MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

Other West Chesapeake Watershed Sediment TMDL Implementation Plan

February 8, 2019

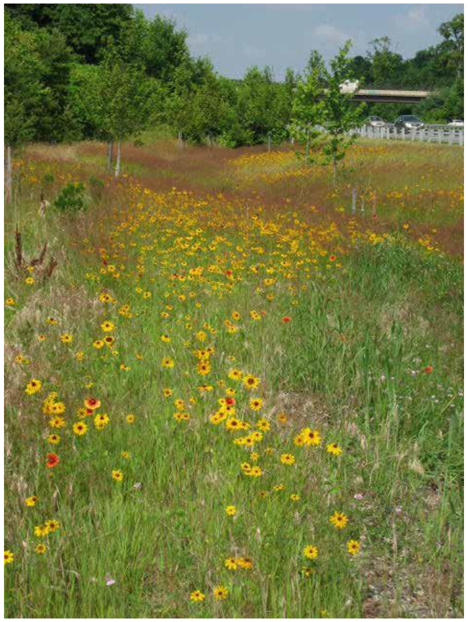


TABLE OF CONTENTS

OTHER WEST CHESAPEAKE 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.

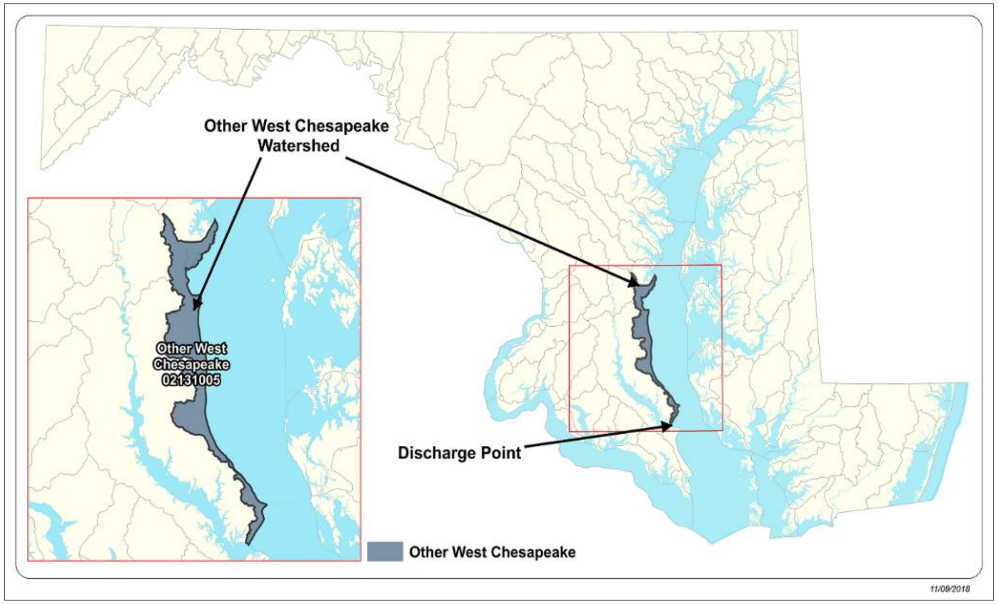


Figure 1: Maryland 8-digit Watershed Example

County Watershed Assessments

Each MS4 county 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 relies on assessments performed by other jurisdictions in fulfilling its MS4 assessment requirement.

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 Other West Chesapeake 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.

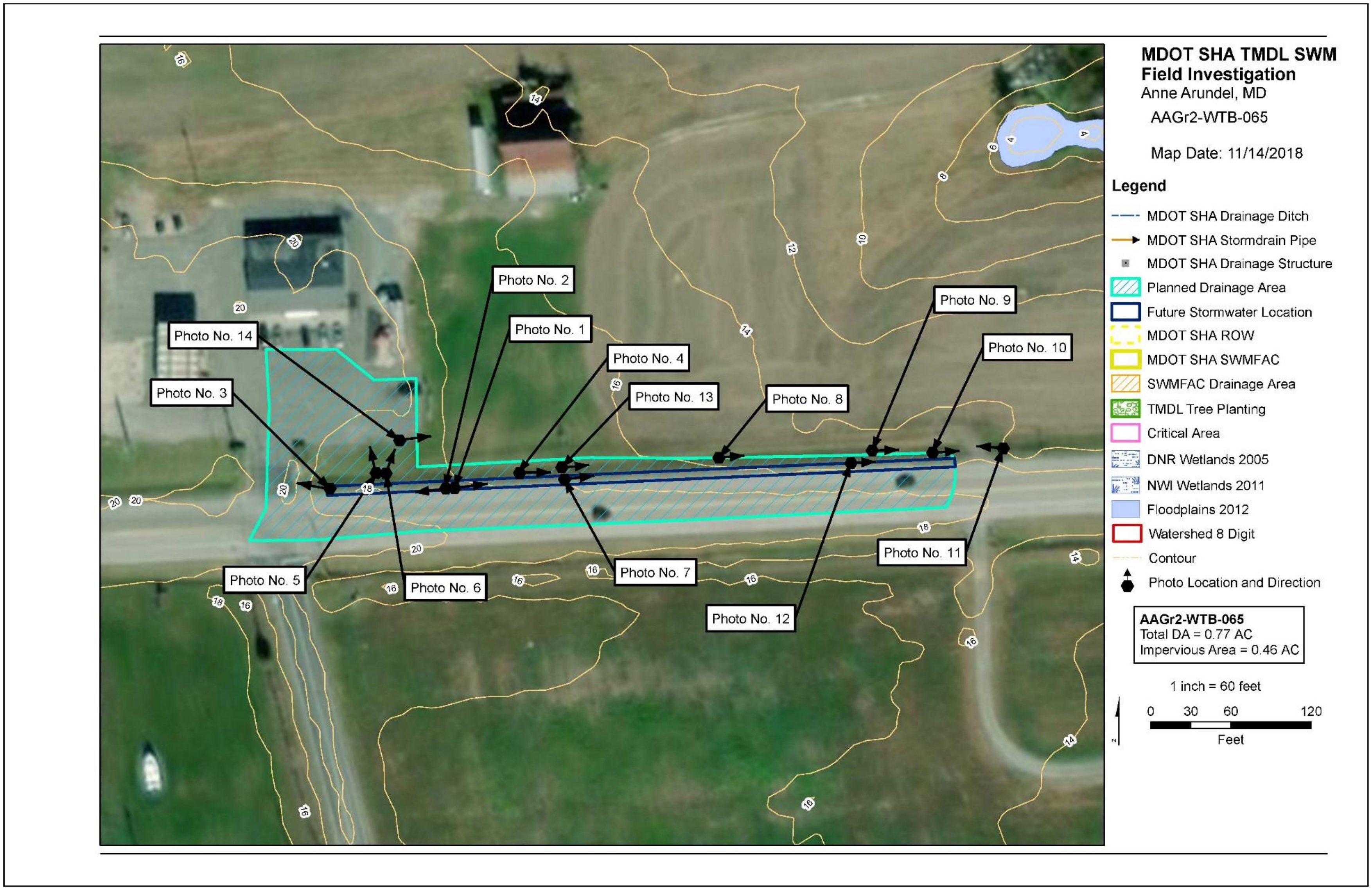


Figure 2: Example Field Investigation Summary Map

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.

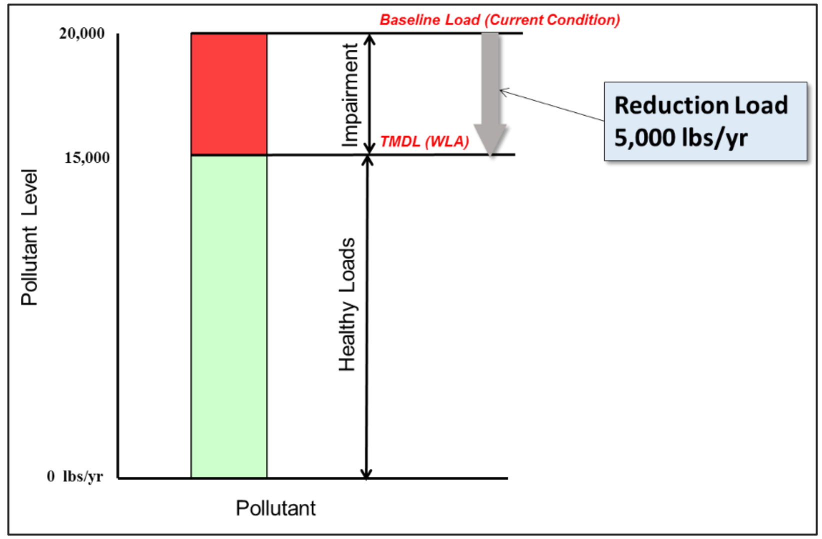


Figure 3: Example Wasteload Allocation and Reduction Requirement

Modeling Parameters

MDE requires that pollutant modeling follow the guidance in MDE's *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (MDE, 2014b); 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, 2018) 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

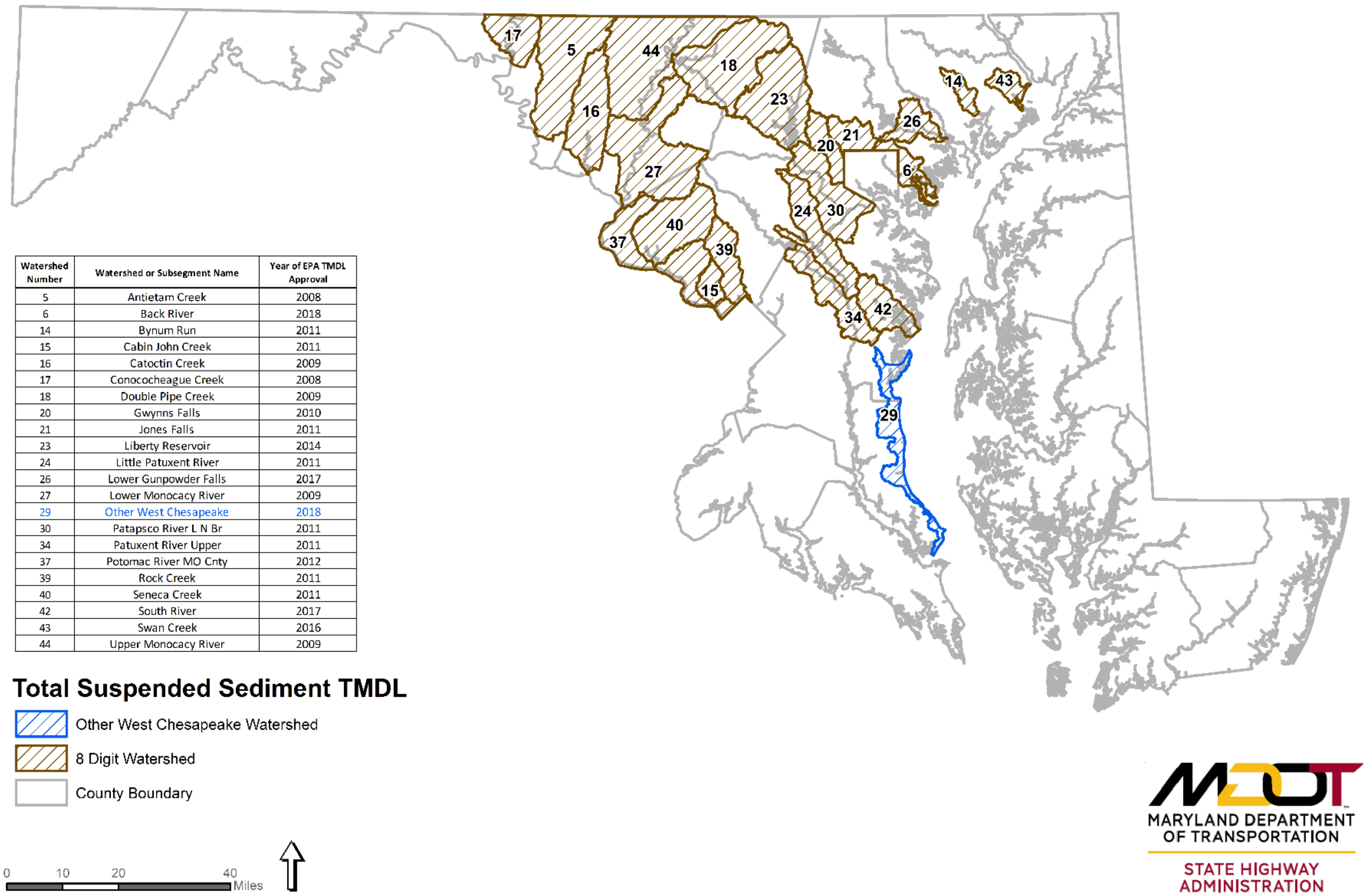
E.2.a. Sediment TMDLs Affecting MDOT SHA

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 Other West Chesapeake Watershed, Anne Arundel and Calvert Counties, Maryland, approved by EPA on February 9, 2018.*

In **Table 2,** the MDOT SHA reduction target for the Other West Chesapeake sediment TMDL is 33 percent, or 18,232 lbs./yr. The watershed can safely receive 37,016 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 Other West Chesapeake 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 34,155 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.



Watershed Number	Watershed or Subsegment Name	Year of EPA TMDL Approval
5	Antietam Creek	2008
6	Back River	2018
14	Bynum Run	2011
15	Cabin John Creek	2011
16	Catoctin Creek	2009
17	Conococheague Creek	2008
18	Double Pipe Creek	2009
20	Gwynns Falls	2010
21	Jones Falls	2011
23	Liberty Reservoir	2014
24	Little Patuxent River	2011
26	Lower Gunpowder Falls	2017
27	Lower Monocacy River	2009
29	Other West Chesapeake	2018
30	Patapsco River L N Br	2011
34	Patuxent River Upper	2011
37	Potomac River MO Cnty	2012
39	Rock Creek	2011
40	Seneca Creek	2011
42	South River	2017
43	Swan Creek	2016
44	Upper Monocacy River	2009

Figure 4: MDOT SHA Sediment TMDL Responsibilities in Local Watersheds

Table 2: MDOT SHA Other West Chesapeake Watershed Sediment Modeling Results

Watershed Name	Watershed Number	County	Pollutant	EPA Approval Date	WLA Type	Baseline Year	Unit	MDOT SHA Baseline Load	MDOT SHA % Reduction Target	MDOT SHA Reduction Target	MDOT SHA WLA	Projected Reduction to be Achieved	Target Year
Other West Chesapeake	02131005	AA, CV	Sediment	02/09/2018	Individual	2009	Lbs./yr.	55,247	33.0	18,232	37,016	34,155	2025

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.

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, 2014b; EPA, 2010b; Hoos et al., 2000; and Schueler, 2011.

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.

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.

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. To date, the load reductions from identified practices exceed the load reduction requirement for the Other West Chesapeake; however, MDOT SHA has set a reduction target date of 2025 to allow for the possibility of changes in programmed or planned sites. For example, MDOT SHA currently has planned stream restoration and outfall stabilization projects in the Other West Chesapeake watershed accounting for a total of 1,192 linear feet with the projected load reductions of 29,876 lbs./yr. Changes to either of these projects would affect whether MDOT SHA meets the TMDL reduction requirement.

F. MDOT SHA OTHER WEST CHESAPEAKE WATERSHED SEDIMENT TMDL IMPLEMENTATION PLAN

F.1. Watershed Description

The Other West Chesapeake Bay watershed (8-digit Basin Code – 02131005) is located on the Western Shore of the Chesapeake Bay within the Lower Western Shore tributary basin. The watershed drains portions of both Anne Arundel and Calvert Counties. 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.

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 (MDE, 2018a).

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, 2018a).

Waters within the Other West Chesapeake watershed are subject to the following impairments as noted on MDE's 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 (1) highway garage and/or shop, one (1) park and ride, and one (1) salt storage facility.

See **Figure 5** 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 TMDL (MDE, 2018a), with a reduction requirement of 33 percent, as shown in **Table 2**. There are no other pollutants with TMDLs and MDOT SHA WLAs for the Other West Chesapeake watershed.

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.

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 Other West Chesapeake watershed is shown in **Figure 6** which illustrates that 20 grid cells have been reviewed, encompassing portions of eight (8) State route corridors. Results of the visual inventory categorized by BMP type follow.

Structural Stormwater Controls

Preliminary evaluation identified 83 locations as potential new structural SW control locations. Further analysis of these locations resulted in:

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

- Three (3) sites deemed not viable for structural SW controls and have been removed from consideration.

Tree Planting

Preliminary evaluation identified 19 locations as potential tree planting locations. Further analysis of these locations resulted in:

- 11 sites constructed or under contract.

- Eight (8) sites deemed not viable for tree planting and have been removed from consideration.

Stream Restoration

Preliminary evaluation identified one (1) site as a potential stream restoration location. Further analysis of this location resulted in:

- One (1) site 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 six (6) outfall potential for stabilization. Further analysis of this site resulted in:

- Six (6) outfall site deemed not viable for outfall stabilization and has been removed from consideration.

Retrofit of Existing Structural SW Controls

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

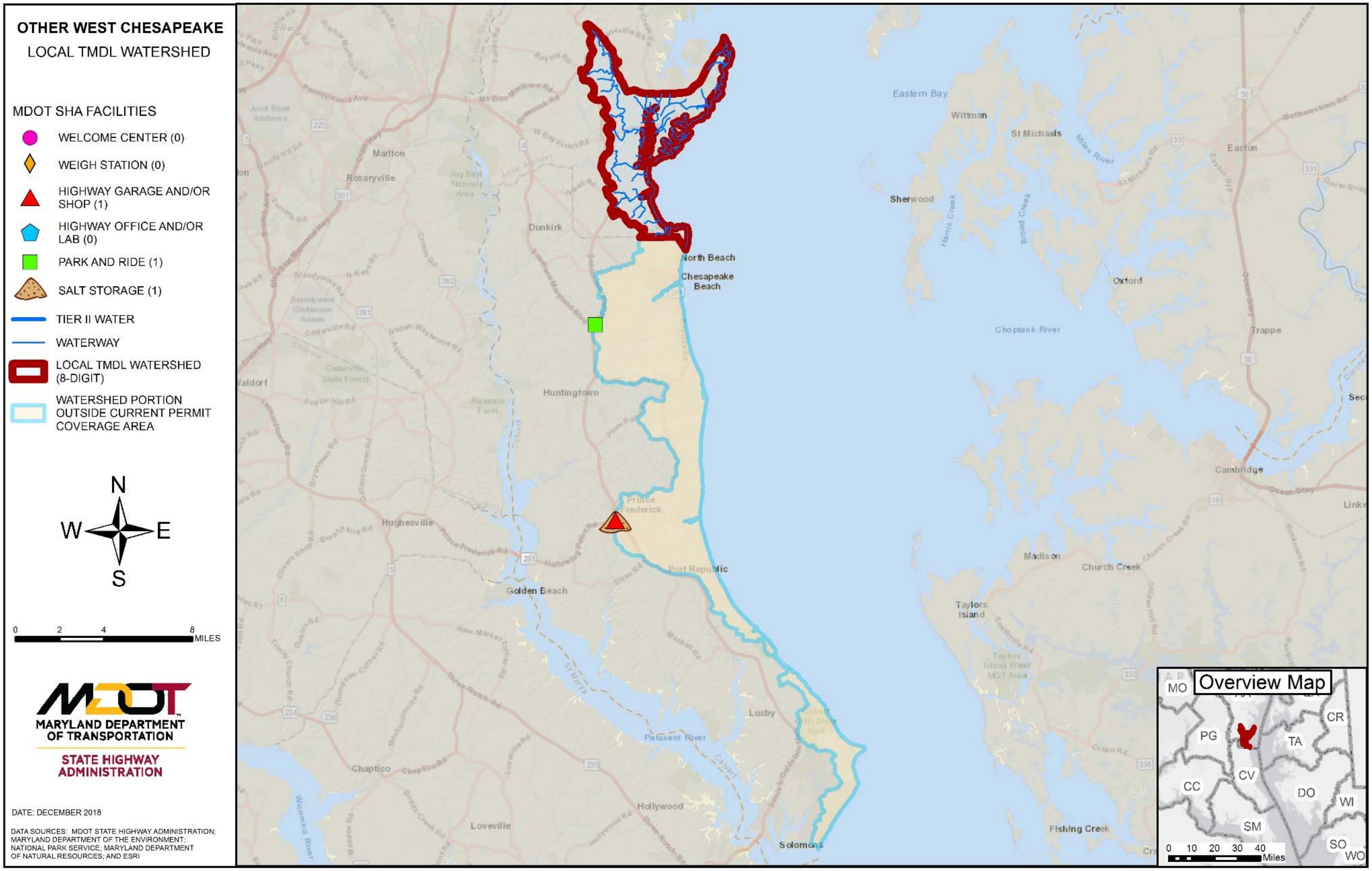


Figure 5: Other West Chesapeake Watershed

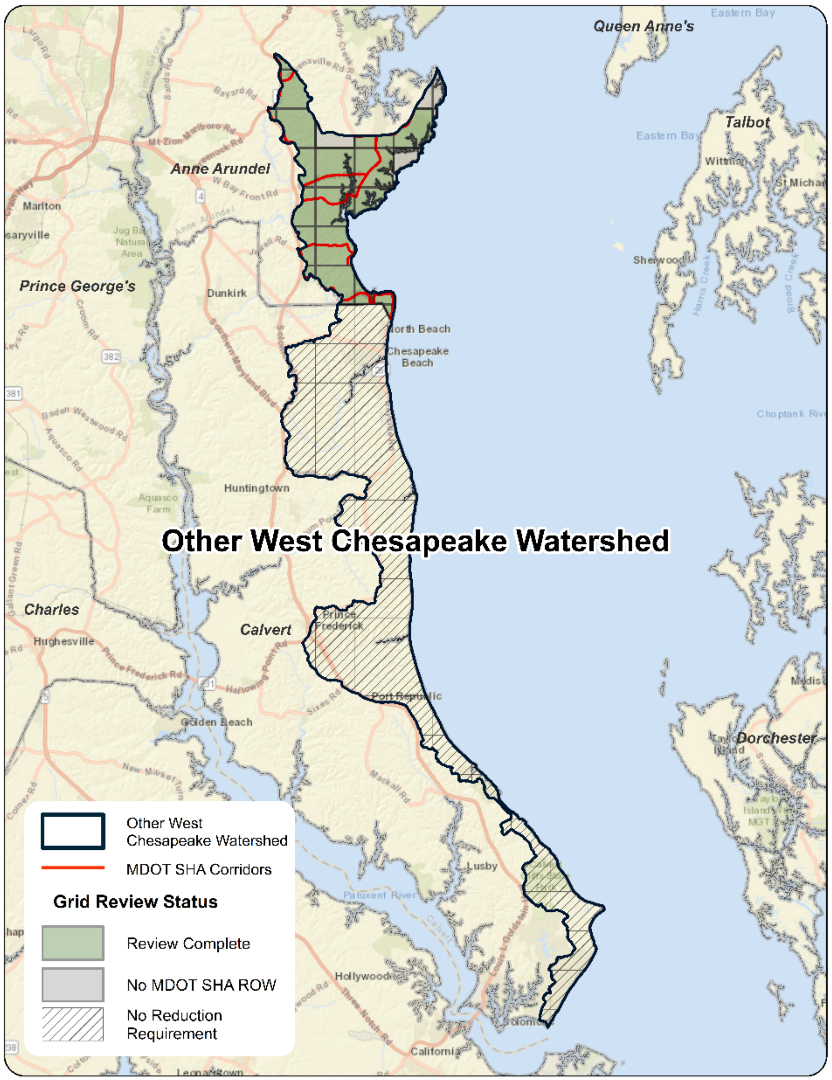


Figure 6: Other West Chesapeake Site Search Grids

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 (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). The 2018 Report serves as Anne Arundel County’s assessment of the 8-digit Other West Chesapeake Bay watershed within Anne Arundel County.

The Anne Arundel County portion of the Other West Chesapeake Bay watershed—referred to in the 2018 Report and hereinafter as 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. The watershed encompasses 23 square miles (14,682 acres) in drainage and contains approximately 109 miles of streams. The Herring Bay watershed is located entirely in the Atlantic Coastal Plain and is a relatively featureless lowland with very few slopes greater than 15 percent. Land use within the Herring Bay watershed is as follows: mixed woods (41 percent); residential (23 percent); forested wetlands (9 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).

The Herring Bay watershed is divided into 21 subwatersheds of greatly varying areas and channel lengths and includes many large well-known named streams including Deep Cove Creek, Rockhold Creek, Trotts Branch, and Tracys Creek. (AA-DPW et al., 2018).

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.

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 (45.6 percent), the more erodible Group C and Group D soils together account for 54 percent of the watershed (42.6 and 11.4 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).

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. Standard MPHI category breakpoints used by the Maryland Department of Natural Resources (DNR) are as follows:

- 0 to 50.9 – Severely Degraded
- 51.0 to 65.9 – Degraded
- 66.0 to 80.9 – Partially Degraded
- 81.0 to 100 – Minimally Degraded

The 2018 Report states that 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).

Further data collection, hydrologic modeling using the United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) Technical Release 20 (TR-20) model, and pollutant load modeling based off of the EPA's Simple Method and Pollutant Loading Estimator (PLOAD) models provided the quantification of watershed processes and the assessment of existing conditions, future development, and pollutant control scenarios. These models provided a means to prioritize restoration and mitigation projects and to understand the extent of potential water quality improvements necessary for satisfying MS4 permit and TMDL requirements. Of the 21 subwatersheds within Herring Bay, 33 percent have been rated as high priority for restoration and 14 percent have been rated as high priority for preservation (AA-DPW et al., 2018).

Urban stormwater BMPs are currently utilized throughout the County and the installation of either structural or nonstructural BMPs is required in all new development areas as well as redevelopment sites. The level of the stormwater management required is dependent on many factors including the size of the development, proximity to Critical Area, and the downstream conditions. In addition to efforts from development or redevelopment requirements, the County also frequently retrofits publicly-owned property with BMPs. 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).

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).

F.5. MDOT SHA Pollutant Reduction Strategies

Proposed practices to meet sediment reduction in the Other West Chesapeake watershed are shown in **Table 4**. Projected sediment reductions using these practices are 34,155 lbs./yr. which is 187 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;
- BMPs implemented after fiscal year 2020 through fiscal year 2025; and
- Future BMPs to be implemented after fiscal year 2025.

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 Other West Chesapeake watershed total $2,983,000. 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: Other West Chesapeake Restoration Sediment BMP Implementation

BMP	Unit	Baseline (Before 2009)	Restoration BMPs			Total BMPs
			2020	2025	Future	
New Stormwater	drainage area acres	6.8	2.7	14.8	N/A	17.6
Impervious Surface Elimination	acres removed		0.1		N/A	0.1
Impervious Disconnects	credit acres	4.6			N/A	
Tree Planting	acres of tree planting	1.7	4.0	4.3	N/A	8.3
Stream Restoration	linear feet			791.7	N/A	791.7
Outfall Stabilization	linear feet			400.0	N/A	400.0
Inlet Cleaning[1]	dry tons		0.1		N/A	0.1
Load Reductions	TSS EOS lbs./yr.		829.1	33,325.5	0	
				Total Projected Reduction	**34,154.6**	

[1] *Inlet cleaning is an annual practice.*

Figure 7 is a map of MDOT SHA's restoration practices in the watershed and includes those that are under design and construction. This map does not include projected strategies for which locations have not been identified. Inlet cleaning and street sweeping are annual areawide practices and not reflected on this map.

Table 5: Other West Chesapeake Restoration BMP Cost

BMP	2020	2025	Total
New Stormwater	$223,000	$1,174,000	$1,397,000
Impervious Surface Elimination	$15,000		$15,000
Tree Planting	$124,000	$130,000	$254,000
Stream Restoration		$529,000	$529,000
Outfall Stabilization		$787,000	$787,000
Inlet cleaning	$1,000		$1,000
Total	$363,000	$2,620,000	$2,983,000

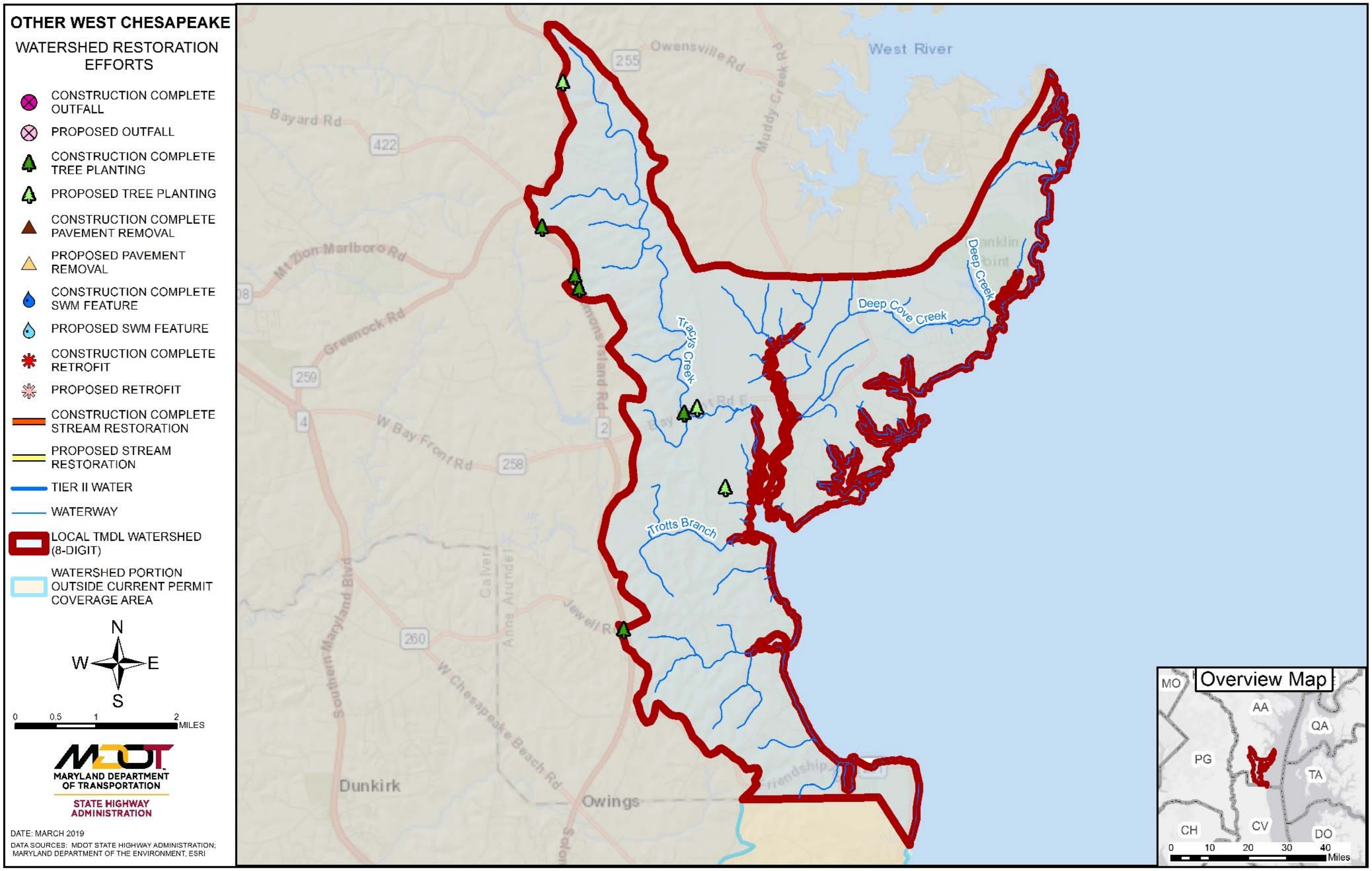


Figure 7: MDOT SHA Programmed Restoration Strategies within the Other West Chesapeake Watershed

ABBREVIATIONS

Note: This list of abbreviations was developed for the 2018 Interim Review Draft of the MDOT SHA *Impervious Restoration and Coordinated TMDL Implementation Plan* (available at www.roads.maryland.gov). Many of the abbreviations may not apply to this document.

AA	Anne Arundel (County)
AA-DPW	Anne Arundel County, Department of Public Works
AAH	Adopt-A-Highway
AASHTO	American Association of State Highway and Transportation Officials
ac	Acre
AFB	Air Force Base
Alt	Alternative
AMT, Inc.	A. Morton Thomas and Associates, Inc.
ATV	All-terrain vehicle
BA	Baltimore (County)
BA-DEPRM	Baltimore County, Department of Environmental Protection and Resource Management
BA-EPS	Baltimore County, Department of Environmental Protection and Sustainability
BARC	Beltsville Agriculture Research Center
BASMAA	Bay Area Stormwater Management Agencies Association
Bay	Chesapeake Bay
BBO	Beaverdam Run, Baisman Run, and Oregon Branch Subwatersheds of the Loch Raven Reservoir Watershed
BIBI	Benthic Index of Biotic Integrity
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
BSID	Biological Stressor Identification
BST	Bacterial Source Tracking
CAFO	Concentrated Animal Feeding Operation
CBP	Chesapeake Bay Program
CBPWM	Chesapeake Bay Program Watershed Model
CH	Charles (County)
CH-DPGM	Charles County, Department of Planning & Growth
CFR	Code of Federal Regulations
CL	Carroll (County)
CL-BRM	Carroll County, Bureau of Resource Management
CRP	Community Reforestation Program
CSN	Chesapeake Stormwater Network
CSO	Combined Sewer Overflow
CTP	Consolidated Transportation Program
CV	Calvert (County)
CWA	Clean Water Act
CWAPTW	Clean Water Action Plan Technical Workgroup
CWP	Center for Watershed Protection
DC	District of Columbia
DD	Direct Drainage
DO	Dissolved Oxygen
DMCF	Dredged Material Containment Facilities
DNR	Maryland Department of Natural Resources
DRMO	Defense Reutilization and Marketing Office
ECD	Environmental Compliance Division (MDOT SHA)

E. coli	*Escherichia coli*
EMC	Event Mean Concentration
EOS	Edge of Stream
EPA	United States Environmental Protection Agency
ESC	Erosion and Sediment Control
ESD	Environmental Site Design
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIB	Fecal Indicator Bacteria
FIBI	Fish Index of Biotic Integrity
FMD	Facility Maintenance Division (MDOT SHA)
FR	Frederick (County)
FR-DPW	Frederick County, Division of Public Works
FR-OSER	Frederick County, Office of Sustainability and Environmental Resources
FY	Fiscal Year
GIS	Geographic Information System
HA	Harford (County)
HA-DPW	Harford County, Department of Public Works
HO	Howard (County)
HWG	Horsley Witten Group, Inc.
ICPRB	Interstate Commission on the Potomac River Basin
IDDE	Illicit Discharge Detection and Elimination
IR	Integrated Report
ISWBMPDB	International Stormwater BMP Database
LA	Load Allocations
lbs	Pounds (weight)
LF	Linear Feet
LID	Low Impact Development
LN	Lower North
LNB	Lower North Branch
LRE	Loch Raven East subwatershed
LJF	Lower Jones Falls (Watershed)
MAA	Maryland Aviation Administration
MD	Maryland
MDA	Maryland Department of Agriculture
MDE	Maryland Department of the Environment
MDOT SHA	Maryland Department of Transportation State Highway Administration
MDP	Maryland Department of Planning
MEP	Maximum Extent Practicable
MEPA	Maryland Environmental Policy Act
MET	Maryland Environmental Trust
MGF	Middle Gwynns Falls (Watershed)
MO	Montgomery (County)
MO-DEP	Montgomery County, Department of Environmental Protection
MOS	Margin of Safety
MPHI	Maryland Physical Habitat Index
MS4	Municipal Separate Storm Sewer System
MSU	Morgan State University
MUTCD	Manual on Uniform Traffic Control Devices
NEPA	National Environmental Policy Act
NJF	Northeastern Jones Falls (Watershed)
NPDES	National Pollutant Discharge Elimination System

OC	Office of Communications (MDOT SHA)
OED	Office of Environmental Design (MDOT SHA)
OOM	Office of Maintenance (MDOT SHA)
PACD	Pennsylvania Association of Conservation Districts
PATMH	Patapsco River Mesohaline
PAXMH	Patuxent River Mesohaline
PAXOH	Patuxent River Oligohaline
PAXTF	Patuxent River Tidal Fresh
PB	Parsons Brinckerhoff
PCB	Polychlorinated Biphenyl
P_E	Rainfall Target Used To Size ESD Practices
PERC	Perchloroethylene
PG	Prince George's (County)
PG-DoE	Prince George's County, Department of the Environment
PLOAD	Pollutant Loading Estimator
RBP	Rapid Bioassessment Protocol
RGP	Regional General Permit
ROW	Right-of-Way
SAH	Sponsor-A-Highway
SB	Spring Branch subwatershed
SCA	Stream Corridor Assessment
SFEI	San Francisco Estuary Institute
SGW	Submerged Gravel Wetlands
SSO	Sanitary Sewer Overflow
SW	Stormwater
SWAP	Small Watershed Action Plan
SWM	Stormwater Management
SW-WLA	Stormwater Wasteload Allocation
TBD	To Be Determined
TBR	Tidal Back River (Watershed)
TCW	Toxic Contaminants Workgroup
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
tPCB	Total Polychlorinated Biphenyl
TSS	Total Suspended Solids
UBR	Upper Back River (Watershed)
UGF	Upper Gwynns Falls (Watershed)
UJF	Upper Jones Falls (Watershed)
US	United States
USACE	United States Army Corps of Engineers
USDA-NRCS	United States Department of Agriculture, Natural Resources Conservation Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USWG	Urban Stormwater Work Group
WA	Washington (County)
WA-DPW	Washington County, Division of Public Works
WAMP	Watershed Management Plan
WCSCD	Washington County Soil Conservation District
WIP	Watershed Implementation Plan
WLA	Wasteload Allocation
WPD	Water Programs Division (MDOT SHA)
WQSs	Water Quality Standards

WQv	Water Quality Volume
WQGIT	Water Quality Goal Implementation Team
WRAS	Watershed Restoration Action Strategy
WSSC	Wetlands of Special State Concern
WTM	Watershed Treatment Model
WTWG	Watershed Technical Work Group
WWTP	Waste Water Treatment Plant
yr	Year
12-SW	Maryland General Permit for Discharges from Stormwater Associated with Industrial Activities

MDE

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
County Name	Anne Arundel / Calvert
Date	11/14/2018

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	79
Pervious Acres in Implementation Baseline Year	135

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			2018	Target Year			2025	
					2009	Progress Reductions				Future Reductions				
					BMPs installed before	BMPs installed from 2009	Reductions achieved between TN lbs/year	TP lbs/year	TSS lbs/year	BMPs planned for	Planned reductions from 2018 to TN lbs/year	TP lbs/year	TSS lbs/year	
		BMP Name	Type	Unit										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										-
				Pervious Acre Treated										-
		Grass Swales	Cumulative	Impervious Acres Treated	1.6					7.1			3,844.1	8.7
				Pervious Acre Treated	5.2					10.5				15.7
		Permeable Pavement	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Urban Filtering Practices (RR)	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Urban Infiltration Practices	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
	Stormwater Treatment (ST) Practices	**Non-Specified ST Retrofits**	**Cumulative**	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Urban Filtering Practices (ST) - Bioretention	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		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										-
				Pervious Acre Treated										-

Alternative Practices	MDE Approved Alternative BMP Classifications	Street Sweeping	Annual **	Acres swept										0.0
		Inlet Cleaning	Annual **	Dry tons removed		0.1			44.1					0.1
		Impervious Urban Surface	Cumulative	Impervious acre converted to						0.1			4.2	0.1
		Urban Tree Planting	Cumulative	Acre planted on pervious	1.7	4.0			180.2	4.3			206.5	8.3
		Urban Stream Restoration	Cumulative	Linear feet restored						791.7			11,875.5	791.7
		Outfall Enhancement	Cumulative	Impervious Acres Treated										-
				Pervious Acre Treated										-
		Outfall Stabilization	Cumulative	Linear feet						400.0			18,000.0	400.0
		Impervious Disconnects	Cumulative	Credit acres	4.6									4.6
				REDUCTIONS:		TOTAL	0	0	224	TOTAL	0	0	33,930	

* 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
		55,247

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

Current Load		
TN	TP	TSS
0	0	55,023

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

Load under full implementation		
TN	TP	TSS
0	0	21,092

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	37,016

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 FY2018 progress reductions which are defined as reductions achieved between baseline year and FY2018.

REFERENCES

Note: This list of references was developed for the 2018 Interim Review Draft of the MDOT SHA *Impervious Restoration and Coordinated TMDL Implementation Plan* (available at www.roads.maryland.gov). Many of the references may not apply to this document.

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