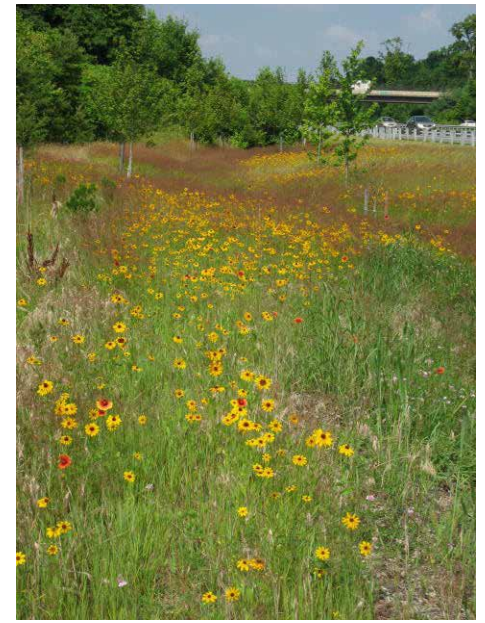




STATE HIGHWAY  
ADMINISTRATION

# Non-tidal Back River Watershed Sediment TMDL Implementation Plan

**PUBLIC REVIEW DRAFT** February 04, 2019



## OPPORTUNITY FOR PUBLIC REVIEW AND COMMENT

### *DRAFT IMPLEMENTATION PLAN FOR THE TOTAL MAXIMUM DAILY LOAD (TMDL) OF SEDIMENT IN THE NON-TIDAL BACK RIVER WATERSHED, BALTIMORE CITY AND BALTIMORE COUNTY, 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 Back River Watershed, Baltimore City and Baltimore County, Maryland* on March 5, 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 February 4, 2019 to March 5, 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 March 5, 2019** by emailing to [wpd@sha.state.md.us](mailto:wpd@sha.state.md.us), 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>.

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# NON-TIDAL BACK RIVER 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*

Designated Uses	Use Classes							
	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](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:*

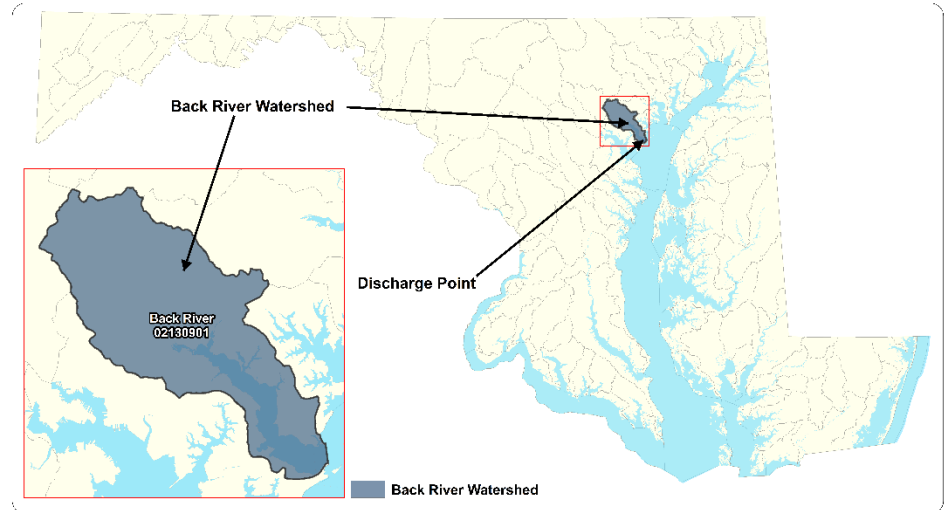
- *Include the final date for meeting applicable WLAs and a detailed schedule for implementing all structural and nonstructural water quality improvement projects, enhanced stormwater management programs, and alternative stormwater control initiatives necessary for meeting applicable WLAs;*
- *Provide 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 Best Management Practices (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 in this Plan under **Section F**. MDOT SHA watershed assessment evaluations focus on the following:

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

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

- On-going coordination meetings with each of the MS4 counties to discuss potential partnerships with the mutual goal of improving water quality;
- Perform visual watershed inspections as described below;
- Model MDOT SHA load reductions within the watershed based on MDOT SHA land uses and ROW; and
- Maximize 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 to ensure that it is thoroughly assessed. 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 MDOT SHA data. MDOT SHA has created a grid system of 1.5 mile square cells to track the progress of the visual watershed inspections, allowing prioritized areas to be targeted first. With this grid system, many spatial data sets are reviewed to determine the most cost-effective use of each potential restoration site. The sites are documented geographically and stored in Geographic Information Systems (GIS) to then 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 Back River watershed.

### Field Investigations

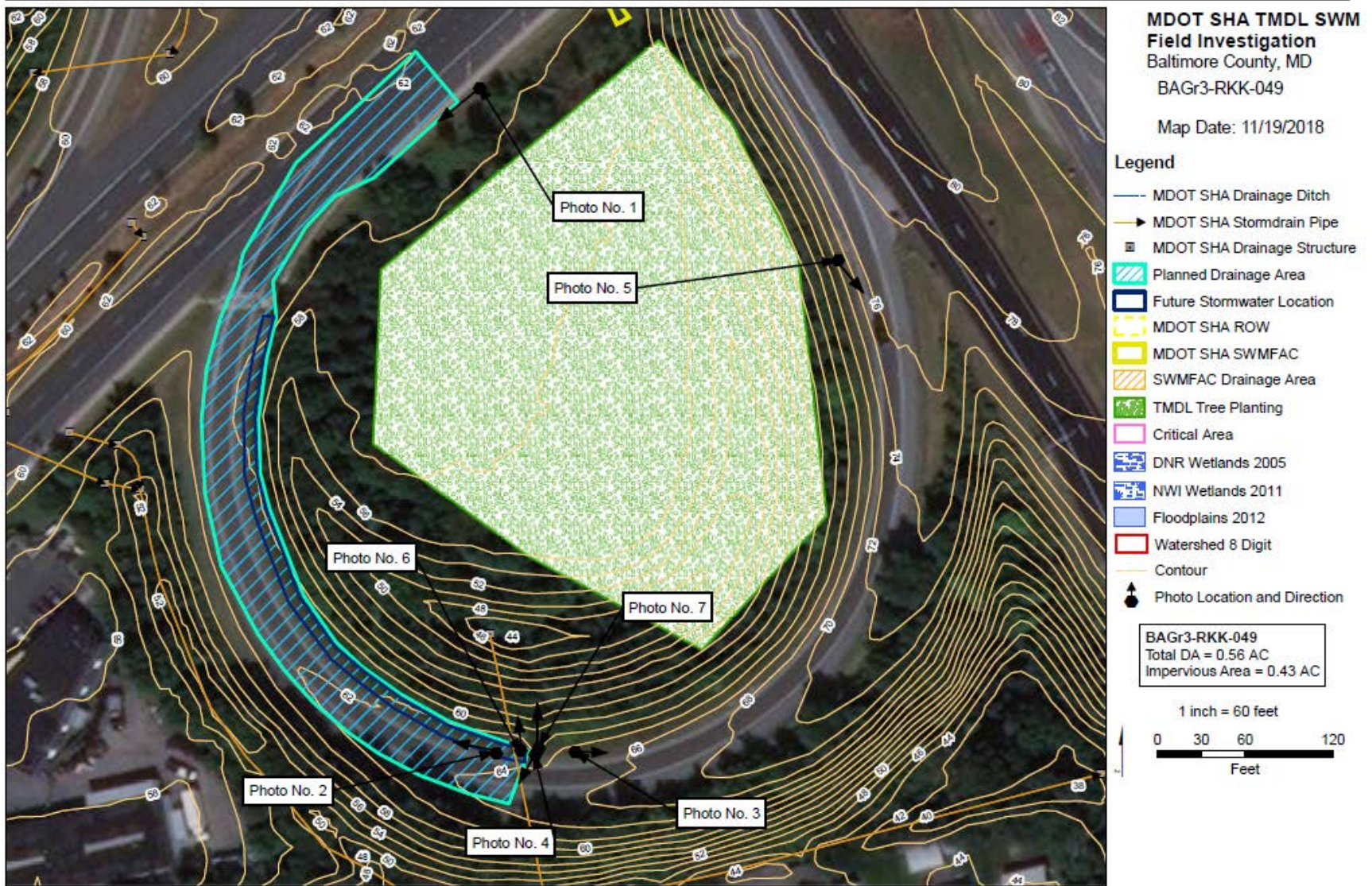
Phase two is a field investigation of each viable site resulting from the watershed desktop evaluation. MDOT SHA inspects and assesses each site in the field to identify and document existing site conditions, water quality opportunities, and constraints. This information is used to determine potential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

MDOT SHA will continue to prioritize visual inspections in the highest need watersheds. **Figure 2** is an example field investigation summary map that documents observations from the field analysis. 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 the watershed discussion 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](http://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

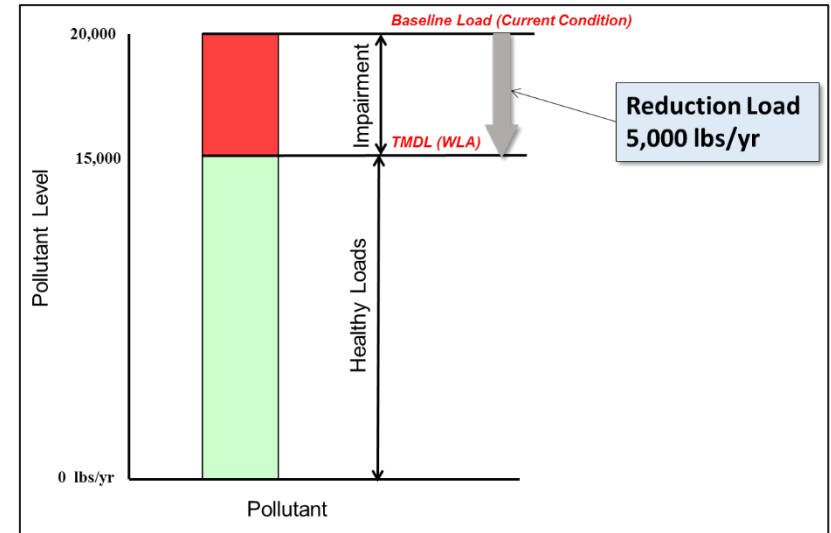
TMDLs define the maximum pollutant loading that can be discharged to a waterbody and still meet water quality criteria for maintaining designated uses. **Figure 3** illustrates the concept of maximum loading. The green area on the bar depicts the maximum load that maintains a healthy water environment 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 the 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 2016 Annual Report. Updates to this protocol will be periodically implemented and resubmitted for MDE consideration. This protocol, *MDOT SHA Automated 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

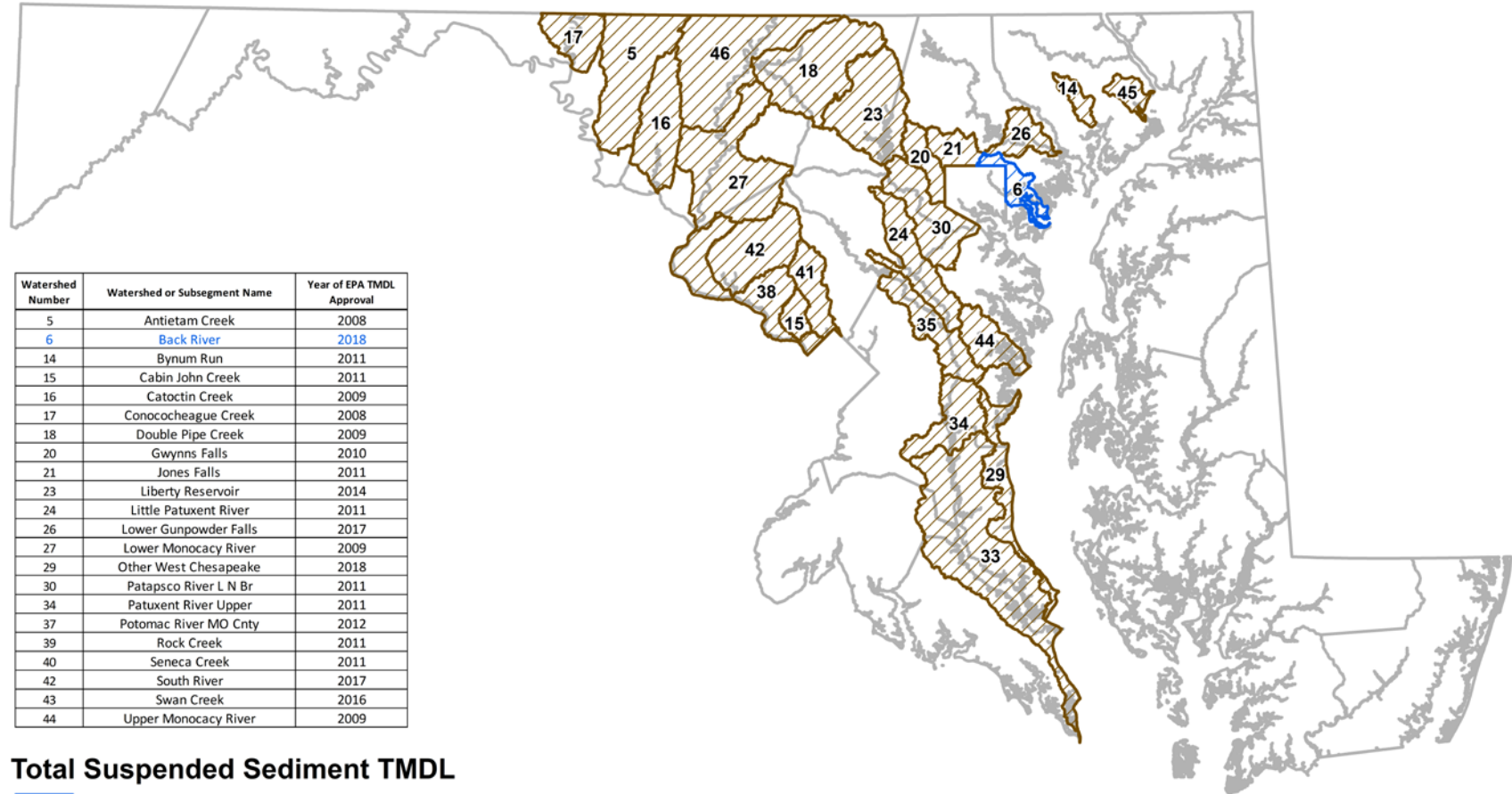
### E.2.a. Sediment TMDLs Affecting MDOT SHA

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 Non-tidal Back River Watershed, Baltimore County and Baltimore City, Maryland, approved by EPA on May 5, 2018.*

In **Table 2**, the MDOT SHA reduction target for the Non-tidal Back River sediment TMDL is 75 percent, or 242,234 lbs./yr. The watershed can safely receive 80,745 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 Back River 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 83,435 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

**Total Suspended Sediment TMDL**

-  Non-Tidal Back River Watershed
-  8 Digit Watershed
-  County Boundary



Figure 4: MDOT SHA Sediment TMDL Responsibilities in Local Watersheds

**Table 2: MDOT SHA Non-tidal Back River 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 Proposed 2020 Interim Reduction	MDOT SHA Proposed 2025 Interim Reduction	% 2020 Reduction Achieved Relative to Baseline	% 2025 Reduction Achieved Relative to Baseline	Target Year
Non-tidal Back River	02130901	BA	Sediment	3/5/2018	Individual WLA	2009	Lbs./yr.	322,978	75.0%	242,234	49,479	83,435	20.4	34.4	2045

### 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 (CBWM). 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, 2014b; EPA, 2010b; 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.

#### **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, adequate numbers of practices have not been identified that reach 100% of the reduction requirement for the Non-tidal Back River; however, MDOT SHA believes that it will be able to reach the reduction target by 2045. We 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 Back River sediment WLA end date.

## F. MDOT SHA NON-TIDAL BACK RIVER WATERSHED SEDIMENT TMDL IMPLEMENTATION PLAN

### F.1. Watershed Description

The Non-tidal Back River watershed (MD 8-digit Basin Code: 02130901) encompasses 55 square miles (35,000 acres) in the western shore region of Maryland within the City of Baltimore and Baltimore County. The Non-tidal Back River watershed drains into the Back River, which ultimately discharges into the Chesapeake Bay. Major tributary creeks and streams of the Non-tidal Back River watershed include Armistead Run, Biddison Run, Bread and Cheese Creek, Brien's Run, Chinquapin Run, Deep Creek, Duck Creek, Herring Run, Moore's Run, Northeast Creek, Redhouse Run, Stemmers Run, and Tiffany Run. The Non-tidal Back River watershed is comprised of the Upper Back River (UBR) subwatershed and the Tidal Back River (TBR) subwatershed excluding the tidal waters of Back River. The UBR subwatershed accounts for 78 percent of the Non-tidal Back River watershed and the TBR subwatershed accounts for the remaining 22 percent.

The designated uses of the Non-tidal Back River are Use Class I – Water Contact Recreation and Protection of Nontidal Warmwater Aquatic Life and Use Class IV – Recreational Trout Waters.

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

- Chlorides;
- Sulfates; and
- Total Suspended Solids (TSS).

There are 869.3 centerline miles of MDOT SHA roadway located within the Non-Tidal Back River watershed. The associated ROW

encompasses approximately 1,532.3 acres, of which approximately 718.4 acres are impervious. MDOT SHA facilities located within the watershed consist of two (2) highway garage and/or shops, and three (3) salt storage facilities.

See **Figure 5** for a map of MDOT SHA facilities within the watershed.

### F.2. MDOT SHA TMDLs within Non-tidal Back River Watershed

MDOT SHA is included in the sediment TMDL (MDE, 2017), with a reduction requirement of 75 percent, as shown in **Table 2**. This TMDL only applies to the non-tidal portion of the watershed. There are also nitrogen and phosphorous TMDLs with MDOT SHA WLAs for this watershed that will be addressed in a separate implementation plan.

While the Non-tidal Back River watershed is located in both Baltimore City and Baltimore County, Baltimore City is currently outside of the MDOT SHA's jurisdiction. Therefore, **Section F.3.**, **Section F.4.**, and **Section F.5.** below only pertain to the portion of the Non-tidal Back River watershed in Baltimore 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 Non-tidal Back River watershed is shown in **Figure 6** which illustrates that 31 grid cells have been reviewed, encompassing portions of 16 state route corridors. Results of the visual inventory categorized by BMP type follow.

### **Structural Stormwater Controls**

Preliminary evaluation identified 205 locations as potential new structural stormwater (SW) control locations. Further analysis of these locations resulted in:

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

### **Tree Planting**

Preliminary evaluation identified 151 locations as potential tree planting locations. Further analysis of these locations resulted in:

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

### **Stream Restoration**

Preliminary evaluation identified seven (7) sites as potential stream restoration locations. Further analysis of these locations resulted in:

- Seven (7) sites deemed not viable for stream restoration.

### **Grass Swale Rehabilitation**

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

- 23 new structural SW controls constructed or under contract.
- Two (2) additional sites deemed potentially viable for new structural SW controls and pending further analysis, may be candidates for future restoration opportunities.
- 76 sites deemed not viable for structural SW controls and have been removed from consideration.

### **Outfall Stabilization**

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

### **Retrofit of Existing Structural SW Controls**

Preliminary evaluation identified six (6) existing structural SW controls as potential retrofits. Further analysis of these locations resulted in:

- Retrofit of two (2) existing structural SW controls constructed or under contract.
- Four (4) retrofit sites deemed not viable for retrofit and have been removed from consideration.



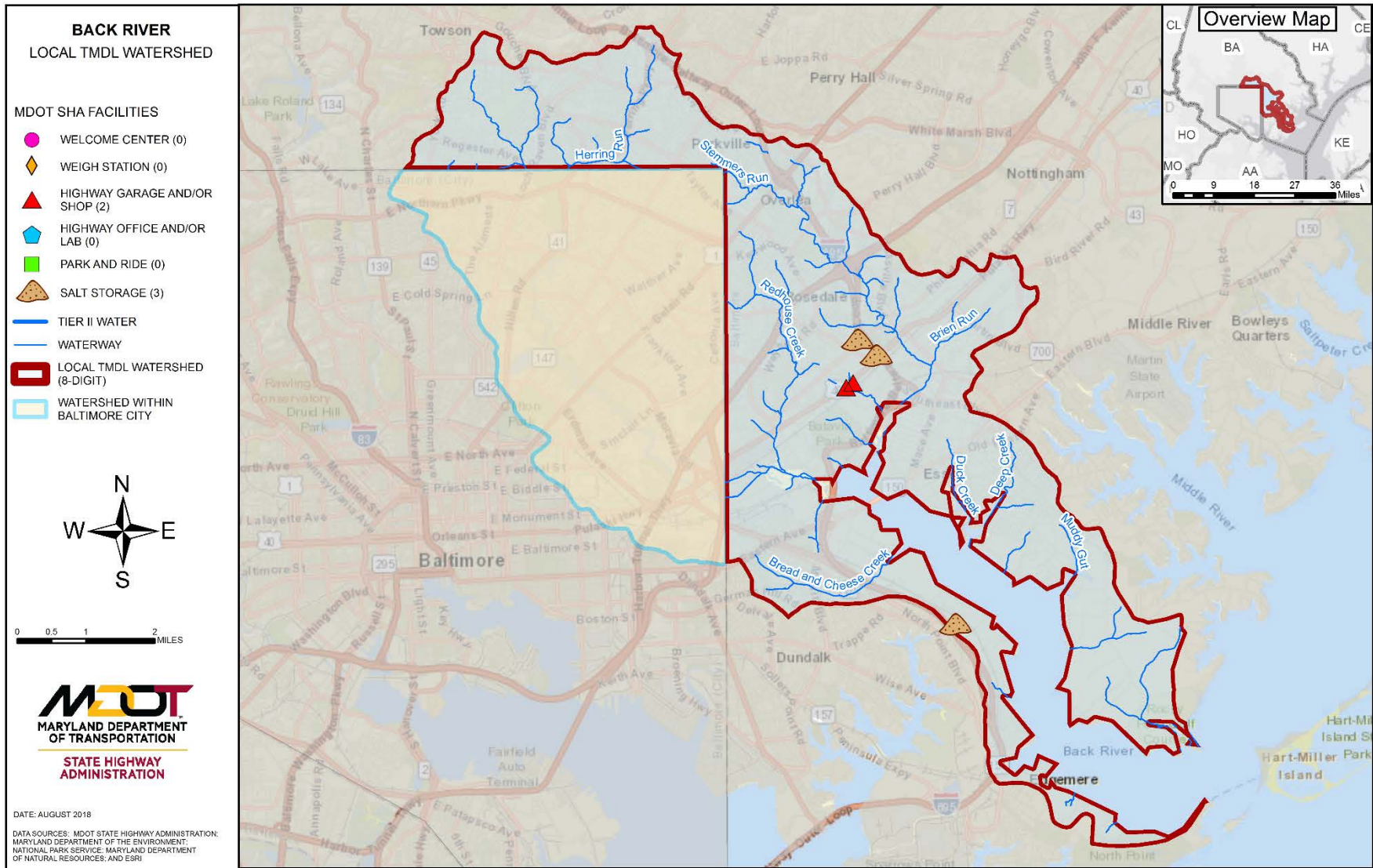


Figure 5: MDOT SHA Facilities within Non-tidal Back River Watershed

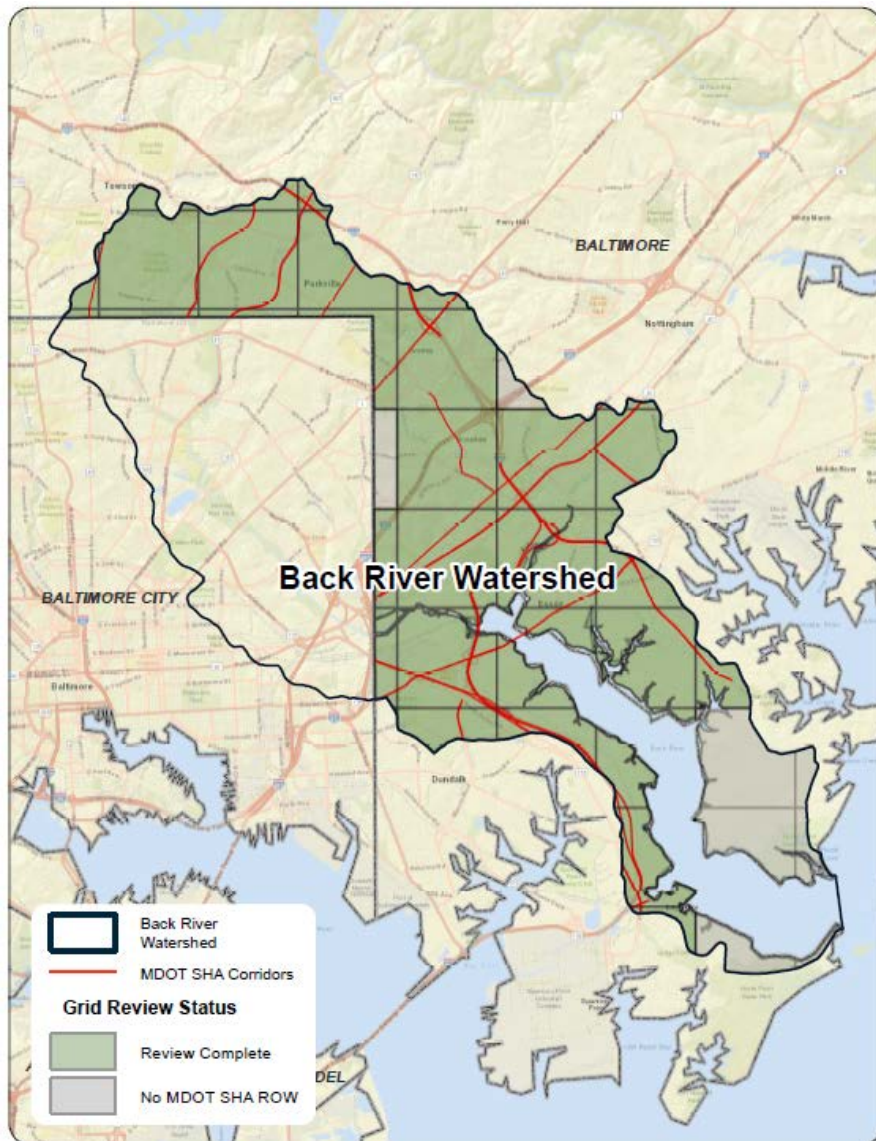


Figure 6: Non-tidal Back River Site Search Grids

## F.4. Summary of County Assessment Review

As previously stated in **Section F.1.**, the Non-tidal Back River watershed is divided into two subwatersheds: the non-tidal UBR and the estuary TBR. Baltimore County completed a Small Watershed Action Plan (SWAP) for the UBR watershed in 2008 and the TBR watershed in 2010. Baltimore City is not currently under MDOT SHA MS4 Phase I Permit Coverage; therefore, only Baltimore County’s watershed assessments will be summarized in this section.

In November 2008, the Baltimore County Department of Environmental Protection and Resource Management (BA-DEPRM) in consultation with the Upper Back River SWAP Steering Committee completed the *Upper Back River Small Watershed Action Plan* (BA-DEPRM, 2008a)—hereinafter referred to as the “UBR SWAP.”

In February 2010, on behalf of the BA-DEPRM, Parsons Brinckerhoff (PB) completed the *Tidal Back River Small Watershed Action Plan* (PB, 2010)—hereinafter referred to as the “TBR SWAP.”

The UBR watershed is a 43.3 square-mile area located in the southeastern region of Baltimore County and northeastern portion of Baltimore City. It represents 78 percent of the total Non-tidal Back River watershed and is broken down into 14 subwatersheds. Jurisdictionally, 44.5 percent of the UBR is in the City and 55.5 percent is in the County. Land use within the UBR watershed is as follows: Residential (55.4 percent), Forest (11.5 percent), Commercial (9.9 percent), Institutional (8.0 percent), Industrial (6.5 percent), and Open Urban (6.2 percent). The total impervious cover at the time the UBR SWAP was published (November 2008) was 30.7 percent of the watershed (BA-DEPRM, 2008a).

The TBR watershed consists of approximately 12 square miles or 22 percent of the entire Non-tidal Back River watershed. It is divided into

10 subwatersheds. The land use within the watershed is as follows: Residential (34 percent), Forest (32 percent), Other Urban (11.4 percent), Commercial (7.2 percent), Institutional (4.4 percent), Agriculture (4.4 percent), Industrial (3.5 percent), and Water/Wetlands (3.0 percent). The total impervious cover at the time the TBR SWAP was published (February 2010) was 18.4 percent of the watershed. (PB, 2010).

The UBR watershed is within the Piedmont and the Coastal Plain regions on the State. The majority (57.2 percent) of slopes within the watershed are categorized as low-medium (3-8 percent). The most common Hydrologic Soil Group is Group D (60.2 percent); this group has the highest runoff potential as it has very low infiltration rates. Overall, the watershed has a fairly even distribution of soil erodibility, with a large proportion of the soils being prone to at least moderate or high soil erodibility. The watershed contains 766 acres of forest, only 3 percent of the total area. The combination of high runoff potential, moderate and high soil erodibility, and a small percentage of forest cover may pose a challenge to reducing sediment loads within the watershed (BA-DEPRM, 2008a).

The TBR watershed is within the Coastal Plain region of the State. The Hydrologic Soils Group is diverse: Group C (40.8 percent), Group B (32.3 percent), Group D (25.4 percent), and Group A (1.5 percent) (PB, 2010).

The UBR SWAP lays out eight main goals:

1. Improve and Maintain Healthy Streams;
2. Restore and Maintain Aquatic Biology and Habitat;
3. Improve Stream Corridors for Water Quality, Biological, and Habitat Enhancement;
4. Increase Tree Cover;
5. Reduce Stormwater Impacts from Impervious Surfaces;
6. Increase the Use of Public Facilities and Properties as Models of Good Best Management Practices (BMPS);
7. Improve Access to Streams; and

8. Enhance Unused Green Space.

The TBR SWAP lays out six main goals:

1. Improve and Maintain Clean Water;
2. Reduce Trash and Promote Recycling;
3. Increase Citizen Participation with Restoration Projects;
4. Restore and Maintain Fisheries and Habitat;
5. Encourage Safe Recreational Boating and Public Access; and
6. Enhance Natural Resources on Public Property.

Many of these goals from both SWAPs assist in directly and indirectly decreasing TSS throughout the entire watershed. Of the UBR goals, goal three most directly affects sediments through increasing forest cover that is adjacent to streams which will in turn reduce sedimentation through the filtering of groundwater and absorption of flood flows. In addition, goal five also directly influences sediment loading. Of the UBR watershed, 31 percent are roads or buildings. These impervious surfaces are channels by which stormwater and the sediments and other pollutants that may be carried by stormwater reaches streams. The two main objectives of goal five, reducing impervious cover and disconnecting impervious surfaces from the stormwater drain system, will directly remove sediments from entering streams. Both the UBR and TBR SWAPs have goals involving public access and increased involvement. These goals will indirectly lead to decreased TSS by the government leading as example to inspire and encourage others to employ BMPs, by providing access and awareness of waterways, and by creating a personal connection for citizens that will lead to changed behavior and a sense of personal responsibility (BA-DEPRM, 2008a; PB, 2010).

In addition, both SWAPs prioritized their subwatersheds based on ranking criteria in order to identify which subwatersheds have the greatest need and potential for restoration. For the UBR subwatershed, Chinquapin Run, Tiffany Run, Herring Run Mainstem, Armistead Run,

Biddison Run, Moore’s Run, and Redhouse Run were rated “very high” and West Branch Herring Run, East Branch Herring Run, and an unnamed tributary were rated “high” in terms of restoration need and potential (BA-DEPRM, 2008a). For the TBR subwatershed, Deep Creek, Duck Creek, and Bread and Cheese Creek were rated “very high” and Lynch Point Cove, Back River-G, and Muddy Gut were rated “high” in terms of restoration need and potential. In the UBR subwatershed, all sites assessed by Baltimore City (42) and County (25) had BIBI scores in the “poor” or “very poor” categories (PB, 2010). For the purposes of planning, the County SWAPS suggest the following generalized restoration strategies to aid in meeting restoration goals within the Non-tidal Back River watershed:

- SWM for new development and redevelopment;
- Existing SWM facility conversions;
- SWM retrofits;
- Stream restoration;
- Street sweeping and storm drain inlet cleaning;
- Illicit connection detection and disconnection program and hotspot remediation;
- Sanitary sewer consent decrees;
- Downspout disconnection;

- Citizen awareness (fertilizer application and pet waste); and
- Reforestation and tree planting.

The County also identified numerous potential restoration sites within each subwatershed by conducting neighborhood source assessments, hotspot site investigations, institutional site investigations, and pervious area assessments. In addition, the County identified multiple potential stormwater conversions within each subwatershed: 91 for the UBR subwatershed and 3 for the TBR subwatershed. Detailed information on site locations can be found in the SWAPs.

The following potential stream restoration sties were identified within the Non-tidal Back River watershed in **Table 4**. An additional six sites were also identified in the UBR subwatershed for SWM retrofit on County-owned property.

**Table 4: Potential Stream Restoration Sites in the Non-tidal Back River Watershed**

Subwatershed	Reach	Number of Sites	Total Linear Feet	Conditions
UBR	Herring Run	24	12,675	-
UBR	Stemmers Run	30	23,488	-
UBR	Brien’s Run	10	8,603	-
TBR	Bread and Cheese Creek	4	2,600	Erosion, dumping, and inadequate buffers
TBR	Duck Creek	3	80	Severe dumping, inadequate buffers, and invasive vegetation
TBR	Muddy Gut	2	-	Severe dumping and disturbance (all-terrain vehicle [ATV] trails)
TBR	Deep Creek	4	1,315	Concrete channels, inadequate buffers, severe channel alterations, severe erosion (scouring), and severe fish barrier

Sources: BA-DEPRM (2008a); PB (2010)

## **F.5. MDOT SHA Pollutant Reduction Strategies**

Proposed practices to meet the sediment reduction in the Non-tidal Back River watershed are shown in **Table 5**. Projected sediment reductions using these practices are 83,435 lbs./yr. which is 34 percent of the required reduction. The following 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.

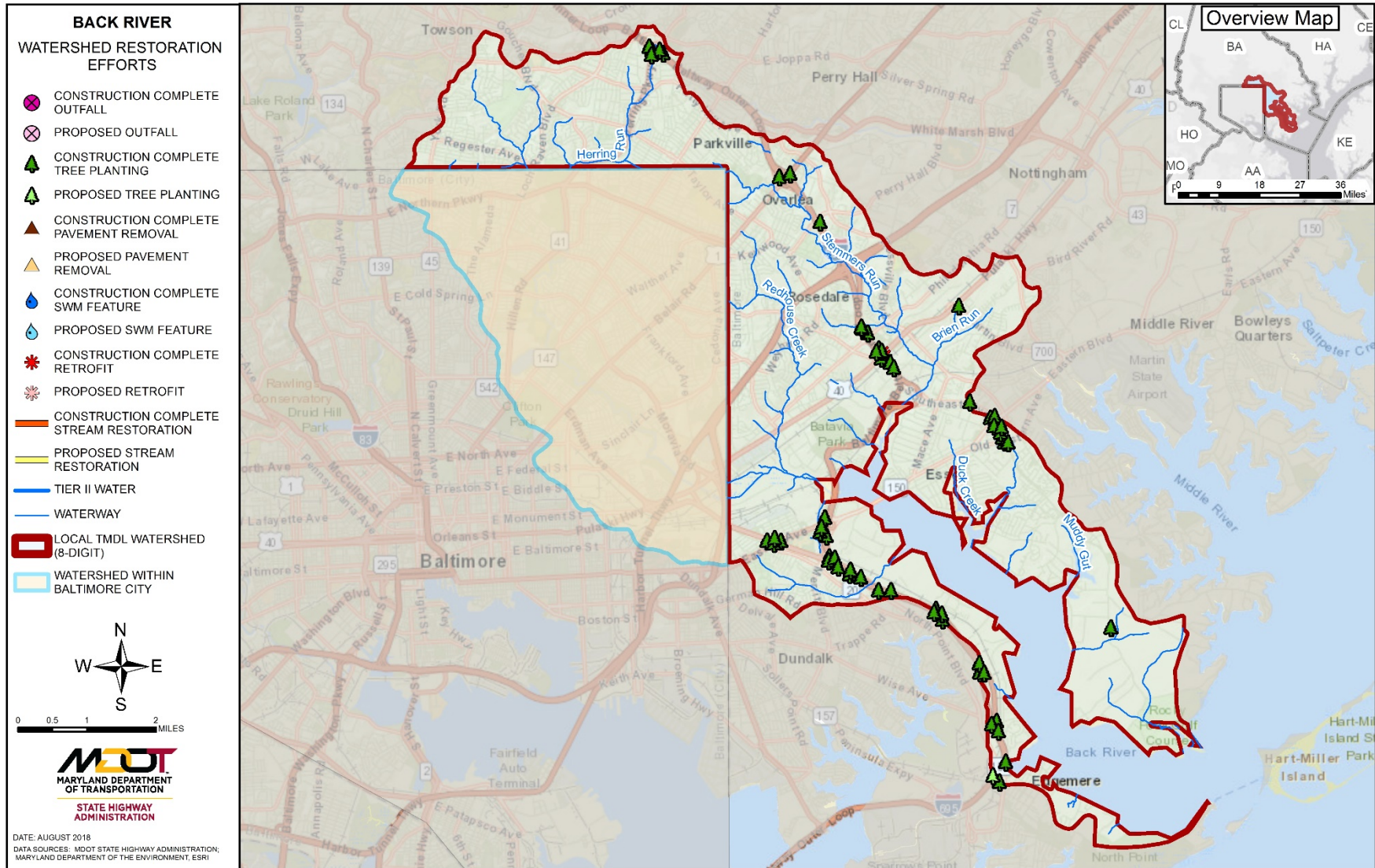
The currently programmed BMPs will not meet the reduction requirement shown in **Table 2**. MDOT SHA will work to increase the excepted reduction requirement achievement for the sediment TMDL in this watershed through strategies identified in Section E.2.c.

Estimated Capital Budget costs to design and construct the programmed practices within the Non-tidal Back River watershed total \$5,447,000. These projected costs are based on an average cost per impervious acre treated that is derived from cost history for a group of completed projects for each BMP type. See **Table 6** for summary of estimated BMP costs.

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

Table 5: Non-Tidal Back River Restoration Sediment BMP Implementation						
BMP	Unit	Baseline (Before 2009)	Restoration BMPs			
			2020	2025	Future	Total
New Stormwater	drainage area acres	307.3	7.0	14.7	TBD	21.7
Retrofit	drainage area acres		12.3		TBD	12.3
Impervious Disconnects	credit acres	5.9			TBD	0.0
Tree Planting	acres of tree planting		44.8	2.6	TBD	47.4
Stream Restoration	linear feet		770.0	782.4	TBD	1,552.4
Outfall Stabilization	linear feet		1.6	400.0	TBD	401.6
Inlet Cleaning <sup>1</sup>	dry tons		17.5		TBD	17.5
Street Sweeping <sup>1</sup>	acres swept		31.1		TBD	31.1
Load Reductions	TSS EOS lbs/yr.		50,294.1	33,141.0	<b>242,234</b>	
<b>Total Projected Reduction</b>					<b>242,234</b>	
<i><sup>1</sup> Inlet cleaning and street sweeping are annual practices.</i>						

Table 6: Non-Tidal Back River Restoration BMP Cost			
BMP	2020	2025	Total
New Stormwater	\$466,000	\$1,160,000	\$1,626,000
Retrofits	\$399,000		\$399,000
Tree Planting	\$1,370,000	\$79,000	\$1,449,000
Stream Restoration	\$514,000	\$522,000	\$1,036,000
Outfall Stabilization	\$3,000	\$787,000	\$790,000
Inlet cleaning	\$100,000		\$100,000
Street Sweeping	\$47,000		\$47,000
<b>Total</b>	<b>\$2,889,000</b>	<b>\$2,548,000</b>	<b>\$5,447,000</b>



**Figure 7: MDOT SHA Programmed Restoration Strategies within the Non-tidal Back River Watershed**

# ABBREVIATIONS

Note: This list of abbreviations was developed for the MDOT SHA 2016 Impervious Restoration and Coordinated TMDL Implementation plan (available at [www.roads.maryland.gov](http://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	Automated Modeling Tool
AMT, Inc.	A. Morton Thomas and Associates, Inc.
ATV	All-terrain vehicle
BA	Baltimore (County)
BARC	Beltsville Agriculture Research Center
Bay	Chesapeake Bay
BBO	Beaverdam Run, Baisman Run, and Oregon Branch Subwatersheds of the Loch Raven Reservoir Watershed
BC-DEPRM	Baltimore County, Department of Environmental Protection and Resource Management
BC-DEPS	Baltimore County, Department of Environmental Protection and Sustainability
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
CBWM	Chesapeake Bay Watershed Model
CC	Charles (County)
CC-BRM	Carroll County, Bureau of Resource Management
CC-DPGM	Charles County, Department of Planning & Growth
CCMS	Customer Care Management System
CFR	Code of Federal Regulations
CIP	Capital Improvement Project
CL	Carroll (County)
CRP	Community Reforestation Program
CSN	Chesapeake Stormwater Network
CSO	Combined Sewer Overflow
CTP	Consolidated Transportation Program
CWA	Clean Water Act
CWAPTW	Clean Water Action Plan Technical Workgroup
CWP	Center for Watershed Protection
DC	District of Columbia
DO	Dissolved Oxygen
DEL	Delivered Loads
DMCF	Dredged Material Containment Facilities
DNR	Maryland Department of Natural Resources



DRMO	Defense Reutilization and Marketing Office	IDDE	Illicit Discharge Detection and Elimination
ECD	Environmental Compliance Division (MDOT SHA)	ISWBMPDB	International Stormwater BMP Database
<i>E. coli</i>	<i>Escherichia coli</i>	LA	Load Allocations
ED	Extended Detention	lbs	Pounds (weight)
EMC	Event Mean Concentration	LF	Linear Feet
EMS	Environmental Management System	LN	Lower North
EOS	Edge of Stream	LNB	Lower North Branch
EPA	United States Environmental Protection Agency	LRE	Loch Raven East subwatershed
EPD	Environmental Programs Division	LJF	Lower Jones Falls (Watershed)
ESC	Erosion and Sediment Control	LU	Land Use
ESD	Environmental Site Design	MAA	Maryland Aviation Administration
FC	Fecal Coliform	MAST	Maryland Assessment Scenario Tool
FC-DPW	Frederick County, Division of Public Works	MC-DEP	Montgomery County, Department of Environmental Protection
FEMA	Federal Emergency Management Administration	MD	Maryland
FIB	Fecal Indicator Bacteria	MDA	Maryland Department of Agriculture
FIBI	Fish Index of Biotic Integrity	MDE	Maryland Department of the Environment
FMD	Facility Maintenance Division (MDOT SHA)	MDOT	Maryland Department of Transportation
FR	Frederick (County)	MDP	Maryland Department of Planning
FY	Fiscal Year	MEP	Maximum Extent Practicable
GIS	Geographic Information System	MEPA	Maryland Environmental Policy Act
HA	Harford (County)	MGF	Middle Gwynns Falls (Watershed)
HC-DPW	Harford County, Department of Public Works	MO	Montgomery (County)
HO	Howard (County)	MOS	Margin of Safety
HUC	Hydrologic Unit Code	MPR	Maximum Practicable Reduction
HWG	Horsley Witten Group, Inc.	MS4	Municipal Separate Storm Sewer System
ICPRB	Interstate Commission on the Potomac River Basin	NBOD	Nitrogenous Biochemical Oxygen Demand
		NEPA	National Environmental Policy Act

NFHL	National Flood Hazard Layer	SFEI	San Francisco Estuary Institute
NJF	Northeastern Jones Falls (Watershed)	SGW	Submerged Gravel Wetlands
NPDES	National Pollutant Discharge Elimination System	SHA	State Highway Administration
NSQD	National Stormwater Quality Database	SPR	State Planning and Research
OCRI	Office of Customer Relations and Information (MDOT SHA)	SSO	Sanitary Sewer Overflow
OED	Office of Environmental Design (MDOT SHA)	ST	Stormwater Treatment
OOM	Office of Maintenance (MDOT SHA)	SW	Stormwater
OP	Orthophosphate	SWAP	Small Watershed Action Plan
OPPE	Office of Planning and Preliminary Engineering (MDOT SHA)	SWM	Stormwater Management
PACD	Pennsylvania Association of Conservation Districts	SWS	Subwatershed
PB	Parsons Brinckerhoff	SW-WLA	Stormwater Wasteload Allocation
PCB	Polychlorinated Biphenyl	TBD	To Be Determined
P <sub>E</sub>	Rainfall Target Used To Size ESD Practices	TBR	Tidal Back River (Watershed)
PERC	Perchloroethylene	TBS	To Be Specified
PG	Prince George's (County)	TCWG	Toxic Contaminants Work Group
PGC-DoE	Prince George's County, Department of the Environment	TMDL	Total Maximum Daily Load
RBP	Rapid Bioassessment Protocol	TN	Total Nitrogen
RGP	Regional General Permit	TP	Total Phosphorus
ROW	Rights-Of-Way	tPCB	Total Polychlorinated Biphenyl
Reqd	Required	TSS	Total Suspended Solids
RR	Runoff Reduction	TWGCB	Toxics Work Group Chesapeake Bay Partnership
RSPSC	Regenerative Step Pool System Conveyance	UBR	Upper Back River (Watershed)
SAH	Sponsor-A-Highway	UGF	Upper Gwynns Falls (Watershed)
SB	Spring Branch subwatershed	UJF	Upper Jones Falls (Watershed)
SCA	Stream Corridor Assessment	US	United States
		USACE	United States Army Corps of Engineers

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USDA-NRCS	United States Department of Agriculture, Natural Resources Conservation Service	WTM	Watershed Treatment Model
USGS	United States Geological Survey	WTWG	Watershed Technical Work Group
USWG	Urban Stormwater Work Group	WWTP	Waste Water Treatment Plant
WA	Washington (County)		
WC-DPW	Washington County, Division of Public Works		
WCSCD	Washington County Soil Conservation District		
WIP	Watershed Implementation Plan		
WLA	Wasteload Allocation		
WPD	Water Programs Division (MDOT SHA)		
WQLS	Water Quality Limited Segment		
WQSs	Water Quality Standards		
WQv	Water Quality Volume		
WQGIT	Water Quality Goal Implementation Team		
WRAS	Watershed Restoration Action Strategy		
yr	Year		
12-SW	Maryland General Permit for Discharges from Stormwater Associated with Industrial Activities		

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Note: This list of references was developed for the MDOT SHA 2016 Impervious Restoration and Coordinated TMDL Implementation plan (available at [www.roads.maryland.gov](http://www.roads.maryland.gov)). Many of the references may not apply to this document.

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