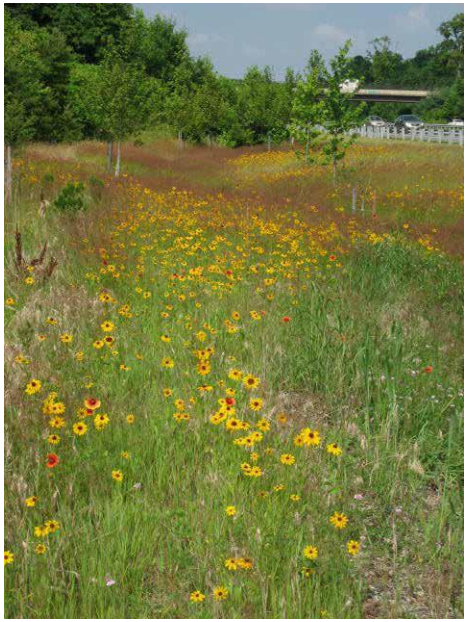
MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

Non-Tidal Patuxent River Lower Watershed Sediment TMDL Implementation Plan

July 2, 2019



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

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July 2, 2019

Mr. Stewart Comstock
Sediment, Stormwater and Dam Safety Program
Water and Science Administration
Maryland Department of the Environment
1800 Washington Boulevard, Suite 440
Baltimore, MD 21230

Dear Mr. Comstock:

The Maryland Department of Transportation State Highway Administration (MDOT SHA) is pleased to submit this Sediment TMDL Implementation Plan for the Non-Tidal Patuxent River Lower Watershed addressing conditions under the MDOT SHA NPDES MS4 permit (11-DP-3313) which took effect on October 9, 2015. This submittal covers the permit requirement to submit a coordinated TMDL implementation plan for any subsequent stormwater WLAs within one year of EPA approval.

The EPA approved the TMDL of Sediments in the Non-Tidal Patuxent River Lower Watershed on July 2, 2018. The public comment period for this Sediment TMDL Implementation Plan was held from May 24, 2019 to June 24, 2019. Notices were posted in the classified section of *The Baltimore Sun* and *The Washington Post* on May 24, 2019. The notices provided the MDOT SHA website, http://www.roads.maryland.gov/Index.aspx?PageId=362, where the plan could be downloaded and where instructions for sending comments were provided should the reader so choose. No comments were received during the public comment period. Please find enclosed documentation confirming the posting of these notices.

If you have any questions or need additional information regarding this delivery, please contact Mr. Travis Vance at 410-545-8623 (or via email at tvance@mdot.maryland.gov) or me at 410-545-8407 (or via email at kcoffman@mdot.maryland.gov).

Sincerely,

Karen Coffman, Chief
MDOT SHA OED Water Programs Division

Enclosures: MDOT SHA Non-Tidal Patuxent River Lower Sediment TMDL Implementation Plan
The Baltimore Sun Media Group (BSMG) Legal Notices Proof
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Cc: Mr. Brian Cooper, MDE WSA SSDSP
Ms. Sonal Ram, Director, MDOT SHA OED
Mr. Kevin P. Wilsey, Deputy Director, MDOT SHA OED
Mr. Travis Vance, MDOT SHA OED WPD

Order ID: 6297132

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MDOT MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

OPPORTUNITY FOR PUBLIC REVIEW AND COMMENT

DRAFT IMPLEMENTATION PLAN FOR THE TOTAL MAXIMUM DAILY LOAD (TMDL) OF SEDIMENT IN THE NON-TIDAL PATUXENT RIVER LOWER WATERSHED, ANNE ARUNDEL, CALVERT, CHARLES, PRINCE GEORGE'S, AND SAINT MARY'S COUNTIES, MARYLAND

The Maryland Department of Transportation State Highway Administration (MDOT SHA) was issued a National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System (MS4) Permit, (Permit No. 11-DP-3313), by the Maryland Department of the Environment (MDE) on October 9, 2015. This permit covers stormwater discharges from the storm drain system owned or operated by MDOT SHA within Anne Arundel, Baltimore, Carroll, Cecil, Charles, Frederick, Harford, Howard, Montgomery, Prince George's, and Washington Counties. The permit requires MDOT SHA to submit an implementation plan to MDE that addresses Environmental Protection Agency (EPA)-approved stormwater waste load allocations (WLAs) within one year of EPA approval.

EPA approved the *Total Maximum Daily Load of Sediment in the Non-Tidal Patuxent River Lower Watershed, Anne Arundel, Calvert, Charles, Prince George's, and Saint Mary's Counties, Maryland* on July 2, 2018. The MDOT SHA Office of Environmental Design (OED) is soliciting comments on its draft Implementation Plan to meet this WLA as required under the MS4 Permit. A 30-day public comment period will take place from May 24, 2019 to June 24, 2019. The draft Implementation Plan is available on MDOT SHA's website at http://www.roads.maryland.gov/Index.aspx?PageId=362.

Comments should be submitted to MDOT SHA **on or before June 24, 2019** by emailing to wpd@mdot.maryland.gov, faxing to (410) 209-5003, or mailing to:

Maryland Department of Transportation
State Highway Administration
Office of Environmental Design, C-303
707 N. Calvert Street
Baltimore, MD 21202

Please note that comments should include the name and address of the person submitting the comments. Responses to comments will not be provided directly, but material comments received during the comment period will be considered and the draft Implementation Plan will be revised as appropriate prior to submittal to MDE. A summary of comments received will be included in the MDOT SHA MS4 annual report submitted to MDE annually on October 9 and posted to this website: http://www.roads.maryland.gov/Index.aspx?pageid=336.

5/24/2019 6297132

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NON-TIDAL PATUXENT RIVER LOWER WATERSHED SEDIMENT TMDL IMPLEMENTATION PLAN

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 the 8-digit watersheds in Maryland.

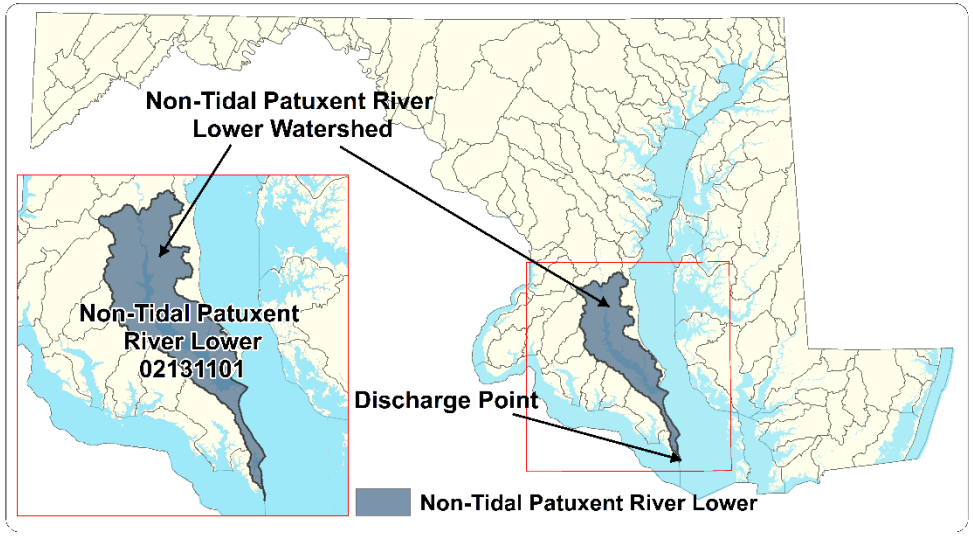


Figure 1: Maryland 8-digit Watershed Example

County Watershed Assessments

Each MS4 county is required to perform 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 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 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 best management practices (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 F**, illustrates the 1.5-mile grid system for the Non-Tidal Patuxent River Lower 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.

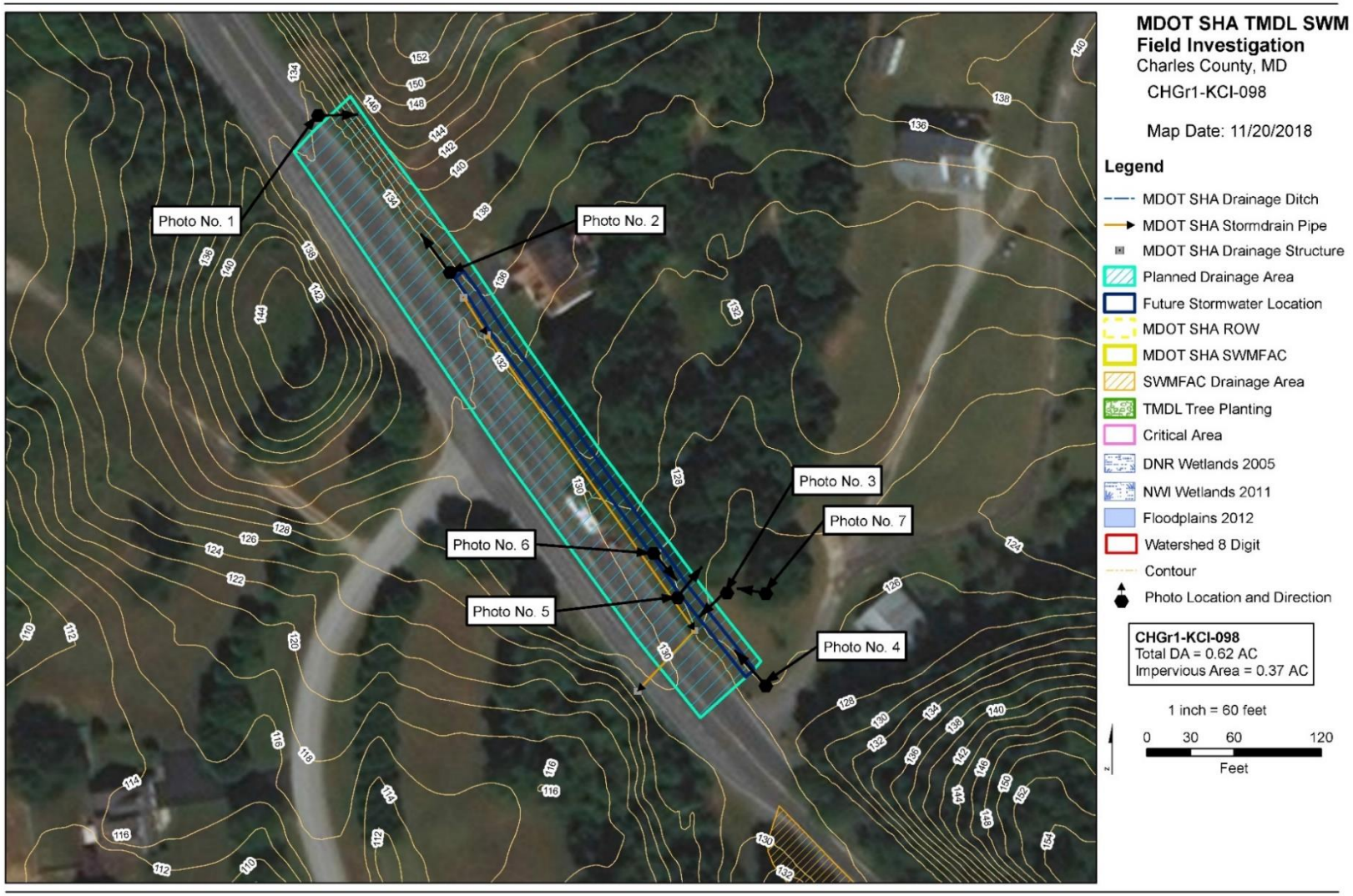


Figure 2: Example Field Investigation Summary Map

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.

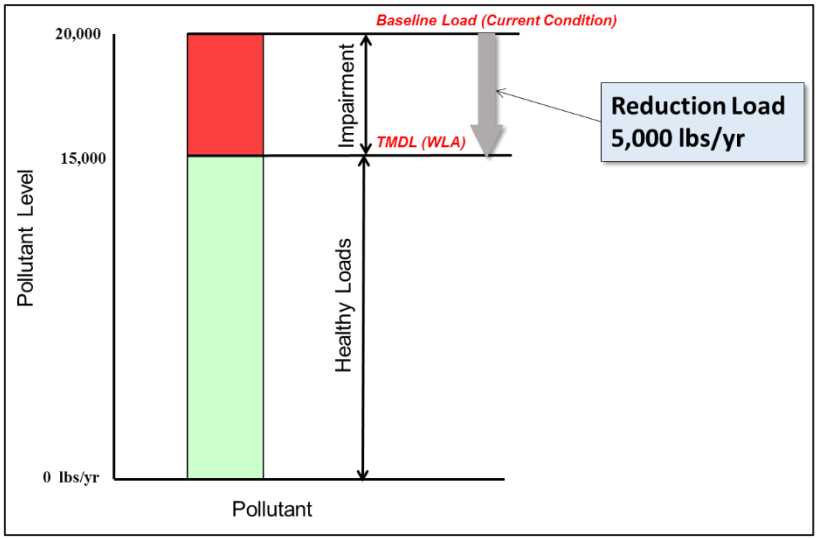


Figure 3: Example Wasteload and Reduction Requirement

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 protocol, *MDOT SHA Restoration Modeling Protocol*, can be found under the "Related Documents" section on the MDOT SHA website, https://www.roads.maryland.gov/Index.aspx?pageid=336.

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, 2017) 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.

E.2. Sediment Pollution Reduction Strategy

E.2.a. Sediment TMDLs Affecting MDOT SHA

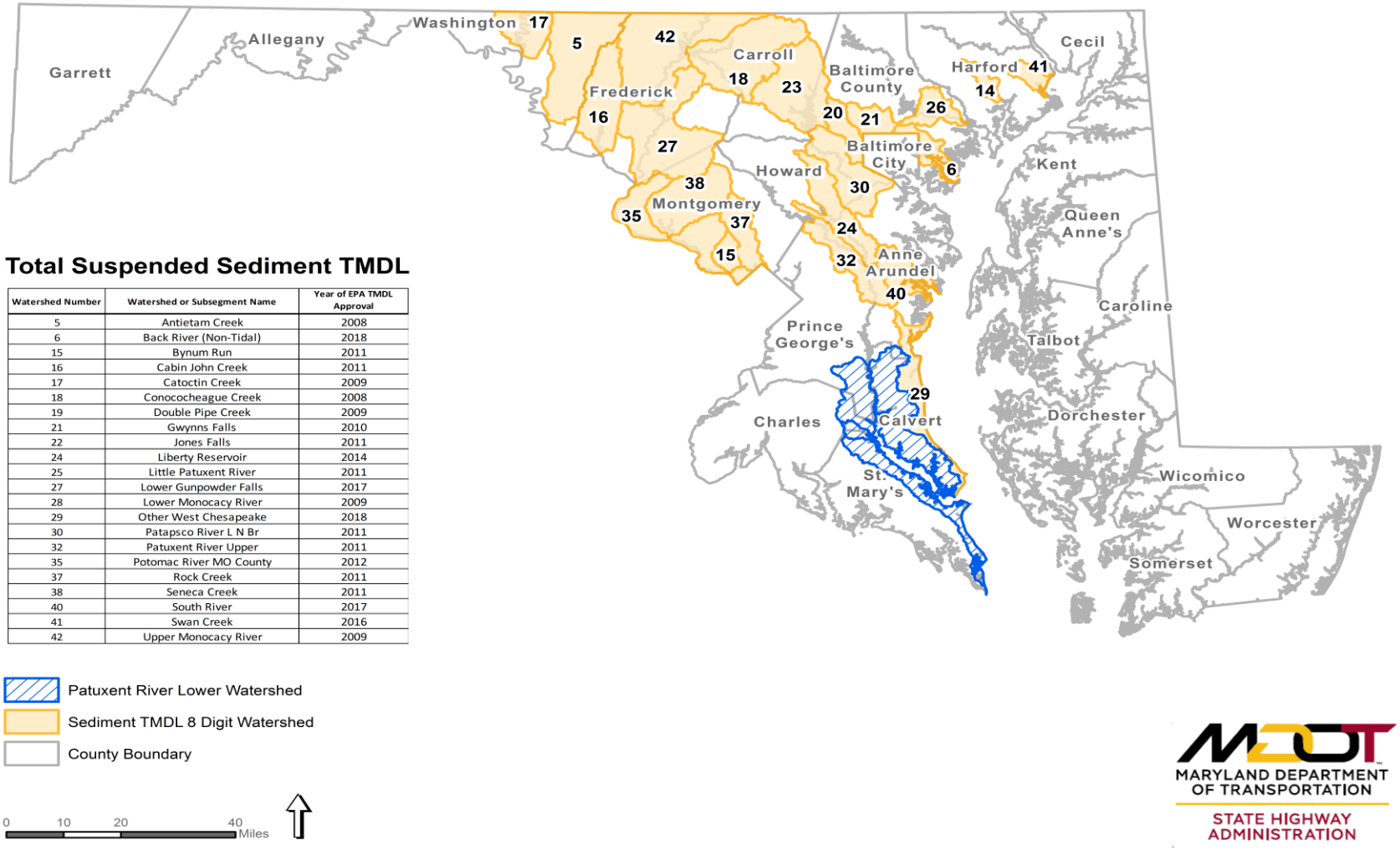
There are many EPA-approved sediment TMDLs within Maryland and **Figure 4** is a map showing MDOT SHA sediment TMDL responsibilities by watershed. The following is a list of TMDL documents for sediment with MDOT SHA responsibility that are addressed in this plan:

- *Total Maximum Daily Load of Sediment in the Non-Tidal Patuxent River Lower Watershed, Anne Arundel, Calvert, Charles, Prince George's, and Saint Mary's Counties, Maryland, approved by EPA on July 2, 2018.*

In **Table 2,** the MDOT SHA reduction target for the Non-Tidal Patuxent River Lower Sediment TMDL is 58 percent, or 25,690 lbs./yr. The watershed can safely receive 18,603 pounds of sediment by MDOT SHA on a yearly basis without being considered impaired. MDOT SHA's reduction target is found by multiplying the MDOT SHA baseline load by the MDOT SHA reduction target percent. The MDOT SHA WLA is found by subtracting the MDOT SHA baseline load by the MDOT SHA target load. The projected reduction achieved is found by modeling the sediment load reduction that will be experienced by the construction of current and future BMPs in the Non-Tidal Patuxent River Lower watershed. These BMPs are either currently under construction or are planned to be constructed in the future. It is estimated that these BMPs will reduce sediment loading by 26,140 pounds to the watershed.

Three dates are shown in **Table 2**: the EPA approval date, the baseline year set by MDE, and the Target Year. The baseline year published on the MDE Data Center will be used for MDOT SHA's implementation planning. This usually correlates to the time-period when monitoring data was collected for MDE's TMDL analysis. The Target Year is the year MDOT SHA proposes to meet the WLA.

Although 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 current MDOT SHA NPDES MS4 permit, MD0068276, coverage area. Therefore, sediment loading from MDOT SHA ROW and load reduction experienced by MDOT SHA BMPs in Calvert and St. Mary's Counties are not apart of the reduction target calculation at this time.



Watershed Number	Watershed or Subsegment Name	Year of EPA TMDL Approval
5	Antietam Creek	2008
6	Back River (Non-Tidal)	2018
15	Bynum Run	2011
16	Cabin John Creek	2011
17	Catoctin Creek	2009
18	Conococheague Creek	2008
19	Double Pipe Creek	2009
21	Gwynns Falls	2010
22	Jones Falls	2011
24	Liberty Reservoir	2014
25	Little Patuxent River	2011
27	Lower Gunpowder Falls	2017
28	Lower Monocacy River	2009
29	Other West Chesapeake	2018
30	Patapsco River L N Br	2011
32	Patuxent River Upper	2011
35	Potomac River MO County	2012
37	Rock Creek	2011
38	Seneca Creek	2011
40	South River	2017
41	Swan Creek	2016
42	Upper Monocacy River	2009

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Figure 4: MDOT SHA Sediment TMDL Responsibilities in Local Watersheds

Table 2: MDOT SHA Non-Tidal Patuxent River Lower Watershed Sediment 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 Baseline	MDOT SHA Proposed 2025 Interim Reduction	% 2025 Reduction Relative to Baseline	MDOT SHA Target Year Reduction	% Target Year Reduction Relative to Baseline	Target Year
Non-Tidal Patuxent River Lower	02131101	AA, CH, CV, PG, SM	Sediment	07/02/2018	2009	Lbs./ yr.	44,293	58.0%	25,690	1,706	6.6%	9,170	35.7%	26,140	59.0%	2040

E.2.b. 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. MDOT SHA has no responsibility for agriculture sources.

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.

E.2.c. 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 is exploring 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. Once the trading program, regulations, and guidance are finalized and approved by EPA, MDOT SHA intends to utilize this program as another practice to meet TMDL requirements.

Cross-Jurisdictional BMPs

MDOT SHA is applying load reductions to the TMDL baseline load from BMPs owned and implemented by adjacent jurisdictions for the amount of MDOT SHA right of way treated. These BMPs can be a mix of various types of stormwater treatment.

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's current assessment will reach the reduction target by 2040. MDOT SHA will continue assessing this potential and will adjust the end date as needed. MDOT SHA will continue to 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 our anticipated Non-tidal Patuxent River Lower sediment WLA end date.

F. MDOT SHA NON-TIDAL PATUXENT RIVER LOWER WATERSHED SEDIMENT TMDL IMLEMENTATION PLAN

F.1. Watershed Description

The Patuxent River Lower watershed (8-digit Basin Code – 02131101) is a 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, 2018b):

- 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 Non-Tidal 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 5** for a map of MDOT SHA facilities within the Non-Tidal Patuxent River Lower watershed.

F.2. MDOT SHA TMDLs within Non-Tidal Patuxent River Lower Watershed

MDOT SHA is included in the sediment TMDL (MDE, 2018a), with a reduction requirement of 58 percent, as shown in **Table-2**. This TMDL only applies to the non-tidal portion of the Patuxent River Lower watershed. In addition to the sediment TMDL, there are also a bacteria TMDL within Indian Creek, a subsegment of the Patuxent River Lower watershed, and a PCB TMDL in the Patuxent River mesohaline and oligohaline Chesapeake Bay segments.

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 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 Non-Tidal Patuxent River Lower watershed is shown in **Figure 6** which illustrates that 30 grid cells have been reviewed,

encompassing portions of 9 State route corridors. Results of the visual inventory categorized by BMP type follow.

Structural Stormwater Controls

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

- 7 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.
- 4 sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 66 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 44 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:

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

Retrofit of Existing Structural SW Controls

Preliminary evaluation identified 3 existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

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

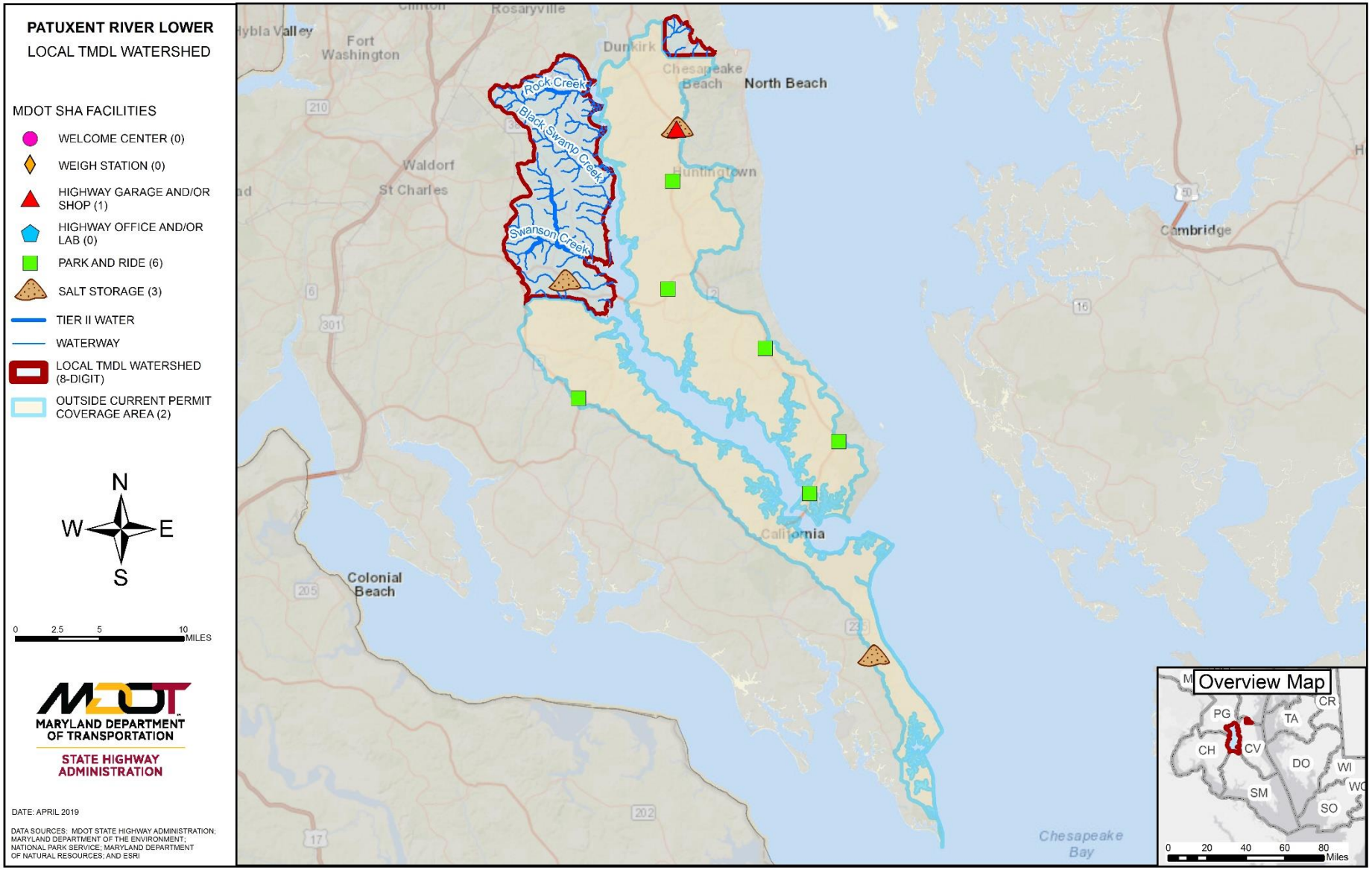


Figure 5: Non-Tidal Patuxent River Lower Watershed

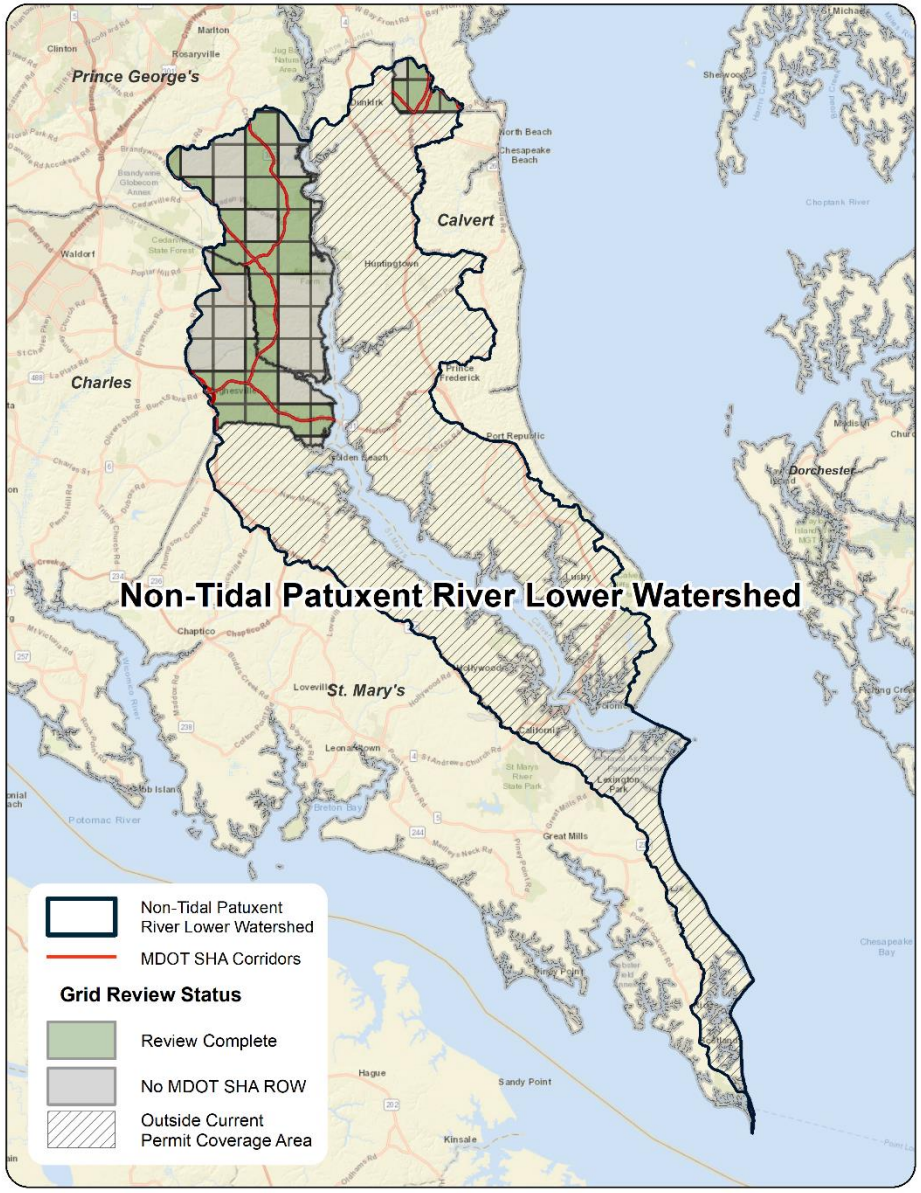


Figure 6: Non-Tidal Patuxent River Lower Site Search Grids

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.

F.5. MDOT SHA Pollutant Reduction Strategies

Proposed practices to meet sediment reduction in the Non-Tidal Patuxent River Lower watershed are shown in **Table 4**. Projected sediment reductions using these practices are 26,140 lbs. which is 59.0 percent of the required reduction. Four timeframes are included in the table below:

- BMPs built before the TMDL baseline. In this case, the baseline is 2009;
- BMPs implemented after the baseline through fiscal year 2020; and
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- BMPs to be implemented after fiscal year 2025 through the target year, 2040.

MDOT SHA will accomplish the projected reduction to be achieved as a percent of the baseline load presented in **Table 2**.

Estimated costs to design, construct, and implement BMPs within the Non-Tidal Patuxent River Lower watershed total $8,601,000. These projected costs are based on an average cost per impervious acre treated derived from cost history for each BMP type. See **Table 5** for a summary of estimated BMP costs.

Table 4: Non-Tidal Patuxent River Lower Restoration Sediment BMP Implementation

BMP	Unit	Baseline (Before 2009)	Restoration BMPs			
			2020	2025	Target Year	Restoration Total
New Stormwater	drainage area acres	106.8	5.9	9.4	21.9	37.2
Retrofit	drainage area acres			3.7	8.7	12.4
Impervious Disconnects	credit acres	4.7				0.0
Cross-Jurisdictional[1]	drainage area acres	2.3				0.0
Tree Planting	acres of tree planting	1.7	93.2			93.2
Stream Restoration	linear feet			430	1,001.0	1,431.0
Outfall Stabilization	linear feet			48	85.0	133.0
Inlet Cleaning[2]	dry tons		1.1			1.1
Load Reductions	TSS EOS lbs./yr.	11,676.2	1,705.8	7,464.0	16,970.0	26,139.8
					Total Projected Reduction	**26,139.8**

[1] Cross-jurisdictional BMPs may be a mix of various types of stormwater treatment.
[2] Inlet cleaning and street sweeping are annual practices.

Figure 7 is a map of MDOT SHA's restoration practices in the watershed and includes those that are under design and construction. Inlet cleaning is not reflected on this map.

Table 5: Non-Tidal Patuxent River Lower Restoration BMP Cost

BMP	2020	2025	Target Year	Restoration Total
New Stormwater	$977,000	$766,500	$1,788,500	$3,532,000
Retrofits		$213,600	$498,400	$712,000
Tree Planting	$3,145,000			$3,145,000
Stream Restoration		$267,300	$623,700	$891,000
Outfall Stabilization		$94,500	$220,500	$315,000
Inlet cleaning	$6,000			$6,000
			Total Cost	**$8,601,000**

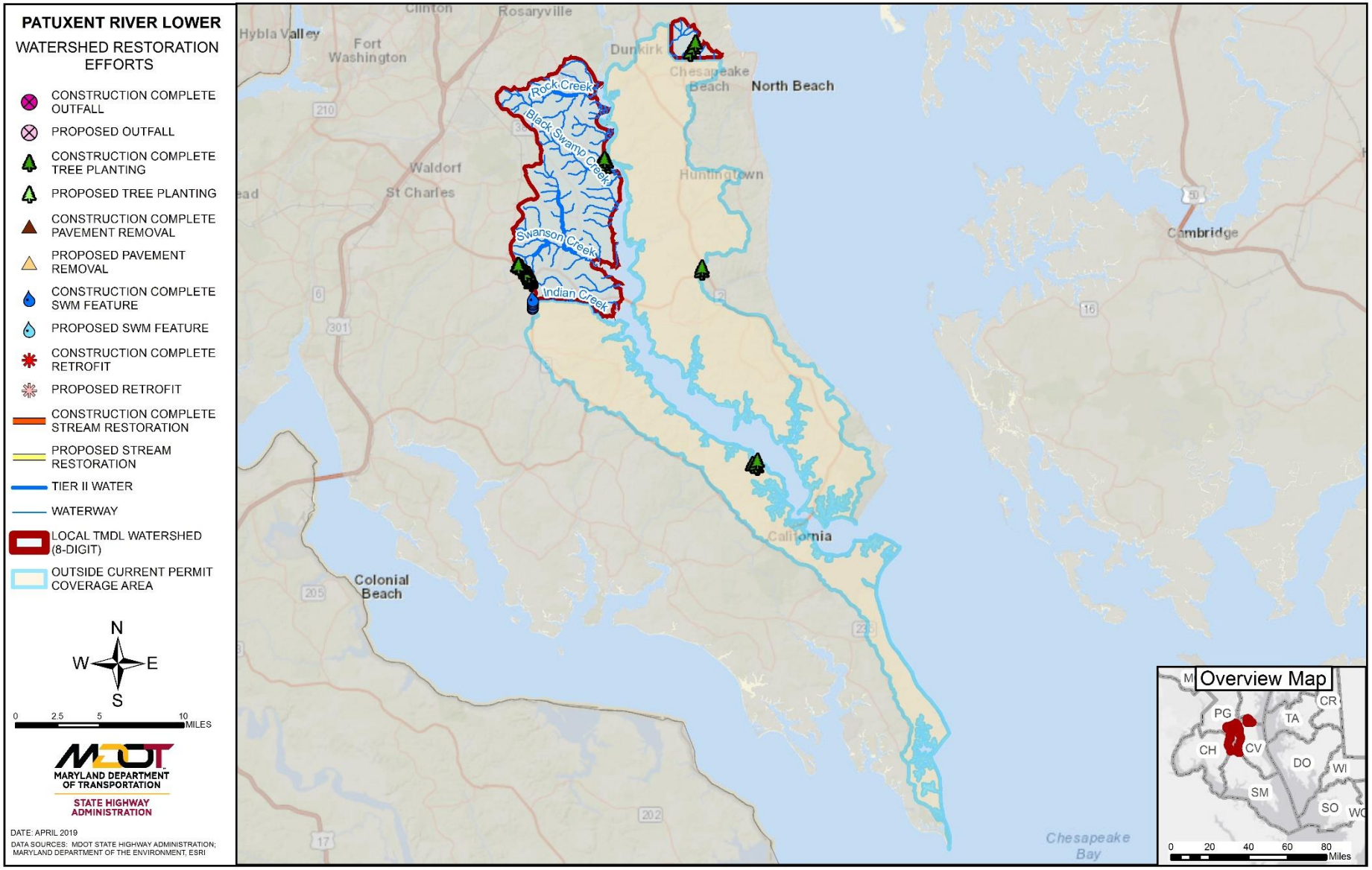


Figure 7: MDOT SHA Programmed Restoration Strategies within the Non-Tidal Patuxent River Lower Watershed

Optional Worksheet for MS4 Stormwater WLA Implementation Planning
Version: Short Aug-15
Maryland Department of the Environment-Science Services Administration

Watershed Name	Patuxent River Lower
County Name	Anne Arundel / Charles / Prince George's
Date	4/5/2019

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	174
Pervious Acres in Implementation Baseline Year	162

REDUCTIONS REQUIRED UNDER THE TMDL	
Required reduction % for TN	
Required reduction % for TP	
Required reduction % for TSS	58.0%
Available on TMDL Data Center WLA Search	

			Scenario Name:	Baseline Year	Progress Fiscal Year			2019	Target Year			2040	
				2009	Progress Reductions				Future Reductions				
						Reductions achieved between 2009 and 2019				Planned reductions from 2019 to 2040			
	BMP Name	Type	Unit	BMPs installed before 2009	BMPs installed from 2009 to 2019	TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for installation from 2019 to 2040	TN lbs/year	TP lbs/year	TSS lbs/year	BMP Total
Runoff Reduction Practices	Runoff Reduction (RR) Practices	**Non-Specified RR Retrofits**	**Cumulative**	Impervious Acres Treated									-
				Pervious Acre Treated									-
		Rain Gardens	Cumulative	Impervious Acres Treated									-
				Pervious Acre Treated									-
		Bioswales	Cumulative	Impervious Acres Treated	2.5	2.6		653.2					5.1
				Pervious Acre Treated	2.1	3.3							5.4
		Grass Swales	Cumulative	Impervious Acres Treated	15.6				12.5			709.2	28.1
				Pervious Acre Treated	16.7				18.8				35.5
		Permeable Pavement	Cumulative	Impervious Acres Treated									-
				Pervious Acre Treated									-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated	0.3								0.3
				Pervious Acre Treated	0.0								0.0
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated	6.7								6.7
				Pervious Acre Treated	2.5								2.5
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated					5.0			264.8	5.0
				Pervious Acre Treated					7.4				7.4
		Urban Filtering Practices (ST)	Cumulative	Impervious Acres Treated	3.2								3.2
				Pervious Acre Treated	0.9								0.9
		Convert Dry Pond to Wet Pond	Cumulative	Impervious Acres Treated	n/a								-
				Pervious Acre Treated	n/a								-
		Dry Detention Ponds and Hydrodynamic Structures	Cumulative	Impervious Acres Treated		n/a			n/a				
				Pervious Acre Treated		n/a			n/a				
		Dry Extended Detention Ponds	Cumulative	Impervious Acres Treated		n/a			n/a				
				Pervious Acre Treated		n/a			n/a				
		Wet Ponds and Wetlands	Cumulative	Impervious Acres Treated	27.0								27.0
				Pervious Acre Treated	29.2								29.2

Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										-
		Inlet Cleaning	Annual **	Dry tons removed						1.1			441.0	1.1
		Impervious Urban Surface Elimination	Cumulative	Impervious acre converted to pervious										-
		Urban Tree Planting	Cumulative	Acre planted on pervious	1.7	93.2			611.6					94.9
		Urban Stream Restoration	Cumulative	Linear feet restored						1,431.0			21,465.0	1,431.0
		Outfall Stabilization	Cumulative	Linear feet						133.0			1,995.0	133.0
		Impervious Disconnects	Cumulative	Credit Acres										-
		Cross-Jurisdictional	Cumulative	Impervious Acres Treated	1.6									1.6
				Pervious Acre Treated	0.8									0.8
				REDUCTIONS:		**TOTAL**	0	0	1,265	**TOTAL**	0	0	24,875	

* 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
		44,293

This represents the load from the watershed at the baseline year of the implementation plan

Current Load

TN	TP	TSS
0	0	43,028

This represents the load from the watershed at the time the implementation plan was developed

Load under full implementation

TN	TP	TSS
0	0	18,153

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%	58.0%

From top of worksheet

Target Load

TN	TP	TSS
0	0	18,603

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 percentage

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 FY2019 progress reductions which are defined as reductions achieved between baseline year and FY2019.
- Data as of 2/25/2019

ABBREVIATIONS

AA	Anne Arundel (County)
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
SM	St. Mary's (County)
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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