5,416		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

billion counts/day		
43.6%		

From top of worksheet

Target Load

billion counts/day		
3,140		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Magothy River - subsegment
County Name	Anne Arundel
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	224
Pervious Acres in Implementation Baseline Year	332

REDUCTIONS REQUIRED UNDER THE TMDL

Req'd Reduction BN counts/day	12.8%

Available on TMDL Data Center WLA Search

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**			**2020 Q2**	**Target Year**			**2050**	
					2001	Progress Reductions				Future Reductions				
							Reductions achieved between 2001 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	Type	Unit	BMPs installed before 2001	BMPs installed from 2001 to 2020 Q2	Bacteria billion counts/day			BMPs planned for installation from 2020 Q2 to 2050	Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		1.2								1.2
				Pervious Acres Treated		0.8								0.8
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	23.7									23.7
				Pervious Acres Treated	30.4									30.4
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	8.4									8.4
				Pervious Acres Treated	5.4									5.4
				REDUCTIONS:		**TOTAL**	**86**			**TOTAL**	**0**			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion counts/day		
30,697		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion counts/day		
30,611		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion counts/day		
30,611		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

billion counts/day		
12.8%		

From top of worksheet

Target Load

billion counts/day		
26,768		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Other West Chesapeake - Tracy and Rockhold Creeks
County Name	Anne Arundel
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	46
Pervious Acres in Implementation Baseline Year	93

REDUCTIONS REQUIRED UNDER THE TMDL

Req'd Reduction BN counts/day	81.6%

Available on TMDL Data Center WLA Search

					Scenario Name:	**Baseline Year**	**Progress Fiscal Year**		**2020 Q2**		**Target Year**		**2050**	
						2001	Progress Reductions				Future Reductions			
								Reductions achieved between 2001 and 2020 Q2				Planned reductions from 2020 Q2 to 2050		
		BMP Name	**Type**	**Unit**		BMPs installed before 2001	BMPs installed from 2001 to 2020 Q2	Bacteria billion counts/day			BMPs planned for installation from 2020 Q2 to 2050	Bacteria billion counts/day		BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated		n/a								-
				Pervious Acres Treated		n/a								-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated								n/a		
				Pervious Acres Treated				n/a				n/a		
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated				n/a				n/a		
				Pervious Acres Treated				n/a				n/a		
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
				REDUCTIONS:			**TOTAL**	0			**TOTAL**	0		

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion counts/day		
7,275		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion counts/day		
7,275		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion counts/day		
7,275		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

billion counts/day		
81.6%		

From top of worksheet

Target Load

billion counts/day		
1,339		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Piscataway
County Name	Prince George's
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	259
Pervious Acres in Implementation Baseline Year	294

REDUCTIONS REQUIRED UNDER THE TMDL

Required Reduction BN MPN/day	42.5%

Available on TMDL Data Center WLA Search

		BMP Name	Type	Unit	Baseline Year 2003: BMPs installed before 2003	Progress Fiscal Year 2020 Q2: BMPs installed from 2003 to 2020 Q2	Progress Reductions (Reductions achieved between 2003 and 2020 Q2): Bacteria billion MPN/day			Target Year 2050: BMPs planned for installation from 2020 Q2 to 2050	Future Reductions (Planned reductions from 2020 Q2 to 2050): Bacteria billion MPN/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated		1.1								1.1
				Pervious Acres Treated		1.2								1.2
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	41.0								41.0
				Pervious Acres Treated	n/a	39.1								39.1
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	39.2									39.2
				Pervious Acres Treated	14.9									14.9
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	0.3									0.3
				Pervious Acres Treated	0.6									0.6
				REDUCTIONS:		**TOTAL**	682			**TOTAL**	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion MPN/day		
32,126		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion MPN/day		
31,444		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion MPN/day		
31,444		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

billion MPN/day		
42.5%		

From top of worksheet

Target Load

billion MPN/day		
18,472		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Rock Creek - Non-Tidal
County Name	Montgomery
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2003
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2003
Impervious Acres in Implementation Baseline Year	741
Pervious Acres in Implementation Baseline Year	489

REDUCTIONS REQUIRED UNDER THE TMDL

Required Reduction BN MPN/day	96.5%

Available on TMDL Data Center WLA Search

					Scenario Name:	**Baseline Year**	**Progress Fiscal Year**			**2020 Q2**	**Target Year**			**2050**	
						2003	Progress Reductions				Future Reductions				
								Reductions achieved between 2003 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	Type	Unit		BMPs installed before 2003	BMPs installed from 2003 to 2020 Q2	Bacteria billion MPN/day			BMPs planned for installation from 2020 Q2 to 2050	Bacteria billion MPN/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated											-
				Pervious Acres Treated											-
		Rain Gardens	Cumulative	Impervious Acres Treated											-
				Pervious Acres Treated											-
		Bioswales	Cumulative	Impervious Acres Treated		0.9									0.9
				Pervious Acres Treated		0.3									0.3
		Grass Swales	Cumulative	Impervious Acres Treated											-
				Pervious Acres Treated											-
		Permeable Pavement	Cumulative	Impervious Acres Treated											-
				Pervious Acres Treated											-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		2.7									2.7
				Pervious Acres Treated		0.3									0.3
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated		16.4									16.4
				Pervious Acres Treated		17.8									17.8
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated											-
				Pervious Acres Treated											-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated		9.2									9.2
				Pervious Acres Treated		3.8									3.8
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated		n/a	7.4								7.4
				Pervious Acres Treated		n/a	22.0								22.0
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated			n/a				n/a				
				Pervious Acres Treated			n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated			n/a				n/a				
				Pervious Acres Treated			n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated		6.6									6.6
				Pervious Acres Treated		3.5									3.5
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept											-
		Pipe Cleaning	Annual **	Dry tons removed											-
		Inlet Cleaning	Annual **	Dry tons removed											-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious											-
		Urban Tree Planting	Cumulative	Acres planted on pervious											-
		Urban Stream Restoration	Cumulative	Linear feet restored											-
		Outfall Stabilization	Cumulative	Linear feet											-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated		11.9									11.9
				Pervious Acres Treated		6.1									6.1
				REDUCTIONS:			TOTAL	856			TOTAL	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion MPN/day		
120,947		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion MPN/day		
120,091		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion MPN/day		
120,091		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

billion MPN/day		
96.5%		

From top of worksheet

Target Load

billion MPN/day		
4,233		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2003 land use is unavailable; so baseline loads will be modeled using 2010 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Severn River - Mill Creek
County Name	Anne Arundel
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2002
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2002
Impervious Acres in Implementation Baseline Year	64
Pervious Acres in Implementation Baseline Year	61

REDUCTIONS REQUIRED UNDER THE TMDL

Req'd Reduction BN counts/day	86.0%

Available on TMDL Data Center WLA Search

		BMP Name	Type	Unit	Baseline Year 2002: BMPs installed before 2002	Progress Fiscal Year 2020 Q2 (Progress Reductions): BMPs installed from 2002 to 2020 Q2	Reductions achieved between 2002 and 2020 Q2: Bacteria billion counts/day			Target Year 2050 (Future Reductions): BMPs planned for installation from 2020 Q2 to 2050	Planned reductions from 2020 Q2 to 2050: Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		1.4								1.4
				Pervious Acres Treated		1.9								1.9
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		0.5								0.5
				Pervious Acres Treated		0.8								0.8
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	8.3									8.3
				Pervious Acres Treated	10.4									10.4
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
				REDUCTIONS:		**TOTAL**	**220**			**TOTAL**	**0**			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion counts/day		
9,953		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion counts/day		
9,733		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion counts/day		
9,733		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

billion counts/day		
86.0%		

From top of worksheet

Target Load

billion counts/day		
1,393		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Severn River - subsegment
County Name	Anne Arundel
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2002
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2002
Impervious Acres in Implementation Baseline Year	699
Pervious Acres in Implementation Baseline Year	890

REDUCTIONS REQUIRED UNDER THE TMDL

Req'd Reduction BN counts/day	19.0%

Available on TMDL Data Center WLA Search

		BMP Name	Type	Unit	Baseline Year 2002: BMPs installed before 2002	Progress Fiscal Year 2020 Q2: BMPs installed from 2002 to 2020 Q2	Progress Reductions (Reductions achieved between 2002 and 2020 Q2): Bacteria billion counts/day			Target Year 2050 (Future Reductions): BMPs planned for installation from 2020 Q2 to 2050	Future Reductions (Planned reductions from 2020 Q2 to 2050): Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated	0.9	0.7								1.6
				Pervious Acres Treated	1.3	0.5								1.8
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated		1.4								1.4
				Pervious Acres Treated		2.0								2.0
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	90.8									90.8
				Pervious Acres Treated	136.3									136.3
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	16.2				4.6				20.8
				Pervious Acres Treated	n/a	69.1				13.6				82.7
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	60.5									60.5
				Pervious Acres Treated	108.9									108.9
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	5.7									5.7
				Pervious Acres Treated	5.9									5.9
				REDUCTIONS:		**TOTAL**	2,091			**TOTAL**	-13			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion counts/day		
88,467		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion counts/day		
86,376		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion counts/day		
86,389		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

billion counts/day		
19.0%		

From top of worksheet

Target Load

billion counts/day		
71,658		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.
- Future reductions show an increase in load because the original BMP had a greater bacteria efficiency than the retrofit BMP.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Severn River - Whitehall & Meredith
County Name	Anne Arundel
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2002
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2002
Impervious Acres in Implementation Baseline Year	83
Pervious Acres in Implementation Baseline Year	93

REDUCTIONS REQUIRED UNDER THE TMDL

Req'd Reduction BN counts/day	90.0%

Available on TMDL Data Center WLA Search

		BMP Name	Type	Unit	Baseline Year 2002: BMPs installed before 2002	Progress Fiscal Year 2020 Q2 – Progress Reductions: BMPs installed from 2002 to 2020 Q2	Reductions achieved between 2002 and 2020 Q2: Bacteria billion counts/day			Target Year 2050 – Future Reductions: BMPs planned for installation from 2020 Q2 to 2050	Planned reductions from 2020 Q2 to 2050: Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	5.9				3.0				8.9
				Pervious Acres Treated	n/a	6.0				3.5				9.5
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	26.6									26.6
				Pervious Acres Treated	38.7									38.7
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	0.6									0.6
				Pervious Acres Treated	0.1									0.1
				REDUCTIONS:		**TOTAL**	498			**TOTAL**	60			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion counts/day		
7,605		

This represents the load from the watershed at the baseline year of the implementation plan

TMDL Reductions

billion counts/day		
90.0%		

From top of worksheet

Current Load

billion counts/day		
7,107		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion counts/day		
7,047		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

Target Load

billion counts/day		
761		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	South River - Ramsey Lake
County Name	Anne Arundel
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	1
Pervious Acres in Implementation Baseline Year	0

REDUCTIONS REQUIRED UNDER THE TMDL

Req'd Reduction BN counts/day	65.0%

Available on TMDL Data Center WLA Search

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**		**2020 Q2**		**Target Year**		**2050**		
					2001	Progress Reductions				Future Reductions				
							Reductions achieved between 2001 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	Type	Unit	BMPs installed before 2001	BMPs installed from 2001 to 2020 Q2	Bacteria billion counts/day			BMPs planned for installation from 2020 Q2 to 2050	Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
				REDUCTIONS:		**TOTAL**	0			**TOTAL**	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion counts/day		
290		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion counts/day		
290		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion counts/day		
290		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

billion counts/day		
65.0%		

From top of worksheet

Target Load

billion counts/day		
102		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	South River - subsegment
County Name	Anne Arundel
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	516
Pervious Acres in Implementation Baseline Year	1,001

REDUCTIONS REQUIRED UNDER THE TMDL

Req'd Reduction BN counts/day	68.0%

Available on TMDL Data Center WLA Search

				Scenario Name:	Baseline Year	Progress Fiscal Year			2020 Q2	Target Year			2050	
					2001	Progress Reductions				Future Reductions				
							Reductions achieved between 2001 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	Type	Unit	BMPs installed before 2001	BMPs installed from 2001 to 2020 Q2	Bacteria billion counts/day			BMPs planned for installation from 2020 Q2 to 2050	Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated		0.9				20.8				22
				Pervious Acres Treated		9.1				19.4				29
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		2.1								2.1
				Pervious Acres Treated		1.2								1.2
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	40.8									40.8
				Pervious Acres Treated	84.5									84.5
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a	29.7				6.1				35.8
				Pervious Acres Treated	n/a	31.7				22.8				54.5
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	52.4									52.4
				Pervious Acres Treated	54.2									54.2
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	8.5									8.5
				Pervious Acres Treated	6.0									6.0
				REDUCTIONS:		**TOTAL**	**1,859**			**TOTAL**	**1,617**			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion counts/day		
46,005		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion counts/day		
44,146		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion counts/day		
42,529		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

billion counts/day		
68.0%		

From top of worksheet

Target Load

billion counts/day		
14,722		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Upper Monocacy River
County Name	Carroll / Frederick
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2004
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2004
Impervious Acres in Implementation Baseline Year	545
Pervious Acres in Implementation Baseline Year	630

REDUCTIONS REQUIRED UNDER THE TMDL

Required Reduction BN MPN/yr	97.0%

Available on TMDL Data Center WLA Search

		BMP Name	Type	Unit	Baseline Year 2004: BMPs installed before 2004	Progress Fiscal Year 2020 Q2 (Progress Reductions): BMPs installed from 2004 to 2020 Q2	Reductions achieved between 2004 and 2020 Q2: Bacteria billion MPN/yr			Target Year 2050 (Future Reductions): BMPs planned for installation from 2020 Q2 to 2050	Planned reductions from 2020 Q2 to 2050: Bacteria billion MPN/yr			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated		13.8								13.8
				Pervious Acres Treated		26.4								26.4
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	2.6	4.7								7.3
				Pervious Acres Treated	1.7	11.3								13.0
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	0.3									0.3
				Pervious Acres Treated	0.1									0.1
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	0.9									0.9
				Pervious Acres Treated	4.5									4.5
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	0.6									0.6
				REDUCTIONS:		**TOTAL**	**1,398**			**TOTAL**	**0**			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion MPN/yr		
79,007		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion MPN/yr		
77,609		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion MPN/yr		
77,609		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions

billion MPN/yr		
97.0%		

From top of worksheet

Target Load

billion MPN/yr		
2,370		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2004 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	West River - Bear Neck Creek
County Name	Anne Arundel
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	11
Pervious Acres in Implementation Baseline Year	5

REDUCTIONS REQUIRED UNDER THE TMDL

Req'd Reduction BN counts/day	43.2%

Available on TMDL Data Center WLA Search

		BMP Name	Type	Unit	Baseline Year 2001: BMPs installed before 2001	Progress Fiscal Year 2020 Q2: BMPs installed from 2001 to 2020 Q2	Reductions achieved between 2001 and 2020 Q2: Bacteria billion counts/day			Target Year 2050: BMPs planned for installation from 2020 Q2 to 2050	Planned reductions from 2020 Q2 to 2050: Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	0.3									0.3
				REDUCTIONS:		**TOTAL**	0			**TOTAL**	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion counts/day		
2,374		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion counts/day		
2,374		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion counts/day		
2,374		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

billion counts/day		
43.2%		

From top of worksheet

Target Load

billion counts/day		
1,348		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes

- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	West River - Cadle Creek
County Name	Anne Arundel
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND

	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS

TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	3
Pervious Acres in Implementation Baseline Year	1

REDUCTIONS REQUIRED UNDER THE TMDL

Req'd Reduction BN counts/day	72.2%

Available on TMDL Data Center WLA Search

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**			**2020 Q2**	**Target Year**			**2050**	
					2001	Progress Reductions				Future Reductions				
							Reductions achieved between 2001 and 2020 Q2				Planned reductions from 2020 Q2 to 2050			
		BMP Name	**Type**	**Unit**	BMPs installed before 2001	BMPs installed from 2001 to 2020 Q2	Bacteria billion counts/day			BMPs planned for installation from 2020 Q2 to 2050	Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
				REDUCTIONS:		**TOTAL**	0			**TOTAL**	0			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load

billion counts/day		
957		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

billion counts/day		
957		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

billion counts/day		
957		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	**Legend**	Does not meet TMDL

TMDL Reductions

billion counts/day		
72.2%		

From top of worksheet

Target Load

billion counts/day		
266		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

MDE

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	West River - subsegment
County Name	Anne Arundel
Date	06/30/2020

LOADING RATES FOR UNTREATED LAND		
	Impervious Rate lbs/acre/yr	Pervious Rate lbs/acre/yr
	see notes below	

BASELINE YEAR DETAILS	
TMDL Baseline Year Available on TMDL Data Center WLA Search	2001
Implementation Plan Baseline Year If different from TMDL Baseline year, provide explanation in write-up	2001
Impervious Acres in Implementation Baseline Year	32
Pervious Acres in Implementation Baseline Year	26

REDUCTIONS REQUIRED UNDER THE TMDL	
Req'd Reduction BN counts/day	35.3%
Available on TMDL Data Center WLA Search	

				Scenario Name:	**Baseline Year**	**Progress Fiscal Year**			**2020 Q2**	**Target Year**			**2050**	
					2001	Progress Reductions				Future Reductions				
		BMP Name	**Type**	**Unit**	BMPs installed before 2001	BMPs installed from 2001 to 2020 Q2	Reductions achieved between 2001 and 2020 Q2: Bacteria billion counts/day			BMPs planned for installation from 2020 Q2 to 2050	Planned reductions from 2020 Q2 to 2050: Bacteria billion counts/day			BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Rain Gardens	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Bioswales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a									-
				Pervious Acres Treated	n/a									-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a				n/a				
				Pervious Acres Treated		n/a				n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated										-
				Pervious Acres Treated										-
Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Pipe Cleaning	Annual **	Dry tons removed										-
		Inlet Cleaning	Annual **	Dry tons removed										-
		Impervious Urban Surface Elimination	Cumulative	Impervious Acres converted to pervious										-
		Urban Tree Planting	Cumulative	Acres planted on pervious										-
		Urban Stream Restoration	Cumulative	Linear feet restored										-
		Outfall Stabilization	Cumulative	Linear feet										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	0.4									0.4
				Pervious Acres Treated	0.1									0.1
				REDUCTIONS:		**TOTAL**	**0**			**TOTAL**	**0**			

* The acres and reductions in these scenarios should reflect restoration BMPs only. They should not include BMPs on new development that occurred following the implementation plan baseline year.

** Annual practice. Implementation should only include additional efforts beyond the previous scenario. So if 10 miles were swept in the baseline year, and 25 miles were swept in 2009, the 2009 scenario would show 15 miles along with the incremental additional load reduction from that increased effort. The mileage swept in the Target Year will equal the sum of the mileages from the Baseline, 2009, Current and Target Year scenarios. Any decrease in effort will require a negative mileage to be entered.

*** Provide a justification in the write-up for load reductions claimed from this practice

**** Note on redevelopment: load reductions from redevelopment projects should be represented by the specific types of treatment instituted at the redevelopment project in the upland treatment BMPs section. This also assumes no prior treatment at the redevlopment site.

Treated Baseline Load		
billion counts/day		
3,563		

This represents the load from the watershed at the baseline year of the implementation plan

Current Load		
billion counts/day		
3,563		

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation		
billion counts/day		
3,563		

This represents the load from the watershed in the year that the plan is fully implemented

meets TMDL	Legend	Does not meet TMDL

TMDL Reductions		
billion counts/day		
35.3%		

From top of worksheet

Target Load		
billion counts/day		
2,305		

This represents the load that must be achieved when the plan is fully implemeted. It is equal to the baseline reduction times the inverse of the required reduction %

Notes
- Refer to MDOT SHA Restoration Modeling Protocol for a detailed description of modeling methodology.
- For local TMDL watersheds with multiple pollutant listings, treatment and load reductions are presented in separate summary sheets due to varying TMDL baseline years.
- Loading rates are calculated by land use category in the WTM as billion MPN/ac/yr. Therefore, Loading Rates for Untreated Land vary within a watershed and are not provided in this summary sheet.
- Accurate MDOT SHA data for 2001 land use is unavailable; so baseline loads will be modeled using 2002 MDP land use and MDOT SHA 2011 ROW. This is likely to overstate the amount of land area and imperviousness compared to the TMDL analysis, which will lead to a higher restoration requirement; in other words, a conservative approach. Baseline load reductions are calculated from BMPs constructed prior to TMDL baseline year.
- Instead of presenting reductions between baseline year and permit issuance year, MDOT SHA is presenting FY2020 Quarter 2 progress reductions which are defined as reductions achieved between baseline year and December, 31, 2019.
- Bacteria load reductions were calculated as the sum of reductions from the suite of restoration BMPs in the watershed. The modeling approach for this pollutant does not report reductions by BMP type.

ABBREVIATIONS

AA-DPW	Anne Arundel County, Department of Public Works
BMP	Best Management Practice
CA	Chesapeake Bay Critical Area
CBPWM	Chesapeake Bay Program Watershed Model
CWA	Clean Water Act
DNR	Maryland Department of Natural Resources
EPA	United States Environmental Protection Agency
ESD	Environmental Site Design
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
LA	Load Allocations
lbs	Pounds (weight)
LF	Linear Feet
MD	Maryland
MDE	Maryland Department of the Environment
MDOT SHA	Maryland Department of Transportation State Highway Administration
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
OED	Office of Environmental Design (MDOT SHA)
PCB	Polychlorinated Biphenyl
ROW	Right-of-Way
SCA	Stream Corridor Assessment
SW	Stormwater
SWM	Stormwater Management
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
tPCB	Total Polychlorinated Biphenyl
TSS	Total Suspended Solids
USGS	United States Geological Survey
WLA	Wasteload Allocation
WPD	Water Programs Division (MDOT SHA)
WQSs	Water Quality Standards
yr	Year

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